

GREAT DISMAL SWAMP  
NATIONAL WILDLIFE REFUGE  
Suffolk, Virginia

ANNUAL NARRATIVE REPORT  
Calendar Year 1992

U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE

Suffolk, Virginia

Nansemond National Wildlife Refuge

ANNUAL NARRATIVE REPORT

Calendar Year 1992

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2/25/93  
Date

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26 Apr 92  
Date

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Regional Office Approval

4/24/93  
Date

## INTRODUCTION

The Great Dismal Swamp National Wildlife Refuge, located in southeastern Virginia and northeastern North Carolina, was established in 1974 when Union Camp Corporation donated 49,100 acres to The Nature Conservancy which then conveyed the area to the Department of the Interior. The refuge now incorporates almost 107,000 acres within the cities of Suffolk and Chesapeake, Virginia, and the counties of Camden, Gates, and Pasquotank, North Carolina. Being the largest refuge that is administered within Region 5, the Great Dismal Swamp NWR includes about a third of all refuge land and half the wetlands that are incorporated into northeastern refuges.

The refuge is a forested wetland that has been greatly altered by drainage and repeated logging operations. Lake Drummond, a 3,100 acre natural lake, is located in the heart of the swamp.

The primary purposes of the refuge can be traced to two public laws. The Dismal Swamp Study Act of 1972 (Public Law 92-478) authorized a study to determine the feasibility and desirability of protecting the Great Dismal Swamp and the Dismal Swamp Canal. The resulting study recommended that the refuge should be established for the primary purpose of protecting the unique swamp ecosystem with the development of public use opportunities as a secondary purpose. The Dismal Swamp Act of 1974 established the refuge and directed that use of the Dismal Swamp Canal would not adversely affect the refuge.

Human occupation of the Great Dismal Swamp began nearly 13,000 years ago. By 1650, few native Americans remained in the area, and European settlers showed little interest in the swamp.

In 1665, William Drummond, a governor of North Carolina, discovered the lake which now bears his name. William Byrd II led a surveying team into the swamp to draw a dividing line between Virginia and North Carolina in 1728. George Washington first visited the swamp in 1763 and organized the Dismal Swamp Land Company that was involved in draining and logging portions of the swamp. A five mile ditch on the west side of the refuge still bears his name.

Logging activities within the swamp proved to be commercially successful, with regular logging operations continuing as late as 1976. The entire swamp has been logged at least once, and many areas have been burned by periodic wildfires.

Presently, the refuge is in the early phases of implementing various habitat management techniques, primarily directed at forest and water management, in an attempt to restore and protect the natural diversity of the Great Dismal Swamp. Most of these activities are still experimental, for many unknown factors related to the swamp's environment and responses to various habitat management techniques still exist.

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## A. HIGHLIGHTS

A wet summer and fall hampered refuge deer hunts and water control structure rehab. (Section B)

Refuge expansion was considered. (Section C.1)

Habitat management research on the Swainsons warbler and other neotropical migrants was initiated by Dr. Gary Graves of the Smithsonian Institution. (Section D.5)

Black bear taxonomic research began under the leadership of Dr. Michael Vaughn, Virginia Cooperative Wildlife Research Unit at Virginia Tech. (Section D.5)

SROS Brad Knudsen and Forestry Technician Bruce Miller transfer out. (Section E.1)

Preparations were made for North Carolina State University to begin Atlantic white cedar research, made possible by a donation from Mr. Brian Martin. (Section F.3)

Significant progress was made towards catching up on the backlog of habitat monitoring. (Section F.3)

North Carolina requested that Region 5 start paying pre-suppression expenses consistent with Region 4's payments for fire detection and suppression. (F.9)

Refuge personnel were assigned to the Dismal Swamp shrew recovery team. (Section G.2)

A manatee visited the Dismal Swamp Canal. (Section G.2)

Mr. William Ashley donated historical documents related to the refuge's establishment, and these materials were transferred to the National Archives. (Section H.1)

The City of Suffolk expressed their support for visitor center development on the refuge. (Section H.1)

Refuge radio communications were converted to high-band frequencies. (Section I.5)

Agreement was reached with North Carolina on the management of the Dismal Swamp State Natural Area. (Section J.1)

The "Defenders of the Great Dismal Swamp" became the "Great Dismal Swamp Coalition". (Section J.1)

## B. CLIMATIC CONDITIONS

Weather conditions during 1992 were slightly cooler and significantly wetter than in 1991 but still relatively mild with an average temperature of 59.6 degrees for the year. Temperature extremes of 96 degrees and 14 degrees were recorded in July and January respectively. Annual precipitation was 57.29 inches; 14% above the 30-year average and about 18% over 1991. The only snowfall occurred on March 23 and melted about as soon as it hit the ground. The first killing frost and below freezing temperature occurred on October 20.

The refuge area was experiencing a rainfall deficit of 71% by the end of April, creating expectations of an active fire season. The fire danger index, however, took a nose-dive during the June-September period when almost half of the year's rainfall was recorded. By the end of the year, the swamp water levels were higher than normal after receiving above average rainfall during November and December.

May was reported as the third coldest May in the 117 years since the National Weather Service began keeping steady records at the Norfolk International Airport. August was dominated by monsoon-like weather. The extremely wet summer and fall prevented refuge employees from turning the first shovel of dirt on two planned water control structures and put a damper on the deer hunt.

### 1992 WEATHER DATA

Month	Rainfall*	Average	30 Year %Change	Temperature		Extremes** Average
				Max	Min	
January	4.75	3.64	+30%	70	11	44
February	2.57	3.65	-30%	70	19	46
March	2.55	3.95	-35%	75	20	50
April	3.95	3.76	-36%	86	26	58
May	3.95	3.98	< 1%	90	39	62
June	5.00	4.49	+11%	91	44	71
July	7.38	6.73	+10%	96	50	80
August	10.70	5.92	+81%	91	52	75
September	4.90	4.37	+12%	90	43	72
October	1.35	3.20	-58%	83	26	58
November	7.28	3.45	+111%	80	23	55
December	4.45	3.28	+36%	66	17	45
Total	57.29	50.42	+14%			

## C. LAND ACQUISITION

### 1. Fee Title

No acquisitions were closed during the year, so the refuge continued to incorporate 106,962 acres in the following cities and counties:

Chesapeake (VA)	- 46,564 acres
Suffolk (VA)	- 35,586
Gates County (NC)	- 11,841
Camden County (NC)	- 9,099
Pasquotank County (NC)	- 3,872

Although no acquisitions were completed, negotiations were in progress with several landowners for various parcels within the refuge's current acquisition boundary. Mr. Alex Bailey and Mr. George Powell expressed interest late in the year to sell small parcels (less than 100 acres) along the refuge's northwestern boundary in Virginia. Another 400 acre tract along the northwestern boundary was being offered by Mott-Shay Consulting Foresters. A portion of this tract had been leased and operated by the Magnolia Shooting Preserve. In addition, the White family was considering the sale of about 1,000 acres of forested swamp along the refuge's southeastern boundary in North Carolina, as the land's owner, legendary swamper Moses White, passed away early in the year. Mr. Joe Davis of The Conservation Fund participated in the discussions with the White family in September, since that organization's assistance may be needed to procure the large tract.

Interest in expanding the refuge's acquisition boundary continued. In February, the refuge staff drafted a Preliminary Project Proposal to expand the acquisition boundary by over 140,000 acres. The draft recommended that the remaining forested Great Dismal Swamp and a modest amount of agricultural land that was threatened by development and critical to hydrologic restoration be added to the refuge. Most of this acquisition would be along the major drainages and remaining forested Great Dismal Swamp in North Carolina. This draft was reviewed at a meeting in March by representatives from The Nature Conservancy, state biologists, FWE staff, and selected refuge neighbors in order to obtain feedback to fine tune the proposal. The group generally concurred with the draft recommendations and even added a few acres along the North Carolina waterways.

Refuge Manager Culp presented the proposal to the Region's Land Acquisition Review Committee in April. The committee informally concurred with the proposal and advised the manager to continue to assess the concerns and reactions of the local communities which would be affected by refuge expansion.

In December, Refuge Manager Culp and Ascertainment Biologist Gib



Chase travelled to Atlanta, Georgia, to meet with Region 4 realty and refuge personnel to obtain information about their acquisition plans in North Carolina. They indicated that North Carolina project leaders had identified over 200,000 acres of potential additions to existing refuges. The Region was still discussing this issue with those stations as the year ended, as regional personnel had concurred with only about 40,000 acres. The need for Regions 4 and 5 to coordinate their efforts in North Carolina seemed to be obvious to all concerned.

Gaging public reaction to possible refuge expansion was difficult without a formal expansion proposal. However, the issue was addressed with a number of local groups in the context that environmental regulations were not protecting Great Dismal Swamp habitat outside the refuge. Moreover, this loss of swamp habitat would have immediate and direct adverse impacts to the wildlife resources associated with the Great Dismal Swamp and could inhibit efforts to restore habitat within the existing refuge. Thus, refuge expansion was being considered to protect the remaining critical areas. In general, local reaction was supportive for refuge expansion. At least two groups, the Great Dismal Swamp Coalition in Virginia and the Albemarle Environmental Association in North Carolina, expressed interest in actively supporting refuge expansion. However, intense development pressures and concerns about loss of tax base would inhibit support from local governments.

The year ended with this station's expansion proposal being listed as a project to be completed by Realty in FY93. However, competing priorities throughout the Region was inhibiting significant tangible progress on the proposal. In the meantime, refuge staff was using the guidelines established in their draft preliminary project proposal for refuge expansion to determine priorities on involvement in off-refuge issues ranging from proposed landfills to highway construction within the historical range of the Great Dismal Swamp.

## 2. Easements

A total of thirteen roads are currently used for vehicle access to the refuge or have occasionally been used in the past. In addition to these major access points, numerous other easement or fee title right-of-way corridors have been transferred to the refuge since 1974 as means of entrance or egress to individual tracts. Most are located along the western boundary and have not been used to date. Information on the control and ownership of these rights-of-way is summarized as follows:

Road Name	<u>Rights-of-Way</u>		<u>Degree of Refuge Control</u>		
	Width	Ownership	Fee Title	Easement	Permission
Lamb		USFWS	X		
North		Kirk			X
Jericho Lane	100 ft.	USFWS	X		
Badger	16 ft.	Brothers		X	
	60 ft.	Badger		X	
Washington	50 ft.	Gambardella		X	
		Baines		X	
		Brinkley		X	
Railroad		USFWS	X		
Corapeake		Hunt			X
Cross	46 ft.	Daniels		X	
Weyerhaeuser		USFWS	X		
Insurance (strip)	100 ft.	Headley		X	
Bull Boulevard	100 ft.	Rhodes		X	
		Williams		X	
		White		X	
Edge	40 ft.	Edge		X	
Portsmouth	100 ft.	USFWS	X		

### 3. Other

In January, SROS Knudsen and Biologist Keel travelled to Lawrenceville, Virginia to conduct the first joint inspection of a Farmers Home Administration easement with Bridgett Costanzo of FWE, White Marsh. Biologists Keel and Costanzo inspected another 55 acre property near Danville in February. The refuge had assumed responsibility for a number of other easements in 1991 when this station was assigned responsibility for most FmHA easements in southern Virginia. The year ended with the refuge staff still

unclear about the extent of future involvement with these properties, as property data (including exact locations) were still incomplete. Concerns exist, however, about the refuge's capability to properly monitor easements that are 150-200 miles away from the station.

The year ended with FWE in the process of establishing a conservation easement on the Hitch property along the refuge's northeastern boundary. This easement and associated wetlands restoration project was developed to mitigate wetlands loss along the Elizabeth River. Initially, FWE had suggested that the refuge manage the easement, but they later decided to retain management responsibility in FWE. In any event, this area should be protected from the rampant residential and commercial development that had occurred in that vicinity.

## D. PLANNING

### 1. Master Plan

No significant progress was made in completing the Final Environmental Impact Statement on the Master Plan, as extended training assignments, staff vacancies, and other competing priorities drained refuge staff from this effort. Completing this project remained a high priority, however, so better results are anticipated for 1993.

### 2. Management Plans

Significant progress was made towards a complete revision of the refuge hunt plan and preparation of a habitat inventory plan. These projects should be completed in 1993.

### 4. Compliance with Environmental and Cultural Resource Mandates

In 1990, six underground fuel storage tanks were removed from the Gornto Tract along the refuge's eastern boundary. These tanks were on the property when it was added to the refuge in 1988. After the tanks' removal, the State Water Control Board (SWCB) required the Service to conduct additional risk assessments to determine the extent of contamination by these tanks. Malcolm-Pirnie, Inc. was awarded a contract to conduct the assessments, and their report was submitted to the SWCB in early 1992. The SCWB finally reviewed the report and directed in late July that the Service submit a Remediation Assessment which addressed various site restoration options. The year ended with the Service's Engineering division awaiting delivery of the Remediation Assessment from Malcolm-Pirnie.

### 5. Research and Investigations

Great Dismal Swamp NR 92 - "Songbird Use in the Great Dismal Swamp Refuge" (51580-2)

Don Schwab, Virginia Department of Game and Inland Fisheries Biologist, began mist-netting at the Jericho Ditch Road site on June 6. Don's efforts are part of VDGIF participation in the Monitoring Avian Productivity and Survival (MAPS) program for non-game birds. About 50 birds were banded by the end of June.

Great Dismal Swamp NR 92- "Popoulation Density, Home Range Size, and Habitat Preference of Swainson's Warbler (Limnothlypes swainsonii) (51580-3)

Dr. Gary Graves of the Smithsonian Institute completed the fourth year of a long term (1989-1994) project on the Swainson's warbler during May. By May 27, he had banded 8 warblers and made 6 recaptures to bring the total to 40+ Swainson's banded since the



inception of the study in 1989. No birds were collected for genetic study this year.

Great Dismal Swamp NR 92- "Habitat Management for Swainson's Warbler and other Neotropical Migrants in the Great Dismal Swamp National Wildlife Refuge" (51580-3)

Dr. Gary Graves submitted the research proposal for approval by the refuge manager in July 1991. The proposal was then submitted to Diane Pence, non-game migratory bird coordinator in the Regional Office, for review and approval. The study is funded under the non-game migratory bird program. Dr. Grave's summary of the study proposal is given below:

"The Great Dismal Swamp National Wildlife Refuge supports the largest and most important population of Swainson's Warbler, a neotropical migrant, along the Atlantic coast. Breeding Bird survey (U.S. Fish & Wildlife) data show that this warbler is one of the rarest passerine species in eastern North America. Recent studies indicate that Dismal Swamp populations have decreased during the past 20-30 years, probably because of maturation of second growth forest. Habitat profiles of Swainson's territories compiled throughout its geographic range suggest that the abundance of the warbler may be limited by lack of suitable habitat--large areas of floodplain woodland with frequent canopy gaps filled with dense undergrowth.

I believe these natural conditions can be replicated by clearing the canopy in small plots (0.25 ha) scattered throughout the Dismal Swamp forest. I propose a canopy removal experiment in a "swainson-less" area (1989-1991) of the refuge in order to promote expansion of the warbler population. Preliminary census work has been completed on 12 plots bordering a 1200 m transect along Lynn Ditch. Plots (100 x 200m) will be assigned to either "treatment" (n=6) or "control" (n=6). In each treatment plot, 95% of all trees in a 50 x 50 m (0.25ha) quadrat will be killed by girdling and left standing. If the experiment is successful, Swainson's will colonize the treatment plots containing regenerating canopy openings. Nearly two-thirds of the 33 species (16 neotropical migrants) present on the census plots are expected to benefit directly from the canopy removal experiments. An additional 4-5 species of neotropical migrants not currently present on the census plots are expected to colonize the treatment plots.

In sum, small plot (0.25 ha) canopy openings may provide a cost effective method of managing populations of Swainson's Warbler and other neotropical migrants as well as increasing the avian diversity of even-aged stands of forest."

The second pre-treatment census was conducted in May. Following the habitat treatments, censuses are planned yearly (1993-1999) during the last week in May. Pre-treatment quantitative vegetation data

was gathered during the summer. During late September and early October, refuge employees Brian Poovey and Kenny Powell girdled about 95% of the tree stems (>6cm DBH) in the treatment quadrats using chain saws. Any stems of Atlantic white cedar and bald cypress encountered were not girdled. Regeneration of vegetation in treatment plots will be monitored on a yearly basis with quantitative measurements and photography.

Great Dismal Swamp NR 92- "Taxonomy of Black Bears in the Southeastern United States" (51580-6)

Dr. Michael R. Vaughan with the Virginia Cooperative Fish and Wildlife Research Unit, Virginia Tech, Blacksburg, Virginia is the principal investigator of this three year study.

The background objectives of the study are given below:

Hall (1981) lists 16 taxonomic subspecies of the American black bear (Ursus americanus). Three of these subspecies (U. a. luteolus), whose original range included eastern Texas, all of Louisiana, and southern Mississippi, was described by Merriam (1893) on the basis of 5 skulls collected in one northeastern Louisiana parish. The Florida black bear (U. a. floridanus), which occurs in Florida and the Coastal Plain of Georgia and Alabama, also was described by Merriam (1896) on the basis of several skulls, all from south Florida.

On March 6, 1987 and May 20, 1990, the U.S. Fish and Wildlife Service (FWS) was petitioned to list the Louisiana black bear and the Florida black bear, respectively, as endangered species under the Endangered Species Act of 1973. The preliminary recommendations of the FWS were to list the Louisiana black bear as threatened (Draft Final Rule) and to place the Florida black bear in a "warranted but precluded category" (12-month Finding). In making the recommendations, the FWS considered a report by Pelton (1989) on the status of the Louisiana bear. The Pelton report described skull morphology and genetic characteristics of bears from Louisiana, Tennessee, West Virginia, Virginia, Arkansas and Minnesota. The morphometric data indicated that Louisiana bears (U. a. luteolus) were distinct from other bears in the sample (all U. a. americanus), but suggested that luteolus and floridanus may prove to be the same subspecies. The genetic data failed to reveal substantial differences in any of the populations. However, because the genetic sample sizes were small, interpretation of the results were open to question.

U. a. luteolus and U. a. floridanus are generally accepted by the scientific community as legitimate taxonomic subspecies. This research, however, will be designed to evaluate genetic and morphologic characteristics of black bears in the southeastern United States to determine if distinct subspecies actually exist.

Objectives:

1. To clarify the taxonomy of black bears in the southeastern United States.
2. To determine if U. a. luteolus and U. a. floridanus are genetically and/or morphologically distinctive from the more widespread U. a. americanus.
3. To determine if U. a. luteolus and U. a. floridanus should be grouped as one subspecies.

Graduate students Mike Schrage (Virginia Tech) and Tom Eason (University of Tennessee) arrived on July 24 to begin trapping bears to obtain blood and tissue samples. The two researchers used as many as 10 Aldrick foot-snare sets and two barrel traps. Although they found plenty of bear sign, only two bears were trapped by August 10 when the sets were pulled. Two other bears pulled out of the foot snares with one hefty bruin managing to break the spring on one snare. The "milk stage" condition of adjacent corn fields worked against their efforts in the swamp, as the bears preferred the fresh corn to the stale pastries that were used to bait the traps.



**Mike Schrage prepared one of the bear snare traps.  
(DIS-92-1, RMK, 7/92)**





The completed trap was baited with stale pastries.  
(DIS-92-2,RMK,7/92)



**This bear was caught just off Corapeake Road. (DIS-92-3,LAC,8/92)**

## E. ADMINISTRATION

### 1. Personnel



**Front Row: (Left to right) Miller, Keel, Brownlie, Williams, Poovey**  
**Back Row: (Left to Right) Culp, White, Rybolt Knudsen, Leary,**  
**Cherry, Marlin, Winningham (DIS-92-4, LAC, 1/92)**

# STAFF

Lloyd A. Culp, Jr.	Refuge Manager	GM-13	EOD	4/10/88	P
Bradley A. Knudsen	SROS*	GS-11	EOD	6/15/91	P
Ralph M. Keel	Biologist	GS-11	EOD	5/27/86	P
Teresa M. Cherry	ORP*	GS- 9	EOD	3/12/89	P
David J. Brownlie**	Forester/FMO*	GS-11	EOD	7/29/90	P
Sally D. Leary	Office Assistant	GS- 6	EOD	1/13/80	P
Helen K. Marlin	Clerk-typist	GS- 3	EOD	12/06/87	P
Bruce M. Miller**	Forestry Tech.	GS- 6	EOD	6/15/91	P
Bailey White	Equip. Operator	WG-10	EOD	3/15/78	P
Dane Winningham	Maint. Worker	WG- 8	EOD	7/24/83	P
Allen R. Carter(1)	RFMC	GS-12	EOD	12/03/89	P
Howard T. Rybolt(2)	Appraiser	GS-12	EOD	12/31/78	P
Bryan F. Poovey**(3)	Tractor Operator	WG- 6	EOD	6/15/91	P
Clint L. Williams**	Tractor Operator	WG- 6	EOD	6/15/91	P
Kenneth Powell**	Tractor Operator	WG- 6	EOD	3/10/91	T
Vanessa Miller**	Tractor Operator	WG- 6	EOD	5/17/92	T
Dierdre Merwin	Student Trainee	GS- 4	EOD	6/1/92	P
Renee Weaver	High School Coop	GS- 1	EOD	6/14/92	

\*Supervisory Refuge Operations Specialist

\*ORP - Outdoor Recreation Planner

\*FMO - Fire Management Officer

\*\*Fire Management Positions

- (1) - Regional Fire Management Coordinator, stationed at Great Dismal Swamp NWR
- (2) - Realty Appraiser, stationed at Great Dismal Swamp NWR
- (3) - Converted to Forestry Technician (GS-6) effective 12/92

Forestry Technician Bruce Miller transferred to the National Park Service (Everglades National Park) in July, just in time to have most of his house-hold belongings destroyed by Hurricane Andrew. Fortunately, Bruce was not hurt.

Temporary Tractor Operator Vanessa Miller began working as part of the fire crew on May 17. She resigned in July to follow Bruce Miller to the Everglades.

SROS Brad Knudsen transferred to Horicon NWR effective November 1. A native of Wisconsin, Brad could not resist the opportunity to work closer to home. Recruiting for Brad's replacement occurred in September, but filling the vacancy had to be delayed until at least March, 1993, due to funding difficulties.

Two coop students began working in June. Dierdre Merwin of Virginia Tech only worked three days, however, before she decided that working in rural Virginia did not suit her. High school coop Renee Weaver worked through the summer and intermittently during the fall refuge hunts.

The refuge manager and the regional fire management coordinator



were upgraded to GM-13. The manager's upgrade was a result of mandatory position reviews that were accomplished when new classification guidelines were implemented.

#### Staffing Pattern

Year	Permanent		Temporary	Total FTE's
	Full Time	Part Time		
1992	12	0	2	12.7
1991	12	0	1	12.5
1990	9	0	4	11.2
1989	9	0	5	11.8
1988	9	0	5	11.8

#### 4. Volunteer Program

Throughout the year, volunteers assisted the refuge with a variety of projects. Although the majority of volunteer assistance was received during the white-tailed deer hunt, volunteers also assisted with inspecting and repairing wood duck boxes, routinely inspecting the Dismal Town Boardwalk Trail, serving as roving interpreters, conducting public use surveys, litter pickup, constructing replacement arms for the Washington Ditch entrance gate, and repairing the hunter check-in stations. A total of 36 individuals donated 258 hours in 1992.

Matt King and Corey Judson, seniors from Nansemond-Suffolk Academy spent a total of 42 hours during March shadowing refuge staff as part of their Senior Awareness week. This is the third consecutive year that the refuge has participated in this program which is designed to give students the opportunity to learn more about their career interests through "first hand" experience. The students assisted refuge with a variety of projects and also took time to interview several employees to learn about educational requirements as well as the responsibilities and duties of the position. Each student was evaluated at the end of the Senior Awareness Work Experience.

Girl Scout Troops 629, 694 and 978 from Chesapeake, Virginia officially adopted the Dismal Town Boardwalk Trail in September, 1991. In April, 1992 the group began their monthly inspections of the area to pick up litter, distribute refuge brochures to refuge visitors, and make note of any needed repairs on the boardwalk trail. The adoption of the trail helps to fulfill the badge requirements for their community service. The group also makes periodic inspections of the refuge's other public entrance, Jericho Lane. The group's efforts have been extremely helpful in keeping the public areas free of litter and providing brochures and information to visitors on the weekends. A total of 21 scouts donated 66 hours (totals included in the amount above).

The majority of volunteer assistance was received during the annual white-tailed deer hunt. Volunteers helped the refuge prepare for the hunt by repairing the check-in stations and updating the information in the stations with current hunt information.

A tremendous amount of assistance in operating the check station was received from volunteers again this year. Eight volunteers donated 82 hours (included in the above total) assisting with staffing the check station which involved weighing and aging the deer and completing the necessary paperwork. Volunteers staffed the check station approximately 70% of the time that it was in operation.

The annual refuge volunteer recognition ceremony dinner took place on September 20th at a local restaurant. All volunteers were acknowledged for their efforts. Each volunteer received a Certificate of Appreciation and a volunteer mug. During the ceremony, Refuge Manager Lloyd Culp expressed the refuge's appreciation for the assistance received from volunteers throughout the year. A total of 38 volunteers, staff, and family members attended the dinner and awards ceremony.



Volunteers completed the final touches on the gate arm for the Washington Ditch gate. (DIS-92-5,TMC,11/92)



**Volunteers repaired hunter check-in stations. (DIS-92-6,TMC,9/92)**



**Volunteer Emmett Powell was one of several volunteers who staffed the deer check station. (DIS-92-7,TMC,11/92)**





Despite the fact that the photo shop printed their picture backwards, these young women of Girl Scout Troops 629, 694, and 978 deserved to be recognized for their fine work in maintaining the Dismal Town Boardwalk. (DIS-92-8,TMC,11/92)

## 5. Funding

### FUNDING LEVELS (BY SUBACTIVITY)

FY	1260(1)	1240/9100(2)	8610(3)	TOTAL
1992	415,612	166,800		582,412
1991	564,181	285,700	139	850,020
1990	443,239	182,992	1,443	627,674
1989	350,553	98,000	2,627	465,180
1988	350,575	60,095		410,670

- (1) Refuge Operations
- (2) Fire Management
- (3) Quarters Operations

The year began with a few problems related to converting from the old Individual Project Worksheet format to the newer Refuge Project Planning System (RPPS) continuing to haunt us. Updates on the RPPS were not being loaded onto the Region's data base, resulting in key projects not getting funded. As the year progressed, these problems were resolved, and updates seemed to be properly added to the Regional budget planning process. Regional budget managers

also corrected the key budget problems by April so that the highest priority habitat management projects, particularly the Ducks Unlimited MARSH tasks, were finally funded.

After the Region worked diligently to assure that the DU MARSH projects were funded, Ducks Unlimited informed us in June that cash flow problems would prevent them from funding their share of the projects until March 1993. Therefore, about half the needed materials for two water control structure projects were procured with the anticipation that the remaining materials would be acquired with DU funds in 1993. Unfortunately, these administrative problems created some delays in ordering materials, so that some critical items were not delivered until late July. Within a few days of their delivery, the late summer floods occurred, literally washing out plans for completing the field work in 1992. The work will resume as the flood waters recede, but catching up on the backlog of water control structure and road maintenance tasks will require some cooperation from Mother Nature and some long work days in 1993.

Fire management funding created some interesting challenges. The Regional Fire Management Coordinator, who is stationed at Great Dismal Swamp, was assigned a separate organization code for Regional funding. Previously, a significant amount of Regional fire funding had been added to the refuge's budget. This accounting change created no particular problems. However, general fire accounting created some real challenges. With fire funds being considered as "no year" accounts, disbursements were being charged to the fiscal year that the invoices were being processed. For example, a dozer that was ordered in 1991 but not delivered until 1992 would be charged to fiscal year 1992. Obviously, this created some accounting headaches, and Refuge Manager Culp and RFMC Carter met with other fire management personnel at the Washington Office during July 14-15 to work on some remedies. Ultimately, it was learned that fire funds would continue to be charged to fiscal year that the invoice was processed, but the previous years' funds which had originally been obligated for these orders could be recovered to pay for these unexpected charges.

## 6. Safety

The primary goals for the station's safety program continued to be accident prevention and providing appropriate response when emergencies do occur. Some proactive safety measures for 1992 are summarized below:

- Safety meetings addressed a variety of issues including fire drill procedures, power tool safety, CPR and defensive driver training, heavy equipment escorts and operations, boating safety, response to lightning storms, search and rescue procedures, and proper use of portable generators.

- Joe McCauley (Back Bay NWR) completed the reciprocal safety inspection for Great Dismal Swamp on February 20.
- Eye wash stations were installed in the oil house and chemical storage area.
- Bridge safety data was submitted to the Regional Office per their instructions.
- More emphasis was placed on routing visitors away from roads and trails where heavy equipment was being operated (ie. water control structure construction, road maintenance, fire suppression).
- Fans were installed on two farm tractors to provide some relief from the summer heat and humidity.
- SROS Knudsen attended the Collateral Duty Safety Officer training in Andover, Massachusetts, during August 2-7.
- Annual inspections and maintenance of fire extinguishers was completed in October.
- Regional Safety Manager Pete Suich retirement prompted a visit and quick safety inspection of refuge facilities with his successor, Ed Bajakian, on September 16.

Unfortunately, refuge personnel suffered through some accidents, which are summarized as follows:

- On February 4, Maintenance Worker Winningham had some grit lodge in his eye as he closed the door of a vehicle that had been washed recently. A local optometrist successfully washed the particle from his eye.
- A lost-time accident occurred on August 27 when Tractor Operator Williams was cut on his left arm by a hand-operated grinder. The cut required 25 stitches, and Mr. Williams had to lose several days' work to keep the arm immobile.

## 7. Technical Assistance

Wildlife research in the Great Dismal Swamp sparked interest. Copies of Eric Hellgren's dissertation on the refuge's bear population were sent to Biologist Otto Florschutz in Washington, North Carolina, to prepare research proposals at Alligator River and Pocosin Lakes NWR's. Another copy was sent to Diane Eckles (FWE) to provide information on black bears to be used in a poster presentation at a forested wetlands symposium in Annapolis, Maryland. Several copies of Brooke Meanley's booklet on the Great Dismal Swamp were sent to Dr. Charles Stine at John Hopkins University for use in a wetlands course.



Biologist Keel met with Mr. Fred Hazelwood on October 21 concerning the revision of a conservation plan for the Boy Scout Pepsico Reservation in Surry County. Mr. Hazelwood is the superintendent of Seashore State Park and serves as the conservation chairman for the Boy Scout's Tidewater Council.

#### 8. Other

The Justice Department approved North Carolina's re-alignment of Congressional Districts, resulting in the refuge being incorporated within the First and Third Districts instead of just the First. Early in the year, First District Congressman Walter B. Jones announced his retirement and later passed away before his term ended. Mr. Jones had represented the refuge district for most of the time since the refuge's establishment in 1974, and he provided significant support for the protection of the Great Dismal Swamp.

The re-routing and expansion of U.S. Highway 17 along the refuge's eastern boundary was a matter which attracted considerable attention. Improving this highway within Virginia has been an "on-off" project for over a decade, and the first half of 1992 recorded at least one set of "start-stop" directives from the state. However, a federal highways bill which passed late in the session seemed to finally secure sound funding for the highway. Since the highway runs along the refuge boundary and through historical Dismal Swamp, refuge personnel will be working with FWE to coordinate efforts to minimize impacts on the refuge and related wildlife resources.

At their invitation, refuge personnel began attending periodic meetings of the Back Bay Focal Area Committee, which chairs the Virginia Joint Venture of the North American Waterfowl Management Plan. A number of interest groups and agencies which could play a role in off-refuge habitat protection were represented at these meetings.

Refuge Manager Culp met with the Chesapeake Planning Department in July to discuss refuge concerns about land and water uses near the refuge and within the historical range of the Great Dismal Swamp. With the city in the process of updating zoning ordinances and land use plans, it was hoped that this communication would promote greater sensitivity by the city towards refuge resource management issues. Also, refuge neighbors have begun to solicit advice and support in dealing with a variety of development issues which could affect Dismal Swamp habitat. A number of official and "back room" proposals for developing Dismal Swamp habitat near the refuge have been discussed, and many residents have perceived that the local governments do not support efforts to control the growth and development. The issues include the development of landfills, borrow pits, residential and commercial development, and even a horse racing track. Some of the inquiries came from neighbors who

obviously just do not want those developments in their "back yard", but at least as many inquiries come from those whose primary interests are concerned with impacts on the refuge.

Pat Holloway of the Inspector General's office conducted a random personal property audit on July 16.

## F. HABITAT MANAGEMENT

### 1. General

The refuge is a forested wetlands that has been greatly altered by ditching and repeated logging operations. Lake Drummond, a 3,100 acre natural lake, is located in the heart of the swamp.

The basic purpose of the refuge is to restore the natural biological diversity of the Great Dismal Swamp to the extent possible. This restoration will be a long-term process of habitat restoration. Major components of the program are experimental, for the restoration of 100,000+ acres of forested wetlands is not a common practice.

Within the refuge, five major forest types and three non-forest types of plant communities comprise the swamp vegetation. The forest types include pine, Atlantic white-cedar, maple-blackgum, tupelo-bald cypress, and sweetgum-oak-poplar. The non-forest types include a remnant marsh, a sphagnum bog, and evergreen shrub community.

Red maple -black gum is the most abundant and widely distributed plant community and is increasing in area. Tupelo-bald cypress, formerly a predominant forest type in the swamp, today accounts for only 12% of the total cover.

Another important forest type is Atlantic white-cedar, covering approximately 8% of the refuge. Stands of cedar are disappearing along the coastal plain and also in the refuge. Changes in forest types in the swamp are due to extensive draining, past timber harvest and the effects of fire (or lack of fire). Forest management activities are focusing on the maintenance of existing forest communities, especially Atlantic white-cedar, tupelo-bald cypress, and sweetgum-oak-poplar.

The Nature Conservancy (TNC) retained general oversight authority through deed reservations over the approximately 49,000 acres of the refuge that were donated through TNC from Union Camp Corporation in 1973. Thus, refuge management has attempted to maintain continuous contact with representatives from the Virginia Chapter of TNC in order to carefully communicate and interpret the refuge's experimental habitat restoration program. This communication has generally involved personal contacts as well as submitting copies of habitat management plans to TNC for their review.

In 1991, efforts continued to develop a computerized geographic information system on the refuge in order to bring state-of-the-art technologies to the overall resource management operations. This development had become an absolute necessity for establishing an aggressive and credible resource management operation program,

since the analysis and interpretation of volumes of ecological data that currently exist were already a slow and inefficient process.

Insufficient knowledge about the complex ground and surface water hydrology of the Great Dismal Swamp has long been one of the major concerns related to habitat restoration and maintenance. Since the mid-1980's, the U.S. Geological Survey has been attempting to obtain funding to conduct a comprehensive hydrologic study of the refuge area. This effort continued in 1992 when constituents in Elizabeth City urged Congressman Walter Jones to support the project. Unfortunately, these efforts have not succeeded to date.

The refuge incorporates only a remnant of the original Great Dismal Swamp. By some estimates, about 85% of the historical Great Dismal Swamp has been cleared, drained, and converted to agricultural, commercial, and residential development. Regulatory protection of the swamp's forested wetlands was developed too late to maintain most of the swamp. Furthermore, the advent of wetlands protection regulations did not stop the loss of swamp habitat outside the refuge boundaries, as evidenced by the continued habitat losses over the past two decades.

Concerns over habitat protection outside the refuge have created some potentially controversial issues in recent times. In 1991, proposed revisions in wetlands delineation guidelines were perceived to further weaken regulatory protection of non-tidal wetlands such as the Great Dismal Swamp. These perceptions resulted in several environmental groups and national press accounts citing the Great Dismal Swamp and the Everglades as two nationally prominent "wetlands" which would not be delineated as such by the proposed guidelines. In January, the public outcry generated by these accounts caused Mr. Jonathon Tolman, policy advisor to Vice-President Quayle, to contact the refuge to obtain basic information about the swamp's habitat in order that they could evaluate a critical report on the issue by the Environmental Defense Fund. The "Conde Naste Traveller Magazine" featured the refuge in their September issue in an article critical of administration wetlands protection policies.

Concerns over habitat loss have also led some local groups to suggest that the Service consider refuge expansion. A significant number of refuge neighbors perceive that local governments and regulatory protection are unable, or unwilling, to protect the remaining swamp habitat. During the year, the refuge was contacted about concerns about potential nearby development or other land activities including logging, commercial and residential development, landfills, borrow pits, and one horse racing track.

## 2. Wetlands

The refuge is primarily a forested wetland and has been divided into seven water management units. Surface water is received by

inflows through breaks in the Suffolk Escarpment from watersheds to the west of the refuge. The major inflow to the Virginia portion of the refuge is the Cypress Swamp drainage. The major inflow in North Carolina is the Corapeake Swamp drainage which receives water from Taylor and Adams Swamp. Other minor inflows are Moss Swamp in Virginia and Hall Pocoson and Folly Swamp (via Folly Ditch) and Acorn Hill Millpond in North Carolina.

Historical outflows from the Great Dismal Swamp were through Shingle Creek to the Nansemond River in the northwest sector, through Deep Creek to the Elizabeth River in the northeast, and the Northwest River to Currituck Sound in the eastern portion. The southeast sector of the swamp was drained by Indiantown Creek to the North River and by the Pasquotank River. Outflows in the southern portion of the swamp drained into the Perquimans and Little Rivers. Construction of the Dismal Swamp Canal by the early 1800's cutoff the headwaters of the Northwest River and outflow to Indiantown Creek. Highway 158 running east to west in North Carolina reduced outflow to the Perquimans and Little Rivers.

Through acquisition of the swamp property, the Fish and Wildlife Service inherited over 115 water control structures and culverts as well as 13 bridges in various states of disrepair. Well above average rainfall during the July-September period precluded replacing old water control structures or installing others at new locations. As of the end of 1992, the refuge had seventeen (17) functional water control structures and three bridges replaced. The functional control structures were checked and adjusted as needed especially during the high water period from January-March.

Peak inflows for Cypress and Corapeake (Taylor) Swamps were recorded on August 18. The lowest water levels occurred in mid-July and late August respectively.



**The Great Dismal Swamp forests are usually flooded in the winter.  
(DIS-92-9,RMK,2/92)**

#### WATER MANAGEMENT UNIT 1

The Washington Ditch diversion structure was operated to shunt excess inflow from Cypress and Pocosin Swamps up Lynn Ditch into WMU's 1A and 1B. Water diversion began on January 6 and continued periodically through May 9. Diversion flow up Lynn Ditch was possible again beginning in late July due to above average rainfall. In late August the main structure was opened to lower water levels in WMU 1A and other sub-units north of Washington Ditch to facilitate the construction of water control structures at Jericho and Camp Ditches and Camp and East Ditches. WCS 33 (South Jericho) was also opened to lower water levels. Above average rainfall through December prevented the installation of the WCS's, but favorable water levels were maintained for the gum-cypress habitat and for waterfowl brood conditions.





The dense maple-gum forests dominate WMU 1. (DIS-92-10,RMK,8/92)

#### WATER MANAGEMENT UNIT 2

The planned peak water level at the 71.60 mark was reached by March 5 behind the South Ditch water control structure. Levels slowly dropped until mid-July. Above average rainfall from July through December kept the water level above planned levels from early August through December. Parts of South Ditch Road were flooded during September-October and December.

The Railroad/West Ditch management site was inundated throughout the year. Two beaver dams in Railroad Ditch enhanced the effectiveness of the cross-flow pipes under Railroad Ditch Road, while the two beaver dams in West Ditch helped to retain water on the management site. The two vegetation monitoring plots were examined on September 2. Water depth on both plots averaged 11.75 inches. Total areal cover in the herbaceous stratum decreased 43% from 1991 in the F1 plot, while percentage of herbaceous cover dropped by 68% in the F2 plot. Smartweed, woolgrass and cattail were the three dominant species. Beggar's tick (*Bidens* sp.) disappeared completely while panic grass, blackberry, and false loosestrife decreased significantly.

Wood duck broods were observed in Railroad and West Ditches. Roosting wood ducks utilized the flooded emergent vegetation in the management site.

Moss Swamp, through not a major inflow, is an important source of

water for this WMU. The inflow dropped to a low of 65.98 in mid-July, then rose just over three feet to the 69.06 mark by August 18. This unit also received surface water inflow from Cypress Swamp via Railroad Ditch.



The Railroad/West Ditch marsh . . . (DIS-92-11,RMK,2/92)



... remained flooded ... (DIS-92-12,RMK,4/92)





... throughout ... (DIS-92-13,RMK,9/92)



...the year. (DIS-92-14,RMK,12/92)

### WATER MANAGEMENT UNIT 3

The remnant marsh was very shallowly flooded early in January, but by early March water levels had dropped to a saturated soil condition. The area remained saturated until at least early August with only small pockets of open water in the "burn holes" from the December 1990 prescribed burn. The water level was at the 21.92 mark by mid-December, inundating the vegetation monitoring plot to a depth of 7.5 inches.

Water levels behind WCS 18 (Forest Line South) never reached planned levels. Planned levels at the Corapeake/Laurel (WCS 48) structure by early June, but, by late August, heavy rains necessitated the pulling of flash boards to lower the level. By early December, the level was down to within desired limits in spite of above average rainfall in November and December.

Peak water levels were not achieved behind WCS 44 (Sycamore) during the first half of the year. Above normal rainfall during the July-September period made it necessary to open the gate in early October. By early December, the water level was within desirable limits after closing the gate in mid-November.

Planned levels were never reached behind WCS 41 (Persimmon/Myrtle) until August through November. By early December, the water level was continuing to rise but had not reached the planned maximum level.



The remnant marsh was last burned in 1990. (DIS-92-15,RMK,6/92)

#### WATER MANAGEMENT UNIT 4

The fringe marsh (WMU 4A) along Highway 158 was flooded by January 8 and remained flooded throughout the year due to above average rainfall and in spite of the leaking county-owned water control structure in the Pasquotank Dike. The lowest water level (22.66) was recorded on May 16 after below normal rainfall in March and April. From May until the end of the year, above average rainfall was recorded every month except October. As a result, the peak water level (26.38) was reached by December 16.

Wood duck broods and one mallard brood were observed in the fringe marsh on April 24. This area is where most of the wood duck nest boxes are located.

Water behind the Pasquotank Dike was at the 4.12 mark by January 8. The lowest level (.75) was reached by July 22, but heavy August rains brought the level to its highest mark (5.48) by August 19. The level dropped and remained below the one foot mark throughout October but rose steadily thereafter and had reached the 4.74 mark by December 16.



The fringe marsh . . . (DIS-92-16,RMK,2/92)





. . . along the refuge's southern boundary on Route 158 . . .  
 (DIS-92-17,RMK,6/92)



. . . remained flooded . . . (DIS-92-18,RMK,8/92)





. . . throughout the year. (DIS-92-19,RMK,12/92)

#### WATER MANAGEMENT UNIT 5

The peak water level (25.60) behind WCS 24 (Portsmouth/Rosemary Ditches) during the first half of the year was not reached until June 13. Flash boards were pulled when heavy rains in July and August brought the level up to the 26.02 mark by August 19. The level dropped to the 25.32 mark by September 1 but was up to the 25.50 level by December 15.

The desired peak level of 29.34 behind WCS 36 (Northeast Ditch) was never reached. A level of 28.35 was recorded on March 27 and provided attractive water conditions for wood ducks and mallards. The lowest level (27.30) was recorded on July 13. The level rose to the highest peak of 28.60 on August 19 but slowly dropped through October until above average rainfall for November and December had brought the level up to the 28.70 mark by December 15.

The first recorded waterfowl production in this unit was a wood duck brood behind WCS 24 on July 13. Otter sign was observed in this unit also.



The water churned through Portsmouth Ditch water control structure throughout much of the summer. (DIS-92-20,RMK,7/92)

## WATER MANAGEMENT UNIT 6

Beavers continued to provide the only water control on the ditches in this unit. The bog burn site remained flooded year-round with up to 373 wood ducks roosting in the area during October. The water level in the bog burn site reached its ebb (67.86) on July 9 and peaked at the 68.78 mark on December 21. Water depths ranged from 1.1 foot to 2.26 feet.

Up to 194 green-backed herons roosted in the flooded bog site in September. Great blue herons utilized the area but not in any great concentrations. Otter use was also noted in this unit.



This beaver lodge housed the primary water level managers in the bog. (DIS-92-21,RMK,3/92)





The bog has also been affectionately dubbed "Lake Carter" to commemorate the fire which created it. (DIS-92-22,RMK,3/92)

#### LAKE DRUMMOND

The lake level is controlled by a 10-gated spillway on the Feeder Ditch about a mile east of the lake. The spillway and ditch is operated and maintained by the Army Corps of Engineers. Excess water from the lake is used to maintain navigational depths in the Dismal Swamp Canal. An informal agreement between the Fish and Wildlife Service and the Corps allows no water to be released at the spillway when the lake level drops to the 3.6 mark at the spillway gauge.

The lake remained at the 5.00 level or higher throughout the year with the highest level, since the refuge was established, recorded at the 5.90 mark on August 19. No lake bottom was exposed.

### 3. Forests

#### General Overview

With most of Forester Brownlie's energies devoted to reviewing the refuge Master Plan DEIS, the 1991 Annual Narrative, and fire training and program management, data analysis for the 1992 Marsh and Water Management Plan, January-March was a slow period for forest habitat management. An inquiry about Atlantic white-cedar timber sales on the refuge from local specialty lumber mill owner Brian Martin early in the year led to a series of meetings and field tours with North Carolina State University and North Carolina Forest Service personnel. Eventually, this led to Mr. Martin providing North Carolina State University with a letter of intent.

to donate \$10,000 toward graduate research on Atlantic white-cedar regeneration at least partially on the refuge and a commitment from N.C. State to furnish us with brief written research project proposals (2) for our use in refuge budget requests and seeking out potential partners to "match" Mr. Martin's gift. By year-end, this timber sale inquiry had turned into a promising graduate research project using two refuge cedar regeneration trial sites that will be completed by M.S. candidate Laura Greenwood who reported to N.C. State in September. A second project proposal looking at faunal impacts, especially on neotropical migratory birds, was promised for early 1993, as yet unfunded.

Heavy emphasis was placed on installing and measuring vegetative monitoring plots during April-August. Forest and fire management activities were essentially shut down upon deployment of most of the station's fire management personnel for inter-agency fire suppression assignments on August 21-22. Following the fire deployment, assisting with the Swainson's warbler study plot treatments, preparations for the refuge deer hunt, recruiting for the Forestry Technician position, and inordinately high water levels throughout the swamp limited forest habitat management activities during September-December.

Dr. Gary Graves, principal investigator for the Swainson's warbler study now underway on the refuge, arrived on the refuge on September 21. Beginning the following day, Tractor Operators Poovey and Powell began the hot, wet, tiring process of girdling mid and overstory trees on six of these study plots. The crew did an excellent job despite the 1-3 feet of standing water present on the plots, averaging 1-1.5 plots treated per day. By month's end, only a portion of one plot remained.

On September 23, Forester Brownlie hosted a group of 25 new employees from the Virginia Department of Forestry on a tour of the refuge. This group has been touring throughout Virginia as part of their new employee orientation program. Forester Brownlie was able to give the group an orientation to the refuge mission and resource management challenges and programs at the refuge during the three hours the group was here. Carl Garrison, the tour leader for the VDF requested a second tour later in FY 93 for a group of State wildlife and forest managers at the conclusion of the tour.

Once again, the refuge deer hunt and fire management related recruiting, training and travel, and holiday and leave schedules left little time for forest habitat management activities during October-December. The continuing high water tables throughout the swamp limited opportunities for field work again as well.

On December 14, refuge staff met with personnel from the North Carolina State Parks Commission to review and discuss the recently completed Cooperative Management Agreement for the Dismal Swamp State Park. The discussions focused mainly on restoring and

maintaining access within the park, water management, prescribed burning and fire suppression, law enforcement, and Atlantic white cedar and pond pine/high pocosin community maintenance and restoration.

#### Remnant Marsh Expansion

This planned clearing project remained uncompleted once again throughout 1993. The cancellation of the Regional Heavy Equipment Safety Training session in May prevented us from certifying Tractor Operators Poovey and Williams and Forestry Technician Bruce Miller for dozer operation. This was a great blow to our forest and fire management operations work schedules, since it meant only Heavy Equipment Operator Bailey White was qualified to do the dozer work. Bailey's time was tied up early in the field season assisting with Back Bay NWR's dike project and grading refuge fire access roads while waiting for spring high water tables to drop.

By the time Bailey had completed these duties and water tables began approaching suitably low levels in late July, it began to rain. It really never stopped raining for any length of time for the rest of the year.

#### Post Treatment Vegetation/Woody Fuels Monitoring

Forester Brownlie spent several days during the latter half of March working on the Refuge Habitat Inventory and Monitoring Plan. This plan will combine monitoring and inventory aspects of the current Marsh and Water Management Plan, the Fire Management Plan, Forest Management Plan, and Wildlife Inventory Plan into a single, integrated document.

During April, refuge staff completed Atlantic white-cedar regeneration stocking surveys at two previously treated sites and another survey at a bald cypress regeneration site. The Camp-Jericho Ditch cedar planting site was surveyed by Forester Brownlie on April 2 and the Lynn-Middle Ditch cedar natural regeneration site on April 14 by Forester Brownlie and Forestry Tech Miller. The East Ditch bald cypress natural regeneration site was visited by Forester Brownlie on April 23.

All three sites remained fully stocked with vigorous stems of the intended tree species (cedar or cypress), generally equalling or exceeding height growth of other woody competitors on the site. All three sites were also among the wetter of our experimental restoration trials, as evidenced by the sizeable percentage of the standing surface water encountered along the transects.

As part of drafting the refuge Habitat Inventory Plan, Forester Brownlie spent several days in April developing draft Habitat Suitability Models to aid Atlantic white-cedar and bald



cypress restoration site selection and using the HSI software to identify potential habitat variables for field measurement during future inventory work.

Forestry Tech Miller and Forester Brownlie completed a fourth growing season bald cypress stocking and competition survey on May 14 at a 1988 cypress planting site just south of Railroad Ditch about 1.5 miles east of the Railroad and West Ditch intersection.

Tractor Operators Poovey and Miller and High School Cooperative Education Student Weaver made considerable progress on vegetative plot installation and measurement throughout June. Forester Brownlie provided some training and field assistance during the month along with Biologist Keel.

All four remaining plots within the Myrtle-Sycamore Pocosin burn block and the adjacent (untreated) control plot were installed and measured by June 11. On June 11 and 12, five new plots were established within the Corapeake-Forestline Atlantic white-cedar natural regeneration trial area along with five additional control plots in an adjacent, untreated stand. They were measured beginning August 5 by Tractor Operator Poovey, Biologist Keel, and high school Coop Student Weaver and completed October 2 by Tractor Operators Poovey and Powell.

Next, the vegetation monitoring crew moved on to the planned New-Hudnell Ditch pine unit. Five new plots were installed and measured within the planned burn area between June 17 and 22 and another five control plots in an adjacent similar stand between June 23 and 25. The crew ended June by completing second growing season measurement of the Jericho Ditch Atlantic white-cedar natural regeneration trials (8) treated late in the 1990 growing season. Plot remeasurement at this Jericho Ditch site began June 25.

During July, Tractor Operators Poovey, Miller, and Biologist Keel installed reference stakes that will be used to establish and relocate fifteen additional vegetation monitoring plots. The plots will include control plots in adjacent, untreated habitat representative of pre-treatment conditions. The Western Boundary Pocosin restoration sites (two treatment areas for 17 acres) and Corapeake Ditch log-landing sites (two areas for 8 acres) are where this next round of plot establishment will take place. Both sites were drum chopped in 1986 and are now dense stands of broad leaved shrub and tree regeneration, but desired pond pine and Atlantic white-cedar regeneration appears absent.

Installation of new habitat monitoring plots is scheduled to begin early in 1993 starting with the previously drum chopped sites along Western Boundary and Corapeake roads and followed by the old Jericho Tower, Forestline, and Countyline-Insurance wildfire sites.



Bryan Poovey measured a 0.1 square meter quadrat at the Corapeake-Forestline cedar regeneration site shortly after unusually heavy rainfall in July. (DIS-92-23,DJB,8/92)



Bryan Poovey counted cedar seedlings and competing stems along a transect at the Corapeake-Forestline Atlantic white cedar regeneration site. (DIS-92-24,DJB,8/92)





Forester/FMO Brownlie counted woody fuels while Vanessa Miller recorded. (DIS-92-25,DJB,6/92)



The Myrtle-Sycamore pocosin was the scene of an escaped prescribed burn in 1988. (DIS-92-26,DJB,6/92)



**The "core crew" for habitat monitoring included Diedre Merwin, Vanessa Miller, and Bryan Poovey. (DIS-92-27,DJB,6/92)**

#### Atlantic White-cedar Restoration

On February 4 and 5, Forester Brownlie attended an Atlantic white-cedar management field tour and conference in eastern North Carolina. Forester Brownlie was able to visit two sites where Atlantic white-cedar seedlings from branch tip cuttings rooted in Weyerhaeuser nurseries were recently planted. One site was on Weyerhaeuser lands near Washington, North Carolina, and the other at Pocosin Lakes NWR near Pungo Lake. The field tour also visited a natural cedar stand on the Virginia Dare Farm near Plymouth, North Carolina.

The growth and survival of the rooted cutting cedar plantation on Weyerhaeuser land was truly impressive. Although the cost per seedling for producing rooted cutting planting stock is 3-5 times higher than for bare-root or tumbling stock from seed, higher growth and survival rates would seem to make this a cost effective method for establishing new stands where no seed source currently exists. Collecting cuttings for rooting also is much easier than collecting and extracting seed, which reportedly only averages 40-50% germination rates in nursery beds.

Forester Brownlie also presented the results of recent refuge attempts to regenerate Atlantic white-cedar naturally during the indoor conference segment at the V.G. James Research and Extension Center near Plymouth. Other presentations dealing with soils, nursery techniques, and problems experienced with seedling



production; K.O. Somerville's progeny source study; and logging systems and merchantability specifications were also made.

### Corapeake-Forestline Cedar Natural Regeneration Area:

Corapeake-Forestline AWC Regeneration --1 year post-treatment

Treatment Type	Species	# Tree Seedlings Per Acre by Height Class						All
		< 0.5'	0.5-1'	1-2'	2-3'	3-4'	>4'	
KG-Blade Sheared '91, No Chemical, Natural Seeding AWC	Plot 1 AW Cedar	11000	0	0	0	0	0	51135
	R. Maple	6750	250	0	0	0	0	7000
	Poison Ivy	0	250	0	0	0	0	250
	Sw. Pepperbush	25750	22750	8250	250	0	0	57000
	Blueberry	1000	250	0	0	0	0	1250
	Cattail	24750	23500	0	0	0	0	48250
	Smilax sp.	9500	0	0	0	0	0	9500
	Panicum sp.	750	250	250	0	0	0	1250
	Dog Fennel	500	0	0	0	0	0	500
	Other	1000	0	750	0	0	0	1750
	All	81000	47250	9250	250	0	0	137750
	Plot 2 AW Cedar	14500	0	0	0	0	0	14500
	R. Maple	9000	500	0	0	0	0	9500
	Sw. Pepperbush	21250	2500	2500	0	0	0	26250
	Blueberry	2250	750	0	0	0	0	3000
	Cattail	14000	11500	0	0	0	0	25500
	Smilax sp.	31000	250	0	0	0	0	31250
	Unknown grass	19000	0	0	0	0	0	19000
	Dog Fennel	250	0	0	0	0	0	250
	Bidens sp.	250	0	0	0	0	0	250
	Fireweed	250	250	250	0	0	0	750
	Pokeberry	250	0	0	0	0	0	250
	Other	2500	500	0	0	0	0	3000
	All	114500	16250	2750	0	0	0	133500
	Plot 3 AW Cedar	3500	250	0	0	0	0	3750
	R. Maple	6000	1250	500	250	250	0	8250
	Poison Ivy	0	500	0	0	0	0	500
	Sw. Pepperbush	30500	20000	13000	1250	0	0	64750
	Cattail	9000	5750	5250	0	0	0	20000
	Smilax sp.	8750	2000	250	0	0	0	11000
	Unknown grass	250	500	500	0	0	0	1250
	Dog Fennel	5500	500	0	0	0	0	6000
	Va. Chain Fern	0	500	500	0	0	0	1000
	Devil's Wlk. Stk	250	500	0	0	0	0	750
	All	63750	31750	20000	1500	250	0	117250
	Plot 4 AW Cedar	18250	0	0	0	0	0	18250
	R. Maple	500	0	0	0	0	0	500
	Poison Ivy	1500	0	0	0	0	0	1500
	Sw. Pepperbush	26250	30500	24750	250	0	0	81750
	Cattail	1750	10000	0	0	0	0	11750
	Smilax sp.	43250	0	0	0	0	0	43250
	Unknown grass	47500	4000	0	0	0	0	51500
	Fireweed	750	2000	250	0	0	0	3000
	All	139750	46500	25000	250	0	0	211500
	Plot 5 AW Cedar	11000	500	0	0	0	0	11500

	R. Maple	6250	750	1500	250	250	0	9000
	Poison Ivy	250	250	250	0	0	0	750
	Sw. Pepperbush	20250	23000	25750	2250	0	0	71250
	Cattail	40000	2750	0	0	0	0	42750
	Unknown grass	1500	3000	250	0	0	0	4750
	Dog Fennel	0	250	250	0	0	0	500
	Fireweed	7000	250	0	0	0	0	7250
	Va. Chain Fern	0	250	250	0	0	0	500
	Other	500	250	0	0	0	0	750
	All	86750	31250	28250	2500	250	0	149000
Avg. n=5	AW Cedar	11650	150	0	0	0	0	11800
	R. Maple	5700	550	400	100	100	0	6850
	Poison Ivy	350	200	50	0	0	0	600
	Sw. Pepperbush	24800	19750	14850	800	0	0	60200
	Blueberry	650	200	0	0	0	0	850
	Cattail	17900	10700	1050	0	0	0	29650
	Smilax sp.	18500	450	50	0	0	0	19000
	Panicum sp.	200	50	50	0	0	0	300
	Unknown grass	13650	1500	200	0	0	0	15350
	Dog Fennel	1250	150	50	0	0	0	1450
	Bidens sp.	50	0	0	0	0	0	50
	Fireweed	1600	500	100	0	0	0	2200
	Va. Chain Fern	0	150	150	0	0	0	300
	Pokeberry	50	0	0	0	0	0	50
	Devil's Wlk Stk	50	100	0	0	0	0	150
	Other	700	100	150	0	0	0	950
	All	97100	34550	17100	900	100	0	149750

Plots installed and measured during June within the Corapeake-Forestline Atlantic white-cedar natural regeneration area indicated remarkably good stocking levels (11,800 cedar seedlings per acre) for newly germinated cedar seedlings. The area was initially treated in late November, 1991. The plot data also suggest these new seedlings will face stiff competition (137,950 stems per acre) over the next few years from woody and perhaps even some tall herbaceous stems. Sweet pepperbush (*Clethra alnifolia*), cattail (*Typha* spp.), greenbrier (*Smilax* spp.), and red maple (*Acer rubrum*) were the major competitors as expected.

The site was revisited several times following plot measurement during 1992. On July 29 following heavy rainfall, water tables at the site had risen considerably, and 25-50% of the site was submerged. The literature indicates that Atlantic white-cedar seedlings rarely survive more than 1-2 weeks of flooding during the growing season. Continued heavy rainfall appeared to have made matters much worse by October 5. At this point, 50-75% of the site was submerged, and an estimated 75% of the cedar seedling crop was at least partially under water, leaning over, and turning yellow. Despite the good initial results, the inability to effectively regulate growing season water tables at the site late in the growing season may result in 90% mortality of the 1992 seedling crop by next year.



## Jericho Ditch Cedar Natural Regeneration Area:

Jericho Ditch AWC Regeneration --2 years post-treatment

Treatment Type		Species	# Tree	Seedlings	Per Acre by Height Class					
			< 0.5'	0.5-1'	1-2'	2-3'	3-4'	>4'	All	
Understory & Mid-story cut '90, No Chemical, Natural Seeding AWC	Plot 1	AW Cedar	26125	1000	4750	1125	0	0	33000	
		R. Maple	10250	0	0	250	1125	375	12000	
		All	36375	1000	4750	1375	1125	375	45000	
	Plot 5	AW Cedar	21750	0	0	0	0	0	21750	
		R. Maple	7625	125	0	0	0	0	7750	
		All	29375	125	0	0	0	0	29500	
	Plot 2	AW Cedar	35000	0	0	0	0	0	35000	
		R. Maple	19125	250	0	0	0	0	19375	
		All	54125	250	0	0	0	0	54375	
Plot 6	AW Cedar	37500	0	0	0	0	0	37500		
	R. Maple	2250	0	0	0	0	0	2250		
	All	39750	0	0	0	0	0	39750		
Understory, Mid-story & Overstory Cut '90, Chemical, Natural Seeding AWC	Plot 3	AW Cedar	57750	250	875	250	0	0	59125	
		R. Maple	4500	1000	1500	1375	0	0	8375	
		All	62250	1250	2375	1625	0	0	67500	
	Plot 7	AW Cedar	26750	500	500	0	0	0	27750	
		R. Maple	500	0	1000	0	0	0	1500	
		All	27750	500	1500	0	0	0	29250	
	Plot 4	AW Cedar	1750	0	0	0	0	0	1750	
		R. Maple	11625	0	0	0	0	0	11625	
		All	13375	0	0	0	0	0	13375	
Untreated (Control)	Plot 8	AW Cedar	250	0	0	0	0	0	250	
		R. Maple	3250	0	0	250	250	250	4000	
		All	3500	0	0	250	250	250	4250	

Plot re-measurement at two years post-treatment at the Jericho Ditch Atlantic white-cedar natural regeneration sites indicated higher cedar seedling stocking levels for all plots, including the untreated control plots, compared with last years one-year post treatment data. Visual inspection of the sites confirmed a significant increase in cedar seedlings on treated sites. However, a slight modification in transect dimensions from last year may have biased results to an unexpectedly large degree. It is not known whether last year's techniques underestimated cedar stocking levels or this year's overestimated. Last year's techniques proved a bit cumbersome for field personnel because of their 100+ foot length, so small cedar seedlings may indeed have been missed last year.

If this year's data are representative, it appears that all three treatment combinations not only increased cedar seedling stocking levels significantly, but increased enough to outnumber red maple

stems several fold when compared with untreated controls. Unfortunately, late growing season visits to the sites in October revealed that high water tables may have impacted this site even more than they did the Corapeake-Forestline site. During the October 6 visit, all eight sites were over 75% submerged by 1-3 feet of standing water. Very few cedar seedlings were observed above the water line during this visit. Again, very high cedar seedling mortality rates are expected by remeasurement time in 1993.

### Camp Ditch Cedar Regeneration Areas:

Camp-Jericho AWC Regeneration --4 years post-treatment

Treatment Type	Species	# Tree Seedlings Per Acre by Height Class						All
		< 0.5'	0.5-1'	1-2'	2-3'	3-4'	>4'	
KG-Blade Sheared	AW Cedar	15514	22610	7027	3270	2018	696	51135
'87, Broadcast	R. Maple	348	1183	904	1113	1322	2296	7166
Burn, No	R. Bay	0	0	0	0	70	139	209
Chemical, Natural	All	15862	23793	7931	4383	3409	3131	58509
Seeding AWC								
KG-Blade Sheared	AW Cedar	0	0	0	0	167	833	1000
Broadcast Burned,	R. Maple	0	0	0	0	0	333	333
No Chemical,	Blueberry	0	0	167	1500	3500	833	6000
Planted Bare Root	Fetterbush	0	0	667	1167	3333	1667	3833
Atl. W.Cedar '88	Unkn.Shrub	0	0	167	333	167	167	833
	Ilex sp.	0	0	167	167	500	500	1333
	Wing.Sumac	0	0	0	0	0	167	167
	All	0	0	1167	3167	7667	4500	16500

Standing Water 29% of Ground Surface

The Camp-Jericho data reveal that total Atlantic white-cedar seedling stocking rates are over 50 times higher on the natural regeneration site than the adjacent planted site. However, the height class distribution of the cedar seedlings at the two sites are radically different. On the natural regeneration site, 95% of the cedar stocking are under three feet tall while 52% of the competing stems are over three feet tall. On the planted site, all (100%) of the Atlantic white-cedar are over three feet tall, and 83% of the competition are over three feet tall.

Because competition is more severe on the natural regeneration site than the planted site, good survival of those cedar seedlings under three feet tall is not obtained without a release treatment (timber stand improvement). At this time, it is not clear what percentage of those 2,714 cedar seedlings per acre three or more feet tall on the natural regeneration site will survive the current intensity of competition until crown closure, when understory competition will finally begin to decline.

The pre-existing, well developed root systems on the planted cedar seedlings apparently gave them a 1-3 year head start over the competition. Virtually all of the 1,000 cedar seedlings per acre

originally planted have survived through four growing seasons and remain relatively free of competition for sunlight by virtue of their height advantage. It appears that most should survive through the crown closure stage without needing release.

#### Lynn-Middle Ditch Cedar Natural Regeneration Area:

Lynn-Middle AWC Natural Regeneration--5 years post treatment

Treatment Type	Species	# Tree Seedlings Per Acre by Height Class						All
		< 0.5'	0.5-1'	1-2'	2-3'	3-4'	>4'	
KG-Blade Sheared	AW Cedar	4333	3333	2667	3333	2333	7667	23667
'86, No Chemical,	S. Peprbsh	0	0	1167	667	1000	3833	6667
Natural Seeding	R. Bay	1167	0	0	0	0	833	2000
Atl. W. Cedar	R. Maple	3000	1167	667	0	0	0	4833
	Ilex sp.	0	0	0	0	0	500	500
(Avg. of 3 Plots)	Poison Ivy	500	167	667	167	0	0	1500
	Smilax sp.	0	333	0	333	0	833	1500
	Unkn. Shrub	0	0	0	167	0	0	167
	All	9000	5000	5167	4667	3333	13667	40833

Standing Water 63% of Ground Surface

The Lynn-Middle Ditch Atlantic white-cedar site was another natural regeneration trial. Total stocking for all species at this site (40,833 stems per acre) was comparable with that for the similarly treated Camp-Jericho natural cedar regeneration trial (58,509 stems per acre). Atlantic white-cedar stocking was not quite as high at the Lynn-Middle site (23,667 seedlings per acre) as the Jericho-Camp site (51,135 seedlings per acre). However, this site was significantly wetter than the Camp Ditch Site.

The distribution of cedar seedlings by height class was also significantly different from that at the Camp-Jericho site. At Lynn-Middle, 42% (10,000 seedlings per acre) exceed three feet tall compared with just 5% (2,714 seedlings per acre) at Camp-Jericho. Additionally, the cedar seedling height class distribution was similar to that for all competing woody stems. This indicates that the cedar seedlings were at least keeping up with the competition, unlike the Camp-Jericho natural regeneration site. However, the Lynn-Middle cedar seedlings did not show any significant height advantage over the competition as was evident at the Camp-Jericho planting site. Release may be necessary, however, prior to crown closure. Therefore, another stocking survey should be completed in 3-5 years at this site.

## East Ditch Bald Cypress Natural Regeneration Area:

East Ditch Bald Cypress Natural Regeneration Site--5 years post treatment

Treatment Type	Species	# Tree Seedlings Per Acre by Height Class						All
		< 0.5'	0.5-1'	1-2'	2-3'	3-4'	>4'	
KG-Blade Sheared	Bald Cypress	0	0	500	1167	333	167	2167
'86, No Chemical	Sweetgum	0	167	667	0	0	0	833
Natural Seeding	Nyssa sp.	0	2167	1167	0	0	0	3333
Bald Cypress	Switchcane	0	0	333	167	0	0	500
	All	0	2333	2667	1333	333	167	6833

(Avg. for 3 Plots)

Standing Water 74% of Ground Surface

The East Ditch cypress natural regeneration trial site continued to be fully stocked (2,167 stems per acre) with bald cypress seedlings that are free-growing and staying ahead of the competition with good height growth. Over 75% of the 2,167 bald cypress seedlings per acre present are over two feet tall, while only 4% of the 4,666 stems per acre in competing stems exceed two feet tall. Continued high survival and good height growth of these cypress seedlings is expected without release for at least the next three years.

## Railroad Ditch Bald Cypress Planting Area:

Forestry Tech Miller and Forester Brownlie completed a fourth growing season bald cypress stocking and competition survey on May 14 at a 1988 cypress planting site just south of Railroad Ditch about 1.5 miles east of the Railroad and West Ditch intersection. Data reflected good survival and very good height growth observed for the planted cypress seedlings. A fully stocked, free-growing stand of mostly 4-6 foot tall bald cypress (many stems exceed seven feet) exists at the site. Red Maple was the primary woody competitor for the cypress followed by raspberry, but most cypress stems remained above this 1-3 foot tall woody competition as well as the even denser (woolgrass and switchcane) herbaceous competition. No cypress release treatment is needed at this time, and the next formal stocking survey can wait until the regularly scheduled 10th year survey (fall-winter of '97-'98). Visual inspections in 1994 and 1996 should provide adequate monitoring of the stand. Soils at the site appeared ideal for bald cypress with 28-43 inches of organic material over a sandy-clay mineral layer. The water table at survey time was 7-25 inches below the surface.

East Railroad Ditch Bald Cypress Plantation--4th season post-planting

Treatment Type	Species	# Tree Seedlings Per Acre by Height Class						All
		< 0.5	0.5-1'	1-2'	2-3'	3-4'	>4'	
KG-Blade Sheared	Bald Cypress	0	0	0	0	333	167	500
'87, No Chemical	Unkn. Caprif.	0	167	0	0	0	0	167
Planted Cypress '88	R. Maple	2167	6667	6500	167	0	0	15501
	Nyssa sp.	0	333	167	333	0	0	833
(Avg. of 3 Plots)	All	2167	7167	6667	500	333	167	17001
	Woolgrass 91% of ground surface							
	Blackberry 8% "	"	"	"	"	"	"	"
	Plume Grass 1% "	"	"	"	"	"	"	"
	Switchcane 1% "	"	"	"	"	"	"	"

Myrtle-Sycamore-Corapeake Pond Pine and Pocosin Burn Area:

All four remaining plots within the Myrtle-Sycamore Pocosin burn block and the adjacent (untreated) control plot were installed and measured by June 11.

NCSU Atlantic White-cedar Natural Regeneration Research Proposal:

On January 9, saw mill operator Brian Martin spoke with Forester Brownlie by phone. Brian had just purchased a high recovery band saw mill and expected to be ready to start milling cedar logs by late January. Mr. Martin asked if we had prepared a timber sale with any Atlantic white-cedar yet. Brian was again advised that the refuge was still years away from initiating timber sales. Brian then turned the discussion toward an experienced "swamp logger" (Pee Wee Temple) who had recently been released by Union Camp to independently find logging jobs. Brian asked if there was any possibility that a maple unit could be prepared for Mr. Temple to clear under a contract granting him salvage rights to any merchantable timber cleared in lieu of paying Mr. Temple for the land clearing.

On April 7, Forester Brownlie took another call from Brian Martin. Brian attended the Atlantic white-cedar field tour in North Carolina and was also favorably impressed with improvements seen in cedar seedling (for planting) production techniques on the tour. Brian asked to meet with Forester Brownlie and Project Leader Culp to discuss his ideas for establishing an Atlantic white cedar regeneration research project in hopes that increased reliability of cedar regeneration treatments might lead to increased availability of cedar timber sales from the refuge.

On May 4, Project Leader Culp and Forester Brownlie met with Mr. Martin Atlantic White Cedar restoration/research partnership possibilities. Brian indicated he plans to budget \$10,000/year for matching other partners in such a project. Forester Brownlie took Brian to the recently completed Corapeake-Forestline cedar natural regeneration trial site and shared slides and data showing other refuge cedar regeneration trial results with Brian following the



meeting at refuge headquarters. Brian subsequently contacted the North Carolina Forest Service who provided him with a written graduate research proposal from a North Carolina State University silviculturist.

On June 5, Forester Brownlie and SROS Knudsen met again with Brian Martin, North Carolina Forest Service Tree Improvement Specialist K.O. Somerville, and North Carolina State University Extension Forester William Gardner to discuss Atlantic white-cedar natural regeneration research possibilities on the refuge. There are now apparently one or two additional prospective financial partners interested in this project besides Brian Martin.

In late July, Brian furnished us with a copy of his letter offering North Carolina State University a \$10,000 gift over twelve months to support a graduate research project on natural regeneration of Atlantic white cedar. Forester Brownlie attempted to follow up with Bill Gardner of the North Carolina Cooperative Extension Service to determine the status of the draft research proposal for this project on July 30 but was unsuccessful.

On July 29, Forester Brownlie accompanied Mr. Martin and one of his clients on a visit to the Corapeake-Forestline cedar regeneration site completed last November. Although the water tables were as high as they have been since treatment at the site, there were at least 5-10 first year Atlantic white cedar seedling per square foot uniformly distributed across the site. Broad leaved shrubs, principally sweet pepperbush, from root suckering averaging 12-18 inches tall were also abundant at the site and already indicated that a follow-up release of cedar seedlings may be needed in a few years. While seeing so many cedar seedlings at this site so soon was gratifying, the cedar seedlings were still very fragile and may be facing stiff competition over the next few growing seasons.

On September 14, Forester Brownlie took a phone call from Bill Gardner, Extension Forester from North Carolina State University requesting a tour of refuge Atlantic White Cedar regeneration trials in October. The tour was provided on October 5-6 for graduate student Laura Greenwood, Dr. Bob Kellison, and K.O. Somerville. These individuals were also involved with investigating cedar regeneration at the Dare County, North Carolina, bombing range which is adjacent the Alligator River NWR.

During mid-November, Forester Brownlie received a phone call from Dr. Bob Kellison, a silviculture professor at North Carolina State University, following up on their October tour. Dr. Kellison stated that he and his (M.S.) graduate student Laura Greenwood did want to include at least two of the refuge cedar regeneration sites in Laura's research project and were interested in doing one additional regeneration trial on the refuge "beginning from scratch". Dr. Kellison also asked about procedure's for submitting a formal research proposal to us for approval and consideration for

cost-share funding to match Brian Martin's recent gift to NCSU. Forester Brownlie indicated that the refuge should be able to contribute equipment and personnel for accomplishing any actual management treatments but probably could not participate in floral or faunal sampling to a great extent. It appears NCSU and possibly the North Carolina Forest Service could provide extra labor and expertise for enhanced flora and faunal surveys at study sites.

Jim Johnson, Refuge Manager at Alligator River NWR contacted Forester Brownlie in late November about touring the refuge Atlantic white cedar regeneration sites on December 8-9 with several Air Force and possibly State of North Carolina staff. The Air Force had funded Alligator River NWR to conduct a multi-year Atlantic white cedar regeneration project on Dare County Bombing Range and Alligator River NWR lands. Unfortunately, all Dismal Swamp treatment sites were under 3-12 inches of water, and roads accessing several of them were also inundated. Therefore, the tour was postponed.

## 9. Fire

### General Overview

No fires were reported, no suppression action taken, and no detection flights were within the refuge during January or February. No prescribed burns were ignited either, since burn plans submitted in December had not yet been approved and returned to the refuge, and water tables at proposed burn sites were too high for burning.

March proved a busy month for refuge fire program activities including: an informal program review with RFMC Carter; a visit to neighboring Pocosin Lakes NWR in North Carolina; hosting part of an orientation for Service Branch of Fire Management staff from Boise and Washington, D.C. and from Region 4; the first wildfire of 1992 on March 3; and recruiting and selecting seasonal fire crew members (Tractor Operators).

There were no wild fires, detection flights or prescribed fires on the refuge during April. High fire danger levels prevailed during early April as cool, dry air behind typical winter and spring cold fronts passed through the area regularly. No prescribed burns were undertaken either, once again because burn plans remained unapproved and water tables high.

Early April's high fire dangers moderated somewhat during May when the weather turned warmer and more humid. However, this onset of normal summer weather also brought with it an increase in lightning. Lightning resulted in initial attack on a lightning caused wildfire on May 20, the second and last wildfire in 1992, and in detection flights on May 20 and 21. No prescribed burns were undertaken during May. May also saw completion of pre-season

preparations with the reporting of seasonal Tractor Operators (fire fighters) Vanessa Miller and Ken Powell and completion of physical fitness testing and annual fire line safety refresher training of all red carded refuge staff.

No initial attack action, fire detection flights, or prescribed burns were undertaken during June-August. Fire personnel worked on fire access road/fuel break maintenance and vegetation monitoring, including sampling woody fuel loadings, in addition to fire equipment maintenance during June. Fire Officer Brownlie and Forestry Tech Miller began control line location and marking at the New-Hudnell Ditch Pine prescribed burn unit on July 8. At month's end, the site was still too wet (water table too high) to begin constructing dozer line or burning and a need to post-pone the burn to the fall-winter season was becoming apparent. Forest and fire management activities were essentially shut down upon deployment of most of the station's fire management personnel for inter-agency fire suppression assignments on August 21-22. Fire Officer Brownlie went on a two-week assignment to the Southern Area Coordination Center as a Support Dispatcher for Crews and Aircraft resource orders, and Tractor Operators Poovey and Powell went to Idaho as a fire fighter and Squad Boss on a 20-person Type II hand crew, seeing duty on several fires near Boise.

No initial attack action or prescribed burns were undertaken for the remainder of 1992. The effects of well above average rainfall from late July through December kept fire dangers very low throughout the period. Most of the refuge was under several inches of water, as were sections of several roads during the period. Fire Officer Brownlie ended September by completing the fire management portions of the refuge annual work plan for FY 1993 and first quarter schedule for himself and all fire personnel.

Refuge personnel responded to what amounted to two false alarms during October. One detection flight was made during October in response to those false alarms, and another combination fire detection-refuge orientation and cover typing flight was made in November.

Late October through November was busy due to training and meetings that took Fire Officer Brownlie away from home a lot. While Fire Officer Brownlie was off station, Tractor Operators Poovey and Williams were busy mowing fire access roads-fuel breaks on the north end of the refuge. When he was home, Fire Officer Brownlie was heavily involved in reviewing applications and interviewing applicants for the Forestry Technician (Fire) vacancy, and coordinating arrangements for the S-205 (Fire Operations in the Urban/Wildland Interface) course scheduled for FY 1993.

On November 10, the refuge hosted and participated in the annual meeting between the Virginia Department of Forestry (VADOF) fire management personnel and service representatives from all Virginia

refuges. Participants reviewed and discussed the recently completed Cooperative Fire Suppression Agreement between the Service and VADOF. On November 13, Project Leader Culp and Fire Officer Brownlie accompanied Regional Fire Coordinator Carter to Elizabeth City to meet with North Carolina Forest Service fire management staff. Again, the topic was a Service Cooperative Fire Suppression Agreement with the State.

Several full days were spent on seasonal fire fighter recruiting and selection during March by Fire Officer Brownlie. A total of 11 applications were received for the one open position. Judy Driscoll from Personnel was of immense help during the entire process. Judy advised us on March 31 that the personnel action confirming Vanessa Miller's selection was finalized on March 30. The other current seasonal fire fighter, Tractor Operator Kenny Powell, was converted from intermittent to temporary full-time status.

Monday April 20 was "fire preparedness '92" day. Following the morning staff meeting, Fire Officer Brownlie presented the annual fire line safety refresher training that included Standards for Survival videotape series, the Butte Fire shelter Deployment, and the Your Fire Shelter videos for the majority of fire line qualified refuge staff. After show-time, came step-testing and 1.5 mile runs for the permanent fire staff that had not previously completed annual fitness testing during 1992. By month's end, Tractor Operators Poovey and Williams, SROS Knudsen, and Fire Officer Brownlie were ready for red-carding for the '92 fire season.

In early April, Office Assistant Sally Leary began calling and visiting prospective food and lodging vendors about their pricing schedules to establish preseason agreements in the event the refuge is ever faced with a "project" sized fire in the future. Forestry Tech Miller contacted Bob Carpenter at Eastern Shore of Virginia NWR about setting up dozer training there for Tractor Operators Poovey and Williams in late April. Fire Officer Brownlie spent April 27-28 updating fire training and fire line experience records along with physical fitness testing results for submission to RFMC Allen Carter so he could issue new "red cards" for the '92 fire season.

Seasonal Tractor Operators Vanessa Miller and Ken Powell reported as planned on May 18 and completed the step test and 1.5 mile run respectively by May 22. Forestry Tech Bruce Miller also passed the step test during May and Biologist Keel the 1.5 mile run in his usual staff humbling time. Ken Powell, Ralph Keel, and Brad Knudsen viewed Standards for Survival, Your Fire Shelter, and the Butte Fire Shelter Deployment videotapes on May 18. This completed annual fire safety refreshers for all refuge red carded staff for the 1992 season.



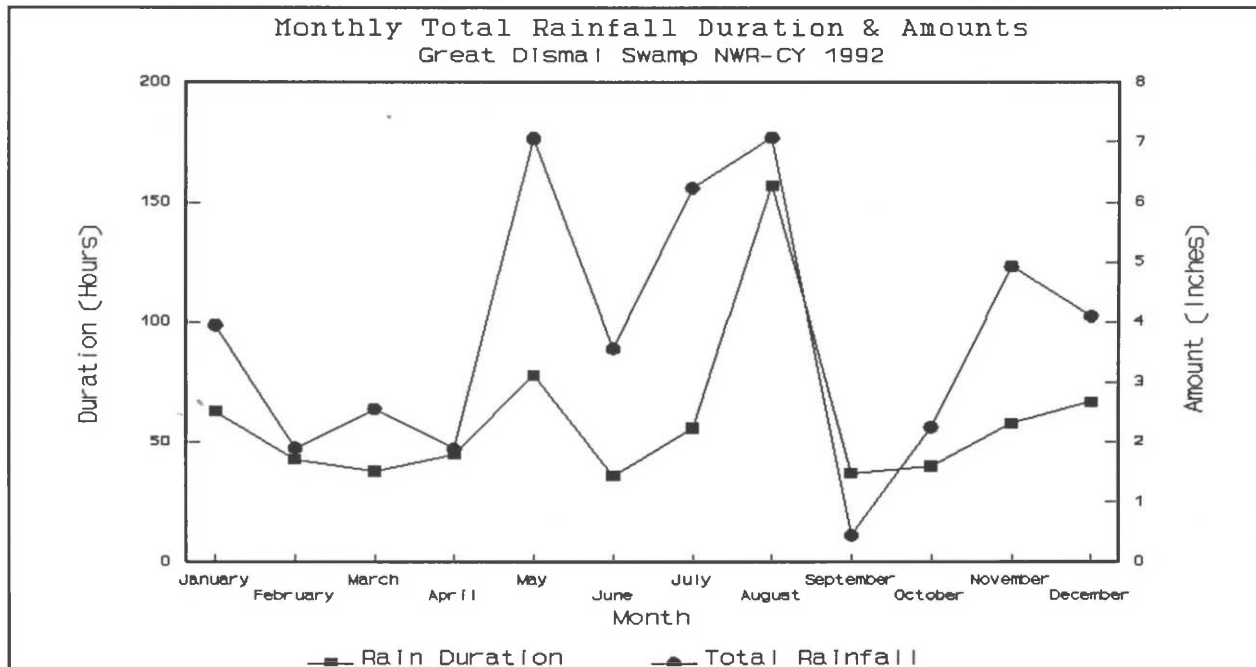
Preliminary fire training needs for FY 93 were identified in early July. Also, Fire Officer Brownlie started coordinating logistics for a S-205 (Fire in the Urban-Wildland Interface) course, tentatively scheduled in FY 93, by contacting a potential instructor from Missoula, Montana.

During November, Fire Officer Brownlie devoted several days to confirming the location, time, date, and lodging arrangements for the planned S-205 (Urban Interface) fire course. He was able to confirm the Virginia Beach Fire Training Center for June 21-23, 1993 along with a block of rooms at the nearby Radisson Hotel within per diem rates. He was also able to confirm Cindy Frenzel from the Virginia Department of Forestry as a speaker, addressing her recent work with local government planning and code enforcement personnel in western Virginia on urban-interface fire issues.

### Weather, Fire Danger and Ignitions

The following table and graphs summarize monthly and annual fire weather observations taken at the refuge automatic fire weather station during 1992.

	Mean Temps.		Mean RH%		(in.)	Rainfall		Wind (mph)	Fuel Moistures(%)		
	Max.	Min.	Max.	Min.		(Hrs)	(Cum.)		10-hr	100-hour	1000-hr
January	54.1	33.0	92	44	3.95	63	3.95	7.8	11.9	20.4	24.7
February	56.9	35.0	94	41	1.91	43	5.86	8.0	11.4	19.3	24.2
March	62.9	36.4	93	33	2.56	38	8.42	9.5	9.7	16.9	23.7
April	71.9	45.2	96	36	1.89	45	10.31	8.9	8.9	16.4	22.9
May	75.0	51.5	99	47	7.06	78	17.37	7.0	11.9	18.1	22.8
June	83.1	58.7	100	46	3.56	36	20.93	5.5	10.6	16.9	22.7
July	89.9	69.9	99	55	6.24	56	27.17	6.5	11.3	17.4	22.2
August	85.0	64.6	99	61	7.07 <sup>1/</sup>	157	34.24 <sup>*</sup>	5.6	13.3	23.5	23.5
Sept.	83.3	61.5	100	62	0.45 <sup>1/</sup>	37	34.69 <sup>*</sup>	6.3	11.9	19.4	24.4
October	71.2	44.9	100	53	2.25	40	36.94 <sup>*</sup>	6.8	10.6	20.1	24.2
Nov.	64.8	43.3	100	55	4.93	58	41.87 <sup>*</sup>	6.7	12.6	22.5	24.3
Dec.	54.1	36.0	97	55	4.10	67	45.97 <sup>*</sup>	8.0	13.2	22.6	24.7
1992 Mean Total	71.0	48.3	97	49	3.83 <sup>1/</sup> 45.97 <sup>1/</sup>	60 718		7.2	11.5	19.5	23.7

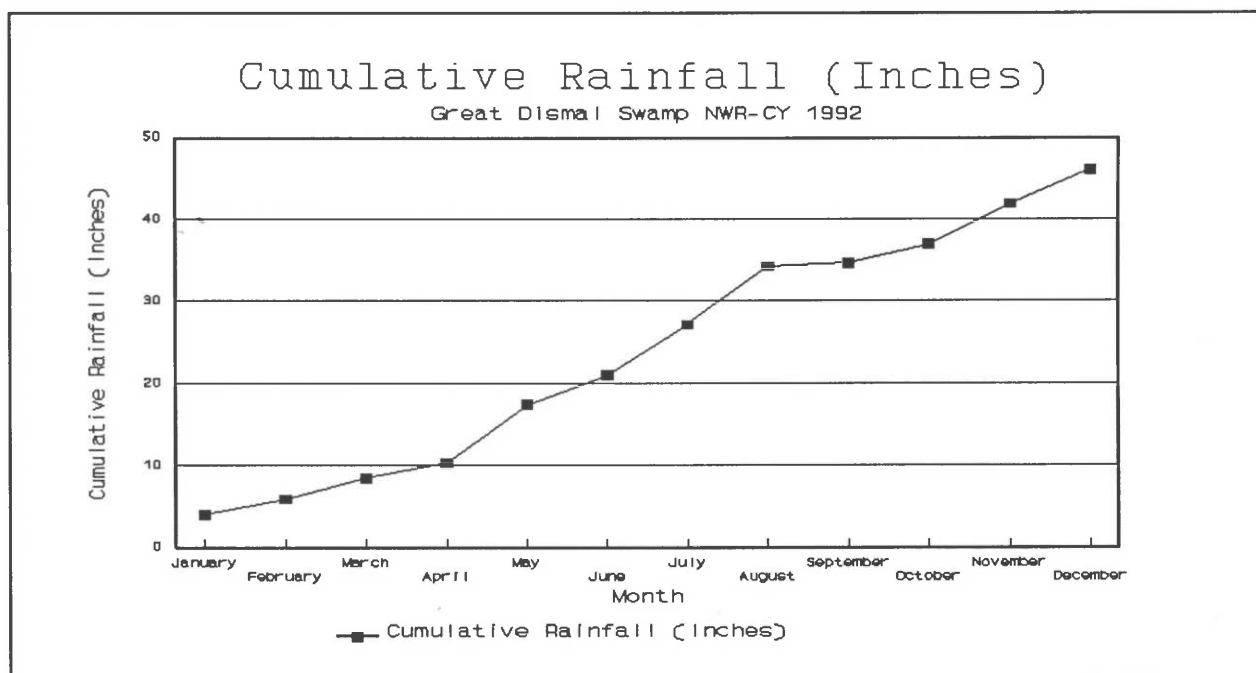


Except for a brief dry spell in mid-month, rainfall was fairly evenly distributed throughout January. The almost weekly rain showers were separated by cool, but dry and windy periods. Minimum daily relative humidities during the first half and last week in January generally remained at or above 40% but were consistently below 30% from January 15-26. Coupled with these low minimum relative humidities during mid-January were average wind speeds of 10-15 mph as a series of arctic cold fronts (Alberta Clippers) passed through the area.

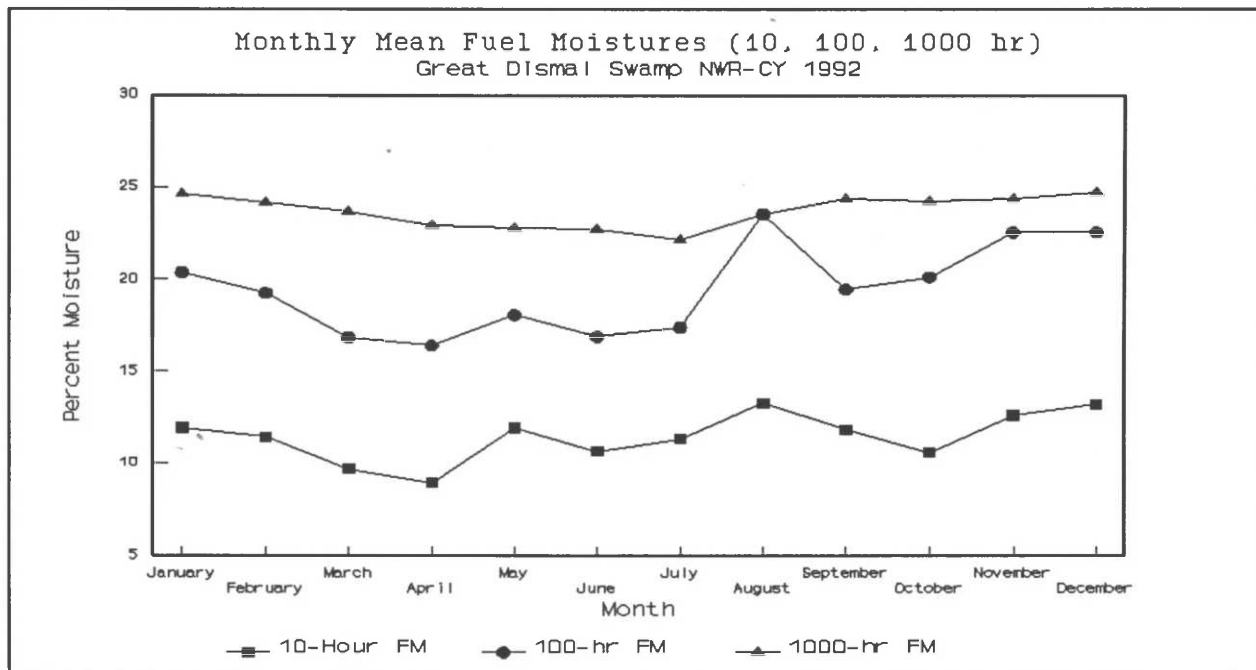
It was breezy, dry, and cool again through February 12 as a series of dry cold fronts again passed through the area. During this early period, no rainfall was recorded at the refuge fire weather station, and winds blew mostly from the north and west, commonly exceeding 10 mph. Correspondingly, 10-hour fuel moistures were below 10% on all but two of these first 12 days reaching a low of 7.1% on two days. The 100-hour fuels dropped to 14.8% moisture on February 6. Daily minimum relative humidities were generally in the 20-40% range, but overnight humidity recovery was good throughout the period (generally in the 80-100% range).

Weather data for February 13-26 contrasted sharply with the preceding 12 days. It rained on all but four days during this period, totalling 1.91 inches accumulation. Correspondingly, 10-hour fuel moistures were generally above 10% and commonly approaching 20%, while 100-hour fuels were in the low 20% range.

Humidities also were obviously high during the period. High pressure returned to the area near month's end, bringing clear, windy and dry weather back again. By February 29, the National Weather Service posted a Red Flag warning due to forecasted high winds, low relative humidities, and warmer temperatures.



The first wildfire of the 1992 season occurred in the early afternoon on March 3. The fire was under 0.1 acre, caused by inadequate monitoring of open trash burning by a private landowner adjoining the refuge boundary. Fire Officer Brownlie observed the residents scrambling for buckets and attempting to control the escaped trash fire while driving by at about 1:45 pm. Since the fire was threatening the refuge boundary and spreading from the neighbors lawn and garden area to forest litter, the refuge engine and fire crew were directed to take suppression action. Initial attack contained the fire outside the refuge boundary, and it was controlled by 2:20 pm. It was declared out on March 4. The Virginia Department of Forestry was notified on March 3, and the DI-1202 Individual Fire Report submitted to RFMC Carter on March 9.

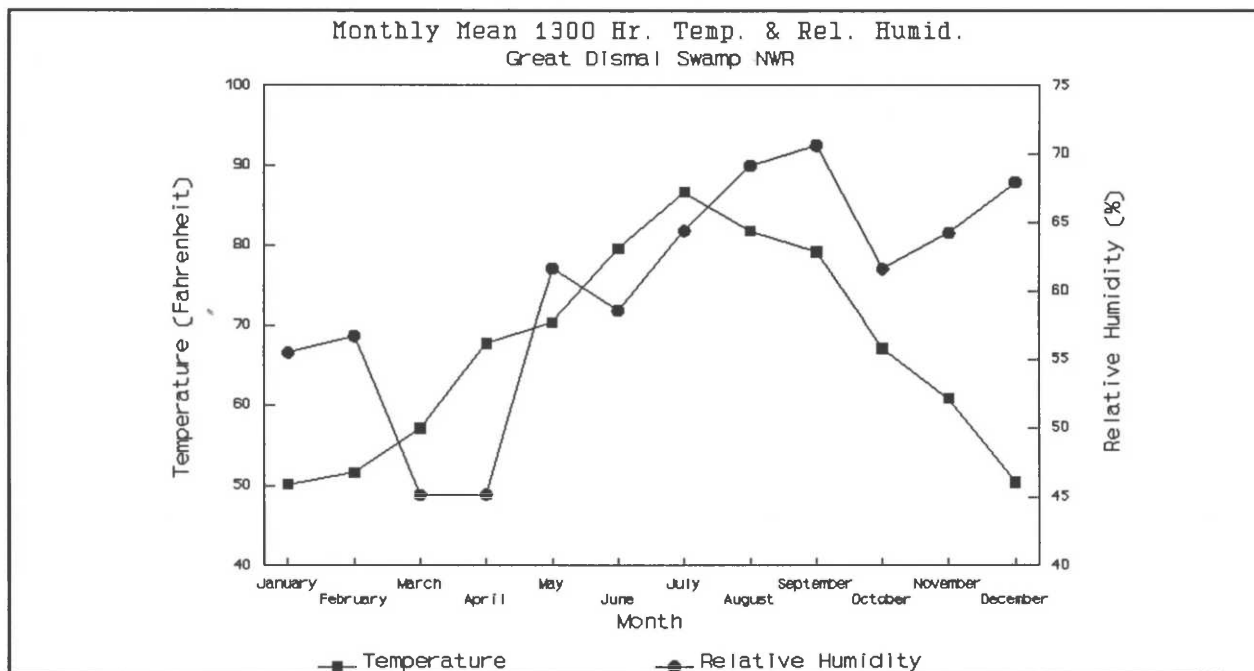


March was another month of alternating extremes in fire weather. Showers were well spaced and brought a total of 2.56 inches of rain. These showers provided only short-term relief, as they were separated by periods of very dry, windy weather and high fire dangers. Afternoon 10-hour fuel moistures were above 15% on just 3 of 31 recording days. These fuel moistures fell below 10% on 23 of 31 days and below 7% (dangerously dry) on March 2-3 and 17-18. Red Flag warnings were posted by the National Weather Service for Virginia several times during March. Fortunately, water tables in the swamp remained relatively high minimizing the risk of serious wild fires in the swamp interior. Perimeter fires remained the primary concern. Several weeks of above average rainfall were needed to stabilize or reverse a steady downward trend in the 1000 hour fuel moistures, an indicator of extended seasonal drought.

There were no wild fires, detection flights or prescribed fires on the refuge during April. High fire danger levels prevailed during early April as cool, dry air behind typical winter and spring cold fronts passed through the area regularly. Red flag warnings were common during the first half of April. Fortunately, water tables remained high throughout the swamp despite well below normal precipitation for the year, minimizing the probable severity of any fires that could have ignited. The last half of April saw the beginning of the typical warmer and more humid summer weather pattern along with the arrival of some badly needed, long duration rain showers. With the corresponding peaking of "leaf-out" near mid-month, fire dangers dropped considerably during the last half



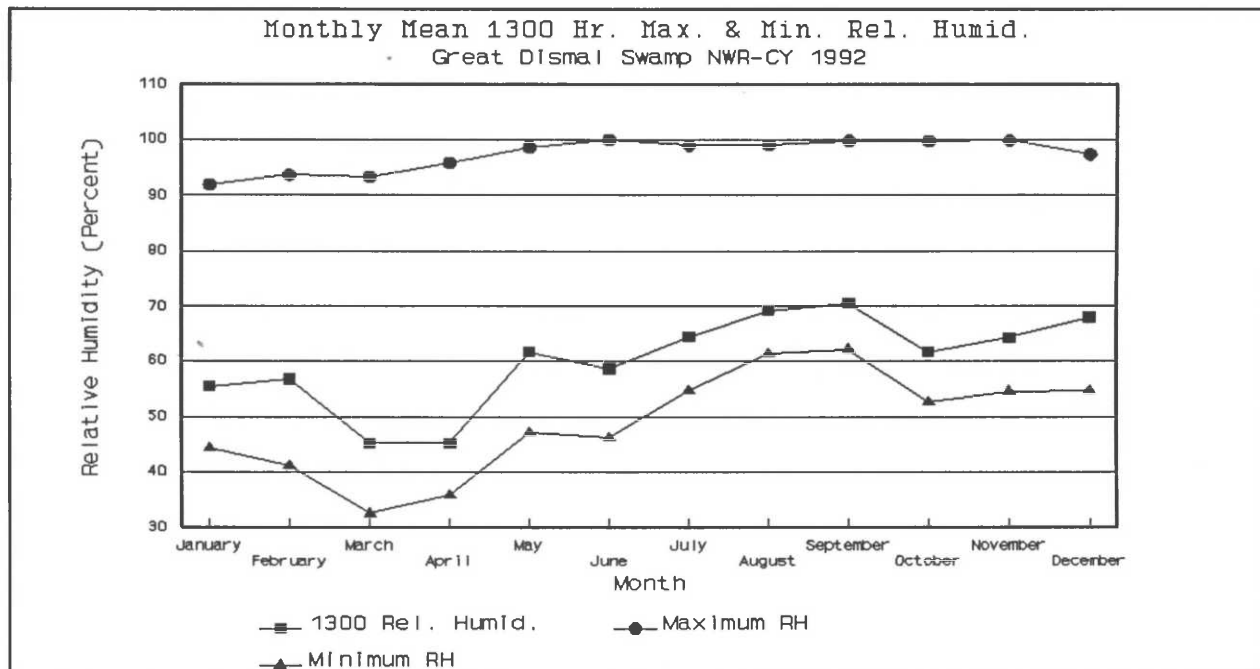
of April. However, with completion of "green-up", evapotranspiration was fully underway, and water tables began to fall noticeably.



Showers in April brought 1.89 inches of rainfall spread over 45 hours, allowing this moisture to soak into the soil and fuels. Afternoon 10-hour fuel moistures were above 15% on just 1 of 30 recording days but below 10% on 23 days and to dangerously dry (<7%) levels on 9 days. Late in April, both the 10-hour and 100-hour fuel moistures began an upward trend with the onset of the warmer, more humid summer weather pattern. However, the 1000-hour fuel moistures drought indicator continued its steady downward decline, dipping below 25% from April 11 through month end.

Fire danger levels during May moderated a bit as expected from April as warm, humid summer-like conditions continued. Thanks to over 5 inches of rain received during the month, fuel and soil moistures and water tables throughout the swamp stayed fairly high, keeping probable fire intensity and severity rather low. However, frequent cloud to ground lightning associated with showers greatly increased our chances for new ignitions. May showers brought nearly 5.5 inches of rain, spread over more than 60 hours. Three heavy downpours each about a week apart brought 4.29 inches of this monthly total. Afternoon 10-hour fuel moistures were above 15% on 6 of 29 recording days, below 10% on 15 days but never fell to dangerously dry (<7%) levels all month. The 1000-hour fuel moistures finally stabilized in the 23-25% range during May. The

driest period all month was May 21-26, when suppression efforts on the Phantom Fire were under way.



An intense lightning storm arrived over the refuge about 4:30 p.m. on May 18, accompanied by nearly 1.5 inches of rain received in just 3 hours. Project Leader Culp's wife Nora took the initial smoke report from the Suffolk Police Dept. around 6 p.m. on May 19. The smoke was discovered and reported as west of Lake Drummond by private pilot/instructor David Calder following an early afternoon flight over the area. Nora relayed the report to Acting Project Leader Knudsen at his home, who contacted Fire Officer Brownlie about 7:30 p.m.

Forestry Tech Bruce Miller and seasonal Tractor Operator Vanessa Miller were dispatched from their home to conduct a road patrol which began at 8:30 p.m. A few minutes later, Fire Officer Brownlie arrived at refuge headquarters for dispatching, and prepared an Incident Action Plan for the following morning once the road patrol proved unsuccessful in locating the fire. Before heading home near midnight, task assignments and incident objectives for the following day were discussed with Bruce and Vanessa.

Fire Officer Brownlie was not able to schedule a detection flight until noon on May 20 because of persistent early morning fog. Meanwhile, heavy equipment, vehicles, and refuge staff prepared for dispatch and were placed on standby at the maintenance shop. Fire

Officer Brownlie located the smoke from the air at 12:30 p.m., provided a fire size-up and directed refuge staff into the fire from the air. The intermittent smoke produced earned this fire the name "Phantom". It was located approximately 0.5 miles south of the West and Interior Ditch intersection and about 0.25 mile west of West Ditch. Forestry Tech Bruce Miller and Tractor Operators Poovey and Vanessa Miller arrived at the fire at 1:25 p.m. Bruce Miller sized-up the fire on the ground while Fire Officer Brownlie returned to the airport at 2:00 p.m.. Bruce reported that a very large bald cypress tree was burning and partially fallen, dropping firebrands over an approximately 0.1 acre area around the tree.

Incident Commander Miller elected "light on the land" rather than heavy equipment tactics given the low fire intensity and high surface fuel and soil moistures that allowed the extra time needed for such tactics. Also, using heavy equipment would have required the portable bridge for crossing West Ditch, adding logistical complexity. Chain saws were used to brush an access trail and path for an approximately 1,200 foot hose lay to the fire from West Ditch, and the hose lay was installed from the new Mark III portable pump and Flo-Mix foam proportioner setup at West Ditch. The first water and foam delivery to the fire occurred at 4:30 p.m. and continued until 7:30 p.m. when the fire was declared contained.

Tractor Operators Powell and Williams, Maintenance Mechanic Winningham, and even RFMC Carter assisted at the fire site with line clearing, water delivery system setup, and operating pumps and nozzles. Personnel were fed one meal on the fire line along with ORP Cherry who stayed late to dispatch back at headquarters. RFMC Carter, ORP Cherry, and Office Assistant Leary all assisted Helen Marlin at headquarters with dispatching. Heavy Equipment Operator White helped organize logistical activities at the maintenance shop as well. In short, virtually all of the refuge staff contributed to a smooth, effective and very professional suppression response, causing minimal soil or vegetation disturbance.

The Phantom Fire was revisited by ground personnel the morning of May 21. The last couple of smokes remaining were extinguished, and the burn area was treated with foam and water through the remainder of the day. Fire Officer Brownlie also flew over the fire shortly afternoon during a follow-up refuge detection flight and observed no smokes. The fire was declared controlled at 3:00 p.m..

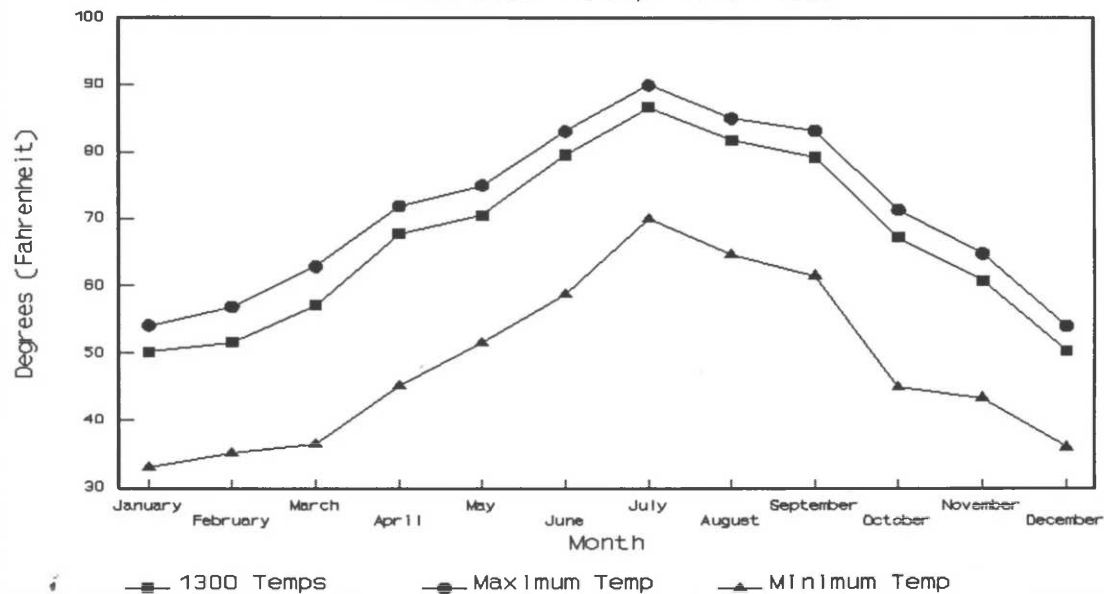
The tactics employed were efficient and effective on this fire, thanks largely to several new pieces of equipment purchased over the past two seasons including the new slip-on engine, Mark III portable pump, chain saws, and Flo-Mix foam proportioner. Everyone involved was especially impressed by the effectiveness of the portable foam proportioning unit on this fire.

Not surprisingly, locating and establishing access to the fire proved the most difficult and time consuming part of the

suppression response. A shortage of serviceable portable radios hampered communications between the aerial observer and Incident Commander when away from his vehicle and from the fire site to pump setup and equipment staging area at West Ditch. This really reinforced the need to make the switch to our new high band radio system without further delay. By the weekend, the weather and ground fuels became much drier, so it was critical to find and extinguish this fire while it was still very small. If left undetected or to burn for another 2-3 days, surface peat layers would have burned readily, making suppression much more difficult than it was.

# Monthly Mean 1300 hr, Max. & Min. Temps.

Great Dismal Swamp NWR-CY 1992





**Foam was applied to a large, lightning-struck bald cypress during the Phantom Fire. (DIS-92-28,DJB,5/92)**

June began where May left off --- wet. But by mid-June, wildfire potential increased as hot, dry weather returned. The monthly total rainfall was 3.56 inches, which occurred over a total of 36 hours. However, 1.24 inches fell from June 4-6 and 1.28 fell on June 27. Between June 6 and 27, only two showers (June 9-10 and June 20-22) occurred, totaling just over an inch. Eight hot, dry days without rain were experienced from June 11-19. Water tables fell significantly over much of the refuge.

Afternoon 10-hour fuel moistures exceeded 15% on just four days and were below 10% on 19 days, but they did not fall below the dangerously dry 7% level. The 100-hour fuel moistures averaged 15-16%, ranging from just over 14% to over 21%, significantly lower than during May. The 1000-hour fuel moistures fell slowly from nearly 25% in early June to a bit over 23% late in June.

Nationally, fire activity continued to pick up throughout June, but shifted more toward western areas. Activity did continue in parts of the east (New Jersey and Maine especially) but subsided in the rest of the east and midwestern states. Discussions about strategies for positioning fire fighting resources around the critically dry west began between agencies. One report discussed sending eastern crews and a Type II overhead team from the east by train to standby locations in western states. That same report indicated expectations that overhead qualified personnel would be the ones hardest to find.

July started out and ended wet, but was hot in the middle. Between



July 1-6, the automatic weather station recorded 2.42 inches of rain. No rain was recorded from July 7-18, but 3.82 inches was recorded between July 19 and July 28 for a monthly total of 6.24 inches. This 6.24 inches of rain fell over a total of 56 hours. These heavy thundershowers helped keep water tables high throughout the swamp, no doubt accounting for the absence of ignitions despite heavy lightning activity. The 12-day period without any rainfall was the hottest period all season. Afternoon fuel moisture observations reflected the two extremes. Afternoon 10-hour fuel moistures exceeded 15% on six of 29 recording days, were below 10% on 17 days, and dropped below the dangerously dry level (7%) on one day. The 100-hour moistures averaged 14-17%, ranging from just over 14% to over 21% similar to June levels. The 1000-hour fuel moistures continued hovering in the 23-24% vicinity throughout July but fell slightly below 23% on July 16, 22, and 28.

September began and remained wet through September 8, turned dry and cool until September 18, then wet again until September 26, finally ending cool, dry and fall-like. Unfortunately, the rain gauge at the automatic fire weather station was not working properly from about August 21-September 21, so rainfall data for those two months were incomplete. Afternoon 10-hour fuel moistures exceeded 15% on 7 days and fell below 10% on 15 days but never fell below the dangerously dry 7% level. The 100-hour fuel moistures averaged 18-20%, ranging from 17.5% to 25% well above the July levels. The 1000-hr fuel moistures computed were lower than actual, because the rainfall amount and duration data used in calculations were 0 because of the rain gauge failure.

On October 19, Forester Brownlie received a call from a local pilot reporting smoke, possibly on the refuge, although the description was vague. A ground search was conducted by Biologist Keel, and Fire Officer Brownlie climbed the Jericho fire tower, but no hints of smoke or fire were detected. The next day, a plane was available, and Brownlie flew surveillance over the refuge from noon to 2:00 PM. Again, no smoke or sign of fire was observed. The report may have been dust from the ongoing peanut harvesting drifting over the refuge. It may also have been smoke from a lightning struck bald cypress along Corapeake Ditch, discovered in late winter by Forestry Tech Poovey.

October was quite dry until a heavy shower beginning October 31. Shortly after the heavy Halloween shower, a series of closely spaced moderate to heavy showers occurred in early November. This was followed by a prolonged dry spell through November 24. Over two inches of rain were then received from November 25-28. Total recorded rainfall for October was 2.25 inches and for November was 4.93 inches.

Afternoon 10-hour fuel moistures exceeded 15% on six days in October and 10 days in November. Those 10-hour fuel moistures fell below 10% on 22 days in October and 14 days in November and fell

below 7% (dangerously dry) on four days in late October, the period when refuge staff responded to the two false alarm smoke reports and Fire Officer Brownlie flew detection. The 100-hour fuel moistures averaged 19-23% during October, ranging from 18.5% to 26.4%, and averaged 20-26%, ranging from 19.8% to 28% in November. The 1000-hr fuel moistures were in the 25-27% range for October and November, reflecting the generally above normal precipitation experienced since late July.

December rainfall totaled 4.10 inches and was well distributed throughout the month. Total rainfall duration during December was 67 hours. Afternoon 10-hour fuel moistures exceeded 15% on 10 days and fell below 10% on 9 days. At no time during December did 10-hour fuel moistures drop below 7%. The 100-hour fuel moistures averaged 23-25%, ranging from 15.7% to 26.3% and 1000-hour fuel moistures continued to range from 24.2-25.3%.

### Burn Planning

On April 23, FMO Brownlie visited the New-Hudnell planned hazard fuel reduction burn site. He took several slides of fuel conditions inside and around the perimeter of the unit. He also inspected the foot bridges providing access and escape routes from the unit for burn team members on foot. This inspection was the first of several planned field visits that will be needed to write the prescribed burn proposal, lay out the unit, and establish interior fire lines.

Plot installation and measurement was completed for the proposed hazard fuel reduction burn unit between Myrtle, Sycamore, Laurel, and Corapeake Ditches beginning June 2 and ending June 11. Biologist Keel, Tractor Operators Vanessa Miller and Poovey, and Forestry Tech Bruce Miller provided most of the labor. College Coop Student Merwin also assisted along with Fire Officer Brownlie. This sampling effort provided an opportunity for further testing and training in using our newly adopted woody fuel transect procedures.

Vegetation and fuels monitoring plots were installed and measured by Tractor Operators Poovey and Vanessa Miller and High School Coop Student Weaver during June at the New-Hudnell Pine burn unit. Five plots were installed within the burn unit itself and an additional five control plots in adjacent similar pond pine not planned for burning.

Fire Officer Brownlie and Forestry Tech Miller began locating and marking control lines at the New-Hudnell Ditch Pine prescribed burn unit on July 8. The remainder of the 4,100 feet of planned dozer line location and marking was completed by Forestry Tech Miller and Tractor Operators Miller and Poovey the following week. At month's end, the site was still too wet to begin constructing dozer line or burning.

### Intra/Inter-agency Coordination

On March 9, RFMC Carter held a brief Fire Management Program review with refuge staff and discussed arrangements for the visit by R-4 and Service Branch of Fire Management personnel. On March 10, Project Leader Culp and Fire Officer Brownlie traveled to Pocosin Lakes NWR near Plymouth, North Carolina, for an orientation and tour of neighboring refuge (Region 4) fire management programs and fuel types by Steve Fowler, FMO, and Chris Farenniti, Fire Control Officer. On March 17, the refuge hosted Roger Erb, Service Fire Management Coordinator; Bill Hartwig and Shaw Davis from the Washington Office; Skippy Reeves, RFMC for R-4; Steve Fowler and Chris Farenniti for a fire management tour. After a brief orientation to the refuge in the headquarters conference room, a demonstration of our automatic fire weather station, a tour of the refuge fire cache and equipment, the group broke up for aerial and ground tours of the refuge and further budget discussions at refuge headquarters.

On April 8, Fire Officer Brownlie contacted Carl Garrison with the Virginia Department of Forestry to discuss the prospects of collaborating to foster more of an interagency approach to the urban-wildland interface situation on the north end of the refuge. Carl expressed great interest in possibly jointly sponsoring the S-205 Fire Operations in the Urban-Wildland Interface course during FY'93 for our respective agency personnel and local structural fire department personnel.

On November 10, the refuge hosted and participated in the annual meeting between the Virginia Department of Forestry (VADOF) fire management personnel and service representatives from all Virginia refuges. A review and discussion of the recently completed Cooperative Fire Suppression Agreement between the Service and VADOF was the primary topic.

On November 13, Project Leader Culp and Fire Officer Brownlie accompanied Regional Fire Coordinator Carter to Elizabeth City to meet with North Carolina Forest Service fire management staff. Again, the topic was a Service Cooperative Fire Suppression Agreement with the State. The North Carolina Forest Service expressed a desire to renegotiate the existing agreement to make it consistent between U.S. Fish and Wildlife Service Regions 4 and 5. Most significantly, North Carolina requested an annual payment of \$0.40/acre within North Carolina for pre-suppression expenses. RFMC Carter will be working closely with R-4 fire management staff on this matter.

Fire Officer Brownlie left again from November 16-20 for the Long Island Complex NWR. He participated in a refuge fire program review by refuge staff, Regional Fire Coordinator Carter, and Sunkhaze Meadows NWR Fire Officer Vollick during the first half of the week. Seeing common problems and differences faced by another

refuge first hand was very beneficial. The rest of the week was spent in the annual R-5 Fire Management Officer's meeting and planning session for basic fire management training courses at the Wertheim NWR headquarters.

Fire Officer Brownlie left again on November 30 to attend the Region 4 Fire Management Officer's Workshop at the Georgia Forestry Commission headquarters facility in Macon, Georgia. Unfortunately, the intended drug testing training by Department personnel was dropped when the Departmental drug testing program folks cancelled travel plans following a recent Inspector General's review of the Interior program.

#### Fire Management Information System (FMIS) Testing

Fire Officer Brownlie logged on to the FMIS for the first time on March 3 for initial testing. He subsequently logged on for additional testing sessions on March 23 and 31. Several "dummy" Individual Fire Reports were entered for a variety of fire types. A few minor "bugs" were detected during these exercises and reported by phone to Andrea Olson at BIFC. These bugs were quickly corrected, and it looks like the Fire Reporting portion of the overall system will soon be ready for Service-wide use.

Final tests of the new Individual Fire Reporting module were made April 16 by Fire Officer Brownlie. The few "bugs" found during earlier testing were virtually gone. Dave also experimented with accessing the Fire Effects Information System (Bill Leenhouts is the Service liaison) and successfully downloaded an overview of Atlantic white-cedar fire ecology and fire effects on April 16. Fire Officer Brownlie also used the fire weather station software to access and download weather data from the weather station's new twin at nearby Pocosin Lakes NWR (Region 4) on April 9 and again in late December when Mackey Island NWR (Region 4) installed their station.

#### Pre-suppression and Suppression Assistance

On January 16, FMO Brownlie traveled to NASA's Wallops Island training facility along with RFMC Carter and Sunkhaze Meadows FMO Rick Vollick. These three individuals planned the S-130\190 Basic Fire-fighting-Basic Fire Behavior course to be taught in late February and also discussed R-5 fire management issues January 16-17.

Fire personnel from Pocosin Lakes NWR picked up our portable bridge truck and trailer on April 29. They hoped several of their local machine shops would inspect it and submit bids for constructing two similar bridges for their refuge.

## 10. Pest Control

Field personnel from North Carolina's accelerated gypsy moth monitoring project "Stop the Spread" visited the refuge during early June to place delta-style gypsy moth traps throughout the southwest portion of the refuge. In late June, Forester Brownlie also fielded a request from a private consultant currently under contract with the U.S. Environmental Protection Agency and U.S. Forest Service for permission to enter the refuge for plot installation and measurement. The consultant's six-person field crew arrived at the refuge in July to install a forest health monitoring plot, one of eleven in Virginia and part of a nationwide assessment of forest health now under way.

Forester Brownlie made the mid-season check of gypsy moth traps previously installed in late May at the Washington Ditch and Jericho Lane entrances on July 30. The two traps at Washington Ditch held 4 and 5 male gypsy moths respectively, somewhat above the long-term average for this site but consistent with "quarantine levels" common to the area. There was no evidence of gypsy moth defoliation noted anywhere on the refuge however. One of the two traps at Jericho Lane was not recovered (damaged or destroyed), and the other held no moths but held many small beetles and about 1/16" of water which may have hindered effectiveness of this trap. The North Carolina monitoring crew reported considerably higher numbers of moths per trap than they originally expected but no evidence of defoliation.

On September 10, Forester Brownlie recovered three of the four gypsy moth traps placed in the field during late May. Despite the loss of one of the four traps, 11 male moths were counted over the season. The last three years of monitoring are summarized as follows:

Year of Traps	Number	Number	Moths
		of Moths	per Trap
1990	6	7	1.17
1991	4	7	1.75
1992	3	11	3.67

With these generally high and apparently increasing levels, the Forest Pest Management staff advised the refuge of their desire to conduct gypsy moth egg mass surveys in the refuge vicinity during the fall. Continued monitoring during 1993 can also be expected.



## 12. Wilderness and Special Areas

The refuge has been recognized as a prominent state and national resource. As a National Natural Landmark, periodic status reports on the condition of the area are submitted to the National Park Service. The North Carolina portion of the refuge has been designated as a Natural Heritage Area by the state's Natural Heritage Program. This voluntary program does not prohibit active habitat management or future development of educational and interpretive facilities. The specific features which drew this state designation include:

- One of the largest remaining stands of Atlantic white-cedar (7,000 acres) in public ownership.
- The northern-most pocosin community type under public protection.
- A 60 acre remnant marsh that is apparently the only open marsh in the swamp.
- Several rare plant species including the log fern (Dryopteris celsa), the silky camellia (Stewartia malacodendron), and the dwarf trillium (Trillium pusillum virginianum).

## G. WILDLIFE

### 1. Wildlife Diversity

To the casual visitor, the refuge may be just a hot, humid, monotonous tangle of trees, dense underbrush and vines that is infested with snakes and biting insects. However, the presence of five forest cover types as well as marsh, bog, pocosin, and a 3100 acre shallow blackwater lake provides a variety of habitats. Unfortunately, some types occupy a disproportionate share of swamp. For example, the maple-gum type covers approximately 60% of the refuge, while mesic hardwoods and some other community types each comprise less than 1 % of the cover. The interspersation of types is less than ideal for wildlife diversity. Maple-gum and Atlantic white cedar are dispersed throughout the refuge, but mesic hardwoods and loblolly pine are limited mainly to the elevated mineral soils along the western and northern perimeters. Nevertheless, found collectively within this swamp ecosystem are at least 43 tree species, 26 shrubs, 21 vines, 17 ferns, 60 herbaceous plants, and over nine species of grasses, sedges and rushes which support the wildlife diversity that is listed as follows:

Mammals	- 42 species
Birds	- 209 species (92 nesting species)
Reptiles and amphibians	- 62 species
Fish	- 27 species
Invertebrates	- unknown

### 2. Endangered and Threatened Species

One lone adult bald eagle was observed on January 2 along the northwest shoreline of Lake Drummond. No further sightings were made until November 6 when four eagles (3 adults, 1 immature) were observed by Biologist Keel. Later in December, one lone adult eagle was seen on three separate occasions (December 19, 21, 22). No eagle has nested in the swamp since 1961.

The canebrake rattlesnake, a state-listed endangered species in Virginia, inhabits the refuge. The only "canebrake" sighting was made by Brad Knudsen on West Ditch Road in June.

The subspecies, Plecotus rafinesquii macrotes, of the eastern big-eared bat is known in Virginia by only five occurrences in the southeaster part of the state. It is designated as an endangered species (state-listed) in Virginia and a Category 2 species at the federal level. This bat is at the northern extremity of its range and its numbers are considered small. The June 1897 confirmation of this bat in Virginia was of one found roosting in a small hollow cypress snag in the eastern portion of Lake Drummond.

A manatee was sighted in the Deep Creek locks of the Dismal Swamp.

Canal on September 28 and received a lot of TV coverage. The manatee was passed through the lock, and it headed south to the Pasquotank River after passing through the South Mills lock at about 10:00 am on September 29. Manatees have been sighted in Virginia waters before, but this one was the first known sighting in the Dismal Swamp Canal, which is maintained and administered by the U.S. Army Corps of Engineers as part of the Intra Coastal Waterway.

The Dismal Swamp shrew, Sorex longirostris fisheri, has the heart of its range within the refuge and has been assigned federal "threatened" status since 1986. Biologist Keel attended a February 10 meeting of the shrew recovery team members at Old Dominion University. The consensus of the group was that the shrew would not be de-listed from its threaten status because of habitat loss. Refuge Manager Culp was assigned to the recovery team late in the year to participate in the preparation of the recovery plan in 1993.

### 3. Waterfowl

Great Dismal Swamp is not noted for large spectacular concentrations of waterfowl, but it does provide scattered year-round habitat for wood ducks. Lake Drummond provides sanctuary for swans and geese during the late fall and winter months.

January found only 125 tundra swans on Lake Drummond along with a few puddle ducks. Tundra swan use was not noted on the lake again until November 30. Snow geese (3,500) were observed on the lake on December 19 for the first time in at least ten years. Lesser scaup (120) were first noted on the lake on October 18.

#### LAKE DRUMMOND WATERFOWL USE

Species	Peak Population	Date
Tundra Swan	368	12/21
Snow Goose	5000	12/22
Lesser Scaup	250	11/1
American Widgeon	250	11/15

No Canada geese were observed on the lake for the fourth consecutive year. In past years, up to one thousand honkers have roosted on the lake.

By March, wood ducks and mallards were the primary waterfowl species using the refuge along with about thirty ringed-neck ducks in the fringe marsh area. On March 9, three wood duck nesting starts were noted in nest boxes located in Water Management Unit 4 with incubation underway in one of the boxes. The first wood duck brood was observed on April 24. Ten waterfowl broods, all wood ducks except for one mallard brood, were observed in April. Eleven

additional broods, all wood ducks, were recorded in May.

The wood duck nest boxes were checked during the July 20-29 period. Nest box production for wood ducks increased 20% with 138 ducklings exiting the boxes. The increase in production in spite of a slightly lower occupancy rate and nest success may be due to multiple hatches from individual boxes.

#### Wood Duck Nest Box Use/Production

	<u>1992</u>	<u>1991</u>	<u>% change</u>
Boxes Available	62	62	0
Occupancy Rate	42%	44%	-2%
Nest Efficiency	73%	85%	-12%
Mean Clutch Size	58%	57%	+1%
Ducklings Exiting Box	9.2	7.5	+23%
Dump Nest	13	15	+20%
Other Bird Use (boxes)	1	1	0
Mud Daubers/Wasps/Bees	16	7	+128%

No wood duck use was found in any of the ten Bellrose double-walled plastic boxes which were located so they would be shaded from the sun. The pole for one wood nest box was chewed off by a black bear, but the box and predator guard were salvaged. One Bellrose box had claw and bear tooth marks but remained in good shape. Other nest box users in the mud daubers/wasps/bees category increased significantly with mud daubers accounting for the majority.

Total waterfowl production for 1992 is estimated at 300 birds based on nest box checks and other broods sighted throughout the refuge. Wood ducks accounted for all the production except for ten mallards.

#### 4. Marsh and Water Birds

Great blue herons used the swamp refuge throughout the year but no large or unusual concentrations were noted. Green-back herons are a common nester along the ditches, but no concentration was noted until September when 194 herons were counted coming into the flooded bog burn site during an evening wood duck roost count. The green-back herons were conspicuous by their complete absence during an October roost count.

A common moorhen was observed in the flooded Railroad/West Ditch management site on September 10. Although the moorhen is on the refuge bird list, it is rarely sighted.

## 5. Shorebirds, Gulls, Terns and Allied Species

The ringed-billed gull was a year-round resident of refuge, utilizing Lake Drummond primarily for roosting. The laughing gull was occasionally seen during the spring and summer on the lake. The gulls were most obvious following farm tractors discing fields to the west and east of the refuge.

## 6. Raptors

The red-shouldered hawk and the red-tailed hawk continued to be the most commonly detected hawks in the swamp. The red-shouldered was more often heard than seen, while the red-tailed was frequently seen hunting the road cuts through the forest. The American kestrel, although a nester in the swamp, was seen only along White Marsh and Desert Roads hunting from power-line perches.

The barred, great horned, and screech owls are year-round residents of the swamp. The barred and great horned owl were frequently heard but seen only occasionally.

## 7. Other Migratory Birds

A black-billed cuckoo was identified by sight and sound by several reliable birders during the Virginia Society of Ornithology field trip on April 25-26. The black-billed cuckoo is listed on the refuge bird list as only an "occasional" species during the spring. The yellow-billed cuckoo far out-numbers the black-billed in the swamp.

The sixteenth annual Dismal Swamp Spring Bird Count was conducted on May 9 by local Audubon members. No unusual sightings were reported.

The Breeding Bird Survey (BBS) route, established in the Virginia portion of the swamp several years ago by Brooke Meanley, became an official BBS route this year. Don Schwab, state biologist, had taken over the route for the past six years and conducted the survey with no other participants this year. The survey, conducted on June 1, recorded fifty-one species. As usual, the prothonotary warbler or "swamp canary" was the most abundant species. The top five species on the route were:

1.	Prothonotry warbler	121
2.	Common yellowthroat	62
3.	Common grackle	43
4.	Wood thrush	30
5.	Gray catbird/White-eyed Vireo	23

Efforts by refuge personnel to establish another 25-mile BBS route in the southern portion of the refuge fell through when it was learned at the eleventh hour from Patuxent Wildlife Research Center that



the route could not cross state lines. The route map will be resubmitted for 1993 with the BBS route kept entirely within the North Carolina portion of the refuge. Establishment of another route is desired due to the increased emphasis on neotropical migrants and the importance of a large forested wetland to these and other bird species.

#### 8. Game Mammals

Black bear sightings were reported for six months of the year. The first sighting was reported on May 9, almost one month later than last year (April 8). Sightings peaked in July when twelve bears were reported by refuge personnel and researchers. Nine of the July sightings occurred on July 1, about the time blackberries growing along the ditch banks reached their peak ripeness.

A sow bear with three cubs was reported by Brian Poovey and Kenny Powell on the State Park property (Corapeake Road) in the swamp. In October, there were two reports by hunters of a sow bear with three cubs. The last bear sighting was made by Biologist Keel on December 22 as it crossed South Ditch Road. Two other bears were observed on the north end of Weyerhaeuser Ditch Road in December.

In August, Don Schwab reported that nine bears had been killed, seven under crop depredation permits and two road kills. Bear hunting is not permitted on the refuge but they are hunted in both North Carolina and Virginia on lands adjacent to the refuge. They may also be killed for crop depredation outside the hunting season.

White tailed deer continued to be the most abundant big game species and the only one hunted legally on the refuge. Hunters killed a known 215 deer during 9.5 hunt days in October. Three hunt days in November got rained out due to poor road conditions. The total harvest was down 42% from 1991, which was a record year. The percentage of does (44%) was up one percentage point over last year.

The Virginia Department of Game and Inland Fisheries provided 250 Deer Management Assistance Program (DMAP) tags for antlerless deer. A total of 163 tags were issued, and only 22 tags (14%) were used. Of these 22 tags, 73% were does. The DMAP kill accounted for about 10% of the total deer killed compared to 16% and 20% in 1991 and 1990 respectively.

Complete age, sex and weight data were obtained on 83% of the reported kill. The biggest deer was a 142-pound field-dressed, 8-point buck taken by Bryan Harrison of Virginia Beach.

Fifty-six per cent of the aged deer (N=178) were 1 1/2 years-old or younger. The average weight (67.7 lbs) of 1 1/2 year-old bucks (N=37) was down about 1%, while the average weight of 1 1/2 year-old does (N=24) dropped five pounds (8.2%) from 1991 figures.

## 10. Other Resident Wildlife

Beaver continued to increase their area of presence on the refuge. The discovery of five new dams brought the dam network up to 25 dams and 3 culvert plugs. Beaver activity was noted in Hardwood Ditch for the first time this year. Three beaver sightings were made this year. Two new food items for the refuge were added to their menu list this year - pine saplings and switch cane.

Otter sign was abundant at most ditch/canal junctions throughout the refuge by June when the first otter was observed. Three otters, one pair in Cross Canal and a lone otter in County Line Ditch, were noted during June. Two otters were observed in Forest Line Ditch during September and may have been the same pair seen in Cross Canal. Higher than usual water levels from late August on through December may have permitted the otter population to forage farther from the ditches. Even so, otter sightings were up over 1991.

Four bobcat sightings were reported by refuge employees this year, up from two in 1991. The first sightings were of two individual cats in June. One bobcat was seen on Corapeake Ditch road on August 31. The sighting of another bobcat the following day in the same area may have been the same individual.

The eastern wild turkey, a native resident of the Dismal Swamp, was observed for the first time this year on March 17 on Railroad Ditch Road. Turkey sign was noted on Hardwood Ditch Road later in March. Turkey sightings were reported in April, May, and July, but no poults were seen. Deer hunters continued to report hearing and sighting these regal birds during the October hunt days.



Beavers blocked water flow at Portsmouth Ditch ... (DIS-92-29, RMK, 12/92)



**... and this cross-flow culvert on Railroad Ditch --- and they didn't have to apply for a Corps permit! (DIS-92-30,RMK,2/92)**

#### 11. Fisheries Resources

Twenty-seven (27) species of fish have been identified in the water of Lake Drummond and the ditches. The yellow bullhead, flier and yellow perch are the most abundant species with the first two species described as too abundant. How many of the twenty-seven species are endemic to the dark, acidic waters of Lake Drummond is uncertain, since some fish were stocked in the lake by the operator of Perry's Minnow Farm before refuge establishment.

The most sought after sport fish in the lake is the black crappie, but past fisheries investigations have recorded citation-size yellow perch.



## H. PUBLIC USE

### 1. General

The majority of public use activities continued to show an increase throughout the year. An estimated 24,324 individuals visited the refuge this year compared to 21,943 visits in 1991. Throughout the year, the refuge was a popular topic among newspaper articles, magazine articles, and TV programs. The variety of articles helped "advertise" the refuge to the public, resulting in an increase in visitation. The most popular activities continued to be hiking, biking, wildlife observation and photography. Spring continued to be the busiest, as the refuge has historically been a popular place for birders to visit during the spring bird migration.

Visitation numbers were estimated based on data from the traffic counter located at the Washington Ditch Entrance. It is estimated that the other entrances (mainly Jericho Lane) receive about 25% of the use recorded at Washington Ditch. These totals are added together to establish the recorded visitation for each month.

In an effort to record more accurate visitation numbers, two new traffic counters were ordered from Compu-tech Systems. The system is composed of a passive infra-red sensor which plugs directly into the trail/road counter. The system is battery powered and, except for the cord which connects the counter to the sensor, there is no other installation required. This system makes it simple to relocate the counter from one location to another. By the end of December, one counter was placed by the entrance to the Dismal Town Boardwalk Trail. The other will be placed along the Jericho Lane Road.

The refuge continued to be the topic of several magazine articles, books, and newspaper articles. Some of the topics included the following: folklore of the Dismal Swamp, the bear study, the refuge managing the 14,000-acre Dismal Swamp State Natural Area, deer hunt season, Lake Drummond, the wetlands delineation issue, and general articles on the Great Dismal Swamp. An extensive article on the refuge and the wetlands issue appeared in the September issue of "Conde Nast Traveler" magazine. In addition, the refuge issued four news releases covering the following topics: the refuge's annual white-tailed deer hunt, Defenders of Great Dismal Swamp sponsoring public canoe trip, and the bear research in the refuge.

Sandy Smith of the National Archives worked with Mr. Ashley to establish a "Deed of Gift for the Historical materials of Alvah Carter Duke" which was signed by Mr. Ashley on March 31, 1992 and Don Wilson (Archivist of the U.S.) on April 14, 1992. These documents were related to local efforts to promote public ownership of the Great Dismal Swamp in the late 1960's and early 1970's. After reviewing the historical information, the documents were boxed up and sent to the National Archives - Mid-Atlantic Region in Philadelphia, PA in November. The Archives will catalog the

information and ensure that the documents are properly stored.

The City of Suffolk continued to express their concerns about the relatively modest development of public use facilities on the refuge. Refuge Manager Culp updated Mayor James Hope in late January and the Suffolk City Council on February 5 concerning refuge public use development plans. Subsequently, the City Council voted to contact the Virginia Congressional delegation to solicit their support for improving visitor facilities on the refuge.

NUMBER OF PUBLIC USE VISITS BY YEAR  
1988 - 1991

<u>Activity</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
Conducted Tour	400	0	40	6	69
Environmental Education (Students)	100	396	525	213	276
Environmental Education (Teachers)	0	70	45	36	22
Other Refuge Programs	200	118	811	276	1,197
Hunting (Deer)	1,800	1,651	2,642	3,714	3,161
Fishing	900	895	1,020	1,911	1,883
Foot Access	6,000	9,700	9,518	10,888	12,367
*Vehicle Access	1,300	2,170	2,827	102	68
Photography	2,500	2,400	2,383	2,779	3,162
**Boating	<u>2,600</u>	<u>1,700</u>	<u>3,289</u>	<u>2,018</u>	<u>2,119</u>
Total Visits	15,800	19,100	23,100	21,943	24,324

\*Prior to 1991, this number included access for hunting and all other Special Use Permits. As a result, some activities were inadvertently included twice. In 1991, this was corrected, and, therefore, a decrease in vehicle access and overall visitation resulted.

\*\*Boating visits were recorded by the Corps of Engineers at their spillway on Lake Drummond.





**This family found the Interior Ditch pier on Lake Drummond to be a good spot to stop for lunch. (DIS-92-31,TMC,5/92)**

## **2. Outdoor Classrooms - Students**

A variety of educational groups ranging from elementary to college visited the refuge for environmental education field trips. The majority of groups received a refuge orientation before they ventured on their own to hike the trails. Some groups also viewed films as part of their orientation. A total of 11 groups comprised of 298 students, teachers, and parents visited the refuge throughout the year.

In addition to hiking the trails, some groups included visiting Lake Drummond as part of their field trips. Seventeen special use permits were issued to allow vehicle access to Lake Drummond for educational groups.

## **3. Outdoor Classrooms - Teachers**

In August, High School Coop Student Renee Weaver and Outdoor Recreation Planner Cherry attended an environmental education meeting organized by Back Bay NWR. Representatives from a variety of organizations also attended the meeting which provided an excellent opportunity to meet the individuals and discuss the educational opportunities the agencies offer. It was agreed that this type of support group could be very beneficial and plans for future meetings were discussed.

#### 4. Interpretive Foot Trails

The Dismal Town Boardwalk Trail, located at the Washington Ditch Entrance, is the refuge's only boardwalk trail. This trail meanders approximately 3/4 of a mile through a variety of refuge habitats. Efforts to make this trail self-interpretive began in 1991 when the first stage of interpretive panels were placed along the boardwalk in September 1991. Unfortunately, in December of the same year, vandals had stolen and/or destroyed five of the eight panels. Replacement interpretive panels were ordered in January. Fortunately, the replacement panels cost about half of the original expense, since no design costs were involved.

Maintenance Worker Winningham made some changes to the designs of the panel frames to provide additional protection from vandalism. Refuge staff also increased off-hour patrols of the primary public use areas. Maintenance Worker Winningham and Tractor Operator Poovey installed the replacement panels along the boardwalk trail in May. By year's end, the panels had not received any further damage.

In November, Outdoor Recreation Planner Cherry began designing the second stage of interpretive panels for the trail. The panels will be paid for out of the donations from the Izaak Walton League of American. Approximately \$3,400 remains in the donation account.



The Dismal Town Boardwalk Trail attracted numerous visitors throughout the year after the installation and dedication of the interpretive signs in 1991. (DIS-92-32,TMC,11/92)

## 7. Other Interpretive Programs

This year was an extremely busy one for the staff who assisted with presenting a variety of on-site and off-site programs. A total of 1,266 individuals participated in these programs compared to 276 in 1991.

The following is a list of some of the programs offered:

Refuge Manager Culp addressed 40 members of the Izaak Walton League in January to provide an update on refuge activities.

Fifteen members of the Virginia Marine Science Museum made their annual visit to the refuge orientation and viewed the film "America's Wetlands" before going to Lake Drummond.

Outdoor Recreation Planner Cherry presented a refuge slide program to 270 and 324 third grade students at Great Bridge Intermediate School (Chesapeake) in May and November respectively. The programs highlighted wildlife found at the refuge to coincide with what the students were studying in the classroom.

Refuge Operations Specialist Knudsen and Fire Management Officer Brownlie provided an orientation and guided tour for 20 members of The Nature Conservancy in May.

In May, Outdoor Recreation Planner Cherry presented a slide program to 161 members of the Great Neck Chapter of the AARP (Virginia Beach).

Refuge Manager Culp presented two off-site programs in July. One program was presented to 85 members of the Suffolk Rotary Club. He was also the guest speaker at the Virginia chapter of the Society of American Foresters meeting in Franklin, which was attended by 60 SAF members.

Members of the Albemarle Environmental Association (AEA) visited the refuge in late September. After Refuge Manager Culp provided a brief overview of the refuge, the group was given a tour to Lake Drummond. The AEA has taken an interest in the refuge since Refuge Manager Culp spoke at their annual general meeting earlier that month.





**The Albemarle Environmental Association group grilled Refuge Manager Culp about refuge issues at the Lake Drummond overlook.  
(DIS-92-33,TMC,9/92)**

#### 8. Hunting

Hunting for white-tailed deer is the only hunting permitted on the refuge. News releases announcing the refuge's 14th annual white-tailed deer management hunt were sent to local newspapers in June and again in July. As a result of the newspaper articles, the refuge office received numerous calls requesting information on the hunt and permit procedures. The refuge's two answering machines provided hunt information on weekends and after hours.

Planning for the 1992 hunt season began early in the year with the completion of the 1992 Hunt Program in April. The program was mailed to the Zone Biologist - South in April, was finally approved in June, and the hunt map and regulations arrived at the refuge by the end of August.

Individuals interested in participating in the hunt applied for the required refuge permit by sending their name, current address, and telephone number on a 3 x 5 card or postcard and the \$10.00 non-refundable permit fee to the refuge office. In an effort to reduce the amount of staff time required in issuing permits, this year the refuge established a specific time period of August 1 - September 15 for accepting applications for a hunt permit. A total of 1,326 permits were issued this year, a slight increase over the 1,304 issued in 1991.

The applications were processed during August 1 through the first of October. The hunt roster was maintained on a DBase computer file.

which printed the labels for the hunt permits. The file also provided updated numerical and alphabetical listings of all permittees. Refuge staff spent a considerable amount of time collating the hunt information and stuffing envelopes. The majority of hunt permits were sent out by the end of September.

All individuals who applied for a hunt permit received one, however, hunter spaces at each of the four refuge entrances were filled on a first-come first-served basis on each hunt day. The hunter capacity at each entrance differs, based on the number of miles of open roads in each area. The four access entrances were Portsmouth Ditch Road (125 hunter capacity), Jericho Lane (250 hunter capacity), Corapeake Ditch Road (Virginia - 125 hunter capacity, North Carolina - 150 hunter capacity), and Railroad Ditch Road (100 hunter capacity) for a total of 750 hunters permitted on the refuge each hunt day. Only two entrances filled to capacity on three occasions throughout the hunt.



**This group of hunters signed in at Jericho Ditch. (DIS-92-34,TMC,10/92)**

All hunter entrances were supplied with a hunter check in/check out station which provided pertinent hunt information. Each station was also equipped with a check in/check out register. Hunters signed themselves in and out by recording the times they arrived and left the refuge. These registers enabled refuge staff to assure that all hunters had safely returned for the day. Hunters also recorded basic deer harvest data on the registers. This information was helpful as the hunters were not required to check their deer in at the refuge check station. However, hunters were encouraged to check their deer in at the refuge since successful hunters in Virginia were issued DMAP tags which effectively permitted them to bag additional antlerless



deer without having them count against their seasons bag limit.

Although the check in/check out procedure was basically self service, refuge staff opened each entrance approximately one hour before sunrise and signed in hunters who were at the entrances at that time. Staff also returned to the entrances in late afternoon to look through the registers and assure that all hunters were out by closing time. This system seemed to work well again this year with only a few cases of hunters neglecting to sign out. All-night traffic control patrols were conducted during the early days of the refuge hunts in order to discourage illicit camping on the refuge.

The season began in October with two days of scouting occurring on October 2 and 3. The refuge was open to Scouting from 8:00 am - 2:00 pm. Only individuals with valid refuge permits were allowed vehicle access for scouting and were required to carry a compass. A total of 565 hunters scouted for 1,339 activity hours.

The refuge hunt season ended on November 7. Wet weather and road conditions prevailed during the last week of the hunt. As a result, all three of the hunt days scheduled in November were cancelled.

The refuge operated a check station from 8:00 am to 8:00 pm on every hunt day. Volunteers provided a tremendous amount of assistance with the operation of the check station by staffing the station approximately 70% of the time that it was operational.

Results of the 1992 deer hunt include a total of 2,596 hunter visits (excluding scouting visits), 20,689 activity hours and 214 deer harvested. A total of 15 deer were reported as hit but not retrieved. Hunter visits recorded in 1992 were approximately 1.3 per cent lower than 1991 recorded visits (3,380). This is probably due, in part, to the hot weather that was experienced and the number of days that were open to hunting. In 1991, twelve days were open to hunting compared to ten days in 1992.

The 1992 hunt season ended with no reported injuries and no search and rescue operations. Several hunters became lost temporarily during the hunts but were found by other hunters and refuge staff with relatively little difficulty. A total of ten days (including one half-day hunt and one rain make-up day) out of the scheduled 13 days were open to hunting.

# DEER HUNT DATA 1983-1992

Year	Hunt Days	Permits Issued	Hunter Visits	Activity Hours	Reported Deer Killed	%Hunter Success
1983	6	375	743	6,981	105	14
1984	7	593	1,247	10,738	188	15
1985	9	2,284	2,216	21,052	211	9.5*
1986	11	2,659	3,825	28,285	281	7.3*
1987(1)	12	2,750	4,124	37,215	324	7.9*
1988(2)	7	3,212	1,807	16,222	123	6.8*
1989	7	2,153	2,084	14,483	115	5.5*
1990	11	1,205	2,642	19,674	233	8.8*
1991	12	1,304	3,714	27,755	369	10.9*
1992	10	1,326	3,161	22,028	214	6.8*

(1) Includes 2 days, archery only

(2) Includes 3 days, archery only

\*Beginning in 1985, hunters were not required to check deer at the refuge check station, so all deer were not checked by refuge personnel.

## 9. Fishing

Lake Drummond, located in the center of the refuge, is open to fishing year-round from sunrise to sunset. Access to the lake is gained via the Feeder Ditch which connects the Dismal Swamp Canal to Lake Drummond.

The tram operated by the Army Corps of Engineers (COE) which is used to portage small boats around their spillway located at the lake on the west end of the Feeder Ditch, was rebuilt and put back into commission this year. The tram was out of commission for almost two years.

Refuge Manager Culp and Outdoor Recreation Planner Cherry met with two representatives from the COE, Norfolk office, in January to discuss the weight limitations of their new tram and establishing a horse-power limit on boats which used the tram. Both the Refuge and the COE were concerned about underwater hazards such as cypress stumps, the disturbance to small boats and canoes, and the disturbance to wildlife. The 3,100-acre lake ranges in depth from 4-6 feet. Refuge Manager Culp and Outdoor Recreation Planner participated in a small "media event" sponsored by the COE to announce the re-opening of their tram in July. In cooperation with the refuge, they also announced the 10 horse-power motor limit for boats using the tram.

Access is provided through the refuge via the Railroad Ditch Entrance to Lake Drummond for fishing purposes only. The permits cover the period of April 1 - June 15. Everyone who requests a permit receives

one, however access is limited to 12 vehicles per day because of limited parking and launching space. Reservations may be made 24 hours in advance and are taken on a first-come first-serve basis.

A total of 174 permits were issued for this purpose in 1992. The theme of National Fishing week was printed on the permits this year to help promote the event. Favorable weather and road conditions prevailed through this period, so access to the lake was permitted 68 of the 76 scheduled days.

A total of 766 permittees and their guests were recorded using their permits to gain access to Lake Drummond and accounted for 3,830 activity hours. A slight increase in this activity was experienced this year when compared to 148 permits issued, 518 visits and 2,516 activity hours recorded in 1991

#### 11. Wildlife Observation

Washington Ditch and Jericho Lane entrances are the two areas that have been developed for public use. The Dismal Town Boardwalk Trail, located at the Washington Ditch entrance, meanders approximately 3/4 mile through a portion of the refuge. The self-interpretive trail offers a viewing opportunity of wildlife and various habitats for the visitor, Washington Ditch Road (4.5 miles one way) leads the visitor to Lake Drummond and offers an excellent opportunity for wildlife observation. Jericho Ditch entrance offers a variety of hiking and biking trails for wildlife observation and continues to be very popular for birders during the spring songbird migration (April - May).

#### 12. Other Wildlife Oriented Recreation

The most popular wildlife oriented recreational activities which occur on the refuge include hiking, biking, wildlife observation, photography, fishing, and boating. Most access for these activities is gained via the Washington Ditch and Jericho Lane entrances. The other entrances receive some use, however, the public is not encouraged to use these entrances because they offer very little if any parking area, no interpretation, and limited security.

Boating and fishing activities are limited to Lake Drummond. Year-round access to the lake is gained via the Feeder Ditch which connects the Dismal Swamp Canal to Lake Drummond. Boating visits are recorded by the Army Corps of Engineers at their spillway, located at the west end of the Feeder Ditch. The COE recorded 2,119 boating visits in 1992.



**Taking a canoe to Lake Drummond via the Feeder Ditch canal seemed to be gaining in popularity. (DIS-92-35,TMC,04/92)**

#### 16. Other Non-Wildlife Oriented Recreation

Firewood cutting and dog retrieval were the only other non-wildlife oriented recreation occurring on the refuge during 1992. Firewood cutting was permitted from June 1 through September 30. The demand for this activity has decreased over the past two years. The number of permits dropped from 83 issued in 1990, 47 issued in 1991, and only 26 issued in 1992.

Special Use Permits are issued for this activity and allow individuals to cut firewood at a specified location and any tree except oak, Atlantic white-cedar, pine, and cypress could be removed within 50 feet of the center of the road. This activity complements road maintenance by removing the tree canopy and opening the roads up to sunlight. As a result, the roads generally remain drier than those with a thick canopy. Poor road and weather conditions prevailed throughout the permit period and as a result, access was limited. A total of 12 visits were recorded for firewood cutting throughout the permit period.

Special Use Permits were issued to hunt clubs and individuals for vehicle access for retrieving hunting dogs from the refuge during the 1992 deer hunting season. In 1990, a \$25.00 non-refundable permit fee was charged to help defray some of the expenses of administering this program. The fee continued to keep the demand for this activity low, as only 10 permits were issued in 1992 compared to 27 issued in 1989 (the last year permits were issued).

without a fee). The permits cover the Virginia and North Carolina hunt season with the period of use being from October 1 through January 2. Permittees were required to contact the refuge headquarters prior to each visit to check on current road conditions, receive permission to gain access, and obtain the current lock combination. Access was permitted from 8 am to sunset and was not permitted on wet roads. Although some staff time is required to issue the permits, allowing this activity helps keep the number of dogs which wander onto the refuge during the white-tailed deer hunting season down to a minimum.

#### 17. Law Enforcement

A staff of four collateral duty refuge officers (including RFMC Carter) was maintained throughout most of the year. All refuge officers were senior management staff, so concentrated efforts were made to combine routine law enforcement patrols with other refuge operations including site inspections and water control structure inspections and maintenance.

With staff time at a premium, law enforcement activities had to be carefully prioritized. Thus, these operations focused on maintaining safe visitor access at Washington Ditch and Jericho Lane; protection of headquarters, shop, and equipment in the field; and investigation of wildlife violations based on reliable intelligence regarding these activities. In 1992, concerns over visitor security became more salient, as several serious incidents indicated that refuge visitors may be jeopardized without increased law enforcement presence.

On January 29, refuge personnel assisted the Suffolk Police Department with recovering the body of a 17 year old homicide victim. The murder occurred off the refuge, the result of a problem during a drug deal. The victim was beaten and deposited in a swampy creek, just off the refuge, about a mile from the refuge headquarters on Desert Road. The investigation of the incident revealed that the perpetrators would have left the victim on the refuge, probably Railroad Ditch, if their access had not been blocked by a gate. The incident represented the fourth time over the past four years that a homicide victim had been found near the refuge boundary.

On February 16, a couple from Maryland had about \$1,200 worth of cash and tools stolen from their van while they walked the Washington Ditch boardwalk. The couple returned to the parking lot just as the perpetrators were leaving. The couple pursued the thieves in a high-speed chase down Washington Ditch, until they lost control of their van as they pulled onto White Marsh Road. Fortunately, no one was hurt, and their van sustained only minor damage.

These incidents prompted increased efforts to stagger tours of duty to provide more off-hour law enforcement coverage concurrent with other refuge operations. These efforts resulted in a number of apprehensions which are summarized as follows:



- Dr. Gary Graves caught two motorcycle riders on Lynn Ditch on May 31. He obtained their names and drivers license numbers and turned the information over to refuge officers. While the staff was appreciative of the apprehension, Dr. Graves was warned that these apprehensions could be dangerous and was not encouraged to repeat the maneuver.

- Two individuals were apprehended for possession of firearms at Jericho Lane on May 27.

- During July 23-24, twelve individuals were apprehended on charges of trespass and destruction of public property after two separate beer-drinking parties were encountered off-hours.

- The metal access gate on Insurance Ditch Road was ripped from the ground on August 8. Subsequent investigations suggested that the event was tied to an attempt to spot-light deer on the refuge, but insufficient evidence was obtained to pursue prosecution.

- During the weekend of August 15-16, the refuge grader and two farm tractors were vandalized, and one of the tractors was taken for a drive down Jericho Lane. Fortunately, the damage was minor. Ironically, weekend patrols had been suspended that weekend, because flooding was making access to the refuge difficult.

- On August 18, refuge staff discovered that someone had stolen the carburetor from the refuge's 1985 Blazer which was parked in the shop compound.

- The Jericho Lane kiosk was vandalized on or about September 26.

- Several hunting violations were recorded during the hunts. One of the more unusual apprehensions occurred when a juvenile was discovered retrieving his freshly killed deer from the Washington Ditch Boardwalk, an area which was closed to hunting to protect non-hunting visitors.

The need to improve operations related to visitor security illustrated one of the more insidious consequences of making modest improvements to refuge visitor facilities. During 1991, new interpretive media were installed at Washington Ditch, and the refuge received considerable press attention when these improvements were dedicated late that year. Thus, the refuge public use areas which were once known more for "lovers lane" and other somewhat nefarious actions were now attracting families on weekends and late afternoons. Many of these newer visitors were driving BMW's and Range Rovers filled with expensive and attractive trinkets. Thus, visitation patterns and visitor income levels shifted dramatically. These observations made it quite evident that increased law enforcement presence would be required to inhibit the criminal element from being attracted to the key public use areas.

"Urban interface" created some law enforcement problems. Illicit trash dumping incidents, particularly along Jericho Lane and refuge roads along the northwestern boundary, were an aggravation throughout the year, as nearby residents resisted paying the expensive tipping fees at the regional landfill adjacent the refuge. Refuge staff also received anecdotal reports, often well after the fact, of alleged drug transactions occurring along the refuge boundaries which abut sub-divisions or remote refuge roads.

Some of the law enforcement activities were more routine. Refuge personnel cooperated with the Suffolk Police Department by providing a remote site on the refuge for some of their officers to participate in a drug interdiction training exercise. Suffolk Police were also helpful by assisting with several apprehensions during various incidents at Washington Ditch and running checks on license plate number. The Chesapeake Police Department continued to permit the refuge to utilize their radio frequencies during emergencies.



Refuge officers throughout Region 5 were introduced to the Smith and Wesson Model 4046 during refresher training at Eastern Shore of Virginia NWR. All current officers at Great Dismal Swamp have made the conversion to the new weapon. (DIS-92-36,RMK,4/92)

## I. EQUIPMENT AND FACILITIES

### 2. Rehabilitation

Significant time was invested in planning and procuring materials for the replacement of two water control structures on East Ditch and the Camp/Jericho Ditch intersection. Valuable time was lost in procuring materials due to the uncertainty over the funding for these programs. These projects were matching grant operations under the Ducks Unlimited MARSH program, but glitches in the Region's budget planning data base prevented allocation of funds for the Service's share of the costs during the first half of the fiscal year. After this problem was resolved, Ducks Unlimited indicated that their cash flow problems would prevent them from funding their half until March, 1993. In any event, about half of the basic material were finally ordered by May and delivered by the end of July. Unfortunately, August floods prevented any real progress in installing the structures, so actual field work on these major rehab projects will be deferred until 1993.

On a smaller scale, the Washington Ditch pier was outfitted with new support runner, decking, and rails after an inspection revealed numerous rotten timbers. Also, the refuge headquarters received a new coat of semi-transparent stain, as the hot, humid conditions had taken its toll on the five-year old building.



**The refuge headquarters received a new coat of semi-transparent stain in October. (DIS-92-37,TMC,10/92)**



### 3. Major Maintenance

As usual, the maintenance of over 100 miles of timber access roads was a year-round chore. Mowing and "boom axing" was completed on a number of roads on the northern end of the refuge (Williamson, New, Hudnell Ditch Roads) during January-June as weather permitted. The mowers were moved to southern refuge roads by August.

By July, many of the roads within the south-central portion of the refuge (Blocks, Corapeake, Insurance, Weyerhaeuser, County Line, Cross Canal, Sherrill) had been disked and graded. The grader was then moved to the northern refuge roads in preparation of continuous road upkeep that would be required to maintain navigable roads during the water control structure replacement.

The August floods wreaked havoc on the routine road maintenance activities, as water continued to inundate portions of some roads through late September. As a result, roads leading from the Railroad Ditch entrance were not mowed, and a number of roads within the north central portion of the refuge remained closed throughout the refuge hunts in October-November. After the hunts, the water finally receded to the point that some grading was accomplished on Washington, Lynn, and Jericho Ditch Roads.



Some refuge roads took a beating during the hunting season. On Insurance Ditch Road, an access right permitted hunters to travel the road during wet weather, resulting in the road becoming almost impassable. (DIS-92-38,RMK,12/92)

Illicit dumping on Jericho Lane and other refuge roads increased. Two new gates were constructed in preparation of eventually closing off portions of some roads to inhibit this activity. In any event, efforts were made to clean up debris as soon as it was detected in order to avoid inviting additional dumping.

#### 4. Equipment Utilization and Replacement

On January 2, FMO Brownlie reviewed the grounding diagrams and materials needed to properly ground the automatic weather station with Maintenance Worker Winningham. Grounding was completed on January 3.

In late April, the refuge's first Pacific Marine Mark III portable pump arrived with accessories. This pump kit, originally ordered in the fall, began the process of replacing our Gorman-Rupp pumps that served well in the past. The Mark III pump is the interagency wildfire portable pump kit standard, is much lighter in weight, yet significantly out-performs the heavier Gorman-Rupps.

Several additions and replacements to the refuge's vehicle fleet were accomplished. The one-ton Dodge Dakota 4x4 pickup was delivered in January, as it will transport the slip-on pumper. Another 3/4 ton 4x4 pickup was delivered in June to accommodate the expanded fire management staff. An S-10 Blazer was also delivered in June to replace the 1985 Blazer, and it was outfitted with law enforcement lights and sound system to accommodate the increased need for night-time law enforcement. A Dodge Ram 4x4 pickup truck was delivered in July to replace a 1981 pickup.

Only one vehicle was transferred from the station, although several have been reported as excess for some time with the arrival of replacements. The 1962 M-37 personnel carrier was sold through GSA in January.

The heavy equipment and vehicle fleet required considerable time for normal maintenance and upkeep. Also, having the ability to transport heavy equipment meant that the staff were often called upon to transport equipment for other refuges and using the equipment on other stations. Thus, considerable time was consumed in transporting equipment between other stations including Back Bay, Eastern Shore of Virginia, and Blackwater NWR's. The Insley excavator was also sent to Back Bay during the spring and summer, as Equipment Operator White spent significant time working on their dike project.

An additional portable fuel tank was purchased in January to support field operations. The tank enhanced the ability to provide clean fuel to tractors and dozers.



## 5. Communications Systems

In 1989, radio communications specialists recommended that the refuge convert to high-band radio communications. The existing antiquated low-band system was due for replacement, as it was unreliable and requiring frequent repairs. Also, most of the refuge's cooperators were utilizing VHF bands. The decision to convert to high-band meant that the refuge staff would embark on the long, arduous road of radio procurement and requesting additional radio frequencies.

In 1990, most of the basic high-band radio equipment was purchased with fire funds, for one of the VHF frequencies (the same one used by Back Bay NWR) was relative easy to obtain. However, the second frequency for the repeater was not obtained until early in 1992, nearly two years after the first frequency request was submitted. In any event, obtaining the repeater frequency permitted final installation of the high-band equipment in June and July.

With the conversion to high-band, the refuge portable and mobile radios are programed to monitor two refuge operating frequencies, two fire suppression frequencies (Incident Command System and Southeastern Compact), two Chesapeake Police Department frequencies, and National Weather Service broadcasts. In addition, several mobile and portable radios are equipped with phone patches to permit emergency connections to telephone calls when other radio dispatchers are not available.

The new radio system exceeded expectations. Despite concerns that the dense swamp forests would hamper high-band communications, mobile radio coverage extended throughout the entire refuge area. Portable radio coverage (5 watts) at least doubled so that portable radios can contact the repeater from the middle 50% of the refuge. Some consideration will be given to eventually installing a taller radio tower (200-300 feet) in order to improve portable radio communications.

## 6. Computer Systems

In 1992, the automatic fire weather station completed its first year of operation. Thus, the ability to download weather data directly into the computers was still new, and, as with most new technology, a number of "bugs" had to be worked out.

The failure of the rain gauge at the automatic fire weather station during August and September revealed some weaknesses in the station maintenance. Heavy showers around August 20 knocked debris into the top of the gauge clogging the screen and preventing rain from reaching the sensor. Fire Officer Brownlie left for Atlanta on August 21, unaware that the gauge was clogged, not returning to work again until September 7. At this point, Fire Officer Brownlie attempted to "log-on" and download stored data but was stopped by repeated system errors. This problem was difficult to trace since

it appeared initially to be a phone line or switching problem. After several days of trying unsuccessfully from the refuge computer, it was corrected simply by reentering the software configuration information which had somehow been corrupted. During this week, the clogged rain gauge screen was first discovered and corrected. Unfortunately, nearly a full month of rainfall readings had been missed. Inspections of all sensors at the station and complete system functions will now be completed monthly at the same time refuge vehicle and equipment preventive maintenance checks are completed. On the bright side, all hardware components at this station continue to perform flawlessly almost a year after installed.

#### Geographic Information System (GIS) Development and Related Activities.

In January, some data entry, spreadsheet development, and production of graphs and tables of water level data supporting the 1992 Marsh and Water Management Plan was accomplished. Hardware and software upgrading, maintenance and troubleshooting dominated much of March and April. Also, preparing and transporting air photos and other materials to M.S. candidate Carmel Kelley at Virginia Tech and inquiring about historical air photo coverage availability for the refuge vicinity with the National Archives and U.S. Geological Survey occurred. This busy schedule continued into May and June with actual downloading of 89 digital, 1:100,000 scale base coverage files for the refuge from the Virginia Tech VAX computer. Refuge Manager Culp and Forester Brownlie met with the Ms. Kelly and Dr. Giles and Paul Steblein (Regional Office) in June to assess progress on the GIS project and adjust long-range objectives.

On March 13, Forester Brownlie met briefly with Ray Powell, a local computer services consultant and Izaak Walton League member to demonstrate and discuss our GIS project. Ray expressed interest in the Volunteer Program to help out with a wide variety of computer operations including software training, database design, data entry, and GIS tasks.

The pace of the GIS project activities slowed at this point as the field season came into full swing, but some work continued through the remainder of the fiscal year. Carmel Kelley made a visit to the refuge in July for ground truthing her cover typing efforts, then returned again in November for an overflight of the refuge. In late November, Forester Brownlie prepared the refuge GIS proposal and reply to the ARD's October request. Also during October and November, Forester Brownlie began converting the digital base layer, 1:100,000 scale Digital Line Graph format files for the refuge into PC ARC/INFO format. At year-end, there were still nearly 80 of the original 89 files requiring conversion, edge matching, and joining.

In late January, a new modem for the refuge 386 GIS work station arrived which was installed and tested in late March allowing remote access to the Virginia Tech VAX computers and the Fire Information

Management System (FMIS). This allows file transfers between the refuge and Virginia Tech and access to much greater GIS computing power for those GIS projects exceeding the refuge 386's capabilities.

On March 23, Forester Brownlie also assisted RFMC Carter with the initial setup of his new 386 computer. Unfortunately, his machine remained "crippled" despite being previously returned to the vendor for addition of the missing 1/4" tape drive. Apparently, a pin on the floppy drive controller board was broken off during the tape drive installation, rendering the two floppy drives inoperable enough to prevent some software installation.

On April 8, Forester Brownlie undertook a long overdue "spring cleaning" of the refuge 80386 Geographic Information System computer. The computer's hard disk was nearing its 110 MB capacity, and the refuge fire weather station software needed to be moved from the primary 80286 PC to the 80386 machine now that the 386 had a modem. Also, there were over 28 MB worth of USGS computerized map files awaiting downloading from the Virginia Tech main frame to the refuge 386 GIS station for lack of adequate disk space. On April 9, Forester Brownlie completed transferring the fire weather station software to the 80386. A couple of minor problems detected when trying to access the weather station with the 386 and its new 9600 bps modem required several calls to the weather station vendor to solve. Once again, FTS, Inc. proved very attentive, patient, and helpful in solving the problems.

On April 15-16, Forester Brownlie installed MS-DOS 5.0 on the refuge 386, reconfigured extended memory usage, and then tested several programs to be sure there were no incompatibility surprises. Although time consuming, this \$29.00 upgrade has finally solved the "RAM cram" problems experienced when using the "memory hungry" PC ARC/INFO software to date. Also on April 16, Forester Brownlie installed and demonstrated the HSI (HEP Procedures) software for Biologist Keel on the 386 PC. Dave and Ralph used the software to help identify potential field data collection items for included in the draft refuge Habitat Inventory Plan.

From April 20-22, Forester Brownlie completed researching and drafting budget proposals for GIS related hardware (a larger capacity hard disk drive and external Bernoulli Box, and 9-track magnetic tape drive) and digital spatial data coverage purchases. These proposals were then provided to Project Leader Culp for inclusion in the RONS update for FY 93 and were also included in the request for GIS proposals.

Kate Utter of Computerland met with the office staff on November 9 to review existing computer capabilities and provide recommendations for improvements. Some of her ideas were used to update and develop IPW's related to computer needs.

## RESEARCH WORK ORDER

Progress continued on our Research Work Order with Virginia Tech and State University initiated through the Cooperative Fish and Wildlife Research Unit last year. Carmel Kelley is a Master's candidate at Virginia Tech primarily responsible for the vegetative history study of the refuge vicinity under the direction of Dr. Robert Giles. Ms. Kelly has indicated that the refuge project should be completed by December, 1993.

During February, Forester Brownlie called M.S. candidate Carmel Kelley for an update on her project status and to try to set a date for a meeting about her project at Blacksburg. Dr. Giles felt a June meeting would allow Carmel time to complete some course work which would be critical to several aspects of the refuge's project. Carmel requested that the refuge provide late-1970's to early-1980's aerial photos and vegetative typing photo overlays plus some even older photos with control points identified on them. Organizing each set of photos and marking recognizable control points on those photos and on USGS quad maps occupied several days during March. However, the effort also helped during the acquisition boundary meeting hosted on March 11 and the fire management staff tour on March 17.

Forester Brownlie departed with a "truckload" of aerial photos, maps, and computer tapes and disks for Virginia Tech on March 24. He spent all day and part of the evening with Carmel Kelley reviewing the materials. Carmel was able to copy the USGS 1:100,000 scale files from the refuge's 9-track tape onto the Virginia Tech GIS work station. The GIS lab at Tech moved the files to their VAX mainframe computer after backing them up onto tape and provided the refuge with modem access instructions for downloading these files onto the refuge GIS work station. Additionally, Carmel displayed the refuge's 1988 SPOT satellite image of the refuge on their GIS work station.

After returning, Forester Brownlie spent most of March 30 and 31 preparing and mailing materials requested during the previous week's trip to Blacksburg. Most of that time was spent researching and summarizing a chronology of important ditch construction, railroad and road construction, logging, and wildfire events for Carmel.

Carmel furnished a draft of her nearly final detailed study plan for her vegetative history project to the refuge during in late June. Copies were routed to the primary refuge staff and to Paul Steblein, Regional Biologist Data Manager, for review prior to the June 26 meeting at Virginia Tech.

Project Leader Culp and Forester Brownlie traveled to Blacksburg on June 25 where they met up with Paul Steblein. On June 26, these three amigos met with Carmel Kelley and Dr. Giles to discuss Carmel's study plan and possible future directions for GIS development. Dr. Richard Neves, leader of the Cooperative Fish and Wildlife Research



Unit was also able to briefly join the meeting.

Carmel demonstrated the results of her initial digitizing and digital map file "enhancement" efforts in the GIS research laboratory at VPI as part of an overall tour of the facility. She had successfully overlaid a digitized version of a circa 1901 map of the original extent of the Dismal Swamp ecosystem on top of our 1:100,000 scale digital base map. There was remarkably little positional error between the two considering the original 1901 mapping effort. Carmel also arranged for the GIS research laboratory manager Les Fuller to provide an overview of the lab's technical capabilities and linkages to the University main frame computer and the nearby GIS computer teaching laboratory. Paul Steblein was particularly interested in this discussion from a Regional perspective. Similarly, faculty from the remote sensing and image processing lab also housed in Cheatham Hall provided a good overview of their computer lab courses and technical capabilities.

Graduate student Carmel Kelley visited the refuge from July 24-26 to ground truth her vegetative typing using air photos. Carmel's trip also allowed her to spend time at the National Archives and Library of Congress in the Washington, D.C. area and at the Virginia Historical Society Museum and Library in the Richmond. Carmel inspected the circa 1938 black and white aerial photos for the refuge and found them to be good to excellent in photo quality and very complete in coverage. She also obtained copies of some old maps of the Great Dismal Swamp area from these library sources. On November 11, Carmel Kelley accompanied Forester Brownlie on an overflight of the refuge intended to improve Carmel's confidence and accuracy in cover typing the different aged aerial photographs she is using in her Master's project.

#### DATABASE DEVELOPMENT USE AND MAINTENANCE

On January 22, the final staff gauge readings for 1991 were entered into the water management database, paving the way for writing the 1992 Marsh and Water Management Plan in February. Additional work on Lotus 1-2-3 macros to assist with generating reports and graphs for individual staff gauges for the 1992 Marsh and Water Management Plan was done by Forester Brownlie in early February.

Forester Brownlie began the actual downloading those files to the refuge 80386 GIS station from Virginia Tech's VAX computer on May 27. By May 30, only the six largest of the 89 total files remained. The slow transfer rate between computers and telephone rates required near "round-the-clock" computer operation over five days in order to take advantage of reduced evening, night, and weekend phone rates.

Richard Smith from the National Archives contacted Forester Brownlie on May 14 to advise that virtually complete air photo coverage of the refuge and surrounding vicinity dated 1938 at 1:20,000 scale was available for purchase. Photo indices for the entire refuge

plus proposed expansion area would cost about \$320 and contact prints (stereo pairs) an estimated \$750-1,000. Apparently, there is also a wealth (seven cans of raw film) of declassified military photography for the refuge area spanning the period from 1938-1970 when civilian photography was very limited. Unfortunately, none of this military imagery has been indexed. Therefore it can only be used at the National Archives facility. The USGS furnished a printout listing known aerial photography existing for one sample 7.5 minute quadrangle (Lake Drummond) within the refuge and literature on their photographic products, including microfiche aerial photography listings by state available at \$2 per state.

During June, Forester Brownlie received diskettes from Virginia Tech graduate student Carmel Kelley containing the compressed versions of the last two computer map files needed to complete the base map layers for the refuge Geographic Information System (GIS). All 89 files resided on the refuge 80386 GIS computer station, awaiting conversion from their original Digital Line Graph (DLG) format into PC-ARC/INFO format by late June. During October and November, Forester Brownlie began converting the Digital Line Graph format files for the refuge into PC ARC/INFO format. At year-end, there were still nearly 80 of the original 89 files requiring conversion, edge matching, and joining.

Carmel reported in November that she had begun photo interpretation and cover typing using the photos she already has and digitizing the resulting cover type maps into ARC/INFO format. She also had initiated the procurement process for the 1938 vintage photo coverage of the refuge from the National Archives in Washington, D.C.

During mid-December, Forestry Tech Poovey resumed initial entry of past fire weather forecast data into a dBASE IV database as part of office "house-keeping". Forester Brownlie provided a brief training session for Forestry Tech Poovey and Biologist Keel on entering staff gauge readings into the refuge water management database. Forester Brownlie updated the Lotus spreadsheet used last year to include 1992 in preparation for producing the water level summary tables and graphs required for the Annual Marsh and Water Management Plan that Biologist Keel will prepare in January.

## J. OTHER PROGRAMS

### 1. Cooperative Programs

Biologist Ralph Keel coordinated the Virginia woodcock survey which was conducted by several state biologists and Irv Ailes (Chincoteague NWR). Some 23 survey routes were covered during April 10-30.

After five years of negotiations, the Service and the State of North Carolina signed a Memorandum of Understanding which will authorize the refuge to conduct some maintenance and habitat restoration operations on the 14,000 acre Dismal Swamp State Natural Area. This area abuts the refuge's southeastern corner and has been managed by the state's parks division since the early 1970's. The agreement should facilitate refuge prescribed burning and water management within this portion of the Great Dismal Swamp.

On September 16, Manager Culp, Forester Brownlie, and Biologist Keel visited the Navy's Northwest River communications facility at their request to inspect potential habitat restoration sites. The facility incorporates forested habitat within the historical range of the Great Dismal Swamp. Naval civilian personnel on the site will be drafting a Memorandum of Agreement which will permit the Navy to provide funds for refuge assistance in habitat restoration projects at the facility.

Refuge personnel continued to cooperate with local efforts to establish a support group. The Defenders of Great Dismal Swamp, which had been started by the Defenders of Wildlife in 1991, changed its name to the Great Dismal Swamp Coalition (GDSC) to officially reflect their severance from the national organization. The national organization decided that it no longer wanted to promote the establishment of refuge support groups, so the local group no longer anticipated continuous support from the Defenders of Wildlife. In 1992, the GDSC's efforts were focused on developing membership and providing orientation to refuge issues. They conducted a canoe trip in April and a bike trip in November to introduce new members to the refuge and discuss some of the issues affecting the refuge.



**Members of the Great Dismal Swamp Coalition picnicked on the banks of Lake Drummond after their bicycle trip down Washington Ditch.  
(DIS-92-39,TMC,11/92)**



**The group posed for one final picture before heading out of the swamp.  
(DIS-92-40,TMC,11/92)**



### 3. Items of Interest

The year began with an unusual request. On January 14, the ashes of Mr. Robert Bryant were scattered near Lake Drummond near the mouth of Interior Ditch. Mr. Bryant, a former Suffolk policeman, committed suicide and requested in his final note that his ashes be dispersed in the Great Dismal Swamp.

Refuge personnel participated in various training programs, workshops, and seminars which are summarized as follows:

- Office Assistant Leary, Clerk-typist Marlin, and ORP Cherry attended a seminar on January 14 on "How to be a Credible, Confident, and Powerful Leader".
- Refuge Manager Culp participated in the Upper Level Management Development Program throughout the first half of the year. His final detail involved drafting the Director's testimony for a Senate hearing on refuge legislation proposed by Senator Graham of Florida.
- ORP Cherry attended the NAI Region II workshop at Chincoteague on March 18-21.
- SROS Knudsen and Biologist Keel attended the Saturated Forested Wetlands Symposium in Annapolis, Maryland, on January 29-31. During that symposium, one of the speakers stated that the Great Dismal Swamp ecosystem is the most threatened ecosystem in Virginia due to continuing development in the Hampton Roads area.

#### FIRE TRAINING

Course Title	Dates	Location	Trainee
Rx-95 Smoke Mgt. Tech.	Jan. 26-31	Boise, ID	Brownlie B. Miller
I-220 Incident Com. Sys.	Feb. 27-28	Wallops, VA	C. Williams V. Miller
S-205 Fire Oper. in Urban Interface S-300 Incident Commander Extended Attack (Type 3)	Feb. 4-10	Fredricksburg, VA	Brownlie B. Miller
S-390 Intermed. Fire Behavior	Mar. 23-27	Triangle, VA	B. Poovey
I-339 Div./Group Supvr.	Mar. 23-27	Roscommon, MI	B. Miller
Fire in Resource Mgt.	Mar. 30-Apr. 10	Marana, AZ	B. Miller

S-260 Fire Business Mgt.	Apr. 13-16	Minneapolis, MN	S. Leary
I-244 Field Observer- Display Processor	Jun. 1-4	Norfolk, CT	Brownlie
Rx-90 Prescribed Fire for Burn Bosses	Oct. 26-Nov. 6	Harrisonburg, VA	Brownlie
R-4 Fire Mgt. Officer's Workshop	Nov. 30-Dec. 2	Macon, GA	Brownlie
Natl. Fire Danger Rating	Dec. 6-12	Albuquerque, NM	Brownlie
S-130/190 Basic Fire Behavior and Firefighting	Feb. 24-27	Wallops, VA	Brownlie B. Miller V. Miller
I-220 Incident Com. Sys.	Feb. 27-28	Wallops, VA	Brownlie

Outdoor Recreation Planner Cherry assisted with the dedication of the new visitor center at Eastern Shore of Virginia NWR on October 24-25.

#### 4. Credits

Helen Marlin - Typing and photo arrangements, Information Packet

Ralph Keel - Sections B, D.5, F.2, G

Dave Brownlie - Sections F.3, F.9, I.6

Teresa Cherry - Sections E.4, H

Lloyd Culp - Sections A, C, D.1-4, E.1, E.5-8, I.1-5, J, K, editing

Sally Leary - Proof-reading

## K. FEEDBACK

Law enforcement was a more serious issue in 1992. The year began with several serious law enforcement incidents, and increased visitation created the need to improve law enforcement presence to assure basic protection of refuge visitors and property. The year ended with serious concerns being raised about the costs related to maintaining each refuge officer and whether or not sufficient law enforcement coverage could be provided with a reduction in the number of collateral duty officers.

The events and issues surrounding law enforcement activities may serve to illustrate a couple of basic points about law enforcement needs on refuges. First, the increased visitation which enhanced the need for law enforcement presence was the result of a modest investment in improving interpretive media at the refuge's main public access. The trails and media remained "self-guiding", so no additional personnel would ostensibly be needed to welcome visitors to the refuge. The improvements and the publicity surrounding the completion of the media improvements had the desired effect of inviting visitors who wanted to enjoy wildlife-oriented recreation on the refuge. Unfortunately, the improvements also provided "prettier" and more valuable trinkets that could be stolen from the refuge and its visitors.

The happier ending to this saga, however, was that the short crime wave ~~and~~ the end of 1991 and beginning of 1992 seemed to essentially end upon increasing refuge law enforcement presence at the public access locations on weekends and evenings. Minor incidents, (primarily night-time trespass, dumping and littering, and some vandalism) continued to occur but often resulted in apprehensions. Serious incidents (ie. theft of refuge interpretive panels, "car clouting") stopped.

The moral of this particular point is that the modest investment in public use facilities created a significant additional and continuous maintenance and law enforcement demand upon already strained refuge resources. This station does not have a visitor center, so the need for staffing the refuge to support operations on all weekends and holidays is not overtly obvious. However, the events of 1992 indicated the need to either have someone on duty or readily available to respond to law enforcement emergencies every day of the year.

The second, and final point, to be made is a word of caution to all Fish and Wildlife Service administrators who are concerned about the different aspects of refuge law enforcement. Assigning a value to the contributions of refuge officers, particularly collateral duty officers, is difficult. Basing their value only on the numbers of violation notices and other law enforcement contacts would be almost meaningless, and that assessment would be even more useless to the visitor who has just been robbed or assaulted on the refuge.



as a result of inadequate law enforcement support. To be succinct, refuge law enforcement coverage and support must be continuous and available around the clock. To maintain this type of support primarily with full-time officers, most stations would probably have to keep at least two full-time officers. Thus, refuge staffs would either have to expand to accommodate full-time law enforcement or reduce other resource and maintenance activities to make room for converting existing positions to full-time law enforcement.

The current situation of relying heavily upon collateral duty officers is not perfect. At this station, various wildlife violations occur without apprehensions, because the collateral duty officers must continue to focus on their habitat restoration priorities. This approach does not mean that opportunities to make apprehensions are ignored. Instead, it means that the collateral duty officers do not have the luxury of spending days or weeks staking out all "hot spots" or pursuing seemingly endless investigations. Thus, law enforcement is directed primarily towards the protection of visitors and refuge property. This pragmatic compromise seems to work in light of the finite resources of this agency, for the loss of habitat creates more adverse impacts, in general, than the consequences of intermittent wildlife violations.

The day may come when the collateral duty refuge officer becomes an anachronism. However, the Service will have to make a huge investment in other means of law enforcement support to replace the continuous coverage that is now provided by collateral officers.

NANSEMOND NATIONAL WILDLIFE REFUGE

ANNUAL NARRATIVE REPORT  
Calendar Year 1992

U.S. DEPARTMENT OF THE INTERIOR  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

## A. HIGHLIGHTS

Nothing to report.

## B. CLIMATIC CONDITIONS

The climate is oceanic, subject to fogs and storms, but tempered by the moderating effect the Atlantic Ocean. Temperature extremes range from eight to 95 degrees, and the average summer and winter temperatures are 80 and 50 degrees respectively. Average rainfall is 48", and there are 210 frost-free days. The last and first frost average April 1 and October 15 respectively.

## C. LAND ACQUISITION

Nothing to report.

## D. PLANNING

Nothing to report.

## E. ADMINISTRATION

The refuge was established when the Department of Defense transferred 206 acres of land, mostly marsh, to the U.S. Fish and Wildlife Service on December 12, 1973. No additional land has been acquired for the refuge. The refuge has been administered as an unstaffed satellite refuge of the Great Dismal Swamp NWR since its establishment.

## F. HABITAT MANAGEMENT

### 1. General

No active habitat management is underway at this time. However, this section will be used to describe the natural communities on the refuge.

The only open public access to the refuge is by water, but no trails or other public use facilities have been developed on the refuge. Land access is possible through the Naval Transmitter Station and has generally been restricted to government employees.

### 2. Wetlands

The Nansemond Refuge is nearly 100 percent tidal marsh. The marshes are salt to brackish of excellent quality. The refuge has over a mile of frontage and some bottom along the Nansemond River and Oyster House Creek. Adjacent property is owned by the U.S. Navy, so there are no developments encroaching upon these marshes.

The dominant vegetation is Spartina patens with Spartina alterniflora in the lower areas. There are numerous tidal guts, pans, and potholes providing excellent interspersions of types. Edge

vegetation grades from salt marsh to tidal marsh and low value trees. These spartina marsh areas have potential for prescribed burning using the creeks and their tributaries as natural fire breaks.

#### G. WILDLIFE

##### 1. Endangered and/or Threatened Species

The area offers excellent potential nesting and food hunting habitat for osprey and bald eagles, and osprey are frequently observed along the Nansemond River. Intermittent observations of bald eagles are reported.

##### 2. Waterfowl

Oyster House Creek and the Nansemond River are wintering areas for black ducks and some divers. Limited census records indicate the area appears to be excellent wintering and migration habitat for Canada geese, black ducks, canvasbacks, and other waterfowl species.

##### 3. Marsh and Water Birds

Common gallinule, clapper, Virginia and sora rails have been observed and/or heard in the area. Also sighted were green-backed, great blue, and black-crowned night herons and the common egret.

##### 4. Other Migratory Birds

Mourning doves are abundant along the edges of the marsh and in the small upland fields.

##### 5. Game Mammals

White-tailed deer, cottontail rabbits, and eastern gray squirrels use the timbered field edge.

##### 6. Other Resident Wildlife

Bobwhite quail have utilized the field edge. Mammals using the refuge include mink, striped skunk, muskrat, river otter, raccoon, red fox, weasel, meadow vole, white-footed mouse, opossum, and shrews.

Muskrat sign is abundant in the marsh. Fiddler crabs are abundant in the marsh along the edge of the tidal creeks and guts.

#### H. PUBLIC USE

The refuge, by land, is almost completely surrounded by a naval transmitter facility where access is restricted. Therefore, the refuge has not been opened for public use.

## Law Enforcement

Refuge officers checked out reports in late October that deer hunters were trespassing on the refuge. No evidence of trespass was found, although the Naval transmitter facility permits its employees to hunt on their reservation. Also, several adjacent property owners permit hunting.

### I. EQUIPMENT AND FACILITIES

Nothing to report.

### J. OTHER ITEMS

This report was prepared and edited by Refuge Manager Culp.

### K. FEEDBACK

Nothing to report.





# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

### FISH SPECIES FOUND IN LAKE DRUMMOND AND CANALS OF THE GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE



COMMON NAME	SCIENTIFIC NAME	FAMILY
Longnose Gar	<u>Lepisosteus ossens</u> (Linnaeus)	Lepisosteidae
Bowfin	<u>Amia calva</u> Linnaeus	Amiidae
Redfin Pickerel	<u>Esox americanus</u> Gmelin	Esocidae
Chain Pickerel	<u>Esox niger</u> LeSueur	Esocidae
Golden Shiner	<u>Notemigonus crysoleucas</u> (Mitchill)	Cyprinidae
White Catfish	<u>Ictalurus catus</u> (Linnaeus)	Ictaluridae
Channel Catfish	<u>Ictalurus punctatus</u> (Rafinesque)	Ictaluridae
Yellow Bullhead	<u>Ictalurus natalis</u> (LeSueur)	Ictaluridae
Brown Bullhead	<u>Ictalurus nebulosus</u> (LeSueur)	Ictaluridae
American Eel	<u>Anguilla rostrata</u> (LeSueur)	Anguillidae
Mosquitofish	<u>Gambusia affinis</u> (Baird & Girard)	Pociliidae
Swampfish	<u>Chologaster cornuta</u> Agassiz	Amblyopsidae
Pirateperch	<u>Aphredoderus sayanus</u> (Gilliams)	Aphredoderidae
Mud Sunfish	<u>Acantharchus pomotis</u> (Baird)	Centrarchidae
Flier	<u>Centrarchus macropterus</u> (Lacepede)	Centrarchidae
Warmouth	<u>Chaenobryttus gulosus</u> (Cuvier)	Centrarchidae
Blue Spotted Sunfish	<u>Enneacanthus gloriosus</u> (Holbrook)	Centrarchidae
Banded Sunfish	<u>Enneacanthus obesus</u> (Girard)	Centrarchidae
Redbreast Sunfish	<u>Lepomis auritus</u> (Linnaeus)	Centrarchidae
Pumpkinseed	<u>Lepomis gibbosus</u> (Linnaeus)	Centrarchidae
Bluegill	<u>Lepomis macrochirus</u> Rafinesque	Centrarchidae
Largemouth Bass	<u>Micropterus salmoides</u> (Lacepede)	Centrarchidae
Black Crappie	<u>Pomoxis nigromaculatus</u> (LeSueur)	Centrarchidae

Eastern Swamp Darter	<u>Etheostoma fusiforme</u> (Girard)	Percidae
Yellow Perch	<u>Perca flavescens</u> (Mitchill)	Percidae
Eastern Mudminnow	<u>Umbra pygmaea</u> (DeKay)	Umbridae
Creek Chubsucker	<u>Erimyzon oblongus</u>	Catostomidae



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE TREES, SHRUBS, VINES, FERNS, AND FLOWERS OF THE GREAT DISMAL SWAMP



Vegetational associations found within the swamp include cypress-gum, maple-gum, Atlantic white cedar, pine, mesic hardwoods, persistent emergent wetlands and broad-leaved evergreen shrub-scrub. Many species of vines, ferns, and other herbaceous plants grow here in abundance throughout the swamp. The log fern is one of the rarest and most localized of eastern American ferns. Nowhere is it more common than in the Dismal Swamp. Lady's slipper, dwarf trillium, silky camellia, swamp azaleas, stewartia and other rare and interesting plants can be seen.

The dwarf trillium is located in the northwestern section of the swamp and blooms briefly each year for a two week period in March. Silky camellia is found on the mesic islands and in the northwest corner of the refuge. This is probably its most northern occurrence.

Listed below is an incomplete, but broad list of trees and plants found in the Great Dismal Swamp National Wildlife Refuge.

### Trees

Loblolly Pine (Pinus taeda)  
Pond Pine (Pinus serotina)  
Bald Cypress (Taxodium distichum)  
Atlantic white cedar (Chamaecyparis thyoides)  
Red Cedar (Juniperus virginiana)  
Black Willow (Salix nigra)  
Swamp Cottonwood (Populus heterophylla)  
Hop Hornbeam (Ostrya virginiana)  
Musclewood (Carpinus caroliniana)  
American Beech (Fagus grandifolia)  
White Oak (Quercus alba)  
Overcup Oak (Quercus lyrata)  
Swamp Chestnut Oak (Quercus michauxii)  
Southern Red Oak (Quercus falcata)  
Cherrybark Oak (Quercus falcata var. pagodaefolia)  
Water Oak (Quercus nigra)  
Willow Oak (Quercus phellos)  
Laurel Oak (Quercus laurifolia)  
Post Oak (Quercus stellata)  
Black Oak (Quercus velutina)  
Yellow Poplar (Liriodendron tulipifera)  
Sweetbay (Magnolia virginiana)  
Pawpaw (Asimina triloba)  
Redbay (Persea borbonia)  
Sassafras (Sassafras albidum)  
Sweetgum (Liquidambar styraciflua)  
American Sycamore (Platanus occidentalis)



## Herbaceous Plants

Duckweeds (Lemna valdiviana)  
Duckweeds (Spirodela oligorrhiza)  
Dayflower (Commelina virginica)  
Dwarf Trillium (Trillium pusillum)  
Indian Cucumber (Medeola virginiana)  
Blue Eyed Grass (Sisyrinchium angustifolium)  
Pink Lady's Slipper (Cypripedium acaule)  
Southern Twayblade (Listera australis)  
Downy Rattlesnake Plantain (Goodyera pubescens)  
Crane Fly Orchid (Tipularia discolor)  
Lizard's Tail (Saururus cernuus)  
False Nettle (Boehmeria cylindrica)  
Mistletoe (Phoradendron serotinum)  
Jumpseed (Tovara virginiana)  
Smartweed (Polygonum hydropiperoides)  
Knotweed (Polygonum pensylvanicum)  
Pokeweed (Phytolacca americana)  
Chickweed (Stellaria media)  
Yellow Pond-Lilly (Nuphar luteum)  
Leather Flower (Clematis viorna)  
Buttercups (Ranunculus-species)  
Bitter Cress (Cardamine hirsuta)  
Mock Strawberry (Duchesnea indica)  
Partridge Pea (Cassia fasciculata)  
Lespedeza (Lespedeza cuneata)  
Lady's Sorrel (Oxalis dillenii)  
Wild Geranium (Geranium carolinianum)  
Jewel-Weed (Impatiens capensis)  
St. John's Wort (Hypericum hypericoides)  
St. John's Wort (Hypericum mutilum)  
St. John's Wort (Hypericum virginicum)  
Violet (Viola primulifolia)  
Water Loosestrife (Decodon verticillatus)  
Meadow-Beauty (Rhexia mariana)  
Water Primrose (Ludwigia alternifolia)  
Water Primrose (Ludwigia palustris)  
Mermaid-Weed (Proserpinaca palustris)  
Queen Anne's Lace (Daucus carota)  
Marsh Pennywort (Hydrocotyle umbellata)  
Heal-All (Prunella vulgaris)  
Skullcap (Scutellaria integrifolia)  
Hightshade (Solanum carolinense)  
Gerardia (Agalinis purpurea)  
Squaw-Root (Conapholis americana)  
Beech-Drops (Epifagus virginiana)  
Bladderwort (Utricularia gibba)  
Purple Bladderwort (Utricularia purpurea)  
Great Bladderwort (Utricularia inflata)  
Diodia (Diodia virginiana)

Washington Thorn (Crataegus phaenopyrum)  
Shadbush (Amelanchier canadensis)  
American Holly (Ilex opaca)  
Box Elder (Acer negundo)  
Red Maple (Acer rubrum)  
Silky Camellia (Stewartia malacodendron)  
Black Gum (Nyssa sylvatica)  
Tupelo Gum (Nyssa aquatica)  
Dogwood (Cornus florida)  
Sourwood (Oxydendrum arboreum)  
Persimmon (Diospyros virginiana)  
Horse Sugar (Symplocos tinctoria)  
Carolina Ash (Fraxinus caroliniana)  
Green Ash (Fraxinus pennsylvanica)  
Pumpkin Ash (Fraxinus tomentosa)  
Black Cherry (Prunus serotina)

#### Shrubs

Wax Myrtle (Myrica cerifera)  
Tag Alder (Alnus serrulata)  
Virginia Willow (Itea virginica)  
Swamp Rose (Rosa palustris)  
Red Chokeberry (Sorbus arbutifolia)  
Wild Azalea (Rhododendron nudiflorum)  
Swamp Azalea (Rhododendron viscosum)  
Sheep Laurel (Kalmia augustifolia)  
Male-Berry (Lyonia lingustrina)  
Fetter-Bush (Lyonia lucida)  
Dog-Hobble (Leucothoe axillaris)  
Fetter-Bush (Leucothoe racemosa)  
Poison Sumac (Rhus vernix)  
Winged Sumac (Rhus copallina)  
Winterberry (Ilex verticillata)  
Inkberry (Ilex glabra)  
Sweet Gallberry (Ilex coriacea)  
Strawberry Bush (Euonymus americanus)  
Devil's Walking Stick (Aralia spinosa)  
Sweet Pepperbush (Clethra alnifolia)  
Highbush Blueberry (Vaccinium corymbosum)  
French Mulberry (Callicarpa americana)  
Possumhaw Viburnum (Viburnum nudum)  
Elderberry (Sambucus canadensis)  
Titi (Cyrilla racemiflora)  
Groundsel-Tree (Baccharis halimifolia)



## Vines

Greenbrier (Smilax hispida)  
Greenbrier (Smilax rotundifolia)  
Greenbrier (Sawbrier) (Smilax glauca)  
Greenbrier (Coral Greenbrier) (Smilax walteri)  
Greenbrier (Smilax laurifolia)  
Wild Yam (Dioscorea villosa)  
Leather-Flower (Clematis crispa)  
Climbing Hydrangea (Decumaria barbara)  
Poison Ivy (Rhus radicans)  
Rattan Vine (Berchemia scandens)  
Virginia Creeper (Parthenocissus quinquefolia)  
Muscadine Grape (Vitis rotundifolia)  
Fox Grape (Vitis labrusca)  
Summer Grape (Vitis aestivalis)  
Maypop (Passiflora incarnata)  
Yellow Jasmine (Gelsemium sempervirens)  
Cross Vine (Anisostichus capreolata)  
Trumpet Vine (Campsis radicans)  
Japanese Honeysuckle (Lonicera japonica)  
Coral Honeysuckle (Lonicera sempervirens)  
Climbing Hempweed (Mikania scandens)

## Ferns and Fern Allies

Groundpine (Lycopodium obscurum)  
Running Pine (Lycopodium flabelliforme)  
Royal Fern (Osmunda regalis)  
Cinnamon Fern (Osmunda cinnamomea)  
Climbing Fern (Lygodium palmatum)  
Hay-scented Fern (Dennstaedtia punctilobula)  
Bracken Fern (Pteridium aquilinum)  
Southern Lady Fern (Athyrium asplenoides)  
Log Fern (Dryopteris celsa)  
Fancy Fern (Dryopteris intermedia)  
New York Fern (Thelypteris noveboracensis)  
Marsh Fern (Thelypteris palustris)  
Sensitive Fern (Onoclea sensibilis)  
Netted Chain Fern (Woodwardia areolata)  
Virginia Chain Fern (Woodwardia virginica)  
Ebony Spleenwort (Asplenium platyneuron)  
Resurrection Fern (Polypodium polypodioides)

Partridge Berry (Mitchella repens)  
Cardinal Flower (Lobelia cardinalis)  
Yarrow (Achillea millefolium)  
Daisy Fleabane (Erigeron annuus)  
Dog-Fennel (Eupatorium capillifolium)  
Mistflower (Eupatorium coelestinum)  
Joe-Pye-Weed (Eupatorium maculatum)  
Goldenrod (Solidago erecta)  
Dandelion (Taraxacum officinale)  
Ironweed (Vernonia noveboracensis)

#### Grasses-Sedges-Rushes

Cotton Grass (Eriophorum virginicum)  
Wool Grass (Scripus cyperinus)  
Foxtail Grasses (Setaria - species)  
Panic Grasses (Panicum - species)  
Sedges (Cyperus - species)  
Sedges (Carex - species)  
Switch Cane (Arundinaria gigantea)  
Rushes (Juncus bufonius)  
Rushes (Juncus repens)

#### Reference

- Musselman, L.J., D.L. Nickrent, and G.F. Levy, 1977, Contribution towards a vascular flora of the Great Dismal Swamp: Rhodora, V. 79, No. 818.
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## FISH AND WILDLIFE SERVICE MAMMALS



The Great Dismal Swamp harbors a variety of mammals including otter, raccoon, mink, and white-tailed deer. Although rarely observed by individuals visiting the refuge, black bear, and bobcat also inhabit the area. Following is a complete list of mammals found in the refuge.

Opossum (Didelphis virginiana virginiana)

Southeastern Long-tailed Shrew (Sorex longirostris fisheri)

Greater Short-tailed Shrew (Blarina brevicauda telmalestes)

Least shrew (Cryptotis parva)

Eastern Mole (Scalopus aquaticus)

Starnosed Mole (Condylura cristata parava)

Eastern Long-eared Myotis (Myotis keenii septentrionalis)

Eastern Pipistrelle (Pipistrellus subflavus)

Evening Bat (Nycticeius humeralis)

Northern Red Bat (Lasiurus borealis)

Little Brown Myotis (Myotis lucifugus)

Hoary Bat (Lasiurus cinereus)

Eastern Big-eared Bat (Plecotus rafinesquii macrotis)

Eastern Cottontail (Sylvilagus floridanus)

Marsh Rabbit (Sylvilagus palustris)

Eastern Chipmunk (Tamias striatus fisheri)

Gray Squirrel (Sciurus carolinensis)

Southern Flying Squirrel (Glaucomys volans)

Beaver (Castor canadensis carolinensis)

Marsh Rice Rat (Oryzomys palustris)

Eastern Harvest Mouse (Reithrodontomys humulis)

Cotton Mouse (Peromyscus gossypinus)

White-footed Mouse (Peromyscus leucopus)

Golden Mouse (Ochrotomys nuttalli)

Southern Lemming Vole (Synaptomys cooperi helaletes)

Muskrat (Ondatra zibethicus macrodon)

Meadow Vole (Microtus pennsylvanicus nigrans)

Gray Fox (Urocyon cinereoargenteus)

Black Bear (Ursus americanus)

Raccoon (Procyon lotor)

Mink (Mustela vison mink)

River Otter (Lutra canadensis lataxina)

Bobcat (Felis rufus floridanus)

Long-tailed Weasel (Mustela frenata noveboracensis)

White-tailed Deer (Odocoileus virginianus)

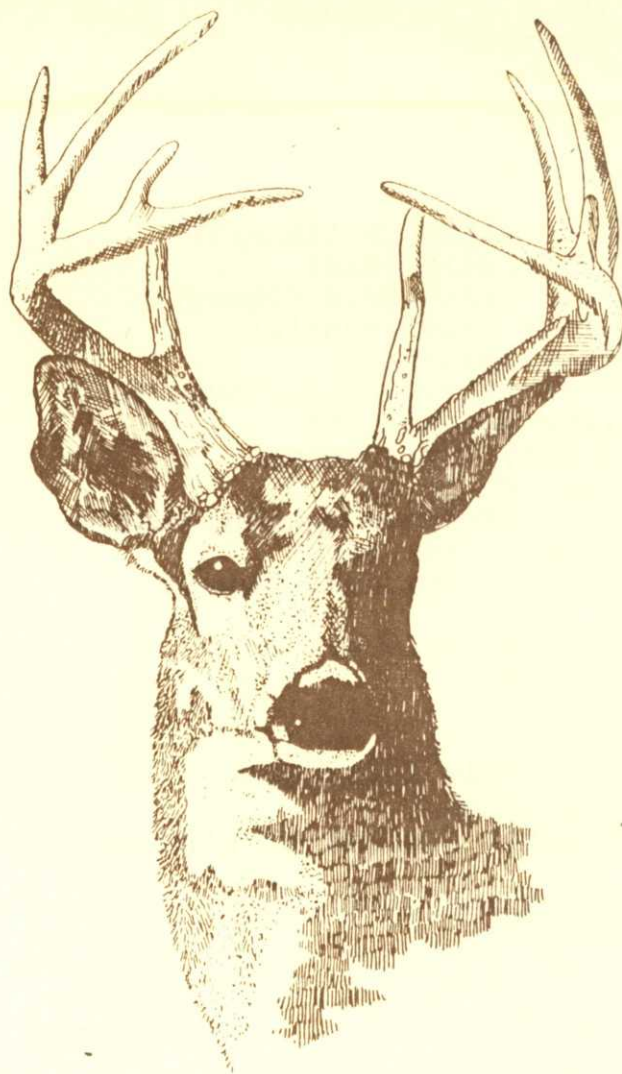
The species listed below have not been observed in the Dismal Swamp. However, they may occur due to their range.

Silver-haired Bat (Lasionycteris noctivagans)  
Big Brown Bat (Eptesicus fuscus)  
Pine Vole (Microtus pinetorum)  
House Mouse (Mus musculus)

#### Reference

Burt, W.H. and Grossenheider, R.P. A Field Guide To The Mammals, 3rd. Ed. Boston: Houghton Mifflin Co., 1976.

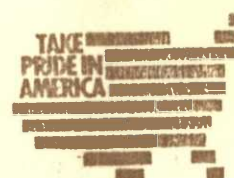
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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE



REPTILES AND AMPHIBIANS

Those unfamiliar with the swamp might associate it with a number of misunderstood creatures from this group - particularly snakes. Although the swamp does contain three poisonous snake species their occurrence is far less frequent than that of the nonpoisonous variety. The rarely found cottonmouth moccasin and canebrake rattlesnake join with the copperhead and a long list of harmless residents such as the northern water snake, the eastern hognose, the northern blackracer, the black rat snake, and the eastern kingsnake.

Turtles are familiar sights in the ditches where they can often be observed basking on logs. Spotted turtles are particularly common along with the painted turtle, mud turtle, yellow-bellied turtle and others. The woodland box turtle and predacious snapping turtle are found in the swamp as well.

An assortment of frogs and toads, some at the northern limits of their range, can be observed in temporary rainwater ponds; in the evergreen shrub bog community; in moist grassy areas; and in various forested locations. Common species include the bullfrog, green frog, spring peeper, southern leopard frog, and the American toad. Various varieties of both lizards and salamanders are found in the swamp.

SNAKES

Brown water snake (Natrix taxispilota)  
Red-bellied water snake (Natrix erythrogaster erythrogaster)  
Northern water snake (Natrix sipedon sipedon)  
Northern Brown snake (Storeria dekayi dekayi)  
Northern Red-bellied snake (Storeria occipitomaculata occipita maculata)  
Eastern Ribbon snake (Thamnophis sauritus sauritus)  
Eastern Garter snake (Thomophis sirtalis sirtalis)  
Eastern Earth snake (Virginia valeriae valeriae)  
Eastern Hognose snake (Pterodon platyrhinos platyrhinos)  
Southern Ringneck snake (Diadophis punctatus punctatus)  
Eastern Worm snake (Carphophis amoenus amoenus)  
Eastern Mud snake (Farancia abacura abacura)  
Northern Black Racer (Coluber constrictor constrictor)  
Rough Green snake (Opheodrys aestivus)  
Black Rat snake (Elaphe obsoleta obsoleta)  
Eastern King snake (Lampropeltis getulus getulus)  
Scarlet King snake (Lampropeltis doliata doliata)  
Southern Copperhead (Agkistrodon contortrix contortrix)  
Eastern Cottonmouth (Agkistrodon piscivorus piscivorus)  
Canebrake Rattlesnake (Crotalus horridus articaudatus)  
Rainbow snake (Farancia erytrogramma)



## TURTLES

Common Snapping turtle (Chelydra serpentina serpentina)  
Stinkpot (Sternotherus odoratus)  
Eastern Mud turtle (Kinosternon subrubrum subrubrum)  
Spotted turtle (Clemmys guttata)  
Eastern Box turtle (Terrepene carolina carolina)  
Eastern Painted turtle (Chrysemys picta picta)  
Yellow-bellied turtle (Chrysemys scripta scripta)  
Red-bellied turtle (Chrysemys rubriventris)

## LIZARDS

Northern Fence lizard (Sceloporus undulatus hyacinthinus)  
Ground Skink (Scincella lateralis)  
Five-Lined Skink (Eumeces fasciatus)  
Broad-Headed Skink (Eumeces laticeps)  
Southeastern Five-Lined Skink (Eumeces inexpectatus)

## TOADS AND FROGS

Eastern Spadefoot (Scaphiopus holbrooki holbrooki)  
American toad (Bufo americanus americanus)  
Southern toad (Bufo terrestris)  
Fowler's toad (Bufo woodhousei fowleri)  
Oak toad (Bufo quercicus)  
Spring Peeper (Hyla crucifer crucifer)  
Green Tree frog (Hyla cinerea)  
Pinewoods Tree frog (Hyla femoralis)  
Squirrel Tree frog (Hyla squirella)  
Gray Tree frog (Hyla versicolor)  
Little Grass frog (Limnaoedus ocularis)  
Upland Chorus frog (Pseudacris triseriata feriarum)  
Brimley's Chorus frog (Pseudacris brimleyi)  
Southern Cricket frog (Acris gryllus gryllus)  
Bullfrog (Rana catesbeiana)  
Carpenter frog (Rana virgatipes)  
Green frog (Rana clamitans melanota)  
Southern Leopard frog (Rana utricularia)  
Eastern Narrow-mouthed toad (Gastrophryne carolinensis)

## SALAMANDERS

Greater Siren (Siren lacertina)  
Two-toed Amphiuma (Amphiuma means)  
Marbled salamander (Ambystoma opacum)  
Red-Backed salamander (Plethodon cinereus cinereus)

Slimy salamander (Plethodon glutinosus glutinosus)  
Many-Lined salamander (Stereochilus marginatus)  
Southern Two-Lined salamander (Eurycea bislineata cirrigera)

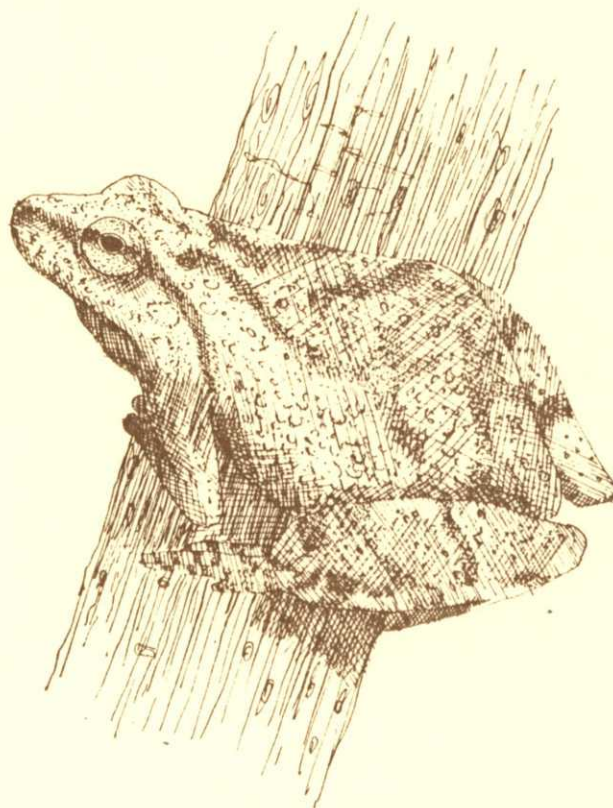
The species listed below have not been observed in the Dismal Swamp.  
However, these species may occur in areas of the swamp due to their range.

Florida Cooter (Chrysemys floridana floridana)  
River Cooter (Chrysemys concinna coninna)  
Eastern Slender Glass lizard (Ophisaurus attenuatus longicaudus)  
Green Anole (Anolis carolinensis carolinensis)  
Eastern Glass lizard (Ophisaurus ventralis)  
Southern Dusky Salamander (Desmognathus Fuscus auriculatus)

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the Great Dismal Swamp, P. Kirk, editor, published 1979.



# *Great Dismal Swamp*

**National  
Wildlife  
Refuge**

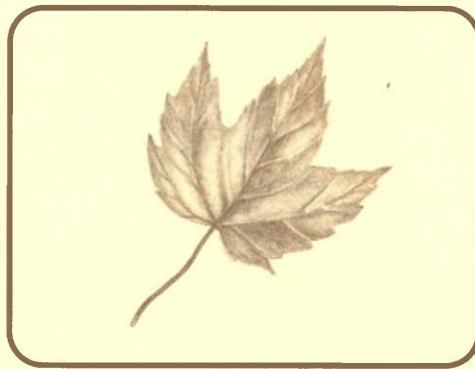


**Virginia**



## DESCRIPTION

Great Dismal Swamp National Wildlife Refuge is located in southeastern Virginia and northeastern North Carolina. Creation of the refuge began in 1973 when the Union Camp Corporation donated 49,100 acres of land to The Nature Conservancy. This land was then conveyed to the Department of the Interior, and the refuge was officially established through The Dismal Swamp Act of 1974. The refuge consists of almost 107,000 acres of forested wetlands that have been greatly altered by drainage and repeated logging operations. Lake Drummond, a 3,100 acre natural lake, is located in the heart of the swamp.



## HISTORY

Human occupation of the Great Dismal Swamp began nearly 13,000 years ago. By 1650, few native Americans remained in the area, and European settlers showed little interest in the swamp. In 1665, William Drummond, a governor of North Carolina, discovered the lake which now bears his name. William Byrd II led a surveying party into the swamp to draw a dividing line between Virginia and North Carolina in 1728. George Washington first visited the swamp in 1763 and organized the Dismal Swamp Land Company that was involved in draining and logging portions of the swamp. A five-mile ditch on the west side of the refuge still bears his name. Logging of the swamp proved to be a successful commercial activity, with regular logging operations continuing as late as 1976. The entire swamp has been logged at least once, and many areas have been burned by periodic wildfires. The Great Dismal Swamp has been drastically altered by humans over

the past two centuries. Agricultural, commercial, and residential development destroyed much of the swamp, so that the remaining portion within and around the refuge represents less than half of the original size of the swamp. Before the refuge was established, over 140 miles of roads were constructed to provide access to the timber. These roads severely disrupted the swamp's natural hydrology, as the ditches which were dug to provide soil for the road beds drained water from the swamp. The roads also blocked the flow of water across the swamp's surface, flooding some areas of the swamp with stagnant water. The logging operations removed natural stands of cypress and Atlantic white-cedar that were replaced by other forest types, particularly red maple. A drier swamp and the suppression of wildfires, which once cleared the land for seed germination, created environmental conditions that were less favorable to the survival of cypress and cedar stands. As a result, plant and animal diversity decreased.

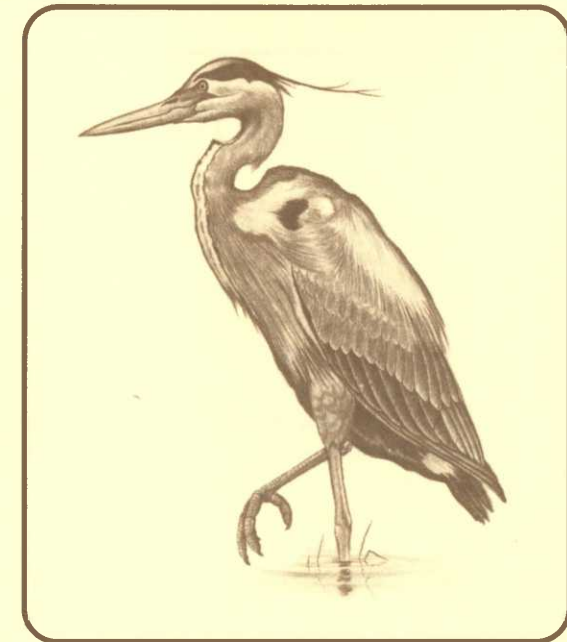
## RESOURCE MANAGEMENT

The primary purpose of the refuge's resource management programs is to restore and maintain the natural biological diversity that existed prior to the human-caused alterations. Essential to the swamp ecosystem are its water resources, native vegetation communities, and varied wildlife species. Water is being conserved and managed by placing water control structures in the ditches. Plant community diversity is being restored and maintained through forest management activities which simulate the ecological effects of wildfires. Wildlife is managed by insuring the presence of required habitats, with hunting used to balance some wildlife populations with available food supplies.

## PLANT COMMUNITIES

Five major forest types and three non-forested types of plant communities comprise the swamp vegetation. The forested types include pine, Atlantic white-cedar, maple-blackgum, tupelo baldcypress, and sweetgum-oak poplar. The non-forested types include a remnant marsh, a sphagnum bog, and evergreen

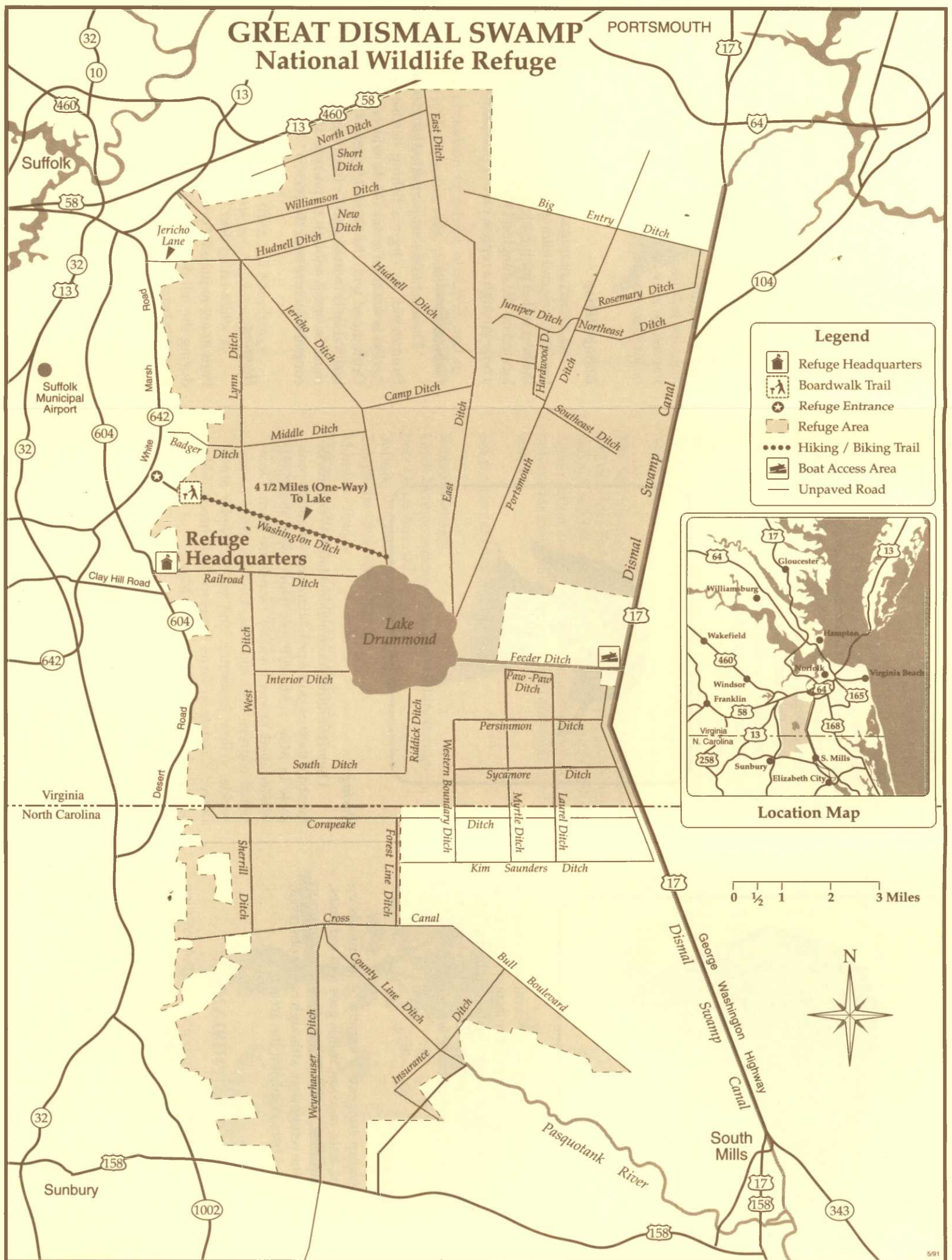
shrub community. Currently red maple is the most abundant and widely distributed plant community, as it expands into other communities due to the lingering effects of past forest cutting, extensive draining, and the exclusion of forest fires. Tupelo-baldcypress and Atlantic white-cedar, formerly predominant forest types in the swamp, today account for less than 20 percent of the total cover. Three species of plants deserving special mention are the dwarf trillium, silky camellia, and log fern. The dwarf trillium is located in the northwestern section of the swamp and blooms briefly each year for a two-week period in March. Silky camellia is found on hardwood ridges and in the northwestern corner of the refuge. The log fern, one of the rarest American ferns, is more common in the Great Dismal Swamp than anywhere else.



## BIRDS

Over two hundred species of birds have been identified on the refuge since its establishment; ninety-three of these species have been reported as nesting on the refuge. Birding is best during spring migration from April to June when the greatest diversity of species (particularly warblers) occurs. Winter brings massive movements of blackbirds and robins to the









swamp. Two southern species, the Swainson's warbler and Wayne's warbler, are more common in the Great Dismal Swamp than in other coastal locations. Other birds of interest are the wood duck, barred owl, pileated woodpecker, and prothonotary warbler.

## MAMMALS

The swamp supports a variety of mammals including otter, bats, raccoon, mink, grey and red foxes, and grey squirrel. White-tailed deer are common throughout the refuge and, although rarely observed, black bear and bobcat inhabit the area.

## REPTILES AND AMPHIBIANS

The Great Dismal Swamp provides habitat for a variety of reptiles and amphibians. Three species of poisonous snakes - cottonmouth, canebrake rattlesnake, and the more common copperhead - occur here, along with 18 nonpoisonous species. Yellow-bellied and spotted turtles are commonly seen in ditches throughout the refuge. An additional 56 species of turtles, lizards, salamanders, frogs, and toads have been observed on the refuge.

## SEASONAL CALENDAR

### Winter

Bear cubs (usually two) are born in late January through February. Great horned owls incubate eggs in late January and February. Redtailed and red-shouldered hawks begin to court and lay eggs. Red maple trees flower in February. Waterfowl migrate with some stopping over on Lake Drummond. Wood ducks pair up and search for nest cavities.



### Spring

Dwarf trilliums bloom in mid-March. Wood ducks incubate their eggs in April. Migrating songbirds peak early in May, with warblers being most abundant. White-tailed fawns (usually twins) are born. Occasional ospreys visit the lake. Orchids, coral honeysuckle, yellow jessamine, and yellow poplar are in flower. Cinnamon ferns develop fiddleheads. Silky camellia begin flowering in late May.

### Summer

Black bears are active in early June as the breeding season peaks. White-tailed bucks are in velvet. Kingfishers and great blue herons are active along ditches. Trumpet and passion vines bloom. The swamp is usually dry, with fire danger high from June to October.

### Fall

Autumn colors peak in late October through November. Large flocks of robins and blackbirds roost in the swamp. Wild fruits such as paw paw, blackgum, devil's walking stick and wild grapes are abundant.

## VISITOR OPPORTUNITIES

Visitors to the refuge may participate in a variety of activities including hiking, biking, photography, wildlife observation, and fishing and boating. The refuge was established for the purpose of protecting and managing the swamp's unique ecosystem which includes wildlife and habitat. Therefore, portions of the refuge may be closed to public use activities in order to accomplish this objective.

### Biking/Hiking

A variety of unpaved roads provide opportunities for hiking and biking with Washington Ditch Road the best suited for bicycle traffic. The Boardwalk Trail, located on Washington Ditch Road, meanders almost a mile through a representative portion of the swamp.

### Fishing/Boating

These activities are permitted year round on Lake Drummond. A Virginia fishing license is required. Access is via the Feeder Ditch, which connects Lake Drummond with the Dismal Swamp Canal. A public boat ramp is located north of the Feeder Ditch. Boats must be small enough to portage around the water control structure near the lake.

### Hunting

A white-tailed deer hunt is held during the fall. Permits are required. Portions of the refuge are closed during the fall deer hunt. Additional information is available from the refuge office.

### Educational Opportunities

A refuge orientation, film presentations, slide programs and outdoor classroom activities are available to organized school, civic, and professional groups. Advance reservations are required for all programs and may be made by phoning the refuge headquarters.



## IMPORTANT INFORMATION FOR VISITORS

For the protection of refuge resources and to ensure a safe and enjoyable visit, please familiarize yourself with the following information:

- Refuge trails are open to hiking and biking only. Please stay on designated trails.
- Collecting or harming any plant or animal life is prohibited. For your safety and the animals' protection do not attempt to handle or feed any wildlife.
- The refuge is open daily from 1/2 hour before sunrise to 1/2 hour after sunset. No overnight use is permitted

## DIRECTIONS TO REFUGE

South of Suffolk, VA, on Rt. 13 to Rt. 32, south for 4.5 miles, then follow signs.

**Boardwalk Trail:** Take White Marsh Road (Rt. 642) to Washington Ditch.

**Boat Access:** Adjacent to Rt. 17 at Dismal Swamp Canal.

## U.S. Fish and Wildlife Service

Great Dismal Swamp is one of more than 470 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 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  
Great Dismal Swamp National Wildlife Refuge  
Post Office Box 349  
Suffolk, Virginia 23434-0349  
Telephone: (804) 986-3705  
Monday - Friday  
7:00 am - 3:30 pm - CLOSED HOLIDAYS

Cover illustration by Mary Friel O'Connor  
Other illustrations by Julien Beauregard



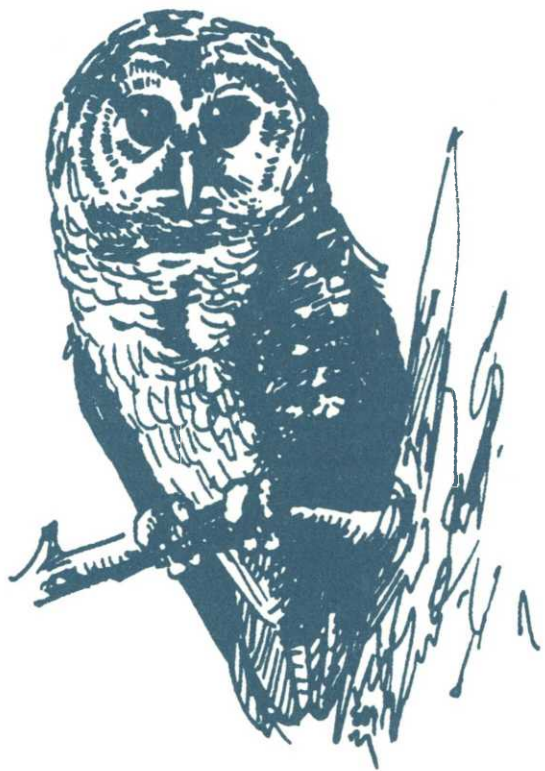
DEPARTMENT OF THE INTERIOR  
U.S. FISH AND WILDLIFE SERVICE

RL-51580-1

October 1991

# *Birds*

Great Dismal Swamp  
National  
Wildlife  
Refuge

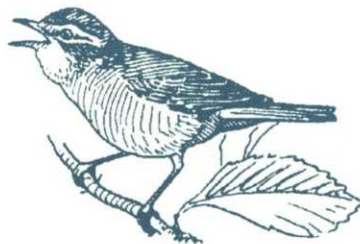


Virginia



**Great Dismal Swamp National Wildlife Refuge**, established by Congress in 1974, consists of almost 107,000 acres of forested wetlands. A primary concern at the Refuge is to offer food, rest and protection for migratory birds. A variety of educational and recreational opportunities are offered for the public, including hiking, biking, photography, hunting, fishing and boating.

Birding is popular in the Swamp from April through June, but is best from mid-April - mid-May, the peak of the spring migration. As many as thirty-five species of warblers have been observed and provide the principal attraction.



*Red-eyed vireo*

This folder lists 209 birds that have been identified on the Refuge, and is in accordance with the Sixth American Ornithologists Union Checklist.

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

† - Birds known to nest on or near the Refuge  
 Italics indicate threatened/endangered species

#### RELATIVE ABUNDANCE:

**a** - abundant      a species which is very numerous  
**c** - common        likely 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            may be present but not every year

#### LOONS - GREBES

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

#### PELICANS - CORMORANTS

Double-crested Cormorant .....	u	u	u	u
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#### BITTERNS - HERONS - IBISES

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

#### SWANS - GEESE - DUCKS

Tundra Swan .....	o		u	u
Snow Goose .....			o	o
Brant .....			r	r
Canada Goose † .....	u		u	c
Wood Duck † .....	c	c	c	c
Green-winged Teal .....	o		o	o
American Black Duck † .....	u	u	u	u
Mallard † .....	u	u	u	u
Northern Pintail .....	r		o	o
Blue-winged Teal † .....	r	r	r	r
Gadwall .....			o	o
American Wigeon .....	o		o	o
Canvasback .....	r		o	o
Redhead .....	o		o	
Ring-necked Duck .....	u		u	u
Lesser Scaup .....	u		o	o
Common Goldeneye .....			o	o
Bufflehead .....	r		o	o
Hooded Merganser † .....	u	o	o	u
Common Merganser .....	o		r	o
Red-breasted Merganser .....	o		r	o
Ruddy Duck .....	r		o	o

#### VULTURES - HAWKS - FALCONS

Black Vulture † .....	u	u	u	u
Turkey Vulture † .....	c	c	c	c
Osprey .....	o		r	
Bald Eagle .....	r	r	r	r
Northern Harrier .....	o		r	
Sharp-shinned Hawk † .....	o	r	c	u



	s	S	F	W
Cooper's Hawk †	o	r	o	o
Red-shouldered Hawk †	c	c	c	c
Broad-winged Hawk	u		o	
Red-tailed Hawk †	c	c	c	c
American Kestrel †	u	u	u	u
Merlin	o		r	
<b>GROUSE - QUAIL - TURKEY</b>				
Wild Turkey	r	r	r	r
Northern Bobwhite †	c	c	c	c
<b>RAILS - CRANES</b>				
King Rail †	r	r	r	r
Sora	r	r	r	r
Common Moorhen	r	r	r	r
American Coot	o		o	o
<b>PLOVERS - SANDPIPERS</b>				
Semipalmated Plover	r		r	r
Killdeer	u		u	u
Greater Yellowlegs			o	o
Lesser Yellowlegs			o	o
Solitary Sandpiper	u		r	
Spotted Sandpiper	c	u	u	
Whimbrel	r			
Sanderling			o	
Semipalmated Sandpiper	o		o	
Western Sandpiper				r
Least Sandpiper			o	o
Short-billed Dowitcher			r	
Common Snipe	o		o	o
American Woodcock †	c	c	c	u
<b>GULLS - TERNS - AUKS</b>				
Laughing Gull	o	o	o	o
Ring-billed Gull	c	u	c	c
Herring Gull	u	u	u	u
Great Black-backed Gull	o		o	o
Caspian Tern	o			
Royal Tern	o			
<b>DOVES - CUCKOOS - OWLS - SWIFTS - HUMMINGBIRDS</b>				
Rock Dove	u	u	u	u
Mourning Dove †	c	c	c	c
Black-billed Cuckoo	o			
Yellow-billed Cuckoo †	c	c	o	
Eastern Screech-Owl †	u	u	u	u
Great Horned Owl †	u	u	u	u
Barred Owl †	c	c	c	c
Common Nighthawk	r	r	r	
Chuck-will's widow †	u	u	o	

	s	S	F	W
Whip-poor-will †	u	u	o	
Chimney Swift	c	c	u	
Ruby-throated Hummingbird †	c	c	u	
Belted Kingfisher †	c	c	c	c
<b>WOODPECKERS - FLYCATCHERS</b>				
Red-headed Woodpecker †	u	u	u	o
Red-bellied Woodpecker †	c	c	c	c
Yellow-bellied Sapsucker	u	o	u	u
Downy Woodpecker †	c	c	c	c
Hairy Woodpecker †	u	u	u	u
Northern Flicker †	u	u	c	c
Pileated Woodpecker †	c	c	c	c
Eastern Wood-Pewee †	c	c	u	
Acadian Flycatcher †	c	c	u	
Eastern Phoebe †	c	c	u	r
Great Crested Flycatcher †	c	c	c	
Eastern Kingbird †	u	u	u	
<b>LARKS - SWALLOWS - JAYS - CROWS</b>				
Purple Martin	u	u		
Tree Swallow †	u	o	u	
Northern Rough-winged Swallow †	u	u	o	
Bank Swallow	o			
Cliff Swallow	r	r		
Barn Swallow †	c	c	c	
Blue Jay †	c	c	c	c
American Crow †	c	c	c	c
Fish Crow †	u	u	u	u
<b>TITMICE - NUTHATCHES - WRENS</b>				
Black-capped Chickadee			r	r
Carolina Chickadee †	c	c	c	c
Tufted Titmouse †	c	c	c	c
Red-breasted Nuthatch †	r		u	u
White-breasted Nuthatch †	c	c	c	c
Brown-headed Nuthatch †	u	u	u	u
Brown Creeper †	r		o	o
Carolina Wren †	c	c	c	c
House Wren †	u	u	o	r
Winter Wren	r		u	u
Marsh Wren	o			
<b>KINGLETS - THRUSHES - THRASHERS</b>				
Golden-crowned Kinglet	o		u	u
Ruby-crowned Kinglet	o		u	u
Blue-gray Gnatcatcher †	c	c	u	
Eastern Bluebird †	u	u	u	o
Veery	o		r	
Gray-cheeked Thrush	o		r	
Swainson's Thrush	o		r	

	s	S	F	W
Hermit Thrush .....	o		u	c
Wood Thrush † .....	c	c	u	
American Robin † .....	u	u	c	c
Gray Catbird † .....	c	c	c	c
Northern Mockingbird † .....	u	u	u	u
Brown Thrasher † .....	u	u	u	u
<b>WAXWINGS - SHRIKES - STARLINGS</b>				
American Pipit .....	o		o	o
Cedar Waxwing .....	c	r	u	c
Loggerhead Shrike .....	r		r	r
European Starling .....	u	u	u	u
<b>UIREOS - WOOD WARBLERS</b>				
White-eyed Vireo † .....	c	c	c	
Solitary Vireo .....	o		o	
Yellow-throated Vireo † .....	u	u	u	
Warbling Vireo .....	o		r	
Philadelphia Vireo .....	o		o	
Red-eyed Vireo † .....	a	a	c	
Blue-winged Warbler .....	c		u	
Golden-winged Warbler .....	o			
Tennessee Warbler .....	u		u	
Nashville Warbler .....	o		o	
Northern Parula † .....	u	u	u	
Yellow Warbler † .....	u	u	u	
Chestnut-sided Warbler .....	o		u	
Magnolia Warbler .....	o		o	
Cape May Warbler .....	o		o	
Black-throated Blue Warbler .....	u		u	
Yellow-rumped Warbler .....	c		u	c
Black-throated Green Warbler † .....	c	c	u	
Blackburnian Warbler .....	o		o	
Yellow-throated Warbler † .....	u	u	u	
Pine Warbler † .....	c	c	c	u
Prairie Warbler † .....	c	c	c	o
Palm Warbler .....	u		u	
Bay-breasted Warbler .....	o		o	
Blackpoll Warbler .....	u		o	
Cerulean Warbler .....	o			
Black-and-white Warbler † .....	u	c	c	
American Redstart † .....	c	c	c	
Prothonotary Warbler † .....	a	a	c	
Worm-eating Warbler † .....	u	u	u	
Swainson's Warbler † .....	u	u	u	
Ovenbird † .....	a	a	c	
Northern Waterthrush .....	c	u	u	
Louisiana Waterthrush † .....	c	c	c	
Kentucky Warbler † .....	r	r	r	

	s	S	F	W
Common Yellowthroat † .....	c	c	c	u
Hooded Warbler † .....	c	c	c	
Wilson's Warbler .....	r		r	
Canada Warbler .....	o	o	o	
Yellow-breasted Chat t .....	u	u	u	
<b>TANAGERS - SPARROWS</b>				
Summer Tanager † .....	u	u	u	
Scarlet Tanager † .....	u	r	r	
Northern Cardinal † .....	c	c	c	c
Rose-breasted Grosbeak .....	u		u	
Blue Grosbeak † .....	u	u	o	
Indigo Bunting † .....	c	c	u	
Rufous-sided Towhee † .....	c	c	c	c
American Tree Sparrow .....	r		o	o
Chipping Sparrow † .....	u	u	o	r
Field Sparrow † .....	u	u	u	u
Fox Sparrow .....			u	u
Song Sparrow t .....	u	u	u	u
Swamp Sparrow .....	u	r	o	u
White-throated Sparrow .....	u		c	c
White-crowned Sparrow .....	r		r	r
Savannah Sparrow .....	u		o	u
Dark-eyed Junco .....	o		c	c
<b>BLACKBIRDS - FINCHES</b>				
Bobolink .....	o		r	
Red-winged Blackbird † .....	u	u	c	c
Eastern Meadowlark .....	o	o	o	r
Rusty Blackbird .....	o		o	o
Brewer's Blackbird .....			r	r
Boat-tailed Grackle .....	o	o	o	o
Common Grackle † .....	c	c	c	c
Brown-headed Cowbird † .....	c	c	c	c
Orchard Oriole † .....	u	u		
Northern Oriole .....	u	u	o	r
Purple Finch .....			o	u
Pine Siskin .....	o		u	u
American Goldfinch † .....	c	u	u	c
Evening Grosbeak .....	o		o	u

## **U.S. Fish and Wildlife Service**

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Refuge Manager  
Great Dismal Swamp National Wildlife Refuge  
P.O. Box 349  
Suffolk, Virginia 23434-0349  
Telephone: (804) 986-3705



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