

Eastern Rivers and Mountains Network Inventory Study Plan for Vertebrate and Vascular Plant Species

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

Appendix A

Summary of the West Virginia River Park's Scoping Workshop

Eastern Rivers/Mountains Network
Summary of the West Virginia River Park's Scoping Workshop
July 25, 2000

Bird Inventories

New River Gorge NR

Avian species from the following papers have been entered into NPSpecies:

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 1996-1998)

Pauley, Thomas K. Report: Vertebrate Surveys Grandview Area, New River Gorge National River. August 1992. (includes birds, amphibians and mammals)

Worthington, Gary et al. Avian Survey of the New River Gorge National River. December 1985.

Canterbury, Ronald A. et al. Three Rivers Migration Observatory: Fall Migration 1998.

Shaw, Paul. Glade Creek Point and Brooklyn Point Count Surveys: 1997-1999

Eye, Osbra L. Kates Branch Wetland (NERI). January 1981. (includes plant and bird species)

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. (in NPFauna-NPSpecies) NRBIB: NERI-0222

Sullivan, R.J. September 25, 1990. Peregrine Falcon Reintroduction Project 1990. New River Gorge National River. NPS Report. 9 pp. (In NPFauna) NRBIB:NERI-0158

Other sources to check for species lists:

Brooks Bird Club (contact Tom Fox)

Breeding Bird Atlas (contact Don Kodak at DNR)

Christmas Bird Counts (contact Jim Phillips)

Cliff Watch Summary 1993-? (Contact Donna Mitchell)

MAPS 1999 & 2000 (Contact Dr. Ron Canterbury)

Point Counts in Hemlock Stands (Contact Petra Wood)-Data received 8/23/00 from Petra
Russ McClain's data on Cooper's hawks, Belted Kingfishers and Whipperwills.

Works in Progress

MAPS 1999 & 2000 (Contact Dr. Ron Canterbury)

A survey for Federally Endangered Species in Abandoned mine Portals. (Bryan, MacGregor and Kiser)

Inventory work needed:

Survey of nocturnal species.

Complete raptor survey. Including distribution and abundance data on the Peregrine Falcon.

Species of concern that need distribution and abundance data:

Golden-winged Warbler

Louisiana Waterthrush

Swainson's Warbler

References to add to NRBIB:

Canterbury, R.A. 1991. Ecology of the green salamander, *Aneides aeneus* (Cope and Packard), in West Virginia. Unpubl. M.S. thesis, Marshall Univ., Huntington.

Canterbury, R.A. 1999. The 1998 Christmas bird count summary. *Redstart* 66(4): 124-128.

Canterbury, R.A., J. Meyer, and D.M. Stover. 1998. Three Rivers migration observatory: fall migration 1998. *Redstart* 66(4):115-123.

Canterbury, R.A., and T.K. Pauley. 1994. Time of mating and egg deposition of West Virginia populations of the salamander *Aneides aeneus*. *J. Herp.* 28(4):431-424.

Canterbury, R.A., and D.M. Stover. 1998. Three Rivers migration observatory: fall migration 1995-1997. *Redstart* 65(4):119-131.

Canterbury, R.A., D.M. Stover, and T.C. Nelson. 1993. Golden-winged Warblers in southern West Virginia: status and population ecology. *Redstart* 60(4):97-106.

Gill, F.B., R.A. Canterbury, and J.L. Confer. 2000. The Blue-winged Warbler. *Birds of NA*. In press.

Gauley River NRA

Avian species from the following papers have been entered into NPSpecies:

Rodrique, Jane et al. Meadow River Point Count Surveys: 1998.

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies)

Draft General Management Plan/Environmental Impact Statement Land Protection Plan: Gauley River. December 1993. (includes birds, mammals, fish, herps, and birds)

Other sources to check for species lists:

Point Counts in Hemlock Stands (Contact Petra Wood)

Brooks Bird Club (contact Tom Fox)

Breeding Bird Atlas (contact Don Kodak at DNR)

Russ McClain's data on Cooper's hawks, Belted Kingfishers and Whipporwills.

Works in Progress:

Vertebrate Survey three year study beginning in 2000 (Pauley)

1999-2000 Point Count Surveys (Lipton)

Inventory work needed:

- Survey of nocturnal species.
- Complete raptor survey. Including distribution and abundance data on the Peregrine Falcon.
- Species of concern that need distribution and abundance data: Golden-winged Warbler, Louisiana Waterthrush, Swainson's Warbler.

Bluestone National Scenic River

Avian species from the following papers have been entered into NPSpecies:

Phillips, Jim. Bluestone River Lodge Point Count Surveys: 1998 and 1999.

Other sources to check for species lists:

Brooks Bird Club (contact Tom Fox)

Breeding Bird Atlas (contact Don Kodak at DNR)

Christmas Bird Counts (contact Jim Phillips)

Russ McClain's data on Cooper's Hawks, Belted Kingfishers and Whipporwills.

Works in Progress:

Point Count Surveys 2000 (continuation of Jim Phillips' work)
Vertebrate Survey Draft 2000 (Dr. Pauley/Canterbury)

Inventory work needed:

- Survey of nocturnal species.
- Complete raptor survey. Including distribution and abundance data on the Peregrine Falcon.
- Species of concern that need distribution and abundance data: Golden-winged Warbler, Louisiana Waterthrush, Swainson's Warbler.

Mammal Inventories

New River Gorge National River

Mammalian species from the following papers have been entered into NPSpecies:

A Survey for Federally Endangered Bat Species in Abandoned Mine Portals in the New River Gorge National River, West Virginia. March 1999.

Pauley, Thomas K. Biological Surveys in Proposed Development Sites in the New River Gorge National River: Volume III: Invertebrates and Vertebrates. February 1997. (electronic file)

Jirka, Kurt J. et al. A Biological Survey of the New River Gorge National River: Volume 4. March 1987

Pauley, Thomas K. Report of Upland Vertebrates in the New River Gorge National River: Volume 1. November 1993. (includes herps and mammals)

Pauley, Thomas K. Report: Vertebrate Surveys Grandview Area, New River Gorge National River. August 1992. (includes birds, amphibians and mammals)

Other sources to check for species lists:

New River Parkway Project, Indiana Bat Mist-Net Survey. Michael Baker Jr., Inc. July, 1999.

State Mammal Collection (contact Marietta Hight)

Park Collection Permits

Bat Surveys of West Virginia (contact Craig Stihler)

Dr Michael retired professor from WVU worked on mammals in the state.

Works in Progress:

A survey for Federally Endangered Species in Abandoned Mine Portals. (Bryan, MacGregor and Kiser)

Inventory work needed:

- Complete bat survey.
- Species of concern in need of distribution and abundance data: Northern Water Shrew, Allegheny Woodrat, Spotted Skunks, Golden Mouse, Rock Voles.

Gauley River NRA

Mammalian species from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies)

Draft General Management Plan/Environmental Impact Statement Land Protection Plan: Gauley River. December 1993. (includes birds, mammals, fish, herps, and birds)

Other sources to check for species lists:

State Mammal Collection (contact Marietta Hight)

Park Collection Permits

Bat Surveys of West Virginia (contact Craig Stihler)

Dr Michael retired professor from WVU worked on mammals in the state.

Works in Progress:

Vertebrate Survey three year study beginning in 2000 (Pauley)

Characteristics of Allegheny Woodrat Habitat (Draft 2000) (Petra Wood)

Inventory work needed:

- Complete bat survey.
- Species of concern in need of distribution and abundance data: Northern Water Shrew, Allegheny Woodrat, Spotted Skunks, Golden Mouse, Rock Voles.

Bluestone National Scenic River

Mammalian species from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of Bluestone Scenic River. November 1992. (includes plants, inverts, mammals)

Other sources to check for species lists:

Documentation of mammals by Jim Phillips during Point Count Surveys

State Mammal Collection (contact Marietta Hight)

Park Collection Permits

Bat Surveys of West Virginia (contact Craig Stihler)

Dr Michael retired professor from WVU worked on mammals in the state.

Works in Progress:

Vertebrate Survey Draft 2000 (Dr. Pauley/Canterbury)

Inventory work needed:

- Complete bat survey.
- Species of concern in need of distribution and abundance data: Northern Water Shrew, Allegheny Woodrat, Spotted Skunks, Golden Mouse, Rock Voles.

Herpetological Inventories**New River Gorge NR****Herpetological species from the following papers have been entered into NPSpecies:**

Pauley, Thomas K. Report of Upland Vertebrates in the New River Gorge National River: Volume 1. November 1993. (includes herps and mammals)

Pauley, Thomas K. Biological Surveys in Proposed Development Sites in the New River Gorge National River: Volume III: Invertebrates and Vertebrates. February 1997. (electronic file)

Buhlmann, Kurt A. et al. A Biological Survey of the New River Gorge National River: Volume 2. March 1987. (herps and insects)

Pauley, Thomas K. Report: Vertebrate Surveys Grandview Area, New River Gorge National River. August 1992. (includes birds, amphibians, reptiles and mammals)

Jirka, Kurt J. et al. A Biological Survey of the New River Gorge National River: Volume 4. March 1987

Other sources to check for species lists:

Black-bellied Salamander doctoral thesis from Marshall University

Dr. Mark Seidel retired Marshall University professor worked on turtles in the parks.

Works in Progress:

Frog calling Surveys 2000 (Pauley)

North American Amphibian Monitoring Program is beginning in 2000 under Dr. Tom Pauley.

Inventory work needed:

- Turtles have not been inventoried in NERI.
- Skink inventory.
 - Species of concern in need of distribution and abundance data: Cave Salamanders, Hellbenders, Black-bellied Salamanders, Rattlesnakes, Hog-nosed Snake, Rough Green Snake, Midland Mud Salamander, Spring Salamander

Gauley River NRA

Herpetological species from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies)

Draft General Management Plan/Environmental Impact Statement Land Protection Plan: Gauley River. December 1993. (includes birds, mammals, fish, herps, and birds)

Other sources to check for species lists:

Dr. Mark Seidel retired Marshall University professor worked on turtles in the parks.

Works in Progress:

Turtle survey 2000 (Pauley)

North American Amphibian Survey is beginning in 2000.

Inventory work needed:

- Skink inventory.
- Species of concern in need of distribution and abundance data: Cave Salamanders, Hellbenders, Black-bellied Salamanders, Rattlesnakes, Hog-nosed Snake, Rough Green Snake, Midland Mud Salamander, Spring Salamander

Bluestone National Scenic River

Herpetological species lists from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of Bluestone Scenic River. November 1992. (Plants, inverts, mammals)

Other sources to check for species lists:

Pauley, Thomas K. Published abstracts from the Upland Vertebrate Survey of the Bluestone National Scenic River. (2000?) This data needs to be entered into NPSpecies.

Works in Progress:

Vertebrate Survey Draft 2000 (Dr. Pauley/Canterbury)

Fish Inventories

New River Gorge NR

Fish species from the following papers have been entered into NPSpecies:

Roell, Michael J. Impacts of Commercial Harvest of Invertebrate Baits on the Predator-Prey Interactions in the New River. 1988. (includes fish species)

Roell, Michael J. The Roles of Predation, Competition, and Exploitation in the Community Dynamics of the New River in West Virginia. September 1989. (includes plants and fish)

Voshell, J. Reese et al. Ecological Monitoring in the New River Gorge National River: Analysis of Environmental Impacts from the Black Fly Pest Management Program. November 1995. (includes fish species)

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. (fish species, includes site location map)

Lobb, M. Delbert et al. A Biological Survey of the New River Gorge National River: Volume 3. March 1987. (2 copies received) (fish and inverts)

Virginia Polytechnic Institute and State University. August 31, 1989. Ecological Monitoring in the New River Gorge National River: Secondary Production at Sandstone Falls in 1988. Interim Report. Blacksburg, Virginia. 70+pp. (In NPFauna-NPSpecies) NRBIB: NERI-0132

Easton, R.S., D.J. Orth, and N.M. Burkhead. First Collection of Rudd in New River Gorge National River. 1993. (In NPFauna-NPSpecies) NRBIB:NERI-0406

Easton, R.S. 1992. Feeding Ecology of Age-0 Smallmouth Bass in the New River, West Virginia. Master of Science Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. (In NPFauna-NPSpecies) NRBIB:NERI-0405

Other sources to check for species lists:

West Virginia Division of Wildlife Resources, District IV, 2006 Robert C. Byrd Drive, Beckley, WV 25801. Contacts include Mark Scott and Jim Reid. Phone number is 304-256-6947.

West Virginia Division of Wildlife Resources, Operations Center PO Box 67, Elkins, WV 26241. Dan Cincotta (304-637-0245) would be the best contact.

US Fish and Wildlife Service, West Virginia Field Office, Elkins, WV. Phone number is 304-636-6586. The receptionist, Sheila Davis (extension 10) can probably direct you to the appropriate contact, probably either Jeff Towner or Bill Tolin.

Works in Progress:

National Park Service, New River Gorge National River, PO Box 246, Glen Jean, WV 25846. Contact is Jesse Purvis (304 465-6513).

Long-Term Ecological Monitoring System includes yearly electrofishing of four (formerly five) locations in the New River. All fish species are included in Voshell 1995 or VPI 1989.

New River tributary streams inventory. We are in the early stages of this, and so far have not collected any fish not found in the New River except for brown trout (*Salmo trutta*) and rainbow trout (*Onchorhynchus clarki*), which are stocked by WV DNR.

Inventory work needed:

- Streams tributary to New River (NERI)
- NERI has six endemic species.
- Exotic species include: White-tailed Shiner, Telescope Shiner, Roanoke Darter (All bait bucket introductions)

Gauley River NRA

Fish species from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies)

Draft General Management Plan/Environmental Impact Statement Land Protection Plan: Gauley River. December 1993. (includes birds, mammals, fish, herps, and birds)

Hocutt, C.H., R.F. Denoncourt, and J.R. Stauffer, JR. 1979. Fishes of the Gauley River, West Virginia. *Brimleyana* 1: 47-80. (In NPFauna-NPSpecies NRBIB: NERI 0208)

Other sources to check for species lists:

Works in Progress:

Inventory work needed:

- Meadow River (GARI)
- All tributaries concentrating on the smaller ones.
- Exotic species include: White-tailed Shiner, Telescope Shiner, Roanoke Darter (All bait bucket introductions)

Bluestone National Scenic River

Fish species from the following papers have been entered into NPSpecies:

Norris, Sam J. Rare Species Survey of Bluestone Scenic River. November 1992. (includes plants, inverts, mammals)

Other sources to check for species lists:

Works in Progress:

Inventory work needed:

- Basic Inventories are lacking in BLUE.
- All tributaries concentrating on the smaller ones.
- Exotic species include: White-tailed Shiner, Telescope Shiner, Roanoke Darter (All bait bucket introductions)

Vascular Plant Inventories

New River Gorge NR

Vascular plant species from the following papers have been entered into NPSpecies:

Eye, Osbra L. Kates Branch Wetland (NERI). January 1981. (includes plant and bird species)

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)

Roell, Michael J. The Roles of Predation, Competition, and Exploitation in the Community Dynamics of the New River in West Virginia. September 1989. (includes plants and fish)

Buhlmann, Kurt A. et al. A Biological Survey of the New River Gorge National River: Volume 1. March 1987. Summary of Findings. Mid-Atlantic Region Research/Resources Management Report No. 23. 82pp.

(Data in NPFlora-NPSpecies) NRBIB: NERI-0174

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. (Data in NPFlora-NPSpecies) NRBIB: NERI-0145

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. Final Report to the NPS. WV Dept. of Natural Resources, natural Heritage Program, Elkins, WV 26241. (Data in NPFlora-NPSpecies) NRBIB: NERI-0650

McDonald, B.R. 1989. Progress Report: Rare Species Cooperative Agreement. Progress Report to the NPS. Natural Heritage Program, WV Dept. of Natural Resources, Elkins, WV 26241 (Data in NPFlora-NPSpecies) NRBIB:NERI-0403

Cole, D.N. and J.L. Marion. 1987. Ecological Impacts on Recreational Sites at New River Gorge national River, West Virginia. Mid-Atlantic Region Research/Resources Management Report. (Data in NPFlora-NPSpecies) NRBIB:NERI-0047

Other sources to check for species lists:

Fortney, Stephenson and Adams. Reconnaissance Vegetation Study of the Bluestone, New, and Gauley River Gorges. March 30, 1995. (this was not sent to Colorado-it is in NRBIB)

Dale Suiter has an article coming out in Castanea on flora of NERI. Suiter collected just in NERI and found 904 species. Suiter mentions the 433 species that Grafton found that he did not find (Grafton worked from Virginia to the mouth of the New River covering a larger area than the park).

Grafton, McGraw and Phillips previously collected in NERI

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.

Jim Vanderhorst plant community plot data (from his vegetation mapping project) includes species lists in MSAccess.-

Work by Violet Phillips (Ph.D.) She listed species that Grafton could not find.

Historic work by Nuttall, 1896, some species not relocated. (Grafton would have citations for these 2 if we do not)

Look at Atlas of WV.

All of the group agreed that we could use Kartez county level data for expected species list.

Data Received so far:

Plot data from NERI vegetation mapping received 8/25/00 from Jim Vanderhorst. Citation: 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)

Gauley River Report, 1997. Sent to us by Jim Vanderhorst 8/25/00.

Rare Plant Species lists in spreadsheet format (4 excel files) sent to us by Kevin Boyle, Nongame Wildlife & Natural Heritage Program Wildlife Resources Section. 8/21/00

Rare Plant Species Lists for the NERI, GARI, BLUE from Brian McDonald, Natural Heritage Program WV DNR. 8/11/00

T&E Species for the NERI, GARI, BLUE from Jennifer Wykle, Natural Heritage Program WV DNR, 8/1/00. Includes vertebrates as well as plants.

Works in Progress:

Heritage Program is funding WVU and Marshall University to automate specimen records per Brian McDonald. Specimen records are being entered into a Foxpro database.

Brian McDonald offered to put BCD (Heritage Program Biological Conservation database) data in excel format. BCD is in advanced revelation software similar to the National Park Service ANCS+ database. The BCD also includes species lists in the field labeled "associated species" or "general description" that might be useful.

Park would like WVDNR (Vanderhorst) to map middle section of NERI.

Inventory work needed:

- The flat rock community or “riverside prairie” in NERI is important. This is an expanse of flat rocks with soil in between. Includes Liatrus, Big Bluestem, Baptisia warm season grasses.
- Wildflower populations are decreasing because of deer overpopulation and overcollection.
- Consider inventorying species that have been overlooked because they are considered “taxonomic problems”-need to be in seed or flowering in order to key out. Examples: Asters and Sedges.
- Aquatic systems- Inventories needs to be seasonal in order to identify all aquatic plant species, therefore, may not have been completely inventoried in the past.
- Invasive Species: Purple Loosestrife (*Lythrum salicaria*), Japanese Knotweed (*Polygonum cuspidatum*), Japanese Honeysuckle (*Lonicera japonica*), Bush Honeysuckle (*Lonicera morrowii*), Russian Olive (*Elaeagnus umbellata*), Garlic Mustard (*Alliaria petiolata*), *Microstegium vimineum*, (*Lespedeza sp.*), Multiflora rose (*Rosa multiflora*), Tree of Heaven (*Ailanthus altissima*), *Vinca mina* (don’t invade natural areas), English Ivy (*Hedera helix*) (don’t invade natural areas), Wysteria (don’t invade natural areas)
- Map areas of important native plant species “exemplary natural communities” and then evaluating those areas for invasive species.

Gauley River NRA

Vascular plant species from the following papers have been entered into NPSpecies:

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. (In NPFlora-NPSpecies-NRBIB: 0065)

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies) NRBIB: NERI-0143

Norris, Sam J. Rare Species Survey of the Gauley River National Recreation Area. August 1992. (includes plants, fish, birds, mammals, herps, butterflies) NRBIB: NERI-0144

Other sources to check for species lists:

Jim Vanderhorst Natural Heritage plot data

John Woods hemlock study plot data (contact John Perez about this).

Grafton report, 1993 (see above) digitize and enter locational data from report.

Frank Boteler, tech report on white water rafting. (Grafton offered to check for species list)

Bob Richardson grew up on the GARI worked for NRCS. Talk to John about him and how he could help.

Check USFS Legacy program for data

Charlie Yuill. WV GAP Analysis. Data most likely not specific enough to determine if within park boundary.

Grafton thinks, in the 60s, Charlie Baer/Clovis surveyed area as part of Natural Landmarks Program.

Works in Progress:

Inventory work needed:

- Less than 50% of species documented
- Cliff habitat-not many surveys have been done because of accessibility.
- Seep outcrops-State listed Carey's saxifrage is found here.
- Along floodplains
- Hemlock forests
- Cobble beach communities
- Old growth hemlock, yellow poplar, white oak, black birch, red maple.
- One flatrock with different species than NERI.
- GARI section that is not railroaded from Summersville dam to Meadow River confluence: assess old growth forest.
- Wildflower populations decreasing because of deer overpopulation and over collection.
- Consider inventorying species that have been overlooked because they are considered "taxonomic problems"-need to be in seed or flowering in order to key out. Examples: Asters and Sedges.
- Aquatic systems- Inventories needs to be seasonal in order to identify all aquatic plant species, therefore, may not have been completely inventoried in the past.
- Map areas of important native plant species "exemplary natural communities" and then evaluating those areas for invasive species.

References to add to NRBIB:

Walton, Dean et al. Critical Habitats and Associated Communities in the Riparian Zone of the Gauley River. November 1997.

Bluestone National Scenic River

Vascular plant species from the following papers have been entered into NPSpecies:

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. (conference paper only) (In NPFlora-NPSpecies) NRBIB: NERI-0065

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. (NRBIB: NERI-)

Other sources to check for species lists:

Sam Norris looked for rare species and listed associated species (should be in BCD) Fortney (WVU) 1996 reported on mostly woody species. Updated report due out in 2000. From Fortney bibliography there is a report by Edwin Oxley on Pipestem Park (in BLUE) possibly Indian Branch.

Bill Grafton offered to check if the Fortney data is electronic...John Perez might know as well.

Grafton report , 1993 (see above) digitize and enter locational data from report.

Works in Progress:

Fortney updated report due out in 2000.

Inventory work needed:

- Sandstone cliffs
- White cedar communities
- Dry shale (not in NERI or GARI) calcareous shale community, not shale barrens exactly, but unique. Includes Smoke Hole Bergamot.
- Wildflower populations decreasing because of deer overpopulation and over collection.
- Consider inventorying species that have been overlooked because they are considered “taxonomic problems”-need to be in seed or flowering in order to key out. Examples: Asters and Sedges.
- Aquatic systems- Inventories need to be seasonal in order to identify all aquatic plant species, therefore, may not have been completely inventoried in the past.
- Invasive Species: Purple Loosestrife (*Lythrum salicaria*), Japanese Knotweed (*Polygonum cuspidatum*), Japanese Honeysuckle (*Lonicera japonica*), Bush Honeysuckle (*Lonicera morrowii*), Russian Olive (*Elaeagnus umbellata*), Garlic Mustard (*Alliaria petiolata*), *Microstegium vimineum*, (*Lespedeza sp.*), Multiflora rose (*Rosa multiflora*), Tree of Heaven (*Ailanthus altissima*), *Vinca mina* (don't invade natural areas), English Ivy (*Hedera helix*) (don't invade natural areas), Wysteria (don't invade natural areas)
- Map areas of important native plant species “exemplary natural communities”, and then evaluate those areas for invasive species.

Priorities and Cost Estimates for Inventories in the BLUE, NERI and GARI

Birds

1. Raptures presence/absence. Using broadcast playback surveys this could include Peregrine Falcons, Red Shouldered Hawks and Accipiters as well as Owls. -----**\$20K**
2. Bird surveys within hemlock stands. This would include Swainson's Warblers and other species on the PIF list. -----**\$5-6K**
3. Nocturnal species especially Whippoorwills and Nighthawks. Could be surveyed by broadcast calls. ---**\$5-6K**
4. Getting distribution and abundance data on species from the PIF list such as: Golden-winged Warbler, Louisiana Waterthrush, Acadian Flycatcher, Swainsons Warbler etc... -----**\$???**

Mammals

1. A bat inventory at mine portals using anabat, harp traps, mist nets at portals, existing structures and streams. WVDNR has a protocol listed on their website. -----**\$???**
(An inventory of mine portal habitat has been done in the park's 115 mine sites)
2. Northern Water Shrew- using snap traps and pitfalls.-----**(9K)**
3. Allegheny Woodrat Inventory in mine portals.-----**\$7-10K** for one season.
4. BLUE special habitats such as ravines, shale barrens and wetlands.-----**\$25-30K**
(GARI scheduled for year #2 of the Pauley study)

Herps

1. NERI turtle inventory.-----**\$10K** (Could include Hellbenders at the same time +**5K**)
2. NERI, BLUE,GARI distribution/abundance information on Skinks.-----**\$5K/park**
3. Rattlesnake den inventory.-----**\$20K** (Locate rocky areas using infrared leaf-off photos. Sampling can only be done for 2-3 days in the spring and fall)

Plants

1. BLUE and GARI basic inventories. GARI should be done first.-----**\$???**
2. Vegetation mapping for each park to identify unique areas to inventory.-----**\$100K/per park**
(The ecological landuse unit (ELU) will be available soon through TNC)
3. Map areas of important native plant species "exemplary natural communities" and then evaluating those areas for invasive species. Or map natural areas using existing plot data and evaluate threat from invasives.-----**\$???**
4. Sandstone Cliff inventory.-----**\$???**

Fish

1. BLUE (mainstem) basic inventory.-----**\$5-10K**

2. NERI tributaries/basic inventory.-----**\$30-50K**
3. Meadow River basic inventory.-----**\$5-10K**
4. BLUE tributaries basic inventory.-----**\$20-30K**
5. GARI tributaries basic inventory.-----**\$20-30K**

Note: At the meeting it was suggested that surveying complete habitats could combine the inventory of multiple species, for example, cliff habitats could include species such as: Peregrine Falcons, bats, Allegheny Woodrats, and Rattle Snakes. Or a survey of mine portals could combine the inventory of bat species, Woodrats and Cave Salamanders. Wetland maps were deemed important to the plant group; amphibian work in each park has created wetland maps.

Other species suggested to consider for Monitoring:

Fungi
 Crayfish
 Mussels
 Lichens
 Bryophytes
 Odonates
 Butterflies

Voucher Information

Below is a list of the Museums and collections contacted so far for voucher specimen information. This data is currently being entered into NPSpecies.

NERI

Carnegie Museum of Natural History
 American Museum of Natural History
 Cornell University
 Marshall University Herbarium
 Florida Museum of Natural History
 University of Kansas Museum of Natural History
 University of Michigan Museum of Zoology
 University of Pennsylvania Morris Arboretum
 West Virginia University Herbarium

GARI

Cleveland Museum of Natural History
 Cornell University
 University of Kansas Museum of Natural History
 University of Michigan Museum of Zoology
 West Virginia University Herbarium

BLUE

Carnegie Museum of Natural History
American Museum of Natural History
Cornell University
University of Kansas Museum of Natural History
West Virginia University Herbarium

Other Sources to check for voucher specimens:

Concord University (bird, plant and mammal specimens)
Marshall University holds the state Herp collection (Dr. Pauley's work).
Marshall University Fish and Mammal collections.

List of NERI Scoping Workshop Participants:

Name	Address	Affiliation	E-mail	Phone #	Expertise
Sam Norris	PO Box 115 Norton, WV 26259	DNR Natural Heritage Program	snorris@dnr.state.wv.us	304-338-4518	Vascular plants
Dr. Jim Anderson	West Virginia University Division of Forestry PO Box 6125 Morgantown, WV 26506		jander25@wvu.edu	304-293-2941x2445	Herps and Birds
Dr. Bill Grafton	West Virginia University Agriculture and Natural Resources 311-B Percival Hall PO Box 6125 Morgantown, WV 26506-6125	West Virginia University Extension Specialist- Wildlife Associate Professor	wgrafton@wvu.edu	304-293-4797x2493 Fax: 304-293-2441	Botanist
Stuart Welsh	West Virginia University 313 Percival Hall PO Box 6125 Morgantown, WV 26506-6125	West Virginia Cooperative Fish and Wildlife Research Unit, USGS, BRD	swelsh@wvu.edu	304-293-2941x2419 Fax: 304-293-2441	Fisheries
Scott Klopfer	CMI 203 West Roanoke Street Blacksburg, VA 24061		sklpofer@vt.edu	540-231-7348	GIS, database, Vegetation mapping
Jesse Purvis	NPS PO Box 246 Glen Jean, WV 25846	National Park Service Fisheries Biologist	jesse_purvis@nps.gov	304-465-6513	Aquatics
Gary Hartley	NPS PO Box 246 Glen Jean, WV 25846	National Park Service Chief Natural Resource Manager	gary_hartley@nps.gov	304-465-0508x218	
Jim Vanderhorst	PO Box 67 Elkins, WV 26241	DNR Natural Heritage Program	vanderhorstj@dnr.state.wv.us	304-338-4518	Plant Communities
Doug Chambers	11 Dunbar Street	USGS Water Resources	dbchambe@usgs.gov	304-347-5130	Biologist

	Charleston, WV 25301	Division West Virginia District		Fax:304-347- 5133	
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Scoping Workshop Participants cont.

Name	Address	Affiliation	E-mail	Phone #	Expertise
Donna Mitchell	PO Box 67 Elkins, WV 26241	WV DNR	dmitchell@dnr.state.wv.us	304-637-0245	Birds, Fungi
Brian McDonald	PO Box 67 Elkins, WV 26241	WVDNR-Nongame Wildlife Natural Heritage Program	Bmcdonald@dnr.state.wv.us	304-637-0245	Plants
Dr. Mark Watson	55 Ford Street Salem, WV 26426	Marshall University Research Biologist	mbwatson@citynet.net	304-782-2918 Fax: 304-782-2918	Herps
Jeff Hajenga	2006 Robert C, Byrd Drive Beckley, WV	WVDNR-Nongame Wildlife Natural Heritage Program	hajenj@mail.wvnet.edu	364-256-6947	Mammals, Herps
Dr. Petra Wood	PO Box 6125 West Virginia University Morgantown, WV 26506-6125	WV University Coop Unit USGS	pbwood@wvu.edu	304-293-3794x2433	Birds, Herps, Mammals
Dr. Ron Canterbury	Dept. of Biology Concord College Athens, WV 24712	Concord College	canterburyr@concord.edu	304-384-5214	Birds, Herps, Mammals
Ken Stephens	NPS PO Box 246 Glen Jean, WV 25846	National Park Service Chief of Resource Management	Ken_stephens@nps.gov	304-465-6531	
Jennifer Wykle	PO Box 67 Ward Road Elkins, WV 26241	WV DNR	jwykle@dnr.state.wv.us	304-637-0245	Zoologist

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

Appendix B

*Scoping Workshop Report - Delaware Water Gap NRA and
Upper Delaware SSR*

Scoping Workshop Report
Delaware Water Gap NRA and Upper Delaware SSR
October 24th and 25th, 2000

The National Park Service's primary mission is to conserve the natural and cultural resources and values of the national park system. In order to address this issue, Congress passed the National Parks Omnibus Management Act in 1998 in recognition of the need to manage parks by mandating 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". Efforts had already been coordinated to compile and organize all existing data and create 12 basic data sets for 265 parks recognized as having significant natural resources. These 12 data sets include basic information on air and water quality; base cartography; weather; geology, soil and vegetation maps; a natural resource bibliography; and data on the occurrence, distribution, and relative abundance of vertebrate and vascular plant species in the parks. When the Park Service began evaluating their existing natural resource information, it became evident that many parks were lacking in basic, credible, scientific data about the nature and condition of these resources in their parks. In response to this lack of information, Congress now funds the Servicewide Inventory and Monitoring Program (I&M) of the National Park Service.

The basic goals of the I&M Program is to compile and organize existing data for all parks and then fill data gaps through targeted field investigations. Once this is complete, long-term monitoring programs can be established in order to document change in each park's natural resources. This will help to provide park managers with the groundwork to be able to formulate effective management strategies.

To attain the basic goal of the NPS I&M Program, biological inventories will be designed to meet three basic objectives:

- ◆ To document through existing, verifiable data and targeted field investigations the occurrence of at least 90 percent of the species of vertebrates and vascular plants currently estimated to occur in the park.
- ◆ To describe the distribution and relative abundance of species of special concern such as Threatened and Endangered species, exotic, and other species of special management interest occurring within park boundaries.
- ◆ To provide the baseline information needed to develop a general monitoring strategy and design that can be implemented by parks once inventories have been completed, tailored to specific park threats and resources issues. (*Guidelines for Biological Inventories*, WASO 1999)

In order to complete these three basic goals in a cost efficient manner, the I&M Program is funding efforts involving 32 cooperative groups of parks. This does not mean that funding is not available to individual parks if better results can be obtained, but it is a way to minimize duplication of effort. Parks with common resource issues and within similar biogeographic areas, have been grouped together to form networks. Parks within these networks are to work jointly in obtaining efficiency and quality in the collection of inventory data, and in developing and implementing strategies for long term monitoring programs.

One of the networks established by the I&M Program, is the Eastern Rivers and Mountains Network. It includes nine parks covering four states, New Jersey, New York, Pennsylvania, and West Virginia (Table 1). Although the rationale behind the establishment of the network system was to ensure economy of effort and quality assurance, in some cases, such as with the Rivers and Mountains Network, broad differences in inventory needs exist. In some parks, park-specific inventories have been ongoing for years and in other cases parks are newly established, with little or no inventory work complete.

Part of the I&M strategy is to hold scoping workshops in order to bring together local taxa experts, agencies familiar with the parks, and park representatives, to:

1. Review existing inventory data for vertebrate and vascular plant species in the network parks.
2. Identify gaps in presence/absence data for vertebrate and vascular plant species existing within the network.
3. Prioritize baseline inventories for the network.
4. Articulate rationale for the prioritization of these inventories.
5. Develop sampling schemes and cost estimates for network-wide inventories.

Because the Eastern Rivers and Mountains Network covers such a vast area, across four states, it was decided that separate scoping workshops would be 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.

On the 24th and 25th of October an I&M Scoping Workshop was held for the Upper Delaware SRR (UPDE) and the Delaware Water Gap NRA (DEWA). The meeting was held at DEWA in Pennsylvania.

Identifying Park Inventory Needs

The process for identifying inventory needs began prior to the workshop. Preparation for the workshop was critical. A week before the meeting the documents listed below were e-mailed as well as sent via ground mail to each person invited:

- **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.
- **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.
- **Voucher information.** Lists of museums and herbaria known to house specimens collected from the parks.
- **Park Bibliographies.** Information retrieved from the Servicewide natural resources bibliographic database.
- **A list of Key Resource Issues.**
- **A list of Habitats of Management Interest.**

Discussions with the attending taxa specialists and resource managers during the workshop focused on reviewing and refining inventory needs. Participants of the DEWA/UPDE workshop were divided into workgroups each day, birds and plants on the first day and mammals and fish on the second. 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 – Delaware River, 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

- Delaware River main stem: key resource for both parks (fish and plants);

- “Generic Terrestrial Habitat”: the hardwood forest that makes up 70% of DEWA land mass (all taxa except fish);
- Wetlands (all taxa);
- Riparian corridors(all taxa except fish);
- Managed Open Space, defined here as current and abandoned farm fields, managed at DEWA to maintain a mosaic of old field succession (all taxa except fish);
- Hemlock Forest (plants, birds and mammals); key scenic, recreational, and "biodiversity" resource;
- River Tributaries (fish and plants);
- Impoundment's / Ponds: includes old farm ponds as well as natural vernal ponds. (all taxa)
- Rare Plant Communities: small areas that support rare species and/or diverse plant communities. River shore outcrops, seeps, calcareous fens, shale cliffs and talus (all taxa except fish).

The goal for the two day workshop was to have developed “Inventory Plans” for fish, vascular plants, birds, and mammals for DEWA and UPDE. In order to guide each workgroups in developing such plans, a 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.

NOTE: Since most of the UPDE River Corridor is private land, and inventorying vertebrate and vascular plants on private lands is not part of the NPS I&M Program, the focus for inventory work for UPDE will be 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 database, Data Set Catalog, Natural Resources Bibliography).

The following summaries are those plans developed by each workgroup; birds, mammals, plants and fish. Appendix A includes tables listing the workgroup members.

Summary of Workgroup Discussion: BIRDS

Participants: Al Ambler, Terry Masters, Bob Ross, Nate Rice, Larry Hillaire, Patrick Lynch, Don Hamilton, David Smith, Sara Stevens

1. Review of Existing Inventory Data

- Work by Terry Masters in hardwood forests of DEWA, due for publication in December.
- Collections to search:

Academy of Natural Sciences (Digital Database) Contact, Nate Rice
East Stroudsburg University
Carnegie Museum (Digital Database)

2. Identifying the Gaps

The group first developed a list of habitat types existing within the parks, they included:

1. Managed Open Space
2. Hemlock Forest
3. River Bottom Forest (Floodplain)
4. Riverine (Main stem)
5. Beaver Impoundments
6. Cobble Shoreline
7. Shale Cliffs, Talus Cliffs
8. Upland Forest (Hemlock and Hardwood)
9. Kittattiany Ridge
10. Tributaries

The group then created a general species list for each habitat type (*note some habitat types were grouped together) (Table 1.)

Table 1. Habitats and Associated Avian Species for the Delaware Water Gap NRA

<p>Grasslands (Managed Open Space)</p> <ul style="list-style-type: none"> ▪ Northern Harrier ▪ Horned Lark ▪ Whip-poor-will ▪ Nighthawks ▪ Bobolink ▪ Henslow’s Sparrow ▪ Savannah Sparrow ▪ Vesper Sparrow ▪ Grasshopper Sparrow ▪ Bobwhite ▪ Short-Eared Owl ▪ Sedge Wren ▪ Rough-Legged Hawk 	<p><u>Hemlock Forests/Tributaries</u></p> <ul style="list-style-type: none"> ▪ Blackburnian Warbler ▪ Black Throated Green Warbler ▪ Blueheaded Vireo ▪ Winter Wren ▪ Magnolia Warbler ▪ Acadian Flycatcher ▪ Louisiana Warbler ▪ Long-Eared Owl ▪ Hermit Thrush ▪ Veery Barred Owl 	<p>River Bottom Forest (Riparian)</p> <ul style="list-style-type: none"> ▪ Common Merganser ▪ Wood Duck ▪ Warbling Vireo ▪ Yellowthroated Vireo ▪ Osprey ▪ Bald Eagle ▪ Bank Swallow ▪ Yellow Throated Warbler ▪ Spotted Sandpiper ▪ Shorebirds ▪ Migratory Waterfowl
<p><u>Wetlands (Beaver Impoundments included)</u></p> <ul style="list-style-type: none"> ▪ Heron Rookeries ▪ Rails (Historic Reports)(Virginia Rail) ▪ Prothonatary Warbler ▪ Green Winged Teal ▪ Hooded Merganser ▪ Pied-Billed Grebe ▪ Snowy Egret ▪ Black-Crowned night Heron ▪ Little Blue Heron ▪ Great Blue Heron ▪ Green Heron ▪ Marsh Wren ▪ Red-Headed Woodpecker ▪ Swamp Sparrow ▪ Canada Warbler ▪ Mallard ▪ Nashville Warbler (In bogs only) 	<p>Cliffs (Shale and Talus)</p> <ul style="list-style-type: none"> ▪ Worm-Eating Warbler ▪ Raven ▪ Golden-Winged Warbler (Also found in scrub-shrub habitat) ▪ Turkey Vulture ▪ Black Vulture 	<p><u>Upland Forest</u></p> <ul style="list-style-type: none"> ▪ Cerulean Warbler ▪ Great Crested Flycatcher* ▪ Black and White Warbler* ▪ Wood Thrush* ▪ Scarlet Tanager* <p>(*Note-Dr. Terry Masters has collected data on these species and has seen a decline in the last 5 years, this information is due for publication sometime in December, 2000)</p>

3. Prioritizing Baseline Inventories and 4. Rational for prioritization

After creating this generalized species list for each habitat type, the group identified four of the most important habitats and prioritized them. They were prioritized as follows:

1. Grasslands
2. Wetlands
3. Hardwood Forest (some information already exists for these areas in DEWA)*
4. Hemlock Forest (some information already exists for these areas in DEWA)*

(*The DEWA and UPDE upland forest is the largest block of forest between the Adirondacks and the South and is a very important area for non-breeding Neotropical migrants. These forests were not identified as first and second priority for inventory simply because there has been some work done in these habitats on birds, versus very little work done in Open Space and Wetland areas.

5. General sampling strategies

Open Space/Grassland Birds (Cost estimate=32K)

Possible Protocols to follow could come from the Pennsylvania Game Commission Protocol for sampling Grassland Birds

Point Count Surveys

- Select features from GIS-2 main classifications would be Grasslands and Farmland
- Identify various successional stages of grassland
- Categorize field size (i.e. small, medium, large)
 - Another possible scenario for selecting survey sites would be to create categories of grassland by acreage and then randomly select the areas to sample.
- Establish points at each site 1 point=250-m radius Each site would have as many points put into that area as possible.
- Actual Point Counts (Two person crew)
- Passerines sampled for three weeks, beginning in June
- 10 minute counts at each point + an average of 20 minutes to next point = 30 minutes/point = 10 points/person/day.

Costs involved:

- Labor (student interns \$8-\$10/hour)
- Per diem rate \$80/day

Wetland Birds (Cost estimate=71.5K ~160 sites)

Secretive Wetland Birds (Rails/Bitterns)

Call-back Surveys

- to be sampled after midnight and/or at dusk in June
- 15 minute tape (tape includes 6 species)

Wetland Passerines

Point Counts

- 2 points/site

Costs involved:

- 45K labor
- 10K report writing
- 5.5K 10% for GIS input
- 11K 20% overhead

Summary of Workgroup Discussion: MAMMALS

Participants: Jim Hart, Carolyn Mahan, Jeffrey Shreiner, Larry Hillaire, Tony Davis, Al Hicks, Dave Smith, Jill Dodds, Neal Woodman, Patrick Lynch, Sara Stevens

Review of Existing Inventory Data and Identifying the Gaps

The workgroup began by reviewing the DEWA T&E mammal list provided to participants prior to the workshop. This list consists of those species that possibly could occur in the park, but have not yet been documented.

▪ N.E. Cottontail	▪ Indiana Bat
▪ Southern Bog Lemming	▪ Silver-haired Bat
▪ Ermine	▪ Small-footed Bat
▪ Northern Flying Squirrel	▪ Least Shrew
▪ Long-tailed Shrew	▪ River Otter
▪ Hairy-tailed Mole	▪ Fisher
▪ Northern Water Shrew	▪ Deer
▪ Woodland Jumping Mouse	▪ Deer mouse

The group also created a list of species of special concern for the parks.

- Bobcat
- N.E. Cottontail
- Snowshoe Hare
- River Otter (Study already complete)
- Pygmy Shrew
- Northern Myotis

Prioritizing Baseline Inventories

The group then identified important habitat types found at DEWA and those species associated with that habitat.

Managed Open Space

- Least Shrew

Early Successional Forest

- N.E. Cottontail

Riparian Areas/Wetlands

- Ermine
- Rock Vole
- Rock Shrew
- Southern Bog Lemming

- (Northern Water Shrew)
- (Woodland Jumping Mouse)

Talus Slopes

- Long-tailed Shrew
- Rock Vole
- Rock Shrew
- (Allegheny Wood Rat)

Hemlock Forest

- Northern Flying Squirrel

Woodlands

- Hairy Tailed Mole

Bats (found in a variety of habitats)

- Indiana Bat
- Silver-haired Bat
- Small-footed Bat
- (Hoary Bat)

Prioritization of Habitats by the group

1. Riparian (Hemlock tributaries)
2. Talus Slopes (Small-footed Bat)
3. Early Successional Forest

Sampling strategies and Cost Estimates

Trapping Methods identified for Riparian Species (Hemlock Forest)

- Ermine (Track plates, Conibear traps)
- Rock Vole (Snap traps)
- Rock Shrew (Snap traps and/or Live traps)
- Southern Bog Lemming (seeps and bogs) (Snap traps and/or Live traps)
- Flying Squirrels (Live traps)
- Northern Water Shrew (Snap traps/pitfalls)
- Woodland Jumping Mouse (Snap traps and/or Live traps)

Mammal Inventory - Hemlock and Hardwood Forests (Cost estimate=40-50K)

- Identify two pair of Hemlock Forest and Hardwood Forest Sites (size category = > 5 hectares) on both the NJ side and the PA side of the river. (Hemlock stands were identified by Carolyn Mahan in '93 and '94, sites could be chosen based on her work, all are now in a GIS coverage)
- Trap stations: 20 stations, 25-m apart, 5 traps/station

- 4 snap traps
- 1 pitfall
- 2 tomahawk traps
- 1 nest box every 50 m
- Thirty days = establishing stations/trapping the 8 sites for 5 nights each
- Approximately \$500/day for labor
- Total costs for 8 sites = approximately 40-50K (this includes GIS products, specimen prep., and overhead)

Mammal Inventory - Talus Slopes (Cost estimate=?K)

Species of Concern

- Long-tailed Shrew
- Rock Shrew
- Rock Vole
- Allegheny Woodrat

Step 1-Identify Sites (Talus slopes have been mapped for PA)

- Four Site-2 in NJ/2 in PA

Step 2 -Trapping Method

- Establish 25 trap stations/site – 4 traps/station
 Mouse traps (Not museum specials)
 Presence of Woodrats would be identified by evidence)
- Trap 5 days/site

Rabbit Inventory (Inventory for N.E. Cottontail and Snowshoe Hare) (Cost estimate=?K)

It was suggested that if during rabbit season at DEWA, hunters were to leave the heads of those rabbits taken in the park, that it would be an easy way to get presence/absence information on rabbit species as well as some abundance info.

Cost would involve:

- Setup-Project education and requirements for hunters.
- Materials to give to hunters, such as bags for disposal/deposit.
- A freezer or freezers for deposits.
- Specimen preparation and identification.

Summary of Workgroup Discussion: VASCULAR PLANTS

Participants: Ann Rhoads, John Kunsman, Tony Davis, Bill Olsen, Jill Dodds, Ernie Schuyler, Jeff Shreiner, Rob Brooks, Rich Evans, Mike Reuber, Tim Smith, David Smith, Elizabeth Johnson

Goals for the workgroup:

1. Review existing Inventory Data
2. Identify Data Gaps
3. Prioritize baseline inventories
4. Articulate rationale for prioritization
5. Describe how species will be sampled
6. Describe time needed for this inventory process
7. Develop cost estimates

Review of Existing Data

Have 90% been documented? While it is difficult to know when 100% of the species have been documented, experts felt that we have documented at least 90%. The majority of records are from 1980-2000.

All agreed that a plant communities/vegetation map is needed to develop a sampling strategy for rare communities if the object is to get park wide distribution. Mapping of exemplary communities and mapping of all communities is important. Sampling can be stratified based on important habitats (management interest, species presence, etc), existing vegetation map, aquatic plant inventory. Sampling grids can have unequal allocation to large blocks and smaller habitats.

Additions to existing data:

Annotated Checklist and Atlas, Ann Rhoads (late 1992)

- have added increments of data
- spatial data from Morris Arboretum database are mapped to nearest named place and referenced to vouchers
- comments from Rhoads and Schuyler on separating distribution and abundance sampling and data management

Forest Inventory and Analysis plot system:

- 6 plots (hexagons) in DEWA more are planned
- based on nationwide grid system (8-10 plots)
- USFS plans to add the 28 hemlock/hardwood plots
- revision of coarse grid system possible, subdivide hexagons?
- Comment: grids work well for large similar types and do not work well for rare or linear features. Use generic grid sampling for large blocks (eastern forest, for example)

Voucher Specimen locations

- Brooklyn Botanical Garden – NJ

- Atlas for PA
- Academy of Natural Science, Muhlenberg College, Rutgers University, all campuses, Penn State, PA Natural Diversity Inventory. Morris Arboretum (specimens before 1993 are in the Atlas, UPDE collections were made after 1993), Cleveland Museum, NY Botanical Garden, Carnegie, State Museum in Harrisburg

Note: There may be NJ and NY locations to add to this list

Collection of vouchers

- Do NOT collect common species
- Use judgement for T&E species, collect part of the plant

Identify Vascular Plant Data Gaps

Data Gaps for Specific Habitats:

Delaware River

What are the patterns of biodiversity in the main stem? What data is available?

Aquatic Plants includes: submerged and floating not strand

- (Kunsmann work) no scientific sampling strategy. Used DRBC maps to guess location.
- Justification for sampling aquatic plants: They are a bioassay tool, they accumulate metals, root to shoot ratios can indicate environmental health (Schuyler) Also, and aquatic plants are in a priority area for both parks.

Sampling strategy:

- Map Delaware River UPDE and DEWA (available)
- Identify important features (backwater, pools, riffles, runs, islands, bedrock geology, tributary streams)
- Assemble existing spatial data
- Assemble existing plant data (PA Natural Heritage (Kunsmann's work), Morris Arboretum (Rhoads' work), PA Fish and Boat Commission (Belleville, PA))
- Identify data gaps for targeted field investigation/ develop sense of species and habitat relationships
- One suggestion to map habitats, assemble existing data by habitat then predict species distribution

Products:

- spatial data layers of important features
- relational database of plants, communities and attributes
- summary of expected species by habitat or feature (predictive GIS map)
- validation phase/error rate (RICH TO WRITE UP)

COSTS:

- \$20-25k to prepare maps and database
- \$20-25 to validate

Terrestrial Habitat

Important features: soils, slope, aspect, bedrock geology, elevation terrain shape, disturbance history/age (1939 photos), deer browse/intensity (monitoring question), invasive, plant pests.

Existing data:

- GIS themes
- 1981 veg cover : 3-4 dominant species/stand data
- 14 hardwood plots: overstory species composition, age
- 3-6 Forest Inventory and Analysis Forest Health Monitoring Plots: forest composition, C-cycle, N-cycle monitoring, compare stand level data with physical features and analyze 6-12 forest types, inventory to target forest types, exotics, understory/herbaceous layer, browse intensity.

Products:

- distribution and relative abundance for understory (there are TNC crosswalks to SAF data for veg map)

Wetlands

Important features: canopy closure, hydrology, seasonality, soils, natural vs. artificial, bedrock geology, topography

Existing data:

- 1981 vegetation map,
- wetlands map (modified Cowardin classification to less than 1 acre (Mark Hurd maps)
- water bodies GIS layer
- herp study and vernal pond points
- 7 sites (Brooks) plant list
- emergent “bog turtle” wetlands
- impoundment wetlands
- rare species inventories
- quantitative community plots data (Arnott Fen, Delaware River shore seeps)
- USGS vernal ponds: plan to use GIS layers to group “types” and sample 200

Data gaps

- Less than one acre wetlands

Products from filling gaps

- GIS analysis for gaps to target field survey, 2-3 visits (\$15-20K)
- Sampling approach: Nested plots, seasonal aspect, quantitative data
- Choose quantitative sampling method, e.g. TNC veg mapping protocol, PSU wetlands/veg protocol (100 plots = \$25K)

Hemlock Forest

Use methods/protocols developed for hardwood forest

Sampling design for hemlocks is adequate.

14 hemlock sites exist

basic plant data for Louisiana Water Thrush studies exists
Nested plots used for woody species and sampling understory

Riparian Corridor

Coordinate with River, wetlands, impoundments and open space work

Habitat Description (existing information):

- islands (location)
- emergent habitat
- strand, floodplain (100 year)
- 50 streams (location/GIS)
- 120 miles of river (GIS)
- Riverbank seeps (some rare plant work NJ, 1 PA site, UPDE (Rhoads))
- scour areas (rare species work)
- oxbows, old river channels

Issues and Features:

- Distribution of Invasive plants (unknown)
- Bedrock geology (GIS layer)
- Stream size and order (GIS layer)
- Slope/stream discharge gradient

Targeted Field investigations for Invasives in Riparian Corridor

Stratify based on topographic maps, aerial photos, gradient, stream order

Sample Methods

- belt transect/line intercept parallel to shore
- island heads to tails
- plots along belt
- 50 transects per day
- Sample 2x per year
- \$100K

- Variables:
- plants (TNC classification)
 - Substrate (cobble, sand alluvium)
 - Infer hydroperiod (height above water)
 - Stream channel width
 - Discharge
 - Wrack line

Products:

- GIS data layer

Managed Open Space (7500 acres)

Important features that influence plants (existing information):

- Distribution of Open Space (GIS map of cropland, mowed fields, burned areas, “abandoned farmland”)
- Soils (GIS Map)

- Historic Use: Plow evidence, soil profile, tiles, drains (1939 air photos, geo-referenced, showing open space at that time)
- Soils profile to develop history (no existing information)
- Glacial features: sand dunes
- Wet areas (wetlands map)
- Upland dry: cedar, pine
- Vegetation present: asters, goldenrod vs. brome grass

Group felt this was low priority relative to other habitats

Rare Plant Communities

Community locations (small, hard to detect in riparian belt transects)

- River scour
- Riverbank Seeps
- Calcareous Fens
- Shale Barrens
- Waterfalls
- Partial peat bogs (Kunsman description)
- Talus slope
- Acidic rocky summit?
- Calcareous upland forest

Data gaps:

- Update element occurrence records for species listed since work was done in the early 80s - state lists have changed since that time
- Riverbank seeps and river scours may be complete

Methods:

- Revisit know sites (estimate 60)
- Gather quantitative data on invasives in these areas
- Use GIS data layers (bedrock geology, slope, topography, DEMs, wetlands) to predict additional occurrence of communities (calcareous upland forest, shale barrens, talus slopes, calcareous fens)
- Analyze new potential rare species (PNDI and NJ)

Costs:

- Visit sites 2 times
- 30-40K

At the end of the session, participants set priorities for vascular plant inventories based on the day's discussion. Sampling invasive species in the Riparian Corridor was deemed the highest priority.

HABITAT	Number of votes
Delaware River	1
Terrestrial	1
Wetlands	3
Riparian Corridor (invasives)	8
Hemlock	0
Rare Plants	3

- Rhoads work to look for T&E species is old (early 80s) new species of concern have been listed to date and herbaria were not searched for these additional species.
- Sphagnum species are listed in NJ, proposed in PA no search has been accomplished

Summary of Workgroup Discussion: FISH

Participants: Don Hamilton, Rich Evans, Dave Arnold, Jay Stauffer, Tim Stetko, Bob Ross, David Smith (statistician), Allan Ambler, Colleen Hara, Elizabeth Johnson,

1. Review of existing Inventory Data

Has there been documentation of at least 90% of the existing species?

- Delaware River: well documented
- PA Fish and Boat Commission working on IBI for streams (Rick Spears)
- PAFBC focus on game fish
- 1st and 2nd order streams sampled by Ross
- NY and NJ not present to comment

It is very difficult to determine when 90% has been reached since new introductions occur regularly. There is a big problem with incidental introductions of new species from bait bucket dumping.

What is the age limit for “current” data?

PA standard for fish data:

Widespread/common species:

- 20 year old data is ok (common species probably still present),
- 30 year old data is outdated

For T&E species (PA and NJ list was provided) and these candidates -mud minnow(*Umbra pygmea*), white catfish (*Ameiurus catus*), Slimy sculpin (latin name??may be significant in river habitats), swamp darter (*Etheostoma fusiforma*)

- 10-year-old data is outdated. Exceptions in PA: sheild darter and brook trout in PA are common so year old data is ok

2. Identifying the Gaps?

We have entered into a cooperative agreement with Penn State (Dr. Jay Stauffer) to locate fish vouchers for Northeast Parks and put data into the *NPSpecies* vouchers database. This information can identify temporal gaps, geographic gaps and sampling method gaps using Dr. Stauffer’s spatial database that is under development.

Project Title: “Identify Existing Fish Collections in the Vicinity of Northeast Region I&M Parks”

Background: Stauffer has 1.25 million fish catalogued from Cooper’s Fish of PA, Fish of WV, and 200,000 from MD, NY and VA. Data up to 1996 is in electronic format with lat/long, collector, identification, and descriptions. A detailed stream map of PA has been used to locate specimens by stream. Fish from 1995 to present are sorted, identified and catalogued. These records will be entered into the electronic database on a cost share basis with PENNDOT. Once in the database, maps can be produced that show distribution of species, sampling locations based on vouchers data (species, sampling date, collector, etc.)

Expected Products:

1. Electronic database for fish vouchers in *NPSpecies* format
2. Species distributions and sample location maps based on lat/long values from Northeast parks (obtained from www.nature.nps.gov/gis or Bill Slocum at NCState University)
3. Locate parks in Virginia (based on Slocum data) and document species occurrence in those parks based on Jenkins “Fishes of VA”. Put data in *NPSpecies* format.
4. Locate NY State and other Northeast parks and document species occurrence in parks based on Edward Rainey’s data in Cornell collection.
5. For DEWA and MORR, use Rudy Yarn’s Fish of NJ to document species occurrence
6. For ASIS, evaluate data for Fishes of MD based on Ph.D. student work
7. Search other collections including Academy of Natural Science, Smithsonian and University of Missouri for vouchers for Northeast parks. Provide data in *NPSpecies* format.

3. Priority Baseline Inventories, Sampling Methods and Cost Estimates

Low lying swamps, wetlands, natural ponds and impoundments

There are possibly 3-4 species within these habitat types that need “pristine” sites.

Methods discussed:

Use available GIS theme for water bodies

1. Use a double sample stratification method.

- Select all wetlands (except vernal pools that dry up or large stocked ponds Stuckeys, Hidden Lake, Egypt Mills, Farda, PEEC ponds (2), Loch Lomond, Whitsell) for rapid assessment (200 sites) and qualify fish habitat as “suitable” or “unsuitable”; then,
- sample a proportion of “suitable” sites.

2. Use a sample site selection with good spatial coverage from north to south.

- List sites stratified by size and terrain (elevation, gradient) and type
 - Terrain: low gradient = possibly natural High gradient = possibly disturbed
 - Size: large = fish probably present, small = fishless
 - Type: disturbance

- Prioritize : natural, undisturbed are highest priority

- Select equally from each strata and sample disproportionately (sample more small, low lying ponds)

3. Sample Stratification for wetland, pond and impoundment rapid habitat assessment:

- Size (small, medium, large)
- “Pristine” criteria: water quality, exotics, isolation, low pH, based on plants present)
- Cover types: wetland open water, wetland forested, wetland modified, wetland herb/shrub

stratify by cover types; then, stratify by size (sample unequally to get all sizes), stratify to get good spatial coverage (order north to south)

select large number of sites for rapid assessment (determine pristine or not pristine – presence of introduced species = not pristine)

sample “many” of pristine sites (must determine how much sampling define “many”)

Costs:

- rapid assessment \$ 8400 (200 sites, 2 crews of 2, 2 weeks)
- Sampling 100 sites \$20,000
- GIS data mgt. \$10,000
- Analysis/Reporting \$10,000
- Overhead (15%)

Back Channel Sloughs

In the Delaware River these are low gradient, low velocity areas. All of these sites should be sampled for rare species.

UPDE locations (10):

PA Side:

- just below confluence
- ¼ mile south of Buckingham PAFBC Access
- Frisbie Island lower end
- ½ mile above Hankins opposite Long Eddy Rd
- slough above Big Island
- ¼ mile above Milanville opposite Smith Switch
- ¼ mile above Narrowsburg
- slough above Hawks nest

NY Side:

- Reed Island
- Big Island slough south of Calicoon

DEWA locations (13):

Mashipacong, Namanock, Minisink Island, Raymondskill, VanCampens, Bushkill mouth, Hornbecks, 209 old river channel, Poxono Island, Brodhead, Cherry, Sand Hill Creek

Methods:

- Backpack shocker
- Seining
- Tow boat shocker

Costs:

- \$2000/day with volunteers, 3 sites per day
- Total: \$14,000 plus overhead

Appendix Scoping Workshop Participant List

Bird Workgroup

Dr. Terry Master East Stroudsburg Univ. 129 Moore Biology Hall 200 Prospect St. East Stroudsburg, PA 18301-2999 (570) 422-3709 tmaster@esu.edu	Dr. David Smith USGS-BRD Aquatic Ecology Laboratory 1700 Leetown Rd. Kearneysville, WV 25430 (304) 724-4467 David_R_Smith@nbs.gov	Dr. Robert Ross -USGS Northern Appalachian Research Lab R. D. #4 Box 63 Wellsboro, Pennsylvania 16901 Tel: 570-724-3322x239 email: rossr@usgs.gov
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Don Hamilton UPDE	Larry Hillaire DEWA	Al Amblers DEWA

Plant Workgroup

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Jill Dodds	Dr. Ernie Schuyler	Greg Podniesinski
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401-874-7060 Beth_Johnson@nps.gov	(304) 724-4467 David_R_Smith@nbs.gov	
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Mammal Workgroup

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Fish Workgroup

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Richard Evans DEWA	Don Hamilton UPDE	Patrick Lynch DEWA
Chris Urban	Allan Ambler DEWA	Jamie Meyers UPDE

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

Appendix C

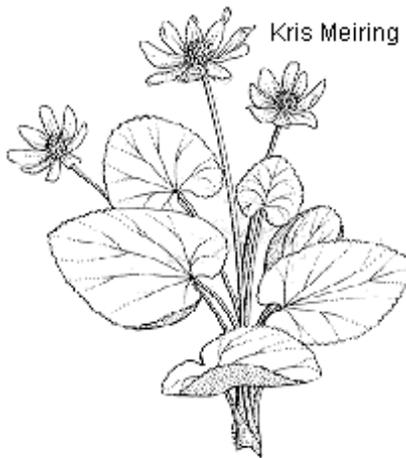
Northeast Region Product Specifications



The National Park Service

Northeast Region I&M Program

Product Specifications



Caltha leptosepala

Introduction

The National Park Service (NPS) Inventory and Monitoring (I&M) Program is in the initial stages of developing Product Specifications. The current specifications may change as the program develops, and especially as data management programs evolve. This document was written to provide cooperators/contractors with a straightforward list of deliverables that are required at the completion of each biological inventory project. If any inconsistencies or errors are detected, please contact Sara Stevens at 401-874-2930 or sara@edc.uri.edu.

Cooperators and contractors are to provide the following deliverables (specifications are described in this document and in greater detail at <http://www.nature.nps.gov/im/apps/specs/>):

1. Species Data

Raw Data

Copies of all raw data, such as hand written field forms (if used), must be provided if requested. Do not destroy any forms without first contacting Sara Stevens for permission.

Species Inventory Database

All inventory data must be provided in an MS Access database. Database templates are being developed for inventory and monitoring data. Available templates and a data dictionary can be found at: <http://www1.nature.nps.gov/im/apps/template/>. If a template is available that is applicable to the protocol you are using, please use it. Dependent upon the individual project and data collected, cooperators can add additional fields.

Eventually, all data collected for the I&M Program will be linked to the NPS GIS Theme Manager so that parks can easily access maps showing species locations and data collected in their park. In order for databases to be linked to the NPS GIS Theme Manager, it is mandatory that your MS Access databases contain a Locations table, an Events table, and a Sampling Component table. Please see the mandatory tables and associated field requirements in the appendix (section I).

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. The data entry form is provided in the Appendix (Section IV).

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 which can be found at <http://www.fgdc.gov/metadata/metadata.html>. NPS data managers familiar with creating FGDC metadata will assist the cooperator with the development of metadata. Please fill out the metadata questionnaire in the Appendix (Section V) prior to contacting NPS staff for assistance.

4. Voucher Specimens

The I&M program has requested that vertebrates and vascular plants existing in parks be documented either through voucher specimens or scientific references. The Northeast Region I&M Program 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. See Section VI of the Appendix for guidance on vouchering.

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. See Section VII of the Appendix for report guidelines.

Final Reports

The final report must first be submitted digitally as draft in MS Word, and as paper copy if requested, 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 must be submitted in digital and paper copy (if requested) 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. See Section VII of the Appendix for report guidelines. Cooperators are responsible for submitting all other required products with or prior to the final report.

APPENDIX

Section I	Mandatory Tables and Fields for Relational Database
Section II	Field Data Collection with Global Positioning Systems
Section III	Spatial Data format
Section IV	Dataset Catalog Entry Form (Complete for all Non Spatial Data)
Section V	FDGC Metadata Questionnaire (Complete for all Spatial Data)
Section VI	Voucher Specimen Collection
Section VII	Report Guidelines

Section I

Mandatory Tables and Fields for Relational Databases

The following three tables must be included in all species inventory databases submitted to the NPS I&M Program. The listed fields are mandatory because of relationships with other tables or for use with the GIS Theme Manager. Primary Keys are noted in bold type. For more information about the NPS database templates and relational database please visit the following website, <http://www1.nature.nps.gov/im/apps/template/>

Locations Table

ParkCode: Identify the 4-character NPS unit code. This code is necessary because many of the databases will be managed at the network level, and it is important to identify which data were collected in which parks.

Program: This is a 1-10 character code that describes which component of the overall inventory and monitoring program the data pertain to such as water quality monitoring, vegetation plots, bird monitoring, bat monitoring, soil erosion, etc. (e.g. VEGPLOT for vegetation plots, BVCP for bird VCP counts). There are no National Park Service standards or naming conventions for developing this code.

LocationID: This is a 1-50 character code that uniquely identifies a sampling location or sampling unit (e.g., a plot, transect, stream segment, or sampling station). To allow different parks and PIs to work independently, we recommend that the LocationID include the 4-character ParkCode, the Program code, and some combination of characters that, when combined, will uniquely identify the location. For example, ACAD_HERPS_ACC0001 could be the LocationID code for amphibian call count station #1 in Acadia NP and ACAD_VEGPL_0123 could be the LocationID code for vegetation plot number 123

Descript: This is a field that provides a brief description of the unique sampling location identified by the LocationID field (up to 200 characters in length).

StartUTMX: Identify the UTMX (easting) coordinate for the center of the plot OR the starting point of a line or polygon. The field should represent the data in the following manner: data type = number; field size = double (double precision floating point, 15 significant figures); decimal places = auto. Double precision to 15 significant digits should be maintained.

StartUTMY: Identify the UTM Y (northing) coordinate for the center of the plot OR the starting point of a line or polygon. The field should represent the data in the following manner: data type = number; field size = double (double precision floating point, 15 significant figures); decimal places = auto. Double precision to 15 significant digits should be maintained to allow millimeter accuracy.

StopUTMX: Identify the UTMX (easting) coordinate for the ending point of a line or polygon. The field should represent the data in the following manner: data type =

number; field size = double (double precision floating point, 15 significant figures); decimal places = auto.

StopUTMY: Identify the UTM Y (northing) coordinate for the ending point of a line or polygon. The field should represent the data in the following manner: data type = number; field size = double (double precision floating point, 15 significant figures); decimal places = auto.

UTMZone: Identify the UTM zone (zones 1-52). This information is required if coordinates are specified with the UTM grid coordinate system. UTMZone is defined as a Text field to accommodate data collected by PLUGR GPS units that record zone as 15T.

Datum: Identify the reference system used for defining the coordinates of points (i.e. North American Datum of 1983 (NAD83)).

EstHError (Estimated Horizontal Error): Calculate the “error buffer” associated with the x,y coordinates for the location. This value makes it possible with a GIS to show the uncertainty associated with a location, depending on how the coordinates for that location were obtained. Report error in meters (or some fraction of a meter if available). The required Federal reporting standard in the horizontal component is the radius of a circle of uncertainty, such that the true or theoretical location of the point falls within that circle 95% of the time.

Determining horizontal error from maps:

For maps on publication scales larger than 1:20,000, error, in inches, is calculated by multiplying the scale by 1/30, for maps on publication scales of 1:20,000 or smaller, the multiplier is 1/50.

Determining horizontal error from GPS data:

If using a Global Positioning System (GPS) to determine the spatial coordinates, accuracy varies and is dependent on a number of values (e.g., maximum PDOP and minimum number of satellites). For point data, when you export a file from Pathfinder Office (PFO), point features have an instantaneous attribute value for Vertical Precision, Horizontal Precision and Standard Deviation. Use the Standard Deviation to determine the value of Estimated Horizontal Error. For line and polygon data, accuracy cannot be clearly determined (according to Trimble), and we recommend that you enter the horizontal error for the starting point as an approximation of the positional error associated with the line.

Events Table

LocationID: See description under “Locations Table” above.

EventID: This code, in conjunction with the LocationID field, provides a unique identifier for the starting time of a particular sampling event. The duration of a sampling event may be minutes, hours, or days, depending on what is being sampled. We recommend a code that includes the Program code, the date in a format of YYYYMMDD for cases where only one sampling event can occur each day, or YYYYMMDDhhmm (24 hour clock) where a field crew may conduct many sampling events in the same day for a particular component. For example, a code of LBIRD_20000711_0730 might be entered for a 5-minute sampling period for land birds that began at 7:30 am on July 11, 2000.

Year: Identify the year the sampling occurred.

StartDate: Identify the date (YYYYMMDD) when sampling began.

EndDate: Identify the date (YYYYMMDD) when sampling ended.

Sampling Component Tables

LocationID: see description under “Locations Table” above.

EventID: see description under “Events Table” above.

Each component of an inventory and monitoring program (e.g., water quality monitoring, vegetation plots, bird monitoring, bat monitoring) will require one or more tables to store the data for that component. The table structure and fields in these tables will be determined by the sampling protocol. For example, a coastal park may have separate tables for land birds, shorebirds, marsh birds, and nest surveys because different sampling protocols are used and different types of data are collected for each component.

The LocationID and EventID fields should be included in each component’s table as foreign key fields. The primary key for a component table could either be a composite key that includes these two fields plus some identifier that makes each record unique, or it could be an autonumber or other record identifier that uniquely references each record in the table.

Section II

Field Data Collection with Global Positioning Systems Standard Operating Procedures and Guidelines

The purpose of this section is to complement the (Draft) Natural Resources Data and Information Handbook (NRDIH). This section addresses instrument settings, field operation and data processing for GPS data collection only. It does not address the important issues of database design, applicable scientific measurement protocols, data verification/validation, data documentation, data maintenance, archiving, security or distribution. Please consult the NRDIH for further information on those critical subjects.

Positional Data:

The National Map Accuracy Standard (NMAS) published by the USGS is the NPS *minimum* standard for map data accuracy. Typically a GPS will provide much better accuracy than NMAS if it is used carefully and with full attention to the parameters that the user can set or track. To achieve a reasonable and reliable level of accuracy with a GPS, please use the parameter settings described below. Please note that different GPS units use different names for these parameters or define them slightly differently. The discussion below tries to accommodate for these differences. For further discussion of the significance of these parameters and rationale for the recommended settings please see the NRDIH. If you have any questions please contact Tim Smith at Tim_Smith@nps.gov.

Definition of the Global Positioning System

GPS (Global Positioning System) is currently a constellation of 25 Department of Defense satellites that orbit the earth approximately every 12 hours, emitting signals to Earth at precisely the same time. The position and time information transmitted by these satellites is used by a GPS receiver to trilaterate a location on the earth using three or more satellites to determine a coordinate on earth.

The satellites broadcast on two carrier frequencies in the L-band of the electromagnetic spectrum. One is the "L1" or 1575.42MHz and the other is "L2" or 1227.6MHz. On these carrier frequencies are broadcast codes, much like a radio or television station broadcast information on their channels (frequencies). The satellites broadcast two codes, a military-only encrypted code (PPS) and a civil-access or Standard Positioning (SPS) code.

GPS Receivers

All commercial consumer GPS receivers are SPS (Standard Position Service) receivers. There are two basic types of SPS receivers, those that use the broadcasted code to do their positioning (code-phase) and those that do carrier phase measurements (carrier-phase). PPS (Precise Position Service) or P(Y)-Code (Rockwell PLGR and Trimble Centurion) receivers utilize the P(Y)-code broadcast on the L2 carrier frequency for positioning. This type of receiver is only available to the military and some government agencies.

GPS Positional Accuracy

Positional accuracy for autonomous, code-phase, resource grade or C/A-code receivers range from 100 meters to less than 2 meters. Accuracy for carrier-phase units (commonly referred to as geodetic receivers) can be measured in millimeters.

Accuracy is dependent on a number of factors. Several factors that can significantly impact data accuracy can be monitored in the field: the number of satellite vehicles, Positional Dilution of Precision (PDOP) and Estimated Horizontal Error (EHE). One should always acquire at least 4 satellites. This gives you a 3D position. More satellites are better than fewer. PDOP relates to satellite geometry at a given time and location. Keep the PDOP as low as possible (ideally, maximum PDOP=4) when collecting mapping data. Some receivers have the ability to stop collection of a position if the PDOP value rises too high. This is referred to as “PDOP masking”. Most receivers (but not all) give you a field estimate of horizontal error (EHE or EPE). With the Rockwell PLGR and Garmin GPS III Plus, the EHE (or EPE) has been shown to be a very good indicator of overall positional accuracy (most of the time your accuracy is going to be better than the EHE). In the field, EHE is not presently available on the Trimble GeoExplorer 3.

Positional accuracy for both C/A Code and Carrier types of receivers strongly depends on a process called differential correction. In order to achieve greater accuracy, the differential correction procedure is used to limit Selective Availability (controlled by the Department of Defence [DoD]) and Ionospheric/Tropospheric degradation of the satellite signals. Although DoD has now set Selective Availability degradation to zero, Ionospheric / Tropospheric degradation can add from 1 - 7 meters of error to your position. Therefore, differential corrections are required to improve accuracy, maintain positional integrity (confidence), and make a survey tie to a ground-based geodetic survey network.

Real-time differential corrections should be used whenever possible. This saves both time and money. Real-time differential corrections are available through the NDGPS/Coast Guard Beacon System, the WAAS (FAA) satellite based differential system, OmniStar, or a variety of paid private differential services.

Receiver Specific Recommended Settings:

Garmin and PLGR units:

1. *EHE*: less than or equal to 12 (this will keep you just within the NMAS for a 1:24,000 map, which is the maximum acceptable for GPS in the eastern parks).
2. *Minimum of 4 satellites (3D)* for every position.
3. *Position Type*: real-time differentially corrected position.

Trimble Units (GeoExplorers, Pathfinder Pros)

1. *PDOP*: less than or equal to 5 (we recommend starting with a PDOP maximum of 4 and shifting to 5 if data collection is not successful at 4; this will keep you around the NMAS for a 1:5,000 map).
2. *Minimum of 4 satellites (3D)* for every position.
3. *SNR*: less than or equal to 5.
4. *Elevation Mask*: 15.
5. *Antenna height*: be sure to check for correct antenna height setting. This setting should be the typical height at which the antenna will be carried. If the antenna is attached to a pole, it must be located above the user's head and the antenna height setting should be the height of the top of the pole. Wherever possible, the antenna should be clear of any obstructions.
6. *Position Type*: must be post-processed or real-time differentially corrected.

All GPS units:

1. Check the graphics data collection screen regularly to see if you are getting multi-path or other apparent distortions to the data.
2. Be aware of the possibility of multi-path interference and use offsets or other methods to keep the antenna away from building overhangs, tall fences or walls, and heavy canopy wherever possible.
3. ALWAYS do differential correction, either real-time or post processed
4. Feature settings:

Point

- *Trimble* - minimum of 5 positions, collected at 5 second interval and averaged.
- *All Others* – 90 to 120 positions, collected at 1-2 second interval and averaged.

Line/Polygon

- use a 3-5 second interval for walking, force (i.e. wait for) a position at each corner, and use a minimum of 3 positions to define any curve/change in direction.
- use a 3-5 second interval for road driving, depending on the road type and speed of the vehicle, force (i.e. wait for) positions at each corner and use a minimum of 3 positions to define any curve or change in direction.

Try to map all features in a single area in a single day or on consecutive days.

Attribute Data:

Data Dictionaries

Data dictionaries are designed to simply, efficiently, and without redundancy, describe features (landscape, biological, cultural, or historical). It organizes data into types or ‘themes’. It is an inefficient use of time and energy not to use a data dictionary. Set up a menu and picklists in a database and load them into the GPS unit or data collection device prior to going out into the field. Create and use a data dictionary whenever you anticipate collecting attribute data.

Data Conversion to GIS/Data Archiving

Always record the EHE/EPE or maximum PDOP (using 4 satellites) for a file to record in the metadata associated with the resulting GIS data. Without this information the GPS data are considered unreliable and may not be useable for spatial analysis and map production.

Section III

Spatial Data Guidelines

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.

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.

Regional Technical Support Center for the Philadelphia Support Office
Bill Slocumb
North Carolina State University
NCSU Campus Box 7106
Raleigh, NC 27695-7106
Email: bill_slocumb@ncsu.edu
Phone: 919-515-3432
Fax: 919-515-3439

Regional Technical Support Center for the Boston Support Office
Chuck LaBash
University of Rhode Island
1 Greenhouse Road
Coastal Institute in Kingston
Kingston, RI 02881
Email: labash@edc.uri.edu
Phone: 401-874-5406
Fax: 401-874-4561

Dataset Catalog Data Entry Form (6/8/00): **Park Code (4):** _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Section IV

NPS Dataset Catalog Form

Copy and use a separate form set for each data set. Complete all fields. Numbers after field names are the sizes of the fields.

Dataset Title (150):

Citation Info: (Use Citation Form or Author/Origin, Date, Ver./Ed., Series, Issue, Pub. Place, Publisher, Larger Work Cit.):

Project ID (20): _____

Data Originator (Name/Source, Position, Affiliation, Address, Phone, Fax, E-mail):

Dataset Contact (Name/Source, Position, Affiliation, Address, Phone, Fax, E-mail):

Subject (30): _____ Keywords (100):

Dataset Catalog Data Entry Form (6/8/00): **Park Code (4):** _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Single/Begin Date: _____ End Date: _____ Update Frequency (10):

Multiple Dates (Date/Time):

Status (10): New ___ Active ___ Inactive ___ Partial ___ Legacy ___ Historic ___ Other

Progress of Work on Data Set: Planned ___ In Work ___ Complete ___

Location (100):

W. Longitude (Dec. Degrees): _____ N. Latitude (Dec. Degrees):

E. Longitude (Dec. Degrees): _____ S. Latitude (Dec. Degrees):

UTM Zone (Optional): _____ W. Easting (Opt.): _____ N. Northing (Opt.):

E. Easting (Opt.): _____ S. Northing (Opt.):

Coverage (6): In ___ Out ___ In&Out ___ Park Clip ___ Park Area ___ NPS-wide ___ Region-wide ___ Other

Data Type (6): GEORAS ___ GEOVEC ___ GEODB ___ DIGRAS ___ DIGVEC ___ DIGDB ___ ANAORG
___ ANAUNO ___

Data Type 2 (20): Polygon ___ Line ___ Point ___ DEM ___ Raster ___ DOQ ___ Landsat ___ Imagery ___

Spreadsheet ___

Database ___ Document ___ Delimited text ___ Tagged text ___ ASCII text ___ Other

Coordinate System: UTM ___ Lat/Lon ___ State Plane ___ Other _____ Datum: NAD27 ___
NAD83 ___

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Source/Attribute?, Table/Layer Name (50 each), Cit.?
Optional Table Page(s)?, Scale Denominator,

Source or Attribute, _____, _____,

_____ , _____

Source or Attribute, _____, _____,

_____ , _____

Source or Attribute, _____, _____,

_____ , _____

Source(s) Contribution (Also use Citation Form and attach pages as needed, 250):

Data Format (80): Paper ___ dBASE ___ Access ___ Lotus ___ Excel ___ WordPerfect ___ Word ___
ASCII ___ or

Other (list):

Conversion Needed? Yes or No File Size (50):

File Location (100):

Data at Park? Yes or No Distribution Costs: None ___ Other

Distribution (100):

Online Link URL (150):

Quality (15): Unknown ___ Not Ver./Val.(?) ___ Verified ___ Validated ___ Metadata ___

Quality Report: (250):

Dataset Catalog Data Entry Form (6/8/00): **Park Code (4):** _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Metadata Status: None Planned In Work Complete Metadata Priority: High
Medium Low

Metadata Standard: FGDC NPS Dataset Catalog None Other

Metadata Link URL (150):

Metadata Contact (Name/Source, Position, Affiliation, Address, Phone, Fax, E-mail):

Is the Dataset Sensitive? Yes or No If So, How is the Dataset Sensitive? Archeology Cave
Classified Law Enforcement Paleontology T&E Species Other

Classified Data Type: N/A Unclassified Sensitive Restricted Confidential Secret Top
Secret

Access Restrictions (12): Public Fed. Only NPS Only Park Only Contact Only

Comments: (250):

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Citation Information: Dataset __ Source __ Related Doc. __ Related Data __ L. Work __
Copy form and use for citations. Complete applicable fields. Numbers after field names are the sizes of fields.

Origin/Author(150):

Publication Date: _____

Publication Time (optional):

Title (150):

Edition/Version (50):

Geoform (pub. format) (50):

Series (50):

Issue (50):

Publication Place (50):

Publisher (100):

Other Citation Details (100):

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Online Linkage:

Larger Work Citation (list below or on another form):

Citation Information: Dataset __ Source __ Related Doc. __ Related Data __ L. Work __

Origin/Author(150):

Publication Date: _____

Publication Time (optional):

Title (150):

Edition/Version (50):

Geoform (pub. format) (50):

Series (50):

Issue (50):

Publication Place (50):

Publisher (100):

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Other Citation Details (100):

Online Linkage:

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Data Dictionary Form: Theme, Table Structure, and Field Definitions

Copy form and use for table/theme descriptions. Complete applicable fields. Numbers after field names are the sizes of fields.

Spatial Theme (if applicable, 50):

Spatial Theme Description (if applicable, 250):

Table Name (50):

Table Filename (8 characters or less is best, 50):

Table Description (250):

Table Format (text, dBase IV, MS Access, etc., 50):

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Number of Fields (50):

Field Definitions (continue on back or other page(s) as needed):

Field Name _____ Field Type _____ Size _____ Description

(10 chars. or less is best) (text, etc.)

Field Value or Pick List and Brief Definitions (if applicable, continue on back or other page(s) as needed):

Field Name _____ Field Value _____ Value Definition

Dataset Catalog Data Entry Form (6/8/00):

Park Code (4): _____ **Form Set/Page #:** _____

Form Completed by _____ **Date:** _____

Section V
METADATA QUESTIONNAIRE

Please fill out all four sections completely for each data layer you are submitting.

SECTION 1: This section gathers contact information about the person completing this form, in case parks needs to clarify some of the information in the questionnaire.

Date you completed this form: _____

For person completing this form:

Name: _____

Address: _____

Phone Number: _____

E-Mail: _____

SECTION 2: Questions in this section gather information used to identify and describe the contents of your data layer.

1. NAME OF THE DATA LAYER:

2. For the person who created the data layer (if different from the person completing this form):

Name: _____

Address: _____

Phone Number: _____

E-Mail: _____

3. What does the data layer contain?

POINTS _____ which represent

LINES _____ which represent

POLYGONS/AREAS _____ which represent

ANNOTATION/TEXT _____ which describes

4. For what purpose was this data layer created (please describe):

5. What is the date of the last revision, change or update to this data layer?

(MM/DD/YYYY): _____

6. When did you actually collect this information and/or map these locations?

DATE or range of dates:

(MM/DD/YYYY) _____

7. What is the status of this data layer (pick one):

COMPLETE _____

IN PROGRESS, MORE DATA TO BE ADDED _____

When do you expect to add additional data?

INCOMPLETE, NO ADDITIONAL WORK PLANNED _____

Please describe what is lacking:

8. Is the data layer part of a larger work or related to a particular study? YES _____

NO _____

If YES, give a complete reference for that work or study:

9. Does the data layer contain information related to

a) Rare, threatened, or endangered plants or animals?

YES _____ NO _____

IF YES, please describe briefly:

b) Archeological or cultural resources?

YES _____ NO _____

IF YES, please describe briefly:

10. Please list some keywords describing the contents and/or purpose of this data layer:

11. Which of the following geographic areas would include all of the features depicted in your data

layer? (please pick the smallest area that would work):

Mount Desert Island (MDI) only _____

MDI and surrounding islands (Bar, Porcupines, Cranberries, Baker, Bartlett) _____

Schoodic Peninsula (SCH) only _____

Isle au Haut (IAH) only _____

MDI and SCH _____

MDI and IAH _____

MDI, IAH, and SCH _____

Penobscot Bay shipping channel to Hancock/Washington County line _____

Other (please describe!): _____

SECTION 3: Questions in this section will tell future users of this data layer what information is contained in the database associated with each feature. Examples are given in the shaded part of the table.

Please complete the following table listing all database fields (attributes) you added. You do not need to list ArcInfo's default fields such as AREA, LENGTH, COVERNAME#, COVERNAME-ID, RPOLY#, LPOLY#, etc. However, if you calculated a field such as ACRES (which contains the area of a polygon in different units) or MILES (length of a line in miles), you must describe it.

Please copy additional pages of the table if you run out of room or add rows if you are completing this form digitally.

EXAMPLES:

ITEM NAME (use ITEMS command in ARCTABLES)	DATA BASE STRUCTURE (use ITEMS command in ARCTABLES)	DEFINITION/DESCRIPTION OF THE ATTRIBUTE	SOURCE OF THE DEFINITION/DESCRIPTION	UNITS OF MEASURE (if applicable)	SET OF POSSIBLE VALUES	OTHER CITATION OR REFERENCE WITH INFORMATION ABOUT THE ATTRIBUTE OR ATTRIBUTE VALUES
---	---	---	--------------------------------------	----------------------------------	------------------------	--

TYPE	2 2 I	TYPE describes what kind of structure is represented by the point using a numeric code. 1=single family residence, 2=multiple family residence, 3=commercial, 4=municipal, 5=agricultural, 6=scientific research, 10=industrial	K.Anderson (if I made up the classification) OR "Structural Definition Codes for Municipalities," 199X, Maine Department of Something or Other, Report No. XXXX-0061.	Not Applicable	Minimum value of 1, maximum value of 10	Not applicable
TOWN NAME	20 20 C	The name of the town represented by the polygon.	Names taken from the 7.5min USGS topo quadrangle maps.	Not applicable	Bar Harbor Mount Desert Southwest Harbor Tremont	Not applicable
DBH	6 6 N 2	Diameter at breast height of the tree represented by the point.	K.Anderson	Inches	Minimum value 0.01, maximum value 1000.00	Doe, J., 1964, <u>Standard Forestry Measurements</u> , Greenhill Publishing House, NY, pp.121-135.
ADDRESS	40 40 C	Mailing address of the house indicated.	US Postal Service	Not applicable	Too varied to define.	Not applicable.

DATABASE ATTRIBUTE INFORMATION

Please describe each attribute in the PAT (polygon/point attribute table) and AAT (arc attribute table) that is not an ArcInfo default attribute. The idea is to describe the attributes so someone *completely* unfamiliar with them could understand and use them!

ITEM NAME	DATABASE STRUCTURE (from ARC or TABLES)	DEFINITION/DESCRIPTION OF THE ATTRIBUTE	SOURCE OF THE DEFINITION/DESCRIPTION	UNITS OF MEASURE (if applicable)	SET OF POSSIBLE VALUES	OTHER CITATION OR REFERENCE WITH INFORMATION ABOUT THE ATTRIBUTE OR ATTRIBUTE VALUES

SECTION 4: Questions in this section will help future users understand how your spatial data was created, evaluate its quality and accuracy, and determine if it will be useful to them. Shaded text denotes examples.

1. Is this data layer, in accordance with Acadia National Park GIS Standards, in Universal Transverse Mercator (UTM) coordinates and projected using the NAD83 datum?
YES _____ NO _____
IF NO, what coordinate system and datum is used and why is it not to standard?

2. Describe any rules you used to create the data set. For instance, how did you decide what to include/exclude? Did you use a minimum mapping unit? Examples:
-Only wetlands greater than or equal to a half-acre (0.5) were mapped.
-Only the sample sites at which we found mercury were included.
-"Pond" means any open water body less than 1 acre, "Lake means any open water body greater than or equal to 1 acre.
-Includes only currently maintained park trails; no "historic" or "abandoned" trails, no "social" trails, no trails outside park boundaries.

3. Please list your estimate of the horizontal accuracy of the positional data and how you arrived at that estimate. Examples:
*estimated accuracy is +/- 1-3 meters based on the published accuracy of the GPS unit we used to collect the positional information (you can use this one if you mapped with GPS using the park units, standard settings, and differentially corrected your field data).
*estimated accuracy of +/- 30 meters based on gut feeling
*within National Map Accuracy Standards for 1:24000 data
*+/-1 foot according to FruFru Correlation Test
*digitized with an RMS error of .003 or less

4. PLEASE FILL OUT THE FOLLOWING TWO TABLES ACCORDING TO THESE DIRECTIONS:

The Source Information Table asks you to list and describe all the sources of information (including other data layers) you used to create your data layer. The Processes & Operations Table asks you to describe the processing steps you took to combine the sources into your data layer. *These two tables are related*—each source should be “used” in a process. Sometimes a processing step produces an intermediate source that should be described in the source table. An example is provided in the grey-shaded boxes of the two tables. Please include as much detail as possible including software version numbers, critical settings, tolerances, etc. *You may find it helpful to fill these tables out as you are creating your data layer.*

Please copy additional pages or add additional rows if you need more space. Remember, the idea is to describe what you did well enough that someone else could understand, and perhaps replicate, what you did!

SOURCE INFORMATION TABLE

Please list and describe each source of information or data layer used in the creation of the data layer you are describing.

Boxes highlighted in grey are examples related to the examples in the Processes & Operations Table.

SOURCE NAME	NARRATIVE DESCRIPTION OF SOURCE AND THE INFORMATION IT CONTAINS AND CONTRIBUTES	ORIGINATOR OR CREATOR OF THE SOURCE DATA	DATE OF SOURCE MATERIAL	SCALE OF SOURCE MATERIAL	SOURCE MEDIA (digital, paper, mylar, etc.)	IS THIS SOURCE PART OF or RELATED TO A LARGER WORK? IF SO, GIVE CITATION
GPSDATA	Rare plant locations depicted by points collected with a Trimble ProXL GPS set to following critical settings: PDOPMask=6, SNRMask=6, Manual3Dmode, LoggingInterval=5sec, MinimumPositions=36, ElevationMask=15. Rated accuracy of differentially corrected files with this GPS is +/-3-5 meters. GPS files were differentially corrected using base station files from the University of Maine at Orono (Louis Morin, sysop) using Trimble's Pathfinder Office ver2.11.	K.Anderson operated the GPS. L.Gregory assisted in locating the plants.	GPS field work conducted May to Sept. 1999	Not applicable	digital	Greene, Craig. 1990. Rare plants of Acadia National Park.
PLANTLOC	Arc/Info point coverage, generated from GPSDATA, showing the location of rare plants. Attributes include scientific name and ID number.	K.Anderson and L. Gregory	Sept. 1999	Not applicable	Digital	Not applicable
SOILS	Arc/Info polygon coverage of soil types for Hancock County. SSURGO soils data from NRCS.	NRCS (Natural Resource Conservation Service)	1991	1:24000	Digital	Not applicable

PROCESSES & OPERATIONS TABLE

Please list and describe the major processing steps you took in the creation of this data layer.
 Boxes highlighted in grey are examples related to the examples in the Source Information Table
 You do NOT need to document every CLEAN or BUILD in complex editing sessions.

SOURCES USED (must reference a source listed in the SOURCE TABLE)	PROCESS DESCRIPTION (Describe what was done and how you did it. Include tolerances used, software versions, etc.)	PROCESS DATE	SOURCE PRODUCED	NAME AND CONTACT INFORMATION for the party responsible for the processing step.
GPSDATA	Points exported from Pathfinder Office ver.2.11 to ArcInfo generate format. In ArcInfo (ver7.2.1), GENERATE was used to create a GIS data layer of the points. The data layer was BUILDED for points. About 10 of the points were checked to ensure that the attribute information entered in the field was still associated with the correct point; all the attributes checked were correct.	9/15/1999	PLANTLOC	Karen Anderson Geographer (GIS Specialist) Acadia National Park P.O. Box 177 Bar Harbor, ME 04609 207-288-5463 (voice) karen_b._anderson@nps.gov
PLANTLOC SOILS	The following ArcInfo command was executed: IDENTITY PLANTLOC SOILS RPSOIL POINT # JOIN All attributes from SOILS except FLD_SYM were DROPIEMed from RPSOIL's point attribute table (PAT). This produced the data layer being described (RPSOIL)—an ArcInfo point cover with attributes about the rare plant and the soil type in which it is likely to be growing.	9/22/1999	RPSOIL	SAME AS ABOVE

--	--	--	--	--

Section VI

Voucher Specimen Collection

The final decision on the collection of voucher specimens will be left up to the discretion of the 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. This may mean that certain taxa, such as fish, may require more intensive vouchering than other taxa.
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 (unless found as roadkill) and common plant species. If vouchering is necessary for any of these because no voucher exists for a particular park, photo documentation is required.

Photo Documentation

The Northeast Region I&M Program is requiring all cooperators to use non-invasive methods of vouchering, such as color photography, or other 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 the NPS NPSpecies database. Photographs taken to provide documentation of a species must be taken with a macro or close-up lens. Photographs should show features used for identification of the species and be to proper (Sara – what is “proper”?) scale. 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. Mandatory fields that must be provided to NPS curatorial staff can be found at the end of this section?????. 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 roadkill 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.

Taxa	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	3 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 mortalities occur.
Medium-sized mammals	whole specimens not necessary, photo vouchers or specimen voucher for trap mortalities and roadkill, 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. Please follow the guidelines for vouchering fish specimens by Dr. Jay Stauffer and Timothy Stecko from Penn State University. (Please request this document from either Sara Stevens or Elizabeth Johnson). 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 may only be vouchered through photo documentation.

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 cooperator 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 vouchered specimens, please fill in the information below and submit information as an Appendix with your final report. If you have more than one specimen with the same genus/species collected at the same site, only fill in one sheet). This information will enable the park to fully document your research in the National Park Service’s National Catalog.

BIOLOGY SPECIMENS:

- Collection Permit number: _____
- Fixative or killing agent used: _____
- Preservative agent used: _____
- Number of specimens: _____

- Order: _____, Genus _____, Species: _____
- (Sara—what’s this???) UTM, Latitude/ Longitude, or elevation: _____
- Collection Site: _____

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

Section VII

Report Guidelines

Progress Report Format Guidelines

- As requested, submit progress reports double-sided and single-spaced on 8 1/2" x 11" white bond paper and/or in MS Word (most recent version) files as an email attachment or on a Windows formatted 3.5" diskette.
- Use Times New Roman 12 pt font.
- Commence pagination on the first page of text as a footer and centered.
- Begin paragraphs left justified without indentation on the first line and separate paragraphs from each other double-spaced.
- Use title case (i.e. first letter of all words capitalized except articles, prepositions, and conjunctions) for all section headings.
- Use the following style for section headings:

First Order Header [center]

Second Order Header [flush left]

Third Order Header [flush left, underlined]

Fourth Order Header: [flush left, colon, two spaces, continue with text].

Fifth Order Header [flush left, italicize]

- Submit the specified number of copies (usually five) to the designated NPS Key Official on or before the date(s) identified in the research permit, contract, or agreement.
- Depending on the scope of the project, progress reports are usually required quarterly, semiannually, or annually.

Progress Report Content Guidelines

The progress report is a brief, informal, narrative statement of the status of all work accomplished during the period specified, and a summary of work to be performed during the following period.

Progress reports should include:

- a) a title page containing the following information: the words "Progress Report"; title of project; investigator name(s), affiliation, and address; NPS contract, agreement, or purchase order number; date of submission; and time period covered by report,
- b) a quantitative description of overall progress and significant findings to date,
- c) an indication of any current problems that may impede performance and proposed corrective actions, and
- d) a brief discussion of the work to be performed during the next reporting period.

Draft final and final report format and content guidelines

At the completion of a research study, the investigator must submit a draft final report that documents the study methods, results, and conclusions of the entire project as required by the

contract. The specified number of copies (usually five to ten) must be submitted to the designated NPS Key Official on or before the date identified in the contract. The report should be written to an "audience" of park managers who may lack training or exposure to the particular discipline. The report may also be distributed to other government agencies, the scientific community, politicians, reporters, and the public. Keep the main body of the report short and concise. This may be accomplished through the use of appendices for extensive literature reviews, detailed explanations of the research design and methods, supplementary data, information which does not directly address the research objectives specified by park managers, and highly technical material (equations, statistical analyses, and testing). Write in a non-technical jargon-free style, avoiding or clearly explaining any scientific terms or terms unique to a specific discipline. Your goal is to clearly and concisely convey study results and management implications to a nonscientist. It is very important for purposes of proper review that both the draft and final reports adhere to the format and content guidelines presented in this manual.

Upon submission of the draft final report, the designated NPS Key Official will review the manuscript and seek additional management and scientific review comments from appropriate NPS regional and park personnel and peer members of the scientific community to ensure technical quality and accuracy of information. Review comments and recommended changes will then be returned to the author(s) for consideration and preparation of the final report.

All appropriate comments from draft final report reviews should be addressed and incorporated during the preparation of the final report. Before duplication, a copy of the final report must be sent to the designated NPS Key Official for final approval of review modifications and format. Upon approval, a letter quality original, reproducible copy of the final report and the specified number of copies (usually ten to fifteen) must be submitted to the designated NPS Key Official on or before the date identified in the research permit, contract, or agreement. A diskette, containing the report in MS Word 97 must be submitted along with the paper copies.

The final report may be printed and distributed as part of an NPS Technical or Natural Resources Report series. Reports printed in these series are not considered formal publications, and the information may be subsequently submitted by authors to peer reviewed journals. The designated NPS Key Official will notify the author of the decision to print the final report in one of the series and will assign the series name and number to be included on the title page. Preprinted front and back covers will be provided for final duplication and distribution.

Draft Final and Final Report Format Guidelines

- Submit all reports double-sided on 8 1/2" x 11" white bond paper and in MS Word (most recent version) files on a Windows formatted 3.5" diskette.
- Start all first order sections on a new right hand page.
- Use Times New Roman 12 pt font throughout and avoid bolding text.
- Double-space draft final reports and single-space final reports.
- Allow 1" on all margins.
- Left-justify paragraphs without indentation on the first line and separate paragraphs from each other double-spaced.
- Do not hyphenate whole words at the end of a line, instead use an unjustified right margin.

- Number all pages sequentially at the bottom of the page, centered.
 - The initial sections (Table of Contents, List(s) of Figures, Tables, and/or Appendices, Summary, and Acknowledgments) should be numbered sequentially using lower case Roman numerals (i, ii, iii, ...) with numbering beginning with, but not appearing on, the Title Page.
 - The main body of the report (beginning with the Introduction) should be numbered sequentially using Arabic numerals (1, 2, 3,...).
 - Blank pages are counted but not numbered.
- Use title case (i.e. first letter of all words capitalized except articles, prepositions and conjunctions) for all section headings.
- Use the following style for section headings:

First Order Header [center]

Second Order Header [flush left]

Third Order Header [flush left, underline]

Fourth Order Header: [flush left, colon, two spaces, continue with text]

Fifth Order Header [flush left, italicize]

Table of Contents

- Include only first and second order section headings in the Table of Contents. Include all first and second order section headings that follow the Table of Contents (i.e. beginning with and including headings for lists of figures, tables, and/or appendices).
- Use title case on all Table of Contents entries.
- Double-space entries.
- Indent second order section headings from first order section headings 7 spaces.
- A space followed by a line of dots followed by a space should proceed from the last word of each entry to a right justified page number.
- Allow page numbers to “stand alone” on the right side of the page by spreading longer entries to additional lines, making sure that each line of the entry is indented to the same starting point as the first word of the entry.
- Repeat the heading (i.e. Table of Contents) followed by “continued” in parentheses at the top and centered for each additional page of the Table of Contents.

List of Figures, List of Tables, and List of Appendices

- Each of these lists must begin on a new right hand page.
- Double-space entries.
- Begin entries with a capitalized label followed by a space then a number (for figures and tables) or capitalized letter (for appendices) then a period then a double space then a title (e.g. “Figure 1. Map of survey area“, “Table 21. Estimated larvae in survey area“, or “Appendix G. Checklist of butterfly species“).
- If there is only one appendix, do not include a List of Appendices page; list it as the last entry in the Table of Contents as “Appendix” with no letter afterward.
- A space followed by a line of dots followed by a space should proceed from the last word of each entry to a right justified page number.

- Allow page numbers to “stand alone” on the right side of the page by spreading longer entries to additional lines, making sure that each line of the entry is indented to the same starting point as the first word of the entry.
- Use sentence case (i.e. capitalize only the first letter of the first word and any proper nouns) for titles.
- Repeat the heading (e.g. List of Figures) followed by “continued” in parentheses at the top and centered for each additional page of the list.
- Consult Tables. 1, 2, and 3 for example lists.

Citing Literature

- Follow the author and year system for citing literature references in the text. If you wish to mention the author in your discussion say, for example, "Wakeley (1954) reported that...". Otherwise, place the author and year within or at the end of your statement, (Wakeley 1954).
- Semicolons separate citations of works by different authors in one set of parentheses (Wakeley 1954; McManus 1957).
- Commas separate several cited works by the same author (Hackett 1970, 1972a, 1972b).
- List all references in the “Literature Cited” section of the report using the Council of Biology Editors (CBE) bibliographic style as outlined in Table 4.

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Table 4. Literature cited section format

Journal Article

Format

First author Surname, Forename initial Middle initial(s)., and Second author Forename initial Middle initial(s). Surname. Publication date. Article title. Journal title. Volume number(Issue number):page number-page number.

Example

Kinbote, C. V., and D. N. Haze 1948. A new species of *Cyclarus Nabokov*. *The Entomologist*. 81(1027):273-280.

Book

Format

First author/editor Surname, Forename initial Middle initial(s)., and Second author/editor Forename initial Middle initial(s). Surname, editors [if applicable]. Publication date. Title of book. Edition number. Publisher, City of Publication, State/Country of Publication. number of pages pp.

Example

Knight, S. V., and V. N. Darkbloom, editors. 1998. *Butterfly identification in our National Parks*. Second edition. Blackwell Scientific Publications, Ithaca, New York. 512 pp.

Report

Format

First author Surname, Forename initial Middle initial(s). and Second author Forename initial Middle initial(s). Surname. Publication date. Title of report. Report Identification Number. City of Publication, State/Country of Publication. number of pages pp.

Example

Quilty, C. V., and A. N. Vokoban. 1961. A study of Lepidoptera at Shenandoah National Park. National Park Service Technical Report NPS/SHEN/NRTR-91/016. Luray, Virginia. 161 pp.

Table 4. Literature cited section format (continued)

Chapter in Book or Paper in Conference Proceedings

Format

First author Surname, Forename initial Middle initial(s)., and Second author Forename initial Middle initial(s). Surname. Publication date. Title of chapter or paper. Pages page number-page number in First editor Forename initial Middle initial(s). Surname and Second editor Forename initial Middle initial(s). Surname, editors. Title of book or conference proceedings. Publisher, City of Publication, State/Country of Publication.

Examples

Chapter in Book:

Pnin, P. V., and H. N. Humbert. 1999. Yesterday's caterpillar: A re-examination of Lepidoptera morphology at Hopewell Furnace National Historic Site. Pages 131-313 in .S. V. Odon, and K. N. Krug, editors. Insect Studies in National Parks of the Eastern United States. University Park, Pennsylvania

Paper in Conference Proceedings:

Pnin, P. V., and H. N. Humbert. 1999. Yesterday's caterpillar: A re-examination of Lepidoptera morphology at Hopewell Furnace National Historic Site. Pages 131-313 in .S. V. Odon, and K. N. Krug, editors. Insect Studies 1998-1999. American Society of Entomologists. University Park, Pennsylvania

Thesis

Format

Author Surname, Forename initial Middle initial(s). Date of thesis. Title of thesis. Type of thesis. University. number of pages pp.

Example

Zembla, V. N. 1997. A comparative ecological study of Madeleinea mashenka and Madeleinea lolita in Northeastern National Parks. M. S. thesis, Cornell University. 242 pp.

Figures and Tables

- Figures and tables should have brief descriptive titles.
- Numbers and titles for figures should be below the figure and left justified.
- Numbers and titles for tables should be above the table and left justified.
 - Explanatory information and keys to symbols should be placed in the legend to the figure or as a footnote at the bottom of the table.
- The title, heading, legend, and footnotes must contain all the information the reader needs to understand a table or figure without referring to the text.
- All figures (including maps and photographs) and tables should be in digital format as part of the final document. If line drawings and artwork are necessary, they must be in high-contrast black and white and of a professional reproducible quality.
- Figures and tables should not be placed on a page with text but should be on their own numbered page immediately following the page (double-sided) in which they are referenced.
- Use sentence case for all figure and table titles.
- Figures and tables, respectively, are numbered sequentially with Arabic numerals in the order of their presentation in the text
- Every table and figure must be cited in the text (e.g. “(Table 1)” or “...in Figs. 2 and 3”).
- For figures and tables which are more than one page, repeat the figure or table number and title followed by “continued” in parentheses, for each additional page.

Appendices

- Each appendix must begin on a new right hand page
- Appendices are labeled sequentially with capitalized letters (e.g. “Appendix A”, “Appendix B”, etc.) followed by a brief concise title in sentence case at the top of the page and centered.
- A single appendix is labeled “Appendix.”
- If possible, the title should appear on the same page with the appendix material; if not, the title can be placed centered on the top of the preceding right hand page.
- For appendices that are more than one page, repeat the title at the top and centered, followed by “continued” in parentheses, for each additional page.

Measurement Units

- All measurement units must be metric.
- Include U.S. equivalent measurements parenthetically.
- Use abbreviated standard units of measure when with a numeral, whereas, units of measure are to be spelled out if no quantity is given (e.g. “10 m” or “...meters”).
- Retain only the final unit of measure in a series (e.g. 10 to 15 kg).
- Use a “/” for ratios with numbers (e.g. 10 deer/ha) but use “per” for ratios without numbers (e.g. deer per hectare).

Numbers

- Numbers from one through nine are written out; numbers above nine are expressed as numerals except when first word of sentence. Ordinal numbers (e.g. second, 23rd) are treated the same.

- Physical measurements (length, width, distance, area, volume, decimals, percentages, degrees, symbols, latitude/longitude, fractions over one) and time (days, years) are always expressed as numerals.

Taxon Names

- The NPS has adopted ITIS (Integrated Taxonomic Information System) as its standard for taxonomy and nomenclature, and all scientific names should follow that standard. See <http://www.itis.usda.gov/plantproj/itis/index.html>
- Use common species names of plants and animals initially followed with scientific names parenthetically; thereafter, only the common name is necessary.
- If a large number of species are referred to in the text, a reference list of common and scientific names must be included as an appendix.

Copyrighting

Authors are responsible for obtaining written permission for use of any copyrighted figures, tables, graphs, and information.

Errors

Authors are responsible for conducting an editorial review of the draft report to ensure: clarity; proper grammar, spelling, and punctuation; accuracy and completeness of all numbers, tables, figures, and references; and adherence to these format and content guidelines.

Draft Final and Final Report Content Guidelines

The following list provides a general outline of first order headings for all draft and final reports. Each first order heading must begin on a new right hand page. These headings may vary or others may be added, but their order should approximate the following:

- Title Page [see Table 5 for example]
- Table of Contents
- List of Figures [if applicable; see Table 1 for example list]
- List of Tables [if applicable; see Table 2 for example list]
- List of Appendices [if applicable; see Table 3 for example list]
- Abstract and Key Words
- Summary
- Acknowledgments [optional]
- Introduction
- Study Area
- Methods
- Results
- Discussion
- Conclusions
- Literature Cited [see Table 4 for example formats]
- Appendices [if applicable]

Title Page

The following information, duplicating as close as possible the title page format shown in Figure 5, must appear on the title page.

- Title [use title case and bold]
- Author(s) [first name, middle initial(s), surname; no professional titles or academic degrees; avoid the use of “by”]
- NPS Report Identification Code and Number [if assigned by designated NPS Key Official]
- Author's Organization Mailing Address
- Month/Year
- Month/Year of Update(s) [if applicable]
- Contract or Agreement Number [include Supplemental Agreement Number, if applicable]
- Appropriate Regional or Support Office Mailing Address

Table of Contents

Include a table of contents listing lists of figures, tables and /or appendices, and all first and second order section headings.

List(s) of Figures, Tables, and/or Appendices

Include a separate list for each set of figures, tables, and/or appendices that are included in the report.

Abstract and Key Words

Provide a brief abstract (a paragraph or two in length) which concisely describes or gives a brief overview of the research (i.e. where/when/how the research was conducted, results, and conclusions)

Also include a list of two to four keywords beneath the abstract.

The abstract and keywords must be together on no more than one page.

Summary

This “stand alone” section should summarize the prominent facts discussed in the report and the conclusions reached in relation to research objectives. It should be as brief as possible, yet cover the subject in a clearly written, non-technical style so that, on its own, this section tells the reader what the project was about and what conclusions were made. This section is often removed from the report and used by the park Superintendent to inform legislators, public individuals and organizations, and NPS park, regional, and Washington Office staff of the completion and results of the study.

Acknowledgments (optional)

Briefly acknowledge those who directly helped with research or writing. Acknowledgments of typists, illustrators, editors, and referees may be included, but generally are discouraged. Use only forename initials with surname(s) and do not include professional titles or academic degrees.

Introduction

The introduction should include the hypotheses and purpose of the investigation, research objectives, conditions under which the study was conducted, the general plan of treatment of the subject, and summary of previous work accomplished (literature review) that relates to the project.

Study Area

Provide a concise narrative description and justification of the study area(s) for the research. Include a detailed map of the study area(s) for further clarity.

Methods

Present a detailed explanation of the methods, materials, and analytical techniques that were used in the field, laboratory, and office during the study. Describe how, when, where, and by whom the data were acquired for the investigation. The methods should be documented so that the investigation could be exactly repeated, if necessary. Be sure to include how data were analyzed and what statistical tests were employed. Describe the process used for determining whether the data met the data quality objectives and, if not, what corrective actions were taken. Detailed information about QA/QC procedures for data collection, verification, and validation should be placed in an appendix if it is too lengthy and detracts from the main body of the text.

Results

In a logical sequence, present, in detail, the findings of the study that either support or provide evidence against the hypotheses or that answer the question(s) presented in the “Introduction”. Basic descriptive statistics (sample size, percentages, mean, median, maximum, and minimum) are appropriate when clearly presented. Avoid technical discussions of complex statistical testing; instead refer readers who may be interested in this type of information to an appendix.

Discussion

This section and the “Conclusions” section are the most important parts of the report. Present a clear interpretation of the data that addresses the hypotheses, objectives, or purpose for which the study was conducted. Be sure to include how this research is applicable to the park where it took place, and to other studies that have been conducted in that area of research. Other findings may be reported that would be of general interest to the scientific community.

Conclusions

Provide a specific and detailed summation of the conclusions of the research. In some instances, this is one of the few parts of the report that park managers will read. If the research was initiated

due to specific park management needs, management implications should be emphasized and thoroughly discussed.

Recommendations regarding policy positions of the agency should not be included. If desired, recommendations of this nature should be covered in a special supplementary report separate from the scientific report.

Literature Cited

List all references cited in the report.

Appendices

Include supplementary materials (e.g. QA/QC procedures) that support the main body of the report.

Table 5. Title page format

FLORA OF PETERSBURG NATIONAL BATTLEFIELD

Michael S. Rosenweig
and
Duncan M. Porter

Technical Report NPS/PHSO/NRTR-98/075

Department of Biology
Virginia Polytechnic Institute
and State University
Blacksburg, VA 24061-0324

January 1991
Revised September 1993

Cooperative Agreement
4000-9-8014
Supplemental Agreement 4

National Park Service
Northeast Region, Philadelphia Support Office
Stewardship and Partnerships
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

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

Appendix D

*Guidelines for Using Digital Photos as Fish Vouchers For
Pennsylvania Fishes*

Guidelines for Using Digital Photos as Fish Vouchers

for

Pennsylvania Fishes

Dr. Jay R. Stauffer and Timothy D. Stecko

The Pennsylvania State University

March, 2001

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Introduction

It may not always be desirable to harvest all fishes collected while conducting aquatic sampling and/or inventories. Species of special concern must often be released on site. The use of hazardous chemicals for tissue fixation and preservation can be prohibitive, and the storage of preserved or live specimens may require resources that are not available or could be put to better use. The use of digital photographs to document which species have been collected can be a suitable method to voucher fish species, addressing the concerns previously mentioned. With the exception of the initial cost of purchasing a digital camera and computer, the costs of digitally vouchering fishes is a relatively economic method of vouchering fish species: there are no film development fees, reproduction of images is essentially without cost, and storage costs of images is negligible.

The guidelines within this document explain how to use digital photographs to accurately voucher fish specimens. Although it may not be possible to identify all fish specimens from digital photographs taken in the field, these guidelines will help with the identification of most fishes collected, thus permitting their release back to the waters from which they were collected. The fish specimens likely to be the most difficult to identify from digital photos are immature fishes of all species and some of the minnow species, particularly in the genus *Notropis*. If the identification of such fishes is necessary, these specimens must be identified on site or properly preserved for later identification.

Choosing the Right Camera

Digital cameras come in many different styles with varying functionality. It is critical that the appropriate camera be selected for use in vouchering fishes with digital photographs. Fortunately, there are many models that meet the requirements for digital photo vouchers. Several specifications that should be met when selecting a camera: 1) color photographs, 2) high pixel density CCD or CMOS, 3) macro capability, and 4) built-in or external flash.

Color Photographs

The color capabilities of digital cameras are often described in terms of color depth. Color depth is the number of colors or shades of which an image is comprised. Color depth is referred to in terms of bits. Camera users will see ratings such as 8-bit, 16-bit, 24-bit, and 32-bit. The bit number refers to the number of binary digits used to code for color or tone. An 8-bit coding scheme uses 8 digits to code for color. Each of the 8 digits can assume a value of a 0 or 1. Thus, a one bit image can have 2 colors or tones, typically black and white. Eight bit images can contain a maximum of 256 colors or shades ($2^8=256$). This depth of color is insufficient for voucher images. Only at 16-bit or greater do digital images approach photo-realism, and thus better represent the coloration of the specimen. A 16-bit image has a maximum of 65,536 colors ($2^{16}=65,536$).

The color of the voucher specimens can be a powerful discriminating tool. Colors of fish vary by species, time of year, age, sex, and even geographic location. Unless conditions dictate otherwise, digital image vouchers should be 16-bit color images at a minimum.

Pixel Density

A pixel is the smallest graphical element of a digital image. Each pixel represents a single item of graphical information about the object being photographed. The more pixels comprising an image, the more information about the object you will have. Pixel densities of cameras are typically expressed in terms of horizontal and vertical resolutions. For example, the Olympus C-2500L digital camera has a 2.5 megapixels CCD. The camera claims maximum horizontal and vertical resolutions of 1712 pixels by 1368 pixels. Multiplying the maximum horizontal and vertical resolutions yields a value of 2.34 million (or mega) pixels, close to the 2.5 megapixels rated CCD. Obviously, not all of the CCD's 2.5 megapixels are used in the final image. But, this example does explain the basics of the pixel densities/CCD and image resolution relationship. It is important to have images with resolutions of at least 1024 pixels by 768 pixels, simply expressed as 1024X768. Larger images would provide more information upon which to base an identification. Factors such as camera specifications and available storage memory will limit the size of the digital image being captured. Each user must determine how large these images will be.

Macro Capability

The most difficult of fishes to identify are often the smallest ones. To identify such fish it is necessary to take large photos of these small specimens. To take photos of small objects the camera must be able to focus on objects that are very close to the lens. When selecting a camera for this use, choose one that is able to focus on images as close as 4 cm. Some macro features on digital cameras will allow even shorter focal distances, which can also be useful.

Built-in or External Flash

The use of a flash can serve two purposes, provide adequate lighting, and increase shutter speed. Proper lighting will highlight the specimen's natural colors, assisting in an accurate identification, and permit photography in low light conditions. The fast shutter speeds are critical when taking photos without the use of a tripod or some other device for stabilizing the camera. Even the most steady of grips can produce miniscule movements that can blur images. In full sunlight, shutter speeds are very fast and hand held shots can be exceptional. When light conditions are low, a flash will compensate for the lack of natural light, producing fast shutter speeds and crisp photos. If possible, use natural light by moving specimens from the shade to full sun.

Photographing Specimens

Once a suitable camera has been selected, particular attention must be paid to a number of aspects of the image collection and handling process. When photographing the specimens you must make the most of the field of view, provide references for determining size and the identification of individuals. The handling of images involves the naming of image files, addition of voucher information to the image, and selection of file formats.

Field of view

As a rule, when taking voucher photos, it is best to fill as much of the field of view as possible with the subject (Figure 1). The macro option of your camera will be useful when photographing small fish or when photographing particular structures or areas of the specimen.



Figure 1. Photo A (*Rhinichthys atratulus*) depicts an improper use of the field of view. Photo B (*Rhinichthys atratulus*) shows a proper use of the field of view. Photo B is much more useful as a voucher photo

Size referencing

The size of the specimen is important information to document. Size can be helpful in the identification process and assessing population characteristics, such as presence of breeding age individuals and health factors. It is therefore important to provide a means of estimating size for each specimen photographed. By simply including a tape measure, meter stick, or some calibrated device, size can be estimated from the photographs (Figure 2).



Figure 2. Image of *Catostomus catostomus* from Whites Creek, Somerset County, PA. The measuring tape in the upper portion of the image can be used to estimate the length of the specimen. Additionally, the tape can be used to assign a number to the individual for this collection site. Notice the mechanical pencil pointing to the number 3 on the measuring tape. A text label has also been added to the lower right part of the image. This text label provides information regarding species identity, specimen number, collection site, collecting institution, collection number, and date of collection.

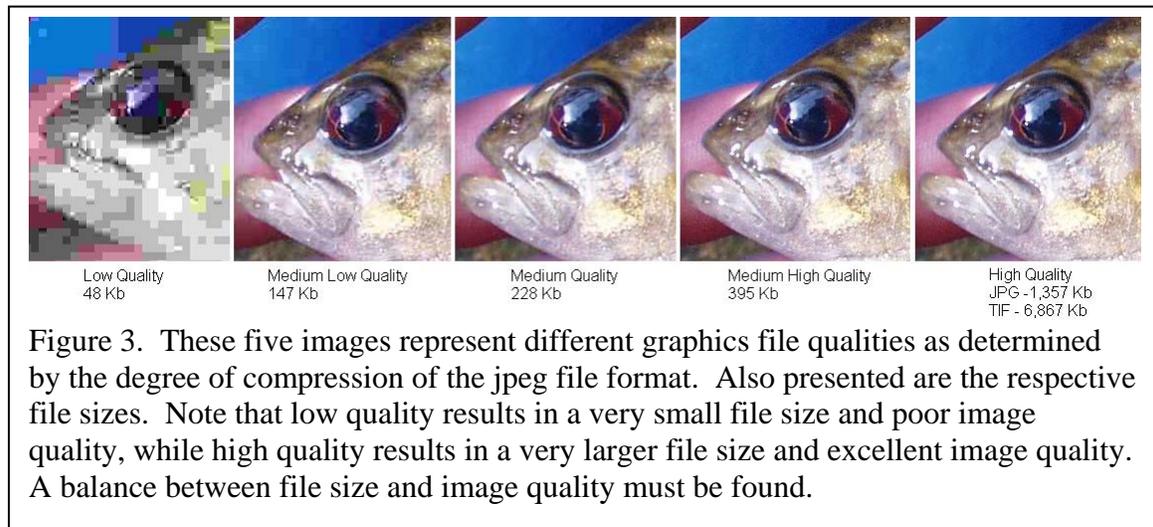
Identification of individuals

Often more than one individual will need to be vouchered. Therefore it will be necessary to identify individuals from the digital images. Figure 2 demonstrates a simple method of assigning a number to each individual collected. If larger numbers of individuals are being vouchered, another system of numbering will likely be needed, as a tape measure will provide limited numbers and could become awkward to use.

Saving files for voucher purposes

File format and compression

In most cases, you will have two opportunities to select the file format and compression quality. The first opportunity will arise prior to taking the photos. Digital cameras allow the user to select different image qualities for image storage. The highest quality is typically and uncompressed format known as TIF. This format requires a great deal of space for storage and can seriously limit the number of images you can save on your camera's storage device. Even though this format will be the highest quality permitted by the camera, the gain in image quality is minimal compared to high or even medium-high quality compressed images and the loss of storage room for additional images makes it less desirable (Figure 3). Be aware that printed images may not be as clear as their digital originals. The originals can be zoomed in on to view greater detail and are not compromised by the limitations of a printing device.



Cameras will usually allow for the storage of images in compressed jpeg format. The degree of compression or size of the captured image may also be selected. Always choose the physically largest image available, largest in terms of the horizontal and vertical resolution. Large images capture more detail and are better for identification. Some of the more highly compressed image options can degrade the image somewhat (Figure 3). It is best to choose medium to high quality jpeg formats so as not to reduce

image quality. After all, there is no point in making efforts to improve image quality by optimizing lighting and stabilizing the camera only to lose these gains by choosing a low image quality compression ratio.

File names

When the camera captures a digital image it will automatically assign a name to the file. The name is typically a combination of alpha and/or numeric characters that give no indication as to the file contents. Giving the file a descriptive name will help users identify the file without having to view the image. Furthermore, descriptive names can be very useful when searching hard drives, CD-ROMs, or other computer media for images of a particular content. For instance, if the file name contains the name of the species, one could find all voucher images for that species on a computer simply by searching filenames for the species name. The renaming of digital images is best done on a computer soon after the images are captured. Information that should be included in the file name is; species scientific name (if identified), individual identifying number, collection site description or collectors reference code, and date of capture. If the specimen has not been identified, this information can be added at the time of identification. The individual identifying number was described in a previous section. Review the section titled “Identification of individuals” for more information. A description of the collection site can also be useful. The collector’s reference code is a code, catalogue number, or some marker that provides information about the sampling event that resulted in the collection and subsequent digital image vouchering of the specimen. For instance, the image in figure 2 has been tagged in the lower right corner with additional information. The line labeled “Coll. ID” contains a string of characters that refers to the collector’s field code for a very specific collection. This is a unique code assigned by the investigator. No other collections by this investigator have this code. Referencing this code will provide access to more detailed information about the collection, the site, collection crew, sampling methods, etc. All investigators conducting fisheries sampling should keep copious field notes and assign such codes to their sampling efforts. Table 1 lists examples of file names that provide good descriptions of their contents.

Table 1. A list of file names. The name of each file provides useful descriptive information regarding the nature of the digital image file.

 Catostomus commersoni 4 - TDS-00-29 - Casselman River - Whites Creek - 10-21-00.jpg
 Onchorynchus mykiss 2 - male photo 2 - TDS-00-30 - Casselman River - Whites Creek - 10-21-00.jpg
 Salmo trutta 5 - TDS-00-29 - Casselman River - Whites Creek - 10-21-00.jpg
 Salvelinus fontinalis 1 - male in breeding coloration 2 - TDS-00-28 - Casselman River - McClintock Run - 10-21-00.jpg
 Semotilus atromaculatus 1 - TDS-00-29 - Casselman River - Whites Creek - 10-21-00.jpg

File names are useful in identifying file subject matter and in performing searches for files of particular content. However, file names can become corrupted, thus eliminating crucial information about the image. Corruption of file names, although not common, can be a problem when sharing files with long names between different computing platforms (i.e., Unix, Macintosh, Windows XX). To preserve the link between image and collection information, one must include this information as part of the image itself. The text in the lower right corner of the image in Figure 2 contains all the information necessary to determine the images origins and content. Only if the image becomes corrupted will the voucher be rendered useless. There are a variety of methods to incorporate text into graphics. It is not necessary to use an expensive graphics software package for the addition of text. The user should familiarize his or her self with the various graphical software packages available. Almost all camera manufacturers will distribute software with the digital camera that is more than capable of this task.

Rules for Capturing Voucher Images of Fishes

This section discusses the types of digital photographs that will be helpful in the identification of fish species. Specifically, the photographic viewing aspect for each fish family or type of fish will be discussed. Not all fishes can be identified from voucher images. Fortunately, with the following of the aforementioned guidelines and the application of a few simple rules, most fish species, particularly those of a threatened or endangered status, can be successfully identified from digital images.

Because it is likely that individuals taking the voucher photos will have varying degrees of fish identification experience, voucher photo instructions will be provided as two methods. Each method is based on the concept that species can be identified from digital images provided that the appropriate view or views are captured by the images. A description of the views used is provided below. Method one will provide generalized instructions directing the user to take photos of a particular aspect based on easily discernable features of the specimen. Method two will provide photo instructions for individuals capable of identifying fishes to family.

Description of photographic views

Every effort should be made to photograph the left side of the fish. This has been the conventional view, because much of the physical work done on preserved fishes is done on the right side, often damaging tissues and blemishing the specimen's appearance. If the left side is of poor quality, the right side may be used.

Lateral View – Side view of specimen from tip of snout to the end of the tail.



Oral Disk – Applies to lampreys only. Clear view of mouth opening and teeth. Allowing lamprey to attach to a piece of glass or plexiglass can help expose oral disk.



Lateral closeup of head – Side view of head from tip of snout to beginning of pectoral fin.



Ventral view of head and jaw – Bottom view of head from tip of snout to the end of the gill covers.



Clear view of dorsal and caudal fins –

Make sure the dorsal fin(s) and caudal fin are clearly visible. Both fins should be flared, exposing fin structure and pigmentation.



Ventral view of pelvic fins –

Bottom view of pelvic fins. Must be able to count rays in fins.



Clear view of anal fin –

Can be complete snout-to-tail lateral view of specimen. May need to manually flare anal fin to expose anal fin spines.



Method 1

This method can be applied with very little knowledge of fish identification, although a basic knowledge of fish anatomy is required. Field guides, such as The Peterson Field Guide Series “A Field Guide to Freshwater Fishes – North America North of Mexico” provide information concerning fish anatomy. Users of this method must follow the information in the order it is presented. When determining which view or views to photograph, start with row number one in the table below and progress sequentially until the proper view is determined.

	Features to look for	Example Image	View to Photograph
1)	Specimen is snake-like and lacks a boney jaw LAMPREYS		-(adults) lateral view & view of oral disk -(juveniles) keep specimen
2)	Specimen lacks or has few scales, has large head and mouth, two dorsal fins, no barbells present on chin, specimen usually < 15 cm SCULPINS		**best to keep specimen** -(all specimens) lateral view, ventral view of pelvic fins

	Features to look for	Example Image	View to Photograph
3)	<p>Specimen has 2 dorsal fins that are separate or very narrowly joined. Three anal spines present, spine present on opercle</p> <p>TEMPERATE BASSES</p>		<p>-(all specimens) lateral view & clear view of anal fin</p>
4)	<p>Long snout, dorsal fin much closer to caudal fin than the head, forked tail</p> <p>PIKES</p>		<p>-(adults) lateral view & lateral closeup view of head -(juveniles < 10 cm) keep all specimens or views same as adult</p>

	Features to look for	Example Image	View to Photograph
5)	<p>Specimen is scaleless, has chin barbells, has adipose fin which may be connected to caudal fin</p> <p>CATFISHES</p>		<p>- (all specimens) lateral view (clear view of dorsal and caudal fins) and ventral view of head and chin</p>
6)	<p>Body is scaled, does not have an adipose fin, has a single, separate dorsal fin, front of dorsal fin is about in the middle of the body or closer to the head, pelvic fins are about midway between pectoral fins and anal fin or closer to anal fin.</p> <p>SUCKERS & MINNOWS</p>		<p>- (adults) lateral view & ventral view of head and jaw - (juveniles) – same as adults or keep specimen</p>
7)	<p>ALL OTHER FISH</p>		<p>Lateral view</p>

Method 2

Users of this method must be able to identify fish to family level. Below is a list of families and their respective photographic views.

Petromyzontidae (Lampreys) – (adults) lateral view & view of oral disk – (juveniles) keep specimen
Acipenseridae (Sturgeons) – lateral view
Polyodontidae (Paddlefish) – lateral view
Lepisosteidae (Gars) – lateral view
Amiidae (Bowfish) – lateral view
Anguillidae (Freshwater eels) – lateral view
Clupeidae (Herrings) – lateral view
Hiodontidae (Mooneyes) – lateral view
Salmonidae (Trouts) – lateral view
Osmeridae (Smelts) – lateral view
Umbridae (Mudminnows) – lateral view
Esocidae (Pikes) – (adults) lateral view– (juvenile < 25 cm) – lateral view & lateral closeup of head
Cyprinidae (Minnows) - (adults) – lateral view & ventral view of head and jaw – (juveniles) – same as adults or keep specimen
Catostomidae (Suckers) - (adults) – lateral view & ventral view of head and jaw – (juveniles) – same as adults or keep specimen
Ictaluridae (Bullhead Catfishes) – lateral view (clear view of dorsal and caudal fins) and ventral view of head and chin
Apherododeridae (Pirate Perch) – lateral view
Percopsidae (Troutperches) – lateral view
Gadidae (Codfishes) – lateral view
Fundulidae (Topminnows and Killifishes) – lateral view
Poeciliidae (Livebearers) – lateral view
Atherinidae (Silversides) – lateral view
Gasterosteidae(Sticklebacks) – lateral view
Cottidae (Sculpins) – lateral view, ventral photo of pelvic fins, best to keep specimen
Moronidae (Temperate Basses) – lateral view – flare anal fin
Centrarchidae (Sunfishes and Basses) – lateral view
Percidae (Perches) – lateral view
Sciaenidae (Drums) – lateral view
Gobiidae (Gobies) – lateral view

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

Appendix E

*Preproposal for Biological Inventories: Eastern Rivers and Mountains
Network*

Preproposal for Biological Inventories: Eastern Rivers and Mountains Network Parks

Introduction

This pre-proposal describes the approach to be used by nine parks in the Eastern Rivers/Mountains Network to initiate biological inventories of vertebrates and vascular plants as described in the "Guidelines for Biological Inventories". The nine parks will work together to complete the steps up to and including the development of a detailed study plan for inventorying the vertebrates and vascular plants in the parks. The initial steps include

1. doing an inventory of existing data sources, and organizing and compiling existing data;
2. identifying data gaps and determining priorities and the level of detail required for additional field sampling; and
3. developing the full study plan that describes the spatial sampling strategy and methodology for collecting additional information, as well as listing the products to be generated by the inventories.

Meetings were held at Delaware Water Gap NRA, New River Gorge and State College, PA with park representatives, Chief Scientist and Regional I&M Coordinator to:

1. describe the new direction/ goals for biological inventories,
2. discuss the new guidelines,
3. review the differences between inventories and vital signs monitoring,
4. gather information on the status of inventories in each park, and
5. identify species or habitats for which detailed distribution and relative abundance measures are needed.

The NPSpecies database was emphasized at these meetings as a means to manage inventory data. Parks were asked to send information on vertebrates and vascular plants (documents and species databases) to the Washington I&M Program. These documents would be used to populate the NPSpecies database with documented occurrence information for vertebrates and vascular plants.

For this pre-proposal, parks were asked to provide

1. a report on the status of biological inventories,
2. a description of management issues,
3. a preliminary list of species for which relative abundance and/or distribution information was needed and a justification of that need and
4. a list of outside "experts" that might participate in a scoping session to refine both species lists and inventory needs assessments

Park Setting and Resources

The Eastern Rivers/Mountains Network includes 9 parks: Upper Delaware Scenic and Recreational River (UPDE), Delaware Water Gap National Recreation Area (DEWA), New River Gorge National River (NERI) Bluestone National Scenic River (BLUE), Gauley River National Recreation Area (GARI), Allegheny Portage Railroad (ALPO), Johnstown Flood (JOFL), Fort Necessity (FONE) and Friendship Hill (FRHI).

The Upper Delaware Scenic and Recreational River is a 73.4 mile segment of river, and part of the National Wild and Scenic Rivers System. It 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 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 through cooperative management with adjacent townships, is 55,574.5 acres, of which the National Park Service presently owns about 30 acres. Annual visitation to the River is about 300,000. Threats from recreational use, land use within the corridor (railway accidents, etc.), adjacent lands development and corridor management by council are some of the issues facing UPDE.

Only 8 river miles below UPDE, 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 National River includes 53 miles of river, portions of 77 tributaries and the surrounding 70,762 acres. Some of the land base is privately-owned inholdings. The New 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. Since the New River was 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. Almost 1 million people visit NERI annually.

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. Visitation is 300,000 and increasing. 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.

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.

ALPO is a long and narrow park that follows the historic railroad trace. The park is primarily forested (76%) and is contiguous to large forested areas. The Allegheny Front limits the development potential, but mining and lumbering activity on adjacent lands occurs. Other habitats include early successional lands, and a variety of wetlands (pond and intermittent streams), grasses and forbs and conifers. Critical management issues include adjacent land use, open fields management, and management of invasive species in conjunction with JOFL.

JOFL preserves the site of the breached dam and is dominated by early successional habitat (43%) located adjacent to the river. Critical management issues include management of open

fields, and invasive species management (giant knotweed, garlic mustard, Asiatic bittersweet, Eurasian honeysuckle, multi-flora rose, Japanese barberry, and Japanese honeysuckle).

FONE is in three units; the main unit includes battlefield, the earthworks, the fort and an historic tavern, a second until includes Jumonville Glen, a ravine, the third unit a historic property. The park includes forests and meadows, wetlands and 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.

FRHI preserves the historic property of Albert Gallatin along the Monongahela River. Federally listed plants are known to occur here. 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.

Summary and Status of Biological Inventories

All of the river parks have had some level of inventory accomplished since they were established. But most are relatively “new” parks, (DEWA established in 1965, NERI and UPDE in 1978 and BLUE and GARI in 1988) and limited funding has been devoted to resource inventory as compared to “creating a park”. Table 1 gives a brief summary of the status of biological inventory for each park.

Various Penn State research associates, most recently Jen Mravintz, have gathered and verified a tremendous amount of vertebrate and vascular plant information for some of these 9 parks (not DEWA). This information has been provided to WASO I&M in the NP Flora and Fauna database. These data are now in the NPSpecies database. DEWA provided a detailed MS Access database discussed below. In addition, Jen has been working with the parks to identify additional documentation of species occurrence in parks. She has provided her list of contact for voucher specimens to the I&M program.

Biological inventory data is in various states of management. Document- and specimen-based information regarding biological diversity (species richness) at Delaware Water Gap National Recreation Area (DEWA) was compiled and entered into an MS Access, (version 7.0) database in 1996. Biodiversity information was collected for amphibians, reptiles, birds, mammals, vascular and non-vascular plants, and invertebrates. The database was designed in cooperation with resource managers at DEWA. DEWA has maintained the MS Access database, but there is still much data entry and review to be done. The remaining parks have species information mainly in report or document form. (Sometimes easily retrievable, sometimes not). All of the parks rely heavily on local experts who have worked in the park for species-level information. None of the parks have maintained the NRBIB, although it was up to date as of several years ago.

TABLE 1: Summary of Existing Biological Inventory for Eastern Rivers/Mountains Network

UPDE	Plants	Partially complete for presence/absence for 90% of species Rhoads, et.al., 1985, <i>Endangered, Threatened, Vulnerable, and Rare Vascular Plants of the Pa Portion of the UPDE</i> Lyons-Swift, L.A., 1987, <i>Rare Plants and Natural Communities of the NY Side of the UPDE</i> . Both studies are more survey (as was their purpose) than comprehensive inventories, although species lists for plant community types were done in both studies. Also, Pa Science Office, TNC, 1994, <i>A Survey of the Aquatic Vascular Plants of the Upper Delaware River</i> This study is a general inventory and survey, and is an initial step, with much additional research and inventorying needed to properly document, protect, and manage the aquatic plant resources. Twenty-eight species were recorded, 196 sites inventoried over 122 miles of river. Five of nine species of concern (from historical records) could not be located in this study, with a recommendation of more searching needed. This study was done down through DEWA
	Birds	Complete for 90% by NY Breeding Bird Atlas(1987, Cornell) and PA Breeding Bird Atlas (1987, Brauning)
	Herps	Complete for 90% by NY State Reptile and Amphibian Atlas, 1990-1999, Al Breisch
	Mammals	Incomplete for small mammals
	Fish	Complete
DEWA	Plants	2211 records*
	Birds	284 records*266 potential** species, 241 documented***, 25 not documented, 60 special concern species no known specimens, achieved 90%= COMPLETE
	Reptiles	35 records, 28 potential species, 25 documented, 3 undocumented, 6 species with known specimens, 7 special concern species 89.3 % documented =Nearly COMPLETE
	Amphibians	43 records, 32 potential species, 28 documented, 4 not documented, 17 with known specimens, 15 special concern species 87.5 % documented = Nearly COMPLETE
	Mammals	88 records, 57 potential species, 47 documented, 10 not documented, 18 with known specimens, 19 special concern species 82.5 % documented =Nearly COMPLETE
	Fish	Incomplete: 58 reported to date (more likely), 57 documented, 1 not documented, 10 special concern species, no known specimens
Note:	For DEWA	Data from query of MS Access database that also includes documents *Records include taxonomy that may be redundant and in dispute **Potential species determined by review of literature and

		specimens by Mahan ***Documented species are those for which at least one reliable written record exists. Taxa with known specimens were determined by Mahan, et al after review of specimen records (includes subspecies)
NERI	Plants	? 1976 Grafton, 1986 RTE by McDonald, 1987 Biological Inventory, Riparian by VPI, 1997 vascular and nonvascular by Pauley
	Birds	Complete 1987 inventory by VPI, 1997 survey by Pauley, peregrine reintroduction program
	Herps	1992 and 1997 inventory by Pauley
	Mammals	Complete? 1987 biological inventory by VPI and in progress “Abandoned Mines-bats by Hal Bryan WV mammal survey lists 69 species, 40 probably occur in park. Hall and Kelson(1959) documented 57 species in NERI + BLUE
	Fish	Incomplete 1987 biological inventory by VPI, 1995 LTEMs by VPI 5 endemic species(COMPLETE), little information on tributaries, needed for 6 tributaries(INCOMPLETE) per park fisheries biologist
BLUE	Plants	Complete? 1987 inventory 4 volume set VA Tech, 1992 WV Natural Heritage rte survey
	Birds	Underway 2000 vertebrate survey draft by Pauley
	Herps	Underway in 2000 vertebrate survey by Pauley
	Mammals	Underway in 2000 vertebrate survey by Pauley
	Fish	Complete? 1987 inventory Orth VA Tech, may be 5 species of concern Incomplete for 1 tributary
GARI	Plants	1992 rte survey (Norris), 1993 vascular flora Grafton), 1996 critical habitats (Walton)
	Birds	Underway, first year of three year study in 2000 by Pauley, neotropical migrants sink
	Herps	Underway, first year of three year study in 2000 by Pauley, timber rattlesnake
	Mammals	Underway, first year of three year study in 2000 by Pauley
	Fish	Incomplete, needed for 1 tributary(Meadow River), 1990 study, 6 species of concern could occur
ALPO	Blants	Complete by Melton 82, 265 species –need exotics data
	Birds	Underway by PSU, 78 species
	Herps	Incomplete: have variety of habitats
	Mammals	<u>Incomplete</u>
	Fish	Complete by Arnold 97, 6 species
JOFL	Plants	Complete by Mountain 82, 260 sp, have maps for top 10 exotics
	Birds	Underway by PSU, 71 species
	Herps	<u>Incomplete</u>
	Mammals	<u>Incomplete</u>
	Fish	No fish, river polluted

FONE	Plants	<u>Incomplete</u>
	Birds	Incomplete, observations species list by Krueger
	Herps	Underway by CAUPA
	Mammals	Complete
	Fish	Incomplete, warm and cold water fishery
FRHI	Plants	Complete, 433 species, need exotics, need to resample state listed from 1986
	Birds	Incomplete, observations by Audubon
	Herps	Underway by CAUPA
	Mammals	Complete
	Fish	<u>Incomplete</u>

Preliminary Park-Specific Objectives for biological inventory

These river parks are linear, bottom-of-the-watershed parks so that many influences or adverse impacts originate outside of NPS jurisdiction. Inventory and monitoring objectives must approach issues on a regional scale to make a difference.

The following criteria have been, and will be used to identify and justify priority species, communities, and habitats for biological inventory.

1. Ecologically Important Natives: “keystone” species that strongly influence ecosystem qualities and/or biodiversity (e.g. white-tailed deer, beaver, eastern hemlock). Research is needed to determine these species.
2. Ecologically Disruptive Exotics: Invasive species that can potentially produce major ecological effects (e.g. purple loosestrife, Japanese knotweed...). Again, there is a research aspect to determining which species are the most disruptive.
3. Rare, Threatened, or Endangered: federal or state species, or communities, of special concern (e.g. bog turtle, shield darter, timber rattlesnake, Northern flying squirrel;)
4. Habitat Specialists: species or communities dependent on rare, vulnerable, “high quality,” or “extreme” habitats (e.g. cactus & fence lizards-dry summit/cliffs, *Ambystoma* salamanders-vernal pools).
5. High Profile Species of public or park management concern (e.g. black bear).
6. Manageability: planning and management for the species/community/habitat could be effective and practical.
7. Lack of Information about the species/community: an inventory could provide information otherwise not available.
8. Scientific Interest: occurrence or distribution of species/community is of special interest to science.

Past research and inventory work at these river parks by park staff, state agencies, other federal agencies universities and private citizens was used to develop preliminary park objectives for development of species distribution and abundance level data. Perhaps more than presence/absence level data, species distribution and relative abundance data for selected species and habitats are critically needed by each of these parks. This discussion also reflects needs for additional funding to reshape inventory work that was proposed and funded prior to the revision to the *Guidelines for Biological Inventory*. Data management will be the responsibility of the

Regional Office where parks cannot take on the responsibility. Data review will be the responsibility of the park. Penn State staff through an existing Cooperative Agreement will update NRBIB.

In UPDE, species of special management concern for which distribution and abundance information is needed include the following vascular plants. Purple loosestrife, Japanese knotweed are invasive exotics that alter native plant communities. Eastern Hemlock is a keystone species that influences ecosystem qualities. Reed Canary grass acts like an invasive, uncertain if native (per Rhoads). PA or NY listed or includes Prostrate Sand Cherry, *Prunus pumila* var. *depressa*, Checkered Rattlesnake Plantain, *Goodyera tessellata*, and Roseroot Stonecrop -*Sedum rosea*(endangered in PA). Also, Miners lettuce *Montia chamissoi* (PA endangered, not known to occur in NY), has been described as "most disjunct species in Pennsylvania" (Wherry, 1964). "Both populations occur w/in a few feet of the river bank, and could easily be damaged by recreationists seeking a resting or picnicking spot along the bank" (Rhoads, 1985). Aquatic vascular plants of concern are: Water-milfoil, *Myriophyllum spicatum* an invasive exotic in the lower Delaware River and moving upstream, and Curly Pondweed, *Potamogeton crispus*, an invasive found to be frequent in 1994 TNC study, and apparently still spreading.

Bird species of concern at UPDE include Bald eagle, a federally threatened (proposed for delisting) and endangered species in NY, PA, NJ. There is need for better species distribution, relative abundance information, and documentation of their most important habitats areas (roosting, perching, foraging, nesting) along the Upper Delaware. Increasing numbers, nests, and conflicts with people warrant additional work on this high profile species. Also, Cerulean Warbler, a bellwether neotropic that prefers riparian habitat, for which sightings have declined considerably in recent years. Cornell University has interest in this species. Also possibly worm-eating, yellow-throated, blackburnian warblers, acadian flycatcher.

Mammal species of concern include: Indiana bat (federally and state listed, UPDE provides suitable habitat such as floodplain, bottomland dead trees w/ loose bark and there is a large (9k bats) known colony in Kingston, NY within flight distance).

Also possibly small-footed bats (NY concern w/ declining numbers), least shrews (suitable habitat here), least weasels, woodrats, Northern flying squirrel, and Rock vole.

Fish species of special management concern include: Bridled shiner, *Notropis bifrenatus*, is PA endangered, disappearing on East coast, found in Marshals Creek recently and Ironcolor Shiner, *Notropis chalybaeus*, thought to be extirpated but rediscovered in PA in 1996. Of Special Concern in NY, found in Basher Kill in NY, suitable side-channel/backwater habitat may exist in Delaware River. There is a difficult issue at UPDE with entry to private lands that make up the corridor. Close coordination with the park is required and perhaps additional staff time to contact landowners seeking permission to sample.

In DEWA, Level 2 (species distribution and relative abundance measures) biological inventories should focus on habitats and species. Priority habitats include the following:

1. Ponds/Impoundment's: Complete taxonomic lists of aquatic vascular plants and fish (using an appropriate sampling strategy to select ponds). Rationale: Occurrence of aquatic vascular plants and fish in these habitats is not known; ponds and impoundment's are, or can be, greatly affected by management; vascular plants impact water quality, fisheries, and visitor experience.
2. River Riparian: Complete taxonomic lists of amphibians and breeding birds in riparian areas adjacent to agricultural fields and forested areas. Rationale: Riparian habitat is important to

many species of amphibians and birds that are of “special concern” (e.g. cerulean warbler, bald eagle, wood turtle, bog turtle, etc). Agricultural practices near riparian areas could be having deleterious effects on these species, and is under park management.

3. Hemlock Forests/Tributaries: Complete taxonomic lists of amphibians inhabiting tributaries and riparian areas of hemlock forests and hardwood forests. Rationale: Many amphibian species of special concern prefer such habitats (e.g. long-tailed salamander, spring salamander, red salamander, etc.); hemlock forests threatened by exotic insect (hemlock woolly adelgid) and indirectly threatens habitat of these amphibians. Could use the 28 already established hemlock and hardwood study sites.

4. Agricultural & Old Fields: Surveys for species of special concern such as Henslow’s sparrow, grasshopper sparrow, Savannah sparrow, and vesper sparrow, bobolink and Eastern meadowlark. Rationale: Habitat under active park management that could support species of special concern; also direct link to invasive, exotic plants.

Priority species at DEWA include the following:

1. Bog turtle: distribution and abundance data needed for NJ side of park. Rationale: Federally listed, wetland habitat specialist species, for which lack of information precludes appropriate planning and management.

2. American brook lamprey: Distribution and abundance data needed throughout DEWA. Rationale: Both scientific and management interest: “reliable written record” (1993) of this species of special concern in park represents very isolated occurrence in PA; possible “side catch” of this species with exploitation of sea lamprey.

3. Bridal Shiner & Ironcolor Shiner: Rationale: Both are species of special concern, not documented in park since 1978; Ironcolor now believed to be extirpated from PA.

4. Northern flying squirrel: Surveys of appropriate habitat throughout the park. Rationale: State listed species of special concern very possibly in park, but not documented or confirmed. Also, possible geographic overlap in distribution with Southern flying squirrel of scientific interest. Note ESU professor starting study of this species.

5. Purple loosestrife: Survey wetlands throughout park. Rationale: Ecologically disruptive exotic species threatening special habitats; information would improve planning and effectiveness of applying biocontrols.

6. Additional Invasive exotics (Garlic Mustard, Japanese knotweed, tree-of-heaven, etc): Surveys in priority habitats and sites. Rationale: Ecologically disruptive exotic species

7. Northern goshawk: Survey throughout park. Rationale: Species of special concern, associated with hemlock forests, which are threatened by hemlock woolly adelgid.

8. Northern saw-whet owl: Survey throughout park. Rationale: Species of special concern, possibly associated with hemlock forests, which are threatened by HWA.

9. Virginia Rail: Survey throughout park. Rationale: Species of special concern, requiring sedge/cattail wetlands, but also hunted.

4. Common Snipe and Woodcock: Survey throughout park. Rationale: Species of special concern, requiring wetlands, but also hunted in the park.

11. Northern Cricket Frog: Rationale: Species of special concern requiring wetlands or ponds/impoundment’s under active park management.

In NERI, GARI and BLUE there is a need for a thorough review of existing data prior to establishing priorities for presence/absence inventories and species or habitat priorities for

species distribution and relative abundance. Park resource inventories have been well funded in some cases. Preliminary objectives for Fish inventories at these parks would likely include sampling tributaries in each park, 6 in NERI, and one each in BLUE and GARI. Vascular Plants are probably incomplete for presence absence for all three parks although there have been rte surveys in the past. Birds may be complete for NERI and BLUE, but not for the GARI. Herpetological inventory is incomplete and there are species such as the timber rattlesnake that will need special consideration. Mammals were sampled in NERI and BLUE in the late 50's (prior to establishment of the parks) and there is a WV mammal survey. From which we can guess what occurs in the parks. Mammal inventory is planned at GARI.

For ALPO, JOFL, FONE and FRHI, the only park in this group needing a baseline vascular plant inventory is FONE. State-listed plants are found in two of the parks (FONE, FRHI,) and those sites need to be revisited. Bird and fish inventories are needed at 2 parks (FONE and FRHI) and possibly fish at HOFU. Herpetological inventories are incomplete at 3 parks (ALPO, JOFL and HOFU). Mammal inventories are needed at 4 parks: ALPO, JOFL, FONE and FRHI

All River and Mountains Network parks contain a large number of exotic species for which distribution and relative abundance data are needed. Invasive exotics are one of the most serious threats to the cultural landscape and natural processes in these parks. Limited work to control invasive species is going on in parks, and ALPO has mapped the distribution of the most aggressive exotics. There is still work to be done and it is a high priority.

Table 2 Identifies park and regional staff that will be involved in scoping biological inventories.

TABLE 2: Park Contacts/Scoping Team for River and Mountains Network

ALPO/JOFL	Brian Eick	814-886-6128
ALPO/JOFL	Keith Newlin	814-886-6121
FONE/FRHI	Chuck Smith	742-329-5812
FONE/FRHI	Connie Ranson	742-329-5818
NERI/GARI/BL UE	Ken Stephens Jesse Enk John Perez	304-465-6531
DEWA	Jeff Shreiner Richard Evans Allan Ambler	570-296-6952 x28 570-296-6952 x30
UPDE	Don Hamilton	570-729-7842
PHSO	John Karish	814-865-7974
NER	Beth Johnson	401-874-7060

Information on species will be solicited from the following experts to contribute to a full study plan for biological inventories.

List of Experts for DEWA
Compiled 12/1999

FISHES

Dr. Jay Stauffer
Penn. State Univ.
2C Ferguson Bldg.
University Park, PA 16802
(814) 863-0645
vc5@psuvm.psu.edu

Dave Arnold
PA Fish & Boat Comm
Bushkill, PA 18324
570 588-6388
fisheries biologist; knows PA side of park

Mark Boriek
NJ Div of Fish, Game & Wildlife
Bur. Of Freshwater Fisheries
PO Box 394
Lebanon, NJ 08833
Fisheries biologist; knows NJ side of park

BIRDS

Dr. Terry Master
East Stroudsburg Univ.
129 Moore Biology Hall
200 Prospect St.
East Stroudsburg, PA 18301-2999
(570) 422-3709
tmaster@esu.edu
researcher with grad students working in park; interest in neotropical migrants.

John Benzinger
783 Wilderness Acres
East Stroudsburg, PA 18301
(570) 223-0855
Writer; birder; some fieldwork in park

Fred Tetlow
41 Upper N. Shore Rd
Branchville, NJ 07826
home 973 948-3152
Expert field birder; knows park.

MAMMALS

Dr. Richard Yahner
Penn State Univ.
Ferguson Bldg.
University Park, PA 16802
(814) 863-3201
rhy@psuvm.psu.edu

Dr. Neal Woodman
East Stroudsburg Univ.
129 Moore Biology Hall
200 Prospect St.
East Stroudsburg, PA 18301
(570) 422-3714
nwoodman@esu.edu
Small mammal researcher; projects underway in park

James Sciascia
NJ Div. Fish, Game, & Wildlife
Endangered & Nongame Species Program
26 Rt. 173 West
Hampton, NJ 08827
(908) 735-8975
nrojscia@nac.net
PI for Small Mammal & Amphibian inventory in 2 DEWA hemlock ravines

Dr. Carolyn Mahan
Penn State Altoona
Biology Dept
Altoona, PA 16601
814 949-5530
cgm2@psu.edu
small mammals

Dr. Karen Campbell
Albright College
Biology Dept
Reading PA 19612-5234
610 921-7728
karenc@joe.alb.edu
bat researcher; conducted DEWA bat inventory

Rick Dutko
NJ Dept of Env. Prot.
Div of Parks & Forestry
Natural Lands Management

PO Box 404
Trenton, NJ 08625-404
609 984-7849
NHP Zoologist; knows NJ side of park

VASCULAR PLANTS

Dr. Ann Rhoads
Univ. Penn. & Morris Arboretum
(215) 247-5777x134
rhoadsaf@pobox.upenn.edu
author of PA flora; expert field botanist; knows PA side of park

Steven Clemants
Brooklyn Botanic Garden
1000 Washington Ave.
Brooklyn, NY 11225
(718) 941-4044x234
steveclemants@bbg.org
NY Metropolitan flora project; some fieldwork in NJ side of park
David Snyder
NJ Dept of Env. Prot.
Div of Parks & Forestry
Natural Lands Management
PO Box 404
Trenton, NJ 08625-404
609 984-7849
NHP Botanist; expert field botanist; knows NJ side of park

William Olson
1005 Lakewood-Farmingdale Rd
Howell, NJ 07731
BOlson@maserconsulting.com
732 583-5900
Expert field botanist; knows park.

Ann Newbold
50 Renninger Rd
Bechtelsville, PA 19505
610 754-7573
Expert field botanist; knows PA side of park

John Kunsman
The Nature Conservancy, PA Science Office
208 Airport Drive
Middletown, PA 17057

717 948-3962
Expert field botanist; knows PA side of park

Richard Radis
69 Odgen Ave
Rockaway NJ 07866
973 586-0845
rradis01@sprynet.com
expert field botanist; knows NJ side of park; writer

GENERAL

John Serrao
2113 Rosemount Dr.
Tobyhanna, PA
(570) 894-9791
Expert naturalist; wealth of knowledge about DEWA flora and fauna

HERPS

Clay Spencer
119 Walnut St
Bloomfield NJ 07003
748-3840

Park volunteer for many years, conducting herp inventories throughout the park. Special interest in timber rattlesnake. Wealth of knowledge concerning locations of amphibian breeding ponds, wood turtle hibernation sites, timber rattlesnake dens, etc.

Dr. Thomas LaDuke (tcladuke@esu.edu)
Dept of Biology
East Stroudsburg University
East Stroudsburg, PA
570 422-3520

Research interests include northern dusky/mtn dusky salamander. Participates in PA herp atlas project, with work in DEWA. Seeking grad student and \$\$ for wood turtle research in park.

Raymond Stein
Jill Dodds (jsdodds@worldnet.att.net)
Biostar Associates
884 Old Chester Rd
Far Hills, NJ 07931
908 234-0870

While at NJ State Museum, Ray Stein conducted the baseline herp inventory for DEWA in late 1970's. Extensive knowledge of park herpetofauna. His consulting firm, Biostar, recently conducted T&E surveys of selected impoundments in park.

Jim Sciascia (nrojscia@nac.net)

Mike Valent (nromvalent@nac.net)
908 735-8975
Endangered & Nongame Species Program
Div. of Fish, Game & Wildlife
RD#1 Box 383
Hampton, NJ 08827

DEWA consults with ENSP on T&E management issues. Cooperative research projects in park include Small Mammal & Amphibian Inventory in 2 Hemlock Stands (Sciascia, early 1990's) and Timber Rattlesnake research (Valent, underway).

Jason Tesauro (tesauroj@worldnet.att.net)
1 Limestone Sink Lane
Blairstown NJ 07825

Works for NJ ENSP. As private consultant, conducted bog turtle habitat inventory for NJ portion of DEWA in 1997-98 and bog turtle searches at 6 sites in 1998-99.

Tony Davis (tdavis@dcnr.state.pa.us)
Richard Ring
The Nature Conservancy, PA Science Office
208 Airport Drive
Middletown, PA 17057
717 948-3962

Conducted bog turtle habitat inventory for PA portion of DEWA in 1997-98 and bog turtle searches at 6 sites in 1998-99. TNC contracts with PA state to do heritage program work.

Andrew Shiels
Endangered & Nongame Program
PA Fish & Boat Commission
359-5113

In PA, Fish & Boat has legal responsibility for amphibians and reptiles. DEWA has not recently collaborated with Fish & Boat on herp issues in the park.

Dr. Russell Burke (BIORLB@Mail1.Hofstra.edu)
Department of Biology
114 Hofstra University
Hempstead, NY 11549
(516) 463-5521

Clemmys researcher. Has a long-term study underway on NJ state land adjacent to the park. Has interest in working with DEWA to fund a grad student to do wood turtle research at VanCampens Brook.

Experts for UPDE
Vascular plants:
Dr. Ann Rhoads,
Morris Arboretum,
Univ. of Pennsylvania,

215-247-5777 ext 134, rhoadsaf@pobox.upenn.edu.

Aquatic vascular plants:

Steve Fleckenstein,
Sullivan County Community College,
914-434-5750 ext 4203, fleck@warwick.net

Birds:

Dr. Valerie Freer, 914-647-5496, vfreer@sullivan.suny.edu
Voni Strasser, NEPA Audubon, 570-226-8847
Dan Brauning, PA Game Commission, 570-547-6938, brauning@csrlink.net
Pete Nye, NYSDEC Endangered Species Unit, 518-478-3053, penye@gw.dec.state.ny.us

Mammals:

Al Hicks, NYSDEC Endangered Species Unit, 518-439-7635 ext 6, achicks@gw.dec.state.ny.us
Cal Butchkoski, PA Nongame/Endangered Species, 814-667-3463, cmbutchk@penn.com

Reptiles and Amphibians

Al Breisch, NYSDEC Endangered Species Unit, 518-478-3057
Randy Stechert, 914-252-3517, 42 School St. Narrowsburg, NY 12764

Fish

Doug Carlson, NYSDEC, 315-785-2497
Bob Angyal, NYSDEC Region 3, 914-256-3067
Andrew Shiels, PA Nongame/Endangered Species, 814-359-5113.

Experts for NERI, BLUE, GARI

Vascular Plants

Brian McDonald and Sam Norris
DNR Natural Heritage

Bob Grafton
WV Coop Extension

Mr Suiter
Studied development sites

Birds

Donna Mitchell
NonGame DNR
(Birds, threatened and endangered species, bats)

Dr. Canterbury

Kodak ?

Herps

Dr. Pauley
Marshall University

Mammals

Petra Wood
Biological Resources Division, USGS
WV University Coop Unit

Craig Stihler
DNR NonGame
Endangered species coordinator for State

Fish

Reese Voshell
VA Tech

Dan Cincotta
DNR Heritage

Paul Angermeier/ Andy Dollof
VA Tech
USFS
Don Orth
VA Tech

Plans for Gathering Existing Data and Developing a Full Study Plan

Although experts overlap somewhat between DEWA and UPDE, are generally the same for NERI, GARI and BLUE, and there is some overlap between ALPO/JOFL and FONE/FRHI, note that there are no identified experts that are knowledgeable about all 9 of these parks. Travel costs between the PA/NY/NJ parks and the WV parks are extreme, over \$1,500 for airfare since there is no government rate at the airport located several hours from NERI. It is not feasible to hold one scoping session with experts representing these parks without significant funding for travel. It has not been determined if a scoping session with all of these parks and with experts from each park for planning inventory is feasible. This will be considered after the major portion of existing data is gathered.

A research associate stationed at Penn State or University of Rhode Island will be hired to gather existing data, develop a data set catalog (for non-spatial data), continue to populate the NPSpecies database, coordinate with NRBIB update and find subject matter experts to assist with review of materials. We plan to use Patuxent Wildlife Research Center and Leetown Science Center scientists (Allan O'Connell, Brian Underwood, Craig Snyder, Bob Ross, other to be identified) and park staff to develop a strategy for completing biological inventories.

The Wildlife Conservation Society is beginning herpetological inventory work in 2000 that was previously funded under the “old guidelines” WCS is contributing time from the Curator of Herpetology ,is not charging overhead and is using some volunteers to accomplish work. This study has been altered to assure that data will be compatible with the data browser, GPS and GIS work and the data management task were not planned in the original funding request. Additional funds requested to augment that study are itemized in the budget section.

North Carolina State University will create a data set catalog for spatial data sets. They also will identify available thematic maps that may be used to develop a habitat maps for sampling vertebrates and vascular plants by collecting presence absence data for all species and/or developing species/habitat distribution and abundance data for a small subset of species or habitats.

BUDGET

- 1. Compile Existing Data (minus NRBIB and spatial data set catalog), Interview Managers, Develop Data Set Catalog for non-spatial data, Continue to document NPSpecies database, Identify and interview subject matter experts, Organize scoping workshop with BRD and park staffs to review data, Prepare scoping report, Develop Scope of Work and seek cooperators,
 - Hire Research Associate and Experts \$37,450
 - Travel \$ 6,000
- 2. Update NRBIB (Penn State Coop Agreement) \$10,700
- 3. Amend Wildlife Conservation Society Coop Agreement
 - Vehicles, mileage (crew of 3) \$15,600
 - Housing \$ 6,680
 - Expert assistance (timber rattlesnake \$150-200/day) \$ 5,500
 - GIS tech work/post processing GPS \$ 7,100
 - Volunteers \$ 7,000
- 4. Purchase 3 real time GPS units for I&M work \$12,000
- 5. NCState University Data Set Catalog \$ 4,000
- 6. Develop full study plan

Total \$112,030

Deliverables

- Compiled and Verified NPSpecies Database
- Voucher Specimen Database started
- Updated NRBIB
- Complete summary of existing information, including experts’ views, park managers’ views on biological inventory data needed
- GIS thematic layers for habitat delineation
- Data Set Catalog
- Summary of scoping session with scientists

WCS Amendment to Cooperative Agreement for data compatible with arc view
3 GPS units for use in I&M