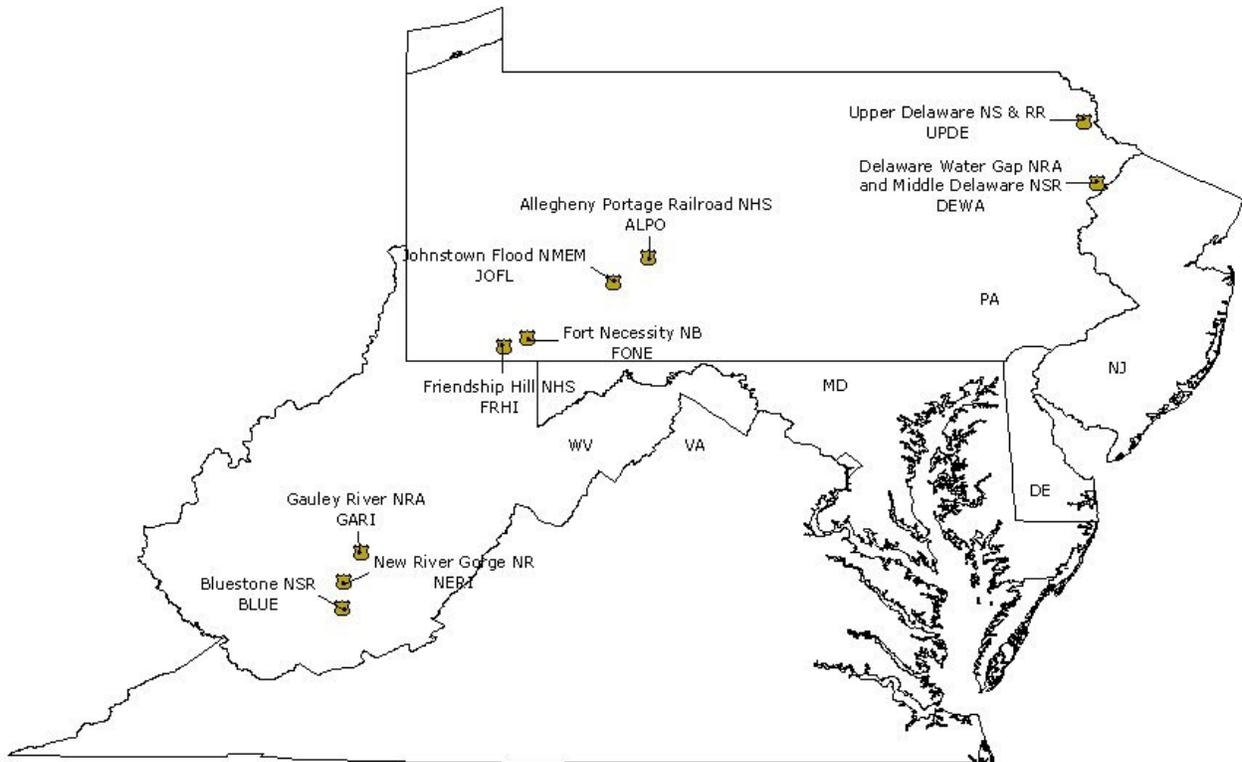


*National Park Service
Inventory and Monitoring Program*

**Eastern Rivers and Mountains Network
Inventory Study Plan For:
Vertebrate and Vascular Plant Species**

October 1, 2001



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SECTION I-INTRODUCTION

Habitat loss and fragmentation are two of the most significant threats to biological diversity today (Primack, 1993). As large tracts of public lands, such as national parks, become more insular from increased fragmentation due to agricultural development, urbanization, or other land use changes, these lands will become increasingly valuable for the long-term maintenance of floral and faunal diversity as well as the functional integrity of landscapes and ecosystems in the United States (Ambrose and Bratton 1990, Yahner et al. 1995). As one of the largest land managers in the United States, it is crucial that the National Park Service (NPS) first determines the extent and then maintains existing biological diversity within its parks.

Since the establishment of the National Park Service, natural resource data has been collected by various sources, university scientists, scientists within the parks, and organized groups such as state breeding bird atlases, state herpetological atlases and other similar watch groups. Although this biological information exists for many of the parks, much of it has never been compiled and reviewed by the Service. Over the past decade, the National Park Service, has been working to establish what is now called the Inventory and Monitoring Program (I&M program). The principal functions of this program are to gather existing as well as new information about the natural resources in the parks and to make that information easily available at different levels, to park resource managers, the scientific community and the public. Another function of the I&M Program is to develop long-term techniques and strategies for monitoring the diverse expanse of ecological communities that make up the National Park System. A basic component of this program is the creation of databases that can store such an enormous amount of information and at the same time be user friendly and accessible. The National Park Service has created three such databases, NPSpecies to store information about the existing and historical records of species in each park, the NRBIB a bibliographic database to house all existing natural resource publications for each park, and the Dataset Catalog which references park spatial and electronic data sets.

For park managers to effectively try to maintain the biological diversity and ecological health of their parks, they must have a basic knowledge of what natural resources exist in parks as well as an understanding of those factors that may threaten them. One of the first goals of the I&M program will be to establish baseline biological inventories for vascular plant and vertebrate species in order to provide reliable species lists, a fundamental tool for management. The program will also begin to gather relative abundance and distribution information for species of special concern. Detailed information on exotic invasive plant species for example, as well as on rare and threatened species can enable more effective management practices. The simple knowledge of what and where species exist in the parks is crucial in making decisions on such things as building new trails, buildings and restoring cultural landscapes. Phase II of the I&M program will involve developing long-term monitoring programs to efficiently and effectively monitor ecosystem status and trends over time within the parks. Without the baseline information that will be gathered in Phase I, such long-term monitoring programs can not effectively be established.

In order to reduce costs and increase efficiency, the National Park Service has clustered parks into I&M Program “networks” so that data acquisition might occur simultaneously at several locations. The basic data themes that have been identified for the Phase I natural resource inventory represent the recommended minimal data set for all natural resource parks. These data theme descriptions can be

found in the Inventory and Monitoring Guidelines for Biological Inventories (National Park Service, 1999).

Priority biota groups include:

- ◆ vascular plants
- ◆ vertebrates
- ◆ federally and state listed threatened and endangered species
- ◆ species of special concern within the park, including endemic, nonnative, and other species identified by legislation.

1.1 Goals and Objectives of the Eastern Rivers and Mountains Network (ERM Network)

The ERM Network Inventory Study Plan is a detailed plan for completing inventories of both vascular plant and vertebrate species within nine National Parks covering four states in the Northeast Region. This plan reflects the goals and objectives of the Eastern Rivers and Mountains Network within the context of the national I&M Program goals and objectives listed below:

- ◆ To document through existing, verifiable data and targeted field surveys the occurrence of at least 90 percent of the species of vertebrates and vascular plants currently estimated to occur in each park.
- ◆ To describe the distribution and relative abundance of species of special concern, such as Threatened and Endangered species or exotic species occurring within park boundaries.
- ◆ To provide the baseline information the parks need to develop and implement a general monitoring strategy once inventories have been completed.

With these goals in mind, the ERM Network began to develop this inventory plan, and during its development, specific Network goals and objectives evolved based on what has already been done in the parks and where their inventory needs lie. Inherent in the National Program goals is the fact that objectives must be met prior to being able to meet the National goals. For example, in order to determine whether or not at least 90 percent of the vascular plants occurring in a park have been documented, that park must have an up-to-date species database that contains verified records with associated, credible documentation. With the exception of a few of the ERM Network parks, verified, accurate and up-to-date species lists are not yet available for the Network, making it impossible to determine exactly how many species exist in each park. The Network also has many inventories in progress, so whether or not the 90 percent goal has been reached can not be accurately determined until these projects are complete and the data analyzed.

The following list of goals and objectives were developed by the Network in response to these issues, and after much discussion it was determined that conducting targeted field investigations to reach the the national program's 90 percent goal, would not be the highest priority for the Network at this time, unless a park was lacking in baseline inventory data on a specific taxa. Regional I&M staff, park staff and consulted experts feel that priority should be given to those inventories with specific management purpose, and that in conducting such inventories the 90 percent goal will eventually be attained. The Network hopes to accomplish the following two goals over the next four years.

Goal 1

Data Management and relational database development of existing, large, network data sets.

Goal 3

To determine the distribution and abundance of targeted groups of vertebrate and vascular plant species identified by the Network parks.

SECTION II-EASTERN RIVERS AND MOUNTAINS NETWORK PARK DESCRIPTIONS

The Eastern Rivers and Mountains Network includes nine national parks. The parks range in size from approximately 66 to 30,000 hectares and are located across four states (Table 1). Five of these parks are large “river” parks, three of which, Delaware Water Gap, the Upper Delaware, and the Bluestone, are part of the National Wild and Scenic Rivers System. Signed by Congress in 1968, the National Wild and Scenic Rivers System Act established protection for selected rivers as well as their immediate environments in their free-flowing condition. All of the parks in this network cover a wide range of temperate forest, from coniferous to mixed deciduous. They also include a wide range of habitat types, from old field to talus slopes. There are a number of special habitats found in these parks as well, such as cliff face habitat, recently discovered as containing some of the oldest living trees in eastern North America (Fortney, et. al., 1995). Simply the uniqueness of riverine habitat is important in itself, and the many taxon dependent upon it.

This Network has a wide range of inventory needs. After data mining and scoping workshops with local taxa experts, it became clear that the ERM Network has few baseline inventory gaps, but rather gaps in information on specific species groups such as grassland and wetland birds, fish and bats. Many vertebrate and vascular plant inventories are already in progress in the Network’s parks initiated by regional and park staff who recognize the need for biological inventory work in these parks. These projects will help to fill data gaps and to reach the I&M Program 90% goal.

Table 1. Parks in the Eastern Rivers and Mountains Network.

Park Name	Code	State	Yr. Est.	Acres	Ha
Upper Delaware Scenic and Recreational River	UPDE	PA/NY	1978	75,005	30,354
Delaware Water Gap National Recreation Area	DEWA	PA/NJ	1965	70,000	27,018
New River Gorge National River	NERI	WV	1978	69,833	28,261
Bluestone National Scenic River	BLUE	WV	1988	4,310	1,744
Gauley River National Recreation Area	GARI	WV	1988	11,506	4,656
Allegheny Portage Railroad National Historic Site	ALPO	PA	1964	1,249	505
Johnstown Flood National Memorial	JOFL	PA	1964	164	66
Fort Necessity National Battlefield	FONE	PA	1974	903	365
Friendship Hill National Historic Site	FRHI	PA	1978	675	273

Upper Delaware SRR (UPDE)

PA/NY

Visitation 356,486

The Upper Delaware Scenic and Recreational River is a 73.4 mile segment of river designated by Congress in 1978 as part of the National Wild and Scenic Rivers System. It lies within the Appalachian Plateau physiographic province of the Northeastern United States, and forms the border between New York and Pennsylvania where it extends from the confluence of the East and West Branches of the Delaware River at Hancock, NY to Sparrowbush, NY. The Upper Delaware Scenic and Recreational River was established to protect the outstanding scenic, recreational, geologic, fish, wildlife, historic, and cultural resources of this section of the Delaware River, to protect its water quality, and to provide for the enjoyment of same by present and future generations. A landward boundary was established to satisfy the resource protection requirements set forth in the Wild and Scenic Rivers Act and in the Special Statutory Provisions for the Upper Delaware. This corridor area to be conserved averages 1 to 2 miles in width and consists of 55,574.5 acres, most of which are forested with a predominate mix of hemlock and hardwood. Agriculture (corn and pastureland) is common on the fertile flats along the river, and low-density development (except for a few hamlets) is spread throughout the valley. The National Park Service presently owns only about 30 acres within this corridor. Threats from recreational use, land use within the corridor (railway accidents, etc.), adjacent lands development and corridor management by the Upper Delaware Council of private lands are some of the issues facing UPDE. UPDE and DEWA are separated by a developing 8 mile stretch of undesignated river.

Delaware Water Gap NRA and Middle Delaware S&RR (DEWA)

Walpack, NJ, Bushkill, PA

Visitation 5,132,149

DEWA includes 40 miles of the free-flowing Delaware River, part of the National Wild and Scenic Rivers System, and the surrounding 70,000 acres bordered by the most rapidly developing landscape in PA and NJ. Unique geologic and natural features found here form some of the best-known scenic landscapes in the northeast. The park includes, the gap, part of the Appalachian Trail, exceptional water quality, and unique habitats such as fens and seeps, waterfalls and plunge pools, river islands, cobble beaches, talus slopes, shale cliffs, rocky cactus barrens, hemlock ravines and rhododendron glades. Some 12 rare plant communities, 89 plant species of concern, 15 herpetological species of concern, 50 bird species of concern and 11 mammals of concern inhabit the park. Threats to natural resources from recreational use and development, visitor/wildlife interactions, adjacent land use, invasive and exotic species and landscape management practices are issues that require biological inventory information. DEWA is the 10th most visited park in the NPS with over 4.2 million visitors annually. Key management issues at DEWA include 1. Water quality protection of the Delaware River, tributaries, ponds & impoundments, groundwater, in relation to development, both internal and external to the park, 2. Landscape management related to land use, pesticides, erosion & sedimentation, fertilizers & nutrients, exotic species, species of special concern, and wildlife habitat, 3. Species and habitats of special concern, especially in relation to recreation and development, both internal and external to the park, and 4. Exotic species management, especially in wetlands, hemlock forests, and other priority habitats.

New River Gorge NR (NERI)

Glen Jean, WV

Visitation 1,188,901

New River Gorge National River includes 53 miles of river, portions of 77 tributaries and the surrounding 69,833 acres. Some of the land base is privately owned. The New River is said to be among the oldest rivers on the continent. It was established to conserve and interpret natural, scenic and historic values and to preserve the free-flowing stream. Because the New is a geographically old river that flows into the state from the south, it has been recognized as an important corridor into West Virginia for plant species indigenous to the Southern Appalachians. As a natural migration corridor for species, the area supports a wide variety of plants and animals. Unique habitats include the gorge, broad floodplains, flatrock communities, canyon rim and walls, exposed geological formations, cliff faces and outcrops, islands, waterfall and plunge pools, wetlands and seeps, and sandstone ridges. New River Gorge National River lies within the Lower New River Watershed that is further subdivided into 10 watersheds. The predominant land cover in all 10 watersheds is deciduous forest, ranging from 55.77 to 84.96 percent coverage. Mixed forests and conifer forests ranges from 3.50 to 15.33 and 0.20 to 6.75 percent coverage, respectively. The greatest percentage of developed land in a watershed is 7.94 percent. Developed lands are less than 2 percent in the eight remaining watersheds. Farmland, including hay, pasture, grasslands, and croplands, comprises less than 10 percent of most watersheds. Wetlands, mainly riverine, comprise from 0.28 to 2.44 percent of the watersheds. The online database lists 94 surface mining permits and 59 underground mining permits for the Lower New River Watershed. Threats to natural resources are from adjacent land use, disturbed lands (abandoned mine sites, surface and underground, active mining both surface and underground, oil and gas extraction, logging), exotic species (knotweed, honeysuckle, kudzu), impoundments, former land use, recreational use and development. Water quality and aquatic biological resources are of particular concern including bacterial contamination from sewage as a problem for water based recreation. West Virginia has no state listing of species; however, the park has adopted the Nature Conservancy rankings for species of special concern. Five species of fish are endemic and federal and state listed species are found in the park.

Bluestone NSR (BLUE)

Athens, Pipestem, Hinton, WV
Visitation 58,610

The Bluestone National Scenic River was established to preserve the river's free-flowing condition, the outstanding primitive and scenic qualities, natural and cultural resources and to provide recreational opportunities. This 11 miles of river and 4300 acres (1258 state-owned) is relatively unspoiled and undeveloped. Exposed rocks of shale, limestone and sandstone add to the impressive landscape. Bluestone National Scenic River lies within the Upper New River Watershed, which is divided into 13 watersheds. Deciduous forests are the predominant land cover in most of the watersheds covering between 26.75 to 80.01 percent. Mixed forests and conifer forests cover 4.855 to 17.84 percent and 0.37 to 11.00 percent, respectively. Developed lands comprise less than 4 percent of most watersheds. Farmlands cover 9.06 to 42.83 percent of the watersheds. Wetlands comprise from 0.05 to 3.64 percent of the watersheds. The database lists 7 surface mining permits and 8 underground mining permits; all but one of these permits are located in the Middle Bluestone River and Lower Bluestone River watersheds. Management issues include adjacent land use, (coal mining, oil and gas extraction, logging, runoff), sewage outfalls, surface mining, agricultural runoff, etc.

Gauley River NRA (GARI)

Summersville, WV

Visitation 236,918

The Gauley River National Recreation Area is 11,145 acres (almost 10,000 privately owned) and includes 25 miles of free-flowing Gauley River and 6 miles of Meadow River that pass through narrow canyons and valleys in over 100 class III to V+ rapids. It is one of the most adventurous rivers in the east and was established to preserve the scenic, recreational, geological, fish and wildlife resources of the river and its tributary, the Meadow River. Unique resources include sandstone cliffs, high knobs and ridges and large river boulders. The extremes in elevation, topography and microclimate support a variety of plants and animals.

Allegheny Portage Railroad NHS (ALPO)

Gallitzin, PA

Visitation 111,571

ALPO is a long and narrow park that follows the historic railroad trace. It is approximately 500 ha in size, and is dominated by forested habitat (76%) composed of plateau, pioneer and northern hardwoods. Other habitats include early successional lands that make up approximately 16% of the park. A pond and numerous intermittent streams exist, as well as grasses and forbs (5%) and a small coniferous forest (1%). Critical management issues include adjacent land use, open fields management, and management of invasive species. The Allegheny Front limits the development potential, but mining and lumbering activity on adjacent lands does occur.

Johnstown Flood NM (JOFL)

South Fork, PA

Visitation 179,285

JOFL preserves the site of the breached dam and is approximately 66 ha. It is dominated by early successional habitat (43%) located adjacent to the river. The main drainage in the park is the Little Conemaugh River, and wetlands and river acreage compose approximately 3 ha. Herbaceous habitat makes up approximately 23 % of the park and 33% of the habitat at JOFL is plateau and pioneer deciduous forest. Critical management issues include management of these open fields, and invasive species management (giant knotweed, garlic mustard, Asiatic bittersweet, Eurasian honeysuckle, multi-flora rose, Japanese barberry, and Japanese honeysuckle).

Fort Necessity NB (FONE)

Farmington, PA

Visitation 85,558

FONE is comprised of three distinct units; the main unit includes the battlefield, the earthworks, the fort and a historic tavern, a second unit includes Jumonville Glen, a ravine, the third unit, Braddock's Grave, is a historic property. Both Jumonville and Braddock's Grave consist mostly of deciduous forest. The main unit of FONE consists of approximately 106 ha of pasture/meadow, 209 ha of deciduous forest, and 35 ha of coniferous forest. There are a number of wetlands at the main unit as well, including ponds and both perennial and intermittent streams. Warm and cold-water fisheries are found in the park and two state listed plants are known to occur. Critical management issues include Great Meadows Cultural Landscape rehabilitation, exotic/invasive species management (Tartarian

Honeysuckle, crown vetch, multiflora rose, canada thistle and common teasel), lack of biological inventory, water quality and quantity, white-tailed deer and effects of browsing, and management of rare species habitat.

Friendship Hill NHS (FRHI)

Point Marion, PA

Visitation 24,558

FRHI preserves the historic property of Albert Gallatin along the Monongahela River. It covers approximately 273 ha, 19 of which are mowed fields, 51 of which are abandoned drift mine and 202 ha consist of deciduous and coniferous forest. There are a number of small wetlands on the property including four permanent streams and a pond. Federally listed plants are known to occur at FRHI based on surveys done in the 1980's. Critical management issues include acid mine drainage and monitoring of mitigation measures, water quality, management of cultural landscape, exotic species management, white tailed deer population dynamics, management of rare species habitat.

SECTION III-COMPILATION OF EXISTING INFORMATION

Beginning in 1999 all existing information on vertebrates and vascular plants occurring in the ERM Network parks began to be compiled. Information in the form of species checklists, research, technical reports, management plans, wildlife observation cards, collecting permits, and voucher specimens information from both museum and university collections were gathered and entered into NPSpecies and NRBib. Since 1999 this process has continued. Currently the Northeast Region's scientific librarian, hired to gather all bibliographic information for parks in the Northeast, is visiting each park to individually search their libraries and work with park staff in compiling information and update the NRBib database. Research Associates from Penn State University as well as taxa experts continue to work on the Network's NPSpecies database by adding new species and voucher specimen records. The data mining process and database update, is and will be an ongoing process for a number of years for the Network.

3.1 NPSpecies

In the fall of 1999, resource managers in all nine of the ERM Network parks were asked to gather as many documents and electronic datasets as they could containing information on vertebrate and vascular plant species collected in their parks. These documents and electronic files were then sent out to the Natural Resource Information Division of the Inventory and Monitoring Program in Colorado for data entry and conversion to the NPSpecies database.

When the first version of NPSpecies was returned to the Network in 2000, it was clear that some of the larger electronic databases had not converted well into NPSpecies. One of these being the regional NPS NPFlora and Fauna database maintained by John Karish at Penn State University. Unlike other NPFlora and Fauna databases that had been populated and then left untouched for years, this database was maintained and updated with references, vouchers and new species information. Over the years, research associates from Penn State University gathered and verified a large amount of vertebrate and vascular plant information for parks in the Network and entered it into this database. When the Network received its version of NPSpecies, containing this regional NPFlora and Fauna database, references associated with each record had been lost in the conversion, leaving species records either incorrectly documented or with no documentation at all.

The DEWA database, another large database sent to Colorado for conversion had also lost much of its associated species documentation in the conversion. Designed and maintained since 1996, by resource managers at DEWA, this Access database was a compilation of both documented and specimen-based information regarding biological diversity in the park. Existing biodiversity information had been compiled for amphibians, reptiles, birds, mammals, vascular and non-vascular plants, as well as invertebrates, and all species records contained extensive bibliographic material. Both these databases were re-submitted to the I&M Program office to be re-converted in the fall of 2000. In December 2000, the Network also submitted its updated and verified NPSpecies database to the national office, this time to be converted to the web-based version of NPSpecies. At that time, the ERM Network had recently received the re-converted portions of its NPSpecies database, containing the re-converted NPFlora and Fauna and the DEWA databases. This did not allow time to verify all records before it was converted to the web version. Verification began again on the web-based version of the database once it was released in February 2001. Presently experts and other qualified people are being hired to review and update portions of the NPSpecies database for ERM Network parks.

Ongoing Work

Penn State Research Associate

Beginning in May 2001, a research associate (RA) at Penn State University, hired to clean up and continue work on the database has been verifying each NPSpecies record with the records in the original NPFlora and Fauna database to assure that the conversion was complete and correct. This RA will continue to extract information from the databases and hardcopy documents originally sent by the Network parks to the I&M Program office in 1999. Detailed information from these sources such as abundance, habitat associations, nativity, etc... was not entered in the first effort to populate the database and all of this information still needs to be entered. This RA is also acting as the Network's NPSpecies "specialist" in answering any questions about the database for park staff as well as making sure that as the database is updated that this information is available to the parks. The RA is also responsible for coordinating the effort by experts and park staff in updating and maintaining the database. As the main contact for the Network, the RA keeps track of when and who is working on what sections of the database, so there is no overlap and when converted to the web-based version no new or existing data is lost. This person works cooperatively with the URI RA for other Northeastern Networks.

West Virginia Parks Vascular Plant Database

In May 2001, the Network contracted with a botanist from West Virginia to verify, update and revise existing plant records in the web version of NPSpecies for the GARI, BLUE and NERI parks. This botanist has worked collecting endangered species data for the West Virginia Department of Natural Resources in all three of these parks. He has years of expertise, familiarity and knowledge of West Virginia flora. The following is the list of tasks that will be completed during this project:

1. Revise NPSpecies plant lists for the New River Gorge National River, Bluestone National Scenic River and the Gauley River National Recreation Area. Inaccuracies will be corrected in Latin name, common name, park status, abundance, nativity, cultivation and invasiveness fields. Further data will be added where reference is available. Use will be made of BONAP county level data for the Northeast, state and regional floras and other publications and state herbaria as well as consultation with knowledgeable colleagues at the West Virginia Department of Natural Resources (Natural Heritage Program).
2. Inventory completeness (the Program goal of 90%) will be determined by comparing a “master species list” which will contain a list of vascular plant species expected to exist in a park, with the current list of plants that have actually been documented in that park. The “master species list” will be generated using local flora databases, range maps and expert opinion. The master species list will need to be reviewed carefully in order to eliminate those species that are endemic to specific habitats that do not occur in the park. This will require a familiarity with habitats existing in each park, i.e. wetland types, rock outcroppings, etc... These judgements will be based on expert botanical opinion and familiarity with the flora and habitats of West Virginia.
3. Data gaps and the need for further inventory work will be identified based in part on inventory completeness determined as part of this project, and on analysis of past field methods used in previous botanical studies and accountability as well as expert opinion.
4. Prepare final report describing changes made to the database, including the number of new species records added, a list of documents, databases and collections used during the project to revise the lists. Describe the project’s accomplishments and findings as well as description of inventory completeness for these parks, and recommendations for future work to accomplish inventory completeness.

The goal at the end of this project is to have an up-to-date plant database for the three WV parks and a clear picture as to further inventory work needs in each of the three parks, whether that is simply completing baseline inventories, or targeting identified taxonomic gaps.

DEWA Database

A Student Conservation Association (SCA) technician was hired, Sept. 2001 to work on NPSpecies for DEWA. Stationed in the park, the technician will be supervised by Park staff who originally created the DEWA database. This person will be error-checking all of the DEWA references and their species links and then begin to enter the backlogged references. If time permits, this same technician will begin

to make Dataset Catalog entries for the smaller non-spatial datasets contained at the park. The goal is to have all DEWA NPSpecies records including references and vouchers and their species links, and NRBIB, up-to-date by Dec 2001. Once this is complete, then subject matter experts will be asked to look at the park-species data fields, i.e., park status, abundance, and fill in those fields. The following taxa experts will review the database: Dr. Carolyn Mahan from Penn State Altoona will review mammals, Bill Olson a private consulting Botanist will review plants, Dr. Terry Master from East Stroudsburg University will review the birds, Dr. John Behler from the Wildlife Conservation Society will review the herps and a fish expert has not yet been identified. Dr. Jay Stauffer from Penn State University is completing an extensive search for fish vouchers that will be entered into the database as well.

3.2 NRBIB Database

In 1996-1997 parks in the ERM Network were visited to initially gather existing bibliographic information to create the Network NRBIB database. Since then, little or no updating of this database has taken place. Some parks maintained a box of new references to add to the NRBib as time permitted. In April 2001 the process to update the original database began. The Northeast Region's scientific librarian has been visiting each park in order to interview staff and to locate additional sources of information. Simply searching staff bookshelves and filing cabinets has resulted in new references to be added to the database. Because the database has not been regularly updated since 1997, it has required some initial editing and revision, specifically, checking for duplicate records, missing bibliographic information, and/or incorrect bibliographic information before new records are added. Once this is complete, the databases will then be updated with the addition of new records. Existing records will be updated if necessary with new storage locations when applicable and/or more detailed bibliographic information if needed. Part of the database update will include searching local and state government resources and repositories such as Natural Resource Commissions, Utility Commissions, Land Management Offices. Local and regional libraries such as public, college, university, and state libraries will also be searched as well as private and public agencies such as bird clubs, trail clubs, adjacent land owners or facilities and finally CD-ROM, online and Internet resources will also be searched.

At present, NRBIB databases in the ERM Network vary greatly in size with the largest being DEWA (2003 records) and the smallest being ALPO (45 records). Other databases in the Network include UPDE (1557 records), NERI (405 records), FRHI (290 records), FONE (216 records), GARI (57 records), BLUE (48 records), and JOFL (46 records). Once update visits have been completed for these parks, it is expected that database updates for this region will take 4-5 weeks in the fall 2001. Parks such as DEWA, ALPO, and UPDE already have designated park personnel regularly updating the databases since they were created, and therefore, may require less intensive onsite updating and revision. Conversely, the remaining parks in the region may require a more intensive degree of revision and updating in order to meet existing NRBIB standards.

3.3 Dataset Catalog

The Network entered into a cooperative agreement (FY2000) with North Carolina State University (NC State) to complete FDGC metadata for all existing spatial data sets from the Network parks. All parks with GIS capabilities were visited by NC State staff and FDGC metadata was written on data

sets during those park visits. All other Network spatial data information was compiled at NC State. The University has also been data mining for other spatial data sets existing outside of the parks and writing metadata for those as well. NC State staff are currently in the process of transferring the FDGC metadata they have created for the Network to the revised version of the Dataset Catalog released, May, 2001, this will be completed by October, 2001. Information will be entered concerning geospatial data sets as well.

3.4 Voucher Specimen Data Mining

In order to provide verifiable and legal documentation of a species occurrence within the Network parks, one hundred and eight natural history museums and other institutions were searched in 1999-2000 for records of vertebrate and vascular specimens collected within park boundaries (Table 2). All Investigator's Annual Reports (IAR) and collection permit contact information were reviewed in order to identify potential collections containing NPS specimens. An initial contact letter was mailed out to the identified sources requesting catalog number and specific locality information on specimens that were collected in the Network parks. Institutions were given a preliminary deadline of one month to receive records, however, since this deadline was rarely met, a second letter verifying receipt of the initial letter and offering further assistance was mailed out at that time. Additional contacts were made for delinquent institutions on a monthly basis until a response was received. Most larger institutions (e.g. Carnegie Museum of Natural History) requested monetary compensation for querying their databases. The decision to provide monetary compensation was made based on the likelihood of the institution providing a sizable amount of relevant data for the Network.

Records that were received from most, if not all, institutions were not specific to a given park. In order to verify whether or not a specimen was collected from within a park, the data was sorted by park based on state counties. This information was then mailed to each park resource manager for further verification. As with the initial institutional contact letters each park was requested to return the verified records within one month upon receipt and re-contacted if the data was not returned.

Table 2. Institutions contacted for information on specimens collected in the Eastern Rivers and Mountains Network.

1. Academy of Natural Science	2. Rhode Island c/o FIIS	3. Normandeau Associates, Inc.
4. Agricultural Research Service	5. Fire Island National Seashore	6. NC State Museum of Natural Sciences
7. Allegheny Portage Railroad National Historical Site	8. Florida Museum of Natural History	9. North Carolina State University
10. Allbright College	11. Fort Necessity National Battlefield	12. North VA Community College
13. American Museum of Natural History	14. Friendship Hill National Historic Site	15. Old Dominion University
16. Appomattox Court House National Historical Park	17. Fredericksburg & Spotsylvania NMP	18. PA Bureau of Plant Industry
19. Assateague Island National Seashore	20. GAI Consults, Inc. for Columbia Gas Corp	21. PA Dept. of Agriculture
22. Bluestone National Scenic River	23. George Mason University	24. PA Fish and Boat Commission
25. Gauley River National Recreation Area	26. Gettysburg Area High School	27. PA State Museum at Harrisburg
28. New River Gorge National River	29. Gettysburg College	30. Pennsylvania State University
31. Booker T. Washington Nat'l Monument	32. Hampden-Sydney College	33. Petersburg National Battlefield
34. Canada Museum of Nature	35. Harvard University	36. Ramapo College
37. Columbia University	38. Hopewell Furnace National Historical Site	39. Randolph Macon College
40. Brooklyn Botanic Garden	41. Johns Hopkins University	42. Richmond National Battlefield
43. Carnegie Museum of Natural History	44. Kent University	45. Rutgers University
46. Univ. of MD Center for Environmental Sciences	47. Indiana University of Pennsylvania	48. Rutgers, the State University
49. Cleveland Museum of Natural History	50. Lord Fairfax Community College	51. Salem Teikyo University
52. The College of William and Mary	53. Marshall University	54. Seneca Valley High School
55. Colonial National Historical Park	56. Maryland Dept. of Natural Resources	57. Shenandoah National Park
58. Cornell University	59. Mercer Museum	60. Shippensburg University
61. Delaware Museum of Natural History	62. Michigan technical University	63. U.S. Dept. of Agriculture
64. Delaware Water Gap National Recreation Area	65. Missouri Botanical Gardens	66. U.S. Regional Pasture Research Lab
67. Drew University	68. Montclair State University	69. University of California
70. Drexel University	71. Natural History Museum of LA County	72. University of Delaware
73. Duke University	74. Natural History Society of MD	75. University of Illinois
76. East Stroudsburg University	77. The Nature Conservancy	78. University of Kansas
79. Elizabethtown College	80. New Jersey DEP	81. University of Maryland
82. EPA	83. NJ Fish, Game, and Wildlife	84. University of Massachusetts
85. Farimont State College	86. NJ Heritage Program	87. University of Michigan
88. Ferrum College	89. NJ State Museum	90. University of Minnesota
91. University of Wisconsin	92. NY Botanical Garden	93. University of North Carolina
94. Upper Delaware Scenic and Recreation River	95. University of NC at Chapel Hill	96. Virginia Museum of Natural History
97. Valley Forge National Historical Park	98. University of PA, Morris Arboretum	99. University of Richmond
100. Virginia Polytech	101. West Chester University	102. West Virginia University
103. VA Commonwealth University	104. West Virginia Department of Agriculture	105. The Field Museum
106. VA Dept. of Cons. and Rec. Div. Of Nat. Heritage	107. West Virginia Natural Heritage Program	108. NY State Museum at Albany

Fish Voucher Search

Dr. Jay Stauffer and Research Associate, Timothy Stecko, from Penn State University are conducting a fish voucher search for the Northeast Region's parks in PA, MD, VA, NY, and WV. All of the ERM Network parks are included in this search. The project entails putting together species lists, gathering distribution maps, and catalog information of fishes collected in and adjacent to national parks in these three states. Parks are being contacted for information regarding scientific collections permitting within the park. If fish collections are known to have occurred within the park the collector(s) are being contacted and the fish data obtained. Collections made near each park can also provide important information about fish distributed within, therefore each state's fish management agency is being contacted as well to determine other fish data sources. A list is being developed of all entities known to have conducted fish surveys within each state. All data collected during this project is being entered into the NPSpecies database as well as a relational database that will eventually be linked to the GIS Theme Manager.

3.5 Gathering Information from Outside Sources

The network scoping workshops provided an excellent way to gather information from sources outside of the parks. References not in either NRBIB or NPSpecies were gathered from people attending the meetings who were familiar with inventory work done in the parks. Additional contacts were suggested by workshop participants to help locate data that may have been gathered by scientists or local experts with study sites in the parks. Many of these outside organizations and individuals were contacted following the workshop (Table 3). This has been a successful venture. New data has been obtained that was collected within the parks but never acquired by the park. We found that some state projects sampling within park boundaries, had specific park data that could be separated from the broader state databases, and some that could not.

Table 3. Contacts made to outside sources for the Eastern Rivers and Mountains Network.

Organization	Contact Info
West Virginia Breeding Bird Atlas	WVDNR, Don Kodak
Brooks Bird Club, West Virginia	Contacted to obtain species list for parks
West Virginia Christmas Bird Counts	Jim Phillips, obtained species list
Marshall University, Dr. Ron Canterbury	1999-2000 MAPS station data for NERI
West Virginia University-Dr. Petra Wood	Obtained avian species list for WV parks
Craig Stihler	Bat Surveys of West Virginia
WVDNR Collection Permits	Names of collectors working in WV parks.
WVDNR Natural Heritage Program	Obtained species lists for NERI, GARI, BLUE
WV State Mammal Collection	Dr. Marietta Hight
WVDNR Jim Vanderhorst	Obtained NERI plant community plot data
East Stroudsburg University-Dr. Terry Masters	Avian species of DEWA hardwood forests
U. of Penn/Morris Arboretum-Dr. Ann Rhoads	Checklist and Atlas of PA Flora
PA Fish and Boat Commission-Rick Spears	IBI for streams in PA

SECTION IV-DETERMINING INVENTORY NEEDS

Most of the UPDE River Corridor is privately owned land, and inventorying vertebrate and vascular plants on private land is not part of the NPS I&M Program, the focus for inventory work for UPDE was based on the Delaware River to mean high water. This limits UPDE to work with those taxa associated with this area. However, this does not mean that all of the existing data for the UPDE River Corridor will not be gathered and put into NPS formats (NPSpecies, Dataset Catalog, NRBib).

DEWA was the only park in the Network that was able to calculate the percentage of documented species in their park using master lists (Table 4). A database created at Penn State University that was comprised of county level species data was used to develop a “potential species” list for DEWA. This list was then compared to a list of documented species created from the park database. Documented species were considered those for which at least one park-specific reliable written record or museum specimen existed. Fish were the only taxa that a list of “potential park species” could not be developed and therefore were not included in the table.

For the other Network parks, species lists from NPSpecies could not be used with confidence and no other park in the Network had their own reliable database. The completeness and correctness of the Network’s NPSpecies database is currently being verified as part of the database work described in Section III and therefore has not been used as a means for determining inventory completeness. In some cases such as the smaller PA parks in the Network, data from current inventory projects has not yet been entered into NPSpecies. Because of this lack of accurate or verified species data, actually calculating the percentage of species found in the parks was not possible. The next most logical step in best determining inventory gaps in the Network parks was to compile and review a variety of information. The following steps were taken to help determine inventory needs:

1. Review the existing references for each park by taxa.
2. Hold Scoping Workshops and invite local experts familiar with or doing research in the parks that could assist in identifying inventory gaps.
3. Review and compile descriptions of inventories in progress in the parks.

4.1 Review of Existing References

The regional I&M Program librarian searched the Network NRBib database by park and by taxa, creating individual bibliographies for each. These references were then reviewed by Regional I&M staff, park staff and taxa experts attending the scoping workshops. The most recent references on inventory work (within the last ten years) were compiled and a table created with the most updated, or in some cases the most complete work, even if it was older than ten years (Table 5a-c). Park managers also provided information on current inventory work taking place in the parks, and this was added as well. All hardcopy documents sent to WASO for the initial population of NPSpecies were sent back to the Regional I&M office and these documents themselves were reviewed for completeness and scientific validity. Compiling all of this information and putting it in an easily viewable format helped the parks to identify their inventory gaps.

Table 4. Summary of Taxonomic database information for Delaware Water Gap National Recreation Area

		Fish	Amphibians	Reptiles	Birds	Mammals	Plants
# Records*		58	43	35	284	88	2211
# Potential Species		-	32	28	266	57	2000
	Documented*	57	28	25	241	47	1600
	Not documented*	1	4	3	25	10	400
% Species Documented							
	Of # Records	98	91	91	91	89	82
	Of # Potential Species	-	88	89	91	82	80
# Taxa with known Vouchers		-	17	6	-	18	1200
# Special Concern Species (SC)*		10	15	7	60	19	190
	Documented	9	13	7	60	10	120
	Not documented	1	2	0	0	9	70
% SC Species	Documented	90	87	100	100	53	63
% Documented Species that are SC		16	46	28	25	21	8

*** Notes:**

Records includes alternative taxonomic designations (genus, species, or subspecies) that may be redundant and in scientific dispute.

Potential species of fish is the number of species reported in the park to date; more are likely. For other vertebrates, it is the number of species that could occur in the park as determined by a review of literature and specimen records by Penn. State (Mahan et al.).

Documented species are those for which at least one reliable written record exists.

Taxa with known specimens was determined by the Penn. State review of specimen records, and includes sub-species designations.

Special Concern taxa includes all species so designated federally, or by either PA or NJ nat heritage program (S1,S2,S3)

Table 5a. Inventories either complete or in progress in the E. Rivers and Mountains Network.

Park	Herps	Mammals
UPDE	<ul style="list-style-type: none"> ▪ NY State Reptile and Amphibian Atlas, 1990-1999 	<ul style="list-style-type: none"> ▪ No comprehensive inventory completed for small mammals.
NERI	<ul style="list-style-type: none"> ▪ Pauley, T. K. 1993. Report of the Upland Vertebrates in the New River Gorge National River. Volume I-III. 1,119 pp. (Marshall University) ▪ Pauley, Thomas K. Biological Surveys in Proposed Development Sites in the New River Gorge National River: Volume III: Invertebrates and Vertebrates. February 1997. ▪ North American Amphibian Survey began in 2000. 	<ul style="list-style-type: none"> ▪ Pauley, T. K. 1993. Report of the Upland Vertebrates in the New River Gorge National River. Volume I-III. 1,119 pp. (Marshall University) ▪ Pauley, Thomas K. Biological Surveys in Proposed Development Sites in the New River Gorge National River: Volume III: Invertebrates and Vertebrates. February 1997.
BLUE	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Published abstracts from the Upland Vertebrate Survey of the Bluestone National Scenic River. 2000. (Marshall University) (This data not yet entered into NPSpecies.) 	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Published abstracts from the Upland Vertebrate Survey of the Bluestone National Scenic River. 2000. (Marshall University) (This data not yet entered into NPSpecies.)
GARI	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Upland Vertebrate Survey of the Gauley River National Recreation Area . Three year study, work began in 2000 . (Marshall University) (This data not yet entered into NPSpecies.) ▪ North American Amphibian Survey began in 2000. 	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Upland Vertebrate Survey of the Gauley River National Recreation Area . Three year study, work began in 2000 . (Marshall University) (This data not yet entered into NPSpecies.)
ALPO	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University) 	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University)
JOFL	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University) 	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University)
FONE	<ul style="list-style-type: none"> ▪ Paulson, Brian. Herpetological Inventory at FONE and FRHI. 2000-2001. California University of PA. 	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University)
FRHI	<ul style="list-style-type: none"> ▪ Paulson, Brian. Herpetological Inventory at FONE and FRHI. 2000-2001. California University of PA. 	<ul style="list-style-type: none"> ▪ Yahner ,Richard, Vertebrate Inventory at Four Pennsylvania National Parks, 2001-2005. (Penn State University)

Table 5b. Inventories either complete or in progress in the E. Rivers and Mountains Network.

Park	Birds	Fish
UPDE	<ul style="list-style-type: none"> ▪ NY Breeding Bird Atlas, 1987, Cornell University Press ▪ PA Breeding Bird Atlas, Dan Brauning, 1987 	<ul style="list-style-type: none"> ▪ Springer, Jerry E. and Thomas M. Groutage, 1962. <i>The Tri-State Fishery Study: A Cooperative Investigation of the Delaware River Fishery, 1959-62.</i> ▪ Jay Stauffer voucher search (2001)
NERI	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Report of Upland Vertebrates in the New River Gorge National River: Volume 1. November 1993. Canterbury, Ronald A. Monitoring Avian Productivity and Survivorship in New River Gorge National River, West Virginia. May 1999. (This includes MAPS data from 1996-2000) (Not yet entered into NPSpecies) ▪ Pauley, Thomas K. Report: Vertebrate Surveys Grandview Area, New River Gorge National River. August 1992. ▪ Canterbury, Ronald A. et al. Three Rivers Migration Observatory: Fall Migration 1998. ▪ Shaw, Paul. Glade Creek Point and Brooklyn Point Count Surveys: 1997-1999 ▪ Michael, E.D. and R.A. Voytko. 1990. Wildlife Inventory and Management of Railroad and Transmission Line Right-of-Way on the New River Gorge National River. Final Report. Division of Forestry, West Virginia University, Morgantown, WV 26506. 114 pp. 	<ul style="list-style-type: none"> ▪ Welsh, Stuart. Inventory of fish species in tributaries of the New River Gorge. 2001. ▪ Cincotta, D.A., D.B. Chambers, and T. Messinger. 1999. Recent changes in the distribution of fish species in the New River Basin in West Virginia and Virginia. pp. 98 - 106 In Proceedings New River Symposium, April 15-16, 1999 Boone, North Carolina. National Park Service, Glen Jean, WV. 123 pp.
BLUE	<ul style="list-style-type: none"> ▪ Pauley, Thomas K. Published abstracts from the Upland Vertebrate Survey of the Bluestone National Scenic River. 2000. (Marshall University) (This data not yet entered into NPSpecies.) ▪ Phillips, Jim. Bluestone River Lodge Point Count Surveys: 1998-2000. 	<ul style="list-style-type: none"> ▪ No recent or complete data existing.
GARI	<ul style="list-style-type: none"> ▪ Rodrique, Jane et al. Meadow River Point Count Surveys: 1998. ▪ Pauley, Thomas K. Upland Vertebrate Survey of the Gauley River National Recreation Area . Three year study, work began in 2000 . (Marshall University) (This data not yet entered into NPSpecies) 	<ul style="list-style-type: none"> ▪ No recent or complete data existing.
ALPO	<ul style="list-style-type: none"> ▪ Yahner, Richard. Comprehensive Inventory Program for Birds at Six Pennsylvania National Parks: Phase II. 1999-2001. ▪ Yahner, Richard H. et al. Inventorying of Bird and Butterfly Biodiversity at ALPO and JOFL. 1998. 	<ul style="list-style-type: none"> ▪ Jay Stauffer voucher search
JOFL	<ul style="list-style-type: none"> ▪ Yahner, Richard. Comprehensive Inventory Program for Birds at Six Pennsylvania National Parks: Phase II. 1999-2001. ▪ Yahner, Richard H. et al. Inventorying of Bird and Butterfly Biodiversity at ALPO and JOFL. 1998. 	<ul style="list-style-type: none"> ▪ Jay Stauffer voucher search
FONE	<ul style="list-style-type: none"> ▪ Yahner, Richard. Vertebrate Inventory at Four Pennsylvania National Parks. 2001-2005. 	<ul style="list-style-type: none"> ▪ Jay Stauffer voucher search
FRHI	<ul style="list-style-type: none"> ▪ Yahner, Richard. Vertebrate Inventory at Four Pennsylvania National Parks. 2001-2005. 	<ul style="list-style-type: none"> ▪ Jay Stauffer voucher search

Table 5c. Plant Inventories either complete or in progress in the E. Rivers and Mountains Network.

Park	Plants
UPDE	<ul style="list-style-type: none"> ▪ Rhoads, Mellon, et.al., 1985, Endangered, Threatened, Vulnerable, and Rare Vascular Plants of the Pennsylvania Portion of the Upper Delaware Scenic and Recreational River. (NRBIB UPDE 915). ▪ Lyons-Swift, L.A., 1987, Rare Plants and Natural Communities of the New York Side of the Upper Delaware Scenic and Recreational River. (NRBIB UPDE 555 and 556). ▪ Kunsman, John. Aquatic Plant Inventory. UPDE ▪ Pennsylvania Science Office, The Nature Conservancy, 1994, A Survey of the Aquatic Vascular Plants of the Upper Delaware River, (NRBIB UPDE 856).
NERI	<ul style="list-style-type: none"> ▪ McDonald, Brian R., Trianosky, Paul. Assessment of and Management Recommendations for the Plant Communities and Rare Species of Camp Brookside, New River Gorge National River. February, 1995. ▪ Evans and Suiter Biological Surveys in Proposed Development Sites in the New River Gorge National River: Volume 1: Vascular Flora. February 1997. (electronic file sent to Colorado) ▪ Rouse, G.D. and B.R. McDonald. December 1986. Rare Vascular plant Survey-New River Gorge National River. Mid-Atlantic Region Research/Resources Management Report No. 31. 55pp. ▪ McDonald, B.R. and P.J. Harmon. September 1990. Rare Species Surveys of the Cunard, Stonecliff and Southside junction Areas of the new river gorge national River. ▪ Fortney, Stephenson and Adams. Reconnaissance Vegetation Study of the Bluestone, New, and Gauley River Gorges. March 30, 1995. (data not yet in the NPSpecies database) ▪ Suiter, Dale. Flora of New River Gorge National River. 2001. Suiter found 904 species. ▪ Add Grafton species list and mapped transects (Grafton work has WVU herbarium records) Grafton work has mapped transects to allow location of species observations/records. ▪ Vanderhorst, J. 2000. Plant Communities of the New River Gorge National River, West Virginia: (Southern and Northern Thirds). (Draft). West Virginia Division of Natural Resources, Natural Heritage Program, Elkins, WV. 2)
BLUE	<ul style="list-style-type: none"> ▪ Only 50% judged to be documented. ▪ Fortney, Ronald H. et al. 1996 Interim Report on the Bluestone River Gorge Vegetation Study. April 1997. ▪ Grafton, W.N. 1993. Vascular Flora on the Lower Sections of Gauley, Meadow, and Bluestone Rivers. Final Report to the National Park Service. Extension Service and Division of Forestry, West Virginia University, Morgantown, WV. ▪ Norris, S.J. November 15, 1992. Rare Species Survey of Bluestone Scenic River. Final Report to Mid-Atlantic Region by West Virginia Division of Natural Resources, Natural Heritage Program, Elkins, WV. 19 pp.
GARI	<ul style="list-style-type: none"> ▪ Only 50% judged to be documented. ▪ Walton, Dean et al. Critical Habitats and Associated Communities in the Riparian Zone of the Gauley River. November 1997. ▪ Grafton, W. N. Vascular Flora on the Lower Sections of Gauley, Meadow, and Bluestone Rivers. Final Report to the NPS. March 1993. ▪ Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992.
ALPO	<ul style="list-style-type: none"> ▪ Western PA Conservancy-Rare Plant Survey and Plant Community Map, 2000-2002
JOFL	<ul style="list-style-type: none"> ▪ Western PA Conservancy-Rare Plant Survey and Plant Community Map, 2000-2002
FONE	<ul style="list-style-type: none"> ▪ Western PA Conservancy-Rare Plant Survey and Plant Community Map, 2000-2002
FRHI	<ul style="list-style-type: none"> ▪ Western PA Conservancy-Rare Plant Survey and Plant Community Map, 2000-2002 ▪ Downs and Abrams. FRHI vegetation study. 1990 (433 species documented)

4.2 Scoping Workshops

Scoping workshops were held to allow discussion between resource managers, outside agencies, local taxonomic experts and scientists about inventory needs, management issues, prioritization of inventory, sampling protocols and cost estimates for the network parks. Because the Eastern Rivers and Mountains Network covers such a vast area across four states, and subject matter experts do not overlap, separate scoping workshops were held for the West Virginia river parks and the Pennsylvania river parks. This would allow more people to attend who might not be able to travel to one state or the other. It also allowed full representation by park staff at the meetings.

WV Parks Workshop Participant List July 25, 2000

The following subject matter experts from West Virginia attended the scoping workshop held at NERI headquarters on July 25, 2000 for the three parks, GARI, BLUE and NERI. Others attending included, park and I&M regional staff (Workshop report Appendix A).

Donna Mitchell	Botanist/Ornithologist	WV Department of Natural Resources (WVDNR)
Brian McDonald	Plant Communities	WVDNR-Nongame Wildlife Natural Heritage Program
Dr. Mark Watson	Herpetologist	Marshall University-Research Associate
Jeff Hajenga	Wildlife Biologist	WVDNR-Nongame Wildlife Natural Heritage Program
Dr. Petra Wood	Ornithologist/ Mammalogist	WV University Coop Unit-USGS
Dr. Ron Canterbury	Ornithologist/Mammalogist	Professor-Concord College
Jennifer Wykle	Wildlife Biologist	WV DNR- Nongame Wildlife Natural Heritage Program
Sam Norris	Botanist	WV DNR- Nongame Wildlife Natural Heritage Program
Dr. Jim Anderson	Herpetologist/Ornithologist	
Dr. Bill Grafton	Botanist	WV U. Ext. Specialist-Wildlife Associate Professor
Stuart Welsh	Fisheries Biologist	WV Coop. Fish and Wildlife Research Unit, USGS-BRD
Jim Vanderhorst	Plant Communities	WV DNR- Nongame Wildlife Natural Heritage Program
Doug Chambers	Biologist	USGS Water Resources Division-West Virginia District

PA River Parks Workshop Participant List October 24th - 25th, 2000

This was a two day workshop held at Delaware Water Gap National Recreation Area. The workshop was held to discuss biological inventories at UPDE and DEWA (Workshop report, Appendix B). The following subject matter experts attended this workshop:

Dr. Terry Master	Ornithologist	East Stroudsburg Univ.
Dr. Robert Ross		USGS-Northern Appalachian Research
Dr. Nate Rice	Curator of Ornithology	Academy of Natural Sciences
Dr. David Smith	Statistician	USGS-BRD
William Olson	Botanist	Private consultant
Dr. Ann Rhoads	Botanist	Univ. Penn. & Morris Arboretum
Rob Brooks	Botanist	Forest Resources Laboratory, PSU
Jill Dodds	Botanist	Private consultant
Dr. Ernie Schuyler	Aquatic Botanist	Academy of Natural Sciences
John Kunsman	Botanist	NJ Natural Heritage Program
Greg Podniesinski	Botanist	PA Natural Heritage Program
Tony Davis	Ecologist	PA Natural Heritage Program
Steve Fleckenstein	Botanist	Sullivan County Community College
Dr. Carolyn Mahan	Mammalogist	Penn State Altoona

Dr. Neal Woodman	Mammalogist	East Stroudsburg Univ.
Jim Hart	Mammalogist	Contractor-PA Natural Heritage Program
Dr. Jay Stauffer	Fisheries	Penn. State Univ.
Tim Stetko	Fisheries	Penn. State Univ.
Dave Arnold	Fisheries	PA Fish & Boat Comm

Workshop Process (DEWA, UPDE, GARI, NERI, BLUE)

The process for identifying inventory needs began prior to each workshop. Preparation for the workshop was critical. Before each meeting the documents listed below were e-mailed to each person attending:

- ***Species Lists*** for each park. These included "predicted species" which could be present in each park, based on range maps, county lists and the like as well as species actually documented in the parks.
- Documentation for Species Lists. A ***list of references*** that provide documentation for the existing park species. (DEWA only)
- ***T&E Species Lists*** for the parks.
- ***Invasive Plants List*** for the parks. A list of aggressive exotics, their habitats and abundance in the parks. (DEWA only)
- Voucher information. ***Lists of museums and herbaria*** known to house specimens collected from the parks.
- ***Park Bibliographies***. Information retrieved from NRBIB.
- A list of ***Key Resource Issues***.
- A list of ***Habitats of Management Interest***. (DEWA and UPDE only)

Discussions with the attending taxa specialists and resource managers during the workshop focused on reviewing and refining inventory needs. Participants were divided into the following taxonomic workgroups; birds, herps, plants, mammals and fish. (DEWA staff elected to exclude discussions on herps because of current inventory work taking place in the park described in Section 4.3. Each group was asked to consider in their discussion the list of key resource issues and habitats of management concern listed below:

Key Resource Issues

- Water Quality / Quantity – mainstem, tributaries, ponds, impoundments, groundwater. Development pressures within and external to the parks.
- Forest Health – regeneration, understory condition, combined effects of deer browse, aggressive exotics, atmospheric deposition, habitat fragmentation.
- Issues with Managed Open Space – pesticide use, erosion and sedimentation, nutrients, exotic species and wildlife habitat.
- Invasive Exotic Species – widespread in habitats of management interest, e.g., purple loosestrife, Japanese knotweed in riparian areas, autumn olive, multiflora rose in managed open space, hemlock woolly adelgid in hemlock forests.

Habitats of Management Interest

- River main stems: key resource for parks

- “Generic Terrestrial Habitat”
- Wetlands
- Riparian corridors
- Managed Open Space, defined here as current and abandoned farm fields
- Hemlock Forest
- River Tributaries
- Impoundment’s / Ponds: includes old farm ponds as well as natural vernal ponds.
- Rare Plant Communities: small areas that support rare species and/or diverse plant communities. River shore outcrops, seeps, calcareous fens, shale cliffs and talus

The goal for the workshops was to have developed “Inventory Plans” for fish, herps, vascular plants, birds, and mammals for the parks. In order to guide each workgroup in developing inventory plans, the following task list was provided:

- Review existing inventory data
- Identify the inventory gaps for each taxa.
- Prioritize baseline inventories for those taxa identified in step #2.
- Articulate a rationale for prioritization.
- Describe how these species will be sampled.
- Describe the time needed and define milestone targets for this inventory process.
- Develop cost estimates.

Small PA Parks Meetings

Scoping workshops to develop inventory plans were not held for the four, smaller PA parks, ALPO, FRHI, JOFL and FONE because most inventories were ongoing or underway. Unlike the other five parks in the Network, these four parks have received substantial regional and pre-network I&M funding for inventory work on vertebrates and vascular plants in the last five years. Instead of scoping workshops, meetings were held for these parks in the fall of 1999 and spring 2001 at Penn State University. These meetings were held to keep park staff updated on the progress and issues faced by the I&M Program and to have researchers who have been funded to do inventory work in their parks give an overview and update on their findings. In order to keep costs low, four other PA parks from the Mid-Atlantic Network were also included in these meetings. The regional I&M staff decided that a meeting to educate park staff and cooperators about the goals of the I&M Program was important, as well as hearing progress reports from cooperators doing baseline inventories. This would also help to assure that studies underway would meet I&M goals for sampling and data management. The following is a list of people who attended the meetings. This list includes park staff and cooperators working in the Mid-Atlantic Network PA parks as well.

Participant List:

Dr. Richard Yahner	Penn State University
Brad Ross	RA Penn State University
Dr. Harry Tiebout	West Chester University of PA
Dr. Brian Paulson	California University of PA
Timothy Stecko	Penn State University
John Karish	NPS Chief Scientist NE
Beth Johnson	Regional I&M Coordinator
Bert Frost	NPS-GETT/EISE

Connie Ranson
Brian Eick
Brian Lambert
Ed Clark

NPS-FONE/FRHI
NPS- ALPO/JOFL
NPS-VAFO
NPS-HOFU

The agenda's included:

- Reviewing the goals of the I&M Program with the parks and cooperating scientists, by Beth Johnson, Northeast Regional I&M Coordinator.
- A progress report on avian inventories taking place at ALPO FRHI, FONE and JOFL by Dr. Richard Yahner from Penn State University and Research Associate, Brad Ross.
- A progress report on the herpetological inventories taking place at FONE and FRHI, by Dr. Brian Paulson from California University of Pennsylvania.
- A progress report on the fish voucher search being conducted by Dr. Jay Stauffer from Penn State University and Research Associate, Tim Stecko.
- Discussion of product specifications for the Northeast Region I&M Program by Dr. John Karish, NPS.
- Update and review of the NPSpecies database by Penn State University Research Associate hired to work on the database for the Network.

4.3 Descriptions of Inventory Projects in Progress

As part of the data gathering process and in order to determine the completeness of inventory work for vertebrate and vascular plant species in each park, information on both completed and currently funded projects has been compiled. A great deal of funding has been allocated through various funding sources for inventory work in the smaller PA parks. Although some of the projects described were not funded by the I&M Program and others were funded prior to new guidance, cooperators have been made aware of all I&M formats so that products from these projects will be compatible with the I&M Program goals.

Inventories Involving Multiple Taxa

GARI

Through a cooperative agreement with Marshall University in West Virginia, a complete inventory of amphibians, reptiles, birds and small mammals will be completed over the next three years. Dr. Thomas Pauley from Marshall University is the principal investigator on this project and has done extensive inventory and monitoring work for the park service in both the BLUE and NERI over the past ten years. Year one of this study (2000) included reconnaissance surveys throughout the Gauley to determine existing habitat types and sites to be surveyed over the following two years. The actual

surveys proposed are designed to reveal species diversity, species abundance, range and distribution of species, reproduction status, and habitat types.

Herpetological Inventories

DEWA

The National Park Service entered into a Cooperative Agreement with the Wildlife Conservation Society (WCS) in 1998, to conduct inventories of amphibians and reptiles in the “New England Cluster” of National Parks. The principal investigators on this project are, Robert Cook, Ph.D., Herpetologist, National Park Service, Cape Cod National Seashore and Dr. John L. Behler, Curator of Herpetology, Wildlife Conservation Society. DEWA was added in 1999 to the cooperative agreement due to its geographic proximity to Bronx, NY and Dr. Behler’s prior knowledge of DEWA. The general approach to this inventory is one that balances the need for standardized methods and quantifiable results with the primary goal of determining species presence. A number of methods, both general and habitat/taxa specific are being used. Collectively, a variety of methods will effectively sample a site and provide a comprehensive list of species occurrence and a reasonable estimate of relative abundance and habitat use.

This project was funded prior to the I&M strategy and database development requirements. Funds were added in 2000 to assure that GIS datasets would be created from sampling rather than a paper report only. The University of Rhode Island was funded to assist with the database development and GIS products. GPS units were also purchased for this project (\$6,000). An amendment was also made to this cooperative agreement in 2000 that included extended survey work at DEWA (\$30,452). This extended inventory work at DEWA was cost-shared with Regional Science funds and includes surveys for the presence of bog turtles and wood turtles, timber rattlesnake denning sites, and the distribution and abundance of species of concern at DEWA.

In 2001, a \$53,000 amendment funded by Planning and Development was added to the cooperative agreement to complete additional inventories and as well as conduct an extensive wood turtle population and habitat use survey. Biological Inventories identified the largest Wood Turtle population in the East at one of the river access sites slated for Capital Improvements and recreational development.

Major Delaware River tributaries and islands will be evaluated for wood turtle populations and significant habitats including overwintering, foraging and nesting sites. Surveys for the presence of timber rattlesnake denning areas as well as recommendations made for the protection of habitats and prevention of visitor-snake interactions will continue. And finally, a survey will be conducted to gather distribution and abundance data for the following species of concern: *Acris crepitans*, *Pseudacris triseriata*, *Rana pipiens*, *Ambystoma jeffersonianum* complex, and *Eurycea longicauda*, as well as locating and mapping turtle basking and nesting sites. GPS coordinates will be taken at every site as well as readings taken on the perimeter of each site surveyed, data will be entered into the herp database currently being developed by Steve Fancy and DEWA staff and a report completed following USFWS Guidelines. The following paragraphs give a brief description of the herp inventories in progress at DEWA.

Bog Turtle Inventory-The objective of the bog turtle inventory is to document the occurrence and map the distribution of bog turtle throughout DEWA. Bog turtle is a federally listed threatened species. This inventory is part of a multiyear effort which began in 1997-98 with a comprehensive, parkwide evaluation of emergent and shrub-scrub wetlands, to assess their suitability as bog turtle habitat. Suitable habitat was documented at 44 sites. Searches for the presence or absence of bog turtle at suitable sites began in 1998. In 2000, the WCS teams searched 11 wetlands, 13 more are planned for 2001.

Wood Turtle Inventory-The objective of the wood turtle inventory is to document the occurrence and map their distribution at DEWA. Park operations and visitor activities may affect this species. Wood turtles, a state listed species of concern, are vulnerable to illegal collection and may suffer from increased predation near recreation sites. They depend upon open fields for nesting and may benefit from farming in the park. In 2000 populations were documented along 12 out of 25 waterways in the park. In 2001 25 watershed and river islands will be surveyed.

Timber Rattlesnake Den Inventory-The objective of the timber rattlesnake den inventory is to map the distribution of rattlesnake winter dens within the New Jersey portion of DEWA. Timber rattlesnakes are state-listed in NJ and many other Northeastern states throughout their range. In 2000, the teams located and searched suitable habitat along two of the five sections of Kittatinny Ridge, the last stronghold of timber rattlesnake in NJ.

Vernal Pool Inventory-The objective of the vernal pool inventory is to identify and map temporary ponds located throughout the park and to document their use by breeding amphibians, especially the mole salamanders, three of which are of special concern in NJ. Fieldwork began on this project in 2000 in which 144 sites were visited.

GARI and BLUE

Through a cooperative agreement with Marshall University in West Virginia, a complete inventory of amphibians, reptiles, birds and small mammals was just completed for BLUE in 2000 and will be completed over the next three years for the GARI. Dr. Thomas Pauley from Marshall University is and has been the principal investigator on these projects and has done extensive inventory and monitoring work for the park service in the NERI over the past ten years. Year one of each of these studies (BLUE '97, GARI '00) included reconnaissance surveys throughout the parks to determine existing habitat types and sites to be surveyed over the following years. The actual surveys are designed to reveal species diversity, species abundance, range and distribution of species, reproduction status, and habitat type associations for amphibians, reptiles, birds and small mammals.

ALPO and JOFL

Through a cooperative agreement with Dr. Richard Yahner at Penn State University, herps will be inventoried at both ALPO and JOFL beginning in 2001. This work is part of a larger cooperative agreement to inventory mammals in these two parks as well as birds and mammals at FONE and FRHI. Completion of this work will be in 2005. Information such as herp species richness, abundance

and distribution will be collected during this project at all the parks, and management guidelines presented to the parks at its completion.

Plant Inventories

ALPO, FRHI, JOFL, FONE

The National Park Service has entered into a Cooperative Agreement with the Western Pennsylvania Conservancy (WPC) (August 2000), to conduct comprehensive surveys of plant and animal species of special concern, and natural communities in four ERM network parks, ALPO, FRHI, FONE, and JOFL. The proposed work involves compiling existing data on each of the parks and searching for new locations for plant and animal species of special concern. This includes species with a federal ranking of candidate or above and/or a state ranking. A list of species that may occur in each park will be developed by querying the Pennsylvania Natural Diversity Inventory database (PNDI). The database will be searched by those regions surrounding the parks. From this list of species, communities in which they may occur will be identified in each park, and searched during targeted field investigations. Also part of this project, a plant community map will be developed by collecting qualitative data on the composition of vegetation. Plant communities identified on the maps will be classified using Fike (1999). This classification is to become the commonly used statewide classification for natural plant communities.

Project deliverables to the National Park Service will include a draft and final report that will include a compilation of all known information on occurrences of exotic invasive species and special concern plants, animals and communities in each park. It will also include a listing of all voucher specimens including information on collection location, catalog numbers and repository locations and contacts. Another draft and final report will be prepared for the classification, delineation, and mapping results of the park plant communities. This will include maps and field survey data collection forms and listings of plant species found in each park. Finally, each park will be provided with GIS layers of all the locations of special concern species and natural communities and of the natural plant community delineation and classifications.

Vegetation Mapping

NERI

Plant communities of the Southern and Northern portions of the New River Gorge were inventoried and mapped by Jim Vanderhorst of the West Virginia Division of Natural Resources Natural Heritage Program (Vanderhorst 2000). The first draft of the project was produced in 2000 and the data has been acquired and entered into NPSpecies. In 2001, the last third of NERI will be mapped and inventoried.

DEWA/BLUE/GARI

Vegetation mapping is scheduled to begin in 2001 at DEWA and 2002 at BLUE and GARI . As part of these projects, 75% of the plant species existing in these parks should be identified, as was the case when plant communities were mapped at NERI.

Avian Inventories

ALPO, JOFL, FONE, FRHI

Avian inventories were conducted (1999-2000) at ALPO and JOFL and four other small parks in the Mid-Atlantic Network as part of a cooperative agreement with Penn State University (Yahner et al, 1999) Avian inventories will be conducted at FONE and FRHI through an amendment to this cooperative agreement in 2001-2002. The objectives of the project are to obtain a comprehensive inventory data set (based on two years) on birds and to develop guidelines for establishing a long-term sampling plan to monitor bird populations in these parks. These objectives will be met by conducting using point-count and vehicular-road surveys (Yahner et al. 1998). As part of the original agreement a waterfowl survey was conducted at JOFL as well.

Mammalian Inventories

FONE and FRHI

Mammal inventories will be conducted as part of a cooperative agreement between Dr. Richard Yahner at Penn State University and the Park Service. Species richness, abundance and distribution of mammals will be determined for these two parks.

4.4 Inventory Gaps

Table 6 was developed once references, inventories in progress and scoping workshop information was reviewed. Based on these three sources of information it was determined whether or not baseline inventories for a taxonomic group were thought to be complete or incomplete. Inventories in progress are noted.

Table 6. Status of baseline inventories by taxonomic group for the nine parks in the Eastern Rivers and Mountains Network. The shaded areas indicate gaps in baseline inventory data.

Park	Plants	Fish	Herps	Mammals	Birds
NERI	Baseline Data Complete	Inventory in Progress	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
GARI	Baseline Data Incomplete	Baseline Data Incomplete	Inventory in Progress	Inventory in Progress	Inventory in Progress
BLUE	Baseline Data Incomplete	Baseline Data Incomplete	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
DEWA	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
UPDE	Baseline Data Incomplete?	Baseline Data Incomplete?	Baseline Data Incomplete?	N/A	Baseline Data Incomplete?
ALPO	Baseline Data Complete	Voucher Inventory in Progress	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
JOFL	Baseline Data Complete	Voucher Inventory in Progress	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
FONE	Baseline Data Complete	Voucher Inventory in Progress	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete
FRHI	Baseline Data Complete	Voucher Inventory in Progress	Baseline Data Complete	Baseline Data Complete	Baseline Data Complete

After review of existing or current inventory work within the Network along with expert opinion given by taxa experts attending the scoping workshops, it became clear that a great deal of baseline inventory work has been conducted in all of these parks. The exception to this is UPDE, which consists of mostly

private land, much of the work done on that property was not considered for this plan. Table 7 lists the inventory projects identified during the preliminary process of identifying gaps. From this list, parks prioritized these projects based upon what they considered their greatest need. Although five of the ERM Network parks are large river parks covering four states, the Network found that for example using the same cooperator to do all of the fish inventories was difficult. The travel time and distance is extensive between these parks and the range in knowledge among researchers who have spent years working in a park versus someone who is not familiar with a park was too broad. Therefore the Network will work with local cooperators or those most familiar with the park in need of inventory work.

Table 7. Inventory projects identified by the ERM Network.

Park	Project
NERI/BLUE/GARI	Review/clean up of NPSpecies Plant database
NERI/BLUE/GARI	Enter and create a relational database for Dr. Tom Pauley’s vertebrate data
NERI/BLUE/GARI	Invasive Plant Species inventory
NERI/BLUE/GARI	Create GIS layers for past plant inventory work by Grafton, Suiter and Fortney.
NERI/BLUE/GARI	Inventory turtles and lizards
NERI/BLUE/GARI	Baseline Bat Inventory
NERI/BLUE/GARI	Woodland songbird inventory with emphasis on the Cerulean Warbler
NERI/BLUE/GARI	Woodland Raptors and Nocturnal Avian Species Inventory
NERI/BLUE/GARI	Map “exemplary natural communities” and evaluate those areas for invasive species.
GARI	Fish Inventory- Mainstem and Tributaries
GARI	Veg Map/floristic inventory
NERI	Sandstone Cliff Vegetation Inventory
NERI	Lizard and rattlesnake inventory
NERI	Inventory Allegheny Wood Rats in Mine Portals
NERI	Vegetation Map-last 1/3 of Park-Include floristic inventory
BLUE	Vegetation Map/floristic inventory
BLUE	Fish Inventory-Mainstem and Tributaries
DEWA/UPDE	Analyze existing Delaware River aquatic plant data collected in 1991.
DEWA/UPDE	Survey Backchannels of the Delaware River: Fishes and Plants
DEWA/UPDE	Survey Palustrine Wetlands for Birds and Plants; assess Habitat Suitability for Native Minnows
DEWA/UPDE	Invasive Plant Species in the Riparian Corridor
DEWA	Fish Inventory of Low lying swamps, wetlands, natural ponds and impoundments
DEWA	Grassland Bird Inventory
DEWA	Wetland Bird Inventory
DEWA	Mammal Inventory (1.Talus slopes 2. Hardwood and hemlock forests)
DEWA	Inventory for N.E. Cottontail and Snowshoe Hare
ALPO/JOFL/ FONE/ FRHI	Baseline Bat Inventory
UPDE	Data mining and database development

4.5 Prioritization, Justification and Selection of Inventories

As shown in Table 6 there are very few shaded areas referring to incomplete baseline inventories.

UPDE is the only park that extensive data mining is needed to determine the current completeness of inventories there. The majority of land in the UPDE Corridor is privately owned and the National Park

Service does not intend to purchase private property within the Corridor boundary. It is too difficult to develop a sampling strategy and get permission from private landowners to allow the park to make inferences to other locations based on sampling of plants, mammals, birds, reptiles and amphibians that are found beyond the mean high water mark of the Delaware River. There has been a considerable amount of inventory work accomplished by state, federal and private groups that should be assembled as a database for the Upper Delaware. A top priority for the network is to assemble existing data for the UPDE into I&M formats. Should inventory gaps in River habitats be noted through this exercise, it may be possible to accomplish those inventories in later years.

Similarly, the 3 West Virginia parks (NERI, BLUE and GARI) have a tremendous amount of existing data that is scattered and in various formats. A top priority for the network is to gather all of the existing data for the three parks and get it into I&M program formats including NPSpecies, the data set catalog and data base template format.

The scoping workshop, park staff and subject experts identified known gaps in baseline plant and fish data for BLUE and GARI. Fish inventories have been requested through the regional science program and other sources for BLUE and GARI. Basic plant inventories will be partially fulfilled through ongoing review of the NPSpecies database by a botanical expert (funded 2001) and by mapping and description of plant communities as part of the vegetation mapping program. Other vegetation mapping plot work in West Virginia indicated that 75% of the species could be documented by this approach. A NERI vegetation map is underway and the GARI and BLUE are scheduled for 2002-2004.

With so much presence/presence not detected data and so many studies underway, the ERM Network also identified species or habitat specific sampling needs. As a group, bats were identified by all parks. There is potential for federally listed Indiana Bats at NERI, BLUE, GARI and DEWA. For the four PA parks, bats have the least amount of inventory work completed out of all vertebrates in the parks and therefore were identified as priority for those parks. For NERI, GARI and BLUE, bats were identified by park staff as their number one inventory priority based on management concerns and a complete lack of data. Numerous abandoned mine portals and buildings within NERI, may provide summer and winter roosts for a number of species. NERI is currently faced with the dilemma of having to close some of these mine portals due to the potential hazards to park visitors. Another area used heavily by recreational climbers includes the cliff lines in all three parks that again may provide summer and winter roosts to bat species. Additionally, the three parks contain approximately 30,000 hectares of suitable Indiana Bat maternity colony habitat, and currently the three parks lie equidistant between known Indiana Bat hibernacula and known summer maternity colony areas. Baseline inventory data on bat communities within NERI, BLUE and GARI is necessary to help park staff better manage existing portals and abandoned structures as well as manage current recreational practices occurring in the parks.

Out of all the inventories identified by experts at the scoping workshop, DEWA prioritized the grassland bird survey, the wetland bird and the back channel fish surveys as their top priorities. To maintain managed open fields requires a great deal of planning and maintenance by the park. Because this habitat may support a number of avian species of special concern, DEWA staff and outside experts agree that baseline information on existing grassland species is crucial for proper management practices. The wetland bird survey was also identified as a priority for DEWA. The working group on

birds at the scoping workshop ranked wetland birds as the second priority group next to grassland (open space) birds. There are 892 palustrine wetlands existing in the park, and with recent declines in wetland species and their habitat, DEWA wishes to have baseline information on these species to better manage these areas within the park.

A fish inventory of the Delaware River's back channel habitats was identified as another top priority inventory for DEWA as well as UPDE. Little is known about native fish species in the 120 miles of river. Past inventories have been on non-native, game species. Back channel areas of the river were identified as potential habitat for two species of special concern, the ironcolor and bridal shiners and therefore became a priority for inventory.

SECTION V-MEETING THE NETWORK GOALS

INVENTORY GOAL 1

Data Management and relational database development of existing, large, Network data sets.

Project 1 Data Management

Total \$ 30,000 (2002 request)

Description: A full-time term data manager will be hired for the ERM Network to begin managing and coordinating existing and newly acquired data for the Network. The Network has many large data sets scattered throughout the parks as well as projects close to completion. The data manager will be in charge of completing a data inventory for the Network and making sure that all scientifically based existing data is in a useable format for the parks and available for the future development of the Network's long-term monitoring program.

Project 2 NERI, GARI, and BLUE Vertebrate Database Development

Total \$ 31,065 (2002 request)

Description: Dr. Tom Pauley has been collecting data on vertebrate species in the West Virginia parks since 1991. Much of this data is in hard copy format only, or in simple, underdeveloped databases. This project will compile all of Pauley's data into a relational database that can be utilized by the parks for management.

Full Proposal

Title: Development of a Database for New River Gorge National River (NERI), Bluestone Scenic River (BLUE), and Gauley River National Recreation Area (GARI).

Principle Investigator: Thomas K. Pauley, Marshall University

Introduction

Since the establishment of the National Park Service, natural resource data has been collected in parks by various sources and although this biological information exists much of it has never been compiled and reviewed by the Service. Over the past decade, the National Park Service has been working to establish what is now called the Inventory and Monitoring Program (I&M program). A goal of this program is to gather existing as well as new information about existing natural resources in the parks and to make that information easily available at different levels to park resource managers, the scientific community and the public. A basic component of this program has been to create databases that can store an enormous amount of information and at the same time, user friendly and accessible. Inventory and monitoring information compiled in these databases will hopefully assist resource managers in making future management decisions based on scientific information.

As part of the National I&M Program Eastern Rivers and Mountains Network, three parks, the New River Gorge National River, the Gauley River National Recreational Area, and the Bluestone National Scenic River are part of this large effort to gather and compile all of their existing natural resource data and compile it into one useable park database. Dr. Tom Pauley, from Marshall University, and his associates have been studying and collecting data on both vertebrate and invertebrate species in these three West Virginia parks since 1989. This data includes hundreds of voucher specimens that are now housed in the Marshall University Vertebrate Museum.

The proposed scope of work entails compiling and converting Dr. Pauley's vertebrate and invertebrate species data, collected in the three river parks into a relational database. This database will follow the NPS Database Template format, currently being developed by the Washington Support Office (WASO). The National goal, as well as for the goal of this project, is to eventually link this relational database to the NPS GIS Theme Manager. This would enable the parks to view their species data on park maps in GIS.

Project Timeframe

Database work will be completed by May 2002. A graduate student of Dr. Pauley's will be hired at Marshall University and will work 20 hours per week on this project. In addition, a research assistant with a master's of science degree in biology that is knowledgeable about the species, vertebrate museum, and Dr. Pauley's work will be hired to work full-time for 6 months.

Objectives

- To convert all hard copy data and digital data collected by Dr. Tom Pauley in the New River Gorge, Bluestone and Gauley river parks to an Access database in the NPS database template format.
- If time allows, to convert other large data sets from other West Virginia Cooperators who have collected data in the New River Gorge, Bluestone and Gauley river parks to an Access database in the NPS database template format.

- To search the Marshall invertebrate and vertebrate collections for all vouchers collected in either the New River Gorge, Bluestone or Gauley river parks and enter this information into an Access database that can be converted to NP Species and the I&M Relational Database Template.
- To complete a Dataset Catalog entry for each of the existing data sets as well as any new ones created during this project.

Scope of Work

- Make copies of the raw data files and archive them. Make a permanent record in the Dataset Catalog for each of these files. (By completing a Dataset Catalog entry for each of these files, a data dictionary will be created automatically).
- Each digital file will be converted separately into its own Access database by using the import/export command.
- Hard copy data forms will be entered into their own Access file or table.
- All data will be proofed once converted or entered into Access, before further conversion takes place.
- Each of these new Access data files will be copied and archived away. A Dataset Catalog entry will be made for each of these files.
- All applicable fields will be converted to the Locations and Events tables.
- Search and enter specimen records for vertebrate and invertebrate species collected in the three West Virginia river parks that are stored in Marshall University's collections. (*Note: some of this information may already be part of the raw data files and therefore will not need re-entry).

Deliverables:

1. A master database for each of the three river parks, the New River Gorge, the Bluestone and the Gauley, containing all vertebrate and invertebrate data collected by Dr. Tom Pauley. These databases will be in the format of the NPS relational database templates, with appropriate fields and tables to enable linkage to the GIS Theme Manager (i.e.: Data converted to the Events, Locations and Sampling Component Tables).
2. If time allows, large data sets from other West Virginia Cooperators who have collected data in the New River Gorge, Bluestone and Gauley river parks will be added to the above master databases for each park.
3. A digital or hardcopy journal of all file conversions and steps taken to convert each file, from raw data to completed product.

4. All voucher specimen information from Marshall University collections must be included as part of the final database product.

Project Budget:

Personnel will include one graduate student, one master's level assistant, and Dr. Tom Pauley or Dr. Mark Watson (PI's).

Personnel	\$20,000
Graduate Assistant	\$6,000
Research Assistant	\$10,080
Principal Investigators	\$3,920
Travel	\$2,000
Equipment/Supplies	\$2,500
Benefits	\$4,264
SUBTOTAL	\$28,764
Indirect Cost (8% Total direct cost)	\$2,301
TOTAL	\$31,065

Project 3 DEWA Vascular Plant Database

Total \$3,000 (2002 request)

Description: A botanist will be hired to verify, update and revise existing plant records in the web version of NPSpecies for DEWA. The goal at the end of this project is to have an up-to-date, verified plant database for DEWA along with a clear picture of further plant inventory needs in the park. The following is the list of tasks that will be completed as part of this project:

- Revise NPSpecies plant lists for the DEWA. Inaccuracies will be corrected in Latin name, common name, park status, abundance, nativity, cultivation and invasiveness fields. Further data will be added where reference is available. Use will be made of BONAP county level data for the Northeast, state and regional floras and other publications and state herbaria.
- Data gaps and the need for further inventory work will be identified based in part on inventory completeness determined as part of this project, and on analysis of past field methods used in previous botanical studies and accountability as well as expert opinion.
- Prepare final report describing changes made to the database, including the number of new species records added, a list of documents, databases and collections used during the project to revise the lists. Describe the project's accomplishments and findings as well as description of inventory

completeness for these parks, and recommendations for future work to accomplish inventory completeness.

INVENTORY GOAL 2

To determine the distribution and abundance of targeted groups of vertebrate and vascular plant species identified by the Network parks.

Project 4 Bat Community Composition and Distribution at the New, Gauley, and Bluestone River National Park Areas

Total \$ 192,627 (2002-2004 request)

Note: This proposal was received late in the year. Tasks and products have not been negotiated.

Title: Bat Community Composition and distribution at the New, Gauley, and Bluestone River National Park Areas

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Abstract:

We propose to examine community composition, relative abundance, distribution, and foraging and roosting habitat use of bats in the New, Gauley, and Bluestone River national park areas using a variety of techniques and analytical tools. Information gained from this effort will provide immediate guidance for National Park Service staff to better monitor and manage bat communities. This research will also provide valuable insights into bat community ecology in less intensively managed Appalachian environments that can serve as baseline environmental standards for managed landscapes.

Background:

Statement of Issue-

Although the ecological importance of bats in eastern forested landscapes is evident, most aspects of basic bat biology and bat community ecology remain poorly known. In West Virginia, recent regulatory concern regarding the potential summer presence of the endangered Indiana bat (*Myotis sodalis*) has highlighted the need for sound, credible bat biology and bat community ecology information. To date, many bat research efforts in the Appalachians have been narrowly focused to precede forest management projects or other land-clearing activities on both private and public lands. Generally such work has sufficed to allay regulatory concerns about Indiana bats or other rare, threatened, or endangered species such as gray bats (*M. grisescens*), small-footed bats (*M. leibii*), Virginia big-eared bats (*Corynorhinus townsendii*) and Rafinesque's big-eared bats (*C. rafinesquii*) at localized levels without providing substantive ecological data (Stihler 1995, Owen 2000, Edwards et al. 2001, Johnson et al. 2001, Menzel et al. 2001a, Daniel Arling, USDA Forest Service, pers. comm.). Holistic efforts to examine bat ecology (species assemblage, foraging ecology, and roosting ecology) across wider landscapes and in less intensively managed settings rarely have been undertaken in the Appalachians.

The New River Gorge complex (New, Gauley, and Bluestone River National Park areas) provides an opportunity to examine bat communities and various ecological relationships in a large, semi-natural Appalachian landscape that encompasses great variability in elevation/surface geology, riparian zones, forest types, and legacies of anthropogenic change and impact (mining, abandoned structures, etc.). More importantly, such research is necessary for National Park Service personnel to adequately fulfill regulatory and statutory obligations stemming from requirements of the National Environmental Policy Act and the Endangered Species Act.

The park complex lies almost equidistant between known Indiana bat hibernacula and known summer maternity colony areas (Menzel et al. 2001b) and encompasses approximately 30,000 hectares of primarily mature hardwood forests on exposed xeric sites that are favored by maternity colonies. These lower elevations and dry exposures probably provide suitable conditions for Indiana bat

maternity activity (as well as other species), unlike the higher Allegheny Mountains to the immediate east (Brack et al. 2001, Ford et al. 2001). The combination of protected forests and large riverine riparian zones likely also provides abundant summer roosting and foraging habitat for more common tree cavity and exfoliating bark roosting species, such as the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*), as well as foliage-roosting red bats (*Lasiurus borealis*) and hoary bats (*L. cinereus*). Clifflines (some heavily used by recreational climbers), rockhouses, abandoned deep mines and abandoned buildings in the New River Gorge complex also could be potential winter hibernacula for Indiana bats, little brown bats, and northern long-eared bats as well as both hibernacula and summer roosting habitat for small-footed bats, Rafinesque's big-eared bats, big brown bats (*Eptesicus fuscus*), and eastern pipistrelles (*Pipistrellus subflavus*). In addition, the large river corridors cutting through the Allegheny Plateau in this region may also serve as important early-late spring and fall migration routes for silver-haired bats (*Lasionycteris noctivagans*) between their wintering areas in the South and summering areas in the Lake States and Northeast.

Scope of study-

We propose to conduct baseline surveys for bat community composition and relative abundance at the New River Gorge National River (NERI), Gauley River National Recreation Area (GARI), and Bluestone National Scenic River (BLUE) national park units. Of special interest are endangered, threatened, and species of concern that may occur on the study areas. We will describe the distribution of bat species among the primary habitat types occurring on the areas. The resulting information will be used to establish protocols for long-term monitoring of bat communities.

Intended use of results-

Bat community inventory and distribution data will provide guidance in making informed management decisions regarding the biological resources within the 3 park units. This effort will also produce information necessary for development of long-term bat monitoring programs. Standard monitoring protocols, annual reports, a final report, and peer-reviewed publications will be prepared throughout the course of the study. Nothing of commercial use will be derived from the study.

Objectives:

The objectives of our research are to: 1) provide a thorough inventory of bat community composition and relative abundance at the NERI, GARI, and BLUE national park units; 2) examine distribution and habitat associations (foraging and roosting) of selected bat species; and 3) develop an effective protocol for long-term inventory and monitoring of bat communities by the NPS.

Methods:

Description of study area-

The study areas for our proposed work include the NERI, GARI, and BLUE national park units located in the Allegheny Plateau physiographic province of southern West Virginia. Investigations will proceed in all primary habitat types occurring in the 3 areas. Primary habitat designations are based on vegetative community, geology, and gorge and river morphology, and include: 1) primary river channels and lakes (Rivers); 2) lower slope mesic forests (Lower Slope Forests); 3) mid-elevation

rocky summits and cliff faces (Cliffs); and 4) dry ridge-top forests (Ridge Top Forests); 5) open fields and roadsides (Open) (modified from Suiter and Evans 1999).

Procedures-

Primary habitat types within each park unit will be delineated using ARCVIEW (Environmental Systems Research Institute 1999) and appropriate GIS coverages available through NPS, U.S. Geological Survey, and the Natural Resource Analysis Center at West Virginia University. We will randomly chose 3 replicate sites of each primary habitat type within each park unit for monitoring. We will visit each chosen primary habitat to locate areas of concentrated bat activity to be used as monitoring locations.

To reduce bias in sampling methodologies, a variety of methods will be employed to determine bat community composition and relative abundance. Mist net sampling will be conducted using 12 x 2.4 m mist nets positioned over areas of concentrated bat activity, such as small streams, ephemeral pools, and road ruts. Species, age, sex, forearm length, and weight will be recorded for each captured individual. Age class will be defined as adult or juvenile based on epiphyseal-diaphyseal fusion (Anthony 1988). Each primary habitat within each study area will be sampled for 4 consecutive nights in each year of the study, following the Indiana bat monitoring protocol for standardization (USFWS 1999). Bat species richness and diversity measures will be calculated for each park unit and for each primary habitat type. Macrohabitat variables, such as elevation, aspect, stand age, and distance to riparian areas, will be determined for each monitoring location.

Mine shafts and portals from previous mining activities that may provide habitat for cave roosting bat species, such as the endangered Virginia big-eared bat, will be sampled with harp traps (Constantine 1958, Tuttle 1974). Harp traps will not require entry, as these areas are potentially unstable and unsafe. Harp traps will be positioned across the entrance and black polyethylene sheeting will be used to cover the remainder of the opening, forcing bats to fly through the trap. Bats will be collected from the catch bag and data recorded as above. Harp traps also may be employed at entrances of abandoned buildings, the most likely sites for capture of Rafinesque's big-eared bat, a species of concern throughout the Southeast. However, NPS approval will be required and safety concerns will be addressed.

We will use the Anabat II detection system (Titley Electronics, Australia) to record and identify bat echolocation calls at monitoring locations following sampling protocols established by Johnson et al. (2001). The Anabat methodology will be used in conjunction with other methods, but also will be used to sample areas that cannot be sampled with mist nets, such as open lakes, wide river corridors, and upland areas distant from open water. We will establish a New River Gorge Complex call library of echolocation calls from netted bats released in open areas using an Anabat II detector linked to a portable tape recorder (Menzel 1998). Bat calls at sampled habitats and at bat release sites will be directly downloaded to a computer using a Zero Crossings Analysis Interface Module (ZCAIM, Titley Electronics, Australia). We will analyze and identify bat calls using the Anabat6, Anlook4, and Analyze software packages.

We will use radiotelemetry to further assess distribution and habitat use of bat species occurring on the study areas. Most efforts will concentrate on common species such as little brown bats, big brown

bats, and red bats. We also will be prepared to opportunistically attach radio-transmitters to rare, threatened, endangered, or sensitive species such as Indiana bats, small-footed bats, or Rafinesque's big-eared bats when possible. Bats will be captured using mist nets and harp traps as described above. Radio-transmitters (0.45 g, LB-2; Holohil Systems Ltd., Ontario, Canada) will be glued to the back of selected species with Skin-bond surgical adhesive (Pfizer Hospital Products Group, Inc., Largo, Florida). Transmitters weigh less than 5% of body weight, which has been shown to have negligible impact on bat movements (Aldridge and Brigham 1988, Hickey 1992).

We will assess bat foraging habitat selection by comparing use versus availability of primary habitats within each park area. Telemetered bats will be located using simultaneous triangulation techniques. Locations of foraging bats will be calculated from telemetry station UTM coordinates and location azimuths using program LOCATE (Kie et al. 1996). Home ranges will be calculated with the Animal Movements Analysis Extension in ARCVIEW (Environmental Systems Research Institute 1999, Hooze and Eichenlaub 1998). Home ranges will be overlaid onto GIS coverages of primary habitats and the proportion of each habitat within the home range will be calculated. Proportion of available habitat will be determined from GIS coverages of the study areas.

Time and resources permitting, we also will identify features influencing roosting habitat selection of radiotelemetered bats. We will compare characteristics of known roost trees and surrounding habitat with randomly chosen potential roost trees. Roosting bats will be located during the day using radio-receivers and three-element Yagi antennas. We will conduct exit counts at each roost tree to determine the exact location of the roost and the approximate size of the colony. Characteristics will be measured within 0.04 ha plots centered on roost trees and random trees and will include: height of roost, roost tree height, roost tree dbh, distance to the nearest overstory tree and nearest taller overstory tree, canopy density, percent snags in the overstory, overstory richness and diversity, understory richness and diversity, and understory density (Menzel 1998, Owen 2000).

Collections-

No specimens will be intentionally collected. However, capture related mortalities will be prepared and deposited into the Georgia Museum of Natural History.

Analyses-

Bat community richness, diversity, and relative abundance (expressed as catch/unit effort) determined by mist netting/harp traps will be compared among primary habitats and among park areas using Analysis of Variance (ANOVA). Presence/absence of species at each monitoring location will be analyzed in reference to macrohabitat variables using logistic regression. Species richness from Anabat data will be compared among primary habitats and park areas using ANOVA. Measures of foraging activity (number of calls and number of feeding buzzes) by species and all species combined will be analyzed with ANOVA. Use versus availability of primary habitats within each park area will be assessed with compositional analysis (Aebischer et al. 1993). Characteristics of roost trees and random trees will be compared univariately using a t-test. Multivariate analysis of roost tree characteristics will be conducted using discriminant analysis. All analyses will be conducted with SAS statistical software (SAS Institute 1990).

Schedule-

Sep 2002 - Apr 2003	Use GIS to delineate primary habitats and identify potential monitoring locations; Conduct site visits to confirm accessibility and feasibility of monitoring locations
May - Aug 2003	Initiate bat surveys using mist netting, harp traps, and Anabat detectors; monitor foraging and spatial activity levels with Anabats; perform radiotelemetry; measure roost and random tree characteristics
Sep 2003- Apr 2004	Data entry, preliminary data analysis, preparation of 2003 progress report
May - Aug 2004	Continued inventory, monitoring of bat activity levels, radiotelemetry, and habitat measurements
Sep 2004 - Aug 2005	Final data analysis and preparation of dissertation; preparation of final report and recommendations to NPS

Budget:

	2002-03	2003-04	2004-05	Totals
Personnel				
Ph.D. Student (half time; UGA)	19,438	20,021	20,621	60,080
Seasonal technicians (3 @ \$1,000/mo. for 3 months)	9,000	9,000	9,000	27,000
Fringe benefits @ 10%	600	600	600	1,800
UGA vehicle (mileage and fuel)	5,000	5,000	5,000	15,000
Housing (\$600/month for 3 months)	1,800	1,800	1,800	5,400
Supplies				
Mist nets (20 @ \$111.50)	2,230			2,230
Harp traps (2 @ \$500)	1,000			1,000
Anabat Detectors (5 @ \$432)	2,160			2,160
ZCAIM (5 @ \$372)	1,860			1,860
Radiotags (15 annually @ \$250 each)	3,750	3,750		7,500
Misc. supplies (lights, batteries, etc.)	2,000	500	500	3,000
Travel (UGA and USFS to site)	1,500	1,500	1,000	4,000
Publication costs	500	500	1,000	2,000
Annual totals	50,838	42,671	39,521	133,030
Indirect costs (44.8 %)	22,775	19,117	17,705	59,597
Project total	73,613	61,788	57,226	192,627

Products:

Publications and reports-

Annual reports will be prepared and submitted to NPS throughout the study. During year 3, a final report containing inventory results, distribution and habitat use, management recommendations, and guidelines for long-term monitoring of bat communities at the NERI, GARI, and BLUE park units will be submitted to NPS. Study results focusing on bat community relationships, habitat associations, and foraging and roosting ecology will be published in peer-reviewed journals.

Collections-

No specimens will be intentionally collected. However, capture related mortalities will be prepared and deposited into the Georgia Museum of Natural History.

Data and other materials-

All data collected will be entered into spreadsheet format and submitted to NPS. We will submit UTM coordinates of foraging and roosting locations of sensitive bat species to NPS.

Qualifications:

All investigators have considerable experience with inventory and monitoring of nongame and endangered species. WMF and MAM have received funding for and completed numerous inventory and research projects on bats and are considered leading authorities on bats in the eastern United States. SBC has been involved in monitoring and genetic analyses of Allegheny woodrat populations at NERI.

Supporting documentation and special concerns:

Safety-

Rugged, difficult terrain at all park units is a primary safety concern. All workers will be informed of potential hazards by NPS personnel. No workers will enter abandoned mine shafts or portals at any time.

Risk of rabies infection is of utmost concern when working with bats. Rabies pre-exposure prophylaxis will be administered to all workers. Post-exposure prophylaxis will be required of all workers with a potential exposure.

Access to study sites-

Monitoring sites will be located near established roads or trails when possible. Access to some remote monitoring sites may require strenuous hiking.

Use of other equipment-

With NPS approval, four-wheeled all terrain vehicles may be used for moving equipment into remote areas. Radiotelemetry stations will be temporarily marked with inconspicuous metal stakes or flagging.

Chemical use- n/a

Ground disturbance- n/a

Animal welfare-

All animal use protocols will be prepared following standard guidelines outlined by the American Society of Mammalogists, Animal Care and Use Committee (American Society of Mammalogists 1998). Animal use protocols outlined in the project proposal must be approved by the Animal Care and Use Committee at the University of Georgia.

NPS assistance-

NPS personnel will be asked to provide maps/GIS coverages of the study areas and assist in study site selection. NPS will be asked to provide safety information to all workers.

Wilderness 'minimum requirement' protocols- n/a

Project 5 Bat Inventory at ALPO, JOFL, FONE and FRHI

Estimate \$40,000 (2003-2004 request)

Description: RFP in preparation. Bert Frost from Gettysburg National Military Park, a Mid-Atlantic Network park, is in the process of putting together a scope of work for this project. This will be a combined effort between the two networks, to inventory bats in four of the small PA parks in the Mid-Atlantic Network and these four small PA parks in the ERM Network. The cooperators working on bats in the West Virginia parks may be approached about cooperating on this project as well.

Project 6 DEWA Grassland Bird Survey

Total \$49,947 (2002-2003 request)

Title: A Point Count Survey of Grassland Birds in the Delaware Water Gap National Recreation Area

**Principle Investigator: Terry L. Master, Ph.D., Department of Biological Sciences
East Stroudsburg University of Pennsylvania**

Abstract

The status of grassland bird populations in the Delaware Water Gap National Recreation Area will be addressed in this proposed project. Grassland habitats within the park, primarily early successional fields, will be sampled with point counts using variable circular plots within three size categories of fields over a period of two years. Habitat analyses will also be conducted at each point in order to determine habitat - grassland bird relationships. The results will be presented as a GIS map which will include the location of point counts along with the presence and density of species and the results of habitat analyses.

Statement of Issue

National Park Service personnel require basic inventory and monitoring (I & M) data in order to properly manage natural resources within their jurisdictions. The National Park Service initiated such an I & M program in 1991 (Williams 1999) and was eventually directed by congress to "undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends in the condition of National Park System resources", under Title II of the National Parks Omnibus Management Act of 1998 (Williams 1999). As a consequence, the Delaware Water Gap National Recreation Area (DEWA) and Upper Delaware Scenic and Recreational River established I & M goals and priorities for a variety of organisms during a Biological Inventories Scoping Workshop held on October 24, 25, 2000.

The Working Group on Birds developed an I & M plan which included recognition of existing inventory data, gaps in previous I & M efforts, subsequent priorities and rationalization for such priorities and general sampling strategies. Discussions during the workshop ranked grassland birds as the top priority group requiring I & M efforts within the recreation area. This ranking results from directives within the National Park Service regarding grassland birds as well as documented concerns about recent declines in these species. These declines often exceed those of the more documented, forest dwelling, neotropical migrants (Herkert 1991; Peterjohn and Sauer 1993; Samson and Knopf 1994; Herkert 1995, 1997). For example, Henlows Sparrows have declined an average of 7.1% per year between 1975 and 1995 in Illinois (Herkert 1997). The three factors most likely responsible for loss of grassland birds are habitat loss, caused by human activity or ecological succession, and fragmentation on the breeding grounds (Herkert 1991; Helzer 1996). The presence and/or current population level of grassland species found in Pennsylvania may be the result of human habitat alteration; many of these species were either never abundant or simply not part of the state's historical avifauna (Brauning 1992; McWilliams and Brauning 2000). However, given population declines in native areas, such populations take on added importance from a conservation perspective which adds impetus and urgency to I & M efforts regarding these species.

Objectives

The objectives of this grassland bird survey are: (1) to determine the array of bird species utilizing available, appropriate habitat in the DEWA using point counts; (2) to confirm the presence of previously documented species in specific areas [DEWA records, PEEC records, PA and NJ Breeding Bird Atlas surveys]; (3) to calculate the densities of breeding pairs and; (4) to correlate habitat structure with species diversity and breeding density.

Methods and Procedures

General Considerations

This study is designed as an inventory but sampling sites will be established and given GIS designations so that monitoring can be done in the future as priorities dictate. The count method to be employed depends on the goal of the census, the habitat type and time and financial constraints. This decision primarily involves whether to use point counts or transects. Point counts are similar in conception and theory to transects in that they can be imagined as transects of zero length conducted at zero speed. They have the advantage of being easier to incorporate into a formally designed study and

to randomly or systematically distribute. A well spaced sample of point counts will provide a more representative survey than will a few transects. Additionally, one's attention is not distracted by having to avoid obstacles and point counts are also more time efficient (Bibby et al. 1992). Point counts are the standard survey technique used for terrestrial songbirds in northeastern national parks (Paton, unpublished report).

The most important point count considerations include; (1) the number of points; (2) placement of points; (3) count radius; (4) duration of counts (replication of counts vs. additional points); (5) number of visits; (6) distance estimation and; (7) observer bias (Bibby et al. 1992; Ralph et al. 1995). Observers will record the species, type of cue registered (i.e., call, song or visual detection), distance to the detection and the count period (i.e., first three minutes or last two minutes) during which the detection was noted. Counts will be done only during the four hour period from 0500-0900 hours (Ralph et al. 1993). They will be conducted during the height of the breeding season from the last week in May through the first week of July.

Target Species

Obviously, all species will be counted but the target grassland species potentially include Killdeer (*Charadrius vociferus*) Upland Sandpiper (*Bartramia longicauda*), Northern Harrier (*Circus cyaneus*), Short-eared Owl (*Asio flammeus*), Eastern Kingbird (*Tyrannus tyrannus*) Horned Lark (*Eremophila alpestris*), Sedge Wren (*Cistothorus platensis*), Field Sparrow (*Spizella pusilla*), Grasshopper Sparrow (*Ammodramus savannarum*), Henslow's Sparrow (*Ammodramus henslowi*), Savannah Sparrow (*Passerculus sandwichensis*), Vesper Sparrow (*Poocetes gramineus*), Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*). Additional species that are either accidental or undergoing range expansions could include Clay-colored Sparrow (*Spizella pallida*), Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*), Lark Sparrow (*Chondestes grammacus*) and Lincoln's Sparrow (*Melospiza lincolni*).

Choosing Sampling Sites - There is currently some conjecture concerning the area sensitivity of grassland birds (Johnson and Temple 1990; Burger et al. 1994; Clawson and Rotella 1998; Winter and Faaborg 1999). Vickery et al. (1994) give specific area requirements for grass land birds in Maine based on a "50 % incidence" index (i.e., a 50% likelihood that the species would be found in proper habitat of at least a certain area). These range in size from Upland Sandpipers, which reached 50% incidence at 200 ha to Savannah Sparrows which attained a 50% incidence in sites of 10 ha and Field Sparrows which exhibited no area sensitivity. In general, vegetation structure, as opposed to vegetation composition, especially litter accumulation, vegetation height and woody cover, appears to be more important than area in determining presence/absence and densities of grassland birds in native prairie habitat (Kendeigh 1948; Bond 1957; Bowman and Harris 1980; Rotenberry and Wiens 1980; Winter 1994; Winter and Faaborg 1999). However, area importance as a determining factor increases if grassland sites are surrounded by forest from which predators can gain access to these ground nesters and for specific species, primarily Henslow's Sparrows (Winter and Faaborg 1999; Clawson and Rotella 1998). Given this ambiguity in the relationship between area and presence and /or population density, grassland sites 4 ha (10 acres) and larger will be sampled and categorized into the following area size classes including 4 - 8 ha (10-19 acres), 9 - 21 ha (20-49 acres) and > 22 ha (> 50 acres). There are 49 fields in the smallest category, 13 in the middle category and only 3 larger than 22 ha (> 50 acres).

Sample Size - # Points/Field – It is not possible to know how many counts are required to achieve the standard inventory goal of documenting 90% of the species found in fields in the DEWA. The number of counts required to meet this goal will depend on species, time of year, count intensity and variability of species occurrence. Generally, this goal should be easier to achieve in relatively simple, homogenous environments like early successional fields (Morrison et al. 1981). It is important to calculate variance estimates for population parameters in order to determine the completeness of counts (Paton, unpublished report). In this structurally simplistic habitat, it is recommended that a 250 m grid system (6.24 ha or 15 acres per grid cell) be used to determine the number of counts per field. This protocol would maintain adjacent counts at the suggested distance of 250 m from each other (Reynolds 1980; Ralph et al. 1995). Point count stations would then be located at the center of each grid cell. Only cells at least 1 grid cell away from forest/field or other ecotones will be used in order to eliminate edge effects (Savard and Hooper 1995). Thus, fields in the small category would have 1 sample point, those in the medium category would have 2-3 and the largest fields would have 8-16 points (100 ha) depending on exactly how large they are. It is estimated that a total of 115 sampling points will be required.

Count Radius - Variable Circular Plots (VCPs) will be used at selected points (Reynolds 1980; Fancy and Sauer 2000). Under this protocol, birds heard or seen will be recorded and their distance from the center of the count circle noted. Markers will be set at 10, 25, 50 and 100 m to clearly identify the boundaries of VCPs. This method permits determination population densities because data can be corrected for variability in the detection of different species (Scott et al. 1981, Bibby et al. 1992).

Duration of Counts - There is inevitably conflict regarding whether or not to establish more points at the expense of time spent at each one or visa versa. In general, whenever you have to compromise between the number of points and the count duration it is most efficient to maximize the number of points (Savard and Hooper 1995). Therefore, each count will last for 5 minutes with detections being separated into those recorded during the first three minutes and subsequently, the following two minutes (Paton, unpublished report; Fuller and Langslow 1984). This will permit estimation of detectabilities for different species. A five-minute count length is reasonable in this type of open habitat, will eliminate the potential of counting individuals more than once, which is an inherent problem in longer counts, and will help prevent detection of birds making long movements which invalidates a standard assumption of point count protocol (Bibby et al. 1992).

Number of Visits - This decision, like that involving count duration, also represents a compromise between replication and the total number of points sampled. It is felt that the number of points to be sampled in fields of different size is maximized in this protocol given that points need to be at least 250 m apart, especially in open, structurally simple habitats. Therefore, it is recommended that each point be visited twice during the field season. This seems reasonable given that three visits were sufficient to record nearly all species in structurally more complex beech-maple and pine-hardwood forests (Petit et al. 1995). Replication of counts at a single point will yield better estimates of species abundance and community composition of birds (Petit et al. 1995; Ralph et al. 1995; Smith et al. 1995).

Habitat Analysis

The most important aspect of habitat structure regarding grassland bird species is vegetative structure (Kendeigh 1948; Bond 1957; Bowman and Harris 1980; Rotenberry and Wiens 1980; Winter 1994;

Winter and Faaborg 1999). An ocular estimate of the percent coverage of bare ground, grasses/sedges, forbs, shrubs, saplings and trees will be done using a 30 x 50 cm Daubenmire frame (Daubenmire 1959; Winter and Faaborg 1999) centered on the census point (BBird Protocol 1994). The same technique and observations will also be conducted at two randomly chosen sites, each 50 m (164 ft.) along a transect line extending 100 m (328 ft.) to either side of the point. The transect line orientation (E-W or N-S) will be determined with a coin toss. Another coin toss will also determine whether the vegetation analysis is done to the right or left of the transect line at the 50 m (164 ft.) distance.

Quality Assurance/Quality Control

Surveys will be conducted by the Principle Investigator and hired personnel with point count experience. Preliminary point counts will be done simultaneously by the study participants and compared for accuracy and consistency. The same standard will apply to the habitat analyses regarding estimation of percent cover and to distance estimation. A test will be given to hired personnel on the calls and songs of the target species as well as other common species which are likely to be encountered. Only one observer at a time will be permitted to survey birds at a particular point. The order of visitation to field sites during the second round of surveys will be reversed, both with respect to travel order and with regard to when particular points in a given field are censused. All data will be recorded on field data sheets, immediately entered into the computer data base and copied onto at least two zip disks.

Deliverables

In general, all appropriate deliverables will be provided as described in the NPS Northeast Region I&M Program Product Specifications draft directive as of 24 May 2001. Specifically, progress reports will be submitted annually via the NPS IAR reporting system in conjunction with annual meetings with park service personnel. A final report will be prepared following completion of field work. Maps of standard scale will be prepared depicting study sites, all GPS sampling stations, species occurrence, species population densities and appropriate habitat analyses in ARCVIEW format. The results of the habitat analyses may also help in determining appropriate management schemes to enhance diversity of grassland birds in the fields. Maps will be accompanied by all field notes, photos, slides and recorded data in MS ACCESS database format

Special Requirements and Concerns

National Park Service (DEWA) GPS units will be required due to the degree of accuracy they afford. DEWA assistance with GPS/GIS matters may also be required throughout the project. Flag markers will be used to mark points used for counts in addition to GPS data. There will be no ground disturbance, use of mechanized equipment, chemical use, voucher specimen or animal welfare issues involved in this study. One other special concern in conducting this project involves the weather. Surveys cannot be done on rainy or windy days due to a depression of cues emitted by birds and difficulty in hearing call or song cues, respectively (Ralph et al. 1995). The study protocol requires that surveys be conducted on approximately one half of the available days during the breeding season from the last week in May through the first week in July. This represents a very conservative approach to ensuring that enough days with proper weather are available to complete the project each year. However, it is always possible that weather restrictions on the number of surveys will occur.

Budget*

<u>Item</u>	FY 2002	FY 2003	Total
<u>Personnel</u>			
P. I. (1 x 3 h/day x 30 days x \$60/h)	5,400.00	5,400.00	10,800.00
Field Intern (1 x 6 h/day x 60 days x \$15/h)	5,400.00	5,400.00	10,800.00
Comp. Tech. (1 x 8 h/day x 30 days x 207/h)	4,800.00	4,800.00	9,600.00
<u>Travel</u>			
Rental Car (1 x \$800/mo. x 4/3 mo.)	3,200.00	2,400.00	5,600.00
Fuel (\$30/wk x 16/12 weeks)	480.00	360.00	840.00
<u>Equipment</u>			
GIS support/field equipment/office supplies	1,000.00	1,000.00	2,000.00
<u>Indirect Costs (ESU overhead)</u>			
0.26 * direct cost total	5,273.00	5,034.00	10,307.00
TOTAL COST	\$25,553.00	\$24,394.00	\$49,947.00

*Budget estimates reflect the following considerations:

- approximately 15 days to select and organize sample points
- 115 sample points will be established covering all fields in all size categories
 - small size category - 1 pt. each - 49 pts.
 - medium category - 2 or 3 pts. each - 30 pts.
 - large fields - 10 - 16 pts each - 36 pts.
- on average, 10 point counts will be conducted per day, including travel/walking time
- 12 days will be required to complete one point count replicate, 24 days for both
- 24 days represents approximately 50% of the available point count days
- remaining days will be used for habitat analyses
- 1 month will be required for data organization, entry and analysis each year
- an additional 3/4 months will be required for final report preparation during the second year

Project 7 Back Channel Fish Inventory, DEWA and UPDE

Estimate \$75,982 (2004-2005 request)

Description: RFP in preparation

The scope of work will entail sampling back-channel habitats of the Delaware River at UPDE and DEWA for fish, with a focus on two native species of special concern, ironcolor shiner and bridal shiner.

Project 8 Wetland Bird Inventory at DEWA

\$74,441 (2004-2005 request)

Title: A Survey of Wetland Birds in the Delaware Water Gap National Recreation Area

Principle Investigator:

Terry L. Master, Ph.D.

Department of Biological Sciences

East Stroudsburg University of Pennsylvania

Abstract

The status of wetland bird populations in the Delaware Water Gap National Recreation Area will be addressed in this proposed project. Wetland habitats will be sampled using broadcast calls/songs for nocturnal species and traditional point counts using variable circular plots within three size categories of palustrine wetlands over a period of two years. The results will be presented as a GIS map which will include the location of point counts along with the presence and density of species.

Statement of Issue

National Park Service personnel require basic inventory and monitoring (I & M) data in order to properly manage natural resources within their jurisdictions. The National Park Service initiated such an I & M program in 1991 (Williams 1999) and was eventually directed by congress to "undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends in the condition of National Park System resources", under Title II of the National Parks Omnibus Management Act of 1998 (Williams 1999). As a consequence, the Delaware Water Gap National Recreation Area (DEWA) and Upper Delaware Scenic and Recreational River established I & M goals and priorities for a variety of organisms during a Biological Inventories Scoping Workshop held on October 24, 25, 2000.

The Working Group on Birds developed an I & M plan which included recognition of existing inventory data, gaps in previous I & M efforts, subsequent priorities and rationalization for such priorities and general sampling strategies. Discussions during the workshop ranked wetland birds as the second priority group requiring I & M efforts within the recreation area. This ranking results from directives within the National Park Service regarding wetland birds as well as documented concerns about recent declines in these species and their wetland habitats.

Objectives

The objectives of this wetland bird survey are: (1) to determine the array of bird species utilizing wetlands in the DEWA using tape playback and point counts; (2) to confirm the presence of previously documented species in specific areas [DEWA records, PEEC records, PA and NJ Breeding Bird Atlas surveys] and; (3) to calculate the densities of breeding species.

Methods and Procedures

General Considerations

This study is designed as an inventory but sampling sites will be established and given GIS designations so that monitoring can be done in the future as priorities dictate. The count methods to be employed depend on the goal of the survey, the habitat type and time and financial constraints. For some types of wetland habitat, both diurnally active species as well as crepuscular and nocturnal species must be sampled. This requires two types of surveys, point counts and the use of broadcast calls. Point counts have the advantage of being easy to incorporate into a formally designed study and to randomly or systematically distribute. A well spaced sample of point counts will provide a more representative survey than will a few transects (Bibby et al. 1992). Point counts are the standard survey technique used for diurnal terrestrial songbirds in northeastern national parks (Paton, unpublished report).

The most important point count considerations include; (1) the number of points; (2) placement of points; (3) count radius; (4) duration of counts (replication of counts vs. additional points); (5) number of visits; (6) distance estimation and; (7) observer bias (Bibby et al. 1992; Ralph et al. 1995). Observers will record the species, type of cue registered (i.e., call, song or visual detection), distance to the detection and the count period (i.e., first three minutes or last two minutes) during which the detection was noted. Counts will be done only during the four hour period from 0500-0900 hours (Ralph et al. 1993).

Broadcast calls/songs are a useful tool for detecting wetland species that include rails and bitterns as well as Sedge Wrens (Cistothorus platensis), which are often vocal at night, and Barred Owls (Strix varia) which are not restricted to but are often found in forested palustrine wetlands. Some considerations that need to be taken into account when using this technique are similar to those for point counts regarding the placement of points, duration, number of visits, etc. In addition, the pattern and timing of call/song playback is important and the protocol suggested by Gibbs and Melvin (1993) will be followed. Both survey techniques will be conducted during the height of the breeding season, from the last week in May through the first week of July. All species heard and seen, including those flying overhead, will be denoted and recorded for point counts and broadcast call surveys.

Target Species

Potential species that will be detected by point counts in palustrine habitats are numerous and will not be enumerated here. Those species which will be targeted with broadcast calls/songs include American bittern (Botarus lentiginosus) (although they can also be heard diurnally), Least Bittern (Ixobrychus exilis), Virginia Rail (Rallus limicola), Sora (Porzana carolina), Black Rail (Laterallus jamaicensis), King Rail (Rallus elegans), Barred Owl and Sedge Wren (Brauning, ed. 1992; McWilliams and Brauning 2000).

Choosing Sampling Sites

There are 892 palustrine wetlands in the DEWA including 128 emergent wetlands (PEW), 147 shrub-scrub wetlands (PSW), 506 forested wetlands (PFW) and 111 open water wetlands (POW). Although

data on the area sensitivity of wetland birds in general is somewhat lacking, personal observation indicates that some species, such as rails, can utilize very small parcels. However, given the total number of parcels, the fact that two types of surveys have to be done in some of them and that access may be time consuming, the following protocol is recommended. All sites greater than 10 acres (69) should be sampled. A stratified random sample of 5% of the PEWs, PSWs and POWs less than 10 acres in size will also be surveyed in addition to 1% of the PFWs in that same area category. Point counts will be done in each and broadcast call/song surveys will be done in PEWs for marsh birds and PFWs for Barred Owls. A species richness-area curve will be compiled as surveys are done and compared to the theoretical list of all species which should be detected. If the proposed sampling protocol falls short of expected results (i.e., some species that are definitely expected are not being detected), then consideration will have to be given to additional stratified random sampling of sites less than 5 acres in extent since they are so numerous and widely distributed over the entire park.

Sample Size - # Points/Field – It is not possible to know how many counts are required to achieve the standard inventory goal of documenting 90% of the species found in wetlands in the DEWA. The number of counts required to meet this goal will depend on species, time of year, count intensity and variability of species occurrence. It is important to calculate variance estimates for population parameters in order to determine the completeness of counts (Paton, unpublished report). Given the number of sites to be sampled, it is recommended that a 250 m grid system (6.24 ha or 15 acres per grid cell) be used to determine the number of counts per wetland area. This protocol would maintain adjacent counts at the suggested distance of 250 m from each other (Reynolds 1980; Ralph et al. 1995). Point count stations would then be located at the center of each grid cell. Only cells at least 1 grid cell away from forest/field or other ecotones will be used in order to eliminate edge effects (Savard and Hooper 1995).

There is only one site > 50 acres which presumably would require no more than 6 points given that each sampling grid cell covers an area of 15 acres. It is safely estimated that, on average, 2 points will be needed per site between 11 and 50 acres (44 sites) for a total of 88 points. Surveying 5% of PEW, PSW and POW sites greater than 1 and less than 10 acres will add an additional 18 sites with 1 point in each. Finally, 1% of PFWs will add another 5 sites, each with 1 sample point. Therefore, a total of 117 points will be surveyed. Those in PEWs and PFWs will be surveyed with tape playback effectively doubling the required effort at 58 points since tape playback will be done at the same sites as point counts.

Count Radius - Variable Circular Plots (VCPs) will be used at selected points (Reynolds 1980; Fancy and Sauer 2000). Under this protocol, birds heard or seen will be recorded and their distance from the center of the count circle noted. Markers will be set at 10, 25, 50 and 100 m to clearly identify the boundaries of VCPs. Individuals observed within and outside the 50 m designation will be noted. VCPs permit determination of population densities because data can be corrected for variability in the detection of different species (Scott et al. 1981, Bibby et al. 1992).

Duration of Counts - There is inevitably conflict regarding whether or not to establish more points at the expense of time spent at each one or visa versa. In general, whenever you have to compromise between the number of points and the count duration it is most efficient to maximize the number of points (Savard and Hooper 1995). Therefore, each count will last for 5 minutes with detections being separated into those recorded during the first three minutes and subsequently, the following two

minutes (Paton, unpublished report; Fuller and Langslow 1984). This will permit estimation of detectabilities for different species. A five-minute count length is reasonable in this type of open habitat, will eliminate the potential of counting individuals more than once, which is an inherent problem in longer counts, and will help prevent detection of birds making long movements which invalidates a standard assumption of point count protocol (Bibby et al. 1992).

Number of Visits - This decision, like that involving count duration, also represents a compromise between replication and the total number of points sampled. It is recommended that each point in open habitats (PEWs and POWs) be visited twice and each PFW and PSW site be visited three times during the field season. This seems reasonable given that three visits were sufficient to record nearly all species in structurally complex beech-maple and pine-hardwood forests (Petit et al. 1995). Replication of counts at a single point will yield better estimates of species abundance and community composition of birds (Petit et al. 1995; Ralph et al. 1995; Smith et al. 1995).

Broadcast Call/Song Protocol - Sessions will be conducted in a stratified random manner at 50% of the points in PEWs and PFWs since those sites are the most likely to harbor target marsh/owl species, respectively. Gibbs and Melvin (1993) suggest that three replicates per point is sufficient to detect 90% of the water birds present. At each survey point, all passively vocalizing species will be recorded for three and five minute periods, according to regular point count protocol, before broadcasting calls/songs of the primary marsh birds (Longcore et al. 2001). Calls/songs will be broadcast using a CD, containing 30 seconds of calls or songs/species alternating with 30 seconds of silence, and speaker system. Calls will be derived from the Stokes Field Guide to Bird Songs (Time-Warner Audio Books).

Quality Assurance/Quality Control

Surveys will be conducted by the Principle Investigator and hired personnel with point count experience. Preliminary point counts will be done simultaneously by the study participants and compared for accuracy and consistency. The same standard will apply to the habitat analyses regarding estimation of percent cover and to distance estimation. A test will be given to hired personnel on the calls and songs of the target species as well as other common species which are likely to be encountered. Only one observer at a time will be permitted to survey birds at a particular point. The order of visitation to field sites during the second round of surveys will be reversed, both with respect to travel order and with regard to when particular points in a given field are surveyed. All data will be recorded on field data sheets, immediately entered into the computer data base and copied onto at least two zip disks.

Deliverables

In general, all appropriate deliverables will be provided as described in the NPS Northeast Region I&M Program Product Specifications draft directive as of 24 May 2001. Specifically, progress reports will be submitted annually via the NPS IAR reporting system in conjunction with annual meetings with park service personnel. A final report will be prepared following completion of field work. Maps of standard scale will be prepared depicting study sites, all GPS sampling stations, species occurrence, species population densities and appropriate habitat analyses in ARCVIEW format. The results of the habitat analyses may also help in determining appropriate management schemes to enhance diversity of grassland birds in the fields. Maps will be accompanied by all field notes, photos, slides and recorded data in MS ACCESS database format

Special Requirements and Concerns

National Park Service (DEWA) GPS units will be required due to the degree of accuracy they afford. DEWA assistance with GPS/GIS matters may also be required throughout the project. Flag markers will be used to mark points used for counts in addition to GPS data. There will be no ground disturbance, use of mechanized equipment, chemical use, voucher specimen or animal welfare issues involved in this study. One other special concern in conducting this project involves the weather. Surveys cannot be done on rainy or windy days due to a depression of cues emitted by birds and difficulty in hearing call or song cues, respectively (Ralph et al. 1995). The study protocol requires that surveys be conducted on approximately one half of the available days during the breeding season from the last week in May through the first week in July. This represents a very conservative approach to ensuring that enough days with proper weather are available to complete the project each year. However, it is always possible that weather restrictions on the number of surveys will occur.

Budget*

<u>Item</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>Total</u>
<u>Personnel</u>			
P. I. (1 x 3 h/day x 40 days x \$60/h)	7,200.00	7,200.00	14,400.00
Field Intern (2 x 6 h/day x 50 days x \$15/h)	9,000.00	9,000.00	18,000.00
Comp. Tech. (1 x 8 h/day x 40 days x 20/h)	6,400.00	6,400.00	12,800.00
<u>Travel</u>			
Rental Car (2 x \$800/mo. x 4/3 mo.)	6,400.00	4,800.00	11,200.00
Fuel (\$30/wk x 16/12 weeks)	960.00	720.00	1,680.00
<u>Equipment</u>			
GIS support/field equipment/office supplies	500.00	500.00	1,000.00
<u>Indirect Costs (ESU overhead)</u>			
0.26 * direct cost total	7,920.00	7,441.00	15,361.00
TOTAL COST	\$38,380.00	\$36,061.00	\$74,441.00

* Budget estimates reflect the following considerations for each year

- approximately 20 days to select and organize sample points
- 117 individual sample points will be established
 - 69 of those sites (PEWs and PFWs) will require broadcast calls
- replication will require a total of 304 individual point counts and 207 broadcast call surveys
- 10 point counts and 10 broadcast call/song surveys will be conducted per day, including travel/walking time
- 25 days will be required to complete point count and broadcast call/song replicates at all sites
- 40 days will be required for data organization, entry and analysis each year
- an additional 3/4 months will be required for final report preparation during the second year

SECTION VI-PRODUCT SPECIFICATIONS

Product specifications are being developed for the Northeast Region I&M Program (Appendix C). The following is a list of deliverables that will be required of all cooperators and contractors working in the Mid-Atlantic Network as part of the I&M Program. Research taking place in the parks, independent of the funding source, will also be required to provide these products at the end of each project.

1. Species Data

Raw Data

Copies of all raw data, such as hand written field forms (if used), must be provided if requested by the Network.

Species Inventory Database

All inventory data will be provided in an MS Access database. Database templates being developed by WASO for inventory and monitoring data will be required and used by the Network.

2. GPS Data

Cooperators must provide GPS coordinates and attributes (e.g. location ID, description, and habitat classification) for all fixed sampling locations (e.g. plots, transects, etc...). Cooperators are also encouraged to obtain GPS coordinates and attributes for observations obtained from general search areas or opportunistic sightings, but are not required to do so. GPS data must be differentially corrected with base station files. The data should be supplied as an ArcInfo coverage or as an ArcView shapefile in the coordinate system currently in use at the park. For most parks, this will be the correct UTM zone in which the park is found. The datum should be the North American Datum of 1983 (NAD83); the ellipsoid should be the Geodetic Reference System 80 (GRS80); and units of measure should be meters. Please review the GPS standard operating procedures for field data collection and the spatial data format requirements in the Appendix (Sections II& III).

3. Metadata

Non-spatial digital data

Metadata must be provided in NPS Dataset Catalog format for each non-spatial digital data set produced.

Spatial digital data

Cooperators must provide metadata for each spatial digital data set (e.g. GPS coverage of fixed sampling locations) produced. All metadata must follow Federal Geographic Data Committee (FGDC) compliance standards.

4. Voucher Specimens

The ERM Network chooses to leave the issue of vouchering up to the discretion of the park where the inventory is taking place. An agreement on vouchering must be reached prior to beginning the inventory.

5. Reports

Progress Reports

Progress reports must be submitted digitally in Word format, and as paper copy if requested. Minimally, they will be due annually dependent upon the length and scope of the project.

Final Reports

The final report will be submitted digitally as draft in MS Word, and as paper copy, to the Regional I&M or Network Coordinator for management and scientific review and comment. It must include methodology, analysis, results and discussion. The final report will be submitted in digital and paper copy formats. Because the final report will be made available on an NPS website, it must be submitted both as 1) a Word 6.0 or higher version document (.doc) in its entirety on diskette or CD-ROM, and 2) a Word 6.0 or higher version document (.doc) containing all text and tables, and individual Tiff documents (.tif) for each graphic image contained in the report on that same diskette or CD-ROM.

6.1 Voucher Specimen Collection

A repository for specimens collected during inventory work in the ERM Network parks has not yet been identified. At this time, any specimens collected will be housed at the cooperating University or associated institution. The final decision on the collection of voucher specimens will be left up to the discretion of each park, but the collections policy for the Northeast Region I&M Program is as follows. **Cooperators may collect whole specimen vouchers** on amphibians, snakes, mammals, fish and plants **only if**:

1. **Identification of a species is in question.** Certain taxa such as fish may require more intensive vouchering than other taxa such as mammals.
2. **Or if a particular species has not yet been collected in a park.** A list of existing voucher specimens will be available for each park, and cooperators are required to review this list prior to fieldwork.

Plants and animals that **may not** be whole-specimen vouchered include birds, turtles, large mammals and common plant species. If vouchering is necessary for identification purposes, then photo documentation is required.

Photo Documentation

The ERM Network is requiring all cooperators to use non-invasive methods of vouchering, such as hardcopy color photography, high quality digital photography or animal signs or remains (e.g. hair samples, scat or tracks) whenever possible. Photographs of a species will be considered a voucher and will be referenced in NPSpecies. Photographs taken to provide documentation of a species must be taken with a macro or close-up lens. Photographs should show known features used for identification of a species. It may be necessary to take more than one photograph of an individual from different angles. All photographs must be submitted with the pertinent raw data. All slides and photographs must be kept in appropriate protective sleeves.

Whole Specimens

Collectors will be responsible for cataloging specimen/field notes for items deposited into non-NPS repositories. The more information a collector can provide, the more useful the specimen/field notes will be to future managers and researchers.

Voucher preparation will be the responsibility of the cooperator who must have a valid park permit to collect specimens. All vouchers taken on NPS lands, regardless of their repository, will be the property of the NPS. Cooperators will be responsible for accessioning voucher specimens into ANCS+.

Voucher specimen collection must follow the guidelines defined by the Components of British Columbia's Biodiversity (CBCB) manual #4, Collection and Preparation of Voucher Specimens and any guidelines a cooperating institution's Animal, Care and Use Committee has developed.

Mammalian Collection

In order to minimize disturbance on mammalian populations in the parks, photo vouchering and collecting animals where death resulted from either trap mortality or road kill will be priority over euthanizing individuals. Vouchering methods are described in Table 1 for some mammalian groups that may be found in northeastern parks. Guidelines found in the *Live Animal Capture and Handling Guidelines*, manual no.3, will be followed for proper capture, handling and euthanasia procedures. Guidelines and references for the preservation of voucher specimens can be found in *Measuring and Monitoring Biological Diversity, Standard Methods for Mammals* (Wilson et al, 1996).

Table 1. Vouchering methods for some mammalian groups.

Taxonomic group	Vouchering Method
Bats	Wing punch or whole specimens for easily misidentified species when capture is part of the inventory protocol. Morphometric data, photographs, digital sonograms or cassette tapes with reference calls should also be collected as evidence of rare or endangered bats.
Small Mammals - Shrews, Voles, Mice, Rats and Lemming	Three of each species: 1 of each sex (if sexes are distinguishable) and the 3rd a juvenile (of either sex) is preferred, especially if there is much difference from the adults.
Moles	Whole specimens only if trap mortality occurs.
Medium-sized mammals	Photo vouchers or specimen voucher from trap mortality and road kill, collection of other sign when possible (tracks, hair, scat).
Large mammals	Photo vouchers, collection of other sign when possible (tracks, hair, scat)

Fish Collection

Digital photographs can be an accurate and economical method for vouchering fish specimens. The Network will follow the guidelines for vouchering fish, developed by Dr. Jay Stauffer and Timothy Stecko from Penn State University, for Northeast Region I&M (Appendix D). Although it may not be possible to identify all fish specimens from digital photographs taken in the field, these guidelines will be useful for most fish collected. Immature fishes of all species and some of the minnow species, particularly in the genus *Notropis*, need to be collected and properly preserved.

Amphibian and Reptile Collection

For identification purposes, most species of amphibians and reptiles can be adequately confirmed from photographs. Collecting whole specimens of amphibians and snakes will only be allowed as stated above, if a whole specimen does not exist for a park. Turtles must be photo documented only.

Vascular Plant Collection

Species that are common to the park or have already been vouchered should not be collected. Because any collection of specimens impacts a population, it is especially important when collecting rare species to weigh the destructiveness of collection against the amount of information gained. Federal and state Threatened and Endangered plants will not be collected in populations of less than 50 individuals (Elzinga et. al, 1998). It is incumbent upon the cooperators to know which taxa are locally or nationally rare or protected, and to be familiar with all federal and state legal procedures for collecting. In small populations, only small portions of plants will be collected if necessary. Cooperators are advised not collect indiscriminately, even in large populations, and to collect only the minimum amount of plant material necessary. (The Plant Conservation Round Table, 1986).

Voucher specimens will be collected during inventory in accordance with collections policies outlined in *NPS Management Policies* (“Museum Objects and Library Materials” and “Preservation of Data and Collections and Protection of Research Potential”) and NPS-77, *Natural Resource Management Guideline*. Obtaining the necessary permits for collecting will be the responsibility of the cooperator/contractor and the parks.

For all voucher specimens, cooperators will be asked to fill in the information below and submit information as an Appendix with their final report. This information will enable the park to fully document their research in the National Park Service’s National Catalog as well as the NPSpecies database.

BIOLOGICAL SPECIMENS:

- Collection Permit number: _____
- Fixative or killing agent used: _____
- Preservative agent used: _____
- Number of specimens: _____
- Order: _____, Genus _____, Species: _____
- UTM, Latitude/ Longitude, or elevation where collected: _____
- Collection Site: _____

- Principle Investigator: _____
- Specimen Identified (classified) by: _____
- Collection Date: _____

6.2 Compliance

The ERM Network will incorporate compliance with park and regional research and collection policies, the National Historic Preservation Act (NHPA), Section 106, and the National Environmental Policy Act (NEPA) throughout the implementation, and reporting phases of its biological inventories.

Individual parks within the Network have specific permitting requirements that will be outlined in the Statement of Work for each contract. At a minimum, each researcher will be required to obtain a park Collection Permit and must submit an Investigator's Annual Report upon completion of each inventory.

Documentation of study plan approval from the Fish and Wildlife Service (FWS) will be required for those projects with the potential to effect federally listed T&E species.

SECTION VII-DATA MANAGEMENT

As the Inventory and Monitoring Program develops and years pass, not only will there be data existing for the nine parks in the Network, but there will be data collected by different biologists, scientists, and technicians, that will consist of unavoidable variation. In order to reduce such variation, and to ensure the reliability and usability of the information gathered, the ERM Network will develop a data management plan that provides sufficient standards for managing such data. An information management system will set the foundation for obtaining consistent end products among studies, and provide for the documentation of all efforts and results in a consistent and comprehensive manner. Sufficient effort must go into the planning and design phase of creating a workable data management plan that will continue to be used throughout the Network's long-term monitoring program. Data management is a high priority for the Network. The Network has and is in the process of converting all of the relevant existing data into NPSpecies and into relational databases as discussed in this plan. A full-time term data manager position will be filled to coordinate and manage both legacy and newly acquired data for the network. This position will work closely with other NPS staff at the network, region and service-wide level to meet the data management goals in the most efficient and cost effective way possible.

There has been a great deal of effort by WASO I&M to develop tools for managing inventory and monitoring data which includes digital, bibliographic and spatial information, and excellent guidance is provided in the data management protocols (NPS 1996). The I&M Database Templates developed by the Servicewide I&M Program will be used to help the Network develop a relational database that is compatible with the GIS Theme Manager. The ERM Network plans to build on these available resources and as discussed in the Heartland Network's Inventory Plan, this Network will emphasize the role of data management in the course of data collection and handling.

The minimum standards that will be required of contractors and cooperators will include(Northeast Region Product Specs, Appendix B):

- Standardized collection and data entry methods

- Software requirements
- Standardized data fields dependent upon the Database Template Data Dictionary
- Data verification and validation requirements
- Metadata requirements

Network Objectives Include:

1. Identifying the data backlog for the Network and complete the entry of this material into the appropriate databases, NPSpecies database, the Dataset Catalog, NRBIB or GIS.
2. Provide a data management framework and methodology for current field collections, which will include protocols for both spatial and nonspatial data collection and handling.
3. Ensure FGDC compliant metadata for all information.
4. Identify partnerships and common strategies for data collection and management.

7.1 Data Collection

The ERM Network will require the use of standardized field forms that contain standardized locations and events codes as well as habitat measures for all inventory and monitoring projects. Field activities are to be well documented by requiring all investigators to document their standard operating procedures used during the course of their study. This will include a step-by-step description of the procedures used to collect data, including any modifications or adjustments made to accommodate field conditions, the precision of instruments, etc... All raw data collected during the biological inventories, as well as all summary products produced will be entered and/or cataloged into the appropriate service-wide product on an annual basis.

7.2 Data Verification

All principle investigators are expected to verify their data 100% before submitting it to the Network. The Network will require copies of all field data sheets from cooperators and sub-samples of the data will be compared with the associated field data sheets. A minimum of 95% accuracy will be expected.

7.3 Data Formats

Non-Spatial Data

All non-spatial inventory data must be submitted to the Network in MS Access database format. The Network Data Manager will begin developing a relational database for the Network that will be based on the NPS I&M Database Template being developed by WASO. The Network database will be provided to all investigators along with standardized field forms, before field work begins. The NPS I&M Database Template will be the final product for newly acquired data from field surveys to facilitate it's linking to the GIS Theme Manager.

GIS Data

Spatial data, which include GPS generated files, must conform to the following guidelines:

Projection and Coordinate System

All digital geospatial data should reference the coordinate system corresponding to the standard presently in use at the park which, for most parks, will be the correct UTM zone in which the park is found. The datum should be the North American Datum of 1983 (NAD83); the ellipsoid should be the Geodetic Reference System 80 (GRS80); and the units of measure should be meters. The contractor should contact the park's GIS Coordinator for specific instructions and/or refer to the contract or cooperative agreement.

Scale and Spatial Resolution (Vector Data)

New data should not exceed 1:24,000. The contractor should contact the park's GIS Coordinator for specific scale and spatial resolution requirements for vector data or they may be specified in the contract or cooperative agreement.

Scale and Spatial Resolution (Image Data-digital or aerial photography)

The contractor should contact the park's GIS Coordinator for specific scale and spatial resolution requirements for image data or they may be specified in the contract or cooperative agreement. For vegetation classification under the NPS/USGS vegetation classification project, the current standard is 1:12,000 color infrared aerial photographs with 60% overlap and 30% sidelap.

Horizontal and Vertical Accuracy

All data should meet or exceed the following National Map Accuracy standards (Source: USGS Fact Sheet 078-96, September 1997).

For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as benchmarks, property boundary monuments; intersections of roads and railroads; corners of large buildings or structures (or center points of small buildings). In general, what is well-defined will also be determined by what is plottable on the scale of the map within 1/100 inch. Thus, while the intersection of two roads or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. This class would cover timber lines and soil boundaries.

Vertical accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error by more than one-

half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

The following table provides the allowable horizontal accuracy for some common scales:

<u>Scale</u>	<u>Allowable error (feet)</u>
1:40,000	111
1:24,000	40
1:20,000	33
1:12,000	20
1:9,600	16
1:4,800	8
1:2,400	4
1:1,200	2

Attribute Accuracy

At a minimum, an 80% or greater overall thematic attribute accuracy at the 90% confidence interval is required. The contractor should contact the park's GIS Coordinator for specific attribute accuracy requirements or they may be specified in the contract or cooperative agreement.

Spatial Data Formats

At a minimum, all vector data is to be supplied as an ArcInfo coverage and ArcInfo interchange file, e00, compatible with the current version of ArcInfo for the MS Windows operating system. All raster data is to be supplied as an ArcInfo GRID and ArcInfo interchange file, compatible with the current version of ArcInfo for the MS Windows operating system. All digital imagery, such as scanned aerial photographs, is to be supplied as tagged image file format (tiff) files with the proper header file for geo-referencing purposes. The contractor should contact the park's GIS Coordinator for specific data formats or they may be specified in the contract or cooperative agreement. All data should be delivered on CD ROMs compatible with the MS Windows operating system.

Quality Control

When the contractor has completed 10% of the spatial and attribute data development, the contractor must supply the data to the park and appropriate Regional Technical Support Center (RTSC) for quality control purposes. The data must be delivered in conformance to the Spatial Data Formats requirements. Once the park and RTSC have checked the data and found it acceptable, the contractor may continue data development. Once the contractor has completed the work, the park and RTSC must accept the spatial data, attribute data, and Federal Geographic Data Committee (FGDC) compliant metadata before the job is considered complete.

Results of tests used to verify all applicable horizontal, vertical and attribute accuracy measurements should also be provided whenever data is provided to the park and RTSC.

7.4 Metadata

All digital geospatial data must have FGDC compliant metadata in digital form developed by the data producer. The metadata should be parsed using the metadata parser provided by the FDGC (<http://www.fgdc.gov>). The metadata should be supplied as ASCII text with a txt extension, hypertext markup language with an html extension and standard general markup language with an sgml extension. The contractor should contact the park's GIS Coordinator or the appropriate RTSC for metadata development instructions.

All digital non-spatial data must be provided to the Network with a digitally completed Dataset Catalog form.

7.5 Data Cataloging

All products cataloged into the NPS service-wide NRBib or Dataset Catalog databases will be archived for future acquisition. Hardcopy products will be stored in file cabinets, shelves or other appropriate structures. Digital products will be copied to CD-ROM and appropriately stored as well. The exact local of archived products has yet to be determined and may occur at the park, network, region (or support office), and/or service-wide level. The copies will be appropriately organized to facilitate future acquisition. Each entry in NRBib or the Dataset Catalog will include the physical location of each product. Conversely, each stored product will be marked with the unique identifying code assigned in the database. On an annual basis, at a minimum, final MS Access files will be stored on CD-ROM, copied, and stored in separate locals. The copies will be appropriately organized to facilitate future acquisition. An entry will be made in the NPS Dataset Catalog for each database file (or files) that includes the physical storage location of the CD. The Dataset Catalog Identification code (or codes if multiple files are stored on one CD) will be marked on each stored copy.

SECTION VIII-NETWORK STAFFING AND SUPPORT

8.1 Staffing

Regional I&M Support

The Northeast Region I&M Coordinator will provide technical assistance with contracting and cooperative agreements for the Eastern Rivers and Mountains Network. She will oversee and assist the Network and provide guidance in completing the inventory initiative in these parks.

The Northeast Region I&M Program Assistant, will continue to act (one quarter of the time for this Network) as a liaison between contractors/cooperators during the inventory process. This research associate from the University of Rhode Island will provide park representatives with updated information about the program and continue to gather existing information for the network parks through local agencies/programs.

8.2 Partnerships

University of Rhode Island-Cooperative Agreement

- I&M Program Regional Coordinator (duty station)
- Northeast Region I&M Program Assistant-Research Associate

Western Pennsylvania Conservancy -Cooperative Agreement

- Rare Plant and Animal Inventories (ALPO, JOFL, FONE, FRHI)

Penn State University-Cooperative Agreement

- NRBIB Specialist-Research Associate
- Collections Search for Fish Specimens-Dr. Jay Stauffer (NY, NJ, PA, VA, WV, MD)
- NPSpecies/Dataset Catalog/GIS Theme Manager-Research Associate
- Inventory Program for Birds at Six PA National Parks: Dr. Richard Yahner (FONE, FRHI)
- Inventory of Amphibian and Reptile Species-Dr. Richard Yahner (ALPO, JOFL).

California University of Pennsylvania

- Herpetological Inventories-Dr. Brian Paulson (FONE, FRHI)

Marshall University-Cooperative Agreement

- Gauley River National Recreation Area Vertebrate Survey-Dr. Tom Pauley
- Relational Database Development for vertebrate data collected at NERI, GARI and BLUE.

East Stroudsburg University

- Grassland Bird Inventory-Dr. Terry Masters (DEWA)
- Wetland Bird Inventory-Dr. Terry Masters (DEWA)

University of Georgia

- Bat Inventory-Dr. Steven Castleberry and Dr. W. Mark Ford (NERI, GARI, BLUE)

West Virginia University

- Fish Inventory-Dr. Stuart Welsh (NERI)

SECTION IX-BUDGET

9.1 Eastern Rivers and Mountains Network Pre-proposal

Table 8. Projects funded through the ERM Network I&M Program funds requested in the pre-proposal (Appendix E) (FY00-\$112,000).

Projects	FY 00	Cooperator
Update NRBIB	\$11,250	Penn State-Scott Tiffney (Cost share with 4 networks)
NPSpecies (Research associate)	\$11,509	Penn State University (PSU) (cost share with 3 networks)
Northeast Region I&M Program Assistant (Research Associate)	\$10,690	University of Rhode Island (Cost share with 4 networks)
Dataset Catalog development	\$2,000	North Carolina State University (NCS)
Herpetological Inventories	\$30,452	Wildlife Conservation Society
	\$11,059	Housing, vehicle (2000)
Scoping Workshops (travel, other)	\$6,000	WV and PA workshops
GPS Units for I&M Projects	\$12,000	3 units purchased
Total	\$94,960	
Funds remaining	\$17,040	Put toward other projects and repaid in 2001

9.2 Eastern Rivers and Mountains Network I&M Funds FY01

Table 9. Projects funded through ERM Network I&M funds (\$47,040 available in FY01)

Projects	FY 01	Cooperator
NPSpecies (Research associate)*	\$10,000	Penn State University (PSU) (cost share with 2 other networks)
Northeast Region I&M Program Assistant (Research Associate)*	\$23,642	University of Rhode Island (Cost share with 4 networks)
Travel	\$1,072	Travel to PSU-NPSpecies RA meeting
WV park's NPSpecies Plant Database	\$7,200	Private Contractor-Sam Norris
DEWA NPSpecies clean up	\$2,286	SCA Intern
DEWA Herpetological Inventory	\$5,980	WCS-Housing/vehicle
Total	\$50,180	
Over Budget	\$3,140	Request in FY02

Table 10. ERM Network Inventory Projects funded by sources other than designated Network Funding (FY00-01).

Projects	Amount	Source	Cooperator
Avian and mammal inventories at FONE and FRHI and Herp and mammal inventories at ALPO and JOFL	\$158,661	I&M (pre-network funding)(2001-05)	Penn State University –Dr. Richard Yahner
Avian Inventories ALPO/JOFL	\$173,201	I&M (pre-network funding)	Penn State University
Herp inventories-FONE and FRHI	\$142,332	I&M (pre-network funding) (\$15,000 Regional Science funds)	California University of PA-Dr. Paulson (3 yr. study)
Herp inventories-DEWA	\$70,000	I&M	Wildlife Conservation Society
	\$15,000	Regional Science (FY2000)	
	\$52,324	Line Item Construction Funds FY01	
Rare Species Survey (FONE, FRHI, ALPO, JOFL)	\$17,400	Regional Science (FY2001)	Western Pennsylvania Conservancy
Fish Voucher Search (Shared by 4 Networks)	\$33,966	Regional Science (FY2000-2001) I&M (pre-network funding)	Penn State University-Dr. Jay Stauffer
Vertebrate Survey of the Gauley River National Recreation Area	\$68,240	Regional Science funds (FY2000-2001)	Marshall University-Dr. Tom Pauley
Fish Inventory of the New River Gorge National River	\$25,000	Regional Science funds (2001)	West Virginia University-Dr. Stuart Welsh
Inventory of a newly discovered population of Endangered Dwarf Mussel (UPDE/DEWA)	\$50,000	BRMD funds (2002 funds)	USGS
	\$24,000	Regional Science (general survey)	
Vegetation Mapping-NERI	\$29,223	Regional Science (FY2001)	Private Contractor Jim Vanderhorst
	\$54,000	Veg Mapping Program (2001)	
NERI (photo mosaic)	\$8,733	Veg Mapping Program	NC State
NERI/BLUE/GARI(Air photos)	\$16,775	Veg Mapping Program (2001)	GeoVantage (Photography)
Vegetation Mapping-DEWA	\$240,066	Veg Mapping Program Fire Program	PA Natural Diversity Inventory(plots+fuels+vegmap)
	\$24,810		Kucera, Intl (photography)
	\$10,097		NC State U. (photo mosaic)
	\$12,479		ABI (Veg crosswalk)
Total	\$1,226,307.00		

9.3 Eastern Rivers and Mountains Inventory Plan Budget

The total funds to be provided to the Network for vertebrate and vascular plant inventories is \$602,551, \$142,000 of this was allocated in FY00-01. The Network went over budget by \$3,140 in FY01, this amount is requested in the following FY02 budget.

Table 11. Budget for the ERM Network Inventory Plan.

Budget Item	FY02	FY03	FY04	FY05
Database Development (NERI/GARI/BLUE)	\$31,065			
Data Mining (UPDE)	\$10,000*			
Bat Community Survey (NERI/GARI/BLUE)	\$73,613	\$61,788	\$57,226	
Grassland Birds (DEWA)	\$25,553	\$24,394		
Wetland Birds Survey (DEWA)			\$38,380	\$36,061
Back Channel Fish Inventory (DEWA/UPDE)			\$53,000*	\$23,000*
Bat Inventory (ALPO/FONE/FRHI/JOFL)		\$20,000*	\$20,000*	
subtotal	\$140,231	\$106,182	\$168,606*	\$59,061*
Administrative costs				
Network Data Manager	\$30,000	\$52,707**		
subtotal	\$170,231	\$158,889	\$168,606*	\$59,061*
	\$3,140			
I&M Funds Requested	\$173,371	\$158,889*	\$168,606*	\$59,061*

*Estimates-Although the total requested funds exceed the funding allotted to the Network, these figures are only estimates and other funding will be sought to complete projects if necessary.

** Monitoring funds available to the Network in FY03 may cover this amount.

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