

# **Strategic Science Plan**

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***USGS Patuxent Wildlife Research Center***

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## ***Introduction***

**Background.** The U.S. Geological Survey (USGS) Patuxent Wildlife Research Center (PWRC) is a biological research center in the USGS, the premier Federal earth and biological sciences research organization in the Nation. PWRC is among the largest of the wildlife research centers in the world. It is home to nearly 70 scientists and 100 support staff. PWRC's headquarters is located at the U.S. Fish & Wildlife Service's (FWS) Patuxent Research Refuge in Laurel, Maryland. The facilities are jointly operated and maintained by USGS and FWS. PWRC has eight Field Stations from Maine to Mississippi, co-located with universities or partner agencies. PWRC's largest Field Station, the PWRC Biological Survey Unit, is located at the Smithsonian Institution's National Museum of Natural History in Washington, D.C. In addition several scientists are located at off-campus sites through work agreements.

As a research facility of the Department of the Interior (DOI), PWRC is directed to conduct research and deliver scientific information necessary to fulfill DOI's responsibilities to the Nation. Funds appropriated by Congress to USGS support a significant part of PWRC's science; however, because much of its science is driven by the needs of other agencies, funding from partners is essential for full realization of PWRC's science potential.

Since its establishment in 1936 as the nation's first wildlife experiment station, PWRC has been a leading international research institution for wildlife and applied environmental research, for transmitting research findings to those responsible for managing the Nation's biological resources, and for providing technical assistance in implementing research findings to improve biological resource management. PWRC's scientists have been responsible for many important advances in biological resource conservation. PWRC's fundamental research strengths are in the areas of migratory birds, wildlife population analysis, vertebrate systematics and biodiversity, habitat management, wetland ecology, coastal zone and flood plain management, contaminants, endangered species, urban wildlife, ecosystem management, and management of National Parks and National Wildlife Refuges. PWRC develops and manages or coordinates a variety of national and regional bird and amphibian monitoring programs and has responsibility for the national Bird Banding Laboratory. PWRC's scientific and technical assistance publications, wildlife databases, and electronic media are used nationally and worldwide in managing biological resources.

The strength and future of PWRC lies as a Center of methodological excellence in comprehensive wildlife and ecosystem research built from the combination of staff expertise in biodiversity, coastal and wetland ecology, contaminant science, endangered species science, population ecology, and survey design science. Ultimately, PWRC's science is shaped by the interface between pressing public natural resource needs, often identified through Federal mandates, such as the Migratory Bird Treaty Act and the Endangered Species Act, and the intellectual creativity and motivation of its scientists and technical staff. The research of PWRC scientists is at the forefront of wildlife and ecosystem science, which significantly enhances the long-term success of Federal natural resources management. As PWRC evolves to meet new challenges of the twenty-first century, it must maintain expertise and leadership in innovative wildlife-oriented ecosystem science to be maximally responsive to future science directions identified by the USGS and to the needs of partner agencies and the public.

**Purpose of the Science Plan.** The purpose of this Science Plan is to provide a blueprint for future science directions for the PWRC. The plan will be a fluid document reflecting adjustments to future considerations. It will serve as a primary source of guidance over a 5-year period for resource allocation, organization, and decisions regarding staffing, facilities, and other infrastructure needs. The Plan was written by a team of scientists and managers, drawing on the products of intensive workshops involving PWRC staff, partner agencies, USGS Disciplines, and other stakeholders. Final goals and objectives were validated against a landscape of Departmental and USGS missions, visions, and policies.

### ***The PWRC Vision***

**To be recognized in the international scientific community as a premier research institution for wildlife science.**

### ***The PWRC Core Purpose***

**To provide information needed to strengthen the scientific foundation for managing the Nation's biological resources.**

### ***The PWRC Mission Goals***

- Strengthen the scientific underpinnings of wildlife and biological resource conservation, particularly as related to the trust responsibilities and agency needs of the Department of the Interior and the Nation.
- Address and solve the most critical, pressing, and complex problems in wildlife and ecosystem management, through integration of its biological science capabilities with those of other USGS Disciplines and agency partners.
- Serve as a leader in assessing the status and trends of the Nation's biological resources, and in managing and delivering scientifically credible databases and analytical products associated with biological surveys to resource managers.
- Improve understanding of the effects of human impacts and natural processes in the management of biological resources.
- Improve understanding of the fate and effects of contaminants and other stressors in the environment.
- Support the Patuxent Research Refuge as a model of long term ecological research and a focal point for study and interpretation of the ecological and economic role of the green space in the agricultural and urban landscape of Maryland.

## *Current and Emerging Science at PWRC*

### **Overview**

PWRC is a leader in many areas of wildlife-related science. Major areas of expertise include conducting whooping crane and endangered species research and propagation; estimating population; applying adaptive management; and developing, managing, and interpreting long-term wildlife surveys. The Center is a leader in determining the effects of contaminant exposure on mammals, birds, and amphibians and developing new methods for identifying interactions among other stressors in wildlife populations. Additionally, PWRC is a leader in understanding the ecological dynamics of coastal marine environments; identifying the effects of human activities and global warming on fragile environments; investigating wetland ecology; and understanding vertebrate evolution and systematics. PWRC applies this wealth of expertise and knowledge to a wide variety of biological resource problems through extensive interactions within the U.S. Geological Survey and with other agencies of DOI and the Nation.

### **Science Emphasis for the Next Five Years**

The vision for PWRC science for the next five years spans four conceptual themes important to the USGS: biodiversity and systematics; coastal and wetlands ecosystems and landscapes; contaminant ecology; and population and community ecology. Below, each theme is described and organized in terms of PWRC's current capabilities and its plans for development over the next five years.

#### **Assessing Biodiversity: Systematics, Status and Trends**

**Current Program.** Museum-based systematics research provides the evolutionary framework that enables us to understand the identities, relationships, and adaptations of species and other taxonomic units and to manage ecological systems in a biologically meaningful way. Assessing status, trends, and abundance of taxa in any system requires a solid understanding of the taxonomy of its biotic components. Taxonomically and statistically reliable monitoring programs are vital for conservation planning by resource management agencies and organizations.

PWRC biologists at the Biological Survey Unit (BSU) at the Smithsonian Institution's National Museum of Natural History (NMNH) conduct original research on systematics, nomenclature, and biodiversity of vertebrates. They also provide taxonomic identification services crucial for regulatory agencies like the FWS and are responsible, through a Memorandum of Understanding with the NMNH, for curation of nearly one million specimens of North American vertebrates. The formal association between the Smithsonian and BSU and its precursors dates from 1889. Subject matter and methodology experts in BSU and elsewhere at PWRC continue to play important roles in preparing and revising authoritative checklists of vertebrates and definitive guides for measuring and monitoring biodiversity around the world.

BSU contributes important expertise on behalf of USGS to the development and management of the Integrated Taxonomic Information System (ITIS), an important standard for scientific nomenclature adopted by the Federal government.

PWRC has the USGS lead for long-term program of research for assessing status and trends of bird populations and management of associated databases. Paramount among these efforts is the Breeding Bird Survey (BBS), a statistically designed, roadside survey of birds breeding in North America conducted annually since 1966 by volunteers with bird identification expertise. Center biologists, either independently or in collaboration with others, are developing methods for surveying colonial waterbirds, secretive waterbirds, and shorebirds. They also design and manage databases including those associated with the BBS, colonial waterbird surveys, avian point programs, and State breeding bird atlases. PWRC's experience and capability for managing large, long-term, population databases is unmatched in USGS. Web accessibility to the databases, including Geographic Information Systems (GIS)-based tools for on-line summary and analysis, is in place or in various stages of development. Analogous programs are being developed to monitor amphibians, including the North American Amphibian Monitoring Program (NAAMP) and the Northeast Amphibian Research and Monitoring Initiative (Northeast ARMI). The latter incorporates the on-line National Atlas for Amphibian Distributions. PWRC is also investigating development of methods to assess the status and trends for other taxa of interest to DOI, such as pollinating insects. PWRC's status and trends databases are widely used by conservation agencies and other organizations to help establish conservation priorities

**Future Directions.** The partnership with the Smithsonian will be maintained and strengthened as opportunities permit, in order to meet the increasingly complex needs of both the biological and legal arms of the wildlife conservation community for expert taxonomic support and biodiversity assessment. Immediate priorities will be to maintain existing expertise in mammals, amphibians, and reptiles, and to rebuild expertise in avian taxonomy lost through attrition. As the FWS and the NPS embark on major programs to inventory and monitor biodiversity on public lands, greater emphasis will need to be paid to PWRC's biodiversity capabilities, including museum support. Development and refinement of monitoring resources such as the on-line tutorial and the series on biodiversity monitoring methods will continue in order to meet increasing demands of the resource management community. New technology for real-time, on-line interaction with population databases will be developed and adapted for use by USGS partners. Collaboration with the National Biological Information Infrastructure (NBII), the USGS Geography Discipline, and the Smithsonian Institution will be expanded to improve electronic data development, analysis, and sharing capabilities. The development of status and trends programs will require the expertise of quantitative population ecologists and biometricians versed in modeling and estimation to deliver the most credible procedures available.

The goals of these collaborations will be to explore ways of (1) identifying and minimizing biases that may exist in survey design, (2) integrating methods for estimating detection probability into surveys, and (3) improving the value of monitoring programs through collection of ancillary data on potentially significant environmental attributes. Finally, PWRC will assure that the infrastructure for state-of-the-art database management, storage, and

retrieval is sufficient to meet the increasing demands for information by the conservation and scientific communities.

### **Goals and 5-Year Objectives.**

#### Goal 1. Restore and enhance capability through personnel recruitment.

Objective 1: Recruit and hire for BSU a museum-collections-oriented, Ph.D.-level, 4-factor ornithologist skilled in modern taxonomic theory and in the tools of important developing fields such as molecular genetics (laboratory facilities available through the Smithsonian). Research focus on North American birds.

Objective 2: Recruit and hire a 9-factor biologist to coordinate development of waterbird monitoring efforts and databases.

Objective 3: Recruit and hire a biometrician to institutionalize analytical support for the Status and Trends group.

Objective 4: Recruit and hire a North American freshwater fish systematist for BSU.

Objective 5: Review thoroughly the needs for both permanent and temporary science support positions (curatorial, field, GIS, data processing, programming, Internet) and develop a staffing proposal.

#### Goal 2. Enhance the reliability and applicability of monitoring programs by incorporating technical improvements, in collaboration with quantitative population scientists.

Objective 1: Evaluate the effectiveness of alternative methods of estimating detectability and incorporate methods as feasible into existing programs (specifically the BBS) and new designs to assess status and trends.

Objective 2: Incorporate into operational status and trends programs, measurement of potential environmental correlates of population change, or adaptation of existing remote-sensing data.

Objective 3: Implement off-road surveys as a complement to the BBS.

Objective 4: Collaborate with FWS and the broader bird conservation community to identify opportunities for tailoring long-term status and trends assessment programs to meet specific management/conservation needs as they arise, without compromising the ability to draw continental inferences.

Objective 5: Explore developing technologies for their ability to improve the processing and management of population databases.

Goal 3. Enhance the benefits of biodiversity science to customers.

Objective 1: Complete development of a functional, peer-reviewed, on-line tutorial on monitoring concepts and methods for refuge and park biologists and other resource managers. Improve and update in response to user feedback.

Objective 2: Continue production of the taxon-based series of books on standard methods for measuring and monitoring biodiversity.

Objective 3: Continue to develop sophisticated on-line tools allowing customers to communicate with population databases, emphasizing GIS applications such as those being developed for the NBII Bird Conservation Node.

Objective 4: Expand collaborative data management programs with the FWS and explore the potential for other federal partnerships related to biodiversity databases.

Objective 5: Continue to collaborate with the Smithsonian Institution to provide maximum on-line public access of electronic collections records. Internet access of Natural History collection records will start in FY 2004.

Objective 6: Continue and complete geo-referencing of data for North American amphibian, reptile, bird, and mammal specimen records at the National Museum of Natural History, to facilitate use of locality information for research and conservation.

**Coastal and Wetland Ecosystems and Landscapes**

**Current Program.** Coastal and wetland science at PWRC addresses the information needs of land and resource managers from an ecosystem and landscape perspective. Investigations are characterized by interdisciplinary approaches involving partnerships with Department of the Interior management bureaus, other federal, state, and local management agencies, other USGS disciplines, and universities. Research focuses on identifying, understanding, and quantifying the relationships among natural and human-induced threats to ecosystem integrity and their ecological consequences. Approaches emphasize developing predictive relationships needed to forecast responses by fish and wildlife populations, biological communities, and ecosystem processes to the primary agents of change in coastal and wetland environments. The primary geographic areas of emphasis are the mid-Atlantic and northeastern regions of the U.S. A major strength of this program lies in improving the scientific basis for solutions to resource management problems, with specific emphasis on restoration and long-term monitoring of coastal and wetland ecosystems and their component plant and animal communities. Results provide fundamental ecological knowledge to the scientific community, resource managers,

and resource policy-makers, and are applied to the preservation, protection, and management of coastal and wetland ecosystems.

**Future Directions.** PWRC will engage in integrated, interdisciplinary research to address high priority management issues in coastal and wetland ecosystems. Anthropogenic and natural threats to coastal and wetland environments span multiple temporal and spatial scales. New research will be initiated to increase scientific understanding of how populations, communities, and ecosystem processes respond to multiple, interacting threats and stressors. Primary threats of concern include the invasion and spread of non-native species, eutrophication, global change and associated impacts on shoreline and habitats, and direct human alterations to coastal and wetland systems. Improved methodologies must be developed for assessing ecosystem integrity and sustainability, the vulnerability to potential stressors, and the ecological consequences of future changes to these systems. Predictive models, including GIS-based decision support systems and other management tools, will be developed linking agents of change, stressors, and ecosystem responses. These tools will allow planners and managers to address critical natural resource issues in an interactive environment and to determine the likely outcomes of alternative management scenarios. An adaptive resource management framework will be applied to developing approaches for enhancing coastal and wetland plant, fish, and wildlife populations on federal lands. Wetland systems play an important role in processing materials from the upland and contributing materials to nearshore coastal waters. PWRC research will address the function of wetlands in a landscape context and develop the scientific understanding needed for integrated watershed management.

As a federal science organization, PWRC is uniquely poised to contribute to regional-scale understanding of the ecology of coastal and wetland systems. PWRC should integrate its coastal and wetland science program with other scientific strengths of PWRC (e.g. contaminant ecology, wildlife population biology) and other USGS disciplines to address critical habitat and fish and wildlife population issues in the Northeast, the mid-Atlantic, the Southeast, and the Nation. The opportunity to generalize at this scale will enhance capabilities for extending site-specific predictions to management issues at larger spatial scales.

PWRC will assume a leadership role in the development of scientifically-based ecosystem restoration and monitoring programs. A major emphasis will be the identification of improved monitoring variables with increased sensitivity to disturbance, so that managers can detect impending habitat alterations before they occur. PWRC will strive to quantify ranges of values that characterize components of natural coastal and wetland ecosystems, to develop predictive relationship between appropriate monitoring variables and ecosystem response, and to identify the critical thresholds that signal shifts in ecosystem structure and function. PWRC will also focus increased attention on identifying improved performance criteria for determining the success of restoration or ecosystem-creation projects, developing the best approaches to pre- and post restoration monitoring, and developing models for evaluating potential restoration sites. These projects will be developed in an adaptive management framework.

## **Goals and 5-Year Objectives.**

Goal 1. Develop scientifically based tools for managing coastal and wetland populations, communities, and ecosystems and forecasting future ecological conditions.

Objective 1: Improve understanding of responses of selected populations, communities, and ecosystem processes to multiple, interacting threats and stressors in coastal and wetland environments.

Objective 2: Construct predictive models that integrate effects of anthropogenic and natural agents of change on important coastal and wetland habitats and selected fish and wildlife populations.

Objective 3: Develop decision support models that integrate scientific data within a geographic framework allowing planners and managers to address critical natural resource management issues in an interactive and predictive environment.

Objective 4: Develop applications of Adaptive Resource Management for enhancing plant, fish, and wildlife populations on federal lands.

Goal 2. Develop expertise that provides a basis for regional comparisons of coastal and wetland systems and the ability to generalize at greater spatial and temporal scales.

Objective 1: Develop models of coastal and wetland systems and their stressors that provide a basis for larger scale regional comparisons.

Objective 2: Initiate long-term ecosystem studies at several reference sites nationwide that form the basis for understanding the important time scales of critical ecosystem processes.

Objective 3: Integrate ecosystem studies addressing critical management issues in wetlands and coastal habitats in the Southeast.

Goal 3. Develop an understanding of the impact of terrestrial and aquatic invasive species on coastal and wetland populations, communities, and ecosystems.

Objective 1: Develop models of wetland and coastal populations, trophic structure, and ecosystem processes affected by invasive species.

Objective 2: Develop management strategies that reduce the impacts of invasive species.

Objective 3: Develop quantitative ecological risk assessment models that make specific predictions regarding ecosystem vulnerability to threats of certain invasive species.

Goal 4. Develop scientifically based monitoring programs capable of detecting and predicting changes in the status of coastal and wetland ecosystems.

Objective 1: Identify variables and indices with known relationships to specific ecosystem functions that respond to stresses in an interpretable manner, and that are anticipatory, i.e., that are useful for predicting impending changes in ecosystem structure or function.

Objective 2: Quantify information on the bounds of natural temporal and spatial variability of coastal and wetland monitoring variables and indices.

Objective 3: Identify threshold values for monitoring variables and indices that signal shifts in ecosystem structure and function.

Goal 5. Improve the scientific basis for restoration and mitigation of impaired or destroyed coastal and wetland ecosystems.

Objective 1: Develop new and improved methods for restoring and creating coastal and wetland ecosystems and their component flora and wildlife fauna.

Objective 2: Quantify ecological responses of restored/reconstructed ecosystems to particular methods used under conditions of existing, accompanying stressors on the recovering systems.

Objective 3: Develop models for evaluating and selecting restoration sites.

Objective 4: Identify performance criteria for evaluating the success of restored and created coastal and wetland ecosystems.

## **Impacts of Contaminants**

**Current Program.** Research on the impacts of contaminants at PWRC began in the 1960's with work on declining species of raptors. The program was significantly expanded during the 1970's when pioneering progress was made in understanding the impact of pesticides, metals, and other contaminants on avian populations. Since that time PWRC has been a world leader in research on the physiological and ecological effects of metals, chlorinated hydrocarbon pesticides, organophosphorus pesticides, polychlorinated biphenyls, petroleum products, and other contaminants on terrestrial wildlife. Early work focused on acute toxicity but recent effort centers on sub-lethal effects, including endocrine disruption, disruption of enzyme systems and other physiological processes, and identification of biomarkers of exposure and stress.

An underlying theme of contaminants work at PWRC has been to define the environmental hazards caused by contaminants at the individual, population, and community levels. Research has emphasized a coordinated laboratory and field approach to understand these effects. Throughout this period the contaminants program at PWRC has been highly responsive to, and proactive in, meeting the needs of cooperating agencies including the U.S. Fish and Wildlife Service, National Park Service, and other agencies within the Department of Interior, Environmental Protection Agency, and Department of Defense.

Several monitoring activities conducted at PWRC are supported by the USGS Biomonitoring of Environmental Status and Trends (BEST) Program. This is a national program focused on measuring exposure and response of biological resources to environmental contaminants. It is one of the few monitoring programs in the United States that examines such effects in wildlife. BEST projects use techniques of chemical and biological assessment that span multiple levels of biological organization and incorporate information from other sources

**Future Directions.** Overall, the mission of the Contaminants Program is to identify the effects of contaminants on wildlife and with that information, enable land managers to improve the protection of wildlife from these impacts or otherwise mitigate their effects.

To meet this mission, there are several approaches and principles of operation that have been essential in the past and must be part of future operations. These include: (1) the capability to undertake linked field and laboratory investigations on the same contaminant or subject; (2) the use of captive wildlife species as models of other wild species that cannot be studied easily; (3) the generation of data on a broad range of wildlife species and over large geographic scales allowing generalizations of results based on phylogeny, habitat or other constructs; and (4) to undertake and publish large-scale reviews and compilations of data on topics in ecotoxicology. Most important is to hire and maintain a scientific and technical staff with diverse and excellent skills. As noted above, many PWRC scientists work closely, even collaborate with the users of the information developed at PWRC. In the future PWRC will look for those projects that would benefit from analysis resulting from collaboration with USGS scientists in other disciplines.

Linking effects of contaminants directly to population, community, and ecosystem level responses is difficult, in part, due to the uncertain relationship between responses at different levels of biological organization and differences in the time scale of response. In general, measures of effect at the lowest level of biological organization (molecular, cellular) provide information on sensitive and specific responses to particular toxicants, but the relation between chemical stressors and effects at higher levels of biological organization (populations) range from nonexistent to mere association, rather than a direct causal linkage. Conversely, responses at higher levels of organization (species abundance and diversity) cannot by themselves demonstrate environmental pollutants as the cause. Methods are needed to expand existing diagnostic and screening capabilities, and for measuring contaminant effects to a variety of taxa (e.g., amphibians) and in a variety of habitats (e.g., uplands and forests). New and existing biomarkers for contaminant exposure need to be associated with effect levels.

## **Goals and 5-Year Objectives.**

Goal 1. Develop multi-disciplinary, integrated investigations and modeling efforts that evaluate the role of contaminants as one of many stressors that affect wildlife. Stressors may include nutritional plane, disease states, predation pressure, or competition.

Objective 1: Improve understanding of the responses of selected wildlife populations, communities, and ecosystem processes to multiple, interacting threats and stressors.

Objective 2: Develop quantitative ecological risk assessment models with specific, measurable predictions regarding contaminant threats to selected species.

Goal 2. Become more active in identifying emerging contaminant issues. These emerging issues include: (1) the testing of pesticides in the process of registration for use, including genetically engineered pest control agents; (2) mobilization of metals from changing human activities; (3) exposure of wildlife to pharmaceuticals and human health care products; and (4) runoff of feed additives and fertilizer from agricultural habitats.

Objective 1: Construct predictive models that integrate effects of anthropogenic and natural agents of change on important wildlife populations.

Goal 3. Develop molecular methods (e.g., proteomics, genomics) or other bio-indicators and concepts that measure and predict the effects of contaminants in wildlife.

Objective 1: Identify performance criteria for evaluating the success of restored or remediated habitats based on wildlife population structure.

Goal 4. Test the application of new and proposed bio-indicators and provide guidelines for their implementation in long-term monitoring programs.

Objective 1: Develop and validate in the field state-of-the-art biomarkers of contaminant exposure and effects in wildlife.

Objective 2: Identify threshold values for biomonitoring variables and indices that signal shifts in population or community structure and function.

Goal 5. Detect through systematic monitoring contaminant biological effects that are ecologically relevant.

Objective 1: Develop and test new methods that evaluate or even link contaminants to demographic parameters and effects on population and communities.

Objective 2: Design and implement large-scale field investigations of regional to national scope.

Objective 3: Continue retrospective analyses of extant ecotoxicological information to identify significant trends and data gaps.

Objective 4: Evaluate the integration of biomonitoring methods for contaminant effects into other monitoring and assessments of federal lands (e.g., refuge monitoring, monitoring of rangeland health, and vital signs program of the National Park Service).

### **Population and Community Ecology**

**Current Program.** PWRC is a rich center for population and community ecology, because of the broad spectrum of skill sets and focal interests of its scientists and support staff. At one end are the more traditional, field-oriented, species- and system-level biologists. Although the focus among PWRC field biologists has long been on birds, PWRC also has expertise in endangered species, mammals, amphibians, and animal community dynamics. Many of these scientists are internationally recognized authorities on the species and systems they study. At the other end of the spectrum are highly quantitative ecologists and biometricians, specializing in the three broad classes of methods used in science and management/conservation: (1) modeling, (2) estimation and statistical inference, and (3) decision theory. This group works on a wide array of science and management projects, demonstrating the general applicability of their methods. They collaborate with managers from resource management agencies to establish the framework of specific management problems and then follow through to identify and refine appropriate management actions.

Although a stand-alone operation in many respects, the North American Bird Banding Laboratory (BBL) hosts a massive database of bandings and recoveries that have broad application for modeling demographic patterns of bird species. The BBL databases, along with data from the population monitoring programs, provide a treasure trove of data that are used extensively by analytical population ecologists at PWRC and elsewhere. The BBL also provides a variety of essential services to the bird-banding community, including processing of banding permits, provision of bands, acquisition of banding and recovery data, data entry and storage, and distribution of data to partner managers and scientists.

**Future Directions.** PWRC will continue to be an institution composed of scientists and support staff who are leaders in the conduct of science and management and in the application of these broad methods to free-ranging animal populations and communities. PWRC's vision is one of increased collaboration and integration among Center biologists in all aspects of population and community research and management. PWRC plans increased efforts to collaborate with management agency personnel and increased involvement in the management process. This will entail a shift away from the traditional model of research providing various pieces of information to managers, with little guidance about exactly how this information is to be used, toward research more directly integrated with the process of arriving at good, and even optimal, management decisions. Monitoring specialists and quantitative PWRC scientists and management/conservation agencies will collaborate to tailor new programs to meet management needs. Emphasis will be placed on finalizing the re-engineering of the BBL and research use of the BBL database.

## **Goals and 5-Year Objectives.**

Goal 1. Increase PWRC capability as a center of methodological expertise for the future development of the estimation of population abundance, trend, vital rates, and community parameters.

Objective 1: Recruit and hire a spatial statistician dealing with landscape modeling and estimation issues.

Objective 2: Continue current developments in estimation methodologies and apply these to example populations. Current developments include capture-recapture for estimation of abundance and demographic parameters including survival, movement and recruitment; trend analyses from point count data; and community parameters such as species richness and patch dynamics.

Goal 2. Increase PWRC capability as a center of methodological expertise in decision theoretics: tools for managers to make informed decisions in the face of uncertainty in biology, environmental effects, and the impacts of management actions.

Objective 1: Continue the cooperative development of the adaptive harvest management process currently being utilized by the FWS to guide harvest management of ducks.

Objective 2: Utilize adaptive management approaches to guide the management of individual species. Examples are management of endangered manatee and whooping crane populations.

Objective 3: Develop adaptive management approaches to habitat management applications with special emphasis on the management of FWS Region 5 Refuges.

Goal 3. Continue to meet the research needs of management agencies through field investigations of the population ecology of particular species, groups of species, and communities.

Objective 1: Focus population ecology research on modeling mechanisms that determine population responses to conservation management actions. Examples of such agency-driven questions facing PWRC over the next 5 years are evaluating effects of: (1) harvest on American woodcock; (2) agricultural practices on availability of food resources to waterfowl; (3) urbanization, habitat manipulations, and nest parasitism on bird populations; and (4) exploitation on populations of horseshoe crabs, albatrosses, and diamondback terrapins.

Goal 4. Continue to develop and refine quantitative approaches to strengthening the scientific validity of monitoring program design and analysis, and disseminate assessments of monitoring data to agencies and the scientific community.

Objective 1: Develop approaches that incorporate detection into surveys resulting in measures of absolute and relative abundance. Potentially include other variables that will enable statistical inference of relationships between animal populations and the environment.

## ***Role of Science Partners and Collaborators***

The management of quality science involves a number of processes such as defining the PWRC niche, peer review, data and metadata management, communications and structures in function of the Center. These are discussed in more detail in Appendix 1.

### **Recent Status of Partnerships and Collaborations**

During the 1990's, a dynamic partnership was established between PWRC and FWS Region 5, involving grassroots project development between PWRC scientists and Region 5 managers. Another close partnership between migratory bird research, bird-banding, and monitoring interests at PWRC was established with the Division of Migratory Bird Management and the Division of Bird Habitat Management, Region 9. This led to a formal agreement and regular meetings to coordinate on issues of common interest. The joint Adaptive Management and Assessment Program (AMAT) based at PWRC, which developed the important process of adaptive harvest management, was an outgrowth of this partnership. Among the other fruits of this partnership has been the establishment of a shared migratory bird data center at PWRC for managing and delivering bird population data over the World Wide Web. Associated with this effort were collaborative relationships between PWRC, the National Biological Information Infrastructure (NBII), and the USGS Geography Discipline for developing tools and databases for the NBII Migratory Bird Node.

Also during the 1990's the National Park Service (NPS) emerged as a key science partner, especially in the northeastern United States but as far west as Big Bend and Hawaii Volcanoes National Parks. A process similar to the FWS Region 5 partnership was developed with the NPS. To an extent, the direct cooperative work with both FWS and NPS has been replaced by USGS cyclical programs like NRPP, SSP, and Quick Response, all of which have been important sources of funding for PWRC science in support of these agencies. The EPA has also been a regular partner in PWRC contaminant research, as well as in wildlife monitoring efforts relevant to the EPA's Regional Environmental Monitoring and Assessment Program (REMAP). Smaller scale but nonetheless significant partnerships have existed with multiple state agencies, the U.S. Forest Service, and other Federal agencies.

### **Partners for the Future**

To maintain a leadership role in addressing the information and research needs of biological resource management, partnerships such as those described above must continue, strengthen, and expand. PWRC envisions extensive partnership with FWS at regional and national levels, especially through the USGS' SSP cyclical funding program. Enhanced partnership with NPS is essential, including participation in the NRPP and other NPS cyclical funding programs, and also with the Cooperative Ecosystems Study Units. Further collaboration with the NPS

Inventory and Monitoring Division and their Natural Resource Challenge Program will also be pursued. Additional opportunities for partnership with EPA are likely, as programmatic shifts in EPA lead to increasing interest in PWRC expertise in the toxicology of terrestrial species. PWRC has committed to managing two USGS employees stationed at EPA Regional Offices in the Northeast. This will increase opportunity for collaboration with BLM and USFS. Collaborations provide opportunities for combined or leveraged funding, a prerequisite if PWRC is to realize future programmatic growth. Scientists and research managers will continue to be encouraged to seek out appropriate reimbursable funding from partner agencies to supplement base-funded science.

The Friends of Patuxent Wildlife Research Refuge & Center, Inc. is a non-profit organization interested in supporting the mission and programs of the Patuxent Research Refuge and PWRC. The Friends can be an important source of funding for small projects and for future needs for improving facility infrastructure for PWRC science. Examples of past accomplishments of the Friends are: assistance in facilitating the procurement of appropriated funds for the construction of the National Wildlife Visitor Center; facilitating the construction of a new veterinary hospital to support research programs; and facilitating research projects funded by outside sources.

### **USGS Collaboration**

Interdisciplinary collaboration within USGS will be important to PWRC's research, as the need for complex information in ecology, conservation, and resource management increases. Natural resource managers will benefit from expertise available from the Geography Discipline in landscape modeling and photo-interpretation, from the Geology Discipline to understand substrate and soil processes, especially in coastal systems, and from the Water Discipline to understand hydrologic and disturbance regimes and contaminants loading in surface waters. Some PWRC projects have initiated interdisciplinary work with each of the other USGS disciplines. In addition, office space has been provided to one Water Discipline scientist, 3 co-located with Water in Maine, and PWRC seeks to expand opportunities for co-location to enhance its interdisciplinary science capability.

## ***Acknowledgments***

Several groups have been involved in preparing this document. The first draft of the PWRC Science Plan was drafted by members of the Science Council and the Research Managers in September 2002. A facilitated meeting for PWRC scientists was held on October 3-4, 2002 at PWRC. The draft plan was given to the participants at that meeting for review and comment, and then made available to the entire PWRC staff for comment. The ideas generated from the Scientists' Workshop were incorporated into the next draft of the PWRC Science Plan.

Additional facilitated meetings were held on October 29, 2002 for PWRC staff and October 30, 2002 for invited partners to obtain comments, feedback, and perspectives. The Plan was again revised based on the input received. The assistance of Tricia Gibbons of the LEAD Alliance, as meeting facilitator was greatly appreciated. The participants are listed below.

### **Scientists Workshop - October 3- 4, 2002**

**Group 1:** Hilary Neckles, Neal Woodman, Bill Link, Nelson Beyer, Scott DeClemente, John French, and Mark Wimer

**Group 2:** \*Melanie Steinkamp, Carol Bocetti, Mike Runge, Bob Reynolds, Kathy Klimkiewicz, and Don Sparling

**Group 3:** Chandler Robbins, Barnett Rattner, \*Allan. O'Connell, Jeff Spendelow, Don Cahoon, Linda Weir, and Dick Hammerschlag

**Group 4:** \*Jim Nichols, Jerry Longcore, Hank Pattee, Glenn Olsen, Mark Melancon, Bob Munro, and Sam Droege

**Group 5:** Bruce Peterjohn, \*Glenn Guntenspergen, Ron Eisler, Nimish Vyas, Peter Lowe, and Clint Moore

**Group 6:** John R. Sauer, Paula F. Henry, Peter Albers, Joe Meyers, Keith Pardieck, and Robin Jung

Howie Ginsberg and Dave Hoffman participated on October 4<sup>th</sup>.

\*Science Council member

**Staff Workshop - October 29, 2002**

Pete Albers  
Bill Bauer  
Sarah Bennett  
Patricia Brown  
Barbara Dowell  
Jane Fallon  
Marcia Holmes  
Gary Heinz  
Lois Loges  
Laura Moore  
Bob Munro  
Peter Osenton  
Matt Perry  
Diann Prosser  
Chan Robbins  
Geoff Sanders  
John Sauer  
Jeff Spindel  
Mark Wimer

**Partners Workshop - October 30, 2002**

Sarah Gerould, USGS BRD Reston  
David Grason, USGS Eastern Region  
Mark Johnson, USA Aberdeen Proving Grounds  
Janet Keough, EPA Duluth Lab  
Beth McGee, FWS Annapolis FO  
Cherie Miller, USGS MD WRDO  
Holly Obrecht, FWS PRR  
Ellen Paul, The Ornithological Council  
Tom Pheiffer, EPA OWR  
Scott Phillips, USGS MD WRDO  
Bob Shedlock, USGS WRDO  
Greg Smith, USGS BRD Reston  
Elaine Snyder-Conn, FWS Reg. 9 DEQ  
Beatrice Van Horne, USDA FS Hq  
James Woehr, Wildlife Management Institute

# Appendix 1. Science Management

## Managing Science Quality

Anonymous peer review is the accepted and expected mechanism for evaluating the quality of research and maintaining high standards for scientific work. PWRC uses peer review of project plans and final publications or other forms of information delivery to ensure the high quality of individual projects. The Center uses the Research Grade Evaluation Guide and panel reviews to evaluate and manage overall performance of individual scientists.

Peer Review of Science Tasks. PWRC has rigorous, independent, and anonymous peer review standards, which are summarized in Standard Operating Procedures (SOP) documents. SOPs codify expectations for development, review, and approval of science task plans or certain forms of professional expression unlikely to receive external peer review. PWRC does not duplicate manuscript review conducted by scientific journals. Scientists initiate the peer review process by submitting documents to their Research Manager, along with names of potential reviewers. Reviews are solicited and provided to the scientist and managed in accordance with the appropriate SOPs.

Programmatic Peer Review. Certain categories of PWRC's science, such as long-term population surveys and endangered species recovery programs, encompass a variety of science and operational components. It is PWRC policy to subject such programs to peer review at 5-year intervals. Since 1996 programmatic peer reviews have been conducted for the Bird Banding Laboratory, the Breeding Bird Survey, the North American Amphibian Monitoring Program, and the Whooping Crane Program.

Programmatic peer reviews are conducted by panels of experts representing not only the scientific community but also the user community, such as resource managers from partner agencies. Panelists are provided a specific charge with clear objectives, including the requirement to prepare a consensus report with recommendations. Panels are provided extensive briefing materials and convened on site for up to three days for presentations by staff, detailed inquiry of scientific and management staff, and closed panel deliberation. Travel and per diem expenses incurred by panelists are reimbursed by PWRC. The Center Director may establish task forces to evaluate the recommendations and draft implementation strategies.

Toward the end of the period covered by this Science Plan, PWRC will schedule a peer review of the Bird Banding Laboratory and may review newly developing programs, such as the avian point count database and the migratory bird population and habitat data center, a cooperative activity with the U.S. Fish and Wildlife Service and the National Biological Information Infrastructure.

Metadata. Scientists will ensure that all science tasks, methodologies, and data management practices are sufficiently documented to meet national metadata standards. One of PWRC's objectives is to improve data archiving and metadata standards, utilizing pilot projects over the next five years.

Performance and Position Classification Management. The performance and standing of individual scientists will be managed through two standard mechanisms. First, the supervising Research Manager will conduct specific annual performance plans and semi-annual performance reviews. Second, in the case of 4-factor scientists, regional or national Research Grade Evaluation (RGE) panels will conduct both scheduled and unscheduled review of resumes. Guidelines for research position classification of PWRC 4-factor scientists, the person in the place, are provided by the U.S. Office of Personnel Management (OPM). The RGE document of each PWRC scientist is an evolutionary process. It will be reviewed and updated routinely (at least annually) by each scientist as a guide to standing in the scientific community, and reviewed cooperatively with the Research Manager. Research Managers and science staff will participate in research grade panels periodically. To promote the development of productive scientists, annual performance appraisals reflect the criteria of RGE.

Outstanding performance is a mutual goal of scientists and managers. A variety of awards are available for specific achievements. PWRC Scientific Achievement Awards are awarded as warranted to individual or groups of scientists by the Center Director for specific achievements or products of exceptionally high quality.

Emeritus Program. Retiring PWRC scientists will be encouraged to take advantage of the Emeritus Program, through which they will be able to continue to be productive in the PWRC environment with full flexibility to pursue their special research interests.

## **Managing Science Scope and Focus**

Establishing a definable science niche is fundamental to the success of PWRC. The niche must be characterized by (1) core strengths that allow long-term, strategic science to flourish and (2) enough flexibility to respond to short-term tactical science needs and to evolve new strengths. The areas of science conducted by PWRC are determined collaboratively by its scientists and managers (and more recently its partners) in strategic planning exercises, such as the facilitated workshops leading to the present Science Plan.

Science Relevance. Although the scientists themselves have the lead in science planning activities, management's role is to ensure that the ideas proposed are feasible and practical and align with Departmental and Bureau mission and policy statements, Bureau Program Elements, Regional policies, partner needs, PWRC science and partnership traditions, and current PWRC capabilities. Collectively, these factors, particularly those external to PWRC, comprise a landscape that defines the "relevance" of PWRC's science. One of the most important responsibilities of PWRC management is to ensure that its science is relevant. This requires a

working understanding of the bureaucratic fabric sufficient to enable PWRC's science program to thrive and its scientists to capitalize on opportunities to extend or expand their programs. Although Departmental or Bureau policies might be viewed as constraining at times, both PWRC managers and scientists will have many opportunities to help shape those policies. Another important responsibility of PWRC management is to capitalize on opportunities to participate personally, or to encourage scientist participation, in USGS strategic planning and related efforts at both regional and national levels.

Budgetary Influences on Science Planning. The budgetary situation, particularly the balance of base, cyclical, and reimbursable funding available to PWRC, has a profound influence on the stability of the science program and kinds of science PWRC can engage in at a given time. A shift from the base to the reimbursable end of the spectrum generally constrains long-term, strategic science and may necessitate venturing into work that pushes the limits of PWRC's capabilities. It is the responsibility of management to seek a healthy balance of funding sources, beginning with assurance of base funding for all permanent staff salaries and a healthy base salary/operating ratio. Seeking long-term enhancements to base funding through Bureau budget initiatives is an extremely important element of PWRC's budget planning strategy. PWRC science managers will take the lead in positioning PWRC for effective engagement in this process.

Enhancements to operational funding will be sought continually through cyclical or reimbursable outside funding mechanisms, with required overhead assessments incorporated into planning and negotiations. Scientists are encouraged to pursue cyclical and reimbursable funding directly, in accordance with science planning and review requirements embedded in SOP's. Research managers will be assigned specific liaison responsibilities with partner Bureaus to ensure that opportunities to secure outside funding are maximized and facilitated. Such partnerships are crucial elements of PWRC's science program. They are best maintained through regular dialogue and establishment of designated contacts.

Scientist and Partner Perspectives. During the science planning workshops leading to the development of this plan, both scientists and partners were asked to list criteria or questions they considered important in planning new science directions. Appendix 2 presents the results of these brainstorming sessions.

## **Managing External Communication of Science**

The manner in which the results of PWRC's science are communicated is a critical determinant of PWRC's value to the scientific and resource management communities. Acceptance by both audiences is crucial. This presents a challenge to both the scientist and the manager, as the kinds of products needed by these groups can be very different. First and foremost, scientific products must pass the scrutiny of peers, not only for the benefit of the scientists themselves (RGE evaluation), but also to ensure that their science is deemed authoritative by resource managers and will, in the event of the occasional litigation action, survive court challenges to its authority. Second, the science must be packaged in forms that make its

meaning and applications easily understandable by the non-scientist user. Therefore, various forms of scientific expression are expected of PWRC scientists. Science managers and outreach staff will play an important role in assisting the scientist with communications to the resource management community and in tailoring reports of science results and, in some cases, science plans or proposals, for various agency and Departmental reporting documents.

Publications. Written reports in the peer-reviewed scientific literature are essential for archiving the results of scientific research. They also are the most important means whereby the scientific community can evaluate both the productivity and quality of work by individual scientists. In compliance with RGE, PWRC 4-factor scientists are typically expected to publish at least two peer-reviewed papers in a nationally or internationally recognized journal every year.

Open File Reports. Sometimes written reports designed to get research results into the hands of land managers rapidly or larger final reports to other agencies under reimbursable agreements are not published in peer-reviewed outlets. These reports are still subject to internal USGS and PWRC peer and policy review. Generally such products carry less weight in the RGE process and time spent on such reports by 4-factor scientists has to be evaluated tactically in support of partners.

Professional Meetings. Participation in scientific meetings is essential for practicing scientists to remain abreast of new developments in their area of specialty. Such meetings provide both the opportunity for learning and a venue for rapid dissemination of scientific findings. To comply with the guidance of RGE, all PWRC 4-factor scientists are expected to provide at least one platform or poster presentation at a nationally or internationally recognized scientific meeting every other year. Active participation in scientific societies is strongly encouraged.

Technical Assistance. PWRC scientists are expected to respond when possible to short-term requests for assistance from partner agencies. All scientists are ultimately responsible for managing their time and can refer requests to their research manager or alternative providers, if they are unable to provide a requested service. Care will be exercised by both the scientist and the research manager to ensure that the assistance provided is beneficial to the needs of partners, to the PWRC mission, and to the career of the PWRC scientist, i.e., has value in the RGE process. The assistance requested will be clearly definable, be based on the active research expertise of the scientist, and produce measurable effects for the user.

Data Files and Databases. The initial products of any scientific investigation are data. Per PWRC SOP021, each scientist is expected to document data archiving procedures in the study plan so as to maintain data in a recognizable, easy-to-access spreadsheet format, with back-up copies updated frequently and stored at a separate location for safety. The information obtained by government scientists is public domain. Large databases are the primary product of some science activities like some of the major population survey programs. These will be developed in a way to make them readily usable by partners, with emphasis on web delivery.

Web Sites. Web sites have become a popular and easily accessible means of providing information to the public. Such web sites are currently in use by PWRC and some of its field stations. The Web Committee is expected to develop and maintain PWRC web standards, protocols and architecture. SOP 25, "Website and Web Server Policies and Procedures," provides policy and procedures for making PWRC materials available on the World Wide Web (WWW) and provides policy and procedures for establishing, maintaining, and administering Web servers. These protocols are intended to: (1) implement agency guidelines to achieve the missions of the USGS and PWRC in the use of the WWW to disseminate information; (2) ensure that PWRC's Web material undergoes scientific, policy, and ethics reviews prior to release to the public; (3) provide a clear and consistent mechanism for adding, maintaining, and removing Web page information; (4) ensure a seamless Web presence for all PWRC servers; and (5) provide guidelines for Web server establishment, maintenance, and administration.

Science Briefs. Various forms of brief science task summaries will be used to meet communication needs with partners, the general public, and managers at higher levels of the agency and the Department. These include fact sheets, news releases, and posters. The outreach coordinator will have primary responsibility for such communiqués but will require the assistance of scientists to varying degrees, depending on the nature of the topic. Scientists are encouraged to work with the outreach staff to produce descriptive and attractive capsules of their ongoing research. PWRC scientists also are encouraged to give public lectures, and to cooperate with the news media on items of broad public interest, in accordance with public expression policies. The MT and SC will collectively address the best approaches to these opportunities.

### **Communication among Scientists and Managers**

PWRC's philosophy is to harness the collective energy and spirit of its scientists and managers by promoting open communication that breeds mutual understanding, appreciation, and cooperation. The purpose of this section is to describe an operational framework designed to facilitate such a working environment.

The Research Manager – Scientist Interaction. An important component of the science planning process is dialogue between the scientist and the research manager, especially in the initial stages. It is incumbent upon each PWRC scientist to assume a primary role in developing his/her research direction and in seeking financial, supervisory, and partner support. 4-factor scientists will develop vision statements of their research programs, to be reviewed and updated in consultation with their Research Manager at 4-year intervals in conjunction with developing Research Grade Evaluation (RGE) Panel packages. This vision will be based on the scientists' creative abilities and knowledge of the field in which they work and reflected in Factor 3 ("Guidelines and Originality") of the RGEG. Study plans for individual tasks will be consistent with the overall vision. Research Managers must ensure that the vision and individual science task pre-proposals, as defined in the Science Planning SOP, meet relevance criteria and fit within the general context of the PWRC's Science Plan. The Research Manager will be available for consultation with scientists on issues related to the

substance of their science programs, including desirable course corrections to accommodate changes in the relevance or funding environment.

Bi-Monthly PWRC Meetings. Meetings for all PWRC staff will be held bi-monthly. Field stations will be connected by speaker-phone. The meetings will be hosted by the Center Director and provide opportunities for information exchange on a wide variety of topics of interest to scientists and support staff. Special presentations by outside speakers on issues of broad relevance to staff may be scheduled in association with these meetings.

Bi-Annual Science Meetings. The tradition of Science Meetings designed to cultivate and reinforce partnership arrangements, by linking PWRC scientists and managers with current and future partners, will be continued on a bi-annual basis, normally in January or February at a venue near the Laurel campus. The next Science Meeting will be in FY 2004. A broad spectrum of current and future partners will be invited to hear presentations by scientists that demonstrate PWRC's potential value to the resource management community. Ample opportunity will be provided for regularly recurring meetings with long-term partners as well as for ad hoc meetings to discuss new applied science partnerships. Part of each meeting will be reserved for internal discussion of USGS issues at the center, regional, and national levels. The Science Meetings are an important mechanism for establishing connections that can have positive, long-term ramifications for PWRC science. They will be especially crucial during periods of greater dependency on outside support. Attendance at Science Meetings will be required of all professional staff, from both Laurel and field locations.

The Management Team (MT). The Management Team consists of the PWRC Center Director, four Research Managers, the Research Support Manager, and a Management Assistant (Appendix 3). The Research Managers provide management and supervision across PWRC's scientists and field stations, as well as liaison with primary DOI partner agencies. The Research Support Manager supervises administrative, information technology, and facility support services. The Management Assistant provides analytical and technical input to support the MT.

Roles of the Management Team. The MT provides a forum for senior managers to discuss important PWRC-wide issues, to bring issues raised by scientists through supervisory channels to the attention of the Center Director, and to receive important information from the Center Director for conveyance to staff. It is a forum for discussing and finalizing decisions related to staffing and budget allocation. PWRC-wide policies are discussed by the MT. Policies important to the science program, such as many of the Standard Operating Procedures (SOPs) are drafted by the MT and vetted through the Science Council (see below), revised and issued by the Center Director. Appendix 4 lists the current science-related PWRC SOPs, which are readily available to all staff through the local intranet.

The Science Council (SC). The Science Council consists of five 4-factor scientists and one 9-factor scientist appointed by the Center Director to staggered 2-year terms. Under normal circumstances, three members of the SC are replaced annually on March 1. An effort is made to ensure that all areas of science emphasis at PWRC are represented in SC membership.

Roles of Science Council. The SC is a science advisory body to the Center Director. It provides an alternative mechanism for scientists to weigh in on issues of broad concern to the science staff and to influence management decisions. The SC is charged with primary responsibility for drafting comprehensive science strategies, such as the science focus areas in this Science Plan. The members of the SC select a Chair each time new members are added. The SC may establish committees (e.g., discipline-based and cross-discipline teams) that may include scientists not also on the SC.

Table 1 summarizes the roles played by the Management Team and the Science Council with respect to various PWRC functions or activities. In the case of standing committees such as Animal Care and Use, they provide leadership and make decisions for the Center.

**TABLE 1.** TYPICAL MANAGEMENT TEAM AND SCIENCE COUNCIL ROLES AT PWRC  
(C=COMMUNICATE; D=DECIDE; L=LEAD; P=PARTICIPATE; R=RECOMMEND)

<u>Center Functions</u>	<u>Management Team</u>	<u>Science Council</u>
Awards	C, D, P	C, P, R
Staffing—New PIs	C, D, L	C, R
Science Meetings	C, L, P	C, P, R
Programmatic Peer Reviews	D, L, P	P, R
Science Planning	R, P, D	L, P, R
Partner Information Needs	C, D, L (Reg'l)	C, L (Local), P (Reg'l)
Partnerships & Collaboration	C, L, R	C, P, R
Communicating Results	P	P, R

**Permanent Staff Recruitment**

The Context. Opportunities to add completely new permanent science and science support positions have been rare. Opportunities to refill vacated permanent positions have been more frequent and are likely to become increasingly so as many staff approach retirement age and years in service; however, budget constraints at the beginning of this 5-year period are making it necessary to postpone refilling most vacated positions. As budget constraints wane, PWRC will be in an excellent position to attract the highest caliber of scientists to both research-grade and non-research-grade positions.

Achieving the Right Balance of Science and Support Positions. PWRC will emphasize principal investigator positions as hiring opportunities arise; however, it is recognized that research support positions are critical to the success of the research mission. A healthy balance of science and science support is needed. For most kinds of research programs, essential support can be obtained through temporary hires. PWRC will consider employing new temporary personnel from sources such as local colleges and universities. This approach is strongly encouraged except when full-time support is clearly required on a long-term basis, such as in support of ongoing activities like crane propagation, database management, and information technology support. In such cases, the most efficient approach is to seek long-

term incumbency by the same individual. The Student Career Experience Program (SCEP) will be used when practical to develop critically needed permanent expertise and to improve workforce diversity. The need for permanent “consulting” statistician positions has been raised by some scientists and is included in the list of positions desirable for PWRC to fill. Requests for hiring permanent support staff will be carefully scrutinized to be certain that alternate approaches are impractical and that the ability to fill critical principal investigator positions would not be compromised.

Support staff also includes secretarial and clerical assistance. In the projected fiscal climate of the next 5 years, PWRC’s policy will be to maintain a very small corps of permanent secretarial staff serving needs of all scientists, but to require scientists to make use of cyclical or reimbursable funds they have secured if they desire to enhance support above maintenance level.

Process. Replacement of current scientists upon their retirement will be principally through entry-level, 4-year term appointments. After successful performance and, for 4-factor scientists, successful progression through the RGE process, the opportunity to compete for career-conditional status will be offered. Final decisions on the order of filling positions will be based on what PWRC management, with the advice of the Science Council, views as the most critical science/science support need. At management’s discretion, these priorities are subject to modification due to practical considerations, e.g., base funding availability, unforeseen opportunity to recruit in a particular field of expertise, and political necessity. Table 2 presents a composite list of types of permanent positions identified by PWRC scientists as being important for meeting the needs of the emerging science areas from the first planning meeting.

**TABLE 2.** NEEDS FOR PERMANENT SCIENCE AND TECHNICAL SUPPORT POSITIONS, AS IDENTIFIED BY SCIENTISTS AT THE SCIENCE-PLANNING WORKSHOP. NEEDS ARE LISTED IN THE CENTER DIRECTOR'S PROVISIONAL PRIORITY ORDER AND DO NOT INCLUDE RECRUITMENT ACTIONS ALREADY IN PROGRESS AT THE TIME OF THE WORKSHOP.

Physical scientist (coastal geomorphologist) (back fill, Narragansett/Boston)  
 Wetland ecologist (habitat fragmentation) (backfill, Narragansett)  
 Applied behavioral ecologist (backfill, Laurel)  
 Ornithological systematist (backfill, Smithsonian)  
 Research clerical support (2)  
 Spatial statistician/landscape modeler  
 Molecular geneticist  
 Computer programmer/computer security/data management  
 Urban ecologist (environmental modeler)  
 Immunologist (contaminants and emerging disease)  
 Biometrician (survey design/analysis)  
 Adaptive management specialist  
 Research chemist  
 Biometrician (consulting)  
 North American fish systematist  
 Veterinary epidemiologist  
 Botanist  
 Invertebrate zoologist  
 Museum specialist  
 Animal care technicians  
 Field technicians  
 Lab technicians  
 Web designer  
 Website support (expansion and graphics design)

## Science Facilities

Description. PWRC headquarters is located on the FWS' Patuxent Research Refuge (PRR). Its field stations are located in Georgia, Massachusetts, Maine, Mississippi, New York, Rhode Island, Virginia and Washington, D.C., (Appendix 5). Field stations are governed by cooperative agreements with educational or research institutions, except for the Mississippi field station, which shares GSA-leased space with an FWS unit. All headquarters buildings, grounds, facilities and structures belong to FWS. PWRC occupies seventeen buildings on the PRR, not including numerous animal-holding/research buildings, out-buildings, sheds, storage structures, garages, barns, pump houses, etc. In accordance with the "Memorandum of Agreement for the Administration, Operations, and Maintenance of Facilities Co-located at the

PRR and PWRC (including Addendum),” USGS bears all responsibility for utilities costs and considerable responsibility for maintenance of buildings in which it is the majority occupant.

Status. Over the past several years, a series of comprehensive condition assessments have been conducted by engineering firms on the major buildings used by PWRC. For seventeen major buildings, including those housing PWRC staff, the condition summary was as follows:

*“17 buildings studied average 43 years old [excluding Log Cabin and Snowden Hall] and in general, have been poorly maintained. The deferred maintenance is substantial and all of the needs are critical to code, life safety, A[mericans with]D[isabilities]A[ct] and resource protection.”*

A conservative estimate for restoration of all PWRC buildings is \$46 million in the current D.C. area economy.

Joint Facility Working Group Plan. The Patuxent (USGS and FWS) Joint Facility Working Group was charged with evaluating the state of facilities and developing short- and long-term strategies for overcoming the structural and other safety and health problems plaguing the buildings on PRR. After detailed review of the condition assessments, including the relative cost of rehabilitation and new construction, the working group produced a final Plan. The Plan includes a detailed evaluation of the physical condition of all buildings on the Central Tract, based on the condition assessments, and presents alternative and recommended options. The Plan recommends that several older buildings on campus that have historic status (e.g., Merriam and Nelson) be renovated and reoccupied by some staff and partially converted to conference facilities. Under the proposed scenario certain other buildings (e.g., Gabrielson and Stickel) will be demolished.

The majority of staff, both of PWRC and other co-located agencies, are recommended to be moved to a new, state-of-the art building complex on PRR (site yet to be determined). The building complex will include office, meeting, wet laboratory, library, computer, and storage space. Based on input solicited from scientists, the current building specifications anticipate future growth, as well as certain shifts in science emphasis that are embodied in this Science Plan. Dormitory facilities for visiting scientists and volunteers, presently deficient on campus, are being considered, as well as medium- to long-term housing for employees best located on site. These employees are mainly veterinary and other personnel associated with crane research. A new crane propagation and research facility is included in the plan.

It is PWRC’s vision that the new facility will also house scientists from partner USGS disciplines and other agencies, in order to strengthen collaborative potential and create a synergy of ideas and research capability to confront the wildlife conservation issues of the 21<sup>st</sup> Century. Partners will come from a cross-section of the community who have a vested interest in conserving the Nation’s wildlife resources. These partners include USGS disciplines in geology, geography, and hydrology, as well as the FWS, the USDA, EPA, NPS, and potentially non-governmental organizations, such as Audubon, Ducks Unlimited, and the Wildlife Management Institute.

### Interim Steps

Because securing the necessary funds and constructing a new facility will likely require a minimum of five to seven years, interim steps are necessary to eliminate exposure of the occupants of Stickel, Merriam, and Nelson Laboratories to the various health and safety risks that have been clearly documented. Adequate office and laboratory space available on the Beltsville Agricultural Research Center has been secured on a rental basis to serve as a temporary location for 37 occupants of these buildings, beginning in the first quarter of FY 2004. Thirty-eight staff will be relocated into available space in Gabrielson Laboratory. PWRC management will place high priority on ensuring the move will cause the least possible disruption to the well being of PWRC scientists and the continuity of PWRC's science program.

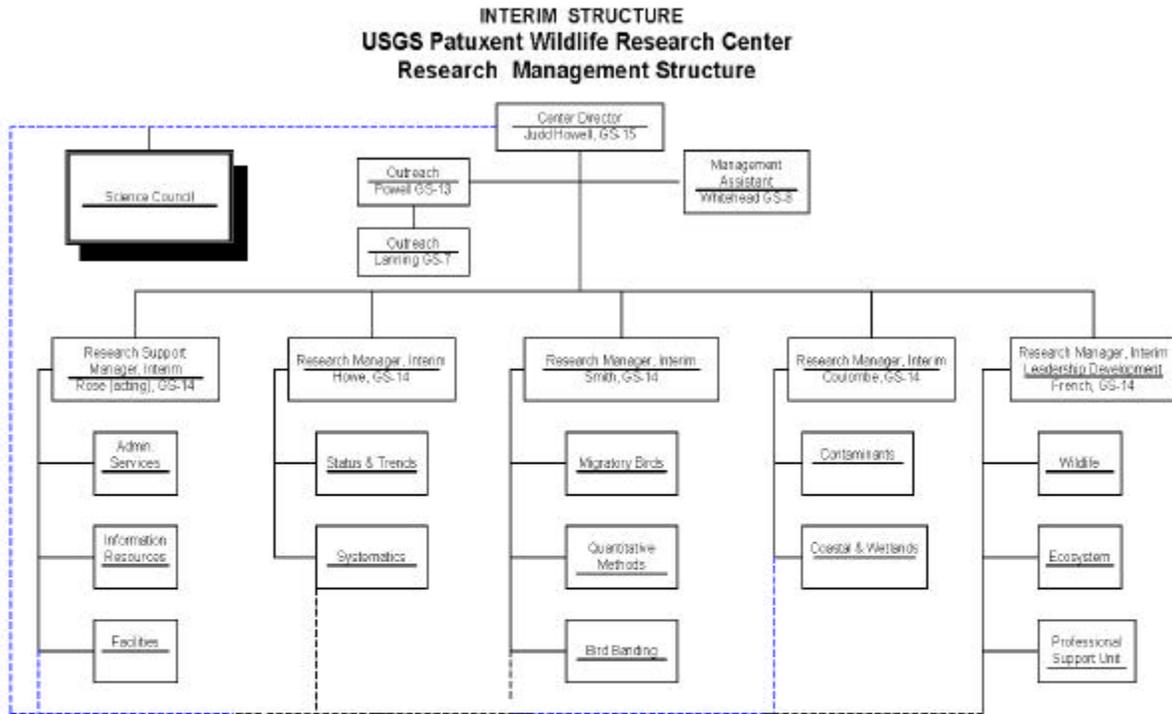
## Appendix 2. Criteria for Determining New Science Initiatives.

The table attempts to align similar types of criteria developed by the two groups during the workshops held in October 2002.

<b>Partner Criteria</b>	<b>Scientist Criteria</b>
Who will benefit from the results of the research?	Does it meet the needs of our partners or customers?
What question does it answer without committing a lot of resources?	
What management/DOI says is important Is this part of a major bureau or DOI issue priority?	How does it align with the USGS regional priorities or national priorities?
Will it benefit DOI trust resources and other obligations and ecosystems on which they depend?	Is it feasible to implement results?
Is the scientific question consistent with the vision and mission of PWRC?	Does it fit USGS's mission and unique capabilities (significance)?
Does the species in question have a demonstrative economic value or base of popular support?	
Do the results have capability of important impact on the management of these issues?	Will this effort produce a usable product for a customer?
Does this research impact other questions? Other work?	
Are there global issues? International? Does it benefit humankind and the environment?	Is there a large conservation/scientific pay-off?
Does the problem have the potential for advancing scientific understanding?	What is the value to the scientific community?
Will it increase the understanding of long-term trends?	

<b>Partner Criteria</b>	<b>Scientist Criteria</b>
What is the impact of not addressing? Will it have a major impact on individual jurisdictions? Will it cost a lot of money if not addressed?	
Can someone else do it better? Does it duplicate the efforts of some other agency?	Do we have the facilities, technology, and equipment?
Do we have the capabilities/resources to do it now? If not, how do we plan to get them in the future?	Does it match our existing and emerging capabilities – the abilities we have now and those we are evolving into?
What do we have to give up to address this problem?	Is there a funding source or a possibility of one?
Are there ways to enhance by partnering with other Science Centers enters, USGS disciplines, or other partners?	<p>Is there an opportunity for integration within the USGS disciplines?</p> <p>Is there an opportunity for collaboration within USGS or with the greater scientific community?</p>
	What is its value to USGS in terms of tools developed and scientific resources added?

### Appendix 3. USGS Patuxent Wildlife Research Center Organization



Temporary Employees:  
 Postdocs 5  
 SCEPs 7  
 STEPs 6  
 Temps 19  
 Temps 3

Recommended: /s/ Judd Howell Date: 10/28/02

Approved: /s/ Suzette M. Kimball Date: 10/28/02

## Appendix 4. List of USGS Patuxent Wildlife Research Center Standard Operating Procedures

### Standard Operating Procedures

Please note: The files below are in Portable Document Format (PDF) so you will need to use Adobe Acrobat Reader to view them. If you don't already have this free tool, please go to: <http://www.adobe.com/prodindex/acrobat/readstep.html> to download and install the latest version of Adobe Acrobat Reader.

- [SOP 7 - Animal Care and Use Policy](#)
- [SOP 8 - Correspondence/Communication Tracking System](#)
- [SOP 9 - Employee Exit Clearance Procedures](#) (see 2 forms listed below that you can fill out via the internet and print)
  - [Employee Clearance Form](#)
  - [Clearance for Non-Controlled \(Non-Accountable\) Property](#)
- [SOP 11 - Scientific Information Release and Professional Expression](#)
- [SOP 11A - Professional Expression Electronic Tracking Form](#)
- [SOP 12.3- Coordination-proposed Refuge Activities-Research](#)
- [SOP 14 - Freedom of Information Act](#)
- [SOP 17 - Animal Quarantine Policy](#)
- [SOP 18 - 2001 Snow Emergency Protocol for Animal Colonies](#)
- [SOP 20 - Scientific Achievement Awards](#)
- [SOP 21 - Development and Review of Project Plans](#)
- [SOP 23 - Safety Policy](#)
- [SOP 24 - Property Management Policy](#)
- [SOP 25 - Web Page and Web Server Policies and Procedures](#)
- [SOP 26 - Use of Firearms for Specimen Collection](#)
  - [Memorandum: Disqualification for Misdemeanor Convictions for Domestic Violence](#)
  - [Certificate of Need for Issuance of a Firearm for Official Use](#)
- [SOP 28 - Use of Volunteers](#)
  - [Individual Volunteer Services Agreement, Form 9-2080](#)
- [SOP 29 - Emeritus Scientist Program](#)
  - Individual Volunteer Services Agreement, Form 9-2080 (under revision--new procedures will be available in the near future)
  - [Reemployed Annuitants, Chapter 100](#)
- [SOP 30 - Research Associates and Collaborators of the Center](#)
- [SOP 32 - Library: Purchasing books and subscriptions](#)

Last modified:

## Appendix 5. USGS Patuxent Wildlife Research Center Field Stations in the USGS Eastern Region

