

Great Swamp National Wildlife Refuge

Basking Ridge, New Jersey

Annual Narrative Report

Calendar Year 1990

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM



Maintenance Mechanic Robert B. Westerman
(DS)

This annual report is dedicated to Robert B. Westerman who passed away on October 2, 1990, from a sudden illness. For two years, Bob was the Maintenance Mechanic at Great Swamp and a refuge officer. He served for about four years in a similar capacity at Mason Neck NWR prior to moving to Great Swamp. Bob loved the Fish and Wildlife Service and brought a great deal of experience and skill to it. He had much to offer and earned a Superior Performance Award after working for the Service only a short while. He also graduated with "Distinguished Academic Status" from Basic Law Enforcement Training (FLETC), Glynco, Georgia. Bob served four years in the U.S. Marine Corps receiving an "Honorable Discharge" at the rank of Sergeant after seeing active duty in Vietnam. For his military service, he earned numerous honors and medals.

Bob felt so strongly about his work with the Service that he requested that his Refuge Officer badge be buried with him. Bob's commitment and dedication to the Service along with his sense of humor and easy going nature will be missed by everyone.

GREAT SWAMP NATIONAL WILDLIFE REFUGE

Basking Ridge, New Jersey

WALKILL RIVER NATIONAL WILDLIFE REFUGE

Sussex County, New Jersey

ANNUAL NARRATIVE REPORT

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NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

GREAT SWAMP NATIONAL WILDLIFE REFUGE

Basking Ridge, New Jersey

WALLKILL RIVER NATIONAL WILDLIFE REFUGE

Sussex County, New Jersey

ANNUAL NARRATIVE REPORT

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William Koch
Refuge Manager

2-25-91
Date

Donald M. Frickie
Refuge Supervisor Review

4-12-91
Date

Donald M. Frickie
Regional Office Approval

4-12-91
Date

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WALKILL RIVER NATIONAL WILDLIFE REFUGE

INTRODUCTION

Creation of the Great Swamp began roughly 25,000 years ago, where the Wisconsin glacier stopped at its furthest point south. In time, the melting glacier retreated northward leaving a geological formation that is best described as a shallow bowl, seven miles long and three miles wide. Waters from the melting glacier filled the basin forming part of Lake Passaic which eventually drained forming what is known today as the Great Swamp Basin. This 14,000-acre basin is surrounded on all sides by low-lying ridges 50-200 feet high.

The Great Swamp National Wildlife Refuge is situated within the Great Swamp Basin, and is located in Chatham, Harding and Passaic Townships of Morris County in north central New Jersey. Morristown, the County Seat of Morris, is seven miles to the north and New York City is twenty-five miles to the east.

Great Swamp National Wildlife Refuge, presently 7,000 acres, comprises the largest land ownership, being 50% of the basin. Remaining lands are predominantly held in private ownership with the exception of Somerset County Park and Environmental Education Center (854 acres) and Morris County Outdoor Education Center (40 acres).

Great Swamp is located in the Piedmont Plateau of the Appalachian Province. The Plateau and the area surrounding the swamp is characterized by gently rounded hills separated by broad valleys with hills rising from 200 to 400 feet above the surrounding land. The refuge averages 230 feet above sea level.

Great Swamp is located in the headwaters of the Passaic River basin and is bordered on the west by the upper Passaic River. The swamp drains 29.2 square miles of watershed northeast of Millington Gorge and receives waters of Primrose, Loantaka, Great and Black Brooks. In short, it drains all of the southern area of the Passaic River watershed above Millington Gorge. Great Swamp normally floods during spring runoff and occasionally during late summer hurricane rains; however, flooding in recent years is occurring more frequently and with greater magnitude due to the urbanization of the Great Swamp Watershed, and conversely low flows of tributaries are lower during dry periods.

Swamp woodland, hardwood ridges, cattail marsh and grassland typify this 7,000-acre refuge. Plant species of both the northern and southern botanical zones are present. The refuge is characterized as a brush and timbered swamp with low ridges or knolls rising from five to 15 feet above the surrounding swamp. In several places, the swamp opens into small marshes. Bottomland vegetation is composed of ash, red maple, highbush blueberry, swamp rose, willow and a wide variety of ground cover types. Many of the low ridges support a forest association of beech, oaks, gray birch, sugar maple, black gum, white ash and shagbark hickory.

Predominant vegetation types within the refuge are: 2,634 acres forest; 391 acres field; 790 acres brushland; 3,130 acres swamp, marsh and other wetlands, and 55 acres administrative land. This acreage may vary as additional land is acquired and through various habitat management activities.

In 1708, for a barrel of rum, 15 kettles, 4 pistols, 4 cutlasses plus other goods, and 30 pounds cash, the Delaware Indians deeded a 30,000 acre tract including the Great Swamp to English investors. Later, settlements dotted the area and during the Revolutionary War, local settlers fashioned wagon-wheel parts with wood cut from the Great Swamp. By 1844, farms appeared on logged-off uplands; farmers drained marshlands, and "foul meadow hay" became a major crop. Small farming operations such as these became uneconomical and gradually disappeared. Consequently, much of the cleared upland returned to woods and the lower flat areas reverted to swampland.

There have been various modern uses planned for the Great Swamp; flood control in the 1920's; drainage projects in the 1930's; and a jet airport proposal in 1959. It was the threat of the jetport which enabled the Great Swamp Committee of the North American Wildlife Foundation to muster the aid of a significant number of volunteers. This effort raised more than a million dollars to purchase nearly 3,000 acres which was donated to the Department of the Interior. These acres formed the nucleus of the Great Swamp National Wildlife Refuge. Through the years, additional acres have been added to the original tract bringing the refuge to its present 7,000 acres. Approximately 2,322 acres, within the approved refuge acquisition boundary, are still in private ownership.

Great Swamp is literally an island of wildlife habitat totally surrounded by suburbanized communities and rapidly encroaching urbanization. New construction, both commercial and residential, are springing up everywhere on remaining land around the Swamp. Great Swamp offers one of the last refuges for wildlife and wild habitats in northern New Jersey and becomes increasingly important to man and wildlife as other natural areas are destroyed.

A. HIGHLIGHTS

The Wallkill River National Wildlife Refuge was approved by Regional Director Ronald Lambertson on March 9, 1990, and authorizing legislation signed on November 16, 1990. Four million dollars was appropriated for land acquisition in FY 91 (see Wallkill River NWR narrative).

Approximately 30 acres of wetlands were restored in the refuge wetland restoration project (see Section F.2).

B. CLIMATIC CONDITIONS

Month	Temperature (Degrees F)		Precipitation (inches)		Snowfall (inches)	
	Max	Min	1990	Normal	1990	Normal
January	63	17	5.45	3.66	5.00	7.10
February	65	5	2.08	2.96	2.00	8.16
March	82	10	2.68	4.30	1.50	4.30
April	92	23	3.56	4.26	2.00	1.00
May	79	33	8.63	4.96	----	----
June	88	42	3.80	4.42	----	----
July	92	52	3.60	4.82	----	----
August	90	50	7.99	4.67	----	----
September	87	34	2.03	5.02	----	----
October	84	27	7.56	3.93	----	----
November	78	20	3.10	4.78	----	1.20
December	62	16	6.56	3.67	8.00	5.20
Max/Min/Total	92	5	57.04	51.45	18.50	26.96
Average	80.16	27.41	4.75	4.28		
	53.79					

Climatic conditions for the year were wetter than normal. This year, rainfall was 5.59" above normal. Flooding was a common occurrence throughout the year.

Snowfall was 8.46" below normal. The heaviest accumulation (8.0") fell December 27-28. Average temperature for the year was 53.78°F which was 4.08°F higher than last year.

C. LAND ACQUISITION

1. Fee Title

One million dollars in FY 90 and two million in FY 91 were appropriated for Great Swamp land acquisition. Refuge Manager Koch worked with the

Regional Realty Office throughout the year on land acquisition priorities, strategies and contaminant issues.

The refuge acquired several tracts this year as listed below:

TRACT #	SELLER	TOWNSHIP	DATE ACQUIRED	ACRES
290	Tobia	Passaic	9/12/90	22.81
279	Sheehan	Passaic	11/1/90	5.1
283	Orrico	Passaic	12/14/90	1.75
TOTAL				29.66

The total refuge acreage as of the end of 1990 was 7000.91.

The McDonough life estate was terminated with the death of Anna McDonough. This gave the refuge responsibility for a two-story wood frame house on Tract 129. The building is in poor condition. Disposing of old buildings by burning is no longer permitted by the State because of air pollution laws. Prior to demolition, the structure must be inspected for asbestos and the asbestos removed if found. With strict wetlands protection laws, burying debris is very limited on the refuge. It is therefore becoming very expensive to remove unwanted structures.



Vacant houses (excess property) are becoming much more difficult to dispose of (TM)

At the request of some residents in the Great Swamp area, a public meeting was held on January 30 to explain retention of life rights when selling their property. The "Great Swamp Residents Advisory Committee" and Manager Koch organized the meeting. Messrs. Turner, Larson, and Beaver (RE) and Manager Koch addressed the group of about 45 people. Passaic Township Mayor Van Deusen was also present for questions. Associate Manager Frickie and Watershed Biologist Moore attended. Many questions were asked and the meeting was very productive. Quite a few landowners expressed interest as willing sellers.

On January 3, Manager Koch met with Mr. DesRochers for a briefing on Sandoz Pharmaceutical's plan for donating land to the refuge as part of a mitigation proposal for a development project at their complex in East Hanover, NJ.

Manager Koch attended a Passaic Township Planning Board meeting on March 20 regarding the subdivision of the Gambino property which is within the refuge acquisition boundary. Sandoz Pharmaceuticals is proposing to mitigate some wetland losses on their East Hanover complex by purchasing and donating to the refuge a portion of Gambino's property. Manager Koch made a statement in support of the subdivision. Sandoz eventually backed out and a donation was not made to the refuge.

On January 23, Manager Koch met with Susan Somer of the "Trust for Public Land" to discuss land acquisition possibilities and strategies for Great Swamp. Wildlife values and physical features of several parcels within the acquisition area were discussed.

On May 16, the Passaic Township Committee passed a resolution to discontinue taxing life estates on property in the Great Swamp NWR because revenue sharing funds are distributed to the Township from the USFWS for payment in lieu of taxes. This resolution is the result of efforts made by local landowners to inform the Township Committee of the inequitable taxing of life estates in the Township.

D. PLANNING

2. **Management Plan**

The Marsh and Water Management Plan was submitted and approved by the Regional Office on February 2, 1990.

The Animal Control Management Plan was also submitted and approved on June 1, 1990.

The station's Public Use Plan was submitted on January 22, 1990, and approved on August 2, 1990.

In September, 1990, the refuge received from the Acting Regional Director the Region 5 "Response Plan for Discharges of Oil and Hazardous Substances" for use by Region 5 employees who may become involved in responding to oil or chemical spills.

The Fire Dispatch Plan was updated in April and October, 1990.

4. - Compliance with Environmental and Cultural Resource Mandates

Manager Koch reviewed and commented on a draft EA and engineering feasibility study for a proposed sediment basin on the refuge. The basin on Primrose Brook is part of N.J. Department of Transportation's mitigation plan for wetlands destroyed in their construction of Rt. 24 (outside the refuge watershed). The basin, if constructed, will trap sediments that would otherwise be deposited in Pool 2.

5. Research and Investigations

Great Swamp NR-90 "An Examination of Rarity in Plants by Comparing Rare and Common Species of Eupatorium". (RS-10)

Conducted by Diane Byers, Department of Biological Sciences, Rutgers University. The purpose of this study is to compare ecological and genetic characteristics of two closely related species of boneset (Eupatorium resinosum rare and E. perfoliatum common) to identify what characteristics may lead to rarity. During CY 90, Ms. Byers continued her demographic survey of E. perfoliatum. Fewer than 100 seedlings emerged in the sample area and very few survived through the summer. Most plants from last year reemerged and flowered; therefore, she stated that "the population maintains itself primarily through survivorship of individuals over several years with only a few seedlings surviving to the following years. E. perfoliatum flowers for a greater period (5-6 weeks) compared to the rare species, E. resinosum (2-3 weeks). The shorter time of flowering may result in a decrease of pollinator visitation which may result in decreased seed set". To test if the rare species is pollen limited, Ms. Byers has added pollen to some of the flowers on twenty plants in both populations and is currently counting seeds from both sample populations.

Great Swamp NR-90 "Mist Netting Study of Spring Migration at the Great Swamp National Wildlife Refuge". (RS-01)

Conducted by Dr. Joseph J. Mahoney, Kean College, NJ. This on-going study was initiated in 1983. Data was collected in the spring and fall of 1990 to continue assessing relative abundance and habitat use by migrating passerines and to document the temporal pattern of change in species composition and diversity. The major peak of this year's spring migration was on May 8 with a second peak on May 22. These dates are almost exactly as observed last year (May 9 and 22). Using exactly the same net sites as in the past seven years, Dr. Mahoney noted 124 "first

time captures". In comparing all eight years of spring net success, four have varied only between 0.26 and 0.28 birds/net hour, placing 1990 slightly in the higher than average.

The most common netted species in order of abundance were: common yellowthroat, gray catbird, veery, eastern phoebe and black-capped chickadee. The veery, a neotropical migrant, is of special interest in Dr. Mahoney's research. Following the Rappole Report (1983), he had hypothesized that the veery would undergo a population decline. For the first six years of his research there was, in fact, an apparent increase. However, in the past two years numbers have dropped to about half that of their peak years and are now back to about the 1983 and 1984 baseline values. Dr. Mahoney also brought to the attention of the refuge staff that almost every year he has netted northern waterthrushes even though the refuge bird list identifies this species as "uncommon". The Louisiana waterthrush, also listed as "uncommon", was represented by only one bird captured during the first two years of his study.

Great Swamp NR-90 "Monitoring Avian Productivity (MAP) Project". (RS-11)

Glenn and Eileen Mahler established a banding station in the Management Area of the refuge to participate in the MAP Project that is being coordinated by The Institute for Bird Populations. This cooperative venture is attempting to monitor the productivity, survivorship and population trends in North American landbirds through the establishment of 180 constant effort breeding season banding stations across the continent. A study site of approximately 12.5 acres has been established on the refuge and banding efforts (mist netting) were operated once during each ten-day period from mid-May through mid-August. A total of 223 birds were banded including 29 species. During 10 separate visits (June-August), a total of 65 species were either seen or heard.

Great Swamp NR-90 "Contaminants in White-tailed Deer Tissue From the Great Swamp N.W.R., Morris and Somerset Counties, New Jersey".

The technical assistance report, "Contaminants in White-tailed Deer Tissue from the Great Swamp National Wildlife Refuge, Morris and Somerset Counties, New Jersey: Results of 1988 Sampling Efforts" was completed and received in June, 1990. This investigation was initiated to quantify levels of environmental contaminants present in the resident white-tailed deer populations and whether the contaminants posed any human health risk. White-tailed deer tissues were sampled during the December, 1988, public deer hunt at the refuge. Sections of 32 deer livers, 10 muscle tissue samples and 30 adipose (fatty) tissue samples were collected and analyzed. The maximum, minimum, mean and median values were calculated for each constituent. Maximum and median concentrations were compared to environmental levels reported in the literature and to U.S. Food and Drug Administration (FDA) action levels to assess the levels of contamination present and the potential human health risk.

Muscle tissue samples analyzed for levels of organochlorine pesticides and PCBs were all below detection levels. In liver tissue, where metals are selectively concentrated, the median and maximum levels of cadmium and other metals were not high enough to pose a threat to human health. Some adipose tissue samples (70%) tested positive for trace amounts of one or more organochlorine compounds; however, median values for individual organochlorine constituents were all below detection levels with the exception of PCB congener CL6. Only two of the observed maximum concentrations in adipose tissue, total PCBs and total chlordane, exceeded FDA action levels. All other values for total PCBs and total chlordane were well below FDA action levels for human health; however, the levels of the total PCBs are of concern because of their potential chronic toxic and carcinogenic affects on the deer.

In summary, low levels of contaminants observed and the lack of strong patterns in the data suggest an absence of localized contamination problems in the resident deer populations within the Great Swamp NWR.

E. ADMINISTRATION

1. Personnel



L to R: 2,6,1,5,4,12

(C. Hoover)

1. William Koch, Refuge Manager, GM-13, EOD 2/19/84, PFT
2. Lydia T. Villanueva, Refuge Manager, GS-11, EOD 2/26/90, PFT
3. Janith D. Taylor, Refuge Manager, GS-9, EOD 12/8/85-2/23/90, PFT
4. Deborah A. Melvin, Wildlife Biologist, GS-9, EOD 7/1/90, PFT
5. Thomas A. McFadden, Outdoor Recreation Planner, GS-9, EOD 7/12/81, PFT
6. Rosemary Klimas, Office Assistant, GS-6, EOD 10/27/74, PPT
7. Martha C. Malavasi, Clerk-Typist, GS-4, EOD 3/19/82, PPT
8. Graham W. Taylor, Maintenance Worker, WG-7, EOD 8/15/85-2/23/90, PFT
9. Robert B. Westerman, Maintenance Mechanic, WG-9, EOD 11/6/88-10/2/90, PFT
10. Jimmie J. Reynolds, Biological Technician, GS-5, EOD 10/25/87-6/30/90, PFT
11. Russel N. Scheirer, Biological Aid, GS-4, EOD 11/6/89, TFT
12. David A. Melvin, Maintenance Worker, WG-7, EOD 7/8/90, TFT
13. Ryan L. Hinesley, Biological Science Student Trainee, GS-3, EOD 7/31/89, TFT
14. Craig Moore, Watershed Biologist, GS-11, EOD 11/89, PFT (stationed at FWE, Pleasantville, NJ, Field Office)



Clerk-Typist Martha Malavasi (TM)



Bio Aid Russ Scheirer & SCA Volunteer Carter Reed
(TM)

15. Lawrence A. Balsamo, YCC Group Aid, GS-4, 7/1/90-9/6/90, TFT
16. Mark Atkinson, YCC Youth Leader
17. Allison Bonanno, YCC Enrollee
18. Judith Marchand, YCC Enrollee
19. Tom Vigliotta, YCC Enrollee
20. James Wegeler, YCC Enrollee
21. Joseph Dupont, YCC Enrollee



L to R: 15,17,18,19,20,16,21
(TM)

22. Richard Carter Reed, Student Conservation Association Volunteer,
1/8/90-3/16/90
23. Bryan Smith, Student Conservation Association Volunteer,
6/17/90-9/7/90



SCA Volunteer Bryan Smith (TM)

On February 26, Sid Mitra started a temporary appointment as a Toxicologist assigned to the refuge asbestos Superfund site (see Section J.1).

Primary Assistant Refuge Manager Terry Villanueva came on board on January 29. Terry transferred from Blackwater NWR.

Assistant Refuge Manager Jan Taylor transferred to E.B. Forsythe NWR, Brigantine Division, on February 23. This FTE was not refilled with an Assistant Refuge Manager, but a new Biologist position was filled instead.

Also transferring on February 23 was Maintenance Worker Graham Taylor. Graham went to E.B. Forsythe NWR, Barnegat Division.

On June 30, Biological Technician Jimmie J. Reynolds transferred to Kootenai NWR in Idaho to accept a promotion to Assistant Refuge Manager.

Biological Aid Russ Scheirer's temporary position was extended to help

cover our current staffing shortage.

Debbie Melvin arrived at Great Swamp on July 1 filling the newly created Biologist position. Debbie transferred from Chincoteague NWR.

David Melvin began a temporary appointment as Maintenance Worker on July 8.

On October 2, Maintenance Mechanic Bob Westerman suddenly passed away after a brief illness.

Project Leader Bill Koch was promoted to GM-13, effective December 16.

Larry Balsamo was appointed YCC Group Aid. Larry was formerly a YCC enrollee and also YCC Youth Leader.

No work assignments were performed during the year by the Biological Science Student Trainee.

YEAR	PERMANENT		TEMPORARY	TOTAL FTE
	FULL-TIME	PART-TIME		
1990	7	2	3	8.11
1989	8	2	4	9.96
1988	8	2	6	10.04
1987	7	2	8	9.48
1986	7	2	9	10.43

2. Youth Programs

This was the 15th year that a YCC camp was in operation at the Great Swamp NWR. Six (6) enrollees were supervised by one Group Aid and on occasion by a Student Conservation Association (SCA) volunteer.

This year's camp was again very successful with many worthwhile projects being completed. These projects included construction of a Wilderness Area foot bridge; trail maintenance; assistance with daily duck banding operations; weekly cleaning of the headquarters and the Wildlife Observation Center; assisting The Raptor Trust in painting flight cages; washing and waxing refuge vehicles; spreading wood chips on two foot trails; wood duck box construction; litter clean-up along the Passaic River/refuge boundary; vegetation clearing along roadways; painting of pipe gates and litter pick-up.

Environmental awareness activities were incorporated into all work projects. Enrollees went on a working field trip with the National Park Service where they canoed a portion of the Delaware River National Recreation Area and removed an assortment of trash found along the river. This was the seventh year that this type of interagency cooperation has occurred.



YCC receiving canoe safety & handling instruction
from NPS personnel prior to Delaware River National
Recreation Area clean-up project (TM)

Tailgate safety sessions along with the camp's Safety Plan and Regional Safety Policy paid off this year with no physical injuries occurring. All enrollees attended a Standard First Aid and CPR course and received Red Cross Certification.

This year's Open House was attended by 18 parents and relatives of the enrollees. The program featured an excellent slide show prepared and conducted by the enrollees showing this summer's projects and activities. Guest speakers Jim and Jean Stamey from The Raptor Trust gave a very informative program on Birds of Prey and a wildlife poster was presented to each enrollee. With all the projects completed, the cost benefit ratio was \$1.90; an excellent return on the dollar.

The Great Swamp YCC program does not receive numerous applications, but it does get quality applicants. The enrollees showed tremendous enthusiasm in their work which was reflected in the number of completed projects and the high standards of quality maintained throughout the program. The "Take Pride in America" theme was demonstrated throughout the entire camp by the Group Leader, the enrollee's attention to detail and their sustained desire to "do the job right the first time".



YCC constructing foot bridge (L. Balsamo)



YCC woodchipping trail (TM)

4. Volunteer Program

The 1990 Volunteer Program was very successful with 86 volunteers donating a total of 1,240.5 hours of service. This was up 15 volunteers and 256.5 hours of service from 1989. Since the program's reorganization in 1982, a total of 10,120 hours of service have been contributed by 457 volunteers who have ranged in age from Tiger Cub Scouts to senior citizens. This time would have amounted to \$70,417 in salaries. Great Swamp takes much pride in its Volunteer Program and the volunteers take much pride in their contributions. Some of the activities that volunteers were involved in included deer hunt assistance; litter pick-up; hunter safety education along with firearm range instruction; trail maintenance; YCC assistance; wood duck box checks; computer assistance; trail and foot bridge construction; waterfowl counts; bluebird box checks; receptionist and clerical duties; boundary clearing; landscaping; timber stand improvement (TSI) and guided bird walks.

Outdoor Recreation Planner McFadden attended Boy Scout Troop 28 Annual Awards Dinner where the scouts and those who volunteered their services to the troop throughout the year were honored.

The 9th Annual Great Swamp Clean-Up was conducted with 34 volunteers picking up 2,000 lbs. of trash along refuge roads and trails. This included an estimated 500 lbs. of glass and 50 lbs. of cans that were separated and taken to the local recycling center.



Volunteer Dan McGuinness proudly displaying bluebird nesting and wintering boxes he made for the refuge (TM)



Annual Volunteer Swamp Clean-Up crew (TM)



Boy Scout Troop 28 constructing foot bridge
(TM)



Annual Volunteer Recognition & Awards Dinner
(RS)

The 4th Annual Volunteer Recognition Dinner was held on March 30 at Refuge Headquarters honoring volunteers. Approximately 20 people were able to attend the event. T-shirts with the US Fish and Wildlife Service volunteer emblem were presented along with Certificates of Appreciation.

5. Funding

Refuge Operations	\$ 230,245
Refuge Maintenance	\$ 180,563
Fire	\$ 61,650
Contaminants	\$ 50,000*
Quarters Operation & Maintenance	\$ 24,463
Transferred from US Dept. of Agriculture	\$ 1,200**
Wetlands Restoration	\$ 9,217***

*Transferred to FWE to complete tasks identified in the annual Watershed Biologist scope-of-work between refuge and FWE.

**Interagency agreement adding \$1,200 to our annual budget in return for providing USDA's Animal and Plant Health Inspection Service (APHIS) office space.

***Charged to Regional Office account for on-refuge habitat enhancement projects.

FY	Refuge Operations and Maintenance	Quarters Operations and Maintenance	YCC	Fire Equipment
1990	\$523,658	\$28,463	\$14,280*	\$61,650*
1989	\$884,881	\$28,779	\$14,280*	\$ 500*
1988	\$573,558	\$26,420	\$13,600	----
1987	\$598,835	\$32,500	\$13,600	\$ 6,100*
1986	\$405,000	\$26,300*	\$26,000	\$ 2,500*

*Amount is included in refuge O&M total and is not in addition to it.

6. Safety

Safety meetings were held on a monthly basis. Some of the topics included tractor operation and safety, proper jump starting of vehicles, rabies, safe lifting, proper handling of deer at check stations to minimize exposure to Lyme disease and rabies, shop safety, safety around welding equipment, seat belt, woodstove, and fork lift safety.

On July 11, refuge staff and YCC enrollees completed and became certified in Standard First Aid and CPR. This course was taught by Somerset County Park Rangers at the Lord Stirling Environmental Education Center.

Tailgate safety sessions were beneficial again this year for the YCC program with no accidents occurring to any of the enrollees or group leader.

Unfortunately, there were several accidents with other staff including:

On February 20, while the JD-550 dozer was being operated, it slid sideways into a small steep-sided pond. The engine was submersed under water requiring servicing.

On April 3, Outdoor Recreation Planner Thomas McFadden, while participating in the 1.5 mile run as part of the Physical Efficiency Battery at the annual law enforcement refresher, tripped and fractured his ankle.

On July 13, while turning and backing the crew cab, a Student Conservation Association Volunteer hit a gate post. Damage was limited to the right front passenger door.

On August 8, Maintenance Worker David Melvin was stung by a wasp while opening the headquarters entrance gate. His arm swelled, requiring medical attention.

On August 22, the door hinge of the dozer was struck by a tree limb and bent while being operated in a wooded area.

Several other minor accidents occurred involving cuts, scrapes, and bruises.

Lyme disease continues to be of concern to refuge personnel and visitors. Refuge staff participated in the monitoring program. None of the staff were diagnosed with Lyme disease during this year.

On August 16, Assistant Manager Macek from Edwin B. Forsythe National Wildlife Refuge (EBFNWR) assisted station Safety Officer Asst. Manager Villanueva in conducting a station safety inspection. On August 20, Assistant Manager Villanueva reciprocated by conducting the safety inspection at the Brigantine Division of the EBFNWR.

7. Technical Assistance

On January 10, Manager Koch attended a Press Conference for the proposed Wallkill River NWR at the Wantage Township Town Hall. The final EA was released at this meeting. RD Lambertson and Acting Commissioner Fenske, NJ Dept. of Environmental Protection, were key speakers. Lambertson presented Fenske with a token of the Service's appreciation for her avid support of new and existing national wildlife refuges in the State. Approximately 75 people attended including Congressional representatives, state, county and local officials, other Service representatives, and the news media. Koch arranged a helicopter tour of the project area, but it had to be cancelled due to foul weather.

In January, FWE (Pleasantville, NJ) Great Swamp Watershed Biologist Moore contacted B. Bauersfeld, Hydrologist with USGS, and discussed interpretation of peak flow hydrologic data for the USGS gage at Passaic River near Millington. Moore requested additional (current year) data for the gage. Moore prepared a graph of hydrologic data (peak above base) versus time for the gage. Moore contacted the National Climatic Data Center in Ashville, North Carolina and long term rainfall data was requested for the nearest (Canoe Brook) National Weather Service rain gage to Great Swamp NWR. The data will be used to normalize long term hydrologic (streamflow) data for the USGS gage at Passaic River.

Manager Koch was one of several guest speakers on March 28 at a seminar sponsored by the Harding Township Environmental Commission's Earth Day Education Project. The seminar, entitled "Protecting Wetlands in the Great Swamp Watershed" was open to the public, but directed at local officials in the watershed. Approximately 25 officials attended. Assistant Manager Villanueva, ORP McFadden and Watershed Biologist Moore also attended and provided helpful information to attendees.

In March, Refuge staff assisted the Regional Engineering Office and Contracting Office in developing a contract bid package for removal of nine (9) underground fuel storage tanks. Two of these tanks were previously excavated by the refuge (see Section I.2).

On May 14, Assistant Manager Villanueva and Manager Koch investigated reports from a refuge neighbor of possible illegal activities in wetlands (vegetation clearing and excavation) by utility companies on and adjacent to the refuge along power line ROW in Chatham Township. No activity on the refuge was discovered, but NJ DEP wetlands enforcement personnel were advised of the activities.

On June 1, Manager Koch met with Lou Schindel, Chatham Township Environmental Commission Chairman and provided information for a brochure that the township is preparing about protecting the Swamp.

On June 1, Manager Koch, Assistant Manager Villanueva and Watershed Biologist Moore(FWE, Pleasantville, NJ) met with a refuge neighbor who was very concerned and informative about wetland encroachment activities by gas and electric utility companies along the ROW near Southern Boulevard. Moore attended a public hearing in Chatham Township on June 4 about Texas Eastern Gas Company's pipeline proposal.

Outdoor Recreation Planner McFadden was on a special detail to Region 3 Regional Office from June 4-15 while the Regional Outdoor Recreation Planner was away.

On June 27, Manager Koch, Assistant Villanueva and ORP McFadden met with Randy Ravitz, a student intern from U.S. Senator Bradley's office. Ravitz requested the meeting because he is working on a project identifying environmental education deficiencies and needs. McFadden conducted a facility tour.

On July 3-16, Assistant Manager Villanueva represented the US Fish and Wildlife Service at a Girl Scouts of the USA (GSUSA) event called "Earth Matters" in Prescott, Arizona. Thirty adult volunteers and high school-age girls from across the US attended the event. The course emphasized the role of federal partnerships to gain technical assistance and for service projects. The group met with the Soil Conservation Service and local and regional representatives of the US Forest Service. Villanueva showed the video "The USFWS: A Challenge and an Adventure" and discussed career opportunities, technical assistance and volunteering. Villanueva's services were made available to GSUSA through the Memorandum of Understanding with the Dept. of the Interior and GSUSA signed in September, 1988. The Girl Scouts provided transportation to Arizona and covered travel expenses.

In July, Manager Koch reviewed and commented on draft versions of the Great Swamp Watershed Advisory Committee (GSWAC) MOU agreement with NJ DEP. On August 1 and 8, Manager Koch attended meetings of the GSWAC to discuss the draft MOU between GSWAC and the NJ DEP. The MOU was ratified at a GSWAC meeting in September. Manager Koch attended monthly GSWAC meetings throughout the year.

During August, refuge staff assisted in planning a September meeting for the New Jersey Skylands Greenway Task Force which will focus on the

proposed Wallkill River NWR. On September 11, Assistant Manager Villanueva assisted Assertainment Biologist Gib Chase (RO-RE), Robin Burr and Cliff Day (FWE, Pleasantville, NJ) in a presentation and tour of the proposed Wallkill River NWR for fifteen members of the New Jersey Skylands Greenways Task Force. The Task Force is developing a plan for a series of public greenways in northern New Jersey.

On September 6, Manager Koch and Assistant Villanueva met with representatives from the Texas Eastern Gas Company regarding the proposed extension of the gas line. The extension will connect in Chatham Township along a power line ROW within twenty feet of the refuge boundary. The meeting was prompted after Texas Eastern had not responded to several requests for information about the proposed project from Craig Moore (FWE, Pleasantville, NJ).

On September 28, Manager Koch conducted a watershed tour for prospective bidders who will be competing for an environmental consultant contract offered by the Great Swamp Watershed Advisory Committee.

On September 28, Assistant Villanueva attended a meeting at Rutgers University to discuss progress in a joint effort to develop a GIS database of the Black River and Great Swamp Watersheds.

In October, Manager Koch and Watershed Biologist Moore (FWE, Pleasantville, NJ) reviewed and commented on the Conservation Plan Element of the Harding Township Master Plan developed by the Harding Township Environmental Commission.

In November, Manager Koch assisted Helen Fenske, former Acting Commissioner of NJ DEP, in planning and coordinating a December 4 tour of the proposed Wallkill River NWR for several foundations to gain their support for the "Greenways Project" which includes the Wallkill River NWR. On December 4, Gib Chase (RO-RE) and Manager Koch conducted a tour of the Wallkill River NWR for Helen Fenske, President of the Natural Resources Education Foundation of New Jersey, Inc., Julie Micou Cerf, Executive Director of the Schumann Fund and a NJ DEP representative. Mrs. Fenske later reported that her foundation obtained a grant from the Schumann Fund as a result, in part, of this tour. Fenske had been instrumental in establishing the Wallkill River NWR.

In November, Manager Koch reviewed a draft EA and an engineering feasibility study completed by NJ Dept. of Transportation for a Primrose Brook sediment basin proposed on the refuge. This project is part of the Dept. of Transportation's mitigation plan from their Route 24 construction.

December 11-13, refuge staff assisted N.J. Division of Fish, Game and Wildlife with trapping a black bear on property adjacent to the refuge. This animal had frequently been sighted in the area over the previous months and had probably been around the Swamp since this past summer. Unfortunately, the bear lost his fear of humans and became too much of a nuisance. He broke into a neighbor's garage twice, smashing a window to

get in the second time. Attempts to scare the animal off proved futile. For his own good, the 225 pound, two year old male was captured, tagged and moved to a more remote part of the State.

In December, Watershed Biologist Moore (FWE, Pleasantville, NJ) prepared comments on Morris Township's permit modification which would allow increased effluent from their Woodland Sewage Treatment Plant into Loantaka Brook, one of Great Swamp's principal tributaries.

8. Other

On January 11, Assistant Manager Taylor attended a meeting at E.B. Forsythe NWR concerning Open Marsh Water Management.

Between January 29 and February 2, Maintenance Worker Taylor participated in the Waterfowl Wing Bee at Patuxent Wildlife Research Center, Laurel, Maryland.

A wetlands restoration meeting was hosted at the refuge on February 15 to discuss the restoration program and answer questions. Attending were ARD's Young and Pisapia and various field and regional office personnel from Refuges and Enhancement. Gary Wege and Jim Piehl from Region 3 also attended to share some of that region's experiences in this program.

On February 22 and 23, Assistant Manager Taylor attended an oil spill coordination meeting in Philadelphia, PA.

The Civil Air Patrol conducted a search and rescue training exercise in the refuge Wilderness Area on February 25.

Refuge Officer Koch successfully completed a one week annual law enforcement refresher training session at Eastern Shore of Virginia NWR, April 2 to 6. Refuge Officers Villanueva and Westerman attended the annual LE refresher training April 23 to 27. On April 3, Refuge Officer McFadden fractured his ankle during the 1.5 mile run and returned to the Great Swamp without completing the training. Much of the session was video-taped and forwarded to McFadden to enable him to complete the training.

On May 10 and 11, Biological Technician Jimmie Reynolds attended Heavy Equipment Training - Dozer and Backhoe/Loader, at Eastern Shore of Virginia NWR.

On May 23, Refuge Manager Koch delivered revenue sharing checks to Harding Township (\$78,996), Passaic Township (\$51,640), and Chatham Township (\$29,676). The Passaic Township check was presented to Mayor Van Deusen at a public Township Committee meeting. An explanation of the Revenue Sharing program was given along with the checks.

On August 13 to 17, refuge Biologist Melvin attended the Symposium on "Managing Predation to Increase Production of Wetland Birds" held in Jamestown, North Dakota.

On September 10 to 14, Manager Koch attended the annual Project Leaders Conference at Cape Cod, Massachusetts.

On September 17 to 20, refuge Biologist Melvin attended the Migratory Non-Game Bird Management Workshop held in Tilghman Island, Maryland.

Refuge Biologist Melvin attended the 8th Woodcock Symposium held in Lafayette, Indiana on October 29 to November 2.

On November 13, Refuge Officers Koch, Villanueva, and McFadden successfully completed their semi-annual pistol qualification at the Morris County Fire and Police Academy. Ranger Dwight Dixon of the National Park Service at Morristown National Historical Park instructed the course of fire.

On November 16, ORP McFadden attended a Public Affairs Seminar in the Regional Office about public awareness, outreach/involvement, and marketing.

The North American Waterfowl Management Plan: An international agreement signed between the U.S. and Canada in 1986 to protect, enhance and restore wetland habitats across the continent presents a number of new opportunities and challenges for NWRs. The Plan establishes conservation goals for wetland habitats in specific regions of the continent; sets objectives for restoring waterfowl populations; and provides a framework for accomplishing local, regional and international goals.

In the United States, six key waterfowl breeding, migration and wintering habitat regions called Joint Ventures (JVs) have been established to implement the Plan. In Region 5, The Lower Great Lakes/St. Lawrence Basin and the Atlantic Coast JVs have coalitions of Federal, State and private partners working together to restore waterfowl populations.

The Great Swamp National Wildlife Refuge lies within the Atlantic Coast JV and is playing an active role in achieving the objectives of the JV and North American Waterfowl Management Plan.

Great Swamp National Wildlife Refuge was established as an area to provide migration, nesting and feeding habitat for migratory birds. Most habitat management is directed toward improving habitat for waterfowl and other wetland species. Particular emphasis is placed on black duck, wood duck and American woodcock. The refuge also provides and preserves habitat to ensure the perpetuation of many other indigenous species, consistent with other important management needs and habitat limitations.

Wood ducks and mallards are the most common waterfowl while Canada geese, black ducks, pintail, blue-winged and green-winged teal are also found in abundance especially during migration. Peak waterfowl numbers during migration range from 10-15 thousand. The wood duck breeding population is estimated at 1,000 pairs with annual production figures ranging from 700 to 2,500 fledged young. Wood duck production is only reported from data obtained from nearly 600 artificial nest box compartments, so overall production estimates are conservative. Natural cavities in wood duck habitat also appear to be abundant; however, production data from these cavities have not been obtained.

Water levels are manipulated in five refuge impoundments, encompassing 571 acres, to favor growth of a desirable mix of native aquatic and emergent plant communities and open water. These habitat types are managed to provide conditions preferred by waterfowl during spring and fall migrations and the summer nesting season.

In support of the North American Waterfowl Management Plan and President Bush's "no net loss - wetlands campaign", the refuge engaged in active on-refuge wetland restoration activities and supported the St. Lawrence private lands initiative in upstate New York by supplying heavy equipment for use by other FWS personnel.

North American Waterfowl Management Plan Highlights

- The North American Waterfowl Management Plan (NAWMP) theme was incorporated into 31 programs and reached 1,086 individuals (see Section H.7).
- The NAWMP Exhibit was displayed at an Annual Waterfowl Decoy Show and on National Hunting and Fishing Day at a local sports shop's annual "main event" (see Section H.6).
- A total of 384 wood duck nest boxes (584 nest compartments) were checked and maintained (see Section G.3).
- Two black duck nesting structures were erected along Middle Brook (see Section G.3).
- Wetlands located in the Management Area were managed for waterfowl through a series of impoundments (see Section F.2).
- Over 60 potential ditch plug sites were identified in wetlands that had been drained by previous landowners. In CY 90, 35 ditch plugs were constructed and one water control structure was installed restoring approximately 30 acres of wetlands (see Section F.4).
- The refuge provided heavy equipment for off-refuge wetland restoration projects in New York (St. Lawrence private lands initiative) for use by other FWS personnel (see Section I.4).

- Refuge spraying operations were conducted to control phragmites and purple loosestrife to encourage growth of plants more beneficial to waterfowl and other wildlife (see Section F.10).

- Wetlands restoration meeting was hosted at the refuge on February 15 to discuss various restoration programs, answer questions and share Region 3 experiences (see Section E.8).

F. HABITAT MANAGEMENT

1. General

Habitat management at Great Swamp National Wildlife Refuge involves two different general approaches. The Wilderness Area (3,660 acres) because of its restrictive legislation is more passively managed while much more active management of various habitats is performed in the remaining 3,340 acres of the refuge. This non-wilderness portion of the refuge is generally referred to as the "Management Area".

2. Wetlands

Wetland habitat occurs throughout the refuge; however, the Management Area is the only portion of the refuge where active water level management takes place. The Wilderness Area is left to more natural processes.

Wetland management activities within the Management Area generally takes place in the five refuge impoundments. Refuge objectives dictate that the impoundments serve as feeding areas during migrations, especially for dabbling ducks such as mallards, black ducks and wood ducks. A secondary objective is management for waterfowl production.

The five refuge impoundments (Pools 1, 2, 3A, 3B and Middle Brook) total 571 acres or 8% of the total refuge and 17% of the Management Area. Water level management concentrated on summer drawdowns in Pools 3A and Middle Brook. A later one month drawdown was performed in Pool 2 to enhance "Rodeo" ground spraying operations to control purple loosestrife. Pools 1 and 3B maintained normal operating levels throughout the year to provide optimum feeding, resting and brood rearing habitat for waterfowl. Various management activities are directed at sustaining stands of a variety of preferred waterfowl plants such as buttonbush, smartweed, cattail, bulrush, arrow arum, pickerelweed, etc.. These plants along with other submergent and emergent vegetation interspersed throughout the impoundments provide excellent waterfowl habitat, especially for wood ducks. Further description of specific impoundment characteristics and management is as follows:

Pool 1: The objective of Pool 1 which totals approximately 116 acres is to provide nesting, feeding and brood rearing habitat for waterfowl during the spring and summer as well as resting, feeding and roosting habitat during the spring and fall migrations. The pool is basically an open marsh characterized by stands of arrow arum, buttonbush, pickerelweed and duckweed. Live and standing dead timber can be found around the perimeter of the pool. The pool receives water primarily from Great and Saw Mill Brooks via the Wilderness Area.

Vegetative diversity of the pool has been steadily decreasing since the completion of its surrounding dike. Vegetative data collected prior to dike construction indicated a higher diversity and abundance of plant species with over 30 wetland species identified. Since water management began, the vegetative diversity and abundance has declined to the aforementioned four dominant species and a greater percentage of open water area has emerged. This decline of plant species is suspected to be due to high water levels from insufficient drawdown capabilities in recent years resulting from increased volumes of storm water run-off in the watershed and water control structures that were not designed for the larger volumes of water.

Although with the present conditions it is nearly impossible to drawdown the majority of Pool 1, a six acre buttonbush swamp area in the southwestern corner of the impoundment can still be effectively manipulated. This capability is suspected to be due to high inverts around the perimeter of the buttonbush swamp and irregular bottom contours. Water Control Structure (WCS) #12 can effectively lower water levels in this area. A mid-May through early September drawdown was performed in this area to rejuvenate the buttonbush.

Middle Brook: The objective of Middle Brook which totals 17 acres is to provide food and cover for waterfowl during migration. The pool is mainly comprised of buttonbush in the upper portions and large stands of smartweed dominate the lower portion of the brook. An informal survey was conducted in September, 1990, which identified dense stands of smartweed, pickerelweed, arrowhead and various species of rushes and sedges. The pool receives water from Pool 1 through WCS #5, a 100 foot emergency spillway between Pool 1 and Middle Brook, and from small regulated ponds in the Wildlife Observation Center area through WCS #1 and 10.

During the past two years, a summer drawdown was initiated to promote germination of smartweed and to rejuvenate the buttonbush. Vegetative response was favorable as shown by the smartweed growth and presence of other emergent vegetation. The lower water level encourages growth of preferred waterfowl foods while the water level at normal operating levels provides suitable feeding areas for migrating waterfowl.

Pool 2: The objective of Pool 2, the largest of the refuge's impoundments (295 acres) is to provide nesting, feeding and brood rearing habitat for waterfowl during the spring and fall migrations.

The pool is basically an open marsh characterized by dense stands of arrow arum, cattail, bulrush, marsh mallow, buttonbush, pickerelweed and willow. Some live and standing dead timber remain around the perimeter of the impoundment. The pool receives water from Primrose Brook, Great Brook through WCS #14, WCS #12 and during high water from the 200' spillway between Pool 1 and 2.



A view of Pool 2 (A. Woodcock)

In the past, summer drawdowns at WCS #22 were performed in an effort to rejuvenate stressed live timber around the perimeter of the pool; however, these drawdowns appeared to have affected only a small area in the western portion of the pool and it is suspected that either silting in or a high invert within the pool is restricting flow through the pool. The remaining live timber is highly stressed and has not responded well to summer drawdown rejuvenating efforts.

This year (1990), a late summer/early fall one-month drawdown was performed by opening one side of the automatic Amil gate (WCS #22) to enhance Rodeo ground spraying operations to control purple loosestrife.

Pool 3A: The objective of Pool 3A which totals approximately 55 acres is to provide additional food and cover for waterfowl during migration and brood habitat during the summer. The pool receives water from Pool 2, WCS #23 via a feeder ditch, flood water from the Passaic River and the Pool 3B cross dike at WCS #34.

Vegetation transects were conducted for the second consecutive year using the Daubenmire method. In CY 89, a systematic random sampling method was used to establish the locations of ten 30-meter transects oriented along a north-south axis and were permanently marked with metal sign posts. Frequency of occurrence and percent cover of each species were recorded within each 20 x 50 cm rectangular quadrant spaced one meter apart along each transect. Ten transects were surveyed yielding 300 sample plots. Dominant species observed in the CY 90 survey included duckweed, carex sedge, spatterdock, cattail, arrowhead, pickerelweed, arrow arum and buttonbush which is very similar to CY 89 findings. The live timber area which is located on the western edge of the impoundment was not surveyed but consists mainly of scarlet and pin oak.

A summer drawdown was accomplished in 1990 when two boards were removed from WCS #310 in mid-May lowering the water level during the summer months to sustain the health of live timber and buttonbush in the impoundment. Normal operating levels were returned in early September and were maintained for the rest of the year to provide feeding, resting and roosting areas for migrating waterfowl.

Pool 3B: The objective of Pool 3B which is approximately 88 acres is to provide nesting, feeding and brood rearing habitat for waterfowl during the spring and summer as well as resting, feeding and roosting habitat during spring and fall migrations. The pool receives water from Pool 3A through WCS #34 and Middle Brook through WCS #35. The pool is basically characterized by stands of cattail, marsh mallow, bulrush, and buttonbush, with some standing dead timber around its perimeters.

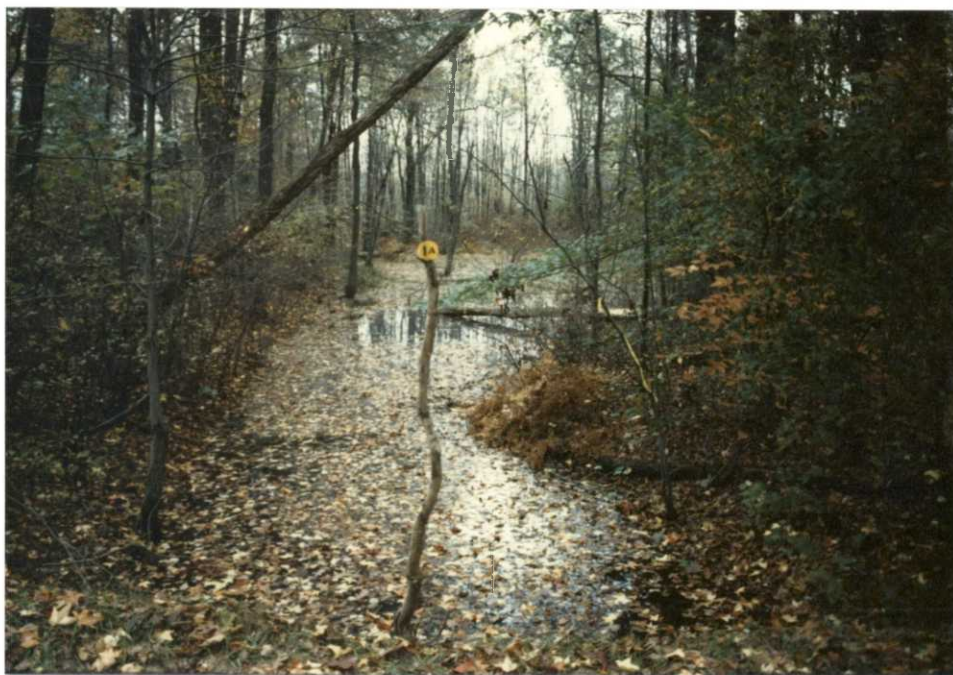
In CY 90, a drawdown was not initiated at WCS #37 (outflow to Passaic River). The aquatic vegetation is not stressed at the normal operating level (average depth 12") and the remaining timber in the pool is beyond rejuvenation and therefore would not benefit from a drawdown. Normal operating levels were maintained throughout the year to provide optimum feeding, resting and brood habitat for waterfowl.

In addition to these impoundments, approximately 35 acres of wetlands have water level management capability. These miscellaneous areas range in size from 1/2 to 4-1/2 acres.

WETLAND RESTORATION

In support of the North American Waterfowl Management Plan (NAWMP) and President Bush's "no net loss - wetlands campaign", the refuge engaged in active wetland restoration activities in CY 90. Over 60 potential ditch plug sites were located in wetlands that had been drained by previous landowners. Wetland restoration efforts concentrated in the Black Brook area south of White Bridge Road. In CY 90, 35 ditch plugs were constructed and one water control structure was installed on the west side of New Vernon Road restoring approximately 30 acres of

wetlands. Each ditch plug was numbered for future field identification and photo reference points to monitor the effectiveness of the restoration efforts.



Refuge wetland restoration ditch plug site
marked for monitoring results (Deb M.)

3. Forests

Before the refuge was established, portions of the swamp were drained or cleared to make them suitable for dry land activities. Many woodlands were first cut by 17th century settlers for firewood and house timbers. The remaining fields were then used for farming and as pastures. With the decline of farming in the "swamp" during the latter half of this century, pasturelands have been reverting back into woodlands.

With the establishment of the refuge, many of the areas that had been cleared were allowed to revegetate naturally and have basically become a red maple monotype, especially in the Wilderness Area, thereby limiting the diversity of wildlife species that inhabit the area. The refuge contains roughly 4,800 acres of timber. The Upland Habitat Management Plan was approved in 1988. It calls for selected forest improvement to approximately 3,000 acres, mainly outside of the Wilderness Area and is directed toward the creation and maintenance of a multi-aged diversity of upland habitat to benefit a variety of species with emphasis on regional priority species such as the American woodcock. Forest habitat management activities in 1990 were a continuation of those initiated in 1989.

The refuge is divided into seven compartments for management and planning purposes. A detailed forest inventory will be completed for each compartment. A forest inventory was completed in Compartment 3 during 1989.

A total of 82.5 acres of early successional stage forest and brush were cleared by the Hydro-ax in 1990. This included 78.5 acres designated for woodcock management which will be maintained on up to twenty year cycles. An additional four acres of brushland were converted to grassland to be managed on a four year mowing cycle. Approximately 115 hours were spent operating the Hydro-ax in 1990 with 57 additional hours required for servicing and repairs (see Section I.3).

There are 10 units incorporated in the brushland management program. They will be mowed on a variable schedule using the Hydro-ax. Each unit will be individually assessed and mowing will occur before woody growth advances beyond pole stage and exceeds our equipment's capability to mow it. The age of units may vary with site growing conditions, but in most instances should not exceed 20 years.

Blocks consisting mostly of red maple were cleared and will be maintained in various age strips with up to a 20-year cycle. Three blocks, 25, 15 and 38 acres each, were entirely cleared this year because most of its stage of growth (20 years and over) was beyond that used by woodcock. They were also at the maximum cutting capability of the Hydro-ax. Another four acres were cut which completed a 60 acre plot that was mostly cut over in 1989.

Timber stand improvements were performed in Compartment 2 west of New Vernon Road. Two acres of red and white pine release and thinning (started in 1989) were completed in 1990.

5. Grasslands

The grassland management objective at Great Swamp is to maintain approximately 542 acres of various age fields for habitat diversity, nesting cover and improved wildlife viewing opportunities to the public. The Upland Habitat Management Plan which also incorporates grassland and brushland management practices proposes to increase grass and brush habitat by approximately 90 acres in the future.

There are currently 54 fields incorporated in the grassland management program. Grassland fields are scheduled for mowing on a one-, two-, three-, or four-year cycle. A breakdown of rotation schedules and acreage follows:



Recently cut with Hydro-ax (TM)



Same Hydro-axed area 6 mos. after cutting
(TM)



Hydro-axed area 1 year after cutting (TM)



Hydro-ax with rotary cutter attachment
(TM)

Rotation Schedule (Years)	Field Type	Number of Fields	Total Acreage
One	Grass	25	318
Two	Grass	13	116
Three	Grass	3	41
Four	Grass	13	67
TOTALS		54	542

Annual grassland mowing began in late July. By early October, 188 acres of the scheduled 352 acres had been mowed. Most of the fields mowed this year were on a one-year rotation and included 61 acres that will eventually be converted to DNC fields. Due to equipment breakdowns, staff vacancies and major emphasis on the refuge wetland restoration project, only approximately 50% of the scheduled grasslands were mowed this year.

The Hydro-ax was used to clear four acres of heavy brush that was encroaching in a grassland unit.

The Grassland Management Program at Great Swamp insures a variety of grassland and old field habitats. The interspersation of habitat types substantially increases the availability of ecotones and promotes wildlife diversity.

Great Swamp has one of the highest breeding populations of Eastern bluebirds in New Jersey due to available habitats and the nest box program (see Section G.7). Managed grasslands provide green browse for wildlife such as Canada geese and white-tailed deer, nesting habitat for songbirds such as the bobolink (State threatened species), "peenting" grounds for woodcock, and hunting areas for raptors and other predators. Mowed areas also enhance wildlife viewing opportunities for refuge visitors and minimize wildfire damage potential.

9. Fire Management

On June 22, Manager Koch discovered and extinguished a small grass fire along Pleasant Plains Road. The burned area was approximately 20 square feet.

10. Pest Control

Refuge spraying operations involved only ground application of the herbicide "Rodeo" to control phragmites and purple loosestrife. Treatment sites were primarily the same as last year.

Hand spraying began on August 2 using portable backpack sprayers, a 50-gallon ATV sprayer and a 600-gallon high pressure sprayer. Spraying continued until September 4. A total of 16.3 acres were sprayed this

year. Due to accessibility problems and lack of personnel, only about 50% of areas needing treatment were sprayed.

12. Wilderness and Special Areas

In 1966, the National Park Service designated the Great Swamp National Wildlife Refuge as a Registered Natural Landmark under the provision of the Historic Sites Act of 1935. The refuge was incorporated in the registry because it possesses exceptional value in illustrating the natural history of the United States.

In 1967, 746 acres in the northeast portion of what is now the Wilderness Area of the refuge were declared a research natural area by the Director of the U.S. Fish and Wildlife Service. The area is known as the M. Hartley Dodge Natural Area and contains undisturbed, largely unditched natural shrub swamp habitat and numerous small upland islands. Two SAF (Society of American Foresters) cover types make up this area: SAF #39 (black ash, American elm, red maple) 716 acres and SAF #52 (white oak, red oak, hickory) 30 acres.

In 1968, 3,660 acres or about 53% of the current refuge total was the first area designated by the Interior Department as Wilderness under the 1964 Wilderness Act. It was also the first Wilderness Area to be designated in the eastern United States. This year, YCC enrollees and Boy Scouts constructed two wooden foot bridges across streams to enable public access to hiking trails.

On July 6, 1990, Manager Koch met with a representative of the National Park Service and assisted with an inspection of the Natural Landmark portion of the refuge which is registered with the National Park Service.

13. WPA Easement Monitoring

The refuge manager at Great Swamp has been designated as the easement manager when interest in lands is conveyed to the Service for inclusion into the National Wildlife Refuge System by the Farmers Home Administration (FmHA) under provisions of the Food Security Act of 1985 (Farm Bill). This responsibility includes all lands in New Jersey. The Pleasantville Fish and Wildlife Enhancement (FWE) field office is responsible for recommending the conservation easement and to assist the easement manager in establishing administration of the easement. Conservation easements are the result of placing restrictions on wetlands that are presently on FmHA inventory properties.

As a general rule, if a farmer in New Jersey is about to lose his farm, FmHA will advise the farmer to sell all or a portion of the farm so that foreclosure can be avoided. FmHA takes this approach because of the higher than average land values in New Jersey. As a result, New Jersey has only had four properties to review whereas most FWE field offices in

Region 5 have had the opportunity to review as many as 40 or 50 inventory properties (New York had over 120 properties). The following two properties have been recommended as conservation easements in New Jersey:

Conservation Easement and Fee Title Transfer of an Inventory Property

A conservation easement and a fee title transfer of a 2.0 acre inventory property (Jeffer's property, Cedarville, Cumberland County) has been recommended to the New Jersey Division of Fish, Game and Wildlife in March, 1988. Although the property is small (2 acres), it is of high value to wildlife and can provide boat access to Cedar Creek and the Delaware Bay. FmHA's new regulations require that the property be offered for sale to the original owners; however, FmHA will notify the previous owner that the property will have severe use limitations because of the recommended conservation easement which covers the entire property. FmHA has been in contact with the Division of Fish, Game and Wildlife and it appears that the transfer will eventually take place.

Conservation Easement on an Inventory Property

A conservation easement on 27 acres of the Codario Property (Buena Township, Atlantic County) was recommended in November, 1987 (an FmHA inventory property with a willing buyer). Approximately 27 acres of palustrine forest were included in the recommendation to deed restrict the property from future development with no third party management rights assigned. Current status of FmHA actions on Service recommendations is pending. The property is currently tied up in litigation because the previous owner is suing FmHA because they foreclosed on the property. Regardless, the recommended easement (deed restriction) is assumed to be acceptable because FmHA has not indicated anything to the contrary. The easement will not take affect until such time as the legal problems have been resolved.

G. WILDLIFE

2. Endangered and/or Threatened Species

Usually at least one sighting of a bald eagle is made on the refuge during the year and this year was no exception. A mature bald eagle was sighted on April 22 by refuge staff and an immature bald eagle reported (unconfirmed) in December.

A peregrine falcon was reported, (unconfirmed) in September.

A number of NJ state endangered and threatened species are found at Great Swamp NWR. These include:

1) Blue-spotted salamander (Endangered-NJ) - No population estimates have been established; however, the species is known to exist in wooded wetland areas throughout the refuge. Sightings are rare since adults live underground most of the year and only emerge to breed during the first thaw.

2) Bog turtle (Endangered-NJ) - Several colonies of bog turtles have existed on the refuge in past years, but sightings of this species are rare because of its secretive nature. No sightings have been documented since the release of three hatchlings in August and a 20-year-old in September, 1987.

3) Wood Turtle (Threatened-NJ) - This species is probably most visible in June when adults come to management road edges to lay their eggs. The most recent documented wood turtle found on the refuge was in September, 1987.

4) Red-Shouldered Hawk (Threatened-NJ) - This species has been commonly seen and is known to successfully nest on the refuge. This year, a dead red-shouldered hawk was recovered by refuge staff near the refuge.

5) Barred Owl (Threatened-NJ) - This species nests on the refuge and is common.



Barred owl, a State threatened species, is common on the refuge (TM)

6) Great Blue Heron (Threatened-NJ) - In April, the Pool 2 and Black Brook rookeries were censused for nests before the foliage thickened. There were 18 nests (14 active) at the Pool 2 rookery and 11 (8 active) at the Black Brook rookery. On June 22, the Pool 2 rookery was surveyed at close range and 18 of 27 nests were active with a total of 27 young counted.

7) Red-Headed Woodpecker (Threatened-NJ) - There were no confirmed sightings this year. Nesting activity has been observed in the past, but no documented nesting has been recorded since 1987.

8) Bobolinks (Threatened-NJ) - Several bobolinks were observed in nesting habitat this spring.

9) Osprey (Threatened-NJ) - Sightings were confirmed in spring and fall.

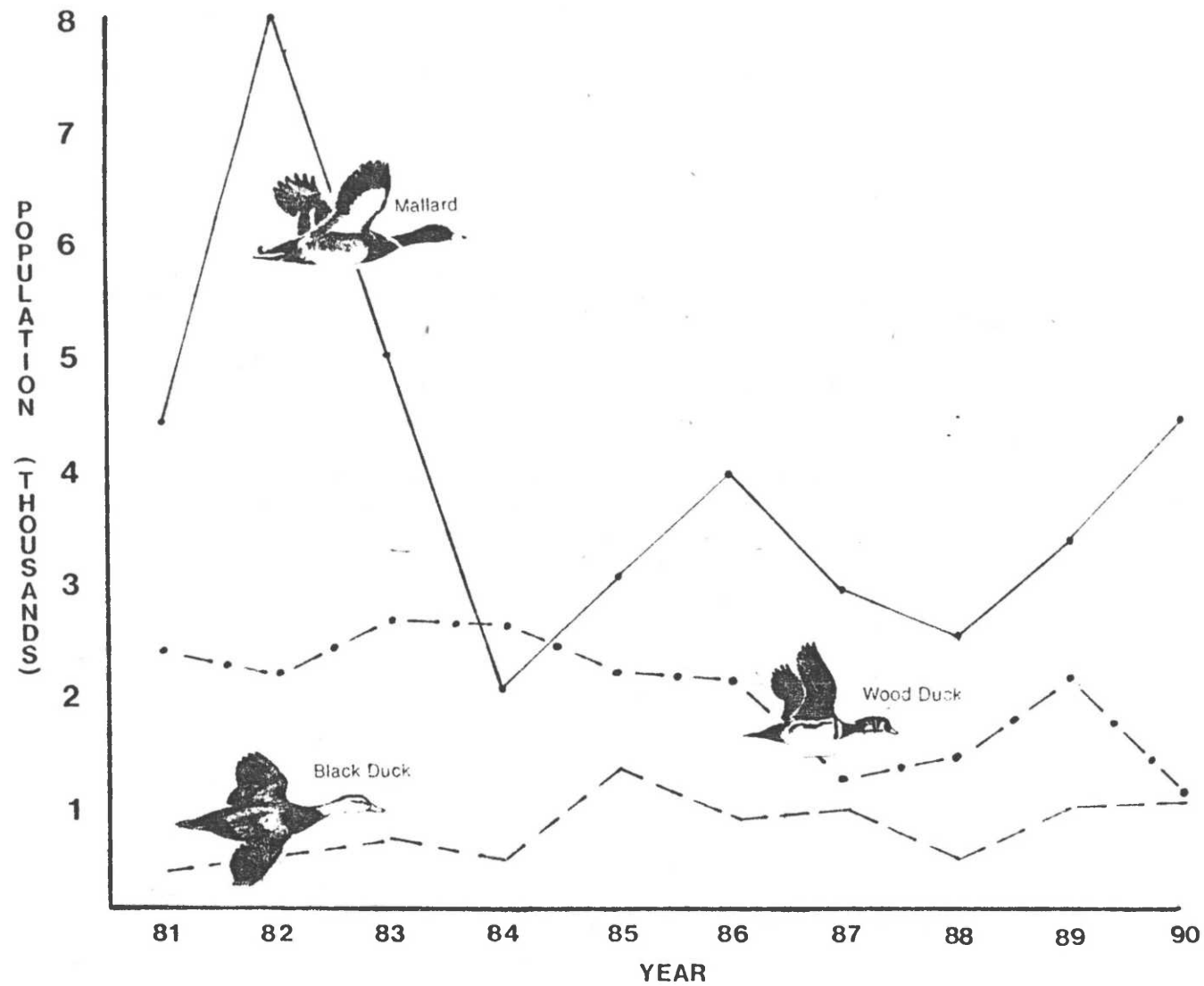
Species listed by the State as having only their breeding populations threatened or endangered that were observed on the refuge include northern harrier, American bittern and a pied-billed grebe. Sightings of northern harriers were common in the winter.

3. Waterfowl

Major waterfowl concentrations are primarily within the 571 acres of impoundments found in the refuge's Management Area. The five main impoundments are managed to allow for maximum waterfowl resting and feeding potential during migratory periods, and as waterfowl breeding and brooding areas. The pools also serve as roosting areas for many species.

A mild January and February resulted in early thaws and migrant waterfowl returning as early as February. Waterfowl was increased throughout the spring with the highest wood duck count for the year (1,040) occurring in March. Most waterfowl use declined as spring migrants moved on. Nesting species included wood duck, mallard, black duck, blue-winged teal, green-winged teal, hooded merganser and Canada goose. Although counts are not conducted in the summer, it is suspected that wood duck use is highest just after the nesting season. This is based on production data from nest box checks. Species with highest counts in the fall included Canada goose (819), mallard (4,388), black duck (967), northern pintail (592), wigeon (313), green-winged teal (605) and blue-winged teal (80). Other waterfowl species occasionally observed on the refuge included ring-necked ducks, gadwall, northern shoveler, hooded merganser and bufflehead. Incidental species included snow goose, common merganser and mute swan. With the exception of mallards and black ducks, most species showed a decline in numbers compared to last year. This may be attributed to a significant number of new refuge personnel conducting counts and fewer count sites actually included because of a staff shortage. The following graph shows the highest number of mallards, wood ducks and black ducks observed for the year taken from bimonthly counts conducted throughout spring and fall migrations over the past ten years.

PEAK POPULATION INDEX OF MALLARDS, BLACK DUCKS AND WOOD DUCKS



Wood ducks are the refuge's most common breeding duck, while mallards, black ducks, American green-winged teal and blue-winged teal nest on the refuge in limited numbers. Many wood duck broods and several mallard broods were observed on the refuge in the spring; however, due to staffing shortages, brood surveys were not done this year.

Wood duck production is reported only from data obtained from artificial nest boxes so overall production estimates can be considered conservative. Natural cavities in suitable habitat appear to be abundant; however, we have no information on their use, locations or predation rates. Raccoons are an effective nest predator and are abundant.

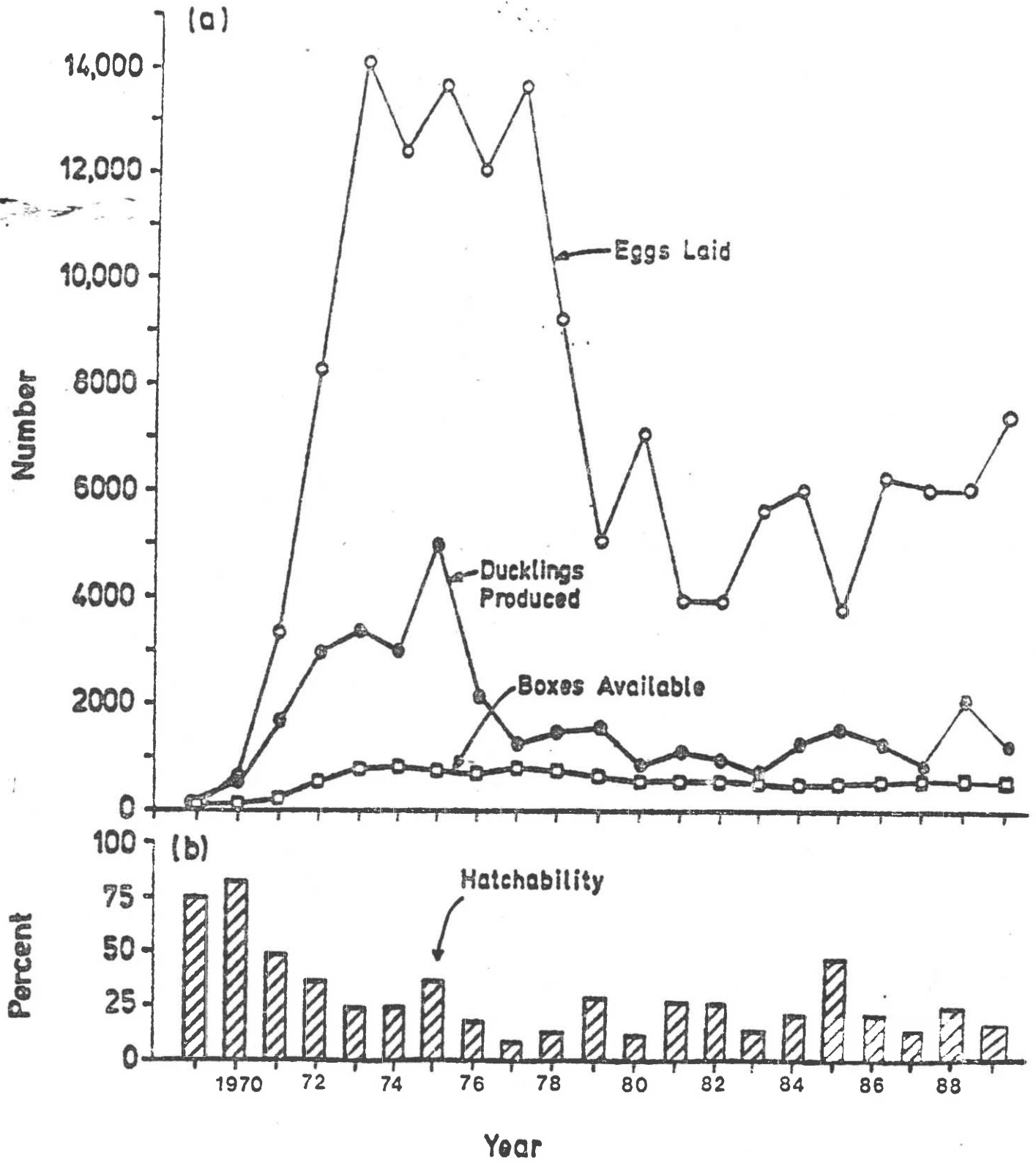
Production data for 1989 which was tabulated too late to be included in the 1989 narrative is as follows: 16% of the 584 available compartments for the 1989 nesting season had a successful hatch; 15% of the boxes were unused; 28% of all nests were abandoned; 26% were dump nests; and 21% were classified as dump/hatch. A total of 1,138 ducklings were produced at a cost of \$2.18/duckling. The long term relationship between available nesting compartments and ducklings produced (1969-1989) is represented on the graph on the following page.

During the 1989 wood duck maintenance period, 52 predator guards were firmly secured to the posts, bringing the total number of secured predator guards to 371. Previous observations revealed that raccoons can get around a predator guard if it isn't firmly secured.

The servicing of boxes and gathering of 1990 production data began in December, 1990, and as of this writing is not complete. The figures for the 1990 nesting season will be reported in the 1991 narrative.

The wood duck box program at Great Swamp represents a traditional program (densely placed boxes in highly visible areas), and has experienced the same "rise and crash syndrome" as other wood duck box programs around the country. We have tried to examine the various reasons for this fluctuating hatchability and are hopefully coming closer to some real answers and recommendations for changes in management techniques. Great Swamp's data was presented at the 1988 North American Wood Duck Symposium by Brad Semel, Paul Sherman and Steven Byers in a paper entitled "The Influence of Nest Box Placement on Interspecific Nest Parasitism in Wood Ducks". These authors suggested the severe reduction in hatchability is not simply due to variations in the environment such as predation, but rather nest box visibility and density play a substantial role in hatchability problems.

WOOD DUCK PRODUCTION 1969-1989





Bio Aid Scheirer collecting wood duck data
and maintaining nest box (C. Hoover)

Management of the 1990 program will continue to concentrate on reversing the "traditional" nest box program of densely placed and highly visible boxes. Box placement will be widely spaced and inconspicuous. Emphasis will be to remove all boxes in poor locations (ie., highly visible to other boxes or having a high incidence of predation or interference). Only boxes determined to be in suitable habitat will be replaced and boxes in poor locations will be removed gradually as they deteriorate. This management strategy will take several years to achieve because of the high density of boxes already established.

The computer continues to be a great asset in maintaining the wood duck boxes and analyzing data. With five years of data on the computer, trends can be examined to determine if any boxes or areas are having better hatching success or increased predation rates. We can also look at boxes that are consistently not used or abandoned and consider the possibility of relocating or removing boxes that are, for various reasons, not producing wood ducks from year to year. Field personnel also use data printouts to determine maintenance needs (ie., new box, lid, predator guard, etc.) which helps with daily planning and reduces the number of return trips to boxes. Since the acquisition of an IBM compatible computer in 1987, all the wood duck data has been transferred over to the RBase computer program from DBase II (see Section I.6).

In the summer of 1988, the refuge received 100 low maintenance plastic Ducks Unlimited (DU) wood duck nest boxes. During the 1988-89 maintenance season, eleven (11) DU wood duck boxes were put up in the Black Brook Acquisition Area (south of hunter parking lot 15), two (2) along lower Middle Brook and one (1) in upper Middle Brook in the Management Area. Another DU box was put up in FY 1987 on a tree along Black Brook behind Building #237. Aluminum flashing was nailed to the tree to serve as a predator guard for this box. Two types of predator guards were used with these boxes as an experiment: a hard plastic two-inch PVC pipe or standard aluminum downspout leader. Each type was cut into five-foot lengths and installed by simply sliding the guard over the pipe. These types of guards have been used successfully with bluebird boxes at Patuxent Wildlife Research Center. It has recently been discovered that the DU box does not ventilate heat well and should not be placed in direct sunlight (Ed Hill, pers. comm.). There are also reports that ducklings are having difficulty climbing out and have been found dead in boxes. The DU boxes already placed out on the refuge will be closely monitored and only slowly incorporated into the nest box program over the next few years until their success can be evaluated.

In addition to wood duck nest boxes, two (2) black duck nest structures were built in February and were placed along Middle Brook in early March. This brings the total to four (4) black duck nesting structures on the refuge along Middle Brook.

4. Marsh and Water Birds

Nineteen (19) species of marsh and water birds are presently known to use the refuge. This year, twelve (12) species of were observed. Sightings included pied-billed grebe, American bittern, great blue heron, green-backed heron, black-crowned night heron, great egret, cattle egret, common moorhen, cormorant, king rail, sora and Virginia rail.

Two great blue heron rookeries on the refuge remain active. In April, the Pool 2 and Black Brook (Rubenstein Marsh) rookeries were censused for nests before the foliage thickened. There were eighteen (18) nests at the Pool 2 and eleven (11) at the Black Brook rookery.

An active nest survey in June was conducted at the Pool 2 rookery. Twenty-seven (27) nests were counted of which eighteen (18) were found to be active. Twenty-seven (27) young were counted in the nests. A second survey was conducted later in the month because some of the young during the first survey were very small and difficult to see from the ground. Four (4) additional young were observed during the return visit. The young were within a week or two of fledging. It is possible that there were young in other nests that were not seen (or counted) because they were not standing.

This year's total production of great blue herons in the Pool 2 rookery yielded 18 active nests which produced 31 young averaging 1.72 young per active nest. Last year's combined rookery count (including the Rubenstein Marsh) averaged 2.35 young per active nest.

A production survey was not conducted in the Black Brook rookery this year.

5. Shorebirds, Gulls, Terns and Allied Species

Reports of shorebirds and gulls on the refuge appear to be consistent with reports of previous years. Species recorded included the solitary sandpiper, semipalmated-sandpiper, greater yellowlegs, common snipe and the more abundant killdeer and American woodcock. Nesting was documented in the killdeer and American woodcock.

Refuge woodcock singing surveys counted an average of 6.2 singing males/survey route. Last year's average was 7.0. Since the count was established in 1985, the highest average was 8.8 in 1988 and the low was 3.0 in 1986. These figures are well above the average for the eastern region which is 1.92 males heard per route.

6. Raptors

Sixteen (16) of the total twenty-two (22) species of raptors on the refuge bird list were sighted and recorded on the refuge during 1990. Red-tailed hawks and kestrels were most commonly observed. In winter, northern harriers were often seen working fields around refuge headquarters. Kettles of hawks were seen occasionally during migrations.

Several interesting sightings occurred this year including: an adult bald eagle, a peregrine falcon and a Mississippi kite. Other observations included the osprey and barred owl. One (1) active red-tailed hawk nest was observed during the year producing two (2) young. The broad-winged hawk, kestrel, screech owl, great horned owl and barred owl are also known to nest on the refuge.

The Raptor Trust, a local bird rehabilitation center, released 61 raptors this year on the refuge or at The Raptor Trust which is adjacent to the refuge. Releases were as follows:

Barred owl	2	American kestrel	18
Screech owl	6	Red-tailed hawk	21
Saw-whet owl	4	Sharp-shinned hawk	3
Great horned owl	1	Broad-winged hawk	4
Long eared owl	1	Cooper's hawk	1
Total owls:	14	Total hawks:	47

7. Other Migratory Birds

The Bluebird Management Program continued to be successful this year. A total of 116 nest boxes were available for use and are located throughout the Management Area in grasslands, fields and along road edges. This year, 44 pairs utilized nest boxes and fledged 160 young of which 48 were banded (see Section G.16). This reflects an increase from last year's figures in which 24 pairs in nest boxes fledged 113 young of which 25 were banded.



Other species such as tree swallow, house wren and tufted titmouse also utilized boxes. (RS)

No breeding bird census was conducted this year due to lack of volunteers.

None of the purple martin houses were utilized by purple martins this year.

8. Game Mammals

A number of game mammals are found at Great Swamp including white-tailed deer, cottontail rabbit, red and gray fox, raccoon, gray squirrel, muskrat, striped skunk, opossum, mink, river otter and occasionally beaver. The only population which is presently manipulated, however, is the white-tailed deer. No other hunting or trapping occurs on the refuge.



Red fox are relatively abundant (S.B. Leventhal)

The refuge's deer hunting program has been conducted annually since 1974 to control the deer herd, improve herd health, reduce habitat damage, reduce deer-auto collisions and other local deer depredation.

This year's program was set up as a split season. The first part occurred on December 6, 7 and 8, 1990, and the last half on January 10, 11 and 12, 1991. The harvest totalled 164 deer compared to 153 last year. The weather during the first three days of the hunt was unseasonably warm with average temperatures reaching 45°F during the day. Approximately 2.5" of rain fell earlier in the week, melting remaining ice and flooding many acres of hunting habitat. The weather during the January hunt was more typical of winter with daytime temperatures in the mid-30's. Snow cover, freezing rain/ice changing to rain prevailed throughout the January hunt with a 6 inch snow storm occurring on January 11, 1991. A comparison of hunt and harvest information are presented in the following table:

Hunt and Harvest Information (1979-1990/91)

Year	Acres Open To Hunting	Total Harvest	Total # Of Days Hunted	Total Hunter Hours Afield	Hunter Hours/ Deer Harvested
1979	5,270	178	10	11,582	65.10
1980	5,270	148	10	11,441	77.30
1981-82	6,019	152	8	11,706	77.00
1982-83	6,019	126	7	10,822	85.90
1983-84	6,019	116	7	8,592	74.06
1984-85	6,019	144	6	7,705	53.50
1985	6,019	150	6	7,167	47.78
1986-87	6,023	179	6	8,524	47.62
1987-88	6,111	149	5	7,710	51.74
1988-89	6,098	143	6	8,942	62.53
1989-90	6,098	153	6	8,216	53.70
1990-91	6,098	164	6	6,873	41.91

Physical condition of the herd was examined at the refuge check station. All deer were aged, weighed and antler measurements taken. Age and sex structure of the 1990-91 deer harvest depicts a healthy herd as evidenced by the large proportion of deer less than 1-1/2 years old in the harvest presented in the following table:

Age & Sex Structure of 1990/91 Great Swamp Deer Hunt Harvest

AGE	1/2	1-1/2	2-1/2	3-1/2	4-1/2	Total
	# (%)	# (%)	# (%)	# (%)	# (%)	# (%)
Male	36(21.95)	26(15.85)	8(4.88)	1(0.61)	1(0.61)	72(43.90)
Female	29(17.66)	22(13.41)	29(17.66)	8(4.88)	4(2.49)	92(56.10)
TOTAL	65(39.61)	48(29.26)	37(22.54)	9(5.49)	5(3.10)	164(100%)

The average antler beam diameter for each buck 1-1/2 years old and older and total number of points were collected. Due to small sample sizes for the older age deer, data analysis was restricted to the 1-1/2 year age class. Average antler beam diameter increased slightly from 15.48 mm (1989/90) to 15.81 mm this year (1990/91).

Field dressed weights were taken for all deer brought into the refuge check station during the 1990/91 hunt. The average weights for all age classes increased this year with the exception of the 2-1/2 year and 4-1/2 year male and female classes which showed a decrease.



Great Swamp resident (WK)

All harvest data was entered into an RBase computer program to aid in analysis.

Copies of the final published report "Contaminants in White-tailed Deer Tissue from the Great Swamp NWR" were received from the FWE, Pleasantville, NJ, field office on July 10. The report analyzes samples collected from refuge deer in 1988 (see Section D.5).

A mammal scent station survey was set up on September 11, 1990, and conducted on September 12, 1990. This was the fourth year this survey was conducted. This census data will provide the refuge with an index in which to monitor mammal populations such as raccoon and fox. A scent station consists of a three foot circle cleared of all rocks and debris, topped with sifted lime or sand, and a scented disk placed in the center to attract mammals. A scent station line was made with 10 of these stations located 0.3 miles apart. During this year's survey, a total of four stations were visited by red fox, and six stations were visited by raccoons. This was the highest visitation of raccoons so far. Fox visitation was about average. It will take several more years before a species index can be used to document trends in the mammal populations.

10. Other Resident Wildlife

Reports of black bear sightings on and adjacent to the refuge were received July through December (see Section G.15).

During January and February, 1988, a total of 22 wild turkeys were released on the refuge by the N.J. Division of Fish, Game and Wildlife as part of its goal of reintroducing the wild turkey to most of its former range in New Jersey.

This year, there were again a number of reported sightings of turkeys in and around the refuge. Repeated observations including hens with poults is evidence of this project's success.

14. Scientific Collections

See Section D.5, Research and Investigations, "An Examination of Rarity in Plants by Comparing Rare and Common Species of Eupatorium".

15. Animal Control

Raccoons have historically been a problem during waterfowl banding at Great Swamp. They frequently find baited areas and discourage ducks from the banding site, rendering it useless for waterfowl trapping. Moving duck traps to new sites only provides temporary relief, since the raccoons quickly discover new baited areas. Once raccoons find bait, they will continue to revisit the site. In 1986, at least eleven (11) raccoons were documented at one (1) baited site and all the banding sites that year were found and used by raccoons. If raccoons do not discover the site during prebaiting, but find it after traps are set and ducks are captured, then there is the possibility, and usually a certainty, that the raccoons will kill all captured ducks.

In June, 1990, an Animal Control Plan was approved which calls for destroying troublesome raccoons instead of relocating them. In 1990, a total of 33 raccoons were captured in live traps at the banding sites and dispatched. In addition, two wood ducks and one opossum were caught and released.

Reports of black bear sightings on and adjacent to the refuge were received in July and August. Numerous reports were received throughout September. On September 19, the refuge was notified that a bear was in a neighbor's front yard on Woodland Road north of the Wilderness Area. On September 20 and 21, the bear visited the refuge dumpster at headquarters and scattered garbage around the area. The bear was sighted by a refuge visitor as it crossed Pleasant Plains Road near Quarter 99, midday of September 21. On September 24, the bear was observed by several staff members while it again visited the refuge



Raccoons are abundant on & around the refuge. In December, a rabid raccoon was found near the refuge. (G. Hall)



Frequent black bear sightings were reported on & around the refuge July - December (E. Degginger)

dumpster. The bear later raided a trash can at Q-7 and left his "calling card" at Q-91. Several reports of similar raids from refuge neighbors were also received. On September 30, the bear attracted a crowd of onlookers while he was up a tree on Fox Hunt Road just off the refuge. The refuge assisted the N.J. Division of Fish, Game and Wildlife by informing the public of properly securing household trash and to assure them that the bear, if left alone, should not be a threat to human safety.

The refuge received calls of area sightings throughout October. On October 21, the bear paid another visit to the headquarters dumpster around noon. A refuge neighbor also observed a bear climbing on her roof, reaching in front of the window, and knocking down her bird feeders.

Reports indicated there were actually three different animals in the area; however, one in particular, a 225 pound two year old male was most frequently sighted on or near the refuge. Unfortunately, he lost his fear of humans and became too much of a nuisance in surrounding neighborhoods. He broke into a refuge neighbor's garage twice, smashing a window to get in the second time. Attempts to scare the animal off proved futile. Refuge staff assisted the N.J. Division of Fish, Game and Wildlife during December 11-13 in trapping the bear on property adjacent to the refuge. On December 13, the bear was captured on the Hado property, tagged and moved to a more remote part of the State.



Refuge personnel assisting State biologist in trapping a nuisance black bear on private property near the refuge (L. Hado)

16. Marking and Banding

The 1990 preseason wood duck banding program began on 6/20/90. Five traps were placed at different locations and prebaited with corn for up to five days. All traps were checked twice a day and bait replenished as needed. Traps were set when sufficient numbers of ducks were using the sites. The first ducks were banded on 6/26/90.

In early August, refuge Biologist Melvin designed a rope and pulley system that facilitated retrieving floating traps for removing ducks and/or baiting. The pulley system proved to be an effective time saving device.

During the banding period, traps were occasionally moved when there was little or no activity at a particular site, or when captured ducks were mostly recaptures. When traps were moved to a new location, they were prebaited until ducks began feeding on the bait and using the site. This usually took from several days to a week, at which point the trap was set. If no use occurred, the trap was moved to another location. Success dropped off significantly so traps were shut down July 27-August 5. Trapping efforts resumed on August 5, but success was poor until preseason banding was concluded on August 31. All traps were picked up and stored in the Cement Plant. A total of 134 wood ducks were banded in 1990.

The final results of the 1990 preseason banding project are as follows:

AGE-SEX	WOOD DUCK
After Hatching Year - Male	2
Local/Hatching Year - Male	50
After Hatching Year - Female	19
Local/Hatching Year - Female	<u>63</u>
TOTAL	134

The station banding quota of 200 wood ducks was not reached this year, but the 134 wood ducks banded was the sixth highest in the last 16 years of banding. Recaptures totalled 120. Ducks stopped going into the traps around early August. All of the wood ducks banded in New Jersey are banded at Great Swamp.

Forty-eight (48) eastern bluebirds were banded in 1990. The primary purpose of the banding effort is to determine the return rate of previously banded birds and to document multiple nesting attempts.

This year's bluebird banding program is due largely to the efforts of volunteers Blane Rothausen and Bruce Morrison who spent 36 and 18 hours, respectively, checking boxes on a biweekly basis. Refuge staff volunteered 15 hours banding fledglings.

17. Disease Prevention and Control

The 16th Annual Deer Hunt was held in December, 1990, and January, 1991, with 164 deer being harvested. All deer were brought to the refuge check station and examined. Physical condition of the animals was good indicating the success of the hunt in meeting its objective of maintaining a healthy herd (see Sections G.8 and H.8).

For the second consecutive year, several mammals (raccoon, fox) in the State of New Jersey were found to have rabies. Those animals observed in 1989 were the first cases of rabies in New Jersey since 1974 excluding bats. Throughout the year, the State Health Department monitored the migration of rabies and in late December, a raccoon confirmed to be rabid was recovered approximately 3/4 mile from the refuge boundary.

H. PUBLIC USE

1. General

Visitation for 1990 was approximately 168,355 which is an increase of about 16% compared to the 144,744 visits in 1989. Some of the possibilities that could account for the significant increase in visitation were the installation of new directional signs and the pleasant weekend weather that occurred during the spring and fall. Approximately 41% of total visits occurred during April, May, September and October while only 10% of total visits occurred in February and December. The majority of this visitation occurred on spring and fall weekends at the Wildlife Observation Center (WOC) when the parking area frequently exceeded capacity. Vehicles were found parked along the roadside, in the field, and at times waiting in line on the main road for a parking space to open up.

In August, the refuge started issuing "Golden Age" and "Golden Access Passports".

2. Outdoor Classrooms - Students

The majority of our environmental education (EE) programs deal with the refuge management programs, principles of wildlife management and impacts of development on the swamp. There are two EE centers adjacent to the refuge which are heavily involved in EE programs dealing with topics other than wildlife management. Our efforts are directed toward complimenting and not duplicating their programs. These two centers often utilize the refuge for their EE programs. Our outdoor environmental education programs this year served 318 students which resulted in 1,008 hours of environmental education. This was up 175%

from last year's outdoor classroom students. This was mainly attributed to the environmental education programs that were established between the refuge and two local high schools.



EE activities in Pool 2 (TM)

Assistant Manager Villanueva represented the US Fish and Wildlife Service at a Girl Scouts of the USA (GSUSA) event called Earth Matters in Prescott, Arizona for one week in July. Thirty adult volunteers and high school-age girls from across the US attended the event (see Section E.7).

3. Outdoor Classrooms - Teachers

Harding Township School and Passaic Township School were visited and outdoor environmental education packets were distributed to the teachers. Possible activities both at the school and on the refuge were discussed. Two teachers visited the refuge to plan this year's environmental education programs which resulted in five class trips involving 318 students.

4. Interpretive Foot Trails

The Wildlife Observation Center (WOC) located off of Long Hill Road on the eastern side of the Management Area is the refuge's primary interpretive facility. Interpretive displays, an information kiosk and several trails are available. A 1/4-mile elevated interpretive

boardwalk trail leads the visitor through field and open marsh to an observation blind while another 1/2-mile elevated non-interpreted boardwalk trail leads the visitor through red maple swamp and hardwood forest to another observation blind. Both of these elevated boardwalk trails and blinds are handicapped accessible.

6. Interpretive Exhibits/Demonstrations

Refuge personnel displayed the "North American Waterfowl Management Plan Exhibit" at an annual waterfowl decoy show which was held at the Somerset County Environmental Education Center on May 13, 1990. The display was viewed by approximately 1,500 people. Believe it or not, only three Duck Stamps were sold at the event!

Refuge personnel displayed the "North American Waterfowl Management Plan Exhibit" on National Hunting and Fishing Day at a local sports shop. Approximately 70 other exhibitors were present. The exhibit was viewed by numerous people and many inquiries were made concerning the refuge and employment opportunities with the U.S. Fish and Wildlife Service. A total of 32 Duck Stamps were sold at the event making the yearly sales total 83 for CY 1990. This was up 80% over 1989 sales.

7. Other Interpretive Programs

Public inquiries concerning regulations, trails, areas for observing wildlife and general information totalled over 7,700 during the year.

Thirty-one (31) programs were conducted in which 1,086 visitors received slide/movie/walk presentations. This was a decrease of 6% from last year primarily due to three weeks of cancelled programs when ORP McFadden fractured his ankle.

Five (5) off-site presentations were conducted this year which was two more than last year. Programs consisted mainly of a general slide presentation on the refuge followed by a discussion.

Three (3) bird walks were conducted by volunteers from the Summit Nature Club. This was one more than last year. Volunteers not only discussed birds, but also current refuge management practices. These walks have become a yearly event.

During October, the Great Swamp Watershed Association sponsored a bus tour of the refuge and its watershed for 70 individuals. The refuge ORP participated as a guide.

The public service announcement video "Wetlands for the Future" was aired several times during July on Cable TV Station 36.

8. Hunting

The annual refuge white-tailed deer shotgun hunt took place on December 6, 7 and 8, 1990, and January 11, 12 and 13, 1991. Hunter orientations and shotgun certification sessions were held on November 4 and 30 and December 1, 1990. A total of 105 hunters attended these sessions.

A federal permit fee to hunt deer on the refuge was charged for the first time this year. The refuge was directed to "charge reasonable and cost effective user fees to help defer the cost of administering controlled hunts". A federal permit fee was required for all hunters in addition to their State Zone 38 shotgun permit and hunting license. The federal permit cost \$20.00 (\$10.00 to persons possessing either a Golden Age or Golden Access Passport). The sale of multiple permits to an individual hunter was also allowed for the first time in an attempt to increase the overall harvest due to the continued decline in refuge hunters. A hunter can increase his daily bag limit one deer for each permit he possesses. Fourteen (14) hunters purchased a second Zone 38 permit thus doubling their daily bag limit. The total number of federal permits sold was 345. A total of \$5,900.00 was collected from the sale of these permits. The refuge share will be 30% (\$1,887.00).

The number of hunters who actually showed up to hunt this year totalled 331, compared to 383 last year and 420 the year before. Hunters were allowed additional opportunities to buy leftover and multiple permits from unfilled Deer Management Zone quotas including the refuge. A total of 89 hunters took advantage of this second opportunity.

Not more than 250 hunters were allowed afield at any one time yielding a maximum hunter density of one hunter/24 acres. The bag limit was one deer of either sex per permit per day. A total of 164 deer were harvested during the six day hunt (see Section G.8). During December, 4,324 activity hours yielded a record total of 140 deer during the first portion of the hunt (average 31 hours/deer). This was the highest first three day total in the history of the hunt. In January, 2,550 hours of hunting yielded 24 deer (average 106 hours/deer). In summary, a total of 6,873 hours were required to harvest 164 deer in a split six-day season which averages out to 42 hours/deer harvested.

There were two hunt demonstrations at the refuge's south gate entrance again this year on the first day of the refuge hunt (December 6, 1990). Special Use Permits were issued to the United Bow Hunters of New Jersey for a pro-hunt demonstration and to the Humane Society of the United States for an anti-hunt demonstration. The two demonstrations were scheduled an hour apart to prevent potential "clashing" of the two groups; however, the anti's showed up earlier than scheduled and began verbal harassment of the pro-hunt group and refuge staff. They created some temporary problems by obstructing traffic on the road, but with the assistance from two FWS Special Agents from Newark, refuge officers promptly gained control of the situation. Both demonstrations were orderly and without serious incidents.



Annual anti-hunting demonstration (GT)



Pro-hunting demonstration (GT)

On December 10 and 11, 1990, Stu Fefer and Tom Comish from the RO along with Zone Biologist Laskowski met with refuge staff to review the deer hunt program. Several recommendations to reduce the annual cost of administering and operating the program were discussed and will be considered further when developing the next annual hunt program.

11. Wildlife Observation

The Wildlife Observation Center (WOC) located off of Long Hill Road on the eastern side of the Management Area is the refuge's primary interpretive facility and wildlife viewing area. Interpretive displays, an information kiosk and several trails are available. A 0.25 mile elevated interpreted boardwalk trail leads the visitor through field and open marsh to an observation blind. Off of it is a field/woodland spur trail that leads to an observation platform. Another 0.4 mile of elevated boardwalk trail takes the visitor from the parking lot through marsh, swamp and forest to an elevated observation blind and handicapped accessible platform for wildlife observation. They overlook fields, marsh, ponds and forest edge. These facilities continue to be some of our main attractions!

Many other visitors also toured the Management Area along Pleasant Plains Road and/or made use of the 7.8 miles of foot trails in the Wilderness Area.

The Summit Nature Club conducted their annual woodcock watch on March 26. Many woodcock were observed.

On May 19, the refuge was again heavily censused during N.J. Audubon's annual "World Series of Birding" (WSB) competition. During this 24-hour competition, twenty-five teams representing such groups as Cornell Laboratory of Ornithology, N.Y. Department of Environmental Conservation, The Nature Conservancy, local Audubon and birding clubs, and a returning British team visited the refuge. Some of the species observed were a king rail, black-crowned night heron, common barn owl, double-crested cormorant, prairie warbler, Lincoln's sparrow, white-crowned sparrow, cerulean warbler and an alder flycatcher. Several teams that participated in the WSB utilized the event to raise funds from sponsors for a variety of conservation projects and activities.

The Summit Nature Club conducted its Christmas Bird Count on December 15 with a total of 47 species counted on the refuge. Total species observed on the refuge were up by eight (8) from last year's count. The increase was probably attributed to the open water that was present during the count which allowed waterfowl to be observed.

12. Other Wildlife Oriented Recreation

Photography and painting continue to increase in popularity on the refuge. Local clubs conduct art classes at the Wildlife Observation Center and in the Wilderness Area. These areas offer scenic viewing opportunities as well as wildlife observation.

16. Other Non-Wildlife Oriented Recreation

Pleasant Plains Road has been closed to through traffic for 4-1/2 years now. The road is used mainly for wildlife viewing and photography by visitors in their automobiles; however, we have also noticed a large increase in pedestrian traffic such as joggers, walkers and bicyclists. We believe the reduced vehicular traffic on the road is attracting this type of visitor. We are monitoring these activities to see how much they disturb wildlife and hinder wildlife observation opportunities from automobiles to determine if regulation is necessary.

17. Law Enforcement

The majority of law enforcement activity on the refuge occurs during the spring and fall months when visitation is heaviest. Hunting still occurs on the refuge periphery for waterfowl and deer which sometimes results in law enforcement problems as well.

Overall, LE activities were reduced this year due to staff reductions. Eleven (11) violations were recorded this year compared to twenty (20) in 1989. Citations were issued for the following offenses:

OFFENSE	NO. OF CASES
Illegal Parking	10
Introducing animal onto a National Wildlife Refuge	1
	—
	TOTAL: 11

On February 26, refuge personnel discovered that someone attempted to deface four interpretive signs along the boardwalk at the Wildlife Observation Center. The signs held up very well to the vandalism and the scratches hardly showed up. The signs are photochemically etched on anodized aluminum and were manufactured by "Nova Color".

During the early morning hours of August 8, the security alarm sounded at the refuge storage facility known as building 237. The local police responded and found no indication of illegal entry. Further investigation on the next day revealed that a raccoon had climbed a nearby power pole and electrocuted itself. This caused the transformer to short out and the alarm to go off.

On July 16th, Harding Township Police reported that a motorcycle had been found in a refuge field near the Wildlife Observation Center. An investigation revealed that it had been abandoned. The motorcycle was eventually returned to the owner and charges for abandonment of property were filed by the local police.

On the evening of August 9th, the Harding Township Police arrested six juveniles in the metal observation blind. They had built a fire in the center of the floor which destroyed the carpeting. The Harding Township Police prosecuted all six individuals which resulted in restitution for the damages being paid to the refuge.

On the evening of December 23, the Harding Township Police requested the assistance of a refuge officer at the Wildlife Observation Center. A teenager had gotten his vehicle stuck in a ditch and had been there for 6 hours in the rain trying to get it out. The individual was transported by local police to a relative's residence and the vehicle was removed the following day.

I. EQUIPMENT AND FACILITIES

1. **New Construction**

The refuge purchased materials to construct handrails on the 0.4 mile long boardwalk. The project was not begun due to staff vacancies and emphasis on other projects.

Two new foot bridges were constructed in the Wilderness Area. One by the YCC and the other by a volunteer scout group.

In March, a new section of trail was cleared in the Wilderness Area tying into an existing trail system. A small 3-4 car visitor parking lot off of Long Hill Road and just outside of the Wilderness Area now provides access to one of our most desirable wilderness trails from this part of the refuge.

A wooden bench was installed along the 0.4 mile boardwalk to the metal blind at the Wildlife Observation Center.

2. **Rehabilitation**

The carpeting in the metal observation blind was replaced after six juveniles burned a hole through the old carpet with a small "camp fire".

New visitor guide signs were erected around the refuge during the spring. The signs are a notable improvement.

Quarters work performed by refuge staff or local contractors during the year included the following:



New trail access to Wilderness Area (TM)

- Q-1: Replaced furnace
 Removed underground heating oil tank
 Installed above ground dike tank for fuel oil storage
- Q-7: Replaced storm door
- Q-91: Replaced electric stove
 Painted downstairs interior
 Replaced shingles and portions of plywood on roof
 Rewired part of kitchen
 Installed fence in back yard
- Q-99: Removed underground heating oil storage tank
 Installed above ground dike tank for fuel oil storage including
 pouring a concrete pad for the tank
- Q-205: Replaced refrigerator
 Painted interior of garage
 Replaced diaphragm tank
 Replaced sump pump
- Q-189: Replaced culvert in driveway
 Replaced shower and bathroom tiles
 Installed foundation vents
 Installed 112 square feet of flooring in attic for storage



Maintenance Mechanic Bob Westerman painting Q-91 (RS)



Q-91 getting a new roof (TM)

On August 2, Detail Associates, Inc., was awarded a contract to sample refuge buildings for asbestos. In September, Detail Associates collected and analyzed samples from twelve refuge buildings. Materials in three buildings were found to contain friable asbestos and were assigned a high priority for planned removal. Removal is estimated to cost about \$25,000.

In August, seven underground fuel storage tanks and two above ground tanks were removed by a contractor including three at headquarters, one at Q-1, one at Q-99, two at the Mill's house (Tract 231), and two above ground tanks that located at Building 237. Leaks were discovered at the headquarters tanks and the Mill's house. The New Jersey Bureau of Underground Storage Tanks was contacted through their hotline within 24 hours of discovering the leaks. The state requires that a hydrogeologist conduct site evaluations, monitoring, and sampling before clean up can begin. The refuge has been cooperating with the Regional Engineering and Contracting offices and the State in contracting these services.

A local dealer installed an air brake package on the new GSA rental dump truck and heavy equipment trailer on March 9.

In May, the Eager Beaver heavy equipment trailer was rehabilitated in preparation for use in the upstate New York private wetland restoration projects. Rehab included replacing bearings and races, decking boards, tongue jack, tail lights, and break-away switch.

Lights on the smaller lawn mower trailer were also rewired.

Vehicle repairs and maintenance included body work on the crew cab, brake repairs on the LE Jeep, installation of a trailer hitch on the Bronco, and installing a new cargo screen on the crew cab pick-up truck.

Repairs were also completed on the vehicle lift in the shop, dump truck and Bronco snow plow attachments, and fork lift.

On March 26, Maintenance Mechanic Westerman fabricated and installed a safety screen on Pool 1's main outlet water control structure #14.

On October 2 and 15, contractor Gittens Enterprises, Inc. returned to complete several final items identified by Regional Engineers on the Great Brook bridge rehabilitation project.

On October 16 and 17, 564 tons of gravel was delivered and spread on refuge roads, dikes, and parking lots to improve deteriorating sections.

Refuge staff constructed a new hunter parking lot #7 on the recently acquired Tobia Tract. Lot #7 was previously on the street in a residential neighborhood. Hunter access should be enhanced with the new location.



Contractor removing underground fuel tanks (TM)



Above ground dike tanks replaced the buried heating oil tanks at Q-99 & Q-1; canopies still need to be erected (TM)

On November 8, Maintenance Worker Melvin repaired traffic treadles at the South Gate which had settled unevenly.



Spreading gravel on dike roads (DM)

3. Major Maintenance

In February, Maintenance Worker Taylor completed an inspection and inventory of the refuge boundary identifying the status of all corners and boundaries. Biological Aid Scheirer completed some boundary clearing.

In March, the John Deere 550G dozer was taken to a John Deere dealer for emergency maintenance after it was almost completely submerged in water. The machine slid into a small pond after an embankment gave way.

The hydro-ax was operated 150 hours during 1990. Most of the time was spent removing trees in sites identified for woodcock management with trees and brush up to twenty years old. Thirty-five of these hours were spent clearing sites and paths for wetland restoration sites.

The Hydro-ax had frequent breakdowns and was expensive to repair. Excluding our labor costs, approximately \$10,680 was spent in 1990 for repairs and maintenance. Repairs included fixing a leaking radiator and the air conditioning, replacing the winch cable, rotary ax blades and hydraulic hoses, and scheduled preventative maintenance. The cutting deck required extensive repairs when the main shaft broke and the blades cut through the metal cone under the deck. In addition, nearly \$500 was spent on diesel fuel.

4. Equipment Utilization and Replacement

In February, GSA replaced the rental GMC dump truck and snow plow with a new 1989 International dump truck and snow plow.

In May, GSA updated our rental 1984 Ram Charger with a new 1990 Ford Bronco.

On June 28, the refuge received a new Ford crew cab pick-up to replace the old one. It arrived just in time for YCC.

On August 16, a 110-gallon transfer tank with electric pump was purchased and installed on the 4X4 Dodge pick-up truck to aid in refueling equipment in the field.

The refuge dump truck, heavy equipment trailer, and dozer were sent to upstate New York from June to August for use on private wetland restoration sites in support of the St. Lawrence joint venture.

On August 18, a 500-gallon skid tank was delivered to the refuge shop area for temporary storage of diesel fuel.

In August, refuge staff picked up several thousand dollars worth of excess office furniture from the U.S. Census Bureau Office in Morristown, N.J. The furniture was relatively new and in excellent condition. The furniture upgraded some of Great Swamp's and will supply the Wallkill River NWR when it's office is established.

The refuge purchased a new Bombardier tracked ATV in September to replace the aging Thiokol IMP. The equipment is scheduled for delivery in February 1991.

In September, the refuge received a new traffic counter and trail counter.

In October, the refuge received two new portable generators for use during power outages.

5. Communications Systems

In September, a 5 watt GE radio with case was received to replace one that was damaged beyond repair.

6. Computer Systems

The refuge received two IBM compatible desk top computers, a lap top computer, and a laser jet printer during 1990. Producing reports and maintaining data records can be achieved more efficiently because the new equipment permits several staff to use the computers at once. The

laser jet printer is much faster, has advanced graphic capabilities and is much quieter than the older daisy wheel printer.

On June 28, the refuge transferred its old Digital Rainbow 100 computer, printer, and associated software to the Division of Law Enforcement, Newark, NJ.

The following computer programs are used:

RBase -- Deer Hunt Program
 Wood Duck Box Program
 Budget
 IPW's

Lotus -- Waterfowl Surveys
 Bluebird Box Program
 Fire Extinguisher Maintenance Program

Pulp and Saw -- Forest Management

XTalk -- Electronic Mail

Word Perfect -- Word Processing

7. Energy Conservation

"3-M" window winterizing kits were installed in offices to cut down on drafts and reduce heating costs.

J. OTHER ITEMS

1. Cooperative Programs

FWE (Pleasantville, NJ) personnel Chezik and Moore attended the Passaic Township Board of Adjustment (zoning) public hearing on the Meyersville Mews (Weber) proposal. Chezik delivered a statement indicating the Service's concerns regarding potential impacts on the Great Swamp NWR. Chezik also outline some steps that could be taken to minimize those impacts. The board voted unanimously against the proposed variance and development on January 9, 1990.

On January 19, FWE (Pleasantville, NJ) personnel Chezik and Moore met with Ken Turner, USGS, to review and discuss the results of an electromagnetic survey of the refuge's portion of Miele Landfill. Also discussed were proposed locations for groundwater monitoring wells and the well drilling schedule. The logistics of the drilling operation and division of responsibilities leading up to the start of drilling

operations at the Great Swamp NWR were also discussed. Moore gave Ken Turner (USGS) a written request for previously discussed summary statistics for long term water quality data from the USGS gage at Passaic River near Millington.

On February 1, Associate Manager Frickie (RF/N), Zone Biologist Leenhouts, Hydraulic Engineer Quinn and Manager Koch met at the refuge to discuss the need for a refuge hydrology study and items to be included in a scope-of-work for the study.

On February 26, Sid Mitra started a temporary appointment as a toxicologist assigned to the refuge asbestos Superfund site. Through an agreement with EPA, \$80,000 has been obligated to the Service and will cover this appointment. Direct supervision will be from the Pleasantville, NJ (FWE) field office.

On February 21, the National Park Service used the refuge shotgun range to qualify several of their law enforcement personnel.

The Civil Air Patrol conducted a search and rescue training exercise in the refuge Wilderness Area on February 25.

The refuge cooperated with Paul Castelli, Waterfowl Biologist for N.J. Division of Fish, Game and Wildlife in trapping black duck hens from refuge impoundments. These hens will be used as live decoys in waterfowl traps in southern New Jersey as part of a cooperative study between the State and the Service to capture and radio collar black ducks. Refuge personnel baited several locations on the refuge from March 1 to March 6. On March 7 and 8, State Technician Mark Steffen set out seven (7) waterfowl traps and captured ten (10) wood ducks, seven (7) mallards and three (3) black ducks. All were released except two (2) black duck hens which were transported to the Nacote Research Station in southern New Jersey.

On March 27, the refuge was advised by RF/N that it will implement a fee program for its annual deer hunt this year (see Section H.8). Coordination with the N.J. Division of Fish, Game and Wildlife was initiated.

On March 23, ORP McFadden met with Ms. Joan Geraghty of the Harding Township Health Department to discuss the threat of rabies in this area. Ms. Geraghty is on the Morris County Rabies Task Force and is providing information on handling cases if and when Rabies arrives.

On April 18, Manager Koch and Zone Biologist Leenhouts met with Tony Ross and Gary Vecellio of the Cooperative Wildlife Research Unit of Penn State University to discuss initial and final preparations for the vegetation monitoring and deer browse study under contract to the University. Data collection started on May 8. Location and data collection of browse plots in refuge woodlands was completed on July 12 and 13. Biologist Melvin accompanied them to review methodology and see some of the plot locations.

On April 19, Manager Koch attended a general planning meeting at the Remote Sensing Center of Rutgers University, Cook College. The college is obtaining current satellite imagery that includes the refuge watershed and is investigating the possibility of mutually beneficial cooperative agreements with any interested agency, organization, municipal or county government, etc..

On April 26, Manager Koch discussed the ground water monitoring well drilling schedule for the Miele Landfill with Watershed Biologist Moore and Ken Turner of USGS. On May 1, Manager Koch met with Ken Turner (USGS) and a representative of Onyx Construction to discuss logistics involved with drilling groundwater monitoring wells near the refuge portion of the Miele Landfill. Turner and the contractor then inspected drilling sites. During the week of May 7-11, three wells were installed. Watershed Biologist Craig Moore monitored the operation. The first set of ground water samples were collected on July 2 and 3. Lab results from the first round of sampling of the Service's groundwater monitoring wells for the Miele Landfill agree closely with the results obtained in previous USGS reconnaissance study. Craig Moore (FWE, Pleasantville) compared them to the EPA and NJ DEP water quality studies. Some levels of metals were elevated above background but, cadmium (0.012mg/l) exceeded the EPA and NJ DEP drinking water standards of (0.010mg/l).

On May 3, Manager Koch and Gib Chase (RE) inspected several properties of willing sellers and met with one landowner in the Wallkill River NWR acquisition area. On May 31, Deputy RD Gillett received a tour of the Wallkill project area from Manager Koch and Gib Chase (RE).

On May 16, the Passaic Township Committee passed a resolution to discontinue taxing life estates on property in the Great Swamp NWR because revenue sharing funds are distributed to the Township from the USFWS for payment in lieu of taxes. This resolution is the result of efforts made by local landowners to inform the Township Committee of the inequitable taxing of life estates in the Township.

On May 18, Manager Koch met with two representatives from Louis Berger International, Inc. (N.J. Dept. of Transportation's consultant) to discuss a feasibility study for a sediment basin proposed for Primrose Brook (on the refuge) as part of NJ DOT's Route 24 mitigation requirements. In November, Manager Koch reviewed a draft EA and an engineering feasibility study completed by NJ DOT and provided comments in December. Refuge comments were provided to the FWE field office in Pleasantville, NJ. The FWE field office will consolidate the Service's comments to NJ DOT.

On June 29, Assistant Villanueva attended a meeting at the Remote Sensing Center of Rutgers University with Craig Moore (FWE, Pleasantville, NJ), Bill Leenhouts (Zone Biologist), representatives from Morris and Hunterdon County Planning Boards, Soil Conservation Service, Rutgers University, NJ DEP, and the Upper Raritan Watershed

Association. They discussed progress on the Black River Watershed Project to develop a GIS model including status of data layer development, needs; and availability of data. The Great Swamp Watershed has been included in the GIS study area, potentially providing a powerful planning tool to assess possible impacts of various land use practices on water quality and quantity in the Swamp.

Copies of the final published report "Contaminants in White-tailed Deer Tissue from the Great Swamp NWR" were received from the FWE Pleasantville field office on July 10. The report analyses samples collected from refuge deer in 1988.

Manager Koch met with Abby Fair of the Chatham Township Committee on July 13 to discuss flooding problems and refuge drainage ditch plugging.

On July 17, it was reported to us that the Morris Township Sewage Treatment Plant experienced a power failure on July 15. Emergency generators were not engaged resulting in raw sewage being dumped into Loantaka Brook, a couple miles upstream of the refuge. A fish kill was discovered at the Loantaka Park on July 16. A spot check of the brook near the refuge inflow did not reveal a fish kill.

On August 2, Algonquin Gas Transmission Company completed the visual screening of valve 6 on the refuge by planting approved shrubbery.

On August 23, we were advised that EPA had been testing for asbestos at the Tielmann house on New Vernon Road. This site is adjacent to the refuge and is one of the satellites of a Superfund site. Test results from indoor air, vacuum cleaner silt, and wipe sampling done by EPA's National Emergency Response Team (NERT) indicated that there was a significant human health risk involved which warranted emergency remediation action. The Tielmanns were advised to evacuate their house and find temporary quarters until further sampling and if necessary, removal actions have been implemented. The Tielmann property is one of the three areas making up Operable Unit II of the Asbestos Dump Superfund Site in Morris County. The other two sites are: a 12 acre parcel owned by the Majors family with five acres covered by asbestos (adjacent to the refuge), and an 11 acre site on the refuge. NERT conducted indoor sampling at the Majors residence. EPA notified some of the homeowners around the area who may be aware of asbestos on their property. Notification of these events was given to the EPA Community Relations Group, relevant political officials, and the potentially responsible party, National Gypsum. EPA officials are also attempting to bring asbestos laden areas on the refuge to the attention of NERT because these areas are also accessible to human receptors.

On August 29, Les Roman, an environmental consultant for Algonquin Gas Transmission Company conducted a survey of phragmites and purple loosestrife on Algonquin's new right-of-way across the refuge.

On September 20, Manager Koch and Sid Mitra (FWE, Pleasantville) attended a meeting at Passaic Township Town Hall for an EPA report on

the status of asbestos hazards in the Swamp on satellite Superfund dump sites. On December 5 and 21, Manager Koch met with EPA regarding posting the refuge asbestos Superfund site with warning signs.

On October 11, Manager Koch and Craig Moore (FWE, Pleasantville) attended an EPA meeting on the progress of the Final Environmental Impact Statement on the Upper Passaic River Basin 201 Facilities Plan.

Manager Koch reviewed and commented on a draft FY 91 scope-of-work between the refuge and FWE (Pleasantville) covering tasks and duties assigned to the refuge Watershed Biologist. A draft water quality monitoring program which will be part of the scope-of-work was also reviewed.

The refuge continued cooperation with the N.J. Division of Fish, Game and Wildlife by operating a deer check station during the State's bow, shotgun and special permit shotgun seasons.

In February, 1988, the Fish and Wildlife Service created an environmental contaminant specialist Watershed Biologist position to work on issues throughout the 55 square mile Great Swamp Watershed. This position is stationed at and is directly supervised by Fish and Wildlife Enhancement field office in Pleasantville, NJ, but works very closely with the Manager on refuge impacting issues throughout the year. Tim Prior vacated this very demanding position on March 24, 1989, and Craig Moore refilled it in November, 1989. Moore previously worked for the U.S. Geological Survey in Delaware.

2. Other Economic Uses

A Special Use Permit was re-issued to a local resident for beekeeping privileges on the refuge.

3. Items of Interest

On January 17, several refuge staff attended a meeting on the Thrift Savings Plan at the National Park Service's George Washington Headquarters in Morristown. The meeting, lead by job counselors from the Veterans Administration Hospital, discussed investment opportunities with the plan and answered many questions posed by the meeting participants.

On March 13, Manager Koch gave a refuge tour to a reporter for the Asbury Park Press and Helen Fenske, NJ DEP Assistant Commissioner for Natural Resources (recently retired). On March 19, Fenske and Koch again teamed up with a photographer for the same newspaper.

On March 15, Manager Koch attended Helen Fenske's retirement party in Trenton. Helen has a long list of accomplishments and contributions to New Jersey natural resources. She was instrumental in the establishment

of the Great Swamp NWR, Cape May NWR and the Wallkill River NWR. Helen recently received the Secretary of Interior's "Conservation Service Award" which is the highest award given to a private citizen by the Department of the Interior!

On May 15, Deputy RD Gillett toured the refuge with Manager Koch.

On October 9, Manager Koch and Assistant Villanueva attended an open house in Morristown celebrating the Trust for Public Land (TPL) grand opening of its NJ field office. This provided opportunities to meet the project managers involved in acquisitions in New Jersey as well as TPL's officers and President.

On November 29, Biological Technician Graham Taylor from Barnegat Division of the E.B. Forsythe NWR picked up 24 DU wood duck boxes and 24 metal predator guards from the refuge. He left sheet metal for the construction of more predator guards by students at the local Vo-Tech.

4. Credits

Refuge Manager Koch wrote Sections A., D.4, G.15, Wallkill River National Wildlife Refuge section and edited the entire report.

Assistant Manager Villanueva wrote Sections C.1, E.6, E.8, F.3, F.5 and I.1-7.

Wildlife Biologist Melvin wrote the Introduction along with Sections D.2, D.5, E.7, E.8 (NAWMP), F.1, F.2, F.13, G.8, G.14, H.8 and J.1-4. Melvin also compiled and edited the report prior to submission to the Refuge Manager for final approval.

Biological Aid Scheirer wrote Sections B., F.9, F.10, G.2-7, G.10, G.13 and G.15-17.

ORP McFadden wrote Sections E.2, E.4, F.12, H.1-4, H.6, H.7, H.11, H.12, H.16, H.17 and L. (Information Packet).

Secretary Klimas wrote Sections E.1 and E.5.

Clerk-Typist Malavasi typed and assembled the report on the computer.

K. FEEDBACK

Overwhelmed and understaffed is unfortunately too often the norm. Too much attention and emphasis is placed on cumbersome administrative requirements and procedures. Paper exercises abound with frequent demands for unrealistic deadlines. While some of this is necessary and unavoidable, it should be known that precious little time is left for the resource, and isn't that what this is all about? Morale tends to suffer under the weight of this imbalance.

It is wonderful that new refuges are being added to the system. Where, however, is the logic in taking positions away from established refuges with complex programs and using them for new refuges? There is no doubt that new units need staff right away, but why must existing programs and commitments be sacrificed? Start-up funds and sufficient staff should ideally be provided just prior to the first acre being purchased, especially if the acquisition program is "healthy."

The bottom line is that refuges need more people and funds to keep up with ever increasing responsibilities. There is a point where we will no longer be able to do more with less!

L. INFORMATION PACKET - - - (inside back cover)

WALLKILL RIVER NATIONAL WILDLIFE REFUGE
Sussex County, New Jersey

Regional Director Ronald Lambertson signed the Wallkill River National Wildlife Refuge establishing document on March 9, 1990. Authorizing legislation P.L. 101-593 Sec. 107 of H.R. 3338 was signed on November 16, 1990.

Great Swamp NWR is an hour drive from the southern end of the Wallkill River NWR project area and has been assigned responsibility for this area until a project leader is designated.

In FY 91, four million dollars was appropriated for Wallkill River NWR land acquisition. At the close of calendar year 1991, no acreage had been acquired, but there were an estimated 2,000-3,000 acres of willing sellers eager to negotiate.

Two sections of the Final Environmental Assessment which was released on January 10, 1990, have been reproduced here:

I. INTRODUCTION

B. Proposal

The Service proposes to acquire, fee simple and through conservation easements, approximately 7,500 acres along the Wallkill River to form the Wallkill River National Wildlife Refuge. Fee simple title acquisition is the acquisition of all interest in property. This type of ownership provides for maximum management control and opportunities for public use. This acquisition will result in the protection of some 4,200 acres of wetlands and 3,300 acres of upland. The area will be added to the National Wildlife Refuge System (NWRS) under the existing authority of the Fish and Wildlife Act of 1956, 16 U.S.C. 742 F (a)(5)(1976). Since the first refuge was established in 1903, the system has grown to nearly 500 units, covering approximately 100 million acres in 49 states. All lands considered by this report are located in New Jersey, but additional parcels along the river in New York could be added if the opportunity arises. For the purposes of this Assessment, the upland will include "critical edge" habitat, which is defined as the zone where wetland and upland communities meet, as well as adjacent farm land. Edge habitat or transition areas between two ecosystems are highly productive and generally exhibit a diverse assemblage of plant and animal species. In this case, the upland habitats include 2,500 acres of farm land and 800 acres of hardwood forest. As wetlands are provided more legal protection than uplands, Service priority will be placed

on the acquisition of adjacent upland which will ensure long-term protection of the wetland resources. A concerted effort has been made to eliminate from the acquisition area any improved property (ie., homes, farm buildings, and commercial buildings).

The acquisition and preservation of existing large parcels of farm land and associated riverine wetland habitat will provide an opportunity for long-term wildlife management and flexibility for access control and the establishment of various environmental education and interpretive programs. The commitment of lands, water, and other resources of the proposed area to management as a unit of the National Wildlife Refuge System is in perpetuity.

Purchase monies are derived from the Land and Water Conservation Fund. This fund is used by federal and state agencies to acquire lands for outdoor recreation and endangered species. The fund is comprised of a portion of motorboat fuel taxes, a portion of receipts from outer continental shelf oil and gas leasing, proceeds from federal surplus property sales, and certain user fees.

D. Background

The Wallkill River bottomlands of Sussex County, New Jersey, is one of the few, high quality waterfowl concentration areas remaining in the northwestern portion of the state. It is also unique as a wildlife habitat due to its expansive wetlands and great diversity of species it supports, including at least eight of the state's list of threatened and endangered species.

The proposed refuge area is located within an hour's drive of the New York metropolitan area, home to over 17 million people, thus, offering exceptional recreational potential. Following up on the recommendations of the President's Commission on Americans Outdoors, New Jersey began planning for a system of Greenways throughout the state which would protect natural resources, offer recreational opportunities, enhance landscapes, maintain visual amenities, and support economic development. The Wallkill River area is a key link in New Jersey's planned Greenway system for the northern part of the state. Both the New Jersey Green Acres Program and Division of Fish, Game and Wildlife have coveted the study area for many years, but lack of adequate funding has prevented its acquisition. In May, 1988, the State DEP and Division of Fish, Game and Wildlife representatives met with the Service's Regional Office staff and presented a proposal to create the Wallkill River National Wildlife Refuge.

As a major watershed and wetland complex, the Wallkill River provides migratory and nesting habitat for Atlantic Flyway

migratory black duck populations. These wetlands have been identified as important black duck habitat in the Service's Category Plan for Preservation of Black Duck Habitat on the Atlantic Coast, 1988. The Category Plan is a high priority of the Service's North American Waterfowl Management Plan (1986) because of declining black duck populations over the past 30 years. The North American Plan implements a 1986 joint agreement between the United States and Canada which calls for the protection and management of important waterfowl habitats to achieve specific population objectives for ducks, geese, and swans. The North American Waterfowl Management Plan is a continent-wide plan that is stepped down to regional Joint Ventures which, in turn, are stepped down to project plans. Joint Ventures--coalitions of state and federal agencies, conservation groups, and individuals--have been set up in each region to achieve the Plan's goals. There are six Joint Ventures in the United States. The Atlantic Coast joint venture area includes the entire state of New Jersey, with the Wallkill River a major "focus area" or project within the larger joint venture geographic area.

The Emergency Wetlands Resources Act of 1986 also directs the Department of the Interior to develop a National Wetlands Priority Conservation Plan that identifies the location and types of wetlands and interests in wetlands that should receive priority attention for acquisition by federal and state agencies using Land and Water Conservation Fund monies. Wetlands acquired under the authority of the Emergency Wetlands Resources Act are those representative of a declining wetland type, have significant functional value, or are threatened by some type of external activity. Candidate sites for the regional Priority Wetland List were compiled by Service biologists, state fish and wildlife and park and recreation agencies working together. Additional information was obtained from private natural resource and land trust organizations. New Jersey has developed a Statewide Wetlands Priority Conservation System, in which wetland systems which have experienced significant losses statewide over time are given preference for acquisition. Threats to the wetlands and ecology, water resources, and recreational values will also be considered in the prioritization of sites for acquisition. The results showed the Wallkill River and bottomlands to be considered as one of the top five priority wetland areas in New Jersey, meriting protection. Wetland loss calculations for the region also show that palustrine emergent and forested wetlands characterizing the Wallkill have experienced a high index of loss. Moreover, this refuge proposal supports a number of the recommendations addressed in the "Final Report of the National Wetlands Policy Forum" chaired by New Jersey Governor Thomas Kean, and prepared by the Conservation Foundation, 1988. This two-year wetlands policy study forum recommends that:

"The Nation establish a National Wetlands Protection Policy to achieve no overall net loss of the Nation's remaining wetlands base as defined by acreage and function and to restore and create wetlands, where feasible, to increase the quality and quantity of the Nation's wetlands resource base."

Other recommendations include the acquisition of endangered acreage, request Congress to establish a National Agricultural Wetlands Preserve Program, proposes coordinated regulations to be conducted chiefly by the states, increase the national wetland base by restoring certain wetlands and expanding others, and tax incentives to encourage private stewardship.

The following activities compiled here were reported in appropriate sections of the 1990 Great Swamp NWR Annual Narrative Report:

On January 10, Manager Koch attended a Press Conference for the proposed Wallkill River NWR at the Wantage Township Town Hall. The final EA was released at this meeting. RD Lambertson and Acting Commissioner Fenske, NJ Dept. of Environmental Protection, were key speakers. Lambertson presented Fenske with a token of the Service's appreciation for her avid support of new and existing national wildlife refuges in the state. Approximately 75 people attended including Congressional representatives, state, county and local officials, other Service representatives, and the news media. Koch arranged a helicopter tour of the project area, but it had to be cancelled due to foul weather.

On March 15, Manager Koch attended Helen Fenske's retirement party in Trenton. Helen has a long list of accomplishments and contributions to N.J. natural resources. She was instrumental in the establishment of the Great Swamp NWR, Cape May NWR and the Wallkill River NWR. Helen recently received the Secretary of Interior's "Conservation Service Award" which is the highest award given to a private citizen by the Department of the Interior!

On May 3, Manager Koch and Gib Chase (RE) inspected several properties of willing sellers and met with one landowner in the Wallkill River NWR acquisition area.

Deputy RD Gillett toured the Wallkill River NWR project area with Gib Chase and Manager Koch on May 31.

On June 28, Great Swamp Watershed Biologist Moore and Biologist Burr from the Pleasantville, NJ, FWE field office, met with Jim Kurtenbach, EPA Ambient Monitoring Section, at the Wallkill River Refuge to observe Jim demonstrate and explain the EPA Rapid Bioassessment Sampling Techniques for monitoring stream water quality.

On August 30, Great Swamp Refuge staff picked up excess office furniture from the U.S. Census Bureau Office in Morristown, NJ. The furniture was

relatively new and in excellent condition. The furniture will upgrade some of Great Swamp's and supply the Wallkill River NWR when its office is established.

In August and September, 1990, Manager Koch and Assistant Manager Villanueva participated in the planning and logistics of a tour of the proposed Wallkill River NWR area for 15 members of the NJ Skylands Greenways Task Force. The Task Force is developing a plan for a series of public greenways in northern NJ. Vans were rented and Assistant Villanueva served as a tour guide on September 11, 1990. An attempt to obtain EPA's helicopter for an aerial tour was made, but the helicopter was unavailable at the time.

In November, 1990, Refuge Manager Koch worked with Helen Fenske, President of Natural Resource Education Foundation of NJ, Inc., in planning a tour of the Wallkill River NWR project area for several foundations which were being approached for environmental education grant funding. Manager Koch and Assertainment Biologist Chase assisted in guiding the tour on 12/4/90. The tour was successful in obtaining a grant for Helen's organization which will indirectly benefit the refuge.

On December 13, Chezik, Moore, Burr, Augspurger and Mitra (FWE, Pleasantville, NJ field office) met with Ralph Pisapia (ARD-FWE) and the Regional Realty staff to evaluate the results and discuss the future plans of the Level 2 Surveys especially for the Wallkill River and Reedy Creek NWR's.

K. FEEDBACK

Overwhelmed and understaffed is unfortunately too often the norm. Too much attention and emphasis is placed on cumbersome administrative requirements and procedures. Paper exercises abound with frequent demands for unrealistic deadlines. While some of this is necessary and unavoidable, it should be known that precious little time is left for the resource, and isn't that what this is all about? Morale tends to suffer under the weight of this imbalance.

It is wonderful that new refuges are being added to the system. Where, however, is the logic in taking positions away from established refuges with complex programs and using them for new refuges? There is no doubt that new units need staff right away, but why must existing programs and commitments be sacrificed? Start-up funds and sufficient staff should ideally be provided just prior to the first acre being purchased, especially if the acquisition program is "healthy."

The bottom line is that refuges need more people and funds to keep up with ever increasing responsibilities. There is a point where we will no longer be able to do more with less!

GREAT SWAMP

National Wildlife Refuge



NEW JERSEY

Small farming operations such as these became uneconomical and gradually disappeared. Consequently, much of the cleared upland returned to woods and the lower flat areas reverted to swamp-land. Various modern uses have been planned for Great Swamp: flood control in the 1920's; drainage projects in the 1930's; and a jet airport proposal in 1959.

It was the threat of the jetport which enabled the Great Swamp Committee of the North American Wildlife Foundation to muster the aid of a significant number of volunteers. This effort raised more than a million dollars to purchase nearly 3,000 acres which were donated to the Department of the Interior. These acres formed the nucleus of the Great Swamp National Wildlife Refuge. Through the years, additional acres have been added to the original tract.

REFUGE MANAGEMENT

Wilderness Area - The eastern half of the Refuge was designated as a Wilderness Area by Congress in 1968. Generally, no permanent structures, motorized vehicles, or equipment are allowed. The Wilderness Area serves as an outdoor laboratory and provides a more primitive outdoor experience for the general public. Hiking on almost eight miles of trails is permitted. By limiting use in this sensitive area to foot travel, the wilderness experience can be preserved. Great Swamp was established as an area to provide migration, nesting and feeding habitat for migratory birds.

Wildlife Management Area - The western half of the Refuge is intensively managed to maintain optimum habitat for a wide variety of wildlife. Water levels are regulated; grasslands and brush are mowed periodically to maintain habitat and species diversity; shrubs are planted; nesting structures for wood ducks, bluebirds, and other birds are provided; other habitat management practices are employed; and research studies are conducted. Public access in this area is limited to the Wildlife Observation Center and Pleasant Plains Road to minimize disturbance to wildlife.



VISITOR ACTIVITIES

People are encouraged to observe, study, photograph, and just walk with nature in designated public areas. The best times for observing wildlife are early morning and late afternoon. Because of large numbers of visitors, wildlife viewing on Sunday afternoon is often less rewarding.

Waterproof footgear or old sneakers are recommended during most seasons in the Wilderness Area. Mosquitoes, ticks, and deer flies may be numerous from May to September so insect repellent and protective clothing are advisable. Ticks can transmit Lyme disease which has been found in the area.

Visitors who are driving through the Refuge on public roads are requested to stay in their cars so the wildlife they see will remain in view for those who follow.

Wildlife Observation Center - The Center, located in the Management Area off Long Hill Road, is particularly good for photography and wildlife observation. It has approximately one mile of trails, interpretive displays, an unstaffed information booth, blinds for observing wildlife, and restrooms. Please stay on the boardwalk to avoid disturbing wildlife so that others may have a chance to view the wildlife.

Tours - To prevent groups from disturbing one another and wildlife, all groups are encouraged to schedule their visit with the office. Groups of 10-15 individuals may schedule a guided tour. Movies and slide talks can also be scheduled for groups of up to 50. There are no regularly scheduled programs.

REGULATIONS

Wildlife have no restrictions. They have free run of the entire Refuge, day and night, because this is their home; people, as visitors, must be regulated.

Hours - Visitors are permitted only in the designated areas during daylight hours.

Trails are open to foot travel only.

Pets must be on a leash and remain in parking areas.

Vehicles may be parked only in designated areas.

Collecting, disturbing, or destroying plants, animals, or parts thereof, is strictly forbidden.

Camping - Picnicking and camping are not permitted on the Refuge. Two county parks in the area that do allow camping by permit are Mahlon Dickinson and Lewis Morris. For information, contact the Morris County Park Commission.

Litter - PLEASE DON'T - maybe you can recycle it!

You are responsible for knowing all Refuge regulations. If you are unsure, please inquire at headquarters.

Great Swamp National Wildlife Refuge exists today because people care what happens to wild animals and natural places.

WELCOME

Great Swamp National Wildlife Refuge, established in 1960, lies 26 miles west of New York City's Times Square and seven miles south of Morristown, New Jersey.

Swamp woodland, hardwood ridges, cattail marsh, and grassland typify this approximately 7,000-acre Refuge. The Swamp contains many large old oak and beech trees, stands of mountain laurel, and species of other plants of both northern and southern botanical zones.



The Refuge bird leaflet lists more than 222 species of birds according to their seasonal occurrence. Mammals found on the Refuge include the white-tailed deer, river otter, muskrat, raccoon, skunk, red fox, woodchuck, grey squirrel, opossum, and cottontail rabbit. An interesting variety of fish, reptiles, and amphibians, including the State endangered bog turtle and the blue-spotted salamander, are also found on the Refuge.

ORIGIN OF GREAT SWAMP

Roughly 25,000 years ago, where the Wisconsin glacier reached its furthest point south and stopped, the creation of Great Swamp began.

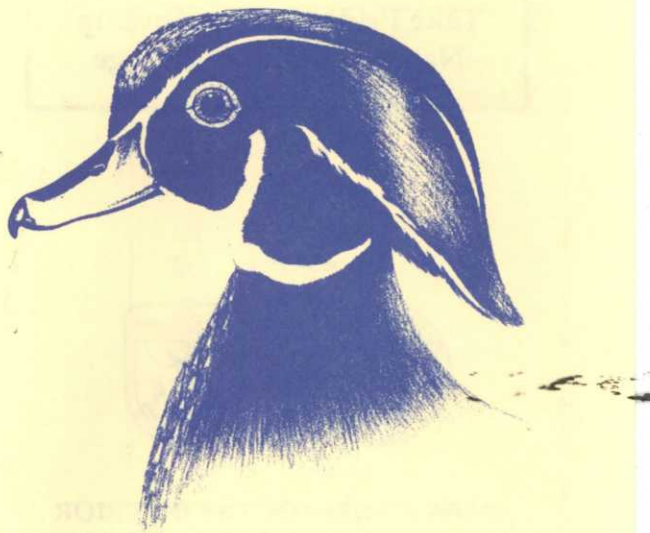
The melting glacier withdrew northward leaving a barren landscape of sand and gravel strewn in long ridges that blocked the outlet of an ancient river basin. Water, melted from the glacier, flowed into the basin behind this natural dam to form a giant lake, 30 miles long and 10 miles wide.

Eventually the retreating glacier uncovered a second outlet at what is now Little Falls Gap, and the lake waters drained out along the Passaic River. The lake disappeared and was replaced by extensive marshes and swamps which would be named Black Meadows, Great and Little Piece Meadows, Troy Meadows, Hatfield Swamp, and Great Swamp.

HISTORY

For a barrel of rum, 15 kettles, 4 pistols, 4 cutlasses plus other goods, and 30 pounds cash, the Delaware Indians in 1708 deeded a 30,000-acre tract, including the Great Swamp, to English investors.

Later, settlements dotted the area and during the Revolutionary War local settlers fashioned wagon wheel parts with wood cut from the Great Swamp. By 1844, farms appeared on cleared uplands; farmers drained marshlands; and "foul meadow hay" became a major crop.

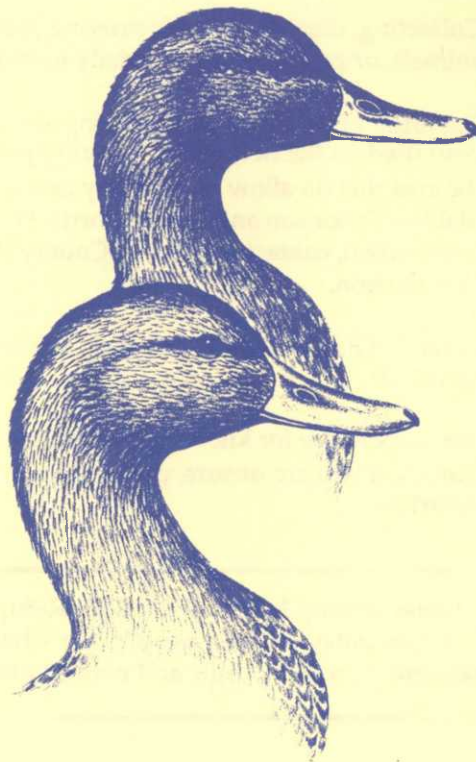


VISITOR INFORMATION

Refuge Headquarters is located on Pleasant Plains Road. Office hours are from 8:00 a.m. to 4:30 p.m., Monday through Friday. During spring and fall the refuge headquarters may be open on Sundays. Please call ahead for information.

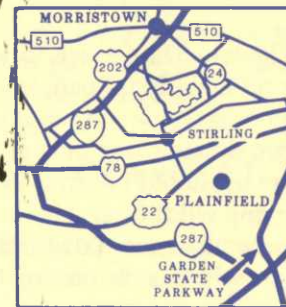
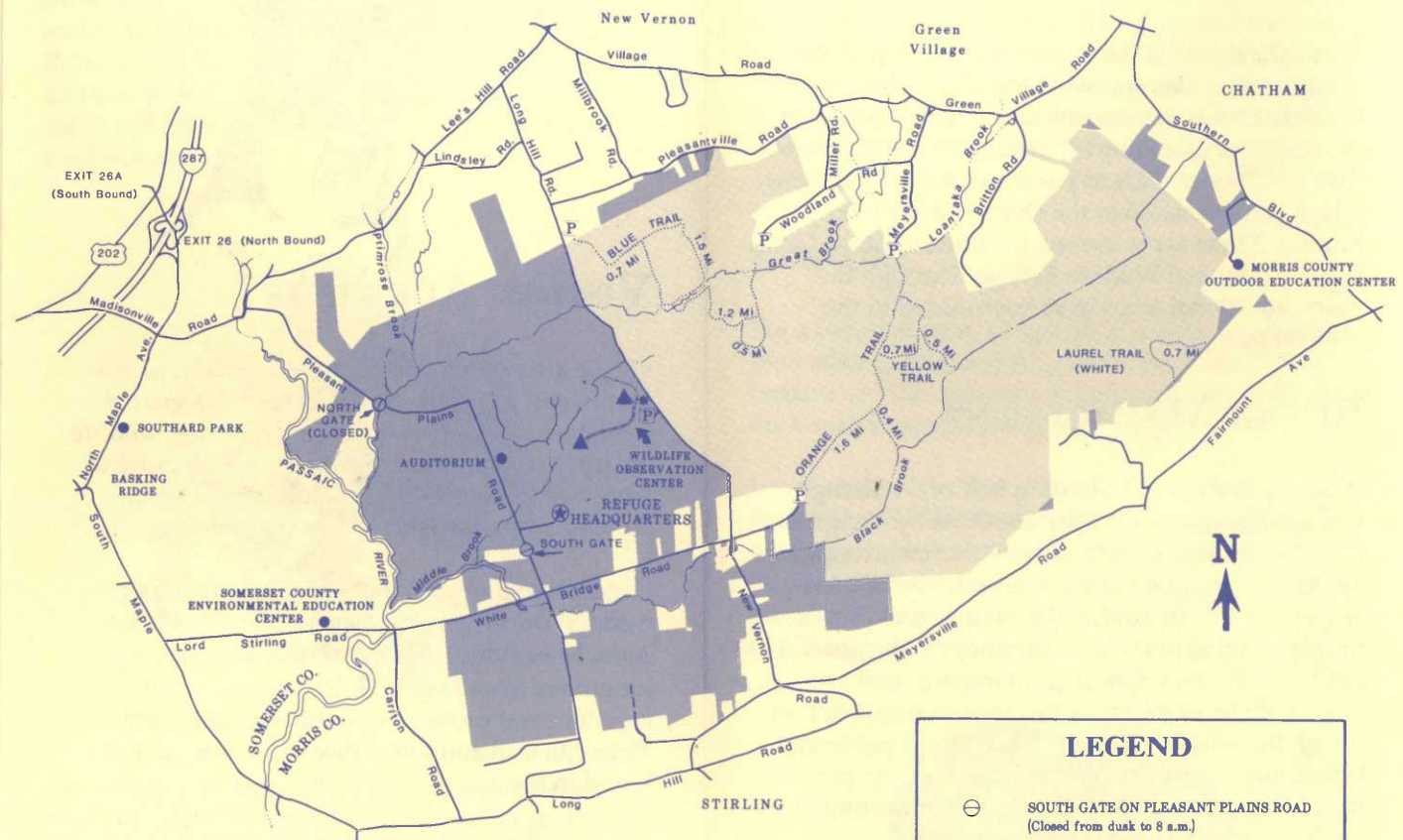
Great Swamp Outdoor Education Center, Morris County Park Commission, is located on the eastern side of the refuge off Southern Boulevard in Chatham. The Center offers a varied natural science program of classes and guided tours, and provides one mile of trail and boardwalk for the public. Details can be obtained at the center. Telephone (201) 635-6629.

The Environmental Education Center, operated by the Somerset County Park Commission, is located on the western border of the refuge in Lord Stirling Park. The park has a varied program of environmental education courses, guided field trips, and 8-1/2 miles of walking trail. For details, telephone (201) 766-2489.



GREAT SWAMP

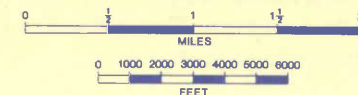
National Wildlife Refuge



LEGEND

- ⊖ SOUTH GATE ON PLEASANT PLAINS ROAD
(Closed from dusk to 8 a.m.)
- ~ RIVERS AND STREAMS
- P PARKING LOTS
- WILDERNESS AREA
- MANAGEMENT AREA
- * HEATED RESTROOM
- ▲ OBSERVATION/PHOTO BLIND
- TRAILS
- SELF-GUIDED INTERPRETED BOARDWALK TRAILS

SCALE



Mission: As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.

For further information contact:

Refuge Manager
Great Swamp National Wildlife Refuge
R.D. #1, Box 152
Basking Ridge, New Jersey 07920
Telephone: (908) 647-1222 ~

The cover illustration of the Eastern Bluebird was donated by the North American Bluebird Society.

**Take Pride in Great Swamp
National Wildlife Refuge**



**DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE**

RL-53530-1

October 1990

BIRDS



of
Great Swamp

NATIONAL
WILDLIFE
REFUGE

NEW JERSEY

	s	S	F	W
— Broad-winged Hawk †	u	o	u	
— Red-tailed Hawk †	c	u	c	c
— Rough-legged Hawk	o	o	o	
— Golden Eagle		r		
— American Kestrel †	c	c	c	c
— Merlin	r	r		
— Peregrine Falcon		r		
GROUSE - QUAIL				
— Ring-necked Pheasant †	c	c	c	u
— Ruffed Grouse †	u	u	u	u
— Northern Bobwhite	r	r	r	r
RAILS - COOTS				
— King Rail †	o	u	o	
— Virginia Rail †	a	a	a	o
— Sora †	c	c	c	r
— Common Moorhen †	u	c	c	
— American Coot	u	u	u	
PLOVERS - SANDPIPERS				
— Killdeer †	c	c	c	o
— Greater Yellowlegs	o	o	o	
— Lesser Yellowlegs	u	o	u	
— Solitary Sandpiper	u	u	u	
— Spotted Sandpiper †	u	u	u	
— Upland Sandpiper	o			
— Semipalmated Sandpiper	o	o	o	
— Least Sandpiper	u	u	o	
— Pectoral Sandpiper	u	u	u	
— Dunlin	r			
— Short-billed Dowitcher	r	r		
— Common Snipe	a	o	c	o
— American Woodcock †	a	c	a	o
GULLS - TERNS				
— Bonaparte's Gull		r		
— Ring-billed Gull	o	o	o	
— Herring Gull	o	o	o	o
— Great Black-backed Gull	o		o	
— Black Tern	r			
DOVES - CUCKOOS - OWLS -				
SWIFTS - HUMMINGBIRDS				
— Rock Dove	u	u	u	u
— Mourning Dove †	a	a	a	a
— Black-billed Cuckoo †	u	u	o	
— Yellow-billed Cuckoo †	u	u	o	
— Common Barn-Owl	o	o	o	o
— Eastern Screech-Owl †	u	u	u	u
— Great Horned Owl †	c	c	c	c
— Barred Owl †	c	c	c	c

	s	S	F	W
— Long-eared Owl	o	o	o	
— Northern Saw-whet Owl		r	r	
— Common Nighthawk	c	c	c	
— Chimney Swift	c	c	c	
— Ruby-throated Hummingbird †	o	o	o	
— Belted Kingfisher	c	c	c	o
WOODPECKERS - FLYCATCHERS				
— Red-headed Woodpecker †	u	u	u	u
— Red-bellied Woodpecker †	c	c	c	c
— Yellow-bellied Sapsucker	o	o	r	
— Downy Woodpecker †	c	c	c	c
— Hairy Woodpecker †	c	c	c	c
— Northern Flicker †	c	c	c	u
— Pileated Woodpecker †	o	o	o	o
— Olive-sided Flycatcher	o	o	o	
— Eastern Wood-Pewee †	c	c	c	
— Yellow-bellied Flycatcher	o	u	u	
— Acadian Flycatcher †	o	o		
— Alder Flycatcher	o	o		
— Willow Flycatcher †	c	c	c	
— Least Flycatcher †	o	o	o	
— Eastern Phoebe †	c	c	c	o
— Great Crested Flycatcher †	c	c	c	
— Eastern Kingbird †	c	c	c	
LARKS - SWALLOWS - JAYS and CROWS				
— Horned Lark	o	o		
— Purple Martin †	u	u		
— Tree Swallow †	c	a	c	r
— Northern Rough-winged Swallow	u	c		
— Bank Swallow	u	u		
— Cliff Swallow	u			
— Barn Swallow †	c	c	c	
— Blue Jay †	a	a	a	a
— American Crow †	c	c	c	c
— Fish Crow	o	o	o	o
TITMICE - NUTHATCHES - WRENS				
— Black-capped Chickadee †	a	a	a	a
— Tufted Titmouse †	a	a	a	a
— Red-breasted Nuthatch	o	u	o	
— White-breasted Nuthatch †	a	a	a	a
— Brown Creeper †	c	u	c	u
— Carolina Wren †	u	u	u	u
— House Wren †	c	a	c	
— Winter Wren	o	o	o	
— Marsh Wren †	c	c	c	r
KINGLETS - THRUSHES - THRASHERS				
— Golden-crowned Kinglet	u	c	u	

	s	S	F	W
— Ruby-crowned Kinglet	c	c	u	
— Blue-gray Gnatcatcher †	c	c	u	
— Eastern Bluebird †	c	c	c	o
— Veery †	c	c	c	
— Gray-cheeked Thrush	u	u		
— Swainson's Thrush	c	c		
— Hermit Thrush	c	c	o	
— Wood Thrush †	c	c	c	
— American Robin †	a	a	a	u
— Gray Catbird †	a	a	a	r
— Northern Mockingbird †	a	a	a	a
— Brown Thrasher †	c	c	c	r
WAXWINGS - SHRIKES - STARLING				
— Water Pipit	u	u		
— Cedar Waxwing	u	u	u	u
— Northern Shrike		r	r	
— Loggerhead Shrike	r	r		
— European Starling †	a	a	a	a
VIREOS - WOOD WARBLERS				
— White-eyed Vireo †	c	c	c	
— Solitary Vireo	u	u		
— Yellow-throated Vireo †	c	c	c	
— Warbling Vireo †	u	u	r	
— Philadelphia Vireo	u	u		
— Red-eyed Vireo †	c	c	c	
— Blue-winged Warbler †	c	c	c	
— Golden-winged Warbler	o			
— Tennessee Warbler	c	c		
— Nashville Warbler	u	u		
— Northern Parula	c	c		
— Yellow Warbler †	a	a	a	
— Chestnut-sided Warbler †	c	o	c	
— Magnolia Warbler	u	u		
— Cape May Warbler	u	u		
— Black-throated Blue Warbler	c	c		
— Yellow-rumped Warbler	a	c	o	
— Black-throated Green Warbler	c	c		
— Blackburnian Warbler	u	u		
— Yellow-throated Warbler	r			
— Pine Warbler	o	o		
— Prairie Warbler	o			
— Palm Warbler	c	u		
— Bay-breasted Warbler	u	u		
— Blackpoll Warbler	c	c		
— Cerulean Warbler	o	o		
— Black-and-white Warbler †	c	c	c	
— American Redstart †	c	c	c	

GREAT SWAMP NATIONAL WILDLIFE REFUGE contains over 6,793 acres of hardwood swamp, upland timber, marsh and water, brush, pasture, and cropland. This diverse habitat attracts a wide variety of migratory and residential birds. With perpetual protection of its wilderness portion and continued management of the rest, the refuge will become increasingly important as a haven for birds amidst the surrounding urban areas.

By means of the boardwalks and observations blinds and habitat manipulation in the Management Area, refuge visitors are provided excellent opportunities to see these wild birds. The best season to see waterfowl and other marsh and water birds is during their early spring migrations, before marsh vegetation emerges to hide them. May is the best time to see warblers and other songbirds.

This folder lists 222 species of birds that have been identified on the Great Swamp Refuge since 1960. Much of the list is from records of the Summit Nature Club and from William Boyle, Richard Kane, Allan Keith, and Robert Lewis. This list is in accordance with the Sixth American Ornithologists' Union Check-list as amended.

Most birds are migratory, therefore their seasonal occurrence is coded as follows:

SEASON

s - Spring	March - May
S - Summer	June - August
F - Fall	September - November
W - Winter	December - February

† - Nesting has occurred on the refuge.

RELATIVE ABUNDANCE

a - abundant	a species which is very numerous.
c - common	certain to be seen or heard in suitable habitat.
u - uncommon	present, but not certain to be seen.
o - occasional	seen only a few times during a season.
r - rare	seen at intervals of 2 to 5 years.

s S F W

LOONS - GREBES

Common Loon	u	r		
Pied-billed Grebe	u	o	o	u
Horned Grebe		r		

BITTERNS - HERONS - IBISES

American Bittern †	c	c	c	o
Least Bittern †	u	c	u	
Great Blue Heron †	c	c	c	u
Great Egret	o	o	o	r
Snowy Egret		o	o	
Little Blue Heron	o	o	o	
Cattle Egret	r	r	r	
Green-backed Heron †	c	a	a	
Black-crowned Night-Heron	o	o	o	
Yellow-crowned Night-Heron	r	r		
Glossy Ibis	o	o	o	

SWANS - GEESE - DUCKS

Mute Swan	r	r	r	
Snow Goose	r	o	o	
Canada Goose †	a	a	a	a
Wood Duck †	a	a	a	o
Green-winged Teal †	c	u	c	u
American Black Duck †	c	c	c	u
Mallard †	a	a	a	c
Northern Pintail	u	r	c	u
Blue-winged Teal †	c	c	c	
Northern Shoveler	o	o	o	r
Gadwall	o	r	o	o
American Wigeon	u	r	c	o
Canvasback	r	r	r	
Ring-necked Duck	o		o	
Common Goldeneye		r	r	
Bufflehead	r	r	r	
Hooded Merganser †	o	o	o	
Common Merganser	r		r	
Red-breasted Merganser			r	
Ruddy Duck		r	r	

VULTURES - HAWKS - FALCONS

Black Vulture	o	o	o	
Turkey Vulture	c	c	c	c
Osprey	o	u		
Bald Eagle	o	o	o	o
Northern Harrier	o	r	o	r
Sharp-shinned Hawk	o	u	o	
Cooper's Hawk	o	r	o	o
Northern Goshawk		r	r	
Red-shouldered Hawk †	u	u	u	o

	s	S	F	W
Prothonotary Warbler †	o	o	o	
Ovenbird †	c	c	c	
Northern Waterthrush	u	u		
Louisiana Waterthrush †	u	o	u	
Kentucky Warbler	o			
Connecticut Warbler		o		
Mourning Warbler	o			
Common Yellowthroat †	a	a	a	r
Hooded Warbler	o	o		
Wilson's Warbler	u	u		
Canada Warbler	c	o	c	
Yellow-breasted Chat †	o	o	o	
TANAGERS - SPARROWS				
Summer Tanager	o			
Scarlet Tanager †	c	c	c	
Northern Cardinal †	c	c	c	c
Rose-breasted Grosbeak †	c	c	c	
Indigo Bunting †	u	o	u	
Rufous-sided Towhee †	a	a	a	o
American Tree Sparrow	c	c	a	
Chipping Sparrow †	c	c	c	
Field Sparrow †	c	c	c	u
Vesper Sparrow	o	o	r	o
Savannah Sparrow	u	u		
Grasshopper Sparrow	o	o		
Fox Sparrow	u	u	o	
Song Sparrow †	c	c	c	u
Lincoln's Sparrow	o	o		
Swamp Sparrow †	a	a	a	u
White-throated Sparrow	c	c	c	
White-crowned Sparrow	o	o		
Dark-eyed Junco	c	c	c	
Snow Bunting	o	o		
BLACKBIRDS - FINCHES				
Bobolink †	u	u	u	
Red-winged Blackbird †	a	a	a	u
Eastern Meadowlark †	u	u	u	o
Yellow-headed Blackbird	o	o		
Rusty Blackbird	c	c	o	
Common Grackle †	a	c	c	o
Brown-headed Cowbird †	c	c	c	o
Orchard Oriole	u	u		
Northern Oriole †	c	c	c	
Purple Finch	u	u	u	
House Finch †	c	c	c	c
Red Crossbill			r	
White-winged Crossbill			r	

	s	S	F	W
Common Redpoll	r	r	r	
Pine Siskin	o	o	o	
American Goldfinch †	a	a	c	c
Evening Grosbeak	o		r	
House Sparrow †	a	a	a	a

ACCIDENTALS (only 1 or 2 records)

White Ibis				
Tundra Swan				
Brant				
Greater White-fronted Goose				
Monk Parakeet				
Chuck-Will's-Widow				
Varied Thrush				
Lesser Scaup				



Please report any unusual sightings to the Refuge Manager. For further information contact:

Refuge Manager
National Wildlife Refuge
Pleasant Plains Rd., RD 1, Box 152
Basking Ridge, New Jersey 07920
Telephone: (201) 647-1222

NOTES

Location _____

Date _____ Total _____

Observers _____

Weather _____ Wind _____

Time _____



THE NATIONAL WILDLIFE REFUGE SYSTEM

Great Swamp is one of over 400 units encompassing more than 90 million acres in the National Wildlife Refuge System, administered by the U.S. Fish and Wildlife Service. The Service also manages more than 70 National Fish Hatcheries and major fish and wildlife research laboratories across the country. As the Nation's primary steward of fish and wildlife resources, the Service provides leadership in habitat and wetlands protection, fish and wildlife research and technical assistance, and conservation and protection of migratory birds, anadromous fishes, certain marine mammals, and threatened and endangered species.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE



RL 52530-2
September 1985



Common Wildflowers

*of the
GREAT SWAMP*

*National
Wildlife
Refuge*

New Jersey



SPRING
March, April, May

White/Green



Containing over 6,793 acres of marsh, hardwood swamp, upland timber, streams and ponds, brush, and grassland, Great Swamp National Wildlife Refuge is home for a great variety of plants and animals. With careful protection and management, the refuge, surrounded by urban and suburban areas, is becoming increasingly important for many kinds of wildlife.

By means of trails, blinds and habitat manipulation, refuge visitors are provided excellent opportunities for wildlife observation and study. So that others may enjoy the wildlife of Great Swamp, now and in the future, your attention to our posted regulations will be appreciated.

Surveys of Great Swamp plant life have identified several hundred species of trees, shrubs, aquatic plants, ferns, sedges, grasses and other forms of plant life. This folder lists 215 of the more common flowering plants in order of their seasonal appearance and according to the color of their blossoms. Some varieties occur in more than one season. Though Oxeye Daisy, for example, is listed here with spring flowers, this plant also frequents fields and roadsides during summer.

The following list was prepared in cooperation with Drs. Robert K. and Florence M. Zuck, professors at Drew University and longtime amateur botanist Robert J. Johnson. References for both common and scientific names were the guide books of Rickett, Newcomb, Peterson and Niering.

Anemone, Rue.....	<i>Anemonella thalictroides</i>
Anemone, Wood.....	<i>Anemone quinquefolia</i>
Bedstraw.....	<i>Galium palustre</i>
Blackberry.....	<i>Rubus allegheniensis</i>
Bloodroot.....	<i>Sanguinaria canadensis</i>
Blueberry.....	<i>Vaccinium corymbosum</i>
Campion, White.....	<i>Lychnis alba</i>
Chickweed.....	<i>Stellaria media</i>
Clover.....	<i>Trifolium repens</i>
Cuckooflower.....	<i>Cardamine pratensis</i>
Daisy.....	<i>Chrysanthemum leucanthemum</i>
Dogwood.....	<i>Cornus florida</i>
Fleabane.....	<i>Erigeron annuus</i>
Foamflower.....	<i>Tiarella cordifolia</i>
Garlic Mustard.....	<i>Alliaria officinalis</i>
Ginseng.....	<i>Panax trifolium</i>
Hellebore, False.....	<i>Veratrum viride</i>
Jack-in-the-pulpit.....	<i>Arisaema triphyllum</i>
Lily-of-the-valley.....	<i>Mianthemum canadense</i>
Mayapple.....	<i>Podophyllum peltatum</i>
Pussytoes.....	<i>Antennaria neodioica</i>
Saxifrage.....	<i>Saxifraga pennsylvanica</i>
Shadbush.....	<i>Amelanchier canadensis</i>
Solomon's Seal, False.....	<i>Smilacina racemosa</i>
Spring Beauty.....	<i>Claytonia virginica</i>
Starflower.....	<i>Trientalis borealis</i>
Star-of-Bethlehem.....	<i>Ornithogalum umbellatum</i>
Strawberry.....	<i>Fragaria virginiana</i>
Trailing Arbutus.....	<i>Epigaea repens</i>
Trillium.....	<i>Trillium grandiflorum</i>
Viburnum.....	<i>Viburnum acerifolium</i>
Violet, Northern White.....	<i>Viola pallens</i>
Violet, Lance-leaved.....	<i>Viola lanceolata</i>

Yellow/Orange

Bellwort.....	<i>Uvularia perfoliatum</i>
Bladderwort.....	<i>Utricularia vulgaris</i>
Buttercup.....	<i>Ranunculus acris</i>
Buttercup, Swamp.....	<i>Ranunculus septentrionalis</i>
Buttercup, Creeping.....	<i>Ranunculus repens</i>
Celandine.....	<i>Chelidonium majus</i>
Cinquefoil.....	<i>Potentilla simplex</i>
Cinquefoil, Rough-fruited.....	<i>Potentilla recta</i>
Coltsfoot.....	<i>Tussilago farfara</i>
Cynthia.....	<i>Krigia biflora</i>
Dandelion.....	<i>Taraxacum officinale</i>
Golden Ragwort.....	<i>Senecio aureus</i>
Iris.....	<i>Iris pseudocorus</i>
King Devil.....	<i>Hieracium praetense</i>
Marsh Marigold.....	<i>Caltha palustris</i>

Spatterdock.....*Nuphar advena*
 Trout Lily.....*Erythronium americanum*
 Wild Indigo.....*Baptisia tinctoria*
 Winter Cress.....*Barbarea vulgaris*
 Wood Sorrel.....*Oxalis stricta*

Pink/Red

Geranium.....*Geranium maculatum*
 Ginger.....*Asarum canadense*
 Lady's Slipper.....*Cypripedium acaule*
 Pinxter Flower.....*Rhododendron nudiflorum*
 Wood Betony.....*Pedicularis canadensis*

Purple/Blue

Bluebell.....*Mertensa virginica*
 Blue-eyed Grass.....*Sisyrinchium angustifolium*
 Ground Ivy.....*Glechonia hederacea*
 Hepatica.....*Hepatica americana*
 Iris, Blue Flag.....*Iris versicolor*
 Iris, Slender.....*Iris prismatica*
 Periwinkle.....*Vinca minor*
 Purple Dead Nettle.....*Lamium purpureum*
 Skunk Cabbage.....*Symplocarpus foetidus*
 Spiderwort.....*Tradescantia virginiana*
 Vetch.....*Vicia cracca*
 Violet.....*Viola affinis*
 Violet, Arrow-leaved.....*Viola sagittata*
 Violet, Marsh Blue.....*Viola cucullata*

SUMMER

June, July, Early August

White/Green

Arrowhead.....*Sagittaria latifolia*
 Beardtongue.....*Penstemon digitalis*
 Bindweed.....*Convolvulus sepium*
 Boneset.....*Eupatorium perfoliatum*
 Bouncing Bet.....*Saponaria officinalis*
 Bugleweed.....*Lycopus virginicus*
 Bur-reed.....*Sparganium americanum*
 Buttonbush.....*Cephalanthus occidentalis*
 Elderberry.....*Sambucus canadensis*
 Honeysuckle, Swamp.....*Rhododendron viscosum*
 Honeysuckle, Japanese.....*Lonicara japonica*
 Indian Pipe.....*Monotropa uniflora*
 Indian Hemp.....*Apocynum cannabinum*
 Laurel.....*Kalmia latifolia*
 Lizard's Tail.....*Saururus cernuus*
 Mallow.....*Hibiscus palustris*
 Mallow, Musk.....*Malva moschata*

Meadow Rue.....*Thalictrum polygamum*
 Meadowsweet.....*Spiraea latifolia*
 Mountain-mint.....*Pycnanthemum virginianum*
 Multiflora Rose.....*Rosa multiflora*
 Orchid, Fringed.....*Habenaria lacera*
 Pepperbush.....*Clethra alniflora*
 Plantain, English.....*Plantago lanceolata*
 Plantain, Rattlesnake.....*Goodyera pubescens*
 Plantain, Water.....*Alisma subcordatum*
 Pokeweed.....*Phytolacca americana*
 Queen Anne's Lace.....*Daucus carota*
 Rattlesnake Root.....*Prenanthes alba*
 Sarsaparilla.....*Aralia nudicaulis*
 Solomon's Seal.....*Polygonatum biflorum*
 Sweet Cicely.....*Oxymorhiza claytoni*
 Sweet Clover.....*Melilotus alba*
 Water Arum.....*Calla palustris*
 Water Hemlock.....*Cicuta maculata*
 Wintergreen.....*Chimaphila maculata*
 Yarrow.....*Achillea millefolium*

Yellow/Orange

Agrimony.....*Agrimonia parviflora*
 Bartonian.....*Bartonia virginica*
 Birdsfoot Trefoil.....*Lotus corniculatus*
 Black-eyed Susan.....*Rudbeckia hirta*
 Butter-and-eggs.....*Linaria vulgaris*
 Butterfly Weed.....*Asclepias tuberosa*
 Canada Lily.....*Lilium canadense*
 Cucumber Root.....*Medeola virginiana*
 Day Lily.....*Hemerocallis fulva*
 Evening Primrose.....*Oenothera biennis*
 Goatsbeard.....*Tragopogon pratensis*
 Hawkweed.....*Hieracium aurantiacum*
 Hop Clover.....*Trifolium agrarium*
 Hop Clover, Smaller.....*Trifolium procumbens*
 Jewelweed.....*Impatiens capensis*
 Loosestrife, Fringed.....*Lysimachia ciliata*
 Loosestrife, Whorled.....*Lysimachia quadrifolia*
 Moneywort.....*Lysimachia nummularia*
 Mullien.....*Verbascum thapsus*
 Mullien, Moth.....*Verbascum blattaria*
 St. Johnswort.....*Hypericum perforatum*
 Scarlet Pimpernel.....*Anagallis arvensis*
 Seedbox.....*Ludwigia alternifolia*
 Sneezeweed.....*Helenium autumnale*
 Sow Thistle.....*Sonchus oleraceus*
 Stargrass.....*Hypoxis hirsuta*
 Sundrops.....*Oenothera fruticosa*
 Sundrops, Small.....*Oenothera perennis*
 Tansy.....*Tanacetum vulgare*
 Swamp Candles.....*Lysimachia terrestris*
 Sweet Clover.....*Melilotus officinalis*
 Turk's-cap Lily.....*Lilium superbum*
 Golden Alexander.....*Zizia aurea*



Pink/Red

Azalea, Flame *Rhododendron calendulaceum*
 Bergamot *Monarda fistulosa*
 Clover, Alsike *Trifolium hybridum*
 Deptford Pink *Dianthus armeria*
 Knapweed *Centaurea maculosa*
 Mallow *Hibiscus palustris*
 Milkweed *Asclepias syriaca*
 Milkweed, Swamp *Asclepias incarnata*
 Milkwort *Polygala sanguinea*
 Partridgeberry *Mitchella repens*
 Smartweed *Polygonum pensylvanicum*
 Steeplebush *Spiraea tomentosa*
 Swamp Rose *Rosa palustris*
 Teasel *Dipsacus sylvestris*
 Thistle, Bull *Cirsium vulgare*
 Thistle, Field *Cirsium discolor*
 Thistle, Canada *Cirsium arvense*
 Thistle, Pasture *Cirsium pumilum*
 Tick Trefoil *Desmodium canadense*
 Tick Trefoil, Panicked *Desmodium paniculatum*
 Woundwort *Stachys palustris*

Purple/Blue

Bittersweet *Solanum dulcamara*
 Burdock *Arctium minus*
 Chicory *Cichorium intybus*
 Clover *Trifolium pratense*
 Dayflower *Commelina virginica*
 Forget-me-not *Myosotis scorpioides*
 Indian Tobacco *Lobelia inflata*
 Lobelia, Spiked *Lobelia spicata*
 Loosestrife *Lythrum salicaria*
 Milkweed *Asclepias purpurascens*
 Mint *Mentha arvensis*
 Monkey flower *Mimulus ringens*
 Phlox *Phlox paniculata*
 Pickerelweed *Pontederia cordata*
 Selfheal *Prunella vulgaris*
 Skullcap, Mad-dog *Scutellaria laterifolia*
 Skullcap, Marsh *Scutellaria epilobiifolia*
 Venus' Looking-glass *Specularia perfoliata*
 Vervain *Verbena hastata*
 Viper's Bugloss *Echium vulgare*

AUTUMN Late August, September, October

White/Green

Aster, Small-flowered *Aster vimineus*
 Aster, White Wood *Aster divaricatus*
 Aster, Calico *Aster lateriflorus*
 Aster, Heath *Aster pilosus*
 Aster, Tradescant's *Aster tradescanti*
 Hempweed *Mikania scandens*
 Ladies' Tresses, Grass-leaved *Spiranthes vernalis*
 Silver-rod *Solidago bicolor*
 Turtlehead *Chelone glabra*
 Water-horehound *Lycopus americanus*
 White Snakeroot *Eupatorium rugosum*

Yellow/Orange

Beggar Ticks *Bidens aristosa*
 Goldenrod, Canada *Solidago canadensis*
 Goldenrod, Early *Solidago juncea*
 Goldenrod, Grass-leaved *Solidago graminifolia*
 Goldenrod, Rough-stemmed *Solidago rugosa*
 Goldenrod, Tall *Solidago altissima*
 Goldenrod, Broad-leaved *Solidago flexicaulis*
 Jerusalem Artichoke *Helianthus tuberosus*
 Sunflower, Giant *Helianthus giganteus*
 Witch Hazel *Hamamelis virginiana*

Pink/Red

Cardinal Flower *Lobelia cardinalis*
 Gerardia, Purple *Gerardia purpurea*
 Gerardia, White *Gerardia albiflora*
 Spotted Joe-Pye Weed *Eupatorium maculatum*
 Joe-Pye Weed *Eupatorium dubium*

Purple/Blue

Aster, New England *Aster novae-angliae*
 Aster, Purple-stemmed *Aster puniceus*
 Aster, Smooth *Aster laevis*
 Blazing Star *Liatris spicata*
 Gentian, Closed *Gentiana andrewsii*
 Ironweed *Veronia noveboracensis*





For further information, contact:

Refuge Manager
Great Swamp National Wildlife Refuge
R.D. #1, Box 152
Basking Ridge, New Jersey 07920
Telephone: (201) 647-1222

*A special thanks goes to the artist, Joyce Cloughly, for
her wildflower illustrations.*

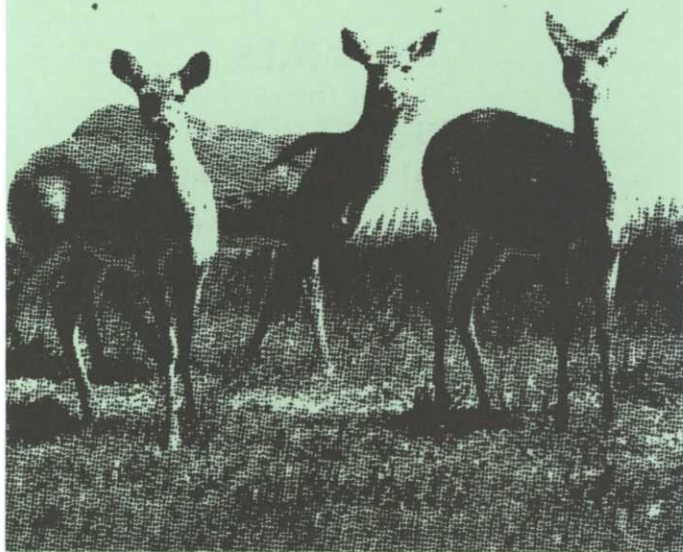
***Take Pride in Great Swamp
National Wildlife Refuge***



**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

RL-52530-6

August 1986



MAMMALS

of

GREAT SWAMP

National
Wildlife
Refuge

New Jersey

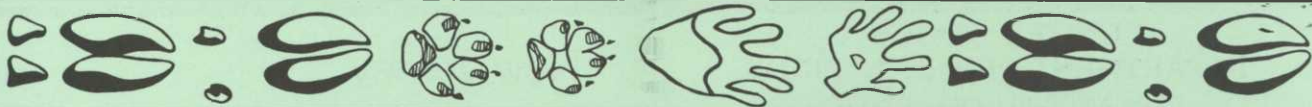
MAMMALS of the GREAT SWAMP National Wildlife Refuge

Great Swamp National Wildlife Refuge is in north-central New Jersey in Morris County. The refuge contains 6,793 acres of hardwood swamp, upland timber, brush, marsh and ponds, and poorly drained pasture. In 1968, the eastern half of the refuge was designated as a Wilderness Area — to be left forever wild.

Although established primarily to preserve habitat for migratory birds, there is an abundance of other wildlife, including many mammals. Toward evening visitors are likely to see whitetail deer grazing in fields. The red fox and raccoon are common but rarely seen during daylight hours. Muskrats are frequently seen in wet areas at dawn and dusk — especially during the spring.

The following list was prepared in cooperation with the Biology Department at Fairleigh Dickinson University. Order of listing and scientific names generally follow Hall, *The Mammals of North America, Second Edition*. Common names are given in Burt and Grossenheider, *A Field Guide to the Mammals*.

- **Opossum** (*Didelphis virginiana*).
Common along streams and marshes near woodland.
- **Masked Shrew** (*Sorex cinereus*).
Found in poorly drained fields.
- **Smoky Shrew** (*Sorex fumeus*).
Inhabits moist fields.
- **Short-tailed Shrew** (*Blarina brevicauda*).
Common in wooded and swampy areas.
- **Starnose Mole** (*Condylura cristata*).
Abundant in vicinity of swamps and brooks.
- **Little Brown Myotis** (*Myotis lucifugus*).
Numerous but rarely seen. Roosts in hollow trees and under eaves.
- **Red Bat** (*Lasiurus borealis*).
This solitary creature is occasionally seen during the day flying along wooded streams.
- **Eastern Cottontail** (*Sylvilagus floridanus*).
Seen frequently in brushy upland areas.
- **Woodchuck** (*Marmota monax*).
Occasionally seen near their burrows in dry upland fields and woodlands.



- **Eastern Chipmunk** (*Tamias striatus*).
Commonly found in upland woods.
- **Eastern Gray Squirrel** (*Sciurus carolinensis*).
Very common in upland hardwoods. When hollow trees are in short supply, look for their round, leaf nests constructed high in the tops of trees.
- **Red Squirrel** (*Tamiasciurus hudsonicus*).
May be seen in evergreen trees or surrounding hardwoods.
- **Southern Flying Squirrel** (*Glaucomys volans*).
Fairly common, but seldom seen during the day.
- **Beaver** (*Castor canadensis*).
A dozen beaver were reintroduced into the Great Swamp in 1969 in cooperation with the New Jersey Division of Fish, Game and Wildlife. One or two colonies have been present since that time. Previous records indicate that beavers were last seen in the swamp in 1959.
- **White-footed Mouse** (*Peromyscus leucopus*).
Abundant in woodland areas.
- **Gapper's Redback Vole** (*Clethrionomys gapperi*).
A ground-dwelling vole of damp and cool forests.
- **Meadow Vole** (*Microtus pennsylvanicus*).
Common in fields and grassy areas.
- **Pine Vole** (*Microtus pinetorum*).
Found primarily in hardwood areas, in contrast to common name.
- **Muskrat** (*Ondatra zibethicus*).
Abundant where there is water. Look for their mound-shaped houses in swamps and marshes.
- **Norway Rat** (*Rattus norvegicus*).
Found in and around old farm buildings.
- **House Mouse** (*Mus musculus*).
Present in buildings and fields.
- **Meadow Jumping Mouse** (*Zapus hudsonius*).
Occasionally seen in fields. May be mistaken for frogs when seen jumping through the grass.
- **Woodland Jumping Mouse** (*Napaeozapus insignis*).
Found in wet and heavily wooded areas.



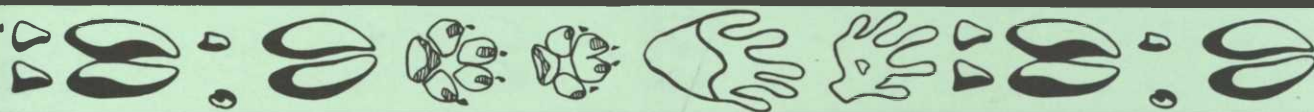
- **Black Bear** (*Ursus americanus*).
Rarely observed on the refuge.
- **Red Fox** (*Vulpes vulpes*).
Very common throughout the refuge.
- **Gray Fox** (*Urocyon cinereoargenteus*).
Fairly common in brushy woodlands.
- **Raccoon** (*Procyon lotor*).
Very numerous over the entire refuge.
- **Longtail Weasel** (*Mustela frenata*).
A common but infrequently seen inhabitant of upland areas.
- **Mink** (*Mustela vison*).
Fairly common in wet areas but rarely seen.
- **Striped Skunk** (*Mephitis mephitis*).
Common but seldom seen.
- **River Otter** (*Lutra canadensis*).
Extirpated in the Great Swamp until it reappeared in the 1970's. Now present in small numbers and thought to be reproducing.
- **Whitetail Deer** (*Odocoileus virginianus*).
Very common. The refuge herd is estimated at several hundred deer.

- **Human Being** (*Homo sapiens*).
Often neglected as belonging to the kingdom of animals. Like other mammals this species requires clean air to breathe, pure water to drink, unpoisoned food, and open space in which to roam.



Other species are probably present on the refuge but have not yet been verified. Reports of additional species are welcome. Please contact:

Refuge Manager
Great Swamp National Wildlife Refuge
Pleasant Plains Road, RD 1, Box 152
Basking Ridge, New Jersey 07920
Telephone: (201) 647-1222.



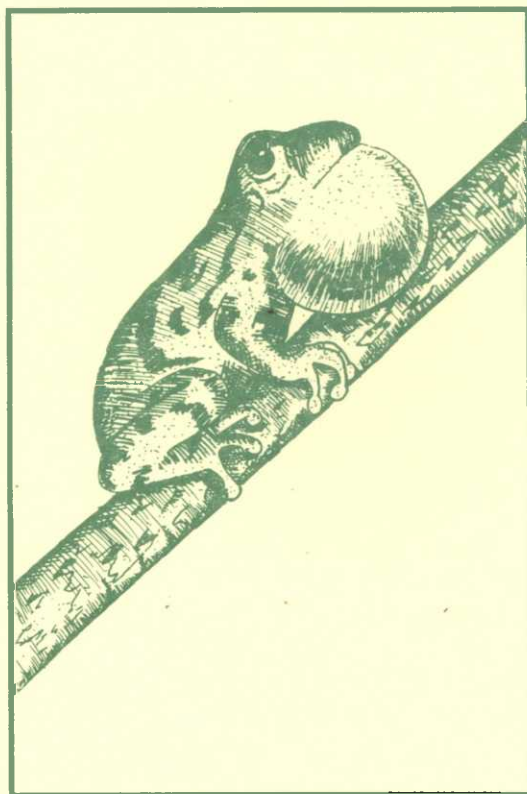
As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U. S. administration.



RL 53520-3
April 1984

**UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE**

Reptiles, Amphibians and Fishes



Piercing eyes and trembling tongues, croaking and peeping in spring, and a ripple in a pond. These are the animals listed in this leaflet. They can be found on the Great Swamp Refuge.

Great Swamp National Wildlife Refuge

The following list includes the reptiles, amphibians and fishes known to be present on the refuge. The common names, scientific names, and order of listing follow Roger Conant's A Field Guide to Reptiles and Amphibians of Eastern North America, 1975.

Numerous reptiles and amphibians are permanent residents of the Great Swamp. During the warm months a careful observer will catch a glimpse of many of them as they scurry for cover.

* Species listed as "Endangered" (E) or "Threatened" (T) by the New Jersey Department of Environmental Protection.

REPTILES

Snapping Turtle (*Chelydra serpentina*). Common. Inhabits any permanent water but most abundant in swamp. Snapping turtles feeding on ducklings is a matter of concern, and some local control is exercised. Some specimens weigh 30 to 40 pounds.

Stinkpot (Musk Turtle) (*Sternotherus odoratus*). Common. Inhabits still water or sluggish streams. Feeds on bottom where brown shell blends with mud, making it inconspicuous.

Eastern Mud Turtle (*Kinosternon subrubrum*). Uncommon. Inhabits still, shallow areas of swamps, marshes, and ponds.

Spotted Turtle (*Clemmys guttata*). Common. Inhabits shallows in swamps or small ponds.

* **Bog Turtle** (*Clemmys muhlenbergi*). Rare. (E) One of the rarest species of turtle in the eastern United States. Inhabits swamps, *Sphagnum* bogs, and slow-moving streams.

* **Wood Turtle** (*Clemmys insculpta*). Uncommon. (T) Although often found on land, it also lives in swamps. May be seen in almost any habitat in the area during the summer. Hibernates under water.

Eastern Box Turtle (*Terrapene carolina*). Common in woods and fields, usually in drier uplands but may also be found along water.

Eastern Painted Turtle (*Chrysemys picta*). Very common. Most conspicuous when sun-bathing. Lives in permanent and temporary bodies of water, usually where vegetation is thick and the bottom muddy.

Five-lined Skink (*Eumeces fasciatus*). Rare. Inhabits woodlands with dry-leaf litter and rocks. Lives in or under rotted logs or under stones and is therefore seldom observed.

Northern Water Snake (*Natrix sipedon*). Common. Found in all aquatic habitats in the refuge. Best observed swimming or basking in the sun during spring and summer.

Northern Brown Snake (*Storeria dekayi*). Common. Lives under logs or rocks or woods but most often at the edges of fields and meadows.

Eastern Ribbon Snake (*Thamnophis sauritus*). Common. Inhabits all aquatic situations and seldom wanders far from water. Forages in vegetation at edges of ponds, streams, and swamps.

Eastern Garter Snake (*Thamnophis sirtalis*). Common. Most easily observed in aquatic habitats but also occurs in meadows and woodlands.

Earth Snake (*Virginia valeriae*). Very rare. Inhabits wooded areas where it lives under logs or rocks. May spend most of its time underground.



Eastern Hognose Snake (*Heterodon platyrhinos*). Uncommon. Open, sunny woods, especially with sandy soil, are preferred but also found in fields and meadows.

Northern Ringneck Snake (*Diadophis punctatus edwardsi*). Uncommon. Very secretive, lives under bark, rocks and in or under logs. Most abundant on wooded slopes.

Eastern Worm Snake (*Carphophis amoenus*). Uncommon. Burrows in rich moist soil, humus, or rotted wood in wet woodlands or moist areas of upland woods.

Northern Black Racer (*Coluber constrictor*). Uncommon. Found in all terrestrial and swamp habitats. In the spring it abounds in fields but prefers open woods during the summer.

Eastern Smooth Green Snake (*Opheodrys vernalis*). Rare. Inhabits grassy areas of woods but most common in fields and meadows.

Black Rat Snake (*Elaphe obsoleta*). Uncommon. Inhabits wooded and rocky areas.

Eastern Milk Snake (*Lampropeltis triangulum*). Uncommon. Lives in most terrestrial habitats using logs and rocks for cover. Some refuge visitors mistake this harmless snake for the Copperhead, which is not found here.

AMPHIBIANS

* **Blue-spotted Salamander** (*Ambystoma laterale*). Common but secretive. (E) Adults live underground most of the year but emerge to breed during the first thaw (March). Eggs deposited in small ponds. Larval period from April to July. Juveniles common in woodlands from August to November. Known only from Essex, Morris and Somerset Counties in New Jersey.

* **Red-spotted Newt** (Red Eft, land stage) (*Notophthalmus viridescens*). Common. Adults and larvae inhabit all standing water habitats. Terrestrial eft found in woodlands with moist leaf litter.

Northern Dusky Salamander (*Desmognathus fuscus*). Uncommon. Found along small streams or near springs. Adults and larvae found under rocks or logs in water at edges of streams.



Red-backed Salamander (*Plethodon cinereus*). Common. Found under logs, bark, or rocks in moist wooded areas. In many individuals the dorsal red color is lacking.

Slimy Salamander (*Plethodon glutinosus*). Uncommon. Inhabits drier slopes in wooded areas where it lives in or under rotted logs or under rocks.

Four-toed Salamander (*Hemidactylium scutatum*). Rare. Inhabits *Sphagnum* bogs. Most abundant March through May.

American Toad (*Bufo americanus*). Common. Breeds in ponds and pools during March and April. Adults common in moist woods.

Fowler's Toad (*Bufo woodhousei fowleri*). Common. Breeds in meadows, shallow ponds or pools, and swamp margins during April and May. Adults common in meadows and woodlands.

Northern Cricket Frog (*Acris crepitans*). Common. Breeds in May or June at shallow margins of any standing water. Prefers open areas but also found in woods.

Northern Spring Peeper (*Hyla crucifer*). Very common. Breeds during March and April in any shallow, standing water. Adults climb in low vegetation, usually grasses and reeds, during non-breeding season.

Gray Treefrog (*Hyla versicolor*). Common. Breeds during late April or May in ponds or at edge of swamp. Adults live in trees during the remainder of the year.

New Jersey Chorus Frog (*Pseudacris triseriata kalmi*). Common. Breeds during March or early April in grassy areas of any standing water. Adults secretive when not breeding.

Upland Chorus Frog (*Pseudacris triseriata feriarum*). Uncommon. Inhabits grassy swales, moist woodlands, river bottom swamps, ponds, bogs, and marshes.

Bullfrog (*Rana catesbeiana*). Common. Breeds during May and June in deeper, permanent water. Adults widespread in all aquatic habitats.

Green Frog (*Rana clamitans melanota*). Very common. Breeds in any standing water during late April or early May. Adults abundant along streams, swamps, ponds, and marshy areas.

Northern Leopard Frog (*Rana pipiens*). Very common. Breeds in swamp, ponds, and meadows during April. Adults are common near any water during summer.

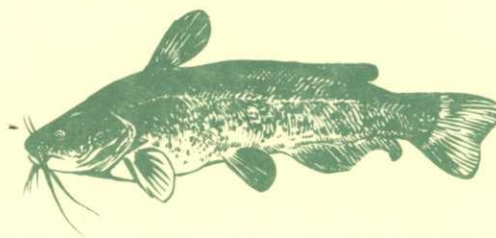
Pickereel Frog (*Rana palustris*). Uncommon. Breeds during March or April in permanent ponds or deeper, open portions of swamp. Adults remain in or near water.

Wood Frog (*Rana sylvatica*). Common. Breeds in shallow woodlands ponds during March (first thaw). Adults common in leaf litter of wet woodlands.

FISHES

The fish on the Great Swamp Refuge are warmwater, freshwater species. Most are of the type that can tolerate shallow water with fluctuating levels, low in oxygen. Game fish are not numerous. There are 29 species of fish on the refuge.

White Sucker (*Catostomus commersoni*)
Creek Chubsucker (*Erimyzon oblongus*)
Carp (*Cyprinus carpio*)
Golden Shiner (*Notemigonus crysoleucas*)
Brown Bullhead (*Ictalurus nebulosus*)



Chain Pickerel (*Esox niger*)
Eastern Mudminnow (*Umbra pygmaea*)
Redfin Pickerel (*Esox americanus*)
American Eel (*Anguilla rostrata*)
Smallmouth Bass (*Micropterus dolomieu*)
Largemouth Bass (*Micropterus salmoides*)
Banded Sunfish (*Enneacanthus obesus*)
Pumpkinseed (*Lepomis gibbosus*)
Bluegill (*Lepomis macrochirus*)
Black Crappie (*Pomoxis nigromaculatus*)
Tessalated Darter (*Etheostoma olmstedii*)
Redbreast Sunfish (*Lepomis aurochirus*)
Fallfish (*Semotilus corporalis*)
Common Shiner (*Notropis cornutus*)
Spottail Shiner (*Notropis hudsonius*)
Yellow Bullhead (*Ictalurus natalis*)
Bluespotted Sunfish (*Enneacanthus gloriosus*)
Satinfin Shiner (*Notropis analostanus*)
Mud Sunfish (*Acantharchus pomotis*)
Spotfin Shiner (*Notropis spilopterus*)
Green Sunfish (*Lepomis cyanellus*)
Blacknose Dace (*Rhinichthys atratulus*)
Creek Chub (*Semotilus atromaculatus*)
Brook Trout (*Salvelinus fontinalis*)

U.S. FISH AND WILDLIFE SERVICE

Great Swamp is one of more than 430 refuges in the National Wildlife Refuge System administered by the U.S. Fish and Wildlife Service. The National Wildlife Refuge System is a network of lands and waters managed specifically for the protection of wildlife and wildlife habitat and represents the most comprehensive wildlife resource management program in the world. Units of the system stretch across the United States from northern Alaska to the Florida Keys, and include small islands in the Caribbean and South Pacific. The character of the refuges is as diverse as the nation itself.

The Service also manages National Fish Hatcheries, and provides Federal leadership in habitat protection, fish and wildlife research, technical assistance and the conservation and protection of migratory birds, certain marine mammals and threatened and endangered species.

For further information contact:

Refuge Manager
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