RESTORATION PROCEDURES MANUAL FOR PUBLIC LANDS IN FLORIDA

Prepared by

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INTRODUCTION

OVERVIEW

Why--This restoration procedures manual was born from a recognized need for a synthesis of the best available science on planning and implementing restoration projects. The purpose of this manual is to guide and establish standards for identification, planning and coordination of restoration projects on public land sites in Florida. The instructions provided will show stewards of Florida's public lands how to develop and proceed with well-thought-out restoration strategies and plans. You will understand how to evaluate the contributions these projects make to the overall ecological health and integrity of Florida's natural ecosystems. This will in turn enable you to create or take advantage of opportunities to accomplish restoration.

What--By restoration, we generally mean *ecosystem restoration*, that is, the re-establishment of ecological functions, natural processes and native communities (plant and animal) on degraded lands. More specific explanations of terminology and the state of the science are found later in this introduction. Terms in *italics* the first time they appear are defined in the glossary. This procedures manual will help you identify potential restoration projects, determine if they are ecologically and economically feasible, and develop detailed plans to accomplish them. In general, each step of the planning process is approached from the standpoint of the common denominators for all projects. In some cases, these common factors are followed by elaboration on variations for specific situations and project types. The manual has five components:

1. The first section is a Stepwise Rapid Assessment to allow you to quickly determine if you have a suitable project and if so, what it will take to develop a restoration plan for it.
2. The second section is a detailed explanation of the planning process, with seven distinct phases: 1) site selection and suitability analysis, 2) site assessment, 3) restoration alternatives development, 4) plan development, 5) defining success, 6) planning the future and 7) estimating costs. Each phase is explained in detail and illustrated with examples.
3. The third component of the manual is an explanation and checklist for the Restoration Project Package. This packet is designed to contain all information necessary for typical government grant, foundation or mitigation solicitations. The Restoration Project Package will also contain details required by regulatory agencies for implementation permits. Once developed, the Restoration Project Package will be the perfect tool to quickly submit project information or proposals for funding opportunities. It can also be used to define a specific deliverable expected from a consultant, contractor or private mitigation banker.
4. The fourth section discusses some basics of implementation, touching on the subjects of funding, permitting, coordination and contracting. This chapter is a guide rather than detailed instructions, as many of these activities are governed by agency policies. This section provides helpful suggestions for

carrying out the plans that will result from applying this manual.

5. The final section contains ancillary information and includes a bibliography, list of information sources, glossary and appendices.

Who--Appendix A lists agencies in Florida, including federal agencies and municipalities, that have responsibility for management of public lands. We recommend that state land managers, district technical staff and agency planners begin to apply this process to all potential restoration projects on sites within their jurisdiction. Managers can also use the manual as a set of guidelines and standards for consultants, private mitigation bankers and contractors with whom the state collaborates to accomplish restoration on state lands.

Where--The scope of this manual covers potential restoration activities on all lands held in trust by the state for the citizens of Florida, regardless of which agency manages them. Appropriate projects are those in which the disturbance is significantly affecting the natural functioning of the site. Examples include (but are not limited to): degraded freshwater wetlands (both isolated and connected), areas affected by regional hydrologic alterations, pastures, impacted estuarine areas and their adjacent uplands, disturbed forest lands, and sites dominated by exotic species. Appendix B lists a number of Florida public lands projects presently identified as having restoration potential or with activities planned or implemented.

When--State, regional and agency planning staff can begin now using the site selection suggestions to rank restoration opportunities within each region and identify resources necessary to develop detailed plans for the highest priority projects. Site and field technical staff can begin now to assemble information required to evaluate previously identified projects and produce restoration plans for them. Time limitations and work loads may allow you only to assemble the pieces for developing a detailed restoration plan but not actually apply the planning process until a need arises. A drawback of this approach is that there may not be sufficient time when the opportunities come, to do the careful thinking required for a good plan. We recommend that you begin applying the stepwise planning process presented here to highest priority projects prior to becoming aware of potential funding or implementation opportunities. Adequate time for planning will result in a better product in the long run and improve your odds of securing the funding or support that you seek. A potential alternative is to hire a consultant to do the planning, with this manual as guidance.

How--The step by step approach, accompanying checklists, worksheets, gray box examples and supplemental appendix materials are meant to make application of this manual and development of the Restoration Project Package as simple, swift and successful as possible. For a quick evaluation to determine if your project is viable and what is necessary to develop a Restoration Project Package, use the stepwise rapid assessment in the beginning of the manual. For detailed instructions and examples on each step in the planning process, walk through the main text of the manual. Extra copies of all the manual's forms, worksheets and checklists can be found in Appendix C. We recommend using these as a copying template to provide forms for each new project.

THE RESTORATION PROCESS AT A GLANCE

Select Site ⇩

- Take a big picture look, see what has been lost in the region
- Identify potential sites, select the most ecologically sustainable, regionally compatible and physically feasible
- Set overall project goal and vision

Site Assessment ⇩

- Current conditions and resources
- Historical conditions and resources
- Land use and perturbations

Restoration Alternatives ⇩

- Identify cause of perturbations
- Develop restoration alternatives
- Evaluate and choose from alternatives

Develop the Plan ⇩

- Action plan based on chosen alternative
- Integrate plan with existing activities
- Fatal flaws analysis, review

Define Success ⇩

- Success criteria (from objectives)
- Monitoring program
- Reporting and evaluating

Plan the Future ⇩

- Long-term management issues
- Ensuring protection and maintenance
- Contingency planning

Estimate Costs ⇩⇩⇩

- Standard and often underestimated costs
- Restoration budgets
- Tracking expenses

Restoration Project Package

- Product of planning process
- Uses for package
- Checklist

Implementation ⇓

- Funding
- Permitting
- Coordination and Contracting
- Adaptive Management

Successful Restoration ☺

BACKGROUND & TERMINOLOGY

Why restore? Over 100,000,000 acres of historical wetlands have been lost in the contiguous United States (National Research Council 1995). These areas provided important *ecological functions* to humans, including groundwater recharge (water supply), groundwater discharge, flood storage, shoreline anchoring, sediment trapping and nutrient retention (water quality), food chain support, fisheries habitat, wildlife habitat and recreation (Erwin 1990). Coastal wetlands provide storm protection and contribute to erosion/accretion processes. We witness the effects of the loss of wetlands throughout the country in the form of severe floods, water shortages and pollution and contamination problems.

Untold acres of upland natural communities have been converted to urban, disturbed or agricultural uses. These converted areas do not provide the same ecological services, such as aquifer recharge and wildlife habitat or recreational value, that the natural system provided. In addition, construction of linear obstructions (roads, fences) and conversion of natural areas often leave adjacent patches too small or unconnected to provide adequate habitat for wildlife, especially to species with large home ranges. Restoration of former natural areas that have been minimally to moderately disturbed can re-establish some of the historical capacity of these areas to contribute to overall ecosystem processes.

> *Ecological restoration is the art and science of recreating viable natural or ecological communities. It means returning a specific area to its pre-disturbance condition, including both functional and structural characteristics. Ecological restoration is large and allows a community to evolve and natural selection to occur. In ecological restoration, we seek not to "preserve" a static entity but to protect and nurture its capacity for change.*
>
> (Harker et al. 1993)

What do we mean by restoration? The primary goal of ecosystem restoration is to "provide self-sustaining ecosystems that closely resemble natural systems in both structure and function" (Zedler 1997). This may be easy to state, but "experience shows that restoration sites do not function as well as natural systems" (Zedler 1997). However, with rapidly improving technology and knowledge, careful planning, a good approach and expert implementation, we have a pretty good chance of sustaining the functions most critical to maintenance of *ecological integrity*.

For something to be restored, it must first have existed in an undisturbed state, either as a wetland, natural community or ecological feature. At some point it became damaged, usually as a result of some action by humans. We refer to these disturbances as *perturbations* or *impacts*. *Restoration* is the process of returning the site, which is in an altered state due to the perturbation, back to its original condition. In the case of wetland restoration, this means returning a former wetland (that no longer functions as a wetland) to a condition that supports wetland processes and would be delineated as a wetland.

Enhancement is similar to restoration and refers to improvement of an area that has not completely lost the characteristics of its natural state, but is under stress from some disturbance. The enhancement activity seeks to increase specific ecological functions or value of the site by relieving the stress on the system. Examples of enhancement include reestablishing natural water level fluctuations or depth within a wetland whose water levels have been manipulated, or reintroducing fire into a fire-climax natural community that has been fire suppressed. *Wetland creation*, on the other hand, is establishing a functioning wetland in a place where a wetland never existed.

In some cases, especially in upland areas that have been intensively disturbed, it may not be practical or possible to re-establish natural processes and communities to restore the site to its historical condition. The best that can be hoped for may be to create a new community that contributes similar or other valuable natural functions. This is usually referred to as *rehabilitation*. An example is the conversion of a citrus grove that was historically rosemary scrub to a planted pine/wiregrass community that at least provides wildlife habitat to native species and carries fire.

The differences among these terms become especially important in understanding the field of *mitigation*. Mitigation is the process of lessening, compensating for or offsetting impacts to wetlands or endangered species habitat that will result from development (or some other action). Regulatory agencies that oversee protection of these resources require that development projects first avoid and minimize impacting the resources, and second provide adequate replacement of the functions that will be lost by impacts to areas that cannot reasonably be avoided.

This replacement of function, or *mitigation*, can include: 1) creation of an equivalent wetland type or habitat (usually on the same site on which it is being lost), 2) restoration of a damaged system that historically provided those same functions, 3) enhancement of a stressed system that provides the functions, or 4) a combination of these types. In some cases, such as in *mitigation banks* or large offsite mitigation projects, *preservation* of natural systems is also given consideration in as much as it contributes to the restored or enhanced areas that it surrounds.

Example of restoration activities

You have a large bayhead wetland on an historic cattle ranch that has been drained by a large ditch to provide cattle with access to forage for more of the year. The wetland is surrounded on two sides by improved pasture and on two sides by pine flatwoods. You want to restore the site, so you first review historical aerial photos to determine pre-disturbance conditions. You decide that filling the ditch will remove the perturbation of altered hydrology and *enhance* the part of the wetland that is existing in a stressed state. *Restoration* of the former wetland edges of the system that have become dominated by upland vegetation as a result of the altered hydrology will involve restoring the hydrology by filling the ditch and reintroducing growing season fire to reduce the woody invaders. You hope to *preserve* the intact pine flatwoods around the wetland by actively *managing* them using growing-season fire. It will not be possible to completely recreate the historical pine flatwoods as a functioning natural community in the improved pastures, but you propose to *rehabilitate* the area by *creating* some ephemeral and seasonal wetlands and planting native flatwoods species around the wetlands after you reduce the exotic sod cover. This area will require long-term *maintenance* to control invasive exotic and native pest plant species. You hope to be able to generate ecological benefits (improved functions) from the project and sell them as credits as part of a *mitigation bank* or large offsite *mitigation project*. You plan, permit and implement your restoration project, *monitoring* it to demonstrate success and track permitted activities.

In general, a good approach to restoration attempts to foster conditions in which *ecological processes* can proceed uninterrupted, eventually (though not always quickly) resulting in a resilient, sustainable, naturally functioning system. This involves determining what historical (pre-disturbance) conditions were and attempting to re-create them. This usually means reversing or removing impediments to natural conditions (in other words, fixing what's broke) or engineering new conditions that allow historical pathways to be re-established.

It is important to look at your project as a dynamic system. Basically, we want to identify and reverse the perturbations that led to the degradation of the area and attempt to predict the most likely response and potential problems. Some restoration efforts attempt to force the area into a preconceived product deemed desirable. Heavy-handed manipulation of the system is more likely to result in unexpected results and a need for perpetual maintenance. Letting nature take its own course often leads to success beyond expectations, though sometimes along an unpredicted pathway.

What actions should be taken to accomplish restoration, enhancement, creation or rehabilitation will depend upon the disturbance being reversed. They may include filling ditches, removing trees, using prescribed burning, excluding cows, excavating spoil or dredge

Success factors for good restoration projects

- ☺ compatibility of adjacent land uses
- ☺ adequate information on site to correctly predict expected response to restoration activities
- ☺ ability to set and achieve attainable objectives to meet goals (e.g. specific hydrologic conditions to restore a wetland)
- ☺ proper pre-construction planning (hydrologic analysis, contour design)
- ☺ appropriate site conditions such as substrate, rooting volume, soil fertility, hydrology, seed bank, etc.
- ☺ construction techniques
- ☺ water quality issues
- ☺ revegetation techniques
- ☺ adequate supervision of construction and monitoring activities
- ☺ control of herbivory and plant (exotics and weedy species) competition for projects involving planting
- ☺ buffers and protection of site
- ☺ long-term management of site
- ☺ adequate monitoring and reporting on restoration progress

Reasons projects failed

- 💣 poor goal setting and planning
- 💣 incomplete evaluation of watershed and regional context
- 💣 incompatible surrounding land uses
- 💣 inadequate knowledge of site
- 💣 improper design (hydrology, planting elevation, slope/drainage)
- 💣 poor supervision of site preparation, construction and planting
- 💣 improper construction techniques, mishandling of plant materials
- 💣 inappropriate substrate or plant materials used in construction
- 💣 improper geohydrology
- 💣 low water quality to restored wetlands
- 💣 failure to maintain site, control exotics and herbivory
- 💣 post-construction impacts (trampling, vehicles, vandalism)
- 💣 no defined success criteria or monitoring program
- 💣 poor monitoring, failure to take corrective actions early
- 💣 lack of long-term management
- 💣 inadequate funding

(From Lewis 1990, Clewell and Lea 1990, Erwin 1990) material, regrading soil, planting native species, killing exotic or nuisance species or any number of other activities. In some cases, these same activities are used to manage a natural system. Restoration activities differ from *management* activities in that they are used to bring about a change in the system rather than to husband and care for a natural area. *Maintenance* generally refers to activities required after restoration is complete, such as exotics control. *Monitoring* is the regular collection of data or information to determine progress toward goals.

A number of other issues and terms are relevant to planning restoration. *Scale* is the relative size or landscape level at which you are working. Ecological processes may vary at different scales, though many processes (like hydrology) are consistent or follow a pattern even across scales. Often however, the larger the scale at which you work, the harder it is to control all the factors that affect restoration. For example, it may be feasible to propose restoration of a 10-acre isolated wetland that has been degraded by a ditch draining it. But if you propose to restore a 10,000-acre watershed that is impacted by large canals that have lowered regional water tables, you will have much greater difficulty developing practical restoration alternatives that will accomplish your goals. Scale is also important in developing and monitoring progress toward success criteria.

Which brings us to another important issue. The land uses on and surrounding a potential restoration site will significantly affect all aspects of restoration. We cannot underemphasize the need to understand as much as possible about what is happening and has happened in the surrounding region. In addition, you need to consider if the results of your restoration will affect the resources, property or uses of adjacent landowners. Any potential negative consequences or liabilities must be anticipated and considered carefully.

At various points during planning, especially early in the process, we recommend that you pause to assess your next course of action or determine if action is even warranted. A number of assessment methods may assist you in this task, so it is worth a moment here to mention some different approaches. A *fatal flaws analysis* allows you to evaluate any number of alternatives and eliminate those that do not meet a set of criteria established at the beginning of the project (such as a cost cap or incompatibility with adjacent land uses). This approach can also be used to decide that no further action is required if the analysis reveals that all alternatives have fatal flaws that eliminate them. Or you may need to re-evaluate your criteria.

A *suitability analysis* looks at a project from an ecological standpoint. This analysis provides the basis for decisions as to whether the project is compatible with existing conditions, will result in a positive ecological contribution and is sustainable. A *feasibility analysis* focuses on the physical and fiscal constraints of each alternative.

One of the first steps of restoration planning is to determine if restoration is necessary or appropriate. Some perturbations are just too severe to be reversible. Some occur in a context where it is impossible to control critical aspects. One aspect of assessing appropriateness involves estimating (at least conceptually) the ecological contributions that will result from the project. We suggest conducting a suitability and feasibility analysis once you identify a site and set the overall project goal.

STEP BY STEP TOWARD SUCCESSFUL RESTORATION:

A GROUP OF WETLAND PROFESSIONALS OFFERS ADVICE ON THE PRINCIPAL STEPS COMMON TO MOST PROJECTS*

Steps	Explanation	How manual addresses
1. Agree upon definitions	Recommend definitions from NRCS Engineering Field Handbook.	We define terms in the **Introduction** and **Glossary** sections.
2. Know what you want	Need a clear vision and set of goals, be specific!	We discuss defining your overall goal in **Site Selection** and objective setting in **Develop a Plan**.
3. Establish an historic baseline	Data need to be gathered to describe and quantify pre-restoration conditions to be able to identify when and what significant benefits are achieved.	Collecting baseline data is a part of the monitoring program described in the **Define Success** step of the **Planning Process**.
4. Identify the overall status of the landscape	A wetland [or any restoration project] cannot be separated from its surroundings. Understand what is going on in the watershed or region around the site.	The regional context of a project is covered in **Site Selection** and referenced in **Site Assessment** and **Plan the Future**.
5. Develop system-wide restoration	To achieve your overall goal, you may have to look outside the boundaries of your project.	The **Site Selection**, **Develop a Plan** and **Implement** sections address work beyond site borders.
6. Include peer and public review	Be open to new ideas, achieve broader acceptance, improve on good work, let knowledgeable people contribute insight and identify potential problems overlooked.	Coordination and collaboration are stressed throughout the **Planning Process** and **Implement** sections.

7. Accept uncertainty	Restoration is not an exact science. Good planning based on the best available information is critical, along with best professional judgment. Adaptive management will help minimize risk.	We attempt to limit uncertainty by providing numerous information sources in the **Planning Process** and tell you how to deal with the unexpected in **Plan the Future**.
8. Employ adaptive management	Unforeseen circumstances must be adapted to. Use new information, new problems, and unexpected events to change/update your plans. View as an opportunity to improve project.	The **Plan the Future** and **Implementation** sections discuss using adaptive management.
9. Avoid quick fixes	Quick solutions are not necessarily best for long term. Look for synergistic opportunities both on the landscape and with cooperators.	Cooperation toward the overall goal is addressed in **Site Selection** and **Implementation**.
10. Explore compatible uses	A restored area does not necessarily need complete protection from use. If appropriate, identify and implement compatible uses that maintain the functions of the restoration but provide additional returns to people.	**Develop a Plan** discusses integrating appropriate activities.
11. Monitor and document results	Monitor progress towards achieving goals established early in the process in order to document success, maintain support, increase understanding and apply adaptive management.	**Define Success** deals with monitoring and documenting restoration results.

*Based on Melanson and Whitaker (1996)

Later in the planning process it may be necessary to quantitatively evaluate the functions to be improved in order to compare restoration alternatives or provide documentation for regulatory review. This may be accomplished by applying a *functional assessment methodology*. This assessment tool was developed to scientifically quantify ecological functions or values assigned by humans to wetlands or other natural areas. Comparison of different functional assessment methods, such as the Hydrogeomorphic (HGM) approach or Wetland Rapid Assessment Procedure are beyond the scope of this manual, but more information on them is readily obtainable from a number of agencies (☞ **Sources of Information**).

The restoration planning process involves identifying and articulating what you want to accomplish with the restoration project and what you want to have when completed. We think developing a set of hierarchical statements (☞ box above) works best, but you may choose another approach.

Components of an Action Plan

Overall Goal (Mission)
Overall Objective (Vision of Success)
- Restoration Goal 1
  - Objective 1.1
    - Strategy 1.1
      - Action 1.1.1
      - Action 1.1.2
        - Step 1.1.2.1
        - Step 1.1.2.2
  - Objective 1.2
      - Action 1.2.1
      - Action 1.2.2

Plans may be developed to different levels of detail. A *conceptual plan* may just include goals and objectives. A *strategic plan* adds strategies for achieving the goals. An *action plan* goes further in defining actions necessary to implement strategies. A *work plan* breaks actions out into tasks or steps and includes timelines and schedules. Choose the appropriate level of planning for your need.

The first thing you need in the plan is your *overall project goal*, which articulates why you are undertaking the project in the first place. It can also be thought of as the *mission* of the project. Are you attempting to improve water quality in the region? Are you connecting large areas of habitat for an endangered species by restoring a connecting corridor? The overall project goal should be stated as a general, big-picture concept. To accompany your overall goal, you need an *overall project objective*. An *objective* is a product or target to strive for and should be measurable. The overall project objective is really the final *vision* for your project, what you want success to look like. It may even help to document it as a picture or map, a portrait or diagram of what you are trying to produce.

Once you have the mission and vision of success for your project explicitly stated, you can go about collecting all the information (*site assessment*) that you will need to develop *restoration alternatives*, which are approaches to achieving your overall goal. Determination of the causes for the current site conditions and how to go about reversing them may be difficult. You will probably need to conduct some type of analysis to select the best restoration alternative.

Based on the selected restoration alternative and information from the site assessment, you can develop a set of restoration goals that will need to be achieved to implement the selected alternative. For each restoration goal you should identify at least one objective (product or target, remember). These will be the measurable outcomes of achieving your restoration goals, and will probably be the basis for *success criteria* set up in your monitoring program. Next, you will attempt to identify the best *strategies* to produce the objective. In some cases, the objective may be so clear-cut that it is not necessary to state a strategy and you can jump to the next level. Finally, you should list specific *actions* that must be taken to implement each strategy. Prior to implementation, it will be necessary to specify concrete *steps* or tasks within each action, and develop a schedule to complete the work plan.

Once you have compiled a site assessment and developed a restoration alternative and action plan, you must complete the planning process by:
1) designing a monitoring program based on the objectives to evaluate success,
2) delineating long-term protection and maintenance measures and 3) estimating costs. All of this information can be compiled into a single document, which we call the **Restoration Project Package**. Now you are ready to proceed to implementation, where you must secure funding, acquire necessary permits, hire contractors, coordinate with all stakeholders, supervise construction, deal with contingencies and emergencies, and practice adaptive management.

Basic Steps of a Restoration Project

1. Seek help from experts
2. Clearly define goals and objectives
3. Conduct a site analysis
4. Develop a site plan
5. Create a detailed restoration design
6. Prepare the site
7. Supervise implementation
8. Control exotic species
9. Establish a plan for monitoring and feedback
10. Develop a plan for long-term management

(Harker et al. 1993)

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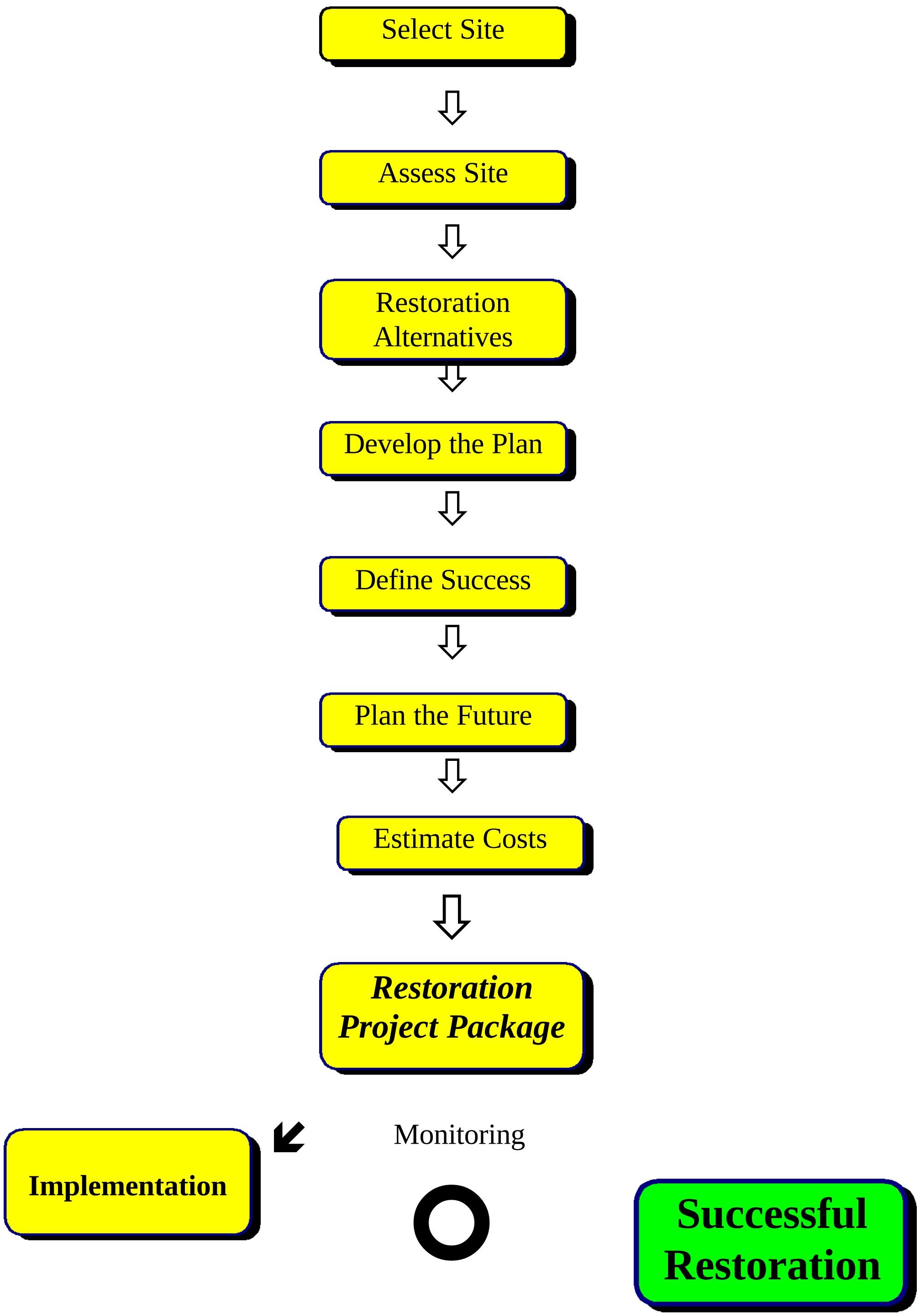
STEPWISE RAPID ASSESSMENT

SUMMARY OF PRIMARY STEPS IN RESTORATION PROCESS



WALKTHROUGH APPLICATION OF RESTORATION PROCESS

In this section, the key leads you through the restoration process step by step, with references to the relevant sections in the main body of the manual where explanations can be found explaining each step.

1. **Select a Site**
   - 1.a. Regional Planning Approach
     - 1.a.i. If your site has been selected through a regional conservation planning process, community planning effort, statewide restoration potential analysis, expert consensus or some other "big picture" effort... *Go to 1b*
     - 1.a.ii. Sites within your region have <u>not</u> been prioritized or selected based on their restoration potential. Coordinate with region or state-level agency staff to confirm that your proposed site is compatible within a regional context (*See* Regional Planning Approaches *on Page 22)*.
       - a) If your site has high priority for the region... *Go to 1b*
       - b) If restoration of this site is not compatible with the regional conditions, will not benefit the region as a whole or is a low priority relative to other projects in the region, resources could best be used in other ways. Restoration is not appropriate for your site at this time… *STOP HERE*
   - 1.b. Conduct a suitability/feasibility analysis by filling out **Worksheet 1** on Page 17 (*See* Judging Suitability Of Your Site *on Page 26*).
     - 1.b.i. If the project is fatally flawed according to the worksheet, proceed no further. Restoration is not appropriate for your site… *STOP HERE*
     - 1.b.ii. If the project is <u>not</u> fatally flawed according to the worksheet... *Go to 1c*
   - 1.c. Set the overall goal for the project and establish a vision of success (*See* Overall Project Goal *on Page 28*). Then... *Go to 2*
2. You have a suitable, feasible project and an overall goal and vision for it. Now **Assess Your Site**.
   - 2.a. Collect detailed information on existing conditions, resources and site issues. Complete Checklist 1, Section A (*See* Current Site Conditions *on Page 32*). Then… *Go to 2b*
   - 2.b. Collect detailed information on historical conditions and resources. Complete Checklist 1, Section B (*See* Historical Conditions *on Page 38*). Then… *Go to 2c*
   - 2.c. Collect detailed information on surrounding conditions, landuses and resources. Complete Checklist 1, Section C (*See* Surrounding Conditions *on Page 38*). Then… *Go to 2d*
   - 2.d. Assemble all of the information, interpret and digest it. Then... *Go to 3*
3. You have assessed your site. The next step is to develop and choose **Restoration Alternatives** that will accomplish the overall goal and produce your vision.
   - 3.a. Identify all potential restoration alternatives (*See* Articulate Restoration Alternatives *on Page* 44). Then… *Go to 3b*
   - 3.b. Evaluate proposed alternatives, using one of several possible methods (*See* Evaluate Proposed Alternatives *on Page* 45). Then… *Go to 3c*

3.c. Based on the results of the evaluation, select the best alternative (*See* Choose the Final Alternative *on Page* 51). Then… *Go to 4*

4. Now you must **Write the Plans** to proceed with the selected alternative.
   4.a. Write on action plan for the chosen restoration alternative, starting with the overall project goal and vision, restoration goals and objectives, and strategies and actions to accomplish restoration goals (*See* Action plan *on Page* 55). Then… *Go to 4b*
   4.b. Develop or contract out development of construction plans to implement restoration actions (*See* Construction plan *on Page* 55). Then… *Go to 4c*
   4.c. Develop an implementation schedule and work plan (*See* Work plan *on Page* 57). Then… *Go to 5*
5. You have the necessary plans to implement. Now identify how you will **Define and Track Success**.
   5.a. Identify an appropriate reference system or standards (*See* Define reference system *on Page* 59). Then… *Go to 5b*
   5.b. Select criteria and environmental variables to monitor progress of restoration (*See* Select criteria and variables to measure *on Page* 61). Then… *Go to 5c*
   5.c. Set performance standards, with appropriate precision intervals and timelines for each variable (*See* Set performance standards *on Page* 60). Then… *Go to 5d*
   5.d. Develop a sampling design and monitoring protocol for the project (*See* Develop Monitoring Design and Protocol *on Page* 64). Then… *Go to 5e*
   5.e. Develop data analysis, evaluation and reporting procedures (*See* Evaluate And Report Progress *on Page* 64). Then… *Go to 6*
6. Now **Plan the Future** of the site (*See* Plan For The Future *on Page* 65).
   6.a. Revise unit management plan to include maintenance of restoration, especially if exotics control is necessary. Then… *Go to 6b*
   6.b. Set up staffing and legal arrangements to cover restoration responsibilities. Then… *Go to 6c*
   6.c. Conduct contingency planning, including what to do if restoration fails or a natural catastrophe disrupts progress or unforeseen events make restoration plans unsuitable. Set up mechanisms to adapt restoration process to these changes. Then… *Go to 7*
7. Everything is in place and you are almost ready to begin restoration. Now accurately **Estimate Costs** so you can budget and control effective implementation (*See* Estimate Costs *on Page* 65).
   7.a. Identify all tasks necessary to implement action plan and list all potential cost items, supplies and materials. Then… *Go to 7b*
   7.b. Quantify result of previous step into measurable units (hours of labor and heavy equipment use, volume of fill, numbers of plants) and get cost estimates or bids for each unit. Then… *Go to 7c*
   7.c. Set up budget with projected expenditures over time (monthly or quarterly). Then… *Go to 8*
8. Compile the **Restoration Project Package** (*See* The Restoration Project Package *on Page* 69). Then… *Go to 9*
9. **Implement** the project
   9.a. Secure funding (*See* Funding *on Page* 71). Then… *Go to 9b*
   9.b. Acquire appropriate permits (*See* Permitting *on Page* 71). Then… *Go to 9c*

9.c. Coordinate with other staff, agencies, adjacent landowners and public (*See* Coordination *on Page* 71). Then… *Go to 9d*

9.d. Set up and manage contracts to complete construction or other activities (*See* Outsource The Work *on Page* 72). Then… *Go to 9e*

9.e. Track costs (*See* Estimate Costs *on Page* 65). Then… *Go to 9f*

9.f. Monitor (*See* Define and Track Success *on Page* 57). Then… *Go to 9g*

9.g. Troubleshoot!

WORKSHEET 1.

QUICK SUITABILITY/FATAL FLAWS ANALYSIS

This is a worksheet of multiple choice questions regarding suitability and feasibility of the project. More detailed discussion about each question appears in Judging Suitability Of Your Site on Page 26. To quickly assess a project's ecological suitability and physical feasibility, answer the 15 questions about the project and then score it based on these instructions: *Questions 1-10 are about primary restoration issues, while Questions 11-15 relate to secondary issues. Primary issues score as follows: a=6, b=4, c=2, d=0. Secondary issues score as follows: a=4, b=2, c=1, d=0. A total score of less than 20 will result in a fatally flawed project.*

Issue	Answer	Score
<u>Primary Issues</u>	Choose most appropriate response	a=6 b=4 c=2 d=0
1. Restoration of this site will contribute to: a) at least 6 ecological functions, b) 3-5 important ecological functions, c) 1 or 2 functions, d) several lesser ecological functions.		
2. In terms of ecological functions, this restoration will result in: a) significant increase in regional capacity, b) measurable increase in region, c) moderate increase or d) qualitative but not measurable increase in ecological functions of the region.		
3. The effect of the restoration will extend to: a) a very large (> 200 square miles) regional area, b) the entire watershed in which the project is located, c) local areas surrounding the project or d) the immediate site only.		
4. The site has been identified by or is completely compatible with: a) greater than 3 regional conservation plans, b) 1-3 plans, c) 1 plan, d) no regional planning product.		
5. The restoration will contribute to increase of ecological functions that are critically limited or impaired in the region: a) to a great extent for a number of functions, b) to a moderate extent for a number of functions or to a large extent for one primary function, c) somewhat for a number of functions or moderately for one primary function or d) only moderately for one function or not at all for any critically impaired functions.		

6. The proposed project fits in with previously established regional restoration and conservation goals: a) to a great extent, b) to a moderate extent, c) slightly, but has its own goals applicable to the site itself, or d) not at all.		
7. Surrounding land uses are compatible with restoration: a) completely, b) for the most part, with areas of incompatible uses on less than 20% of area surrounding the site, c) on 50% to 80% of the area within 1 mile of the site, d) only on 20% of surrounding lands.		
8. Project will be ecologically sustainable: a) almost certainly, b) probably, c) perhaps, d) only with continuous, active influence by managers.		
9. Restoration is financially possible: a) with existing resources, b) with limited fundraising, c) with substantial new allocation or contribution of funds, d) only with significant allocations from unknown sources.		
10. Restoration construction activities are physically feasible: a) in current conditions and plans, b) with minor modifications to existing conditions, c) with substantial modifications to on-site conditions and/or changes in off-site conditions, d) only with detailed planning, major manipulation of on-site conditions and changes in off-site conditions.		
<u>Secondary Issues</u>	Choose most appropriate response	a=4 b=2 c=1 d=0
11. Restoration of the site will: a) be completely compatible with other site goals and activities, with no conflicts, b) conflict to a minor extent for a limited time, c) conflict to a great extent for a short time or to a small extent for a long time period, or d) conflict to a large extent in purpose, area and time.		
12. Resources (staff, equipment, money) to implement the project: a) currently exist onsite, b) can be requested and secured with moderate effort, c) have not been identified but could possibly be secured with effort, d) are unknown.		
13. Based on the best available information and estimates from similar projects, the costs to plan and implement this restoration will be: a) minimal, b) moderate, c) significant or d) astronomical.		

14. There is political support for this project: a) definitely, b) likely, c) unlikely, d) impossible.		
15. The public support for this restoration project is: a) great, b) moderate, c) mediocre or d) nonexistent.		
Total Score		

If your **Total Score** from the worksheet is less than or equal to **<u>20</u>**, your project as you envision it is fatally flawed and does not appear to be suitable for restoration. It may be prudent to abandon planning here, or to completely rethink the scope or location of the project. If your **Total Score** is greater than **<u>20</u>**, please proceed.

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(Write notes on suitability analysis here)

THE PLANNING PROCESS

SITE SELECTION

This section provides some brief guidance for choosing and prioritizing restoration projects. The principle message is take a big picture look. If your site or project has already been selected, you may choose to skip this chapter. However, this section includes helpful information on sources of data that may be useful in planning your project. In addition there are instructions for conducting a suitability analysis on the proposed project and guidance on articulating a project goal. Also, if you are a site manager, you may want to contact regional or state-level staff to learn how your project fits in with others in the region. Priority of restoration sites within an area will be important if you are competing for funding opportunities.

Over 50% of Florida's historical wetlands have been lost. Many of the areas we still recognize as functioning wetlands have suffered some alteration in hydrology or water quality or have been invaded by exotic or weedy plant species. With this legacy of impact, there is no dearth of potential areas where wetland restoration can occur in Florida. As more of Florida is developed, we are also finding it necessary to consider restoring upland natural communities. These restored uplands are important for their contributions to the needs of endangered species, and as linkages and buffers for the larger blocks of protected conservation lands and wetlands.

All restoration is not equal. Some areas will likely respond more readily to restoration efforts than others. Some areas will provide a greater net gain in *functional contributions* than others. Some will be easier to manage long term. In addition, many of our remaining natural systems are isolated and reduced to the point where their long-term viability is in question. It is the tool of restoration that provides the greatest hope for repairing and reconnecting the tattered and beleaguered remnants of our native landscape. No restoration efforts are free. Given these facts, conscious and thoughtful choices of where we will implement restoration must be made.

All natural areas, even disturbed ones, exist within a larger context. They are not isolated landscape features. They persist and maintain maximum health because of multiple complex relationships between diverse plant communities and geological and climatological conditions. In the case of wetlands, they also exist as part of a larger drainage basin. Each natural area unit can contribute both local functions and broader regional functions. We recommend using a regional planning approach to set restoration

Principles in selecting restoration

- Identify and prioritize restoration sites based on their capability to improve the watershed or surrounding region
- Use the best available science to select sites and to design and implement restoration projects
- Involve local people in identifying restoration goals for their watershed or region and implementing restoration projects
- Integrate watershed or regional planning with other landscape planning processes
- Build partnerships with agencies, organizations, businesses, and individuals to establish a broad coalition of restoration cooperators and supporters

(From Foote-Smith 1996)

goals for a region and select and prioritize sites.

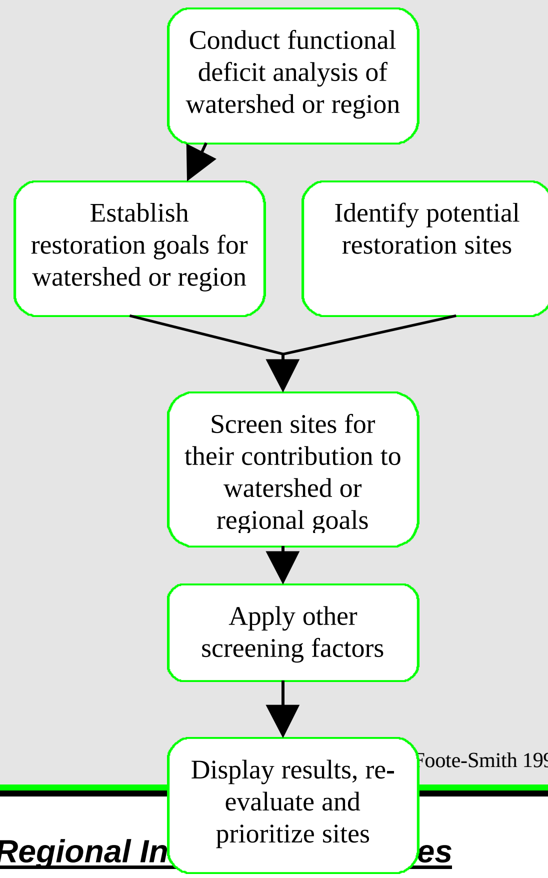
Regional Planning Approaches

You may have already identified a site and developed a valid approach to determining if it is appropriate and cost effective to undertake restoration. But selecting sites based on regional planning promotes first taking a step back and assessing which of all possible sites within a region would contribute the most to what is needed within the context of the entire ecosystem. In this way, priority will be given to those sites that have the greatest potential to improve the health of the region as a whole. It does little good to improve natural functions in one wetland or one small park or preserve if the overall region continues to degrade and decline.

Ultimately, whether restoration occurs or not is usually based on the twin bottom lines, time and money. It is important to ask whether the region as a whole will benefit from this expenditure. If not, should we be spending our limited conservation dollars and time on this site? A regional planning approach will help you determine if the potential benefits of the project justify proceeding with restoration.

There are a number of approaches to regional planning. One uses the analysis of spatial data, usually applying a Geographic Information System (GIS), within a geographically defined area such as a watershed. Another approach is politically based, such as work by regional planning councils. A third approach is that of community planning, which incorporates public input to a great extent. It is beyond the scope of this manual to teach you how to conduct a regional planning process. However, it is likely that one of these types of regional analyses has already been conducted for your area. Please read on for sources of existing regional plans and other information useful in selecting a good restoration site.

Site Identification Framework



Foote-Smith 1996)

Regional In es

Site selection and suitability analyses start with information and a good understanding of the regional context of potential sites. This includes any existing data on feasibility or likelihood of success of your project type. If you have conducted or tapped into an existing regional analysis for your area, you should already understand the regional importance of the site. The more information you base your initial assessments on, the easier your job will be later in making informed decisions on the best restoration strategies, the contributions of your project to regional ecology and appropriate success criteria. This information should give you a feeling for the context of the project in the "big picture". We also recommend that you use this information to conduct a fatal flaws analysis to eliminate projects that are not likely to succeed (☞ **Worksheet 1** on Page 17).

Selection of good restoration projects should start with a long look at different types of spatial data for the region. This will let you size up and compare the value that restoration of different sites will have within a larger ecosystem unit. Examples of good information types that will help you to explore the relationship between your restoration site and the larger watershed include:

- topographic maps
- soils maps
- land cover maps
- road and utility maps
- aerial photographs
- wetlands survey maps
- surface drainage feature maps
- water quality maps
- flood prone area maps
- endangered species location maps
- ownership maps
- development entitlements
- landuse zoning (current and future)
- county comprehensive plans

The following sections describe some basic places to go for these information types and more. In addition, Sources of Information provides you with a list of contacts for much of the readily available spatial data for the state of Florida.

Other staff

If you are not a site manager, one of the first and most important steps is to contact the manager responsible for the site(s) that contains your potential project and open a dialogue. You will probably be partners, at least in the design and planning of the restoration, if not in the actual implementation. In addition, the site staff will provide much of the necessary information and be familiar with crucial on-the-ground aspects. If you are a site manager, you should consider contacting regional or field technical staff that may have skills, time or expertise to contribute to your project. You will need to coordinate with them and rely on them to provide important information on regional processes, agency policies and technical information to which you may not have access.

State agencies

For many parts of the state, regional conservation plans or analyses have already been developed by various state agencies for specific purposes. The best type of plan to assess the regional contribution of your restoration project will be determined by your overall project goal (☞ Overall Project Goal on Page 28), but do not rule out valuable information contained in other plans. For example, if the overall goal for your project is to restore wetlands receiving polluted runoff, you would look for information on improving water quality. The Surface Water Improvement and Management (SWIM) plans developed by the Water Management Districts (WMDs) for areas with identified water quality or quantity concerns will be an excellent source of information.

The Florida Department of Environmental Protection (FDEP) has a Bureau of Information Services. Within that, the Technical Services Map Library is the repository for a large number of base maps in GIS format. The Bureau is responsible for, and actively collects, information on statewide themes such as roads, hydrogeography, hypsography (topography), soils, landuse, public land boundaries, census data, wetlands, water quality issues, land cover, greenways and trails, and wildlife habitat. When beginning a restoration project, consult with FDEP branches that may have the information you need before going to an outside provider. Many regional and field offices already have layers provided to them from this library for their region.

Besides the centralized information available from the Technical Services Map Library, specific program areas have their own datasets. For example, the Florida Marine Research Institute has a collection of marine and coastal data. Check into program areas that are likely to have originated the data you may need before going to the collector of the data.

The WMDs are an excellent source of regional information. Besides SWIM plans, the WMDs have 5-year plans for the Save Our Rivers (SOR) conservation program. This program enables protection of lands necessary for water management, water supply and water resources. The 5-year plans identify priority projects within the region that may include, contribute to or be affected by your proposed restoration. Each District also has a District Water Management Plan. The planning and mapping departments have extensive GIS datasets. Contact the office of public information or the planning department at the headquarters of the WMD (☞ Sources of Information) that your site resides within.

The Florida Game and Fresh Water Fish Commission (FGFWFC) conducted and published an excellent study (Cox et al. 1994) identifying critical habitat protection needs for 30 wildlife species inadequately protected on existing conservation lands and high quality examples of a number of threatened plant and animal communities in Florida. Projects with wildlife habitat enhancement or rare species protection goals should include an assessment of how they correspond to these statewide priorities. In addition, the FGFWFC also has a GIS database with numerous layers and themes that can be provided.

The Florida Greenways Commission made recommendations on creation of a system of corridors of protected open space to be managed for conservation and recreation. A GIS-based coverage that presents recommended trails and other facilities is available from FDEP's Technical Services Map Library (☞ Sources of Information).

> *A regional planning approach is needed to maximize effectiveness of multiple restoration projects in a large area.*
> (Zedler 1997)

Other regional conservation plans and experts

The University of Florida is currently conducting a "gap" analysis as part of their Florida Biological Diversity Project (☞ Sources of Information) to identify habitat important to a large number of species. Information currently available includes a land cover classification map for the state and a wildlife habitat database with species distributions and literature citations for all terrestrial vertebrates in Florida. A product of this study will be a series of maps of hot spots of species richness, i.e. areas where distribution and potential habitat use by many species overlap. Analysis results should be available within the next several years.

There may be a watershed or regional conservation plan completed specifically for your area. For instance, The Nature Conservancy conducted a 2-year study of the Reedy Creek/Lake Marion Creek Watershed in central Florida in order to identify potential restoration areas suitable for the Greater Orlando Aviation Authority to use as mitigation for wetland impacts from expansion of the Orlando International Airport. Rookery Bay National Estuarine Research Reserve (☞ Sources of Information) has developed a Watershed Management Plan for the region surrounding the estuary. A South Florida Ecosystem Restoration initiative is being coordinated by a number of state and federal agencies (☎ SFWMD for info). Contacts from your local, county and state agencies (☞ Sources of Information) will be able to tell you what has been done for your area. There are other sources of regional information available, including the Florida Natural Areas Inventory (FNAI) biological conservation database, which contains element occurrences (rare species or community locations) across the state; Florida data dictionary at Florida State University; and data archives of the GEOPLAN center at University of Florida (☞ Sources of Information). Universities, private and government researchers, and sometimes private consultants may harbor unique expertise on your particular project. Contact the nearest university science or environmental department to see if they have done work on or near your site. Word of mouth may be the best source of information on experts, so do not neglect asking around within your department.

Local governments

Local (county and municipal) governments can provide a wealth of regional information. County zoning and mapping departments are a terrific place to start gathering information. Ask for the county's comprehensive and landuse plans, blueline or regional aerial photos, species lists and any GIS format information they have. Also request the comprehensive regional policy plans, reports, maps, summaries of large development permit activity and any other available information from your local Regional Planning Council (☞ Sources of Information).

Unit management plans

Does a site you have in mind for restoration have a unit management plan? In all likelihood, it does. If you are a site manager, you are already aware (possibly the author) of these site plans. If you are a state-level or regional staff member, one of your first requests of the site managers you contact should be the current site management plans relevant to proposed projects. The plans should include detailed

Scientific principles guiding restoration site selection

- Large systems will have greater potential for sustaining regional biodiversity.
- Good linkages with adjacent ecosystems support greater biodiversity, therefore restoration projects should remove barriers and improve connectivity.
- The restoration site should be located near or adjacent to an existing ecosystem of the same type, because nearby sources of species (plants and animals) offer higher probability for dispersal.
- Small natural areas will have less resilience and resistance to perturbations. It may be better to add on to existing natural areas rather than create or restore small islands of new types.

(From Zedler 1997)

information about the resources and management goals and activities assigned to the public land site. They may even reference or address restoration projects on the site. Any proposed restoration projects MUST be consistent with these existing plans. The site description information in these plans will be essential in the site assessment step of your restoration plan, as well as the suitability analysis. If a unit management plan does not exist for your site, you should consider expanding your restoration plan scope to encompass land management issues.

Judging Suitability Of Your Site

Using the data sources described above and in Sources of Information, *you can use this section to select the highest priority sites in your region or evaluate the suitability of a selected site.*

To maximize our restoration dollars, before we even decide to invest in the restoration of any given area, we must analyze the feasibility and potential for successful restoration at that particular site. If the site was not selected as part of a regional planning effort, it is also important at this point to evaluate the relationship and contribution of the site to the larger watershed or region in which it is found. If you have a number of sites, you can use this analysis to choose the best one.

Though the answers to some of the following questions may seem intuitive or obvious to you, it is none the less necessary to answer each of them before beginning to conceptually plan your restoration project. This will ensure that your project is ecologically suitable and physically feasible. It will hopefully eliminate potential projects that cannot be ecologically justified or are not compatible with surrounding land uses. Use **Worksheet 1** on Page 17 in Stepwise Rapid Assessment to test your project by addressing these issues:

Functional Contribution

Questions 1 & 2 deal with the number and degree of contribution to regional ecological functions. Table 1 lists some functions for both wetland and upland natural areas. Increasing some functional contribution is probably the reason you are proposing the restoration. This should be clearly stated in the overall project goal (☞ next section). However the degree to which the restoration improves ecological functions will vary among projects. A functional assessment is not necessary at this point, as you are just subjectively evaluating the level of regional contributions.

Table 1. Ecological functions of natural areas.

Wetlands	**Uplands**
Flood water storage	Runoff to wetlands
Water quality improvement	Photosynthesis and oxygen production
Wildlife and fisheries habitat	Wildlife habitat
Water supply	Groundwater recharge
Shoreline anchoring	
Sediment trapping and nutrient retention	
Food chain support	Food chain support
Native vegetation	Native vegetation
Buffers and connectors	Buffers and connectors

Regional Contributions

Question 3 concerns the size of the area that will benefit from the restoration. As you would expect, the greater the spatial extent of the restoration effect, the better (Zedler 1997).

Question 4 refers to existing plans developed for the region. Ideally, you have used one or several of these plans to locate your project in the first place. They may include SWIM, SOR, Greenways, Closing the Gaps (Cox et al. 1994) or similar conservation plans.

Question 5 relates to functional deficits that have been identified for a region. For example, it has been documented that Tampa Bay has severe water quality issues, so water quality is a functional deficit for this region. Other areas, such as the Tibet/Butler Chain of Lakes near Orlando, may have extremely limited flood water storage capacity. A watershed or regional analysis may have been conducted to identify these deficits, or you may just have to glean them from existing documents and information.

Question 6 concerns restoration or conservation goals identified for the region based upon any of the previously referenced plans or deficit analyses or studies. These may have been articulated by a state agency or WMD, regional planning council, municipality or university.

<u>Sustainability</u>

Question 7 looks at the compatibility of surrounding landuses. This issue is actually critical to the success of the project, yet is often overlooked, at least initially, in the design of a project. Look at county landuse plans and regional aerial photos and plans to determine both the current and long-term conditions and uses of surrounding lands.

Question 8 goes to the ecological sustainability of the site once it is restored. This includes the minimization of long-term management needs or certainty of maintenance provisions, protection from off-site influences and likelihood that the re-introduced processes and conditions will continue on their own. Areas with high long-term care needs, such as intense and frequent exotic control measures, will not score well on this issue.

<u>Feasibility</u>

The availability and accessibility of financial resources to implement the project are addressed in Question 9. Projects with unknown funding sources should not be considered until these issues are at least examined. Adding the burden of fundraising on top of designing and implementing the project greatly increases the likelihood of success.

Question 10 addresses the physical feasibility of the restoration construction activities. This should include some thought as to the engineering data or information required, or literature review and discussion of ease of implementing similar projects. Projects that require extensive on-site or off-site manipulations to construct will probably become financially ineffective to implement, even if they don't seem so during planning.

<u>Secondary issues</u>

Questions 11-15 address the secondary issues that should be assessed to determine suitability of the project. The degree to which the proposed project is compatible with other site goals and activities (Question 11) will govern how easy it is to implement. Conflicts with other site goals of more that temporary nature, or over a large area or of greatly differing purposes will fatally flaw a project.

Though details of implementation, such as availability of site staff, equipment and financial resources (Question 12), cost estimates (Question 13), information on political (Question 14) or public (Question 15) support may not be known at this stage, they will also contribute to the ease of implementation. Best guesses on how the project fits in these issues will help assess its suitability. If a project is marginal in its ecological suitability (primary issues), these secondary issues will probably deliver the final blow in identifying it as a fatally flawed project.

Overall Project Goal

Once you have selected a site that you think has restoration potential, you must delineate the overall project goal. Accurate articulation of this goal is very important to success of your project! At the same time, or perhaps immediately following, you should establish a vision or picture of what you want success of your restoration project to look like. This vision is your overall project objective and should always be in your mind as you plan the project. Not only will it be the basis for restoration designs, it will allow you to define success criteria and develop monitoring plans to measure progress.

A project may have a number of restoration goals, sometimes nested within each other, but to avoid potential conflicts, one overall project goal should be identified. Though the overall goal may seem obvious to you, it is necessary to establish it up front, to ensure a common understanding of why you are proceeding with the project and to allow you to set realistic, attainable restoration goals and objectives and define measurable success criteria.

Typical goals for restoration projects include creation of wildlife habitat, improvement of water quality, storage of water, reduction of flooding, maintenance of plant and animal diversity, recreation, aesthetics, reduction of landscape maintenance costs, or creation of a representative local ecosystem (Harker et al. 1993).

Common goals for restoration

- offset (mitigate) adverse impacts from activities elsewhere
- create or enhance habitat for fish, waterfowl or other wildlife
- store water for livestock or crop irrigation
- stabilize erosion (estuarine and marine areas especially)
- improve water quality
- increase groundwater recharge
- minimize flood damage by increasing flood storage capacity in restored wetlands
- increase functional contribution or habitat value
- minimize or confine effects of hazardous wastes
- reestablish species composition, structure and function in a damaged natural community
- integration of a disturbed area back into processes of larger ecosystem
- enhance a particular ecological function, such as sediment trapping in a wetland
- leave something wild for future generations
- to recreate "natural beauty"

(From Lewis 1990, Clewell and Lea 1990, Erwin 1990, Zedler and Weller 1990, Whitaker 1996)

CONDUCT A DETAILED SITE ASSESSMENT

This chapter discusses what information is recommended for a site assessment, steps involved in conducting one and various ways of obtaining the information.

A site assessment is the process of collecting and organizing information about the physical/biotic characteristics and the sociopolitical and land management issues of a site to develop a complete resource description. Information is collected about current site conditions, historical site conditions and status of properties adjacent to the site. These data provide a comprehensive foundation from which to proceed with the planning process. This information base feeds directly into the initial steps of developing restoration alternatives - the determination of the causes of observed changes, the exposition of any issues that could constrain the proposed restoration, and the exposition of any benefits that would be realized.

The information collected during a site assessment supports virtually all aspects of the planning process: it is needed to develop and choose between restoration alternatives; it contributes to the early identification of issues that would make the restoration project not feasible, thus preventing wasted time and effort; and it is needed for the design of efficient monitoring programs and can be used to develop more detailed cost estimates.

There are several secondary benefits of doing a written site assessment that can be realized even if the proposed restoration project is not pursued. These benefits include:

- Site managers will have the knowledge of relevant information and its sources.
- Local staff will better understand the site and will be able to provide more complete information to outside inquires.
- The assessment provides a framework in which to summarize existing and organize future information.
- Staff can also use the collected information for annual planning and reporting on land management activities.

Site assessments, while meant to be comprehensive, have a great deal of flexibility in how they are performed. All components should be considered during the site assessment to provide assurance that all issues are addressed and documented in a systematic manner. This helps to minimize the chance that a crucial issue or problem is overlooked. However, depending on the specific situation, each site will have a different level of detail to which it addresses each component. For example, in an area where a few inches difference in topography means a tremendous variation in plant communities, a detailed topographic map product might be needed for restoration. In another case where the entire restoration project area is at the same topographic elevation, other components of the site assessment, such as details of surrounding land use, may require more investment. Each site will have its own list of issues, specific to that site. It is important to complete a comprehensive list. How to assure a complete list will be addressed later in this chapter.

The site assessment may be an iterative process. As decisions are made or new information is acquired, the importance of any one component may increase or decrease. Thus more or higher quality data for that component may be required, or you may choose to de-emphasize a component.

Carrying out a site assessment is part of a continuum of planning for a restoration project. For the purposes of this document site assessment is broken out as a separate step. In reality, it may be that some of the items listed as part of the site assessment were done in the preliminary suitability analysis, or the initial steps of developing restoration alternatives may be done concurrently or before the site assessment work. The planning process is adaptable. It is crucial that a comprehensive examination of issues affecting the restoration project take place.

The answer to the question “What is a complete set of information?” depends on the project. For completeness, this section discusses all the data types that could be needed for a restoration project. Depending on your specific project, some of the information discussed below may not be applicable. However, almost every item will have to be addressed at some level in every project. It is important that each information item be considered and an explicit decision be made as to whether or not its acquisition is needed

The site assessment checklist (**Checklist 1** at end of this chapter) is an aid to ensure that most of the relevant items have been considered. We offer this checklist as a starting point, but you may revise or design your own form. The following are guidelines on how to fill out the form; we suggest you record the status of each topic as one of the following:

<u>Status</u>

- ✓ **Need -** means that this information is necessary for planning and must be obtained.
- ✓ **Have -** indicates the information is in hand and adequate for planning restoration.
- ✓ **Update -** means that some information is in hand but may be incomplete or out of date.
- ✓ **? -** indicates that the existence of or the need for obtaining this information is unknown at this time.

<u>Responsible/Source</u>

The name of the person responsible for obtaining the information, or the source from which the information comes.

<u>Format/Location</u>

This information may specify the media type (paper map, GIS layer) and its location.

Site information can be placed into three categories: current site conditions, historical site conditions and conditions surrounding the site. A complete description of current conditions facilitates planning and assures a common understanding of the site.

The topics identified in this manual as components of a site assessment are also usually required for permit applications. The most likely type of permit that will be required is an Environmental Resource Permit (ERP). This information is required by regulatory agencies to predict future conditions, to anticipate all effects the project will have and to assure the greatest likelihood of success.

Most of the data needed to conduct a complete site assessment probably already exists in the unit management plan, Technical Services Library or other information sources. You just need to assemble and collate it so it is all in one place for easy reference and comparison.

<u>Assembling Information</u>

For the information items discussed below, the following sequence of steps provides an efficient way to acquire the information needed for a complete site assessment.

1. Find out what information you already have
2. Identify the items that are completely missing
3. Are any of the missing items information that is needed for the restoration project? or long-term management? Make a list.
4. Make a list of items that you have in your possession that are of such poor quality or are incomplete. These should be replaced or updated.
5. For each item that is missing or needs to be updated, identify a way to obtain the information and assign the responsibility of obtaining that to a specific person.
6. Establish realistic due dates for obtaining missing or revised materials.

The result of this effort should be a complete set of the information needed to develop a successful restoration plan. The process may be iterative, as you progress in developing restoration alternatives, you may want or need to get better information on a particular topic. There are also no firm lines between steps in the planning process. You may be thinking of restoration alternatives while you are collecting data or even have restoration alternatives in mind right from the start.

It is best to gather the maps that are needed for conservation planning in electronic GIS format. The use of a GIS will facilitate analysis during planning. It will also facilitate the production of graphics needed for permit applications or any other documentation. The FDEP is refining and expanding its GIS capability.

It should be kept in mind that when contracting a consultant to develop completely new data for a project, even if the desired deliverable product is a paper map, the result should be obtained in electronic form as well. For maps, electronic data should be in the most usable format. For example, topographic maps are typically produced as Computer Aided Design (CAD) files. The deliverable you want is the paper map. The deliverable specified to the contractor should be the paper map and the CAD file that produced the map.

If you do not have a CAD program, you will need the data in a generic format. This should provide the X,Y, Z coordinates of each survey point and these can be utilized by other suitable programs. In the rapidly changing world of computer and GIS technology, it is feasible that in the near future the capability to utilize these data will be available, along with an unforeseen need for the data.

If the contractor already has the data, it will take little effort to provide it in multiple formats. If you are unsure in what format to acquire data or are unfamiliar with the correct terminology to use to specify deliverables, contact the Technical Services Map Library (☞ Sources of Information) for guidance. If possible, the paper maps acquired should all be at the same scale to facilitate comparison.

Boundary maps and vegetation maps are perhaps the most useful base layers upon which to develop other information. For example, an access map might show roads, trails, fences and gates and a suitable base map for this would be the boundary map for the site. On the other hand, to show endangered species nest locations, a vegetation map might be more suitable. With GIS, maps can easily be overlain. Boundaries, vegetation, element occurrences as well as other information could be displayed on the same map.

There are several options for organizing the data that are collected during a site assessment. Some options are:

- A spiral bound book with 8.5 x 11 figures
- A spiral bound book with pockets for oversized exhibits or separate exhibits
- A 3-ring binder with pockets for oversized exhibits
- A collection of separate files

One thing to keep in mind is that if these data will have to be submitted as part of an application, a convenient method of storage and delivery should be instituted from the start. However, collecting and organizing information does not necessarily mean that all of it is in one location. The circumstances surrounding the state of the restoration project will dictate the format. If the intent is to apply for funding or a permit, this information will necessarily be bound and collated in some way. If there is no deadline for a submission of this information, the relevant information and documents may only be gathered. The reality may be that only key components are on hand; other information may be in other offices or departments.

What is important is that for each component of the site assessment is that the documentation explicitly state what information is available and its location. Speculation about the existence of particular data ("the survey and mapping department must have survey points along the creek") does not fulfill the purpose of a site assessment. On the other hand, verifying and documenting that the regional office has a signed and sealed 20” by 30” copy of the boundary survey for a site could be considered fulfilling a component of a site assessment.

Current Site Conditions

Within the category of current site conditions, there are 2 broad areas of consideration. The first is site features, which refers to mainly physical features, some of which can change (e.g., vegetation) and some which cannot (e.g., geology). It also includes the nonphysical features, location and boundaries. The second area of consideration are site issues, which may or may not involve physical characteristics of the site. An example of a site issue would be a policy requiring public access to the site that is being proposed for restoration.

We describe site features first and then site issues, but information on both types of topics can be collected simultaneously. In practice, the process of doing a site assessment is flexible and opportunistic. Often the information items are maps that can be combined, with multiple themes on a single map.

Site features that should be considered as part of a site assessment are:

- Location and boundary delineation
- Aerial photographs
- Topography
- Soils/geology
- Hydrology
- Vegetation communities (land cover)
- Wetlands
- Wildlife
- Special elements
- Cultural/historical sites

More detailed descriptions of each are given below, followed by a general discussion of site issues.

Location and boundary delineation

A location map showing the restoration project site in relation to regional features should be developed. This map should be at a sufficient level of detail for a person unfamiliar with the site to find it. Location specified as Township, Range and Sections must also be known. Specifying location in this way is required by the ERP and is a standard notation that can be used to request information. Township, range and section are marked on United States Geologic Survey (USGS) 1:24,000 topographic quadrangles (topo quads), which provide a good base for the location map. A legal description of the site’s boundaries may also be helpful, as well as exact acreages of project parcels.

A good, detailed site map with clearly defined project boundaries is a requirement for a site assessment. A parcel boundary survey, if available, should be obtained. If the site for the restoration project is a subset of land lying within some other surveyed boundary (e.g., a park), a formal survey of the project site may not be available. What is needed in this case is a final delineation of the restoration project site, both on paper and on the ground.

On-paper delineation may involve drawing or digitizing on maps, aerials or GIS layers exactly what the project boundaries are, and also areas that contribute hydrologically, as habitat corridors, buffers or seed sources. On-the-ground delineation can include flagging or collecting Global Positioning System (GPS) points at watershed, wetland or community boundaries. If the project is strictly wetland restoration, a wetland delineation may be performed. Documentation on how the delineation was done should be developed and retained. If done by a professional, it will be part of the survey documents.

Aerial photos

The availability of good current aerial photographs for a project can make all the difference to successful planning. There are many sources of these photos for different parts of the state (☞ Sources of Information). Blueline aerials (large scale paper photos) are an excellent tool for developing field maps; take them out and draw/write on them as you encounter significant features. Smaller scale aerials that cover the entire project are useful for understanding the site and restoration options. The Technical Services Map Library has excellent high resolution digital-ortho-quarter-quads (DOQQ's) for GIS-based planning.

Topography

Site topography can be addressed at different levels of detail. The level of detail needed depends on the nature of the site and type of restoration. For wetland restoration, detailed knowledge of topography is needed to understand ground and surface water flow patterns in order to clearly understand drainage, to design construction activities and to accurately predict area that will be restored. In areas that are relatively flat, 6" contours may be necessary. Information on topography of the project area and contributing hydrologic area is required by the ERP application. For upland restoration, elevation and soil types will be critical to successful planting designs.

Soils

A Natural Resource Conservation Service (NRCS) soils map for the site and vicinity is generally required. Beyond being a requirement for permitting, soils can be used to predict the extent of the restoration area. A site that has predominantly nonwetland plants and hydric soils is a good candidate area for wetland restoration. At a site where extent of historic wetlands is unknown, soils are a good indication of the potentially restorable areas. Undisturbed soils are important in sites where complete recovery of native plant species is a goal.

Soil maps are being digitized into GIS format on a county by county basis. FDEP's Technical Services Map Library is the repository for this digital information. Soil maps are also generally available in paper form from local NRCS offices. If only limited soils information is available and more detailed, accurate data are necessary (*e.g.*, determining extent of historic wetland soils for use in predicting extent of restoration), a soils expert, available from within most state departments or local extension service offices, may be called in.

Geology is most important in Florida because it affects hydrologic processes. See the following section for discussion of relevant issues.

Hydrology

Accomplishing restoration, particularly wetland restoration, often requires that the existing hydrology of the site be modified. This can be the single most critical aspect of a restoration project. You should collect data or gather existing information on important hydrologic parameters to enhance your understanding and ability to predict response of hydrology to restoration activities. Data on existing normal wet and dry season water levels are critical for wetland restoration projects and required for ERP applications. Other hydrologic parameters of great interest are:

- sources (inputs) of water, including ground water, precipitation and inflows
- removals (outflows) of water, including groundwater, drainage, evapotranspiration and natural outlets
- delivery timing and velocity
- volumes of inflow and outflow
- flow type (sheet or channel) and rate
- hydroperiods and inundation depths (or depth to ground water)

- regional hydrologic influences (wellfields, lakes, major canals, control structures, pump stations)

Hydrologic modeling or an in-depth understanding of a site are usually necessary to predict post-restoration normal wet season water levels, which will be needed to determine what effect wetland restoration will have on vegetational community composition and target wetland area. This information may also be used to establish target water levels, which are often used as a success criterion (☞ Establish Success Criteria). The ERP application requires that existing seasonal high water elevations be determined.

Boundaries of existing wetland communities are a good indicator of existing wet season water elevations. The boundaries of transitional communities and/or former wetlands converted to upland vegetation can be used to predict future wet season water levels if historical hydrologic conditions are to be restored. Elevation of community boundaries can be surveyed to determine target water level elevations.

There are a number of hydrologic indicators that can be used to determine average water levels. Some are described and pictured in the “The Florida Wetlands Delineation Manual” (Gilbert et al. 1995). They can be located, flagged and then surveyed to determine existing or historical average high water level elevations.

Hydrology is, of course, very important in wetland restoration. But an understanding of water table dynamics and local hydrology will also be critical to success of upland restoration projects. A disturbed upland area with non-natural hydrologic patterns will be more prone to persistence of exotics and invasive weeds. Restoration of appropriate hydrology and substrate may also be essential to the success of non-wetland restoration.

If possible, you should obtain information on water quality of the site. This is especially true for large wetland restoration projects with offsite water sources, projects in regions with known water quality issues, or projects where high water quality is one of the success criteria. Contact the FDEP Division of Water Facilities for statewide information on water quality (☞ Sources of Information).

Vegetation communities (land cover)

Accurately mapping vegetation communities and land cover types is an important part of planning the restoration project. You will use the current vegetation map to predict the results of the restoration and demonstrate change through the post-restoration monitoring program. Alternatively, you may develop a preferred vegetation conditions map from historical aerials or a desired configuration and then overlay it on the current vegetation map to determine restoration actions needed to produce the change. The current vegetation map can be used as a base map for other maps and exhibits.

If a vegetation map exists, it can be checked by either groundtruthing or looking at recent aerial photography. If no map exists, one can be developed by interpreting aerial photography and then groundtruthing. Depending on the site and existing data, one field visit may be enough to develop a vegetation map. Blueline aerial photos, obtainable from county government planning departments of property appraiser offices, can be used in the field to identify and delineate the vegetative communities.

The vegetation map should use a standard vegetation classification system appropriate for the restoration project. It should clearly show uplands, wetlands and open water areas. The ERP application recommends the Florida Land Use, Cover and Forms Classification System (FLUCFCS) developed by the Florida Department of Transportation (1985) be used for projects submitted to SFWMD, SJRWMD and SRWMD; SWFWMD prefers the National Wetlands Inventory classification system (Cowardin et al. 1979). The FGFWFC also has a vegetation classification system, as does FNAI. The different classification schemes use differing approaches (existing land use versus current vegetation versus natural vegetation/origin versus wildlife habitat). Which system is appropriate will depend on the overall and individual restoration goals of the project.

If the land in question had in the past been included in a Development of Regional Impact (DRI), then a vegetation map (as well as soil maps, drainage maps and other information) can probably be obtained through a regional planning council. Planning councils keep DRI documentation and it is available to the public.

Accompanying the vegetation maps, a site assessment should also include good descriptions of each vegetation community onsite, including condition, dominant species present, acreages and general ecological contributions provided (habitat value, wetland functions).

Wetlands

Wetlands may be mapped as part of the vegetation communities. However, in wetland restoration projects, wetlands will require more detailed information on plant composition and hydrology.

An accurate on-the-ground mapping of existing wetlands will be needed if they are not already mapped. FDEP's Florida Wetlands Delineation Manual (Gilbert et al. 1995) describes the methodology for delineating wetlands types. Wetland delineations can be performed by FDEP or water management district technical staff if formal delineations are needed.

Wetland maps for the entire United States were developed through the USFWS National Wetlands Inventory (NWI) program. These maps, interpreted from aerial photos, have limitations that make them unsuitable for making wetland delineations (Tiner 1997). NWI maps represent the minimum wetlands in an area. Ephemeral wetlands or other wetlands difficult to see on aerial photos may be under-represented. NWI maps are suitable for such things as preliminary assessments, larger scale planning and identifying potential wetland areas.

Wildlife

Documentation of wildlife use of the proposed restoration site should be obtained or developed. The restoration will change vegetative communities and may change the use patterns of wildlife. Knowledge of the existing fish and wildlife habitat of the proposed restoration area and a comparison to expected habitat will be required for permitting.

A species list is typical of the minimal wildlife data usually obtained. Mapping of nests, burrows, rookeries, roosts, sightings or other sign is a second level of information that should be obtained, if possible. Abundance estimates and distribution patterns from organized field surveys are examples of a higher level of information, not available for most restoration projects.

Recording wildlife sightings or signs whenever encountered is a simple way to develop knowledge of the wildlife use at the site. All on-site personnel can contribute to the development of this kind of information simply by recording their observations. Additionally, transects can be laid out to cover diverse vegetation types and walked multiple times to confirm presence of certain species. Lists of technical publications about nongame wildlife and inventory methods are available from FGFWFC's Bureau of

Table 2. Agencies and data source for information on listed species.

FGFWFC	FNAI	USFWS
• Official lists of threatened and endangered flora and fauna. • Eagle nesting data • Guidelines for censusing and habitat improvement recommendations for some listed species; other technical publications pertaining to wildlife • Wildlife observation database • Local/Ad hoc studies	• Special element occurrences or rare species or communities • Maps of CARL, SOR and other managed areas	• Statewide mapping of FL scrub jay territories and habitat • Endangered species regulations and policy information (recovery plans, legislation)

Nongame Wildlife (☞ Sources of Information).

The FGFWFC maintains a wildlife observation database that could provide insight into wildlife use in or around the project area. Number and abundance of different types of wetland or habitat dependent species using an area may be a potential indicator of restoration progress.

Special elements

Special elements generally are plant or animal species that are endangered, threatened, species of special concern or rare. FNAI refers to their documented locations as *element occurrences*. An element occurrence may include sign of a special element, such as a nest or cache. For site assessments, special elements can be vegetative communities that are rare, species that have some special significance to the ecosystem, such as keystone species, or even an onsite population that has special local significance.

Using information from various databases and site reconnaissance, maps of special element locations should be developed so that they are considered in the restoration planning. Listed species utilizing the area in any capacity will be an important permitting and management issue.

Sources of information on special elements include FGFWFC, FNAI and the USFWS (Table 2). Special element locations may have already been mapped at the site as part of the acquisition or management of the site. If not, reconnaissance should be performed to identify or update the listed species that are using the proposed restoration area. The FGFWFC publishes guidelines for censusing some listed species.

A memorandum of understanding (MOU) allows FDEP to request element occurrence information from FNAI for a specific area. This information can be requested by specifying township, range and section or by providing a GIS file with a specific boundary. There is a charge for private consultants requesting this information.

Eagle nest or wildlife observation data can be requested by faxing or mailing a map to the FGFWFC Office of Environmental Services. Eagle nest data are updated annually. The wildlife observation database, which is open to all species, not just protected species, is a database of incidental observations that are reported from a variety of sources and is not updated regularly. The Office of Environmental Services prefers a map or written description of location (e.g., southwest corner of Leon County) to a location specified by township, range and section. They can also accept a request via a GIS boundary file. Responses can be sent with locations on a paper map or as an electronic file.

Cultural and historical sites

The term cultural and historical sites commonly brings to mind sites of important archeological significance, such as Indian middens. Typically these are sites where artifacts of past cultures are found. However, this item is meant to include other sites, such as trees scarred by turpentine collection, historical homesteads, campsites or other physical remains that might be instructive about some aspect of recent history, or have local significance.

Known sites of archeological significance are listed in the Florida Master Site File maintained by Florida's Division of Historical Resources. Checking this source for known historical sites is the minimum level of research that could be undertaken for a restoration project. The Bureau of Archeological Research receives requests to review the Florida Master Site File via phone or fax. Information provided in a request is typically township, range and section or a USGS map on which the project site is delineated. Contracting a cultural resource assessment may be necessary if the proposed restoration site has a very high potential for having significant archeological sites.

As for other more recent, local historical sites, these should be mapped, judged as to their importance and included in the site assessment. Local staff or people who have lived a long time in the area around the project site may have insights into items of historical significance. The Florida Trust for Historic Preservation publishes a directory of local heritage resources organized by organization name, county location and program area.

Site issues

Sites issues include anything that may affect the restoration planning or management of a site. This includes conditions on the site (e.g., presence of exotics, trash piles), physical structures (e.g., buildings, ditches, fences), policies or other obligations that must be met (e.g., public use) and legal questions (e.g., easements). Table 3 shows many of the categories that should be considered when developing a list of site issues. All items in the table should be reviewed and, if they apply, included during planning for restoration. Any other relevant items should be added.

Some issues may have come up in some other contexts. For example, a large area of exotics may have been mapped as part of the vegetation mapping. This information should be included in the site management unit plan.

Physical characteristics are best documented by marking them on a map. In the event that physical site issues are numerous, it may be best to map them using multiple overlay maps, with related site issues grouped together.

All governing documents for the site should be obtained. This will include any guidelines, manuals, memos or documents related to site acquisition, as well as any legal documents that pertain to the property, such as title restrictions, pipeline easements, mineral rights, leases, access easements and flowage easements. These documents must be read with an eye towards how they will affect any planned restoration. Make sure that you take note of any apparent restrictions and be sure to address these in planning.

Table 3. Categories of site issues that should be considered for restoration planning, with issues commonly encountered under each category.

Land Use and Conditions	Physical Structures	Policy Issues	Legal
• Exotics • Trash piles • Dip vats • Trespassing • Poaching • Pastures • Excavated water holes • Spoil piles • Site access	• Existing buildings/facilities • Planned buildings/facilities • Ditches • Fences • Roads • Permanent water sources (open water, hydrants)	• Existing or future policies to which the site must conform • Public use and access • Management policies or guidelines • Obligations that must be met • Large-scale programs or initiatives that affect the site (e.g., a watershed initiative)	• Easements (many types) • Title restrictions • MOUs • Retained rights • Assessments

Policy and legal issues probably will require more effort to obtain than information about physical issues. The key to obtaining a complete picture of all issues is to contact all relevant staff that might have knowledge of the site, even if they have only a narrow field of contact with the site. Legal department and real estate departments should be contacted as well. Leave no stone unturned!

Historical Conditions

Restoration implies the return to some previous condition. It is clear that in many cases these conditions can never be recreated, but only approached. This does not reduce the need for information about past conditions on the site. Knowledge of the previous landuse history, water levels, soils and vegetation communities can contribute to choosing restoration actions that have the greatest likelihood of success.

Probably the best documentation of historical conditions is historical aerial photographs. Historical aerials are available from some county governments, Florida Department of Transportation (FDOT), U.S. National Archives, NRCS, private collections and some universities (☞ Sources of Information). The older the aerial photo, the more likely it is to give the best picture of conditions with the least influence by European settlers. If possible, historical aerials from various time periods should be obtained. This provides a sequence of change, identifying more specifically when changes took place and how long specific conditions have taken to develop.

Historical water levels (average wet season water level) can be determined from the elevation at the upper limit of transitional communities around drained wetlands and presence of organic soils. These elevations may be used as hydrologic targets for restoration success criteria, provided that full restoration of historical water levels can realistically be achieved. If offsite conditions affect the site's hydrology, this may not be possible. The WMDs and other regulatory agencies may have historical water level, flow and water quality data for some water bodies.

Former landowners or local historical knowledge from long-term government agents could also provide insight into past conditions. Inconclusive observations from the field can be corroborated or struck down during a short conversation.

Surrounding Conditions

Because ecological processes are continuous in both time and space, an understanding of what is happening adjacent to the proposed restoration site is critical. This applies not only to physical features but also to land use, political standing and ownership status. Future projections about surrounding land uses must also be considered to try to assure success in perpetuity.

Offsite conditions could impose constraints on what restoration alternatives are developed. For example, a restoration project that causes water flow onto an adjacent property would require consent from the landowner and a recorded flowage easement. There will be substantial difference in stresses on a restoration project that borders conservation land versus one that is adjacent to a housing development. Surrounding well fields can interfere with hydrologic restoration. Application of prescribed fire may be limited by offsite conditions and land uses. Land use may change, so an attempt must be made to discover future plans for adjacent parcels.

Surrounding conditions take on less importance where the restoration project is completely within the boundary of some other tract that is owned and managed by the same organization doing the restoration project. In a case like this, influences from the area surrounding the restoration project site can be more easily controlled.

For restoration sites that are adjacent to water bodies, there may be hydrologic and water quality data available, both current and historical. WMDs or other regulatory agencies may have survey data available as well.

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Checklist 1
Site Assessment

Project Name ______________________ **Project Owner** ______________________

Section A

Existing Site Conditions

	Status	Responsible/Source	Format/Location
Location map & descript/ boundary delineation	________	________________	________
Aerial photos	________	________________	________
Topography	________	________________	________
Soils	________	________________	________
Hydrology/water quality	________	________________	________
Vegetative communities	________	________________	________
Wetlands	________	________________	________
Wildlife	________	________________	________
Special elements	________	________________	________
Cultural/historical sites	________	________________	________

Information gaps ____

Site Issues

Land Use and Conditions/Physical Structures: (exotics, trash piles, dip vats, poaching, access, pastures, man-made water holes, existing or planned buildings, roads, fences, ditches) Make notes and attach additional sheets (maps) as needed.

Site Assessment Checklist - page 2

Policy Issues: (existing or future policies to which the site must conform; management policies or guidelines; obligations that must be met; programs/initiatives affecting the site)

Legal Issues: (easements; title restrictions; MOUs, etc.)

Section B

Historical Conditions

Year	Source	Area Covered	Format/Location
Historical aerial photographs:	________	____________	_____________
Other information (maps, etc.)	________	____________	_____________

Section C

Surrounding Conditions

(ownership of tracts surrounding the project site; current status of adjacent tracts; future development, zoning, etc.)

DEVELOP AND EVALUATE RESTORATION ALTERNATIVES

Overview

There can be different approaches to developing and evaluating alternatives in planning environmental projects. However, the following steps are common to most projects:

1. Identify restoration alternatives
2. Rank alternatives and eliminate fatally flawed ones
3. Choose a final alternative

The quality of data obtained in the site assessment may determine the ease and effectiveness of this process. Site assessment information will be necessary to predict change (determine environmental benefits), estimate costs, and establish successful monitoring. For example, topography and soils data will likely be used in estimating environmental outputs (e.g., acres of restoration). Information about future land use surrounding the project may greatly influence the final choice of an alternative.

Individual circumstances will dictate how alternatives are developed and the method by which they are evaluated. No matter what methodology is used in the planning process, it will require a multidisciplinary team effort to develop and evaluate alternatives.

If you have not articulated an overall project goal and vision, you MUST do so now! Do not make the mistake of thinking it is a *pro forma* exercise to write down the goal. It will direct what restoration actions should be taken as well as the selection of the final alternative. It also influences what success criteria and monitoring efforts will be established. This point is best illustrated by the example described at right. In Florida, the Kissimmee River restoration project staff took years to establish a clear goal for the project. The process, once completed, facilitated the development and evaluation of alternatives.

Kissimmee River Restoration Project Overall Project Goal

The Kissimmee River restoration movement gained strength in the early 1970's, leading to the passage of the Kissimmee River Restoration Act in 1976. This Act established broad restoration goals addressing water management, as did a later executive order issued by then Governor Bob Graham in 1978.

In the years following these legislative acts, the goals for the project expanded to include an array of other environmental values including fisheries, waterfowl, wading birds and wetlands. This posed a challenge for planning restoration as attempts to maximize all of these environmental values led to conflicting objectives.

In 1988, the Kissimmee River Restoration Symposium concluded that an ecosystem perspective was needed to address restoration of lost ecological values, as mandated by various legislative acts. Scientists at the symposium endorsed re-establishment of the *ecological integrity* of the Kissimmee River ecosystem as the primary goal. Ecological integrity was given a specific definition.

This clarification of the project goal enabled scientists and engineers to determine a project vision that would indicate when the goal of re-establishment of ecological integrity had been met. From this, specific hydrologic criteria were developed. These criteria provided the means for evaluating proposed restoration alternatives based on their predicted contribution toward accomplishing the overall goal.

(From Toth 1995)

Articulate Restoration Alternatives

How alternatives are developed will depend on the circumstances of the project. Some approaches include developing criteria that must be fulfilled, asking experts to develop or discuss alternatives, creating combinations of management/construction activities that will achieve the overall goal, or getting alternatives from an outside source (contracting out alternative development). Sometimes all of these approaches are used together.

In a typical restoration project, the following sequence of events is common. First the question is asked, "Given goal X, what are the different actions that can be taken to meet the goal?" A common way to answer this question is to consult experts on ecology, hydrology, or wildlife. The construction and management measures suggested by these experts can then be combined into alternatives, which are evaluated individually.

An example of establishing criteria to develop alternatives would be setting a target water level elevation based on historical water level data. Only alternatives that will meet that criterion are developed.

You may bring in experts to devise alternatives. This approach involves forming a multidisciplinary planning team so that a variety of technical expertise is brought to the problem.

Forming combinations of management and construction actions into alternatives is another common way for alternatives to be developed. Sometimes specific construction activities that will restore an area are readily apparent (e.g., filling existing ditches). Neglected management of an area may also be apparent. Often the causes of change (perturbations) can be determined by studying historical conditions. Anthropogenic activities such as ditches, roads and logging may explain the current landscape patterns.

When causes of change are not obvious, they can often be inferred from biological and ecological conditions on site. Examining historical and current aerial photos, preferably for multiple time periods, can often reveal the time at which visible anthropogenic changes took place and how long it took for particular plant communities to develop. Once causes of change have been identified, the construction and management activities that can successfully reverse or ameliorate them can be identified.

Equally important in this process of identifying restoration alternatives is the recognition of constraints to performing actions that could reverse the changes. For instance, if a road has altered hydrology and caused a reduction in wetland area, one possible action to restore the historical conditions is to remove the road. However, if the road cannot be removed or relocated (for example because of an easement), then that action is not an alternative. The action of installing culverts or low water crossings to restore more natural surface flow might be a viable alternative. By identifying constraints as early as possible, only alternatives that are practical and will facilitate long-term management are developed.

In addition to physical constraints, there may be political constraints that will limit restoration actions and thereby influence the

Because policy choices about resources and environmental quality are made in a political context and are likely to involve comparisons and tradeoffs among variables for which there is no agreement about commensurate values, monetary benefit-cost analysis is not a simple decision rule. [Economics] is simply a tool for organizing and expressing certain kinds of information on the range of alternative courses of action.

(Freeman 1993)

development of alternatives. Neighbors or the general public might object to the use of herbicides or trapping of feral hogs or some other controversial strategy. While such alternatives might not be immediately discarded, clear discussion will reduce the number of surprises later in the project. Applying a fatal flaws analysis again at this point (☞ Judging Suitability Of Your Site on Page 26) will allow you to use these constraints to eliminate alternatives that will not be viable.

Sometimes alternatives are introduced from outside agencies or other organizations In this case, plans need to be evaluated just as alternatives created by the planning team would have been evaluated.

Alternatives should be articulated as a continuation of the hierarchical planning process. Look at the overall project goal and vision and develop a list of restoration goals that would contribute to producing the vision. Then identify the objectives that are the measurable result of each goal. Finally, articulate the strategies or approaches to producing each objective (☞ Restoration Alternative Example below).

Evaluate Proposed Alternatives

The general approach to evaluating restoration alternatives consists of determining the extent to which each alternative meets your established overall project goal (mission) and overall objective (vision), and the extent to which each falls within the constraints that exist (financial, physical, political, ecological). There are a number of different methods that can be used and we present three examples, but each project manager should choose or design his/her own method.

Restoration Alternative Example

Overall Goal (Mission): Create habitat for wetland dependent wildlife.

Overall Objective (Vision of Success): A 10-acre diverse wetland that will provide food chain support for amphibians, birds, aquatic mammals.

Restoration Goal: Create suitable hydrologic regimes.

Objective: An area of open water of approximately 1 acre, with maximum seasonal depths ranging between 12-36 inches, that will provide baseflow of 1 cfs to the adjacent stream during the dry season.

Strategy: Excavate an area of 1 acre to a depth of 3.5 feet below existing grade (12 inches below mean dry season groundwater level), and construct an outlet structure that is 36 inches higher than the maximum depth of open water.

Restoration Goal: Create appropriate vegetation structure and composition.

Objective: Vegetated area around the open water of 3 acres each of emergent, scrub-shrub and forested wetland vegetation classes.

Strategy: Plant appropriate species according to a planting design developed to produce the objective.

Restoration Goal: Ensure suitable habitat for target species.

Objective: Open water and emergent areas that support at least 2 amphibian species and at least one nesting bird species within 5 years; maximum edge habitat and nesting area around open water; upland buffers that provide adequate protection.

Strategy: Grade the open water area so that at least ¼ acre will have water depths sufficient to support the targeted species during critical months, plant species that can support egg masses, develop scalloped edges on open water area, protect a 10-acre upland area around the wetland.

(After Hruby and Brower 1994)

In business, there are straightforward ways to decide between alternatives using standard economic analysis techniques. Typically, cost/benefit analyses are performed and the resulting valuations are used to pick the alternative that maximizes benefits. This approach is useful when the benefits and costs can be quantified in dollars.

However, in restoration and mitigation projects, and for environmental resources in general, benefits often cannot be easily quantified in dollars. Though some economic analysis techniques have been developed to perform this conversion and are appropriate for certain kinds of projects, there is no standard, accepted approach. All approaches have limitations and bias that must be recognized when used to estimate monetary benefits.

On the other hand, estimating costs for environmental planning in monetary terms is, in general, easier than estimating benefits (Tietenberg 1988). The costs for restoration and mitigation projects are costs typical for many other kinds of projects. These include costs for items such as real estate, engineering, construction, ongoing maintenance and operation.

Primarily due to the difficulties in quantifying environmental benefits (e.g., the value of a single species), restoration and mitigation projects often become a political negotiation between groups. Nonmonetary ecological considerations may appropriately be used to make a final decision on restoration; however, making cost-oblivious decisions can lead to inefficient, costly solutions.

Relatively recently, the field of economics has been addressing the problem of evaluating environmental projects. This activity has been motivated by increasing environmental regulation and the growing realization that economics plays a vital role in the valuation of the environment. There are economic analysis methods that can be of benefit in determining cost-effective solutions for environmental projects. They include cost-effectiveness analysis and incremental cost analysis.

These methods do not necessarily lead to an optimal solution. However, they can provide information to negotiate, guide decision making and rule out alternatives that are not cost-effective. Choosing efficient restoration alternatives increases the amount of environmental benefits, by any measure.

Little practical literature is available on how economic concepts and techniques can be used in the decision making needed for restoration or mitigation projects. A well-written and practical set of documents (with software program available) that provides guidance specifically for restoration projects and mitigation planning has been developed by the USACOE's Institute for Water Resources (☞ Sources of Information). These materials were developed to use economic analyses in environmental planning and to elevate environmental restoration to a priority mission in the USACOE's budgetary process (Robinson et al. 1995). The analysis described in these documents can be used to develop and evaluate restoration projects. Even if the procedural steps of the analysis are not used, the concepts and approach they provide could be valuable in restoration planning.

Cost effectiveness and incremental cost analyses

Cost effectiveness analysis and incremental cost analysis are procedures that relate benefits to costs. A cost effectiveness analysis can screen out the alternatives that cost more than others producing the same level of output, thus avoiding the selection of unacceptable alternatives. Incremental cost analysis reveals changes in cost as levels of outputs increase. This gives decision makers a basis for deciding if increases in levels of

Table 4. Cost effectiveness analysis matrix.

PLAN	TOTAL COST ($)	TOTAL OUTPUT (Acres of restoration)
No Action	$ 0	0
Plan **A**	$ 20,000	40
Plan **B**	$ 10,000	40
Plan **C**	$ 15,000	45
Plan **D**	$ 15,000	55
Plan **E**	$ 42,000	105
Plan **F**	$ 40,000	110

restoration activities are worth it. These cost analyses are not meant to lead to the single best solution. Instead they organize information and provide a rational, supportable, focused and traceable approach for evaluating and selecting between alternatives (Orth 1994).

These analyses require a list of solutions (alternatives), and for each alternative, an estimate of the cost and the output. Outputs among alternatives must be measured using the same units and scale [e.g., outputs cannot be expressed as habitat units (output of Habitat Evaluation Procedure) in one alternative and acres of wetland restoration in another]. If more than one environmental output is needed for project planning and decision making, then a separate analysis for each output will be needed.

Table 4 and Table 5 (from Robinson et al. 1995) are designed to illustrate the concepts and outputs of cost-effectiveness and incremental cost analyses. In Table 4 alternatives are highlighted that are not cost effective. Plan A produces the same acreage of wetland restoration at twice the cost of Plan B. Plan C produces the less acreage of wetland restoration at the same cost of Plan D. Plan E produces less acreage than Plan F, at greater cost.

Table 5 shows the various outputs of incremental cost analysis: incremental cost, incremental output and incremental cost per unit of increasing output for each of the cost effective plans from Table 4. This is the basic result that is supplied by incremental cost analysis to decision makers. These data can then be used, along with circumstances specific to the project, to decide on and justify an action plan.

The key to doing both these analyses is to establish consistent environmental outputs between plans. Examples of typical outputs are acres of specific plant communities restored and habitat units. However, any number of outputs are possible; the format will depend on the type of project that is proposed. For instance, reduction of a specific pollutant (as measured in milligrams/liter) in a stream may be the appropriate output for a project. The critical concern is to select a unit of measurement that reflects conditions and changes (Orth 1994).

The level of detail needed to carry out

Table 5. Results of incremental cost analysis.

PLAN	COST	OUTPUT (Acres)	INCREMENTAL COST	INCREMENTAL OUTPUT (Acres)	INCREMENTAL COST PER UNIT
No Action	$ 0	0	Not applicable	Not applicable	Not applicable
Plan **B**	$10,000	40	$10,000	40	$250/acre
Plan **D**	$15,000	55	$ 5,000	15	$333/acre
Plan **F**	$40,000	110	$25,000	55	$455/acre

Performing Cost Effectiveness and Incremental Cost Analyses

Formulation of combinations (create alternatives)	
Step 1. Display outputs and costs	*Steps 1 & 2 may be omitted if*
Step 2. Identify combinable management measures	*alternatives have been developed*
Step 3. Calculate outputs and costs of combinations.	*some other way.*
Cost effectiveness analysis	*Alternatives that produce the same*
Step 4. Eliminate economically inefficient solutions	*or lesser output for an equal or greater*
Step 5. Eliminate economically ineffective solutions	*cost are eliminated.*
Develop incremental cost curve	
Step 6. Calculate average costs	*An optional step if greater detail is*
Step 7. Recalculate average costs for additional output	*needed for decision making.*
Incremental cost analysis	*Progressively compares successive*
Step 8. Calculate incremental costs	*levels of output and their incremental*
Step 9. Compare successive outputs and costs	*costs.*

(From Orth 1994)

cost effectiveness and incremental cost analyses can vary and is project-specific. For example, if a decision is to select among alternative lake water elevations and the elevation differences of a few inches results in hundreds of acres of lands being dry or inundated, a great level of detail would be needed. If in another case it is obvious that alternatives would cost about the same but that one would probably produce more habitat units than the other, a lesser level of detail would be needed to choose between them (Orth 1994). By selecting an appropriate level of detail for the analyses, the analytical effort can be balanced against the information needed to detect meaningful change.

The procedures for these analyses can be divided into a series of specific steps show above. Some of these steps are optional. Regardless of whether or not these analyses are performed, the basic work of designing alternatives, evaluating them, describing project results and estimating costs must be completed. These analyses generally do not constitute additional work for the project. Rather, they are an approach to doing what has to be done.

These steps can be grouped into four tasks: formulation of combinations, cost effectiveness analysis, developing an incremental cost curve and incremental cost analysis.

Under the task Formulation of Combinations there are three steps. These steps refer to the strategy of developing alternatives by combining individual construction and management actions. Table 6 is a simplistic example of a table that could be used to develop alternatives. It shows two management and construction activities and their increments of implementation. Each action is labeled with a letter and each increment of that action is labeled with a subscript. Formulating alternatives then becomes a matter of listing all possible combinations of the actions. From Table 6 we can see that the alternatives become A_1+B_1, A_1+B_2, A_1+B_3, and so forth. Note this applies only to activities that are not mutually exclusive. If activities are mutually exclusive, they cannot be combined to form an alternative! Because a large number of combinations can be generated quickly, use the level of detail that is meaningful.

Formulation of combinations does not need to be performed if alternatives have been generated in some other way. As long as the alternatives adhere to the requirements below, they can be used in the cost effectiveness and incremental cost analyses.

Cost effectiveness analysis, the second task, eliminates alternatives that are either inefficient (alternatives that produce the same output for greater cost) or alternatives that are ineffective (alternatives that produce less output than other alternatives at the same or greater cost). We saw how the data would be laid out in a table to perform this analysis in Table 4.

The third task, developing an incremental cost curve, may not be necessary. It is a level of detail that may be useful depending on the scope of the project and specific circumstances surrounding it. Details of this process are covered in the USACOE Institute for Water Resources report Cost Effectiveness Analysis for Environmental Planning: Nine EASY Steps (☞ Sources of Information). This step eliminates alternatives that have high average incremental costs.

The fourth task of incremental cost analysis produces the result shown in Table 5. This type of information is the culmination of the effort. It is then up to decision makers to decide what incremental costs are "worth it".

Alternatives must be independent and mutually exclusive. That is, an alternative should not be dependent on the implementation of any other alternative or action, and the selection of any alternative should preclude the selection of any other. If individual activities are dependent on one another, then they should be considered together as a single action. A good example of this would be the separate actions of vegetative planting and installing an

Table 6. Example of management and construction increments and combinable activities.

Management/ Construction Action	**Action Increment**	**Outputs (Acres of Restoration)**	**Cost ($)**
A - Construct berm to change water elevations	$\mathbf{A_1}$ - raise water level to 54.0'	20	50,000
	$\mathbf{A_2}$ - raise water level to 54.5'	30	70,000
	$\mathbf{A_3}$ - raise water level to 55.0'	40	95,000
B - Remove encroaching pine trees on wetland edge	$\mathbf{B_1}$ - remove trees on north side	10	10,000
	$\mathbf{B_2}$ - remove trees on north and west	30	20,000
	$\mathbf{B_3}$ - remove trees all sides	40	45,000

irrigation system. The new action of planting and irrigating can be considered a single action.

Estimates of costs and environmental outputs must be measured over the same time period and with the same units. This is either the average annual cost and output or the total cost and total output. Either is acceptable as long as it is consistent throughout the planning process.

Estimates of cost and estimates of outputs should reflect approximately the same level of detail. For example, an extremely detailed cost estimate should not be paired with a rough estimates of the environmental output. Increasing the level of definition, that is, the number of management or construction actions and the various levels of those actions can rapidly increase the number of alternatives to be analyzed. The number considered should be adequate to reveal meaningful changes in outputs and costs, but not so much to produce overwhelming analytical demands (Orth 1994).

Kissimmee River Restoration Project Project Alternatives and Evaluation Criteria

Proposed Alternatives

- Weir alternative
- Plugging alternative
- Level I backfilling alternative (discontinuous backfilling)
- Level II backfilling alternative (continuous backfill, slightly modified)

Hydrologic Criteria for Alternative Evaluation

1. Continuous flow with duration and viability characteristics comparable to pre-channelization records.
2. Average flow velocities between 0.3 to 0.6 m/s when flows are contained within channel banks.
3. Stage-discharge relationship that results in overbank flow along most of the flood plain when discharges exceed 40 to 57 m^3/s.
4. Stage hydrographs that result in floodplain inundation characteristics comparable to pre-channelization hydroperiods, including seasonal and long-term viability characteristics.
5. Stage recession rates on the floodplain that do not exceed 0.3 m/month.

(From Toth 1995)

Criteria method

When specific criteria have been established for the restoration, these criteria can be used to evaluate the various alternatives. This was the case for the Kissimmee River Restoration Project (☞ box at left). Five hydrologic criteria were developed to meet the goal of restoring ecological integrity. These criteria were then used to evaluate 4 alternatives. Physical tests and numerical modeling showed that 3 of 5 hydrologic criteria would not be met by 3 of the alternatives. These findings were part of a fatal flaws analysis that led to the conclusion that 3 of the 4 alternatives would not restore ecological integrity because they could not meet hydrologic criteria (Toth 1995).

A more general example would be an alternative to build a levee to reach a certain historical target water elevation. Hydrologic modeling could then be used to determine whether or not the criteria (target water elevation) can be met.

Pros and cons method

A third, less objective, evaluation method is simply to list the pros (benefits) and cons (constraints or negative aspects) of each alternative, then discuss and compare them. This method will probably be most appropriate for situations in which outputs or differences among alternatives are not clearly quantifiable. As in the other approaches, expert participation or review in the process is essential.

Choose the Final Alternative

After alternatives have been developed, the sometimes more difficult task of choosing among them must be carried out. At this point, expert judgment, outside considerations or negotiated requirements can take on more importance. The information collected during the site assessment about offsite and future conditions and legal and political issues will play an important role here.

Each project will have a unique set of circumstances surrounding it that will influence the selection of the final alternative. A few general guidelines are:

- Include the right staff in the final review of alternatives. Even if a consensus cannot or need not be reached, inclusion of a variety of reviewers can help ensure all relevant issues are raised prior to developing construction-level plans.
- Is this alternative in line with long-term management capabilities and objectives?
- Is this alternative in line with both onsite and offsite legal requirements and any other obligations that must be met?

Even if cost effectiveness and incremental costs analyses are performed and used to reduce the number of alternatives, this does not mean that any possible solution cannot be used. There may be an alternative that has a high incremental cost or even is inefficient but has political or social benefits that must be considered.

There are certain questions that can guide decision making. In some instances, the following criteria may be relevant:

- Output target. Is there some minimum output that must be considered? Examples are a minimum habitat area or patch size needed to support a particular species or a specific number of acres of wetland restoration needed for mitigation.
- Cost. If there is a specific amount of money available for the project? That can be a cutoff for alternatives. (In this situation it is especially useful to develop cost effectiveness and incremental cost curves).
- Substantive change in incremental costs. Is there an alternative at which the incremental cost jumps substantially as opposed to previous alternatives? This potentially flags a breakpoint or cutoff that can be examined. Is there a different construction or management activity for the alternative? Has a construction threshold that increases cost been reached?

After the final alternative has been chosen, it is time once again to ask the question, “Is there any reason this project could not be implemented?”. This means reviewing legal, political, offsite and future conditions. Confirming that the alternative is truly viable is the last step before developing the actual plan for restoration.

DEVELOP A RESTORATION AND ENHANCEMENT ACTION PLAN

Overview

A good restoration plan should consist of all the information necessary to fully understand and implement a restoration project. It should include a comprehensive resource description, which results from a good site assessment. Restoration details should be itemized in an action plan. In addition, if the plan will be needed for a permit application, it must eventually include construction-level detail. Even if no permits are required, detailed information should help ensure proper implementation, common understanding of what is to be accomplished and guidance to contractors.

At this point, the decision has been made as to which restoration alternative will be used. Hopefully, you already have a strategic plan (goals, objectives, strategies) from the articulation of the alternative. For example, strategies for a wetland restoration project may include restoring topography to natural contours, returning hydrology to natural regimes, restoring substrate characteristics by depositing wetland soils, re-establish native vegetation by planting, or restoring chemical integrity by adjusting water quality (Foote-Smith 1996). The implementation of each strategy may involve a number of separate construction and management activities.

The next step will be to add specific actions under each strategy to form an action plan. Finally, you will develop construction plans and add schedule/timeline and responsible parties to form the work plan. The sequence of planning usually includes: 1) developing the conceptual (preliminary) plans, 2) having a pre-application meeting with agency personnel and getting expert input, 3) developing construction plans (usually contracted out), and 4) completing the permitting process.

There should probably be one person responsible for coordinating the plan development. This task includes hiring and monitoring contractors, acquiring information, setting up meetings with regulatory agencies and making sure schedules are met. If more than one person shares this task, there should be a clear delineation of responsibility. The coordinator may also be actually developing many components of the plan. On the other hand, the coordinator may assign the tasks to appropriate personnel and only ensure that completeness, quality standards and time deadlines are met.

In either case, it is likely the coordinator will have to get input from other staff. Specifically, the staff who perform the land management activities and control access to the project site will have to be included in scheduling the construction and management activities. Generally, the person who develops the restoration map and predicted vegetation is the person who is best able to design the monitoring to demonstrate those changes. If it can't be the same person, there must at least be close coordination.

At this point it is time to find out what state policies (☞ Appendix D) apply to the project. There may be rules or restrictions for the proposed activity on state land. The policies referred to here are different from the issues discussed in the Site Assessment and Alternatives Development sections. Those chapters referred to issues and policies that were site specific, such as restrictions imposed by easements on the site. Now is the time to review policies that might apply to the proposed construction or management activities. An example of this would be timbering on state land, and the restriction that any income from this activity cannot be applied to site management. Any Best Management Practices (BMP) that are applicable should also be considered at this time (☞ Appendix D). Mandates to use BMP's may be part of policies that apply to state land.

An important step in the plan development is to set up a pre-application (pre-app) meeting with the permitting agencies that regulate the types of activities that you will be conducting. For instance, if you are creating or restoring wetlands, especially for mitigation, you will probably deal with the USACOE and either your local WMD or FDEP, depending upon the type of project and which WMD the project falls under. See the current operating agreement between FDEP and each WMD, which governs coordination of regulatory issues.

Mitigation bank projects will be reviewed by the Mitigation Banking Review Team, and interagency group lead by the USACOE (contact your local office). Projects that will affect surface water runoff or non-coastal wetlands must be reviewed by the WMD. County and city governments and regional planning councils may also require permits or project review. It is important that the conceptual plan be communicated clearly and with enough detail to the permitting agency that they are able to provide feedback on the feasibility of the plan. The pre-app meeting may or may not include a site visit.

The pre-application meeting is an important part of the ongoing fatal flaws analysis. The permitting agency holds the final decision as to whether or not the plan can be implemented. They know the basis for review, the conventions for construction, the water management in the project area and the range of restoration activity that they will permit. It is very important to get their feedback on your ideas as soon as possible, so that time, effort and money are not spent on developing ideas that cannot be implemented as conceived.

The engineer involved in the project design, the person responsible for the estimating the restoration and the project coordinator should attend the meeting, if possible. There may even be more than one pre-application meeting, depending on the complexity of the project and how planning progresses.

The restoration action plan should include a summary of how monitoring will be used to demonstrate success of the project. Monitoring is conducted to document the effects of the restoration project. It tracks the changes that are expected to occur in the restoration and enhancement areas. The

Wetland Restoration Considerations

Hydrology
- Water source
- Watershed/wetland size ratio
- Periodicity of inundation or saturation
- Seasonal water level elevations
- Velocity of moving water
- Salinity
- Nutrient and chemical levels
- Sedimentation rates
- Permeability of substrates
- Structural influences (berms, ditches, streambeds, control structures, etc.)

Soils
- Hydric soils as indicator of historical wetland conditions
- Topsoil or muck removal and reuse
- Slope, stability of substrates and erosion
- Compaction

Vegetation
- Natural regeneration from adjacent sources
- Plant material types (seed, bare-root seedlings, container-grown stock)
- Species selection based on hydroperiod and depth
- Use of cover crop for stabilization
- Replanting needs if problems arise
- Buffer area

(From Harker et al. 1993)

monitoring plan may be a separate document, but even if so, the restoration action plan should include a summary of how monitoring will be used to evaluate success of the project. The following gives guidance on what to include in the action plan, though it is probably advisable to proceed to developing the monitoring plan first (☞ Define and Track Success) and come back later to add a summary into the action plan.

Typically, restoration projects monitor vegetation change and hydrologic change. Depending on the project, other parameters may be monitored. Examples of other parameters are pollutant load, flow rates, primary productivity, and information on wetland-dependent wildlife populations.

What needs to be included in an application to a permitting agency can be considered a preliminary monitoring design. However, enough information should have been acquired and analyzed by this point that the crucial components to the design should be fixed. That is, the parameters to be measured should be clearly identified, as they are essential to accurately detect and demonstrate change. The fundamental sampling methodology and the frequency of monitoring should be known so that it can be reviewed and approved by the permitting agency.

In some cases, permits specify a time period after the permit has been issued in which to develop or finalize a monitoring design. However, monitoring is not a topic that should be thought about at the end, after everything else has been finished. The permitting agency may have written guidelines that they recommend for monitoring. Or they may have certain expectations for monitoring due to precedents set in other permits. The pre-application meeting is a good time find this out. Guidelines from the permitting agency are just that: guidelines. If a different sampling methodology or frequency of sampling than recommended is logical and ecologically sound for the project do not hesitate to propose it. Be prepared to justify its use with facts, scientific literature or successful examples from other projects.

Pre-restoration baseline data are an important component of demonstrating change over time, and are required as part of a monitoring program. It is critical that baseline data be collected, using the same methodology as post-restoration monitoring, prior to any changes in management, treatments or construction that intentionally or unintentionally affects the restoration site. If it is not possible to get baseline data without any changes having occurred, it should be a priority to collect data such that these effects are minimized. Information on baseline hydrologic conditions is also important and necessary for hydrologic model calibration.

The ERP permitting rules require a cost estimate for the project to be provided to the permitting agency, and this may also be included in the action plan. The requirement is another method of trying to ensure success of the restoration project. By raising the issue of cost, regulators hope to reduce restoration failure due to lack of funds.

At some point, cost estimates will be necessary as part of planning restoration, even if rigorous cost effectiveness and incremental cost analyses are not performed. Cost estimates do not have to be broken out in fine detail for the permitting agency, unless the site is being proposed as a mitigation bank and financial assurances are necessary. Regulators want enough information to know that a) all cost have been considered and b) that the expectations of cost are reasonable for the proposed work and time period. The Estimate Costs section later in this manual details how to derive accurate restoration budgets.

Write the Plans

As mentioned earlier, there are varying levels of detail for plans (☞ Page 10). Every project must have an overall project goal and vision. Beyond that, the level of detail of plans will vary based on where the project is in the planning process. During articulation of the alternatives, the plan may be developed down to strategies needed to accomplish restoration goals and obtain objectives. Prior to implementation, this strategic plan must be expanded into an action plan, from which construction plans and a work plan (with task schedules, timelines and parties responsible) can be derived.

You may decide to hire consultants to develop the action plan, construction plans and/or work plan. If so, please use this manual as a guide in developing the scope of work (☞ Outsource The Work on Page 72).

Action plan

The purpose of the action plan is to concisely convey all actions necessary to implement strategies identified to accomplish restoration goals, which will lead to achieving your overall project goal. The action plan should include the items listed in **Checklist 2** (at right).

Checklist 2
Items in an Action Plan

1. Executive summary of project, including ecological contributions, site history
2. Overall project goal and vision (post-restoration conditions)
3. Project description (from site assessment)
   - project name and proposer
   - location & setting (legal description, regional location map, site map, aerials)
   - topography
   - soils and geology
   - hydrology and water quality
   - vegetation and land cover (including wetlands possibly treated separately)
   - fauna
   - special elements
   - cultural/historical information
   - site issues
   - historical conditions
   - surrounding land uses
4. Restoration plan
   - restoration goals and objectives
   - strategies and actions for each goal, with justification and brief description of methodologies
5. Figures, maps, tables, exhibits and appendices
6. Literature cited

Construction plan

Construction details of the action plan will include all engineering information necessary to assure proper implementation of construction activities of the restoration, as well as accurate maps and acreages of all proposed changes in hydrology and vegetation that will result from the restoration activities.

If part of the restoration plan includes construction, engineering design must be contracted with an outside firm or scheduled with in-house staff. They will need to provide detailed cross-sections, design views and any other engineering drawings or drafts required for construction permits. The pre-application meeting is a good place to discuss the format and detail of the engineering information expected by the permitting agency. This will assist in getting the permit as quickly as possible by reducing the number of questions in Requests for Additional Information (RAIs).

A construction plan describes what changes will result from the restoration activities. The areas in which these changes take place are vegetation, hydrology, and wildlife habitat. Water quality is another area that restoration could affect. Soils change over such a long time scale that, while they are affected by restoration, they are not part of documented change.

Construction plans typically include:

- A map of the project area showing areas to be restored, enhanced or preserved
- For restoration areas, the predicted vegetative community type that will be restored. For enhancement areas, the predicted community type if it is likely to change, or a discussion of what changes in the existing vegetation will be brought about by the enhancement.
- A discussion of the expected response of exotics at the restoration and enhancement sites. If there is a potential problem, a method of control should be included.
- Predicted post-restoration hydrology.
- A discussion of predicted changes in general wildlife use or habitat that will benefit listed species.
- Any other expected changes (e.g., water quality).

In addition to predicting the vegetative communities resulting from the restoration, an idea of what plant species will likely be dominant is helpful. This may be a question that will be asked by the permitting agency.

Hydrology is another area of critical concern for the permitting agency. The information that needs to be supplied to the permitting agency for existing and predicted hydrology may be different than the hydrologic data that are needed to understand the system that is being restored. Historical aerial photos, knowledge of historical vegetative communities, and historical water level and flow data compared with existing conditions all provide an understanding of how the system currently works. This knowledge must be translated into measurable targets for the permitting agency. Most often, this means target water elevations and inundation periods for restoration and enhancement areas. It could also mean providing a target range for water level fluctuations or target flows.

Typically, hydrologic data are provided as a result of modeling done during the engineering phase. Further information may be required. When water level control structures are being built, flows and water levels at design storms (50 or 100 year events) must be modeled. Although this may not be required in some cases, it is probably the best method of predicting hydrology and the most satisfactory to a permitting agency. The documentation that was acquired and used to understand the hydrology of the system will be used in the discussion that

Considerations in restoration planning

1. Preconstruction
   - ♦ location
   - ♦ site characteristics (hydrology, relief, soils, erosion, seed bank)
   - ♦ site preparation
2. Construction
   - ♦ timing
   - ♦ contouring
   - ♦ water management
   - ♦ quality control
   - ♦ substrate
   - ♦ plant material (species selection, nurse crops, site acclimation, quality)
   - ♦ planting techniques (natural regeneration, seeding, bare-root planting,
   - ♦ containerized seedling planting, root cutting planting, sapling planting)
   - ♦ planting scheme and design
   - ♦ buffers or protective structures
3. Post-construction
   - ♦ exotics control
   - ♦ herbivory control
   - ♦ long-term management
   - ♦ monitoring

(From Lewis 1990, Clewell and Lea 1990, Erwin 1990) substantiates the post-restoration hydrology.

Expected changes that will benefit listed species must be discussed and substantiated. Expected changes in wildlife use of the area should also be discussed. Soils cannot really change over the time period in which restoration success must be demonstrated, unless fill or top soil material is brought in. If specific soil characteristics are to be changed by specific treatments, then these expected changes will documented.

Work plan

The work plan adds the details of who and when to the action and construction plans. At the time that restoration activity plans are being finalized, they should also be scheduled. All staff affected by the project should either be involved in scheduling, or at least informed as to what is going to take place as soon as it is decided.

The schedule should include ongoing land management activities that will take place. These do not need to have specific dates in the plan, but must be included to show that they are part of the actions needed to ensure success of the restoration. This includes a schedule (both timing and frequency) for security, exotics control, prescribed burning, maintenance of structures and other activities. **Worksheet 2** (below) is an example of a task timeline for a work plan. Other formats might include a horizontal bar chart for each task or a monthly or quarterly list of activities to occur, with who is responsible for each. The final work plan should consist of the entire action plan plus construction plans plus these timeline/schedules for all tasks, with responsible parties clearly defined. Additionally, the monitoring plan and cost estimates may also be included in the final work plan.

DEFINE AND TRACK SUCCESS

WORKSHEET 2. RESTORATION TASK TIMELINE

PROJECT NAME: ___________________________

PREPARER/NAME: ___________________________

	Year 1	Year 2	Year 3	Year 4	Year 5
	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4
Task #1					
Task #2					
Task #3					
Task #4					
Task #5					
Task #6					
Task #7					
Task #8					
Task #9					
Task #10					

Overview

You have selected a site, evaluated its suitability, conducted the site assessment, selected a restoration alternative and developed an action plan. Now you must determine how you will know if and when your project is a *success*, i.e. you have achieved the overall goal. This involves: 1) establishing success criteria and setting performance standards, 2) designing a monitoring program to measure variables identified in the success criteria and 3) evaluating/reporting on your progress.

The new emphasis on ecosystem management and large-scale restoration projects is forcing everyone in the land management field to reconsider the goals and objectives of our activities. In all cases, and at several scales, we need to better understand and define what success looks like, what our objectives and performance standards are, which variables to measure, and how to measure them. Success criteria and monitoring protocol will be based on this understanding.

Establish Success Criteria

Examples of success criteria

- Establishment of preferred vegetation (species and structure) or threshold density of mature trees for forested systems
- Presence of desired hydrology and satisfactory coverage of a specific community or preferred plant [or animal] species assemblage
- Site is able to function indefinitely on its own as part of a larger ecosystem without intervention
- Functional parameters are equal to those of a reference system monitored simultaneously

(From Clewell and Lea 1990, Erwin 1990)

Success criteria are criteria used to evaluate whether a project achieves success or not. You may say: "My project will have achieved success when it meets all of the following criteria...". Success criteria for monitoring should actually be the documentation that the restoration objectives have been reached. Success criteria may address different restoration goals or aspects of the project (see box below). Some success criteria used as permit requirements may include maps that specify the actual area of restoration that needs to occur. A landscape-based GIS model of the mosaic and spatial configuration of desired and existing communities could be used to evaluate progress toward the desired or specified condition (Gordon et al. 1997).

Establishing success criteria example.-- From The Nature Conservancy's work at Eglin Air Force Base in the panhandle, it was assumed that an open structure of the sandhill community with a contiguous groundcover, all sizes of longleaf pines, presence of red-cockaded woodpeckers (RCWs) and a history of fire indicated a high quality sandhill community. However when a comparison was made of the diversity of the herbaceous community among management units that met these criteria on the Base, it was realized that in some units, only half of the species found in the most diverse sites were present. When the site histories of the lower diversity units were researched, it was found that the area had been logged with heavy machinery around 1970. Neither structure, RCWs, nor process (fire) revealed that this system still reflected the disturbance that had occurred 25 years earlier. Selection of species richness as one of the success criteria better depicted recovery of the damaged system.

Define reference system

A reference system is a representative example, without the disturbance or degradation, of the area that is being restored, against which you can compare measured improvements in the restored system as restoration progresses. It is, hopefully, a real-life example of your vision. The reference system may be a nearby high quality site with similar environmental conditions, or data from the restoration site prior to its disturbance, or a word or picture model based on an aggregation of data collected during a long-term benchmark study in a comparable site. A computer simulation based on validated mathematical or spatial models and adequate, appropriate inputs may also provide some reference conditions, if no physical site is available.

Reference conditions are described from the reference system to characterize the expected range of variation in composition, structure, and function for a particular system (Hardesty et al. 1997). Because of natural variability within and among sites, it is often recommended that several sites be sampled to come up with reference conditions. It is the range (or bounded range) (e.g., 30-60% cover) rather than the mean value for variables of interest from the reference systems that should be of concern. These reference conditions, coupled with historical information, soil maps, elevations, and other available data, should be integrated with the best understanding of how the system functions to develop a written or graphical description of the target system and to set quantitative, measurable monitoring objectives (performance standards).

Finding a local site that is largely intact for a reference from which to obtain empirical reference data may not be possible for many locations. However, sufficient information from which hypothesized reference conditions can be generated is more likely to exist. For example, natural fire and hydrological regimes may be deduced from climate and community information. Community structure, but not necessarily composition, may be similarly derived. Do you have an aerial photograph of the site prior to disturbance? Are there organic soils, lichen lines, stranded cypress trees or other indicators that might show you what pre-disturbance conditions such as the historical high water elevation, were? Can you construct a conceptual word or picture model of the way you believe all of the ecological processes (e.g., hydrology, fire, wildlife, soil development, vegetational succession) interact over time in your system? Do you know where in the ecological model the restoration unit is at the current moment and where you want it to be when restoration is complete?

While our confidence in the reference standards and ability to develop quantitative objectives may decrease when the reference is not a real-world example, confidence in the project's success criteria without this level of analysis would be even lower. As variables are monitored, the reference standards may be refined and objectives modified.

Monitoring should involve quantifiable performance standards base on measurable attributes. A restoration site should be monitored for the long term, usually greater than 5 years, until it achieves functional equivalency with a natural system.

(Zedler 1997)

Set performance standards

A *performance standard* is the value of an individual variable that, when achieved, means success for that variable. These quantitative performance standards should also specify the precision with which biologically significant changes are to be detected, as well as the predicted level. Performance standards should be articulated in terms of amounts, ranges and timeframes: what performance success would mean for a particular site.

The performance standards selected as benchmarks for variables are usually derived from reference system data that provide an estimation of the acceptable variation around a mean value. Alternatively, performance standards may be based on a threshold value (e.g., number of individuals necessary for a viable population). There are also various statistical procedures (e.g., Morisseta or Shanon-Weaver similarity indices; Chi square analysis) that will allow sophisticated comparisons of reference data and collected restoration monitoring data, in which case a target index value may be the performance standard.

Clear performance standards both guide and constrain your monitoring on the ground. The intent is to identify the minimum information necessary that will indicate the condition of those variables that have been defined as important to evaluating success. Further, the performance standards should identify the amount of change in the variable of concern that is considered biologically significant, so that the sampling implemented is designed to detect that level of change. This is an important step, which involves using your best biological intuition and conducting some pilot sampling in the specific site to understand how best to

Performance Standards Example (for Restoration Alternatives Example on Page 44)

Restoration Goal: Create suitable hydrologic regimes.

Objective: An area of open water of approximately 1 acre, with maximum seasonal depths ranging between 12-36 inches, that will provide baseflow of 1 cfs to the adjacent stream during the dry season.

Strategy: Excavate an area of 1 acre to a depth of 3.5 feet below existing grade (12 inches below mean dry season groundwater level), and construct an outlet structure that is 36 inches higher than the maximum depth of open water.

Performance Standards: Area of open water after 5 years will be 1 acre during the wet season, ¼ acre during the dry season, with a minimum depth during the dry season of 12 inches and a maximum depth of 36 inches during the wet season.

Restoration Goal: Ensure suitable habitat for target species.

Objective: Open water and emergent areas that support at least 2 amphibian species and at least one nesting bird species within 5 years; maximum edge habitat and nesting area around open water; upland buffers that provide adequate protection.

Strategy: Grade the open water area so that at least ¼ acre will have water depths sufficient to support the targeted species during critical months, plant species that can support egg masses, develop scalloped edges on open water area, protect a 10-acre upland area around the wetland.

Performance Standards: Use of the wetland by two species of amphibians will be documented by live-trapping and observation of egg masses during the breeding season; nesting by one species of water bird will be documented by providing a photographic record of nest with eggs or successful brood.

(After Hruby and Brower 1994)

Recommendations for measuring success

- To set performance standards, ask what functions should be measured, if simple structural attributes are good indicators of functional capacity, and what methods are best to test for functional equivalency.
- Functions are processes. Performance standards are only a "snapshots" of what is present at the site at given points in time, but they can indicate if a process is going on.
- Performance standards should include indicators of self-sustainability. Measurements through time will show whether functions are occurring and being sustained.
- Avoid comparing performance of site with linear performance curves. Instead try to use reference systems, though beware of short-term variations. Plotting performance curves of data taken simultaneously from both restored and reference system can be a good comparison of functions.

(From Zedler 1997)

sample, given the level of variability that exists, to be able to detect the amount of change you have determined to be the minimum that you want to be able to measure.

Select criteria and variables to measure

In many ways, selecting variables to measure may be the most difficult aspect of restoration. Your overall project goal may be to restore a site to "high quality" or "natural integrity" or "natural function". Even if we define *ecological integrity* to indicate that the system can resist change, retain intact biota and return to a similar state following a severe disturbance like a hurricane with minimal support from the outside (Angermeier and Karr 1994, Karr 1991), we are still left with the problem of what to measure to indicate this state. The problem is exacerbated when we recognize that integrity encompasses a wide variety of processes occurring over many spatial and temporal scales, ranging from cellular processes in plants to ecosystem processes that regulate the flow of energy and matter. Your project vision, which should be a clear "picture", perhaps even a map or diagram, of the desired outcome of restoration will help you pinpoint some indicators to measure progress toward your goal.

In complex ecological systems with many more characteristics that we are unable to control than those that may be controlled, determining which variables and responses will indicate "success" or high performance is very challenging. Both by law and because of concern about rare and threatened species, we are often tempted to use these species as if they are sensitive indicators of dynamics of other populations and the community as a whole. While in some cases this may be true, often rare species are not good overall indicators because many are habitat specific endemics dependent on fairly unusual conditions in the landscape. Many are rare now and have always been rare; they are most threatened from habitat conversion or stochastic environmental events beyond our control.

Long-lived perennial plants and communities generally show change at rates far slower than those of our management activities. Because of this long lag period, changes in population status might well document a threat whose impacts are already too far along to be ameliorated. Thus, we need to select variables that will respond relatively rapidly to our conservation and management activities. If we are using them as indicators, we need to be sure that they truly reflect other changes in the system that we might be most concerned about. Until we understand the relationships between these indicators and the system integrity, they should be considered as weak hypotheses and tested for their predictive value.

In restoration and mitigation work, our goal is often recover a system with the appropriate structure, processes, and special elements. If that is the case, then we should be monitoring variables that are above the individual species level. Where we can, we should be measuring variables that reflect the first-order effects of our restoration actions. Responses of individual species to that restoration may in fact be second- or third-order effects. If we measure the actual variables that we are actively trying to manage, we should detect responses that are at the same spatial scale of our management, and that are more likely to be close to the same temporal scale as well.

For example, if the goal is to protect threatened mussel species, we might create buffer strips to filter sediments before they reach the open water. A measure of success for this action is not the miles of buffer strips constructed, but the decline in sediment loading in the stream. This variable (sediment load) will presumably respond at a faster and more easily manipulated rate than will the mussel populations themselves. The mussels would very likely remain relatively stable and then decrease sharply, by which time it may be too late for them to recover without additional management efforts (R. Unnasch, pers. commun.). This phenomenon is also found in water quality monitoring and is know as the 'titration effect'.

In large-scale ecosystem restoration projects, the overall goal is often to restore the natural hydrological and fire processes, and re-establish the mosaic and extent of wetland and upland communities across the area. Documentation of earth-moving activity, acres burned or wells installed is insufficient for understanding the responses of the plant and animal communities, therefore should not be used as success criteria, though they may be included as construction or permit benchmarks. Instead, variables that indicate the response of the communities, their relationship to elevation, historic distribution of wetland area (through remote sensing or organic soil depth analysis) and to water table levels over time would better assess whether progress toward the overall goal is made.

Scale is very important to how things are measured. Changes within specific hydrological units may be assessed using vegetation and hydrological transects. However, changes across the landscape should be assessed in terms of such variables as reduced fragmentation in the movement of water and fire, natural and dynamic locations of ecotones between uplands and wetlands, water levels that are responsive to precipitation in surface water driven systems, and expansion in the areas of impacted wetlands following management implementation. Other actions will also be necessary to maintain low densities of non-native species and to evaluate trends in species of special concern because of state or federal listing or for site specific reasons.

Scaling up from monitoring a single site to larger projects and ecosystem management goals remains a challenge. The difficulty is in understanding the variables that are most indicative of system integrity or function and the scales at which those variables should be measured. It is likely that we cannot keep measuring at the same scale and simply increase the area over which we monitor, on one level because no one has the resources to support all that data collection and analysis, but more importantly, because the function of the whole is often not reflected by the sum of some of its parts.

Further, movement of processes, like fire and water flows, across the landscape maybe be as important as their local effects. Ecosystem-level community dynamics should remain relatively constant, but individual community patches may transition to different community types depending on chance disturbance and levels of human intervention. We need to develop methods for measuring and evaluating those ecosystem dynamics. Rookery Bay National Estuarine Research Reserve (☞ Sources of Information) is conducting ecosystem level monitoring, using indicators such as invertebrate (fiddler and mud crabs) population distributions and abundances.

For a metric to be useful it must be (1) relevant to the biological community under study and to the specified program objectives, (2) sensitive to stressors, (3) able to provide a response that can be discriminated from natural variation, (4) environmentally benign to measure in the aquatic environment, and (5) cost-effective to sample.

(Barbour, Stribling and Karr 1995:76).

There are some standard variables often measured in restoration projects. They include:

Hydrology
- water flow rate (flow meter)
- surface water depth (staff gauge)
- depth to ground water (groundwater well or piezometer)
- area inundated
- high water level (crest gauge)

Water quality
- dissolved oxygen
- nutrient levels
- sediment loads (suspended solids)
- bacteria
- toxic substances
- heavy metals
- temperature
- pH
- alkalinity or hardness

Soils
- color (Munsell chart)
- pH
- alkalinity
- particle size
- redox potential
- organic matter content
- microbial activity
- time and duration of saturation

Vegetation
- plant survivorship (planted areas)
- species composition
- percent cover by species within each strata
- average height or dbh by tree species
- biomass
- understory structure
- canopy structure
- woody debris

Fauna
- species composition
- species richness and abundance
- guild representation
- population distributions
- use by special elements or all species (presence or sign)

It is important to acknowledge that in most cases there will not be a "one size fits all" type of measurement. We will not have the same performance standards for every site. Variability is different in terms of scale and importance in different locations. Further, the realm of restoration possibilities varies with site history and landscape context. It is incumbent on all of us to be consistent where possible, but recognize and plan flexibly for the inevitable variation.

Develop Monitoring Design and Protocol

Documentation of baseline information collected, reference or model conditions, variables selected, and specific performance standards (monitoring objectives) for each variable will ensure clear tracking and communication of the project. Every monitoring program should have articulated *protocol*, the set of rules governing the collection, communication and transfer of data. This should include:

1. Species and community information, including a summary of the status, habitat, and community types, ecology, and major threats to each entity important to the restoration project. Sources of information include: USFWS recovery plans, TNC Element Stewardship Abstracts, inventory data, including records within the Florida Natural Areas Inventory database, ...
2. Restoration and management concerns, compiled during discussions among managers, regulators, and field biologists and from the literature.
3. Restoration goals and monitoring objectives, where the restoration goals specify the desired change in status of species, communities, or other variables, and the monitoring objectives specify how the goals are measured and accomplished. Modification of objectives resulting from additional information or modification of the model or success criteria should be clearly documented here as well.
4. Site selection for monitoring, in which the actual locations (including maps) of monitoring are specified and explained.
5. Monitoring schedule, which will depend on permit requirements, speed at which change will be detectable, and interaction of management and processes with the ecological characteristics of the variables monitored. Permitting agencies can provide input on what they would like to see.
6. Sampling method protocols for monitoring, which contain a general review of the methods to be used, directions to each monitoring location, the specifications for macro-plots, baselines and sampling units, and the sampling methodology used at each sites. Maps and photographs should be included.
7. Appendices should include blank datasheets, computer file names and sample data printouts. Data summaries and tables may be included here or in reports to be filed with the permitting agency if necessary.

Evaluate And Report Progress

Each agency has its own guidelines or recommended format for submitting monitoring reports. If this is a permitted project, you will need to obtain and follow these. Types of information include:

- purpose of project (overall goal and vision)
- site location and description
- field sampling design
- sampling methodologies (monitoring protocol)
- results (summary statistics and analyses for period of interest)
- discussion (progress to date, reasons for discrepancies in predicted results, projections for future responses)
- appendices with data (can be provided digitally).

PLAN FOR THE FUTURE

Planning for the future primarily involves: 1) identifying long-term management and maintenance needs, 2) revising existing unit management plans to address these issues, 3) setting up staffing and legal arrangements, and 4) conducting contingency planning to deal with unforeseen challenges. Appendix E will help you with the first two tasks, especially if the unit management plan does not exist. Agency legal departments and project planners should address the third task by reviewing existing legal and cooperative arrangements. Arrangements may include establishing easements or cooperative management agreements, or providing an endowment for funding of long-term management and maintenance.

The project manager, with assistance from technical experts that helped in alternative selection, should sit down and think long and hard about contingency plans. These should include what to do if restoration fails (e.g., natural catastrophe disrupts progress) or unforeseen events make restoration plans unsuitable. Set up mechanisms to adapt the restoration and management processes to these changes.

ESTIMATE COSTS

The final component of the planning process is estimating the costs of restoration. This step is a crucial part of your planning. You have probably already derived some ballpark estimates for the alternatives selection process, especially if you did a cost effectiveness analysis. It is time to refine the numbers. Without accurate cost estimates the project may never be funded, or worse, not have enough funds to finish the project. Developing the restoration budget can be divided into four distinct steps: 1) refine actions in the restoration plan into a list of very specific tasks, 2) quantify performance of all tasks into measurable units, 3) verify all measurable units, and 4) track expenses and budget.

Step 1.--Identify all the tasks that are necessary in order to successfully complete the project. To accomplish this, start with the restoration and enhancement plan you have written. From the actions in the plan, list all the specific tasks necessary for each action, when the tasks should take place, in what order they need to occur, and how long will it take for each task. ☞ **Worksheet 2** (in Work plan) for use in determining task schedules.

Sample Costs of Restoration Activities

Filling Ditches	Unit	Cost/Unit
Small	Linear Ft	$10
Medium	Linear Ft	$17
Large	Linear Ft	$27
Fill Dirt		Cost/Unit
High	Cubic Yd	$10
Low	Cubic Yd	$5
Transportation Fee	Truck	$300
Clearing oak trees (<10"dbh)	Acre	$3,000
Clearing oak trees	Hour	$175

Step 2.--Quantify all tasks into measurable units. This is when you get the map and tape measure out. Look at each area you will be restoring (with maps and in person). Measure the length, width, depth, acres and other quantifiable units of the areas to be restored. During the initial planning you developed a general idea of the size of the restoration work to be completed. Now is the time to refine your estimates into measurements. Don't forget to include staff time in your planning and cost estimating. ☞ **Worksheet 3** (end of this section) for use in quantifying and costing out specific restoration tasks. Also ☞ **Sample Costs of Restoration Activities** (above).

Step 3.--After you have quantified the tasks and projected costs, you must verify the estimates. One way is to get bids from contractors (☞ below). Another way is to compare your estimates with real cost data from a recent project similar to your own. ☞ **Sample Costs of Restoration Activities** for some ballpark estimates. After you have verified that your estimates are accurate or revised them as necessary, we recommend that you add 20-50% for contingencies, i.e. to handle unexpected problems.

If you have not previously decided whether each task should be contracted out or done in house, you must do so during this (or possibly the previous) step. This decision should be based on a number of factors (☞ **Implementation**) and may not actually affect the true costs significantly.

Getting Bids.--Take each contractor into the field and explain what is to be done. The contractor should give you an itemized estimate of what he/she would charge to do the work (remember that this includes their markup). They can also point out potential problem areas that may require additional work (though be cautious, they may encourage you to include more work than necessary so that their contract is bigger). You are not obligated to award the contract to them, even if you use their estimates to verify your own costs. ☞ **Outsource the Work** in **Implementation**

Restoration Cost Example.--If your restoration involves filling ditches, classify each ditch as small, medium or large. Small ditches may be about the size of a fire plow line and can probably be filled by onsite staff or volunteers. A large ditch will probably require fill dirt from off site and involve use of heavy equipment, often by a contractor. If you are filling large ditches, it is important to find out where the fill sources are and if they are easily accessible, as transportation fees for fill can be considerable. Often spoil piles from the initial ditch dredging are next to the ditch. If the onsite fill is covered with substantial vegetation, this will have to be removed before ditch filling can begin, which may be a significant task if large trees have colonized the spoil piles. Another consideration is the quality of fill required, which may increase the cost. Engineering work completed during the construction planning phase of developing the restoration plan will have determined fill requirements.

After completing the first 3 steps of the budget process, you should have a very detailed, accurate budget with a list and timeline of activities to be completed. These products will be important components of the **Restoration Project Package**. They will be used to secure funding, construction permits and project approvals and to negotiate contracts to complete the work. You are ready to assemble the Restoration Project Package and proceed with implementation of the project.

Step 4.--Throughout implementation, it is extremely important to monitor the actual costs of the project compared to the budget.

This involves carefully tracking expenses as they are incurred and comparing them to the total budget, usually based on proportion of the work completed versus percentage of the budget used up.

Tracking budgets is a crucial component of good project management (☞ **Implementation**). Set up a separate cost tracking system just for the restoration project. Keep income and expenses segregated. Hopefully, your cost estimates were accurate and no unexpected expenses will occur, though few restoration projects in history have come in under budget. If unexpected problems arise, fall back on your contingency funds for the project. If a catastrophe occurs and contingency funds are not sufficient to compensate, a decision will have to be made about if and how to complete the project.

By following these four simple steps and collecting budget examples from other restoration projects, you should be able to determine accurate cost estimates for your project and develop a good restoration budget. Of course, there are many unexpected issues that are likely to occur during the project. If you have created a detailed plan with contingency arrangements, you will be prepared for most problems even if they are unexpected.

WORKSHEET 3. RESTORATION TASK COSTS

PROJECT NAME: ______________________________
PREPARER/NAME: ______________________________

Activity #1 ____________________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #1			$000000

Activity #2 ____________________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #2			$000000

Activity #3 ____________________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #3			$000000

Activity #4 ____________________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #4			$000000

THE RESTORATION PROJECT PACKAGE

OVERVIEW

The Restoration Project Package is simply the assemblage of all of the information developed during application of the manual thus far (the restoration planning process). It is designed to contain all information necessary for typical government grant or foundation requests, construction permit applications or mitigation solicitations. Its purpose is to serve as a tool to allow quick yet detailed submission of project information or proposals for funding opportunities, permit applications, contractor/mitigation banker scopes of work, or public information.

FORMAT

The physical format of the Restoration Project Package will depend on the project-specific circumstances and the intended use of the package. If it is to be used as a permit application, its format will be based on the requirements of the appropriate agency. For example, a wetland restoration project will require an ERP, therefore the Restoration Project Package should include and follow the format specified by that application.

It may be a bound document with the results (text and small maps) of the site assessment in the front half and the text for the restoration action plan following, with references to oversize exhibits that are either in bound-in pockets or separate from the book. Or a binder could be used to keep text and exhibits together. Some exhibits simply cannot be bound into a document; these should be clearly and permanently labeled as to what they are and to which package they belong.

CHECKLIST

The Restoration Project Package should contain:

______ A description of how the site was selected, included detailed references to regional plans used

______ Results of suitability analysis (☞ Worksheet 1) or other explanation of project justification and feasibility

______ The complete results of the site assessment (☞ Checklist 1), including aerial photos and other maps or exhibits

______ The final restoration alternative and rationale on why it was selected over others

______ The complete action plan, with strategies and actions for implementation of restoration

______ Full construction plans necessary for permits or contractor implementation

______ The completed workplan, including who is responsible for all tasks and the timeline/schedule

______ A detailed monitoring plan

______ An updated long-term management, maintenance and contingency plan for the site (or reference to its location)

______ Detailed cost estimates and budgets for each stage of restoration

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IMPLEMENT THE RESTORATION PROJECT

FUNDING

Hopefully you have already identified the source of funds to complete the restoration; if not, your project may be fatally flawed (☞ Judging Suitability Of Your Site). However, very few restoration projects come in under-budget, and there are always additional activities that should occur but may not have been budgeted.

Potential sources of restoration money may include mitigation funds, federal/state grants, research or conservation foundations and possibly other agencies. The use of mitigation funds on public land has yet to be approved, but if policies are developed to allow it, this is a very suitable source of restoration money, provided there is a true increase in functional contribution at least equivalent to the permitted loss. There are a number of federal and private grant sources listed on the Internet. Contact your agency project development or funding officer for more information.

> *There are a number of federal programs to encourage restoration ... through financial incentives, including the Wetlands Reserve Program and Partners for Wildlife.*
>
> (Foote-Smith 1996)

PERMITTING

Almost all wetland restoration projects and some upland projects will require construction permits from appropriate agencies or municipalities. Contact the regulatory agency offices in your region for information on whether or not your project qualifies. The Restoration Project Package will be your key to quickly and easily obtaining the necessary permits.

Project management components

- General administration
- Permit acquisition and tracking
- Coordination
- Budget tracking (☞ Estimate Costs)
- Contract supervision
- Adaptive management

COORDINATION

Much of the actual work of managing a restoration project lies in the coordination necessary to plan and successfully implement it. You must determine who will do what and when, then follow up with each party to ensure that it is happening. This must include the site staff who will doubtless be involved with not only implementation, but long-term management. Other agencies may be concerned, especially if permits are required. The project manager must coordinate with adjacent landowners and conduct public notice and input prior to implementation.

Send out regular communications and updates during planning/implementation to all parties connected to the project. Make sure each has a copy of the RPP. See your own agency information offices for policies and procedures about public involvement. Hold coordination meetings for those overseeing the execution of the plans, especially contracts. Notify supervisors or policy makers if the project has regional implications. You may need to be the liaison between several agencies or departments within agencies, but this is crucial to efficient completion of the project. Try to be on the site during implementation at least twice a week (much more if you are the contractor supervisor).

OUTSOURCE THE WORK

To implement the restoration project, you will probably rely on at least one, if not several, outside contractors. This may include biological or engineering consultants to assist in the planning (especially hydrologic modeling, if required) or construction companies to actually do the earthwork or planting. The keys to successfully outsourcing restoration work include: 1) selection of reliable and responsible contractors, 2) a good, tight scope of work, 3) regular communication and a solid relationship with the contractor, and 4) regular and thorough oversight of contract execution, compliance and costs.

The first step is to decide what to contract out versus what to do with existing staff. These decisions will be based on considerations that include whether the expertise or equipment exist in-house, whether staff with expertise or equipment have the time or resources available, and whether it would be more efficient or cost effective to contract. Consider carefully. Though it may seem as if hiring a contractor is the most efficient way to get the work done properly, remember the costs of contractor coordination and supervision, which can be substantial.

In general, the contract process starts with the development of a Request for Proposals (RFP), with a detailed description of the work you want performed as well as all the crucial information contractors must submit (cost estimates, professional standards and references, etc.). You must set all standards for important aspects of the project (e.g., plants must be of high quality or size, originating from seed produced within the state, etc.) in the RFP. Proposals should be judged partly on how state that they will deal with standards. Contact your agency contracting office for standard RFP formats and forms. Once proposals are received, they are generally ranked according to pre-established criteria. You may want your team of technical experts that helped with the alternative selection to assist in contractor selection. Once a "short-list" of proposals is selected, you should contact their references and request a presentation from each contract to get additional information on qualifications and cost estimates. Then select the best contractor and have your contract office draw up the legal documents.

Use the detailed information from the RFP to craft a scope of work that is very specific and detailed. Put all standards and specifics agreed to in their proposal in the scope. If appropriate, divide the work into tasks, with itemized deliverables for each. A good scope of work seeks to delineate every expectation (on both sides) so there are no surprises or misunderstandings once the agreement is in place.

Work can begin as soon as the contract is in place. So should contract coordination and oversight. Develop a good relationship with the contract manager and on-site supervisor of the work. You will need to work closely with them to assure the best products. Regular contact and professional communications will ensure that they will respond well to suggestions or mid-course corrections if they become necessary.

Finally, oversee execution of the scope and keep a close eye on cost accounting and invoicing. Make sure that the contractor is compliant with the contract. If small details slip, do not hound them, but keep a good record. You may choose not to work with them in the future, or provide a less-than-glowing reference if requested. Practice adaptive management and revise restoration plans and cost estimates as you learn more during implementation, and to compensate for mistakes made along the way.

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Schneller-McDonald, K., L.S. Ischinger and G.T. Auble. 1990. Wetland creation and restoration: description and summary of the literature. U.S. Fish and Wildlife Service Biological Report 90(3). 198pp.

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Zedler, J.B. 1997. Restoring tidal wetlands: a scientific view. National Wetlands Newsletter. 19(1):8-12.

Zedler, J.B. and M.W. Weller. 1990. Overview and future directions. *Pages* 405-413 *in* J.A. Kusler and M.E. Kentula, eds. Wetland creation and restoration: the status of the science. Island Press, Washington, D.C.

SOURCES OF INFORMATION

Names of organizations that have relevant information on specific topics appear below. Because some organizations have information related to more than one topic, addresses and phone numbers are at the end of the section, in alphabetical order. The addresses of county and local organizations are not given.

AERIAL PHOTOGRAPHY

- FDEP Technical Services Map Library: Digital Ortho Quarter Quads (DOQQ’s) - GIS true-color aerial photographs at high resolution for entire state
- Aerial Cartographics of America, Inc.: All types of current aerial photographs, varying with area of coverage needed
- FDOT: 9”x9” black and white 1970-1990 aerial photographs (statewide coverage) at 1” 2,000’ scale
- County planning or property appraiser offices: 3’x3’ blueline aerial paper photos, usually at 1”=200’ or 1”=400’ scale
- U.S. National Archives: 9”x9” historical (1940s) black and white aerial photos
- U.S. Department of Agriculture-ASCS: 9”x9” historical (1950s) black and white aerial photos
- U.S. Geological Survey-EROS Data Center: Historical aerials, varies with area

COST EFFECTIVENESS ANALYSES

- USACOE Institute for Water Resources

CULTURAL RESOURCES

- Florida Department of State, Division of Historical Resources: Florida Master Site File
- Local historical societies

HYDROLOGY/WATER QUALITY

- WMDs
- FDEP Division of Water Facilities: Statewide water quality report
- FDEP Technical Services Map Library: Digital coverages of drainage basin boundaries, surface water, ground water contaminations sources, water supply wells, Oracle well locations, petroleum and storage tank contaminant sites, dry cleaning sites, solid waste facilities, toxic release sites, hydrography, wetlands, NWI maps, lakes, outstanding waters, etc.

INFRASTRUCTURE/LAND OWNERSHIP

- FDEP Technical Services Map Library: Digital coverages of political boundaries, county boundaries, agency district boundaries, ecosystem management areas, regional planning council boundaries, conservation easements, mitigation banks, conservation lands (public and private), trailways, flood insurance maps, cities, schools, parks, census data, transportation (roads, highways, railroads), etc.

- County property appraisers office
- County governments: Plat map books
- Local book or map stores: Plat map books

LISTED SPECIES/WILDLIFE INFORMATION

- FNAI: Element occurrence data available by special request
- FGFWFC: Official list of endangered species, eagle nest data, wildlife observation data
- USFWS: Florida scrub-jay maps, listed species information and regulations
- County planning departments
- Florida Biological Diversity Project (Gap analysis)
- FDEP Technical Services Map Library: Digital coverage of habitat data

MARINE/COASTAL ISSUES

- FDEP Marine Research Institute: Datasets of marine resources

REGIONAL PLANNING

- Regional planning councils: Comprehensive regional policy plans, applications and plans for developments of regional impact
- Ehrenfeld and Toth 1997

SOILS

- FDEP Technical Services Map Library: Digital coverages of generalized soils and NRCS detailed soil surveys
- NRCS county offices: County soil surveys (hard copy)

TOPOGRAPHY

- WMD-Survey/mapping departments
- USGS topo quads
- Local book or map stores: Quad maps
- FDEP Technical Services Map Library: Digital coverages of drainage basin boundaries, hydrography

VEGETATION CLASSIFICATION SYSTEMS/LAND COVER MAPS

- FDOT: FLUCFCS system
- FGFWFC: Land cover classification system for wildlife habitat
- FNAI: Guide to Natural Communities of Florida
- FDEP Technical Services Map Library: Digital coverages of ecoregions, landcover (generated by WMDs), wetlands, NWI maps, lakes, surface water classification, etc.

WETLAND ISSUES

- FDEP regional permitting offices
- WMD local and regional permitting offices
- USACOE (Jacksonville District)
- Environmental Protection Agency Wetlands Hotline

- Washington State Department of Ecology (wetland planning publications)

Wetlands Literature

- National Wetlands Newsletter
- Schneller-McDonald et al. 1990 (bibliography and literature review)
- National Research Council 1995
- Mitsch and Gosselink 1993
- Salvesen 1994

ADDRESSES

Aerial Cartographics of America, Inc.
1722 W. Oak Ridge Road
Orlando, FL 32809
or P.O. Box 593846
Orlando, FL 32859-3846
(407) 851-7880
(407) 855-8250 (fax)

Environmental Protection Agency Wetlands Hotline
(800) 832-7828

Florida Biological Diversity Project
Florida Cooperative Fish and Wildlife Research Unit
117 Newins-Ziegler Hall
University of Florida
Gainesville, Florida 32611
(352) 846-0637
website: http://www.coop.wec.ufl.edu/gap

Florida Department of Environmental Protection
website: http://www.dep.state.fl.us
Division of Water Facilities (Statewide water quality)
Florida Marine Research Institute
100 8th Avenue SE
St. Petersburg, FL 33701
(813) 896-8626
Technical Services Map Library
2600 Blair Stone Road MS#6520
Tallahassee, FL 32399-2400
(850) 488-0892

Florida Department of State, Division of Historical Resources
Bureau of Archeological Research (Review of Master Site File)
R.A. Gray Building
500 South Brohough

Tallahassee, FL 32399-0250
(850) 487-2299
(850) 921-0372 (fax)
Florida Trust For Historic Preservation (Names of local historical societies)
P.O. Box 11206
Tallahassee, FL 32302
(850) 487-2333

Florida Department of Transportation
Survey and Mapping (Aerial Photography)
605 Suwannee Street
Tallahassee, FL 32399
(850) 488-2332
(850) 488-2587 (fax)
Maps and Publications (FLUCFCS Manual)
605 Suwannee Street
Mail Station 12
Tallahassee, FL 32399
(850) 414-4050
(850) 487-4099 (fax)

Florida Game and Fresh Water Fish Commission
website: http://www.fcn.state.fl.us/gfc/gfchome.html
Office of Environmental Services
620 S. Meridian Street
Tallahassee, FL 32399
(850) 488-6661
(850) 922-5679 (fax)
Division of Wildlife
620 S. Meridian Street
Tallahassee, FL 32399
(850) 921-5990   (Official list of endangered species)
(850) 488-3831   (List of technical publications)

Florida Natural Areas Inventory
1018 Thomasville Road
Suite 200C
Tallahassee, FL 32303
(850) 224-8207
(850) 681-9364 (fax)

National Wetlands Newsletter
Environmental Law Institute
1616 P Street NW, Suite 200
Washington, DC 20036

Northwest Florida Water Management District
Rt. 1, Box 3100
Havana, FL 32333-9700
(850) 539-5999

Regional Planning Councils
Tampa Bay
website: http://www.access.tampabayrpc.org

Rookery Bay National Estuarine Research Reserve
300 Tower Road
Naples, FL 34113

South Florida Water Management District
P. O. Box 24680
West Palm Beach, FL 33416-4680
(561) 686-8800
(800) 432-2045

Southwest Florida Water Management District
website: http://www.dep.state.fl.us:80/swfwmd
2379 Broad Street
Brooksville, FL 34609-6899
(352) 796-7211
(800) 423-1476

St. Johns River Water Management District
website: http://www.sjr.state.fl.us
P. O. Box 1429
Palatka, FL 32178-1429
(904) 329-4500

Suwannee River Water Management District
Rt. 3, Box 64
Live Oak, FL 32060-9573
(904) 362-1001

United States Army Corps of Engineers
Institute for Water Resources (Project cost-effectiveness analysis info and software)
Water Resources Support Center
7701 Telegraph Road
Alexandria, VA 22315-3868

Jacksonville District

Federal Building
400 West Bay Street
P.O. Box 4970
Jacksonville, FL 32232

United States Department of Agriculture - ASCS
Aerial Photo Field Office
P.O. Box 30010
Salt Lake City, UT 84130-0010

United States Fish and Wildlife Service
6620 Southpoint Drive South, Suite 310
Jacksonville, FL 32216-2404
904-232-2580
904-232-2404 (fax)

U.S. Geological Survey
EROS Data Center
Sioux Falls, SD
(605) 594-6151

United States National Archives
Cartographic Branch
8601 Adelphi Road
College Park, MD 20740-6001
301-713-7030

Washington State Department of Ecology
website: http://www.wa.gov/ecology/pubs.html

GLOSSARY AND ACRONYMS

Word/ACRONYM: Dictionary definition (Neufeldt and Guralnik 1988); Literature use, our recommended use, connotation

Action plan: Plan that details, down to level of actions, how to accomplish a project or achieve goals

Action: Something performed; deed; consciously willed activity; an act or thing done; Specific steps taken to accomplish objective, implementation of strategy

Adaptive management: Management that is made fit or suitable by changing or adjusting; Using new scientific knowledge and feedback from monitoring to improve management strategies; the process of implementing policy decisions as scientifically driven management experiments and using the results to improve management plans; mechanism for integrating experience and knowledge into management of natural systems

BMP: Best Management Practices

CAD: Computer Aided Design

Compliance: In accordance with; Consistent with stipulations of a permit or other regulatory instrument

Conceptual plan: Plan that includes the overall project goal, vision, restoration goals and objectives

Cultural resources: Prehistoric or historic sites or artifacts identified as being used by a recognized culture for specific purposes

Degraded: Corrupted, lowered in grade or quality; Altered by man through impairment of or changes to some physical or chemical property, which results in a reduction of habitat value or other functions; (☞ **Perturbation**)

Disturbed: Altered from a natural condition, yet retaining some natural characteristics

DRI: Development of Regional Impact

Ecological functions: Characteristic actions or special duties of a system that affect relations between organisms and their environment*;* Specific contributions or services performed by a natural system, such as the capacity of wetlands to store and filter water

Ecological integrity: The state of being complete, unbroken, whole, perfect, unimpaired and sound, for the complex of relations between organisms and their environment*;* Protection and preservation of native diversity, ecological patterns and natural processes, such that the system can resist change, retain intact biota and return to a similar state following a severe disturbance; the ability to support and maintain a balanced, adaptive community of organisms comparable to that of the natural habitat

Ecological processes: Continuing developments involving many changes that affect relations between organisms and their environment*;* Ecological activities, patterns and interactions, including fire, hydrology, soil development and chemical interactions, as they occur in a natural system

Ecosystem health: The soundness, vitality or well-being of a system of plant, animal and bacterial communities and their interrelated physical and chemical environment; [☞ **Ecological integrity**]

Enhancement: Intensification, heightening, augmentation, improvement in quality*;* Improving the ecological contribution of wetlands, surface waters or uplands that have been degraded from their historic condition; improvement of existing natural areas for a particular function or value

ERP: Environmental Resource Permit

Exotic species: Foreign, imported or not native organism; an invasive or troublesome introduced plant or animal species that displaces native species

Fatal flaws analysis: A method to evaluate any number of alternatives that eliminates those that do not meet a set of criteria established at the beginning of the process

FDEP: Florida Department of Environmental Protection

FDOT: Florida Department of Transportation

Feasibility analysis: Evaluation of the practicality of a project based on physical, economic or political aspects

FGFWFC: Florida Game and Fresh Water Fish Commission

FLUCFCS: Florida Land Use, Cover and Forms Classification System

FNAI: Florida Natural Areas Inventory

Functional assessment methodology: Methods developed to quantify ecological functions or values assigned by humans to wetlands, wildlife habitat or other natural areas; examples include HGM, Habitat Evaluation Procedures and Wetland Rapid Assessment Procedure

Functional contribution: Augmentation of ecological functions

GIS: Geographical Information System

Goal: The result or achievement toward which effort is directed; an object or end that one strives to attain; aim*;* Broad, overlying idea or result you are trying to accomplish; a general concept that defines the intent or purpose of a project

GPS: Global Positioning System

Grant: Conveyance of funds, as by the Federal government or a foundation, to support a specific program or project*;*

Habitat unit: Output of Habitat Evaluation Procedure evaluation methods

HGM: Hydrogeomorphic

Impacts: Events that produce change or strain; (☞ **Perturbation**)

Keystone species: A species whose presence is important or critical to the presence of other species or the continuance of ecological processes; examples include gopher tortoises (maintains commensals) and wiregrass (carries fire)

Maintenance: Upkeep, support, defense, keeping in a state of good repair*;* Any activities required to assure successful restoration after a project has been constructed, such as exotic plant control

Management: The art of handling or using carefully, husbanding; to have charge of; Activities required to protect and sustain a naturally functioning system

Mission: Operational task; special task or purpose; Usually used in the broadest sense, to indicate the overarching goal or purpose of a project or program (☞ **Overall project goal**)

Mitigation bank: A project undertaken to provide for the withdrawal of mitigation credits to offset adverse impacts; wetland or endangered species habitat restoration, creation or enhancement undertaken expressly for the purpose of providing compensation for losses from future development activities, as part of a credit program

Mitigation: The act of lessening, making less severe, or moderating; An action or series of actions to offset the adverse impacts that cause a regulated activity to fail to meet environmental review criteria; restoration, creation, enhancement or sometimes preservation of wetlands or endangered species habitat to compensate for permitted losses

Monitoring: Checking or regulating performance; warning; Periodic evaluation to determine success in attaining goals

MOU: Memorandum of Understanding

Natural area: A relatively undisturbed area, with native species dominating

Natural or native communities: Associations of organisms living together that are wild, unaffected by mankind*;* Assemblages of plants (usually) and/or animals that naturally occur together, such as the pine flatwoods community; community dominated by native biota and occurring in a physical system that has developed through natural processes and in which natural processes continue to take place

Natural processes: ☞ **Ecological processes**

NRCS: Natural Resource Conservation Service

NRCS: Natural Resources Conservation Service; previously known as Soil Conservation Service

Nuisance species: An organism causing danger, trouble or annoyance; similar to exotic species, but not necessarily introduced (may be native)

NWFWMD: Northwest Florida Water Management District

NWI: National Wetlands Inventory

Objective: Purpose; target; the object or goal of one's endeavors or actions; something striven for; Result of strategy or actions toward goal; must be specific, measurable, doable; often tangible; think of as TARGET or PRODUCT

Overall project goal: The articulation of why a project is being undertaken; the mission; a general, big-picture concept of the purpose

Overall project objective: The overall product or target of a project; the final vision, what success looks like

Performance standard: Something set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality; The value for a given variable that has been determined to be the threshold or criteria of success for that parameter

Perturbation: Something that causes disturbance, disorder, or great trouble; Physical disturbances to the functioning of ecological processes or services

Plan: A scheme or program for making, doing or arranging something; project, design, schedule; method of proceeding; outline

Preservation: Protection from development or impact, including maintenance of existing or improved condition

Principle: A fundamental, accepted or professed rule of action or conduct; an essential element; Overriding idea

Protocol: A set of rules governing communication and transfer of data; A specific, detailed set of instructions for collecting data from a site

RAI: Request for Additional Information; a permitting step following submission of an application to a regulatory agency, in which they ask for greater details regarding restoration project in order to issue permit

Rationale: Justification or explanation of goal, strategy, alternative, action, etc.

Rehabilitation: The act of putting back in good condition or bringing to a normal state of health; Conversion of an area that was previously one type into another type deemed to be better

Restoration: A restitution of loss or damage; putting into a former, normal or unimpaired state or condition; reconstruction of original form or health; The act, process or result of returning a natural area to a close approximation of its condition prior to disturbance

Restoration alternative: An outline for a planned or proposed series of events to put something back to original form; scenario or approach to achieving the overall goal

RFP: Request For Proposals

Scale: The ratio between dimensions of a representation and those of the object; a system of grouping or classifying according to a standard of relative size

SFWMD: South Florida Water Management District

Site: Location, a piece of land with a specified purpose

Site assessment: To estimate or determine the significance, importance or value of a site, evaluate; A detailed inventory and description of all aspects of a site's resources

Site issues: Site characteristics, conditions or policies to be considered in restoration planning, (*e.g.*, listed species, facilities, impacts)

SJRWMD: St. Johns River Water Management District

SOR: Save Our Rivers

Special element: Plant or animal species that are endangered, threatened, species of special concern or rare

SRWMD: Suwannee River Water Management District

Step: Any of a series of acts or distinct successive stages in a process; begin to act*;* Equivalent to or subset of actions

Strategic plan: Plan that includes the overall project goal, vision, restoration goals, objectives and strategies

Strategy: A plan, method, or series of maneuvers for obtaining a specific goal or objective; an artful means to some end*;* Methodology to be used, HOW to attain goal or objective; usually phrased as action

Success criteria: Criteria, measurable as quantitative values, used to evaluate whether a project achieves success or not; usually a set of performance standards established for a series of variables that indicate progress toward achieving goals

Success: Favorable or satisfactory outcome or result*;* Documentation of achievement of established goals; requires that measurable success criteria be established prior to commencement of activities and that monitoring data show that performance standards have been met

Suitability analysis: Evaluation of the compatibility of a project with its surrounding environment and potential of the restoration to achieve ecological goals

SWFWMD: Southwest Florida Water Management District

SWIM: Surface Water Improvement and Management; a program implemented by Florida's water management districts, designed to protect and restore priority surface waters of the state

Uplands: Areas that are not wetlands or open water

USACOE: United States Army Corps of Engineers

USFWS: Unites States Fish and Wildlife Service

USGS: United States Geological Survey

Variable: A quality or quantity that varies or may vary, anything changeable; parameter selected to be periodically measured to document progress

Vision: (also Vision of success) A mental image, an imaginative contemplation; What you want success to look like; final outcome or product (☞ **Overall project objective**)

Watershed: The area in which all water, sediments and dissolved materials flow or drain from the land into a common body of water

Wetland creation: Conversion of a nonwetland area into a wetland where a wetland never existed

Wetlands: Those areas inundated or saturated by surface water or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soils. Florida wetlands generally include swamps, marshes, bayheads, cypress domes and strands, sloughs, wet prairies, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas

WMD: Water Management District; any one of Florida's five water management districts, quasi-governmental agencies (agents of the state) charged with controlling and supplying Florida's water

Work plan: Plan that includes the overall project goal, vision, restoration goals, objectives, strategies, actions, tasks, a timeline/schedule and responsible parties

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APPENDICES

A: AGENCIES THAT MANAGE PUBLIC LAND IN FLORIDA

B: POTENTIAL RESTORATION PROJECTS ON FLORIDA PUBLIC LANDS

C: COPIES OF FORMS, WORKSHEETS AND CHECKLISTS

D: STATE OF FLORIDA POLICIES AND REGULATIONS RELEVANT TO RESTORATION

E: MANAGING THE NATURAL RESOURCE LANDS AND WATERS OF THE STATE OF FLORIDA

APPENDIX A: AGENCIES THAT MANAGE PUBLIC LAND IN FLORIDA

(From Blanchard et al. 1998)

United States

US Department of Agriculture
- Forest Service

US Department of Interior
- Fish and Wildlife Service
- National Park Service

US Department of Defense
- Air Force
- Army Corps of Engineers
- Navy

US Department of Commerce
- National Oceanic and Atmospheric Administration

US Department of Transportation
- Coast Guard

US Geological Survey

US Bureau of Land Management

State of Florida

Florida Department of Agriculture & Consumer Services
- Division of Forestry

Florida Department of Environmental Protection
- Division of Recreation & Parks
- Division of Marine Resources
- Office of Greenways and Trails

Florida Department of Military Affairs

Florida Game and Fresh Water Fish Commission
- Division of Wildlife
- Division of Fisheries
- Office of Environmental Services Mitigation Program

Florida State Universities
- Florida Atlantic University
- University of Florida
- University of South Florida

Florida Water Management Districts
- Northwest Florida Water Management District
- Suwannee River Water Management District
- St. Johns River Water Management District
- Southwest Florida Water Management District
- South Florida Water Management District

Local Governments

Counties

- Broward
- Brevard
- Collier
- Dade
- Gulf
- Hernando
- Hillsborough
- Lee
- Manatee
- Martin
- Orange
- Osceola
- Pasco
- Pinellas
- Palm Beach
- St. Lucie
- Sarasota
- Seminole

Various Municipalities

Private (Conservation Organizations)

Archbold Expeditions, Inc.
Florida Audubon Society
Florida Trust for Historic Preservation
Florida Power and Light
National Audubon Society
The Nature Conservancy
Sierra Club
Tall Timbers
University of Florida Foundation
YMCA

Summary of Public Land Acreages Managed by Agencies in Florida

Department	Agency/Division	Area Managed (Acres)
Federal		
Agriculture	Forest Service	1,147,078
Interior	Fish and Wildlife Service	498,945
	National Park Service	1,714,001
Defense	All	680,287
Other	National Oceanic and Atmospheric Administration, Geological Survey, Bureau of Land Management, Coast Guard	4,629
Total Federal		4,044,940
State		
Agriculture & Consumer Services	Division of Forestry	714,170
Environmental Protection	Division of Recreation and Parks	430,420
	Division of Marine Resources	212,140
	Office of Greenways and Trails	69,067
Game and Fresh Water Fish Commission	Division of Wildlife, Division of Fisheries, Office of Environmental Services	1,201,289
Military Affairs		62,340
State Universities		11,524
Water Management Districts		1,127,851
Total State		3,828,801
Local		
Counties and Municipalities		196,248
Total Local		196,248
	Total All Public	8,069,989
Private		98,219
Size of Florida		34,721,280

APPENDIX B: POTENTIAL RESTORATION PROJECTS ON FLORIDA PUBLIC LANDS

(list compiled from sources provided by FDEP staff, information from 1995-1997)

<u>State Parks</u>

Paynes Prairie State Preserve

* major topographical and wetlands restoration includes backfilling, canal blocks, dredging and dike removals

Tosohatchee State Reserve

* 35 miles of main canal filling, topographical restorations of power lines, canals, reservoirs and lakes, and upland restoration

Tomoka State Park

* extensive high marsh restoration; drainage ditches to be filled

Port Bouganville

* part of the Key Largo Hammocks State Botanical Site, major development halted after significant manipulation of hammocks, dredging of a huge marina and construction of some buildings; restoration of tropical hammock and filling of the marina and canal

Falling Waters State Recreation Area

* revegetate eroded area along fence
* construct diverters along fence to prevent off-site erosion and stormwater from entering sink area (must be coordinated with adjacent property owner.)

Florida Caverns State Park

* cave restoration
* upgrade or re-contour golf course to allow stormwater treatment and prevent entry of untreated stormwater into sink holes on the golf course and the park

Henderson Beach State Recreation Area

* remove the remainder of old Highway 98 and restore
* restore dune areas that have been destroyed by foot paths

Lake Jackson Mounds State Archaeological Site

* repair erosion on nature trail
* restoration of improved pasture area

Natural Bridge State Historic Site

* vegetative restoration of the monument area

Ochlockonee River State Park

* revegetation for shoreline erosion control

Perdido Key State Recreation Area
* restore dune vegetation destroyed by foot paths

St. Andrews State Recreation Area (Shell Island)
* remove pilings from submerged land and from salt marsh
* restore two dune blow-outs west of pavilion with sand fencing, native vegetation and interpretive signs

St. George Island State Park
* remove asphalt from dunes (old roadway)
* restoration of beach dune system

St. Joseph Peninsula State Park
* site restoration with native vegetation (two burned areas, fire plow scars, dune blowout)

Three Rivers State Recreation Area
* removal and restoration of the dump area
* invading hardwood removals

Topsail Hill
* restoration of dune damage by unauthorized vehicle use; includes sand fencing and planting of appropriate vegetation

Torreya State Park
* restoration of pine plantations

Wakulla Springs State Park
* redesign and repave parking areas adjacent to lodge; treat and direct stormwater away from sink holes and sensitive areas
* fill 2 borrow pit / dumps with appropriate soils
* wiregrass transplanting and seeding
* beach restoration

Fort Clinch State Park
* fill in some of the mosquito ditches as determined by the Park Manager and District Biologists and revegetate to the appropriate wetland community

Gold Head Branch State Park
* branch outfall restoration
* restoration of Sheelar Lake shoreline and adjacent uplands
* scrub-jay habitat restoration

O'Leno State Park / River Rise State Preserve
* restoration of natural communities in pastures / old fields
* restoration of natural hydrology of Buzzards Roost Prairie drainage at Bible Camp Road

Peacock Springs State Recreation Area
* restoration of natural communities in pastures

San Felasco Hammock State Preserve
* restoration of natural communities in pastures / old fields, and clear-cut areas

Stephen Foster State Folk Culture Center
* restoration of remaining clear-cut areas

Talbot Islands State Geopark
* fill in some of the mosquito ditches as approved by the Park Manager and District Biologist and revegetate to the appropriate wetland communities
* restore central swale on Big Talbot, regulate drainage, remove invasive vegetation and monitor
* restore cattail pond on Big Talbot Island, purchase outparcel, remove and dispose of vegetation and substrate, and monitor
* addition of culverts under the highway impounding the marsh between Simpson and Myrtle Creeks

Anastasia State Recreation Area
* rip rap should be removed, reshaped, added to, etc.; the beach should be renourished, and a dune system established and planted with dune vegetation
* fill in some of the mosquito ditches to remove present breeding sites; ditches to be filled will be determined by the Park Manager and District Biologists
* revegetate dunes
* habitat restoration of conch island - reduction in density of wax myrtle

Bulow Creek State Park
* pine plantation removal and community restoration

DeLeon Springs State Recreation Area
* restoration of acquired improved pasture to original ecosystem of pine flatwoods
* spring bulkhead repairs and restoration

Gamble Rogers Memorial State Recreation Area at Flagler Beach
* removal of exotic plants and revegetation with appropriate wetland / ecotonal plants
* dune restoration
* stabilize and restore shoreline on ICW
* restoration of spoil area

Guana River State Park

* shoreline stabilization at Shell Bluff
* erosion control on dunes through revegetation
* restore swale area

Hontoon Island State Park
* investigation and restoration of old “dump” pond
* removal and restoration of Snake Creek Dam
* investigation and restoration of man-made canal system surrounding the property

Lake Kissimmee State Park
* hydrologic restoration of park

Lake Louisa State Park
* revegetate 700 acres of former mesic flatwoods and sandhill communities

Lower Wekiva River State Preserve
* longleaf pine restoration, LWRSR west
* pasture restoration storage area, LW-15, LW7P
* wiregrass replanting

North Peninsula State Recreation Area
* removal of exotic plants and revegetation to appropriate wetland/ecotonal community

Ravine State Gardens
* removal of bamboo and air potato and revegetation with native ravine plant species
* restoration of base reflection pond and removal of exotic plants
* erosion control of ravine sides by revegetation

Rainbow Springs State Park
* restoration of natural community in springhead
* restoration of natural communities in pastures / old fields

Rock Springs Run State Reserve
* pasture restoration (not ST5)
* tram removals & restoration

Sebastian Inlet State Recreation Area
* exotic tree removal and plant native vegetation
* remove / restore mosquito ditching

Spruce Creek State Recreation Area
* exotic plant removal and revegetation with appropriate native species
* erosion control and river shoreline stabilization with native plant revegetation

Washington Oaks State Gardens

* continue shoreline restoration
* evaluate the potential for filling in some of the mosquito ditches

Wekiwa Springs State Park
* restore retention pond installation at Thomson and Welch Road
* youth camp soil stabilization
* restore retention pond at dip in road on Wekiva Springs Road
* pasture restoration zone WS-03
* wiregrass replanting in ruderal areas
* cypress plantings in flats area - wetlands enhancement / exotic control

Beker Property
* fill canal draining wetland on parcel B and restore filled area with native herbaceous vegetation

Collier-Seminole State Park
* provide native hardwoods for natural community restoration

Egmont Key State Park
* remove exotics, restore native vegetation

Fakahatchee Strand State Preserve
* remove spoil from west boundary
* install culverts on selected trams and provide heavy equipment for tram maintenance

Gasparilla Island State Recreation Area
* provide native vegetation for coastal strand restoration

Hillsborough River State Park
* remove / repair seawall along riverbank and restore shoreline
* stabilize erosion along riverbank caused by foot traffic

Honeymoon Island State Recreation Area
* revegetate select areas with native vegetation

Koreshan State Historic Site
* exotic plant removal, post-treatment and reforestation
* recontour the two one-acre borrow pits to more gradual slopes, with exotic removal and planting of native vegetation
* shoreline stabilization on the Estero River
* clear and stabilize the man-made ditches created by the Koreshans

Little Manatee River State Recreation Area
* clean up several dump sites and restore

* roller-chop old-growth saw palmettos
* reforest 250 acres of improved pasture

Lovers Key State Recreation Area
* reconstruct some berm sites at bay side of park and replant with red mangroves

Myakka River State Park
* flatwoods and dry prairie restoration
* Vanderipe Slough restoration via removal of dikes and filling of ditches

Oscar Scherer State Recreation Area
* fill ditches that were dug to drain wetlands

Port Charlotte Beach State Recreation Area
* remove exotic vegetation; revegetate with native species

Avalon State recreation Area
* restoration of impoundment #2 (breached impoundment)
* filling of non-maintained mosquito control ditches
* exotics removal; planting of native vegetation
* coastal strand restoration

Bahia Honda State Park
* stabilize eroding bay-side beach area
* hydrologic restoration & tidal reconnection to 2 impounded mangrove areas (large campground & split lagoon)

Curry Hammock
* exotics removal and planting of native vegetation

Fort Pierce Inlet State Recreation Area
* continuation of shoreline restoration (fringing mangroves)
* exotic tree removal and plant native vegetation
* hammock restoration

Fort Zachary Taylor State Historic Site
* stabilize shoreline and complete breakwater structure
* exotic removal and plant native vegetation
* vegetate area near moat with appropriate native plants

Hugh Taylor Birch State Recreation Area
* mangrove restoration (removal of dredge fill and Australian pines)
* soften seawall (placement of rip-rap)
* exotics removal and planting of native vegetation

John D. MacArthur Beach State Recreation Area
* exotics removal and planting of native vegetation, north boundary
* hammock restoration (Munyon Island)

John Pennekamp Coral Reef State Park
* revegetate prop-scarred seagrass areas
* exotics removal and planting of native vegetation
* clean up Shaw tract and remove exotics
* complete revegetation of scarified sections of day-use areas

John U. Lloyd Beach State Recreation Area
* beach stabilization
* continuation of shoreline restoration

Jonathan Dickinson State Park
* acquisition and restoration of the pasture lands just west of the park
* Loxahatchee river tributaries; restoration of water quantity and quality of Kitching Creek / Jenkins Canal, Hobe Grove Canal, and Cypress Creek
* restoration of powerline impacts
* exotics removal and planting of native vegetation
* restoration of endangered sand pine scrub community in the area damaged by development of the Murphy Army Base and Hyland terrace
* campground vegetation restoration

Key Largo Hammock State Botanical Site
* exotics removal and planting of native vegetation
* stabilize shoreline of plugged canal at Ocean Reef Shores and backfill to depth of 4-6’ MLW
* replace boulder plug in the canal entrance at Sunland Estates
* restore topography and vegetation at scarified areas, i.e., Port “B,” Bell Hammock, Largo Beach & Tennis Club, Missile Tract site
* restore missile tracking site to hammock; remove all structures
* remove all old paved sections of SR 905

Long Key State Recreation Area
* exotics removal and planting of native vegetation
* shoreline stabilization through coastal plant restoration

Oleta River State Recreation Area

* connect tidal creeks, replace fill roads with pedestrian bridges to create continuous canoe trail and improve water quality
* remove exotics in wetlands and plant mangrove
* exotics removal and planting of native vegetation

Savannas State Reserve
* restoration from stormwater inputs (water quantity and quality)
* exotics removal and planting of native vegetation

St. Lucie Inlet State Park
* removal of 16 spoil piles, which includes “Mt. St. Lucie”
* exotics removal and planting of native vegetation
* dune restoration

Seabranch
* Manatee Creek restoration; removal of guava

Windley Key State Geological Site
* remove all debris and dump sites
* exotics removal and planting of native vegetation.

<u>Marine Resources (primarily mangrove restoration / exotics removal)</u>

East Coast
* Indian River Lagoon Spoil Islands - North and South Indian River Lagoon
* North Fork St. Lucie Aquatic Preserve - South Indian River Lagoon
* Indian River Lagoon Mosquito Impoundments - North and South Indian River Lagoon
* Pumpkin Hill - Nassau River
* Indian River Aquatic Preserves -North Indian River Lagoon
* Sebastian Creek - North Indian River Lagoon

Apalachicola National Estuarine Research Reserve - Franklin County
* East Bay Lands - Apalachicola Watershed
* Unit 4 - Apalachicola Watershed
* Cape St. George Island - Apalachicola Watershed
* Rodrique Tract - Apalachicola Watershed
* St. Vincent Sound and Schoellas Tract - Apalachicola Watershed

Rookery Bay National Estuarine Research Reserve
* Belle Meade Regional Watershed - Henderson Creek Basin
* Rookery Bay Regional Watershed - Henderson Creek Basin
* Water Management District 6 - Lely Canal Basin
* South Golden Gate Estates - Faka-Union Canal Basin

Florida Keys National Marine Sanctuary

* Coupon Bight - Marine
* Coupon Bight / Key Deer - Freshwater Lens
* Card Sound - Southern Glades
* Lignumvitae Key - Marine

Biscayne Bay Aquatic Preserve

* Oleta River State Recreation Area - Biscayne Bay
* Florida International North Campus - Biscayne Bay

Crystal River and St. Martins Aquatic Preserves

* Crystal Cove Tract - Crystal River and St. Martins Estuary

Charlotte Harbor

* Hendry Creek
* Estero Bay Buffer
* North and South (Stardial) Caloosahatchee River Mouth
* North and South Cape Coral Spreader
* Pine Island / Maria Drive and South A. P. Island
* Matlacha Pass A. P. Islands
* Winkler Road Easement
* Charlotte Harbor - Crow Key, Garrod, PGI & Freeland, Angin / Graybeal, Concannon / Watson / Gay & Piel / Asbury
* PGI / Alligator Creek
* Charlotte Harbor State Buffer Preserve - El Jobean, Myakka River Bridge
* GDC Cape Haze
* Lemon Bay / Cedar Point

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APPENDIX C: COPIES OF FORMS, WORKSHEETS AND CHECKLISTS

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WORKSHEET 1. QUICK SUITABILITY/FATAL FLAWS ANALYSIS

This is a worksheet of multiple choice questions regarding suitability and feasibility of the project. More detailed discussion about each question appears in Judging Suitability Of Your Site on Page 26. To quickly assess a project's ecological suitability and physical feasibility, answer the 15 questions about the project and then score it based on these instructions: *Questions 1-10 are about primary restoration issues, while Questions 11-15 relate to secondary issues. Primary issues score as follows: a=6, b=4, c=2, d=0. Secondary issues score as follows: a=4, b=2, c=1, d=0. A total score of less than 20 will result in a fatally flawed project.*

Issue	Answer	Score
Primary Issues	Choose most appropriate response	a=6 b=4 c=2 d=0
1. Restoration of this site will contribute to: a) at least 6 ecological functions, b) 3-5 important ecological functions, c) 1 or 2 functions, d) several lesser ecological functions.		
2. In terms of ecological functions, this restoration will result in: a) significant increase in regional capacity, b) measurable increase in region, c) moderate increase or d) qualitative but not measurable increase in ecological functions of the region.		
3. The effect of the restoration will extend to: a) a very large (> 200 square miles) regional area, b) the entire watershed in which the project is located, c) local areas surrounding the project or d) the immediate site only.		
4. The site has been identified by or is completely compatible with: a) greater than 3 regional conservation plans, b) 1-3 plans, c) 1 plan, d) no regional planning product.		
5. The restoration will contribute to increase of ecological functions that are critically limited or impaired in the region: a) to a great extent for a number of functions, b) to a moderate extent for a number of functions or to a large extent for one primary function, c) somewhat for a number of functions or moderately for one primary function or d) only moderately for one function or not at all for any critically impaired functions.		

6. The proposed project fits in with previously established regional restoration and conservation goals: a) to a great extent, b) to a moderate extent, c) slightly, but has its own goals applicable to the site itself, or d) not at all.		
7. Surrounding land uses are compatible with restoration: a) completely, b) for the most part, with areas of incompatible uses on less than 20% of area surrounding the site, c) on 50% to 80% of the area within 1 mile of the site, d) only on 20% of surrounding lands.		
8. Project will be ecologically sustainable: a) almost certainly, b) probably, c) perhaps, d) only with continuous, active influence by managers.		
9. Restoration is financially possible: a) with existing resources, b) with limited fundraising, c) with substantial new allocation or contribution of funds, d) only with significant allocations from unknown sources.		
10. Restoration construction activities are physically feasible: a) in current conditions and plans, b) with minor modifications to existing conditions, c) with substantial modifications to on-site conditions and/or changes in off-site conditions, d) only with detailed planning, major manipulation of on-site conditions and changes in off-site conditions.		
<u>Secondary Issues</u>	Choose most appropriate response	a=4 b=2 c=1 d=0
11. Restoration of the site will: a) be completely compatible with other site goals and activities, with no conflicts, b) conflict to a minor extent for a limited time, c) conflict to a great extent for a short time or to a small extent for a long time period, or d) conflict to a large extent in purpose, area and time.		
12. Resources (staff, equipment, money) to implement the project: a) currently exist onsite, b) can be requested and secured with moderate effort, c) have not been identified but could possibly be secured with effort, d) are unknown.		
13. Based on the best available information and estimates from similar projects, the costs to plan and implement this restoration will be: a) minimal, b) moderate, c) significant or d) astronomical.		

14. There is political support for this project: a) definitely, b) likely, c) unlikely, d) impossible.		
15. The public support for this restoration project is: a) great, b) moderate, c) mediocre or d) nonexistent.		
Total Score		

If your **Total Score** from the worksheet is less than or equal to **20**, your project as you envision it is fatally flawed and does not appear to be suitable for restoration. It may be prudent to abandon planning here, or to completely rethink the scope or location of the project. If your **Total Score** is greater than **20**, please proceed.

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Checklist 1
Site Assessment

________________________ ________________________

Project Name **Project Owner**

Section A

Existing Site Conditions

	Status	Responsible/Source	Format/Location
Location map & descript/ boundary delineation	________	________________	________
Aerial photos	________	________________	________
Topography	________	________________	________
Soils	________	________________	________
Hydrology/water quality	________	________________	________
Vegetative communities	________	________________	________
Wetlands	________	________________	________
Wildlife	________	________________	________
Special elements	________	________________	________
Cultural/historical sites	________	________________	________

Information gaps ____

Site Issues

Land Use and Conditions/Physical Structures: (exotics, trash piles, dip vats, poaching, access, pastures, man-made water holes, existing or planned buildings, roads, fences, ditches) Make notes and attach additional sheets (maps) as needed.

Site Assessment Checklist - page 2

Policy Issues: (existing or future policies to which the site must conform; management policies or guidelines; obligations that must be met; programs/initiatives affecting the site)

Legal Issues: (easements; title restrictions; MOUs, etc.)

Section B

Historical Conditions

	Year	Source	Area Covered	Format/Location
Historical aerial photographs:		________	____________	_____________
Other information (maps, etc.)		________	____________	_____________

Section C

Surrounding Conditions

(ownership of tracts surrounding the project site; current status of adjacent tracts; future development, zoning, etc.)

Checklist 2
Items in an Action Plan

1. Executive summary of project, including ecological contributions, site history
2. Overall project goal and vision (post-restoration conditions)
3. Project description (from site assessment)
   - project name and proposer
   - location & setting (legal description, regional location map, site map, aerials)
   - topography
   - soils and geology
   - hydrology and water quality
   - vegetation and land cover (including wetlands possibly treated separately)
   - fauna
   - special elements
   - cultural/historical information
   - site issues
   - historical conditions
   - surrounding land uses
4. Restoration plan
   - restoration goals and objectives
   - strategies and actions for each goal, with justification and brief description of methodologies
5. Figures, maps, tables, exhibits and appendices
6. Literature cited

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WORKSHEET 2. RESTORATION TASK TIMELINE

PROJECT NAME:

PREPARER/NAME:

	Year 1	Year 2	Year 3	Year 4	Year 5
	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4
Task #1					
Task #2					
Task #3					
Task #4					
Task #5					
Task #6					
Task #7					
Task #8					
Task #9					
Task #10					

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WORKSHEET 3. RESTORATION TASK COSTS

PROJECT NAME: ______________________________

PREPARER/NAME: ______________________________

Activity #1 ______________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #1			$000000

Activity #2 ______________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #2			$000000

Activity #3 ______________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #3			$000000

Activity #4 ______________________________

Tasks	Units	Cost/Unit	Total
		$000	$00000
		$000	$00000
		$000	$00000
		$000	$00000
Total Activity #4			$000000

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Checklist 3
Items in a Restoration Project Package

_______	A description of how the site was selected, included detailed references to regional plans used
_______	Results of suitability analysis (☞ Worksheet 1) or other explanation of project justification and feasibility
_______	The complete results of the site assessment (☞ Checklist 1), including aerial photos and other maps or exhibits
_______	The final restoration alternative and rationale on why it was selected over others
_______	The complete action plan, with strategies and actions for implementation of restoration
_______	Full construction plans necessary for permits or contractor implementation
_______	The completed workplan, including who is responsible for all tasks and the timeline/schedule
_______	A detailed monitoring plan
_______	An updated long-term management, maintenance and contingency plan for the site (or reference to its location)
_______	Detailed cost estimates and budgets for each stage of restoration

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APPENDIX D: STATE OF FLORIDA POLICIES AND REGULATIONS RELEVANT TO RESTORATION

(To be provided and updated by FDEP staff)

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APPENDIX E: MANAGING THE NATURAL RESOURCE LANDS AND WATERS OF THE STATE OF FLORIDA

(From Young 1997)

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