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SOUTH FLORIDA ECOSYSTEM RESTORATION

Improved Science Coordination Needed to Increase the Likelihood of Success

Statement of Barry T. Hill, Director
Natural Resources and Environment

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GAO-03-518T

March 26, 2003

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Highlights

Highlights of GAO-03-518T, a report to the Chairman and Ranking Minority Member, Subcommittee on Interior and Related Agencies, House Appropriations Committee

Why GAO Did This Study

Restoration of the South Florida ecosystem is a complex, long-term federal and state undertaking that requires the development of extensive scientific information. GAO was asked to report on the funds spent on scientific activities for restoration, the gaps that exist in scientific information, and the extent to which scientific activities are being coordinated.

What GAO Recommends

To improve the coordination of scientific activities for the South Florida ecosystem restoration initiative, GAO recommends that as chair of the South Florida Ecosystem Restoration Task Force (Task Force), the Secretary of the Interior

- clarify the plans and documents the Science Coordination Team (SCT) needs to complete and the time frames for completing them;
- evaluate staffing needs of the SCT and allocate sufficient staff to carry out its duties; and
- take measures to improve the working relationship between the Task Force and the SCT.

In commenting on the draft report, the Department of the Interior agreed with the premises of the report that scientific activities need to be better coordinated and that the SCT's role needs to be clarified. Interior stated that the Task Force would ultimately review GAO's recommendations and approve actions, as warranted.

www.gao.gov/cgi-bin/getrpt?GAO-03-518T.

To view the full report, including the scope and methodology, click on the link above. For more information, contact Barry T. Hill at (202) 512-3841.

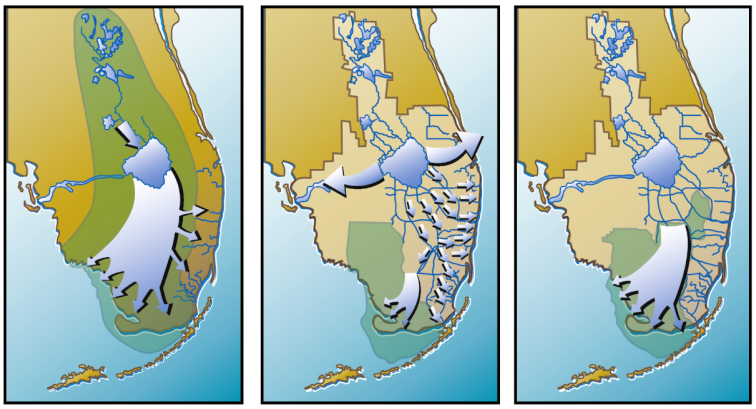
What GAO Found

From fiscal years 1993 through 2002, eight federal agencies and one state agency collectively spent $576 million to conduct mission-related scientific research, monitoring, and assessment in support of the restoration of the South Florida ecosystem. With this funding, which was almost evenly split between the federal agencies and the state agency, scientists have made progress in developing information—including information on the past, present, and future flow of water in the ecosystem—for restoration.

While some scientific information has been obtained and understanding of the ecosystem improved, key gaps remain in scientific information needed for restoration. If not addressed quickly, these gaps could hinder the success of restoration. One particularly important gap is the lack of information regarding the amount and risk of contaminants, such as fertilizers and pesticides, in water and sediment throughout the ecosystem.

The South Florida Ecosystem Restoration Task Force—comprised of federal, state, local, and tribal entities—is responsible for coordinating the South Florida ecosystem restoration initiative. The Task Force is also responsible for coordinating scientific activities for restoration, but has yet to establish an effective means of doing so. In 1997, it created the SCT to coordinate the science activities of the many agencies participating in restoration. However, the Task Force did not give the SCT clear direction to carry out its responsibilities in support of the Task Force and restoration. Furthermore, unlike the full-time science coordinating bodies created for other restoration efforts, the SCT functions as a voluntary group with no full-time and few part-time staff. Without an effective means to coordinate restoration, the Task Force cannot ensure that restoration decisions are based on sound scientific information.

Past, Present, and Future Flow of Water in South Florida



Source: South Florida Water Management District.

Mr. Chairman and Members of the Subcommittee:

The South Florida ecosystem restoration initiative seeks to restore the vast, mixed wetland habitat of South Florida—including the Everglades. Restoration efforts are expected to cost $15 billion and take as long as 50 years to complete, and the ecological effects of these efforts may not be known until many years thereafter. Because of the long-term, complex nature of the initiative, the South Florida Ecosystem Restoration Task Force (Task Force)—the group of federal, state, local, and tribal entities that Congress formally established in 1996 to coordinate the restoration efforts—determined that restoration decisions should be based on sound scientific information. To coordinate scientific activities for the initiative, in 1997, the Task Force created the Science Coordination Team (SCT).[1] Because of the urgency to move forward with the initiative, complete scientific information may not be available when restoration decisions must be made. Recognizing that scientific information may be incomplete and uncertain, the Task Force has endorsed "adaptive management." This approach requires scientific information to be updated throughout the restoration and provides flexibility to make changes to restoration projects and plans as needed.

The Members of this Subcommittee have had a long-standing interest in the restoration initiative and recognize that science plays a critical role in the success of restoration. Multiple federal and state agencies that are involved in the initiative develop scientific information for restoration. These agencies conduct scientific research, monitoring, and assessments of environmental and other conditions in support of their individual agency goals, mandates, and missions. We are here to discuss our report being released today on (1) federal and state agency funding for scientific activities related to the restoration and the progress made in developing scientific information for the restoration, (2) gaps in scientific information needed for restoration, and (3) coordination of scientific information for restoration.[2]

[1] In 1993, the Task Force—which at the time was only a federal group—formed a Science Subgroup; this team was subsequently reformed as the Science Coordination Team.

[2] U.S. General Accounting Office, *South Florida Ecosystem Restoration: Task Force Needs to Improve Science Coordination to Increase the Likelihood of Success*, GAO-03-345, (Washington, D.C.: Mar. 18, 2003).

Summary

Federal and state agencies have already committed considerable funds to develop scientific information to support South Florida ecosystem restoration decisions, a trend that is expected to continue. Since 1993, eight federal agencies and one key state agency spent $576 million to develop scientific information in support of the restoration initiative.[3] The eight federal agencies spent a total of $273 million of which, the largest federal participant—the Department of the Interior—spent $139 million. In addition, the State of Florida's South Florida Water Management District (District) spent over $303 million on scientific activities related to restoration. With this federal and state funding, agencies have made progress in developing scientific information and tools necessary for restoration.

Although agencies have developed some of the information that is needed to facilitate restoration efforts, key gaps remain, that if not addressed quickly, could hinder the success of particular projects as well as affect the health of the entire ecosystem. One particularly important gap is the lack of information regarding the amount and risk of contaminants, such as fertilizers and pesticides, in water and sediment throughout the ecosystem. If this information is not available, scientists cannot determine whether fish and other organisms are being harmed by these contaminants or whether the redistribution of water will introduce potentially harmful contaminants to parts of the ecosystem that are relatively undisturbed.

Because multiple agencies conduct scientific activities for a variety of purposes under the restoration initiative, coordination is necessary to ensure that gaps in information are addressed and that important scientific information is synthesized and made available to managers. However, the Task Force has yet to establish an effective means of coordination. The SCT—the group created by the Task Force to coordinate scientific information for the restoration—has been limited in carrying out its coordination responsibilities by a number of factors. First, the SCT has not been given clear direction on what it is expected to accomplish. Second, it has no processes to ensure that key management issues that need to be addressed in science planning are identified or that critical science issues that require synthesis to provide input into restoration decisions are

[3] All funds have been adjusted to 2002 dollars. Throughout this report, we refer to fiscal years unless otherwise noted. Both the federal and South Florida Water Management District fiscal years run from October through September.

prioritized. Finally, the SCT lacks the resources it needs to adequately carry out its broad responsibilities.

Until the Task Force addresses these limitations, the coordination of scientific activities is not likely to materially improve. The SCT will continue to be limited in its capacity to help ensure that (1) scientific gaps are filled, (2) progress toward restoration is monitored, and (3) adjustments to restoration projects and plans are made as needed. Without effective coordination of scientific activities, the Task Force has scant assurance that the scientific information needed to make key restoration decisions will be made available, thus decreasing the likelihood that restoration of the South Florida ecosystem will be successful. Although we found poor coordination of scientific activities and gaps in scientific information for restoration, we are not advocating the initiative be delayed. Rather, we believe that restoration projects and plans should move forward, given the Task Force's commitment to adaptively manage the restoration, and are therefore making recommendations to improve coordination. Specifically, we are recommending that the Secretary of the Interior, as chair of the South Florida Ecosystem Restoration Task Force, clarify the broad responsibilities of the SCT and evaluate the SCT's staffing needs, ensuring that the SCT has sufficient resources to carry out its responsibilities. In commenting on a draft of our report, the Department of the Interior—as chair of the Task Force—largely agreed with our recommendations, but stated that the Task Force itself will ultimately make the decision on the actions taken to address these recommendations.

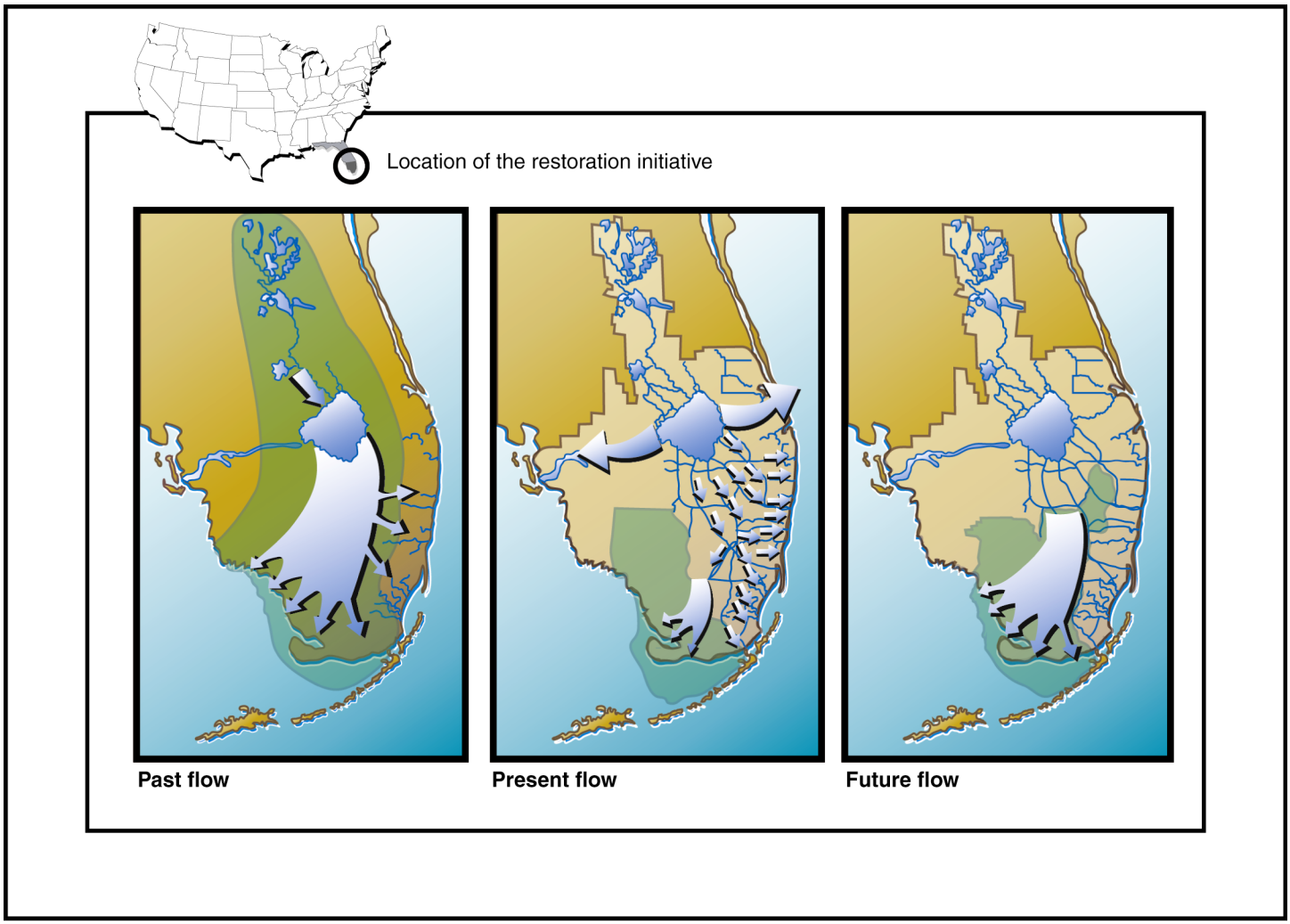
Background

The South Florida ecosystem encompasses a broad range of natural, urban, and agricultural areas surrounding the remnant Everglades. Before human intervention, freshwater in the ecosystem flowed south from Lake Okeechobee to Florida Bay in a broad, slow-moving sheet, creating the mix of wetlands that form the ecosystem. These wetlands, interspersed with dry areas, created habitat for abundant wildlife, fish, and birds.

The South Florida ecosystem is also home to 6.5 million people and supports a large agricultural, tourist, and industrial economy. To facilitate development in the area, in 1948, Congress authorized the U.S. Army Corps of Engineers to build the Central and Southern Florida Project—a system of more than 1,700 miles of canals and levees and 16 major pump stations—to prevent flooding and intrusion of saltwater into freshwater aquifers on the Atlantic coast. The engineering changes that resulted from the project, and subsequent agricultural, industrial, and urban

development, reduced the Everglades ecosystem to about half its original size, causing detrimental effects to fish, bird, and other wildlife habitats and to water quality. Figure 1 shows the historic and current flows of the Everglades ecosystem as well as the proposed restored flow.

Figure 1: The Everglades—Past, Present, and Future



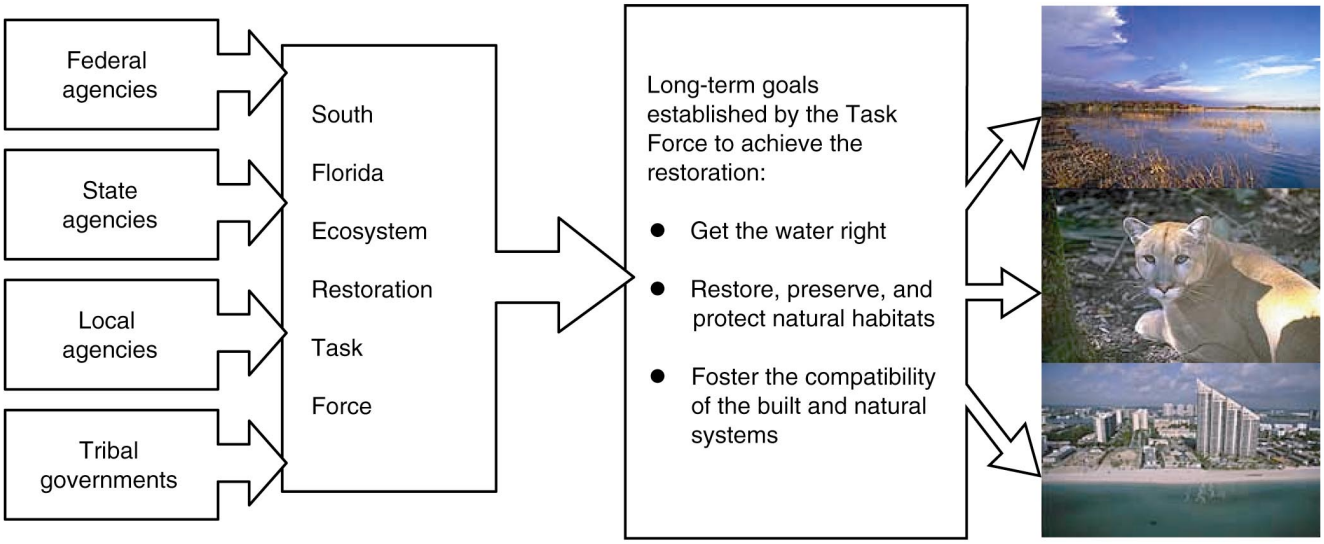
Source: South Florida Water Management District.

Efforts to reverse the detrimental effects of development on the ecosystem led to the formal establishment of the Task Force, authorized by the Water Resources Development Act (WRDA) of 1996. The Task Force, charged with coordinating and facilitating the restoration of the ecosystem, established three overall goals to:

- *Get the water right*: restore more natural hydrologic functions to the ecosystem while providing adequate water supplies and flood control. The goal is to deliver the right amount of water, of the right quality, to the right places at the right times.
- *Restore, protect, and preserve the natural system*: restore lost and altered habitats and change current land use patterns. Growth and development have displaced and disconnected natural habitats and the spread of invasive species has caused sharp declines in native plant and animal populations.
- *Foster the compatibility of the built and natural systems*: find development patterns that are complementary to ecosystem restoration and to a restored natural system.

Figure 2 shows the relationship of the agencies participating in restoration, the Task Force, and the three restoration goals.

Figure 2: The South Florida Ecosystem Restoration Task Force Membership and Goals



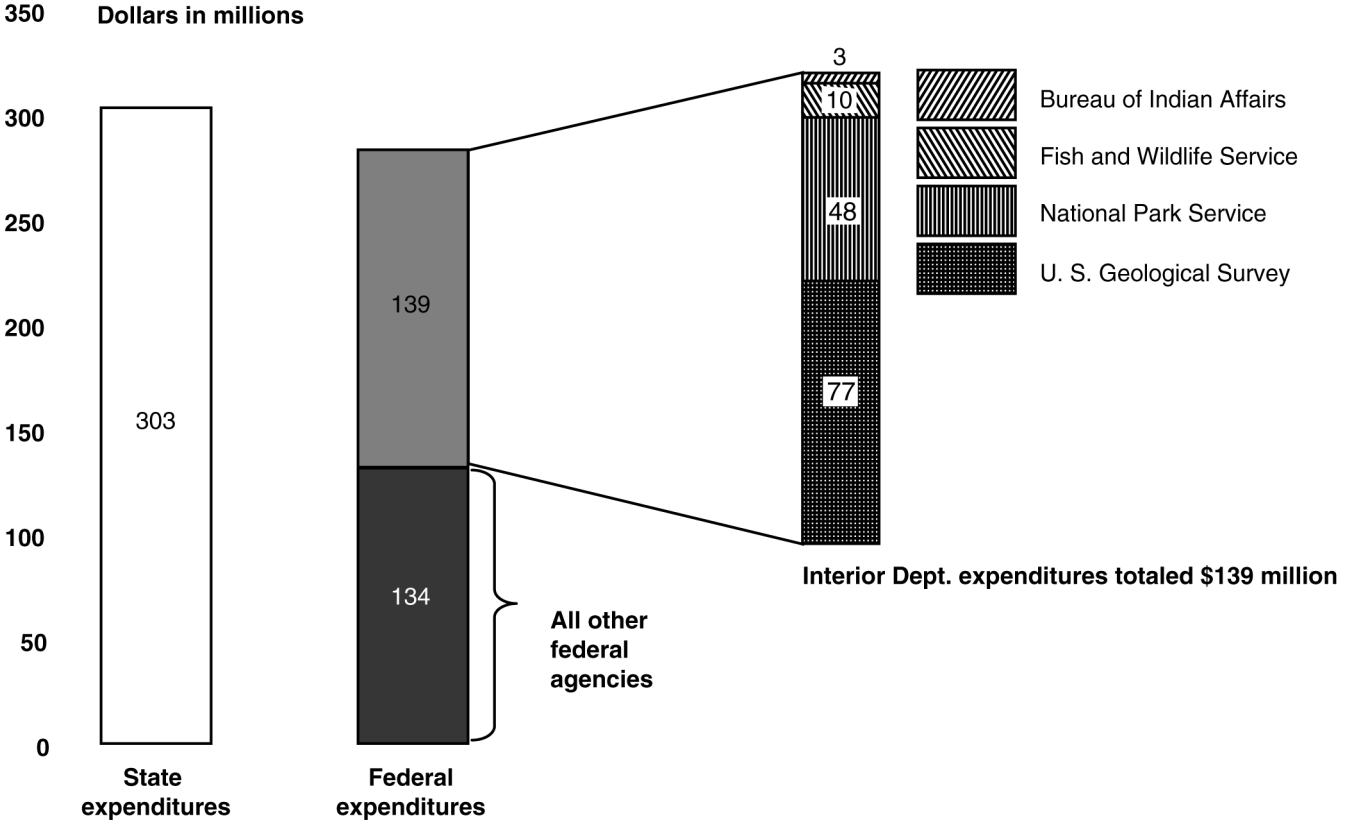
Source: South Florida Water Management District (photos), GAO (presentation).

Because of the complexity of the ecosystem and efforts underway to restore it, and the urgency to begin the long-term ecosystem restoration effort, not all of the scientific information that is needed is available to make restoration decisions. As a result, scientists will continually need to develop information and restoration decision makers will continually need to review it. According to the Task Force, scientists participating in restoration are expected to identify and determine what information is needed to fill gaps in scientific knowledge critical to meeting restoration objectives and provide managers with updated scientific information for critical restoration decisions. Generally, decisions about restoration projects and plans have been—and will continue to be—made by the agencies participating in the restoration initiative. To provide agency managers and the Task Force with updated scientific information, the Task Force has endorsed adaptive management, a process that requires key tools, such as models, continued research, and monitoring plans.

Federal and State Agencies Spent $576 Million on Scientific Activities for the South Florida Ecosystem and Made Progress in Some Areas

Federal and state agencies spent $576 million from fiscal years 1993 through 2002 to conduct mission-related scientific research, monitoring, and assessment in support of the restoration of the South Florida ecosystem. Eight federal departments and agencies spent $273 million for scientific activities, with the Department of the Interior spending $139 million (about half) of the funds. The level of federal expenditures, which increased by over 50 percent in 1997, has since remained relatively constant. The South Florida Water Management District—the state agency most heavily involved in scientific activities for restoration—spent $303 million from 1993 through 2002. The District's expenditures have increased steadily since 1993, with significant increases in 2000 and 2002. Figure 3 shows the total federal and state expenditures for scientific activities related to restoration over the last decade.

Figure 3: Federal and State Expenditures for Scientific Activities for South Florida Restoration, Fiscal Years 1993 through 2002



Source: Federal agencies and the South Florida Water Management District (data), GAO (analysis).
Note: Numbers may not add to total due to rounding.

Eight federal agencies are involved in scientific activities for the restoration: the Department of the Interior's U.S. Geological Survey, National Park Service, Fish and Wildlife Service, and Bureau of Indian Affairs; the Department of Commerce's National Oceanic and Atmospheric Administration; the Department of Agriculture's Agricultural Research Service; the U.S. Army Corps of Engineers; and the Environmental Protection Agency.

Within the Department of the Interior, four agencies spent $139 million on scientific activities. The U.S. Geological Survey spent over half of the Interior funding, or $77 million, primarily on its Placed-Based Studies Program, which provides information, data, and models to other agencies to support decisions for ecosystem restoration and management. The

National Park Service spent about $48 million for the Critical Ecosystem Studies Initiative (CESI), a program begun in 1997 to accelerate research to provide scientific information for the restoration initiative. The National Park Service used CESI funding to support research (1) to characterize the ecosystem's predrainage and current conditions and (2) to identify indicators for monitoring the success of restoration in Everglades National Park, other parks, and public lands and to develop models and tools to assess the effects of water projects on these natural lands. Of the remaining Interior funding, the Fish and Wildlife Service and the Bureau of Indian Affairs spent $10 million and $3 million, respectively.

Four agencies spent the other federal funds—$134 million. The Corps of Engineers and the National Oceanic and Atmospheric Administration spent approximately $37 million each, primarily on research activities. Two other federal agencies—the Agricultural Research Service and the Environmental Protection Agency—spent the remaining $60 million in federal funds.

In addition to the $273 million spent by federal agencies, the State of Florida's South Florida Water Management District provided $303 million for such activities from 1993 to 2002. The District spent much of its funding on scientific activities related to water projects in line with its major responsibility to manage and operate the Central and Southern Florida Project and water resources in the ecosystem.

With these federal and state expenditures, scientists have made some progress in developing scientific information and adaptive management tools. In particular, scientists now better understand the historic and current hydrological conditions in the ecosystem and developed models that allow them to forecast the effects of water management alternatives on the ecosystem. Scientists also made significant progress in developing information on the sources, transformations, and fate of mercury—a contaminant that affects water quality and the health of birds, animals, and humans—in the South Florida ecosystem. Specifically, scientists determined that atmospheric sources account for greater than 95 percent of the mercury that is added to the ecosystem. In addition, scientists made progress in developing (1) a method that uses a natural predator to control Melaleuca, an invasive species, and (2) techniques to reduce high levels of nutrients—primarily phosphorus—in the ecosystem.

Gaps Remain in the Scientific Information Needed for Restoration

While scientists made progress in developing scientific information, they also identified significant gaps in scientific information and adaptive management tools that, if not addressed in the near future, will hinder the overall success of the restoration effort. We reviewed 10 critical restoration projects and plans and discussed the scientific information needs remaining for these projects with scientists and project managers. On the basis of our review, we identified three types of gaps in scientific information: (1) gaps that threaten systemwide restoration if they are not addressed; (2) gaps that threaten the success of particular restoration projects if they are not addressed; and (3) gaps in information and tools that will prevent restoration officials from using adaptive management to pursue restoration goals.

An example of a gap that could hinder systemwide restoration is information on contaminants, such as fertilizers and pesticides. Scientists are concerned that the heavy use of fertilizers and pesticides—which are transported by water and soil and are deposited in sediments—near natural areas in South Florida increases the discharge of chemical compounds into these areas. Contaminants are absorbed by organisms such as aquatic insects, other invertebrates, and fish that live in the water and sediment, affecting the survival and reproduction of these organisms and those that feed on them. Scientists need information on the amount of contaminants that could be discharged into the environment, the amounts that persist in water and sediment, and the risks faced by organisms living in areas with contaminants—even low levels of contaminants on a long-term basis. If this information is not available, scientists cannot determine whether contaminants harm fish and other organisms or whether the redistribution of water will introduce potentially harmful contaminants to parts of the ecosystem that are relatively undisturbed.

An example of a gap that could hinder the progress of a specific project is information needed to complete the Modified Water Delivery project, which has been ongoing for many years and has been delayed primarily because of land acquisition conflicts. The Modified Water Delivery project and a related project in the Comprehensive Everglades Restoration Plan are expected, among other purposes, to increase the amount of water running through the eastern part of Everglades National Park and restore

the "ridge and slough" habitat.[4] However, scientists identified the need for continued work to understand the role of flowing water in the creation of ridge and slough habitat. If the information is not developed, the project designs may be delayed or inadequate, forcing scientists and project managers to spend time redesigning projects or making unnecessary modifications to those already built.

An example of a gap in key tools needed for adaptive management is the lack of mathematical models that would allow scientists to simulate aspects of the ecosystem and better understand how the ecosystem responds to restoration actions. Scientists identified the need for several important models including models for Florida Bay, Biscayne Bay, and systemwide vegetation. Without such tools, the process of adaptive management will be hindered because scientists and managers will be less able to monitor and assess key indicators of restoration and evaluate the effects created by particular restoration actions.

The Restoration Initiative Lacks an Effective Means to Coordinate Scientific Activities

The Water Resources Development Act of 1996 requires the Task Force to coordinate scientific research for South Florida restoration; however, the Task Force has not established an effective means to do so, diminishing assurance that key scientific information will be developed and available to fill gaps and support restoration decisions. The SCT's main responsibilities are planning scientific activities for restoration, ensuring the development of a monitoring plan, synthesizing scientific information, and conducting science conferences and workshops on major issues such as invasive species and sustainable agriculture. As the restoration has proceeded, other groups have been created to manage scientific activities and information for particular programs or issues, but these groups are more narrowly focused than the SCT. These groups and a more detailed discussion of their individual purposes appear in appendix I.

[4] This habitat contains slightly elevated, north-south ridges dominated by sawgrass, interspersed with sloughs, which are open water areas with sparse vegetation. It may also have "tree islands," which have woody vegetation more suited to dry areas than wetlands and serve as important habitat for some species. High water levels have destroyed many tree islands, areas that scientists and others seek to restore.

Although the Task Force created the SCT as a science coordination group, it established the group with several organizational limitations, contributing to the SCT's inability to accomplish several important functions. Specifically, the Task Force did not:

- *Provide specific planning requirements, including requirements for a science plan or comprehensive monitoring plan*. A science plan would (1) facilitate coordination of the multiple agency science plans and programs, (2) identify key gaps in scientific information and tools, (3) prioritize scientific activities needed to fill such gaps, and (4) recommend agencies with expertise to fund and conduct work to fill these gaps. In addition, a comprehensive monitoring plan would support the evaluation of restoration activities. This plan would identify measures and indicators of a restored ecosystem—for all three goals of restoration—and would provide scientists with a key tool to implement adaptive management.
- *Establish processes that (1) provide management input for science planning and (2) identify and prioritize scientific issues for the SCT to address in its synthesis reports*. Scientists and managers have both noted the need for an effective process that allows the Task Force to identify significant restoration management issues or questions that scientific activities need to address. In addition, a process used to select issues for synthesis reports needs to be transparent to members of the SCT and the Task Force and needs to facilitate the provision of a credible list of issues that the SCT needs to address in its synthesis reports. One way that other scientific groups involved in restoration efforts, such as the Chesapeake Bay effort, address transparency and credibility is the use an advisory board to provide an independent review of the scientific plans, reports, and issues.
- *Provide resources for carrying out its responsibilities*. Only two agencies—the U.S. Geological Survey and the South Florida Water Management District—have allocated some staff time for SCT duties. In comparison, leaders of other large ecosystem restoration efforts—the San Francisco Bay and Chesapeake Bay area efforts—have recognized that significant resources are required to coordinate science for such efforts. These scientists and managers stated that their coordination groups have full-time leadership (an executive director or chief scientist), several full-time staff to coordinate agencies' science efforts and develop plans and reports, and administrative staff to support functions.

To improve the coordination of scientific activities for the South Florida ecosystem restoration initiative, we recommended in our report—released today—that the Secretary of the Interior, as chair of the Task Force, take several actions to strengthen the SCT. First, the plans and documents to be

produced by the SCT should be specified, along with time frames for completing them. Second, a process should be established to provide Task Force input into planning for scientific activities. Third, a process—such as independent advisory board review—should be established to prioritize the issues requiring synthesis of scientific information. Finally, an assessment of the SCT's resource needs should be made and sufficient staff resources should be allocated to SCT efforts. In commenting on a draft of our report, the Department of the Interior agreed with the premises of our report that scientific activities for restoration need to be better coordinated and the SCT's responsibilities need to be clarified. However, Interior noted that the Task Force itself will ultimately need to agree on the actions necessary to strengthen the SCT. Although Interior agreed to coordinate the comments of the Task Force agencies, it could not do so because this would require the public disclosure of the draft report.

Mr. Chairman, this concludes my formal statement. If you or other Members of the Subcommittee have any questions, I will be pleased to answer them.

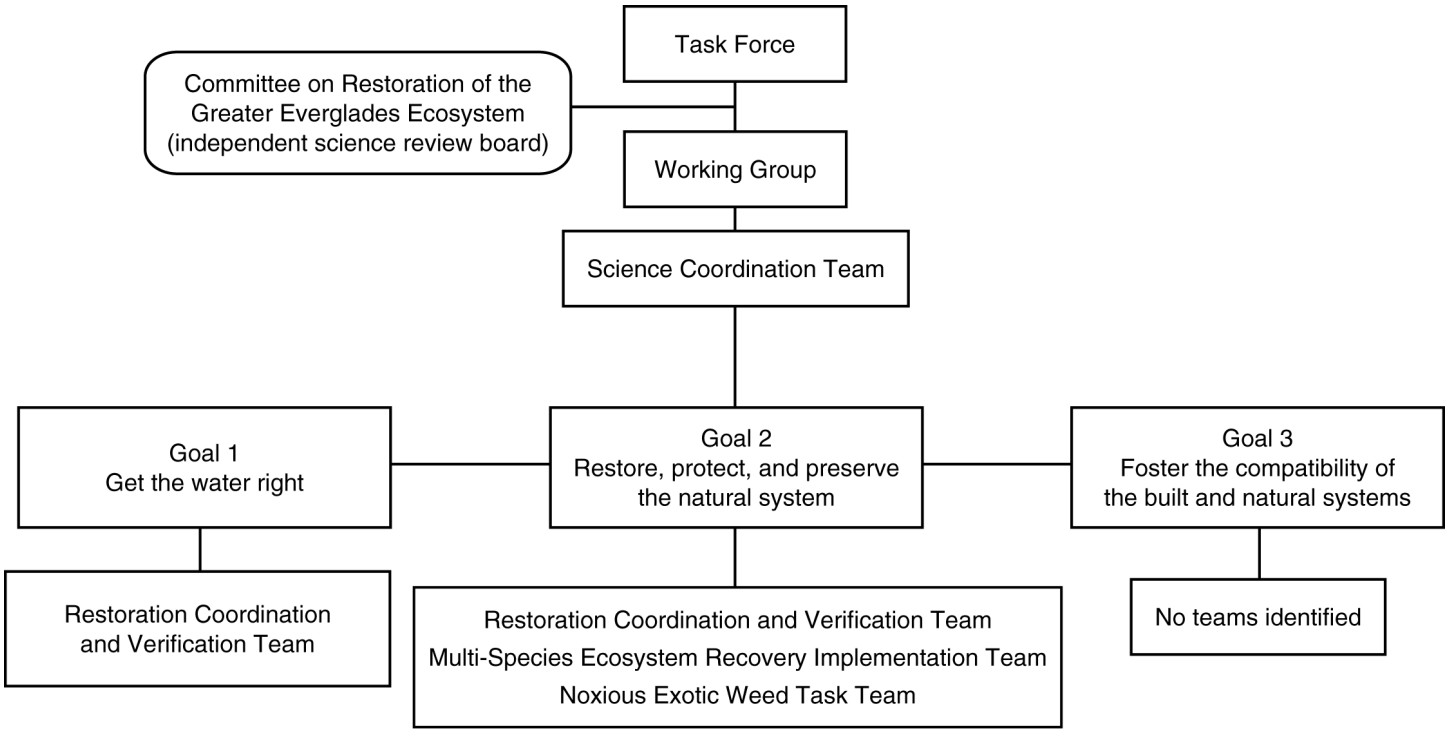
Contact and Acknowledgments

For further information on this testimony, please contact Barry T. Hill at (202) 512-3841. Individuals making key contributions to this testimony included Susan Iott, Chet Janik, Beverly Peterson, and Shelby Stephan.

Appendix I: Groups Responsible for Coordinating Scientific Activities for the South Florida Ecosystem Restoration

The South Florida Ecosystem Restoration Task Force (Task Force) and participating agencies have created several groups with responsibilities for various scientific activities. One of these teams—the Science Coordination Team (SCT) created by the Task Force—is the only group responsible for coordinating restoration science activities that relate to all three of the Task Force's restoration goals (see fig. 4).

Figure 4: Groups Responsible for Coordination of South Florida Ecosystem Restoration Science



Source: Task Force (information), GAO (presentation).

Other teams that have been created with responsibility for scientific activities include the Restoration Coordination and Verification (RECOVER) program teams, the Multi-Species Ecosystem Recovery Implementation Team, the Noxious Exotic Weed Task Team, and the Committee on Restoration of the Greater Everglades Ecosystem (CROGEE). As shown in figure 4, each of these teams is responsible for scientific activities related to specific aspects of restoration.

First, the U.S. Army Corps of Engineers and the South Florida Water Management District created the RECOVER program to help implement their Comprehensive Everglades Restoration Plan, which is a conceptual

plan for improving the quality, quantity, timing, and distribution of water in the South Florida ecosystem. The plan will primarily help to achieve the first restoration goal to restore the flow of water in the ecosystem but will also help to restore wetland habitats affected by water management—part of the second restoration goal. The program is responsible for assessing, monitoring, and evaluating progress in implementing the plan. As part of this responsibility, the RECOVER program teams are to ensure that scientific information is available to make decisions on the effects of the plan on the ecosystem.

Second, the Multi-Species Ecosystem Recovery Implementation Team (MERIT) is a multiagency, multiparty implementation team created to help implement the U.S. Fish and Wildlife Service's Multi-Species Restoration Plan, which is to recover species that are threatened or endangered under the federal Endangered Species Act. MERIT is responsible for identifying and prioritizing actions that can be taken to help recover 68 threatened and endangered species in South Florida.[1]

Third, to coordinate and implement scientific information on invasive species, the Task Force created a team called the Noxious Exotic Weed Task Team, which has written a strategy to coordinate the actions of multiple agencies in South Florida to deal with invasive plants. The Task Force plans to create another team to address invasive animals.

Finally, the Task Force worked with the National Academy of Sciences to form the CROGEE, which is responsible for providing the Task Force with independent scientific and technical reviews for several elements of the restoration, including restoration of marine areas and ecological indicators. The CROGEE was created in 1999 and existed prior to the passage of WRDA of 2000, which authorizes the creation of an independent scientific group to review progress toward achieving the goals of the Comprehensive Everglades Restoration Plan and to assess and report to Congress on the ecological indicators and other measures of progress in the plan. The Secretary of the Army, the Secretary of the Interior, and the Governor of Florida plan to jointly establish the independent scientific review provisions of WRDA 2000 by entering into a 5-year contract with the National Academy of Sciences.

[1] Currently, 69 plant and animal species that are native to the ecosystem have been federally listed as threatened or endangered. Sixty-eight of these species were listed by the Fish and Wildlife Service and one was listed by the National Oceanic and Atmospheric Administration.