



The PRIDE Project – An Assessment of Natural Resource Business Requirements, Information Needs, and Information Technology Applications

Perhaps no other undertaking in the history of the National Park Service will have as much impact upon natural resource stewardship and management throughout the agency as will the Natural Resource Challenge. The fundamental goal of the Challenge, initiated in FY 2000, is to revitalize natural resource stewardship by ensuring that resource knowledge and understanding are driving essential decision-making and planning. To implement the Challenge, the Service requested Congressional appropriations to increase base funding devoted to natural resource management and protection by \$20 million per year for five years, for a total base increase of \$100 million. Funding increases generated by the Challenge were to be distributed across 12 major action areas, two of the major ones being natural resource inventory and monitoring.

From the implementation of the Challenge in FY 2000 through FY 2005, the National Park Service Inventory and Monitoring Program will have expended more than \$140 million establishing core vital signs monitoring programs and conducting baseline natural resource inventories in approximately 270 units of the National Park System. The amount of technical knowledge and understanding these efforts will produce about the natural resources the Service holds in trust is staggering!! However, simply acquiring this tremendous amount of technical knowledge and understanding about park resources may not be sufficient to ensure that the goals of the Challenge are fully realized. The Service must also take steps to ensure that factual knowledge and understanding generated by the Challenge is converted into useful *information* commensurate with the needs of policy makers, managers, and planners at all levels of the organization and to ensure that information is readily available to and accessible by those individuals.

Mindful of this need, the Natural Resource Advisory Group (NRAG), during a May 2002 meeting, decided to undertake a project to conduct a structured assessment of the Service's natural resource business requirements and associated information needs. Conducting this assessment was deemed essential to the long-term success of the Natural Resource Challenge effort because it would help to ensure that information generated through the Challenge is truly useful to managers. Following the NRAG meeting, a contractor-facilitated workshop was held in Denver to formulate a strategy for conducting the assessment service-wide. The strategy formulated during that workshop has come to be known as PRIDE (**P**rotecting **R**esources through **I**nformed **D**ecision-making and **E**ducation).

This manuscript provides an overview of the PRIDE project and its approach to conducting an assessment of major natural resource stewardship processes and functions carried out by the Service (e.g. planning, decision-making, management actions), the information needed to perform those functions, and the data management and information systems that support those efforts.

PRIDE Project Goals and Objectives

The primary purpose of PRIDE is to develop an understanding of National Park Service natural resource business requirements and field data collection efforts, and to conduct a fundamental analysis of the relationship between the mission of the Natural Resource Stewardship and Science Directorate (NRSS), its goals, business objectives, mission-critical decisions, data collection efforts, and Information Technology (IT) solutions. For purposes of the study, the “NRSS” is considered to include all individuals having major involvement with natural resource management and protection activities at the national, regional, network, and park levels, including permanent NPS employees, partners, cooperators, and contractors.

Major goals of the PRIDE effort include ensuring that:

- Data collection efforts are consistent with NRSS business requirements and associated managerial processes.
- Natural resource information processed from data collection efforts is available in a format commensurate with the needs of Park Service planning, decision-making, and management.
- Redundant and unnecessary data collection and IT development are identified and recommendations are provided about how to resolve those situations.

Office of Management and Budget Mandate - In addition to the NRAG decision, other recent developments suggest that the PRIDE project is a timely undertaking. For example, NRSS will soon need to assess its data collection, analysis and information dissemination efforts in response to a mandate from the Office of Management and Budget (OMB). The OMB mandate requires the Service to conduct an independent evaluation of the effectiveness of NRSS programs, thus ensuring they are providing the necessary information for strategic program planning and managerial decision-making. In essence, the OMB mandate requires the Service to answer two fundamental questions relative to natural resource management and protection programs: 1) are we doing the right things? and 2) are we doing them well? The PRIDE project can facilitate this assessment by critically examining data being collected through the Natural Resource Challenge and other resource management programs and determining how those data relate to information needs for managerial decision-making and planning.

Relation to Enterprise Architecture - In addition to the OMB mandated evaluation, there are also legal and political reasons for conducting the PRIDE project. Principle among them is the Clinger-Cohen Act of 1996 which requires all federal agencies to develop and maintain an "Enterprise Architecture". An Enterprise Architecture (EA) is simply a strategic planning process that produces a blueprint of how an organization (i.e. an Enterprise) utilizes personnel, information technology, and data to accomplish its mission and goals. An EA (i.e. strategic plan) includes models, diagrams, and text that link organizational mission and goals, to business processes, information technologies, and data services. In response to the Clinger-Cohen Act, the Department of Interior (DOI) has initiated a department-wide EA Initiative that all bureaus, including the National Park Service, will be required to support. In FY 2004, the DOI Enterprise Architecture Initiative focused on five business areas (recreation, wild-land fire management, law enforcement, financial, and Indian Trust). In FY 2006, the Departmental Initiative will be extended to include the Natural Resource business area. In this regard, the PRIDE project is especially timely because it will lay much of the groundwork the Service will need in order to effectively participate in the DOI Enterprise Architecture Initiative for the natural resource business area.

The Basic Approach

Figure 1 provides a conceptual framework of the NPS resource planning and management system. The first three components of the framework are primarily socio-political in nature and outside the major focus of the PRIDE project. PRIDE will focus primarily upon the last four major components of the framework, as indicated by the box drawn around those components. However, an important focus of PRIDE will be to document the extent to which NPS business processes and associated information collection efforts support attainment of the agency's mission goals and legislative mandates. In carrying out this basic approach, the PRIDE project will focus upon completing four major tasks: 1) identify major NRSS business requirements, 2) document information needed for each requirement, 3) assess information technology solutions and applications, and 4) identify gaps and holes in information availability.

Task 1 - Identify Major NRSS Business Requirements

The term "business requirements" typically includes processes or activities an organization needs to do in order to accomplish its mission. Familiar examples of NPS business requirements include: establishing fishing regulations (decision making), developing Resource Stewardship Plans (planning), summarizing public use statistics for parks (data analysis), and conducting water quality monitoring (data collection). The critical question then becomes "What are the major functions or processes that the National Park Service must perform in order to accomplish its legislative mandate to preserve and protect natural resources?"

Published Policy Documents - There are various ways in which one might go about attempting to identify the essential functions and processes the Service performs related to natural resource stewardship and protection but the PRIDE project is structured around two primary approaches. The first approach is based upon the technical reference manuals,

handbooks, and guidelines published in the Natural Resource Reference Manual (RM-77) or its predecessor, NPS-77. These documents not only define major natural resource business processes but they also represent official agency policy and describe how managerial processes relate back to NRSS organizational missions, legislative mandates and strategic goals.

A review of RM – 77 and NPS – 77 produced a listing of 23 major business processes related to natural resources that are routinely conducted by the Service. Those processes are listed in Table 1 and have been grouped into four categories. Category 1 contains business processes that are directly related to one or more NPS strategic planning goal or a GPRA-related accountability process. Category 2 processes include those not directly linked to a specific strategic planning goal or GPRA-accountability process but for which a well-defined organizational unit (e.g. a division, branch, etc.) has been created to perform the process. Business processes included in Category 3 represent those that deal primarily with a specific natural resource (e.g. soils) while Category 4 includes business processes related to activities conducted outside the purview of NRSS but which NRSS plays an active role (e.g. fire management).

The one exception to the categorization process described above relates to the process of National Data Store Development and Management included in Category 1. While there is currently no available Reference Manual or Guideline dealing with database development, NPS – 77 does include a section related to Data Management. Because data management, both spatial and non-spatial, is an important component of all business processes listed in Table 1, the PRIDE team felt it important to include that as a Category 1 process as well.

Professional Judgment - The second major strategy for defining major natural resource business processes is based upon professional judgments and work experiences. During September, 2004, a PRIDE Planning and Initiation Workshop was held in Denver, Colorado. The workshop was attended by approximately 30 NPS personnel representing the National, Regional, and park/network organizational levels. During the 4-day workshop, attendees focused upon defining the mission and strategic planning goals for the NRSS. For that exercise, the NRSS was likewise considered to include, not only the five technical divisions aligned directly under the Associate Director, but also all NPS employees, partners, contractors, and cooperators at the park, network, regional, and national levels who are directly involved with activities related to natural resource stewardship and protection.

After defining NRSS mission and strategic planning goals, workshop participants were then asked to define, based upon their professional judgments and experiences, the most important business processes/functions performed by the NRSS and the information requirements needed to support the NRSS mission, strategic planning, and managerial decision-making. The business processes and 10 most important information requirements identified by the workshop participants are listed in Table 2.

Examination of the business processes and information requirements listed in Table 2 (derived from professional judgment) suggests that they essentially represent sub-processes or sub-activities of the business functions included in Table 1 (derived from policy

documents). For example, information management, policy and guidance, and partnership development were identified as priority business functions by workshop participants. But, all of those functions can be viewed as steps of Wetland Protection, as well as most of the other business functions listed in Table 1. The one possible exception to this generalization identified by workshop participants is “Climate Change” which is typically viewed as a research function or process, rather than a managerial function. Therefore, given these findings, it is concluded that, if the PRIDE project focuses primarily upon the business functions and processes identified in reference manuals and related documents, it will essentially incorporate the processes identified through professional judgment. In this manner, the results of the PRIDE workshop “validate” the strategy of using reference manuals and related policy documents as the basis for defining NRSS business functions and processes.

Task 2 – Document Information Needs

Once a given business process has been identified that supports attainment of an organization’s mission or strategic planning goal, it becomes important to identify what information the organization needs to implement that process. If the information needed to implement the process or function is not available, or available in a format not commensurate with that needed to implement the process, the organization is handicapped in its ability to achieve its mission.

Data Flow Diagrams - The approach taken by the PRIDE project to identify major information needs associated with NRSS business functions and processes is to have a contractor convert the information provided in reference manuals and technical guidance documents included in RM – 77 and NPS -77 into a series of Data Flow Diagrams (DFD’s). Data Flow Diagrams essentially provide a “conceptual model” representation of a managerial function or process because they depict the sequential steps or actions that must be taken in order to implement the process, along with the information needed for each step. Describing managerial functions and processes in this manner may be unfamiliar to most natural resource managers but the process is well established and widely accepted in the corporate world.

Figure 2 depicts the DFD for the most generalized level of the Wetlands Protection business function. Circles on the DFD represent major steps required to implement the process at this level of resolution. Also indicated in the diagram are sources of input into the process (e.g. USFWS guidelines and NWI maps) and the individuals responsible for implementation of various steps in the process. For example, the DFD indicates that park field personnel are responsible for conducting onsite wetlands evaluations.

A critical component of the DFD is identification of the specific information needed to implement each step in the process. Diagrammatically, information requirements are indicated by open-ended, parallel lines. To illustrate, the DFD illustrates that wetland inventories and enhanced inventories are required sources of information needed to conduct the Park Planning Process (indicated as Level 1.3 on the DFD). Describing business functions in this manner allows analysts to “drill down” through a given step to describe in more specific detail the steps and information needed to conduct a given process. As an

illustration, Figure 3 represents an “exploded” version of process 1.5 – Monitor Park-wide Wetland Inventories depicted on Figure 2.

Peer Reviews by Subject Matter Experts - After the major natural resources business processes have been modeled, the next step in the PRIDE study is to have the resulting DFD’s undergo a peer review process, utilizing NPS “subject matter experts” (SME’s) that are most familiar with the process. Each business process will be peer reviewed by at least two SME’s - one SME who was primarily responsible for developing the technical guidance document (s) from which the DFD’s were generated and at least one SME from a park or network who has had considerable experience attempting to apply the process under actual managerial situations. In this manner, in addition to documenting the accuracy and completeness of the DFD products, the peer review process will also allow analysts to begin gaining insights into how the reviewed business process might be improved as well as documenting the existence and availability of databases and other sources that provide information needed to implement the process under typical field conditions.

Task 3 – Assess Information Technology Solutions and Applications

To effectively manage and utilize the information needed for natural resource management and protection, the National Park Service must have an Information Technology (data management) infrastructure that meets agency needs at all organizational levels. Among other things, that infrastructure should enhance communication, standardize data formats, and increase the accessibility of natural resource data for management, research, and policy decisions throughout the organization. Therefore, a major phase of the PRIDE project involves examining the current data management infrastructure and ascertaining if, and how, any needed improvements should be made.

Document the “As Is Architecture” – During the September 2004 PRIDE workshop, participants were asked to identify, as thoroughly as possible, all of the sources where information needed to implement NRSS business process might be obtained. Most of the identified sources were individual databases (e.g. STORET water quality data base) or information systems (e.g. Air Resource Information System – ARIS). But participants also identified web sites (e.g. Nature and Science Public Web Site) and non-automated information sources as “scientific journals”. In all, workshop participants identified 80 distinct critical sources where natural resource information could be obtained, including those available from WASO – NRSS Sources, Other NPS WASO Sources, and sources outside NPS.

The collection of information sources identified by PRIDE workshop participants, taken collectively, essentially define the current or “As Is” system architecture. For the most part, these sources identify the locations where managers, planners, and decision-makers attempting to implement the natural resource business processes identified in Step 2 may go to obtain critical information. It follows that, if the information is not provided by one of these sources, is provided but is not readily accessible, or is provided and accessible but is not in the format needed for managerial purposes, then the performance of the managerial process will be severely hampered. Therefore, the next logical step in the process should be

to examine the current system architecture and determine if it needs to be modified in some way so as to provide better support to parks and central offices.

Describe the “Target Architecture” – Once the contractors have examined each of the systems identified during the PRIDE workshop (i.e. analyzed their data content, format, linkages, etc.), they will then be in a position to suggest an integrated IT infrastructure that would be most closely aligned with the decision making processes for each NRSS business process. The goal will be to define a desired or “Target System Architecture” that outlines each IT system’s functions, the role those functions play in the decision making process, and also the specific information the system must provide in order for it to meet the requirements of business process implementation and decision making. By comparing the “Target” and “As Is” architectures, the contractors will be able to ascertain if the current NRSS IT systems should be modified, augmented by adding additional systems, or perhaps replaced altogether by new systems.

Task 4 - Identify Information Gaps and Deficiencies

The major focus of the PRIDE project is on documenting the information needed to support NRSS managerial decision-making and planning. It follows that emphasis should be given to not only determining what information is currently available but also what information is needed to support one or more business processes but, for some reason, is not available to the manager or decision maker. Information may not be available to the decision maker for a variety of reasons. For example, the information may not exist entirely, or it may exist but its existence is unknown to the manager.

By comparing the data and information currently available through the multitude of data systems comprising the “As Is Architecture” with the information requirements identified during the information needs assessment process (Task 2) discussed above, the contractor will be able to conduct a “Gap Analysis” and identify what information is not being provided by the current IT systems, as well as what desired business process outcomes are not being supported by the current IT systems. The primary focus of this analysis will be on identifying any gaps in the existence or accessibility of natural resource information needed to answer critical management questions and perform key managerial tasks such as decision-making, planning, and outreach. The gap analysis performed by the contractor will also include providing recommendations about how any deficient information might be provided. In some cases, the deficient information may exist but not be available to decision makers. In that instance, the deficiencies could be addressed through techniques such as warehousing, data mining, or synthesis and integration. In other instance, the data may not exist at all, in which case additional data collection or collaboration with partners may be needed. Information collected during this stage of the project will become the basis for a “Modernization Blueprint” and associated transition plan prepared by the contractors that will describe steps the Service should consider during any subsequent attempts to make its natural resource IT systems more effective and/or efficient.

In Conclusion

In recent years, the National Park Service has created vast amounts of information and built numerous information systems, sometimes with clear objectives for a specific park or program, but often with little recognition of how one database or system might, or should, interact with another. These efforts have led to the development of so-call “stovepipe” systems, which may work well for their intended purpose, but may not meet the demands or needs of information users elsewhere. For example, fire managers often require certain information about vegetation communities within the park upon which to base fire management plans. In similar manner, law enforcement personnel need current information about threatened and endangered species found in parks to deal effectively with poaching issues. Unfortunately, managers can’t always share data easily because of constraints inherent in the data itself or in the delivery system built around it. If the tremendous financial investments the Service is making in data collection and IT systems development are to be fully utilized, then the agency needs to critically examine its information needs and data delivery systems in light of critical business processes and make any necessary adjustments.

PRIDE will provide the Service with some important insights and products it can utilize during subsequent attempts to deal with any identified limitations in its current IT architecture and data delivery systems. By systematically reviewing data and information requirements for multiple natural resource business processes, the project will be able to provide useful insights into how the Service should integrate data and information systems across major resource data categories (e.g. vegetation, water, geology, etc.) to address critical management needs. But, perhaps the most significant contribution the project can provide to the Service is by matching up existing data and information sources with critical steps in selected managerial decision making processes and identifying where additional information is needed. It has often been said that information represents the lifeblood of an organization. Unless an organization has access to timely information in the quantities and qualities commensurate with its management needs, that organization cannot hope to be effective. The PRIDE project will go a long ways toward ensuring that the National Park Service remains an effective organization with respect to its information and decision making needs for natural resource management and protection.

Table 1. Major NPS Natural Resource Business Processes Identified for the PRIDE Project

| Business Processes | Reference Document |
|---|--------------------|
| Category 1 Processes | |
| Wetland Protection | DO 77 - 1 |
| Air Resources Management | RM – 77 |
| Cave and Karst Management | RM – 77 |
| Disturbed Land Restoration | RM – 77 |
| Freshwater Resources Management | RM – 77 |
| Geologic Resources Management | RM – 77 |
| Paleontological Resources Management | RM – 77 |
| Endangered, Threatened, and Rare Species Mgmt | NPS - 77 |
| Non-Native Species Management | NPS - 77 |
| National Data Store Development and Mgmt | Various |
| Category 2 Processes | |
| Environmental Impact Analysis | DO - 12 |
| Resource Damage Assessment and Restoration | DO - 14 |
| Sound Preservation and Noise Management | DO – 47 |
| Native Animal Management | NPS – 77 |
| Integrated Pest Management | RM – 77 |
| Category 3 Processes | |
| Floodplain Management | DO – 77-2 |
| Soil Resources Management | RM – 77 |
| Fish and Fishery Resources Management | NPS – 77 |
| Marine Resources Management | NPS – 77 |
| Shoreline Management | NPS – 77 |
| Vegetation Management | NPS – 77 |
| Category 4 Processes | |
| Wilderness Preservation and Management | RM – 41 |
| Hazardous Waste Management | NPS – 77 |
| Wildland and Prescribed Fire Management | NPS - 77 |

Table 2. Listing of the natural resource business process / functions and priority information requirements identified by participants during the September 2004 PRIDE workshop.

A. Natural Resource Business Processes / Functions

Compilation of Natural Resource Case Histories
Climate Change
Information Management
Management/Administration
Natural Resource Basic Inventory
Natural Resource Inventory Roll-up
Park/Ecosystem Condition roll-up
Partnership Development
Policy and Guidance
Public Affairs/Outreach/Education
Social Science
Technical Assistance

B. Natural Resource Information Requirements

1. Summary Information about the condition of park natural resources
 2. Information about legislation, regulation, case law
 3. Most critical resource management funding needs
 4. Guidelines for natural resource desired future conditions
 5. Acres of Invasive species
 6. Acres of wetlands
 7. Species listing for parks
 8. Database tools for project tracking
 9. Information on effectiveness/efficiency of natural resource management actions
 10. Exotic species information
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Conceptual Framework of the NPS Resource Planning and Management System

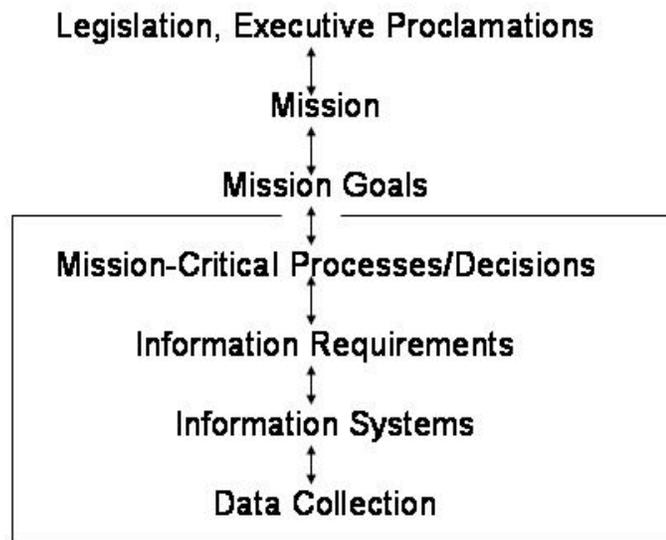


FIGURE 1- Conceptual Framework of the NPS Natural Resource Planning and Management System.

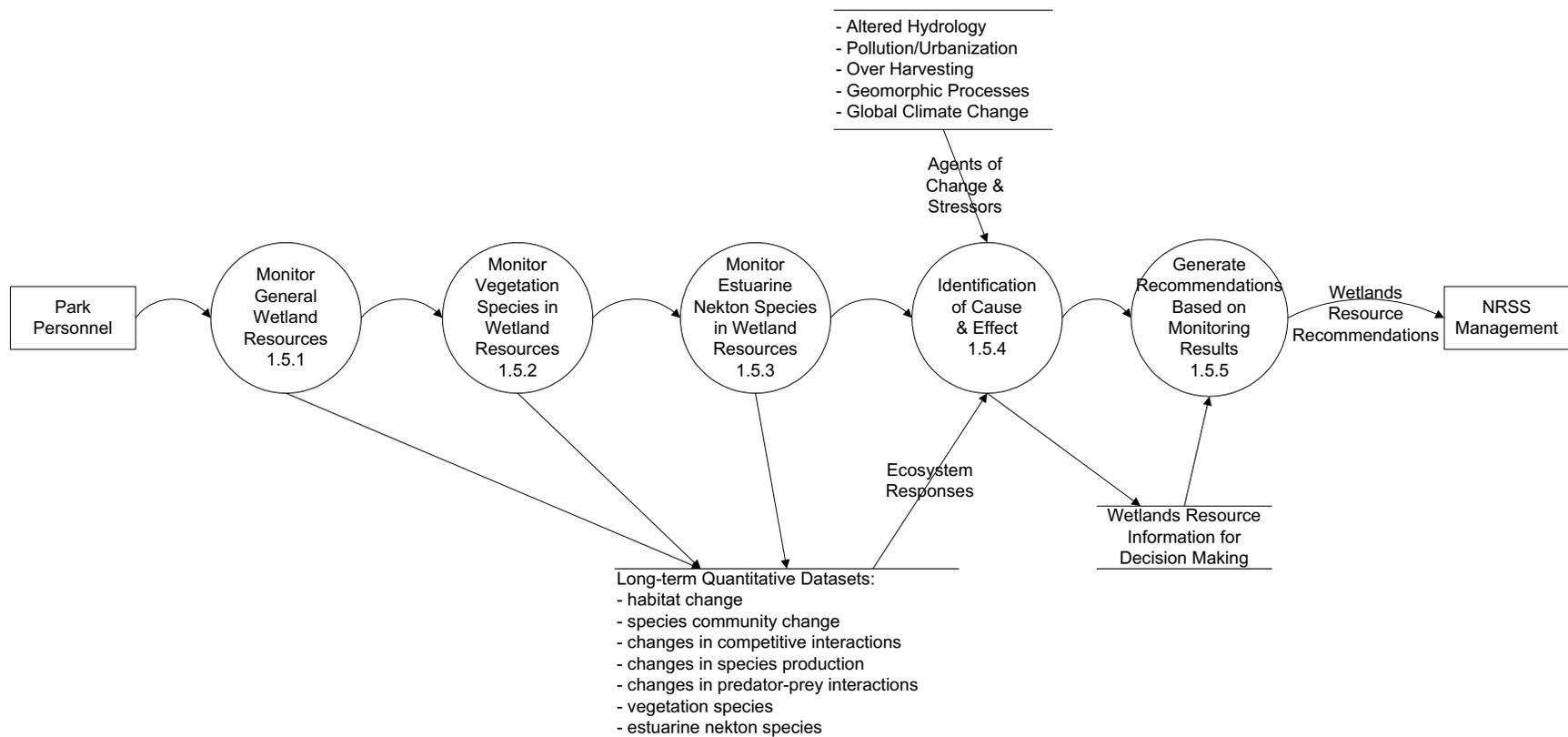


Figure 3 (Sample DFD): Wetland DFD - Level 1.5 “Monitor Park-wide Wetland Inventories”