

AGASSIZ NATIONAL WILDLIFE REFUGE
Middle River, Minnesota

ANNUAL NARRATIVE REPORT
Calendar Year 1988

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United States Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

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Middle River, Minnesota

ANNUAL NARRATIVE REPORT

Calendar Year 1988

<u>Joseph F. Fotsch</u>	<u>3-12-89</u>	<u>Edward S. Grogan</u>	<u>3/21/89</u>
Refuge Manager	Date	Refuge Supervisor Review	Date
<u>John R. Eadie</u>		<u>3/27/89</u>	
Regional Office Approval		Date	

INTRODUCTION

Agassiz National Wildlife Refuge occupies 61,449 acres in eastern Marshall County in the northwest corner of Minnesota. The refuge is situated within the prairie, aspen parkland and northern forest ecotone, an area of interspersed habitat types that attracts a great diversity of resident and migratory wildlife. The primary objective of the refuge is waterfowl production and maintenance.

Before white men came, the area abounded with wildlife. The lakes and marshes teemed with waterfowl and shorebirds. In 1909, the first drainage district was organized in the area to convert the marshes to arable land. The drainage system earned the distinction of being the largest single public drainage project in the United States.

By 1933, approximately 1 million dollars had been expended on the drainage systems to no avail. High tax assessments on drainage costs seriously affected landowners, and ultimately the financial condition of Marshall County. To save the County from bankruptcy, the State legislature passed an act absorbing the drainage taxes and authorized the lands to be purchased for the development of Mud Lake Migratory Waterfowl Refuge. Mud Lake (later renamed Agassiz) was established by Executive Order 7583 on 23 March 1937 and was purchased at a cost of \$6.14 an acre.

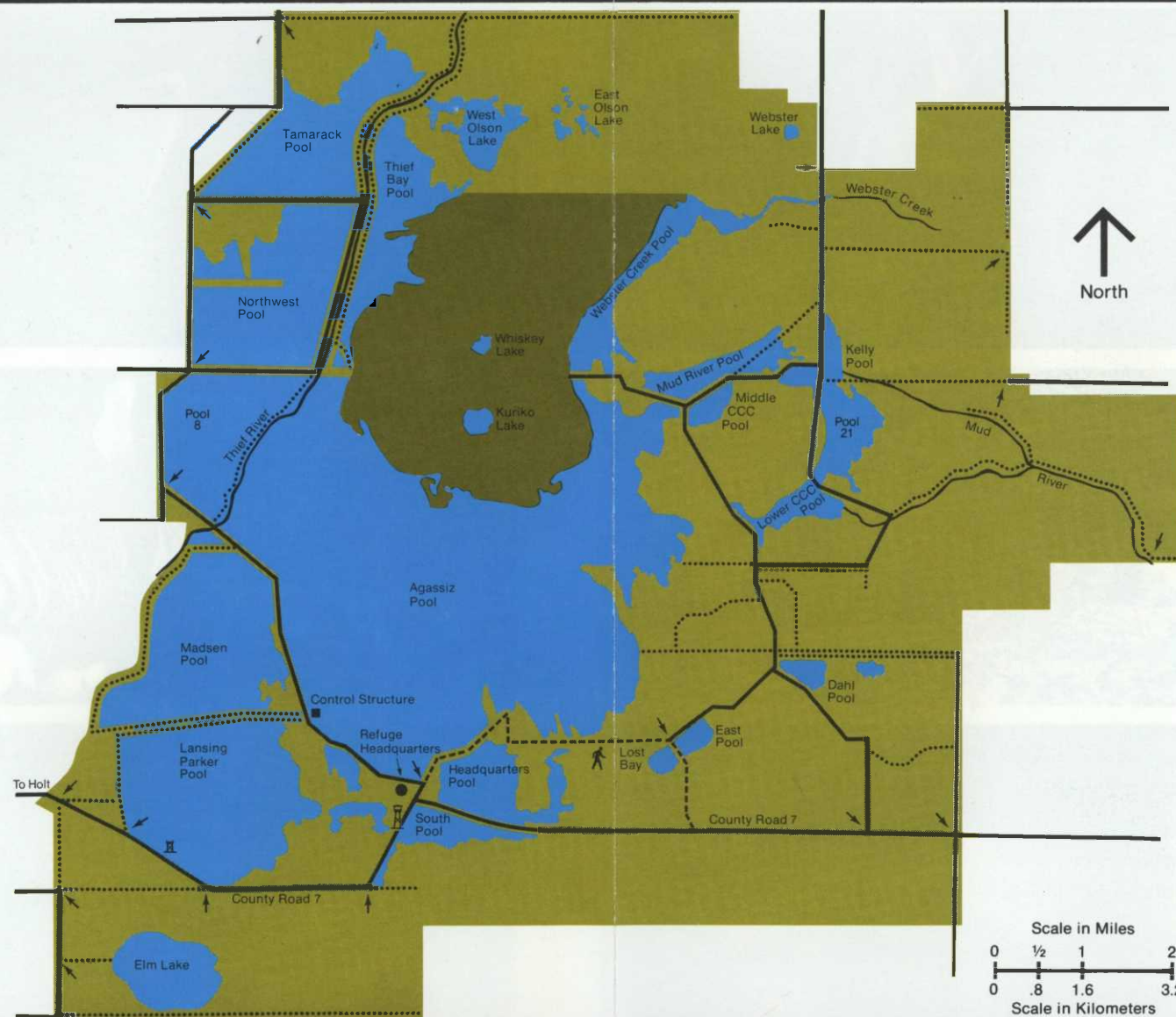
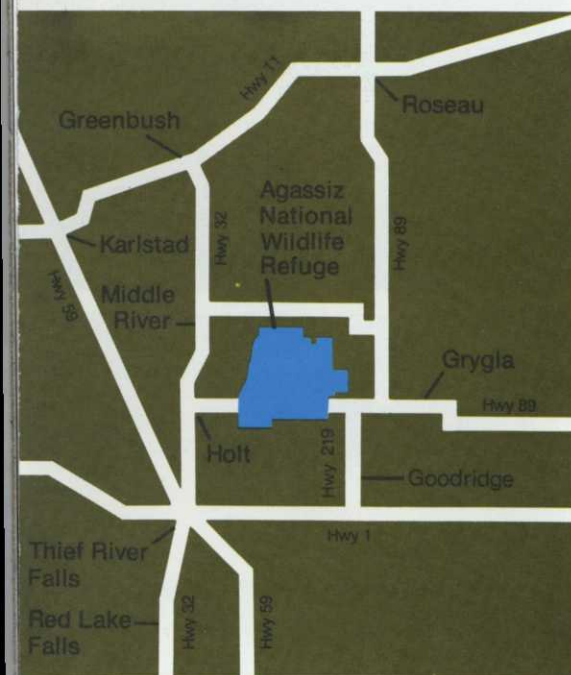
The flat terrain varies only 1-2 feet per mile. The watershed ultimately empties into the Red River of the North. The climate is characterized by wide variation in temperatures and late spring or early fall frosts. The average annual precipitation is about 21 inches and includes an average snowfall of 39 inches. Temperature extremes range from -47° to 108°F . The average frost free period is 115 days.

Refuge habitat acreages occur as follows: wetland 40,043, grassland 4,175, brushland 10,000, woodland 7,000, cropland 160, and administration 71. The dominant wetland vegetation is cattail. Brushland and woodlands are primarily willow and aspen. The area contains a 4,000-acre wilderness interspersed with black spruce and tamarack and two bog lakes.

A diversity of wildlife species inhabit the refuge including more than 274 species of birds and 49 species of mammals. Agassiz has the distinction of having the only known resident pack of eastern gray wolves on any refuge in the lower 48 states.

Legend

Refuge Wetlands	Control Structure	
Refuge Uplands	Observation Deck	
Wilderness Area	Observation Tower	
All Season Gravel Roads	Foot Trail	
Seasonal Roads	Refuge Gates	
Lost Bay Auto Tour Route		



Agassiz National Wildlife Refuge and the surrounding area.

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INTRODUCTION	<u>Page</u>
TABLE OF CONTENTS	i
A. HIGHLIGHTS	1
B. CLIMATIC CONDITIONS	2
C. LAND ACQUISITION	
1. Fee Title	Nothing to Report
2. Easements	Nothing to Report
3. Other	3
D. PLANNING	
1. Master Plan	Nothing to Report
2. Management Plan	4
3. Public Participation	4
4. Compliance with Environmental and Cultural Resource Mandates.	5
5. Research and Investigations	5
6. Other	Nothing to Report
E. ADMINISTRATION	
1. Personnel	10
2. Youth Programs	12
3. Other Manpower Programs	14
4. Volunteer Program	14
5. Funding	14
6. Safety	15
7. Technical Assistance	16
8. Other Items	20
F. HABITAT MANAGEMENT	
1. Geneal	Nothing to Report
2. Wetlands	23
3. Forests	Nothing to Report
4. Croplands	30
5. Grasslands	31
6. Other Habitats	Nothing to Report
7. Grazing	Nothing to Report
8. Haying	32
9. Fire Management	33
10. Pest Control	34
11. Water Rights	Nothing to Report
12. Wilderness and Special Areas	36
13. WPA Easement Monitoring	Nothing to Report

G. WILDLIFE

1. Wildlife Diversity	36
2. Endangered and Threatened Species	36
3. Waterfowl	38
4. Marsh and Water Birds	43
5. Shorebirds, Gulls, Terns and Allied Species	44
6. Raptors	45
7. Other Migratory Birds	46
8. Game Mammals	47
9. Marine Mammals	Nothing to Report
10. Other Resident Wildlife	52
11. Fisheries Resources	53
12. Wildlife Propagation and Stocking	Nothing to Report
13. Surplus Animal Disposal	Nothing to Report
14. Scientific Collections	Nothing to Report
15. Animal Control	54
16. Marking and Banding	54
17. Disease Prevention and Control	Nothing to Report

H. PUBLIC USE

1. General	55
2. Outdoor Classrooms-Students	56
3. Outdoor Classrooms-Teachers	Nothing to Report
4. Interpretive Foot Trails	57
5. Interpretive Tour Routes	57
6. Interpretive Exhibits/Demonstrations	58
7. Other Interpretive Programs	58
8. Hunting	59
9. Fishing	Nothing to Report
10. Trapping	61
11. Wildlife Observation	62
12. Other Wildlife Oriented Recreation	Nothing to Report
13. Camping	Nothing to Report
14. Picnicking	Nothing to Report
15. Off-Road Vehicling	Nothing to Report
16. Other Non-Wildlife Oriented Recreation	Nothing to Report
17. Law Enforcement	62
18. Cooperating Associations	Nothing to Report
19. Concessions	Nothing to Report

I. EQUIPMENT AND FACILITIES

1. New Construction	63
2. Rehabilitation	64
3. Major Maintenance	65
4. Equipment Utilization and Replacement	66
5. Communications Systems	66
6. Computer Systems	67
7. Energy	67
8. Other	Nothing to Report

J. OTHER ITEMS

1. Cooperative Programs	67
2. Other Economic Uses	Nothing to Report
3. Items of Interest	Nothing to Report
4. Credits	68

K. FEEDBACK Nothing to Report

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

A. HIGHLIGHTS

No water was discharged the entire drought stricken year. (Section F.2).

Sixty-one FmHA parcels reviewed resulted in 13 proposed conservation easements. (Section C.3).

Work began on the Elm Lake restoration project by Ducks Unlimited. Eleven thousand feet of dike were constructed. (Section I.1).

Seven thousand feet of dike was cored along the Tamarack Pool east dike. (Section I.3).

The cleanout of 1.25 miles of Berg ditch was completed. (Section I.3).

The Region 3 hydromower was destroyed by fire on 14 September. (Section E.6).

A total 18 CRP restoration agreements were signed to restore 37 wetland basins for a total 250 acres. (Section E.7).

A total 634 district and 66 area SCS wetland appeals were done. (Section E.7).

A total 3,255 staff hours were spent in support of the Farm Bill. (Section E.7).

The first nesting attempt since 1961 by bald eagles was documented. (Section G.2).



Photo 1. The way it was - Drought of 88. GT

B. CLIMATIC CONDITIONS

The refuge has been a National Weather Service station for 31 years. Table 1 compares data for 1988 with the 22-year (1968-1988) period.

The yearly low temperature of -32°F was recorded on 2 February. Average daily temperatures were above average for March through August. Many "hot" days were observed during this time period. The yearly high temperature of 99°F was recorded on 5 July. University of North Dakota (UND), Grand Forks, North Dakota, located 65 miles southwest of the refuge, records reveal July to have been the second warmest July since 1891.

Dry describes the entire growing season for 1988. This was a continuation of the dry conditions during the 1987 fall period. Precipitation was 5 inches below the annual average of 21 inches. Precipitation for April measured only a trace setting a record for being the driest April. Dirt storms were common in April and May. Wildfire potential was very high in April and early May. Minnesota Department of Natural Resources state climatologist in St. Paul, Minnesota has preliminary data that shows April through June was the driest three month period on record and May through July was the warmest three month period on record in Minnesota. Farmers began spring field work on 16 April and by 30 April most farmers had completed planting small grains. Rain seemed to fall at the most critical times during the growing season, providing all plants a new look for life. Small grain harvesting began in the latter half of July and by 15 August 90 percent of the small grain on private land was harvested and by the end of August all small grain was harvested. Crop yields varied from 20 to 60 percent of average yields.

Topsoil and subsoil moisture was in short to very short supply during the entire year. Snow melt runoff lasted only from 1-2 April. Type I wetlands on private lands were dry by 3 April. Water levels in refuge pools declined throughout the ice-free period and by freeze-up water levels had declined by as much as 2.5 feet.

Table 1. Temperatures and precipitation for 1988 and the 21-year average (1967-1988) for temperature, snowfall and precipitation.

	Temperature °F		Snowfall (inches)		Precipitation (inches)	
	Maximum	Minimum	1988	1967-1988	1988	1967-1988
January	34	-30	7.4	8.9	0.7	0.6
February	41	-32	2.7	6.0	0.1	0.4
March	47	-3	10.9	5.9	1.3	0.7
April	75	11	tr.	1.5	tr.	1.4
May	90	30	0.0	0.1	3.0	2.5
June	95	42	0.0	0.0	1.0	3.6
July	99	44	0.0	0.0	2.7	3.2
August	97	38	0.0	0.0	1.7	2.9
September	81	32	0.0	0.0	3.0	2.5
October	79	4	0.3	0.8	0.7	1.8
November	51	-6	6.9	6.3	0.8	0.9
December	39	-24	13.0	7.4	0.8	0.5
Totals			41.2	36.9	15.8	21.0

C. LAND ACQUISITION

3. Other

A major effort of the 1985 Farm Bill as it relates to Executive Order 11990 was the surveying of FmHA Inventory Property for existing and restorable wetlands. Agassiz was given the responsibility of the six northwest counties in Minnesota.

A total of 61 parcels of land were reviewed resulting in 13 proposed conservation easements (CE), see table 8 for the results. Three of the proposals were submitted to have management by the Minnesota Department of Natural Resources (MDNR) and nine by the U.S. Fish and Wildlife Service. Two properties in Lake of the Woods County (C. Rinehart and S. Rinehart) lie within the critical habitat zone for the threatened gray wolf. If all proposals are accepted as written, approximately 24 wetlands will be restored. The 5441 acres proposed for MDNR management is a large palustrine scrub/shrub emergent, saturated wetland dominated by willows and reed canary. The area is excellent for moose, deer and cranes.



Photo 2. First FmHA inventory parcel (80 acres) authorized for transfer to FWS. GT

In mid November, opposition by local farmers grew against the conservation easement (CE) program. A 260 person signed petition against the CE program in Marshall County was received. The petition was answered by a letter jointly written by FmHA and F&WS, signed by FmHA Director Russ Bjorhus and Regional Director Jim Gritman. The letter addressed the farmers concerns but also identified the requirement by law that FmHA protect and enhance wetlands and that the Fish and Wildlife Service was recognized as a needed consultant.

D. PLANNING

2. Management Planning

The station Search and Rescue Plan was approved in 1988 and the Safety Management Plan was revised and submitted to the Regional Office for approval.

3. Public Participation

During the period 20 April-27 May 1988, the Elm Lake Environmental Assessment (EA) was made available to area public libraries for review and comments. The public was informed of the review opportunities through local news releases and radio announcements. Copies were also mailed to local governmental offices, organizations, agencies and individuals that had an expressed interest in the project (see Section D.4. for additional information).

4. Compliance with Environmental Cultural Resource Mandates

1. The Elm Lake development is a Prairie Pothole Joint Venture project in support of the North American Waterfowl Management Plan involving the Fish and Wildlife Service, Minnesota Department of Natural Resources, Red Lake Watershed District, and Ducks Unlimited to restore the historically drained Elm Lake basin and impound approximately 2,360 acres.

In January 1987, a public hearing was conducted by the Red Lake Watershed District at Thief River Falls, Minnesota. Although most of the testimony was opposed to the project, the Watershed Board voted 4-3 in favor of proceeding with the project.

During February 1988, the townships of Agder, Grand Plain and Moylan appealed the approval of the project to the State District Court at Warren, Minnesota. In March 1988, Judge Warren Saetre upheld the project. The townships reappealed to the State Circuit Court and again the project was upheld and authority to proceed was granted.

An Environmental Assessment was prepared, distributed and reviewed in spring 1988. Twelve letters were received in opposition to the project. The Regional Director determined that the project was not a major Federal action that would significantly affect the quality of the human environment within the meaning of Section 102 (a)(c) of the National Environmental Policy Act of 1969. The finding of no significant impact was determined and signed in April 1988. Also the State Historical Preservation Officer determined that no historic or archeological sites were present in the project area. Subsequently, permit applications were prepared, submitted and acquired from the Minnesota DNR, Division of Waters, and the Army Corps of Engineers, authorizing the actual construction (see Section I.1.-New Construction).

2. Environmental action memoranda were prepared for two FY1989 construction projects in Madsen Pool. A one-mile cross ditch cleanout and a water control structure, both located within Madsen Pool. Construction permit applications have been submitted to the Minnesota DNR, Division of Waters, Corps of Engineers and the Red Lake Watershed District. Approval has been granted by the Corps and Watershed District. The State permit is forthcoming. Additionally, these projects were reviewed by the Minnesota State Historic Preservation Office. They determined that no historic or archeological sites are located in the project area.

5. Research and Investigations

Causes and magnitude of mortality of juvenile canvasbacks

USFWS, Northern Prairie Wildlife Research Center
Principal Investigator: Carl Korschgen
Field Investigators: Kevin Kenow and Bill Green
Field Collaborator: Refuge Biologist Mattsson

This was year 2 of a 4-year study. The goal of this study is to develop telemetry techniques and conduct research to determine the cause and magnitude of canvasback duckling mortality.

Objectives:

1. Develop radio-telemetry techniques for canvasback ducklings from hatching to fledging.
2. Determine the daily survival rate of juvenile male and female canvasback from hatching to fledging.
3. Determine the causes and timing of mortality of canvasbacks from hatching to fledging.
4. Determine the growth and development rates of canvasback ducklings.
5. Determine habitat use by juvenile canvasbacks.

Methods:

1. Capture and radio-mark hens in early spring prior to, or in the early stages of nesting.
2. Nest searching by airboat to locate nests.
3. Artificial incubation and hatching of eggs.
4. Implantation of a miniature radio transmitter in ducklings as young as a few hours old.
5. Deployment of radio-marked ducklings to an active canvasback nest.
6. Monitor movements and survival of ducklings using radio telemetry. Location and temperature of each duckling determined using a lap-top computer.
7. Recovery of dead ducklings and determination of cause of death.
8. Determine the affects of radio transmitters on the growth and development of canvasback ducklings.

Results:

Of 16 hens trapped in spring, 15 were equipped with transmitter implants. Eight hens received abdominal implants and 7 received subcutaneous implants on the back. Nests were located for 7 of the 15 hens. Two other hens presumably nested but there nests were not located.



Photo 3. Female canvasback receiving abdominal radio implant. JPM

Table 2. Fate of canvasback nests found at Agassiz NWR, 1987-88.

	1987	1988
Active nests found	31	31
Search period	14 May-10 July	26 May-09 June ^a
Nest fate:		
Abandoned	11 (35.5%)	6 (19.4%)
Used for deployment	11 (35.5%)	12 (38.7%)
Destroyed by predator	8 (25.8%)	10 (32.3%)
Hatched - no deployment	0	3 (9.7%)
Hatched - some eggs destroyed by predator	1 (3.2%)	0

^aInitiation of nest searching was delayed to late May in 1988 to reduce high incidence (35.5%) of nest abandonment observed in 1987.



Photo 4. Finished product. Ducklings are ready for deployment as soon as feathers dry from the zephyrine chloride antiseptic. JPM



Photo 5. Nest deployments usually contained equal numbers of marked and unmarked ducklings.

Table 3. Fate of radio-marked canvasback ducklings released at one day of age.

	1987	1988
No. successful deployments ^a	5	11
No. radio-marked ducklings ^b	28	43
Duckling fate:		
Mink	12 (42.9%)	5 (11.6%)
Avian	0	2
Am. coot	0	1
Unk. predator	0	2
Predators	12 (42.9%)	10 (23.3%)
Exposure deaths	5 (17.9%)	15 (34.9%)

^aEvidence that hen and ducklings accepted one another.

^bSuccessful deployments only

Most mortality occurred within the first few days of life. Carcasses of ducklings recorded as "exposure deaths" are being examined at the National Wildlife Health Research Center, Madison, WI, to evaluate causes of death.

At least 4 transmitters with duckling remains were recovered directly from mink dens. The refuge mink population in 1987 was probably at an all time high as evidenced by fall trapping results (7 trappers caught 265 mink - the previous high was 160). The mink population declined considerably by fall 1988 due to drought conditions.

Iowa State University graduate student, Gary Zenitsky, completed the second year of a 3-year study to examine the growth and behavior of captive, radio-marked redhead ducklings as well as growth of canvasback ducklings released to the wild. A duckling propagation facility was constructed at the headquarters for this aspect of the study. Data are being analyzed.

E. ADMINISTRATION



Photo 6.

3 5 7 2 8 4 1

1. Personnel

1. Joseph Kotok.....Project Leader.....GS 12/10...PFT
2. Larry Rauen.....Primary Assistant Refuge Manager...GS 11/4....PFT
3. James P. Mattsson...Refuge Biologist.....GS 11/7....PFT
4. David F. Bennett....Assistant Refuge Manager.....GS 9/6.....PFT
5. Gary D. Tischer.....Assistant Refuge Manager.....GS 7/7.....PFT
6. Beulah J. Wikstrom..Administrative Technician.....GS 5/7.....PFT
7. Virgil D. Erickson..Maintenance Mechanic.....WG 9/5.....PFT
8. Conrad O. Burrell...Engineering Equipment Operator....WG 8/5.....PFT
9. James E. Sellin.....Tractor Operator.....WG 6/4....CSFT

10. Corey Green.....Youth Supervisor.....6-13 to 8-11.....OJT
11. Shelly Fillmore.....6-13 to 9-09.....SYEP
12. Aaron Dahlen.....6-13 to 8-09.....SYEP
13. Dawn Swenson.....6-13 to 8-10.....SYEP
14. Dickie Johnson.....6-13 to 8-05.....SYEP
15. Tom Pittman.....6-13 to 8-10.....SYEP
16. Nanette Berg.....6-06 to 8-03.....YCC
17. Shannon Henrickson.....6-14 to 8-05.....YCC
18. Steve Sistad.....6-06 to 6-09.....YCC



Photo 7.

13 12 15 10



Photo 8.

16 17

Gary Tischer was selected for the GS-7 assistant manager position in June. Gary was upgraded from a GS-6 Biological Technician.

The tractor operator position was again filled by Jim Sellin. In January, Jim Sellin was offered the opportunity to convert his career seasonal position to permanent status but declined due to health reasons relating to the cold winters.

Table 4. Five-year staffing pattern, Agassiz NWR.

Fiscal Year	PFT	PPT/CSFT	Temporary	Total FTE's
1984	8	2	1	9.3
1985	8	1	0	8.7
1986	8	3	0	9.5
1987	8	3	0	9.7
1988	8	1	0	8.6

2. Youth Programs

This was the fifth year Agassiz National Wildlife Refuge hosted a Youth Conservation Corps (YCC) program. Two enrollees, one female and one male, were selected by lottery drawing with several alternates drawn at the same time. The program began on 6 June and ended 5 August. The first male enrollee worked three days when he resigned to take a better paying job with more working hours. The male alternate completed the work hours for that position. Each position was allotted 320 hours which included one paid holiday.

Supervision and program implementation was the responsibility of Assistant Manager Tischer. Along with YCC, supervision was provided to 5 Summer Youth Employee Program (SYEP) enrollees and 1 On The Job Training (OJT) youth supervisor. Salaries for three of the enrollees were funded through the state Minnesota Youth Program (MYP) and salaries for the two Summer Youth Program (SYP) enrollees were federally funded. Youth from both projects worked together on the assigned projects. Corey Green, an OJT enrollee this year and a previous SYP and YCC enrollee, was designated crew leader. His salary was cost shared 50/50 with the Inter-County Community Council, Incorporated, a job service organization. All SYEP enrollees, except for one, and the OJT enrollee completed their 300 hours of employment by 11 August, when the program terminated. One enrollee chose not to complete his 300 hours.

The 1988 youth program was a good one. As in previous years, most work was associated with maintenance and upgrading of refuge buildings, equipment and public use facilities. Nearly all YCC work activities supported the "Take Pride in America" theme. The largest project was the painting of a mobile home which was moved to Agassiz by Northern Prairie Wildlife Research Center. The color was changed from a tan to a dark brown earthtone color, matching

other refuge buildings. Other work activities included: 1) Removing the old office cement sidewalk and constructing a new one, 2) lawnmowing, 3) painting the office basement floor and walls, 4) painting gates and water control structure railings, 5) painting picnic tables, 6) staining the Parker Pool overlook bridge and replacing several stairway steps, 7) replacing boundary posts and signs, 8) making kiosk displays, 9) washing, waxing and vacuuming vehicles, 10) categorizing slides in the slide file, 11) installing water control structure stoplog racks, 12) filling holes in roadways with gravel, 13) taking weekly car counter readings, 14) recording daily weather observations, 15) maintaining the foot trail, 16) removing vegetation from banding sites, 17) repairing banding nets and holding cages, and attending monthly safety meetings. Most activities required manual labor and were completed outdoors.



Photo 9. Summer youth constructing handicap access sidewalk at office headquarters. JPM

Program strong points were the development of good youth work habits, accomplishment of numerous outdoor manual labor projects and environmental education. Environmental education requirements were met by: 1) explaining refuge management programs, 2) wildlife and plant identification in the field, 3) geology of the area, 4) showing 16mm films on the National Wildlife Refuge System, waterfowl identification and several other wildlife movies, and 6) a field trip to Tamarac National Wildlife Refuge and the Detroit Lakes Minnesota Department of Natural Resources fish hatchery.

Our station safety record remained good with no YCC accidents occurring for the fourth consecutive year.

3. Other Manpower Programs

Six area youth were employed through the local job services organization, Inter-County Community Council, Inc. (ICCC) a youth program operated under the Job Training Program Act (JTPA). The youth supervisor position, under the On The Job Training (OJT) program was cost shared 50/50, and the five other enrollees were cost-free under the Summer Youth Employment Program (SYEP). The refuge's obligation was to provide supervision and a worksite.

Corey Green, OJT youth supervisor, assisted supervising SYEP and YCC assigned daily tasks. The reduced work restrictions of SYEP youth often helped work crew efficiency.

4. Volunteer Program

The greatest interest of volunteers is the preseason waterfowl banding program. However, because the refuge participated in an reward band program this year, volunteers were not used to prevent possible public disclosure which would jeopardize the study. Also, all existing refuge housing is being used by Northern Prairie personnel. As Agassiz is a remote station it is difficult to get volunteers without providing housing. Consequently, there were no volunteers in 1988.

5. Funding

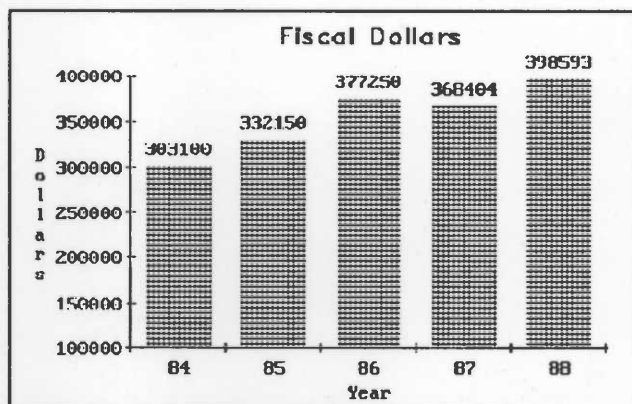


Figure 1. Fiscal Year funding for the last five years.

Agassiz's FY88 budget was \$398,593, an increase of \$30,189 over FY87 allotment of \$368,404. The FY88 O&M dollars (\$345,404) were sufficient to cover salaries, fixed expenses and supplies. Small ARMM'S (\$53,200) allowed for the purchase of an IBM PC/2 microcomputer (to replace the antiquated Datapoint), complete with Hewlett-Packard printer, Hayes Smart Modem, software and furniture, and a Konica-Royal photocopier to replace the worn out Savin 755 copier. Also accomplished by ARMM's funds were the clean out of 1.25 miles of the Berg ditch, rehabilitation of Tamarack

dike and obligation of \$19,000 for gravel. Smaller purchases were for boundary signs and replenishment of our leaflet supply.

Two vehicles were acquisitioned during the year, a 6-cylinder truck to replace the 1979 Chevrolet, and a compact van to replace the 1978 Ford Fairmont station wagon. The compact van acquisition for \$12,000 was cancelled when at year-end the Regional Office needed the dollars to cover the Region's funding shortage.

Ten thousand dollars was received for the Farm Bill. The entire amount was expended for rental of a caterpillar and trailer used for wetland restorations. The allotment of \$3,400 for the YCC program was just enough to cover enrollee salaries.

6. Safety

Only eight scheduled meetings were held during the year. The busy schedule of 1988 Farm Bill activities made it difficult to assemble the staff for safety meetings. This necessitated congregating small groups of employees for informal tailgate sessions prior to starting work projects. Topics of the scheduled meetings were the uses of pesticides on refuges, defensive driving refreshers, hunting safety, chain saw operation, electrical/shop safety, health and physical fitness and AIDS.

On 11 February the safety committee met to schedule meetings and topics for the year.

One lost time accident involving 16 hours occurred on 25 May. Tractor Operator Jim Sellin received injury to his left knee and ankle when bumped by a vehicle during a prescribed burning operation.

On 14 September the Region's hydro-mower was destroyed by fire. The mower was operated by Maintenance Mechanic Virgil Erickson and was used to assist Ducks Unlimited in clearing a survey area within the Elm Lake Project site. When Mr. Erickson was about to quit for the day he smelled smoke around the equipment. After checking, he observed smoke/fire from the engine. His attempt to put out the fire with an extinguisher was unsuccessful. It has not been determined what started the fire. The quick thinking of Mr. Erickson avoided a major wildfire on the state wildlife management area. Mr. Erickson was not injured. Replacement cost is estimated at \$126,000.



Photo 10. Destroyed Regional hydromower. LR

On 20 December, Assistant Managers Rauen, Bennett and Tischer and Maintenceman Erickson took and passed the required annual fire fighter fitness test (step test).

Audiometric examinations were completed by Assistant Managers Bennett, Rauen and Tischer, Biologist Mattsson, and Maintencemen Erickson, Burrell and Sellin on 27 April.

The Safety Health Inspection Certificate was completed on 29 April.

On 18 July, Sally Rygula, Safety Technician, Regional Office, completed a safety inspection of the refuge and YCC activities. She reported no major safety problems.

7. Technical Assistance

With the station's implementation of the farm program in 1987 field activities greatly increased during 1988. Assistance was provided to U.S.D.A. officials in the six northwest counties of Minnesota. These counties included Kittson, Lake of the Woods, Marshall, Pennington, Red Lake and Roseau.

In February 1,950 Conservation Reserve Program landowners were sent a letter explaining the role of the FWS in restoring wetlands. A 11 percent response, or 220 returned letters and phone inquiries, were received. Landowner contacts were made to arrange appointments to meet at county Soil Conservation Service offices. Many responses were dropped because the landowner wanted long dikes, a wildlife dugout or a wetland deepened. Plugging ditches to restore wetlands was the programs purpose. All work was free and was completed by refuge staff. Work items included surveying, staking, plugging and seeding of the plug and disturbed site. All seed was provided by the refuge. A mixture of six grasses and legumes was used except one site was seeded with switchgrass where there was native prairie.

A contract was signed by FWS and the CRP landowner for the length of the ASCS CRP contract. If the landowner cancels within 4 years, the landowner is required to pay back all restoration costs. Otherwise, expiration of each contract ends on 30 September of the year the Agricultural Stabilization and Conservation Service (ASCS) CRP contract expires. CRP contracts expire after 10 years.

Surveying began on the first wetland restoration on 17 June. Plugging of the last drainage ditch was completed on 14 September. A total of 14 CRP agreements and 4 private agreements were signed. Thirty-seven wetland basins were restored with a total of 37 ditch plugs in Marshall, Pennington and Red Lake counties. A total of 250 acres of wetlands have been restored on private lands. Add-on funds for this program totalled \$ 10,000.00.



Photo 11. CRP restoration.

GT

During 1988 technical assistance on district level wetland appeals was provided to seven District Soil Conservation Service Offices. Technical

assistance was also provided to one Area Soil Conservation Service Office on Area Wetland Appeals. Although Agassiz was assigned to the six northwest counties of Minnesota, overlap of District Soil Conservation Service offices into adjacent counties explains the appeals in Beltrami and Polk counties. Also Marshall County has two District Soil Conservation Service offices.

A total of 634 district and 66 area appeals were done in 1988. See tables 5 and 6 for county totals. Of those, two were appealed to state level. In both cases the state appeal upheld the district level determination. Both are headed for Washington level appeal.



Photo 12. Typical agricultural drainage in NW Minnesota. April LR

Table 5. District Wetland Appeals.

County	# of Landowners	# of Areas Appealed	<u>Determination</u>			
			W	FW	NW	CW
Beltrami	4	52	33	1	18	0
Kittson	2	15	6	0	9	0
Lake of The Woods	0	0	0	0	0	0
Marshall	22	201	77	0	116	8
Pennington	11	99	58	0	35	6
Polk	1	23	3	0	20	0
Red Lake	20	50	20	1	28	1
Roseau	42	194	128	0	37	29
TOTALS	102	634	325	2	263	44

Table 6. Area Wetland Appeals.

County	# of Landowners	# of Areas Appealed	W	<u>Determination</u>		
				FW	NW	CW
Beltrami	2	27	19	0	8	0
Marshall	3	27	14	0	13	0
Roseau	4	12	5	0	3	4
Totals	9	66	38	0	24	4

Table 7. Farm Bill Hours - 1988.

Month	<u>Hours</u>			Total
	FmHA	CRP	Swampbuster	
January	116	78	71	265
February	19	164	27	210
March	17	191	51	259
April	56	60	120	236
May	190	51	106	347
June	39	278	137	454
July	85	405	79	569
August	75	249	49	373
September	23	101	45	169
October	46	5	44	95
November	11	21	40	72
December	37	126	43	206
Totals	714	1729	812	3255

Table 8. FmHA Inventory Property Status.

County	Property Name	D-dropped CE ¹ -proposed	Proposed CE size	Proposed CE Manager
Kittson	Karlstad ²	CE(K-10C)	5246 (A)	State
Lake of the Woods	Lambrecht	CE(Lw-13C)	488	F&WS
	Undahl	CE(LW-12C)	150	F&WS
	C.Rinehart	CE(LW-11C)	280	F&WS
	S.Rinehart	CE(LW-10C)	160	F&WS
	Forshen	D		
	Jerczek	D		
Marshall (Grygla)	Barton	CE(M-10C)	65	F&WS
	Dahlen	D		
	Carey	D		
Marshall (Warren)	Hanson	CE(M-14C)	104	F&WS
	King	CE(M-13C)	175	F&WS
	Larson	CE(M-12C)	35	State
	Leader	D		
	Solberg	CE(M-15C)	160	State
	Westerlund	CE(M-11C)	115	F&WS
	Johnson	D		
	Loeslie	D		
	R.Solberg	D		
Red Lake	Bedker	D		
Pennington	Peterson ³	CE(M-10C)	76	F&WS
	Anderson	D		
	Troska	D		
Roseau	Berry	CE(R-10C)	170	F&WS
	Dieter-20	D		
		D=12	5441	State
	25	CE=13	1718	F&WS

¹CE=conservation easement²Originally received as 36 parcels³Accepted 9/26/888. Other Items

A check for \$26,995 was delivered by Project Leader Kotok to the Marshall County Treasurer on 19 April as part of the Fish and Wildlife Service's annual revenue sharing program. The payment represented 59 percent of the full entitled amount.

On 6 January, Assistant Manager Tischer received a Special Achievement Award for his work performance during 1987.

On 22 January, Manager Kotok received a Special Achievement Award for his work performance during 1987.

On 29 January, Maintenceman Erickson received a Special Achievement Award for his extra effort in restoration of wetlands on CRP lands from the Division of Wetlands.

On 26 April, Primary Assistant Manager Rauen attended the Marshall/Beltrami Soil and Water Conservation District meeting in Grygla, Minnesota, to discuss the years construction and water projects.

Due to the extreme dry conditons during summer 1988, a burning ban was declared on 2 May by the Minnesota Department of Natural Resources.

Manager Kotok was interviewed by Discovery Magazine on 4 May. An article on moose and Agassiz NWR, resulting from the interview, was published in the magazine's Fall 1988 issue.

Deb Southworth, Regional ADP Office of Refuges and Wildlife, visited the refuge on 11-12 July and gave a two day training session on the IBM PS2 computer.

The refuge staff hosted the 1988 RF1 Project Leaders meeting on 29 August-1 September.



Photo 13. Mallard wing aging techniques were reviewed at the project leader meeting in Thief River Falls. LR

On 28 September, a new 1/2 ton 4x4 Dodge Ram was received. It replaced the 1977 Dodge Club Cab which was transferred to the Detroit Lakes Wetland Management District.

Biologist Mattsson presented a seminar entitled "Habitat and Production Studies of Canvasbacks and Redheads at Agassiz NWR" to North Dakota State University, Fargo, on 28 September.

On 4 October, ten University of Minnesota students from Crookston participated and learned banding techniques from the refuge staff.

On 17 October, Len Luoma from Northern Engine and Supply Company, Duluth, Minnesota, visited the refuge to inspect the fire damage to the hydro-mower and to determine restoration cost. The cost to replace all damaged parts with new parts was estimated at \$89,568. It was estimated to cost \$79,960 to restore the unit using salvageable parts.

Manager Kotok and Biologist Mattsson met with Joel Vance, Missouri Conservation Department on 27 October. Mr. Vance was compiling information about Agassiz NWR on behalf of the National Wildlife Federation for an upcoming book. Agassiz was selected by the Federation to be one of 100 best wildlife viewing areas in the United States.

In August, Biologist Mattsson was selected to present a paper (in December) on canvasback and redhead nesting ecology at the 50th Midwest Fish and Wildlife Conference. After much preparation for his presentation, his slot was cancelled one week before the conference without prior notification. Dr. Jan Eldridge, WAM-1 Biologist made the presentation for him.

Training sessions, workshops and significant activities attended by refuge personnel in 1988 are listed below:

Joseph Kotok

- Farm Bill/Budget Meeting, Regional Office - 20-22 January
- Inservice 40-hour LE Training, Camp McCoy - 29 Feb.-4 March

Larry Rauen

- Farm Bill/Budget Meeting, Regional Office - 20-22 January
- Area SCS Swampbuster Session, Thief River Falls - 26 January
- Inservice 40-hour LE Training, Camp McCoy - 22-26 February
- Swampbuster Coordination Meeting, Fergus Falls - 10 May
- Farm Bill Meeting, St. Cloud - 14-15 December

Dave Bennett

- Area SCS Swampbuster Session, Thief River Falls - 26 January
- Inservice 40-hour LE Training, Camp McCoy - 22-26 February
- Farm Bill Surveying Techniques Training, Litchfield - 24 May
- Farm Bill Meeting (writing of FmHA conservation easements), Regional Office - 25 July
- Farm Bill Meeting, St. Cloud - 14-15 December

Jim Mattsson

- Area SCS Swampbuster Session, Thief River Falls - 26 January
- Minnesota Sandhill Crane Committee Meeting, Bemidji - 29 March

Gary Tischer

- Area SCS Swampbuster Session, Thief River Falls - 26 January
- Farm Bill Surveying Techniques Training, Litchfield - 24 May
- Non-Game Management Workshop, Regional Office - 10-11 August
- Farm Bill Meeting, St. Cloud - 14-15 December

Beulah Wikstrom

- Administrative Workshop, Twin Cities - 12-14 April

Conrad Burrell

- Farm Bill Surveying Techniques Training, Litchfield - 24 May

F. HABITAT MANAGEMENT

2. Wetlands

The nearly 40,000 acres of wetlands at Agassiz are managed to meet the primary objective for the establishment of the refuge, waterfowl production and maintenance. A variety of other marsh-associated species also benefit.

The wetlands have been subdivided into 18 pools ranging in size from 100 to 10,000 acres. Specific management schemes are developed for each of the pools.

Seventeen pools had approved water levels for 1988. Due to drought conditions, only four pools reached objective levels in May. Seventeen pools have proposed water levels for 1989. All pools are from one to four feet below proposed elevations at time of freeze up (Figure 2).

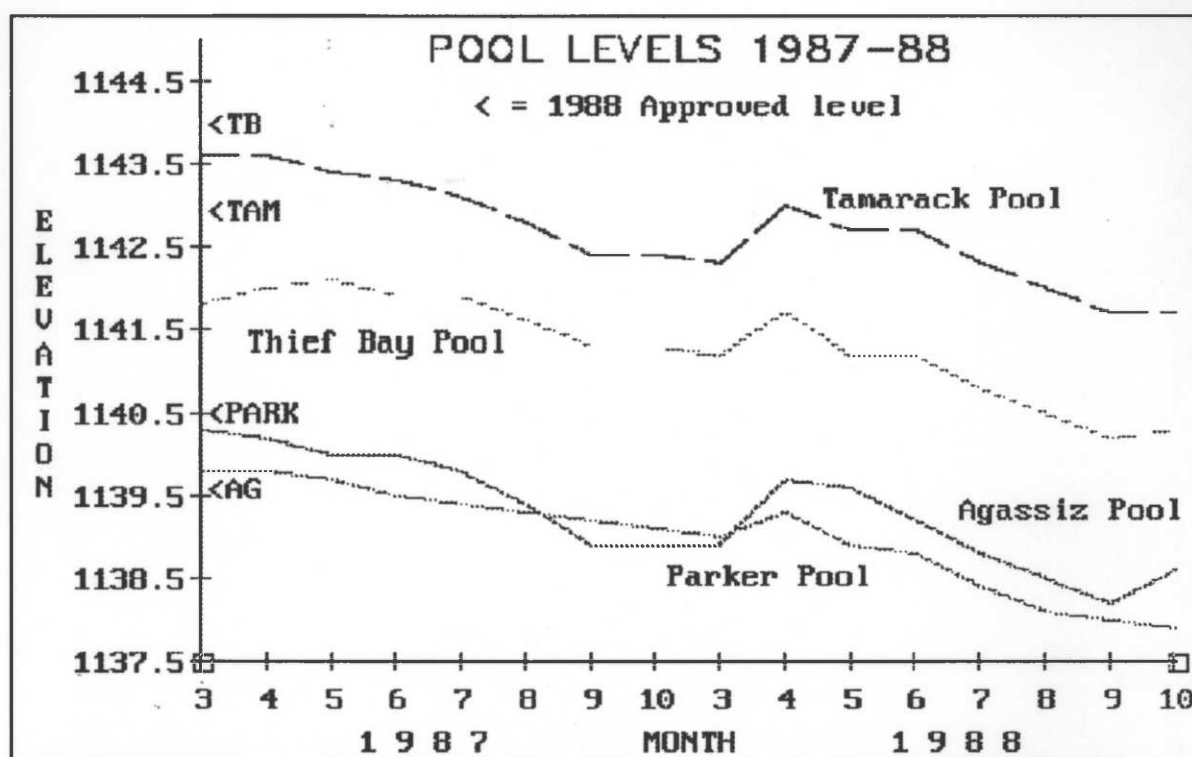


Figure 2. Examples of water level declines during 1987-1988.

During 1988 no water was discharged from the refuge. Rain came infrequent and usually after an extended dry period. Runoff was minimal at best as the parched ground soaked up most of the precipitation, providing no runoff to the refuge in late spring and summer.

Many pools had exposed mud flats by mid summer. Cattail encroachment was very evident in the open pothole areas of the unit. Pools like Madsen (east side) and Lower CCC have never been observed in mud flat condition.

Approximately 7,000 feet of dike-core work was completed along the west embankment of the Thief River, extending north from the southeast corner of the Tamarack Pool. The cored segment included that portion of Tamarack Pool normally inundated with water.

Planned elevation for Tamarack Pool was initially set at 1141.5. This partial drawdown was to provide optimum working conditions for the Thief River Dike core work. As drought conditions became apparent the planned elevation was modified to 1143.0 to provide over water diver nesting in the Northwest portion of the refuge. Tamarack Pool reached its planned elevation of 1143.0 on 15 April. The increase of 1.5 feet had no effect on the quality or quantity of work accomplished on the dike-core work. Water levels remained stable through June, declined July through November.

Nest searching revealed a poor over-water nesting effort due to low water levels. Shallow conditions in late summer and fall provided excellent resting and feeding habitat for several thousand dabblers.

Approximately 1.25 miles of the Berg Ditch was cleaned out from the North-South segment west to West Olson Lake. Water distribution will improve significantly between East and West Olson lakes as a result of this project. Additional benefits from this project is the use of the new ditch as a fire break to conduct prescribed burning in that unit. Approximately 1/4 mile of fire break was constructed in late December to prepare the unit for a spring burn.

The west portion of the Golden Valley unit was managed for moist soil vegetation for the first time since development in 1977. The dominant vegetation, consisting primarily of sedges and cattail, was burned and disced using the D-6 dozer in spring 1988. In early May, water was pumped into the unit from Ditch 11 using a Crusifoli pump. The low elevation of the west dike precluded flooding the upper contours. Water was released from the area immediately after maximum elevation was obtained. However, the level of Ditch 11 precluded drawing the Golden Valley ditch level below the pool bottom and resulted in oversaturated soils. Consequently, sedges and cattails outcompeted desirable annuals. Although moist soil vegetation response was not achieved, excellent shorebird and dabbler use occurred during the shallow flooding stage.

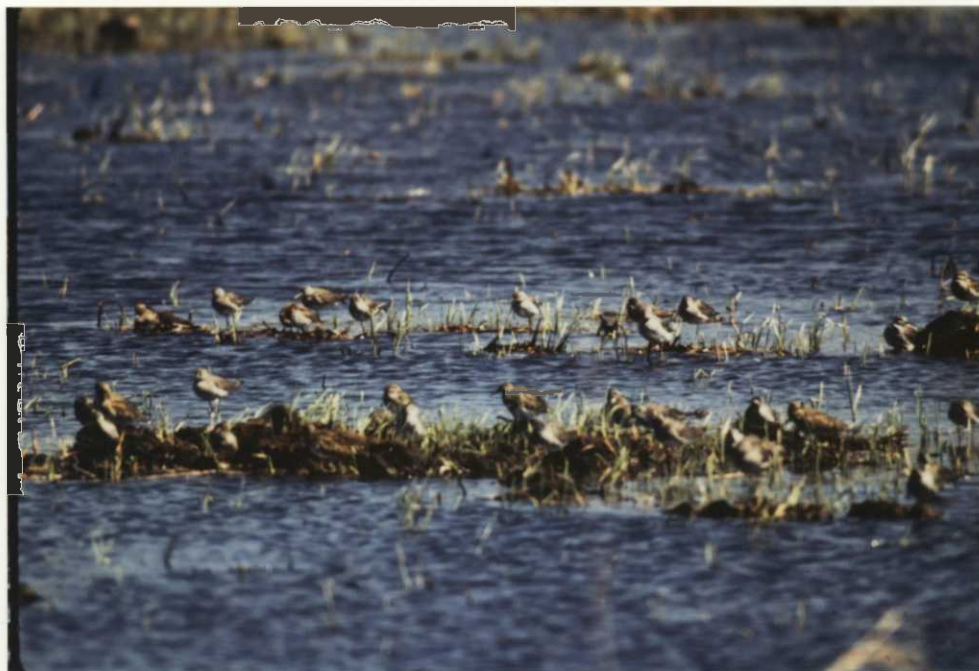


Photo 14. Shorebird response to shallow flooding of Golden Valley moist soil unit.

JPM

Madsen Pool remained in drawdown for mechanical vegetation control. The southwest portion was scheduled for experimental treatment using a D-6 dozer. The area was chosen because it exhibited advanced stages of cattail succession. The bottom of the pool is becoming overgrown with cattail hummocks so excessive in size that they reach near the water surface and preclude over-water nesting and restrict brood movement.

When the ground became adequately frozen in January, a D-6 was used to make 2 treatments, scarification and discing. Cattail hummocks were scarified and pushed into large piles which were burned later in the year. The objective was to completely eliminate cattail from the scarified areas. An adjacent area of cattail was then treated by discing using a heavy Rhino disc. Both of the treated areas were burned in the spring. The mounds were burned once in late spring.



Photo 15. Advanced cattail succession in the form of 2 ft. high rhizome hummocks prior to mechanical treatments in SW Madsen Pool.

Jan JPM



Photo 16. A D-6 was used to shear cattail hummocks in approximately 30 acres of the SW corner of Madsen Pool. Jan JPM

The 2 treated areas remained dry during the summer. The scarified area revegetated very slowly and sparsely, mostly by annuals such as dock and smartweeds. The disced area revegetated rather heavily by smartweed and dock and to a lesser degree by cattail. It is important to note that although the water level in the ditch was at least 2-3 ft below the pool bottom during the growing season, moisture could be squeezed from the organic soil an inch or two below the surface. Thus, "moist soil" conditions suitable for growing desired annual plants for seed production in these high water-retaining organic soils appear adequate when water is completely removed early in the year, even in a drought year.



Photo 17. Scarified cattail area in SW Madsen Pool revegetated to smartweed, dock and some cattail. Dozed mounds were burned during spring and summer.

June JPM

The open bays in the NE provided excellent dabbler, wading bird and shorebird feeding habitat throughout the year. Water gradually evaporated completely from the northernmost bay whereas the large, southernmost bay retained an inch or two of water. Ducks, geese and shorebirds were very abundant in late summer and fall.

Middle CCC is being experimentally managed as a Moist Soil Unit. Drawdowns and irrigations are manipulated to encourage desired waterfowl food plants. Objectives were:

- 1) Flood in spring to 1141.0 and then rapidly dewater by 1 May to encourage seed producing annuals throughout the basin.
- 2) If needed, irrigate briefly in late June or July, then dewater.
- 3) Gradually reflood as seeds mature in late summer.

The pool was flooded to 1141.5 in mid April, then dewatered by 1 May. By mid-June, germination of smartweeds, beggar ticks, and goosefoot was extensive only on the upper contours, especially at the east end of the pool. However, the main open basin again developed a solid carpet of needle rush (Eleocharis acicularis). An attempt was made to control the rush by reflooding to a depth

of 6-8 inches in mid June. After 2 weeks of flooding, it was evident the plant was thriving and showed no stress at all. In late summer, water was slowly raised to irrigate the annuals in the upper contours as seeds began to shatter.

An excellent seed crop in the upper contours was utilized for a brief period by dabblers but was cut short by early freeze-up.

Moist soil management has generally been unsuccessful in this pool thus far. However, observations of conditions in which desired moist soil annuals grow in other pools suggest that southern latitude techniques may be inappropriate here because of the high water holding capability of our organic soils. The water table must be a few feet below the pool bottom to avoid oversaturation of surface soils. Water levels at or near the surface appear to encourage perennials such as cattails, sedges and rushes. These plants germinate early and outcompete annuals. In 1989 water levels will be lowered by pumping the ditch 2-3 feet below the pool bottom. This should cause a reduction in soil moisture in the main, open basin and, hopefully, favor annuals over perennials.

Northwest Pool management objectives for 1988 were to reflood the pool following 2 years of dewatering for the purpose of maximizing over-water nesting and muskrat herbivory to control vegetation. However, when it was apparent that recharge was not possible it was decided to keep the pool in drawdown and to burn the south portion when conditions allowed. Any water that could have been diverted into Northwest Pool was kept in Tamarack Pool to provide at least some diver nesting habitat in the northwest portion of the Refuge.

The discing began in fall 1987 was continued in winter 1988. This was done in the southwest portion of the pool and was intended to stress cattail and create large openings. In addition, approximately 30 small (0.01 ac) breeding ponds were created with the D-6 dozer within the disced areas. Spring runoff was not adequate to fill even these small depressions.

An evaluation of the two 20-acre plots treated with RODEO in 1987 was difficult because of the dry conditions in 1988. However, it appeared that cattail growth within the treated plots was not different from the control areas. It is possible that the cattail had already translocated nutrients to the roots in response to dry conditions just prior to application in September 1987, thus precluding an adequate kill.

The 1988 objective for Kelly Pool of reaching full pool level was fully achieved, maximizing diver nesting habitat. Nest searching revealed an excellent nesting effort by canvasback, redhead and ring-neck, the first significant diver nesting documented for this pool. Presumably, the lack of suitable nesting conditions elsewhere forced birds to this pool in higher than expected numbers, demonstrating the birds adaptability to varying habitat conditions.

Objectives for Agassiz Pool was to encourage expansion of hardstem bulrush and to reduce turbidity and stabilize bottom sediments. Planned elevation was set at 1139.3 with a partial drawdown in early August to stimulate submergent vegetation and increase light penetration. By mid April it was apparent that NW Minnesota could be entering a drought period. Objectives were changed to provide maximum elevation through the summer to maximize diver habitat in anticipation of low precipitation.

In marked contrast to 1987, water clarity in 1988 was very poor throughout the pool. Turbid conditions developed in the spring prior to growth of aquatic plants and persisted throughout the summer, presumably a result of stagnant conditions due to lack of runoff. Periodic inspection of the wild celery plots planted in 1987 revealed no evidence of growth in 1988. Hardstem bulrush continued to expand throughout the central and southern portions of the pool. This plant is being encouraged to provide stabilization of bottom sediments and over-water nesting habitat. The vast stands of new cattail that established in open areas following the drawdown of 1980 have thinned to the point they no longer provide suitable nesting substrate for many over-water nesting species.

It is essential to raise Agassiz Pool to 1141.5 in 1989 during peak runoff in April to supplement recharge of Parker and Headquarters Pools. Discharge will continue into these pools until either they reach approved levels or until a head no longer remains. Agassiz Pool will then be lowered to 1140.0 for the summer and will be lowered to a winter level of 1139.0 by October 1.

4. Croplands

Starting in 1988 it was decided to modify the existing cropland rotation plan for a couple of years to clean up a noxious weed infestation problem.

The past crop rotation emphasized an Organic Farming technique. In the past few years, especially 1985 thru 1987, untimely precipitation has prevented cultivating the farm fields at the proper time. During 1988 and programmed for 1989, is the addition of herbicide chemicals to bring the current problem under control and increase cropland yields. The following table shows the past and present crop rotations.

Table 9. Typical field rotation for Organic vs Nonorganic Farming.

Year	Organic	Non-organic
1 (spring)	Barley/red clover	Spray quack grass, plant barley/oats (broadleaf control)
2 (spring)	Plow down green manure Summer cultivate	Summer fallow
2 (fall)	Winter wheat	Winter wheat
3	Leave standing	Broad leaf control
4 (spring)	Barley/red clover	Spray quack if needed, then back to organic

Table 10 shows the seeding of crops as well as herbicide application to each farm field presently being force account farmed.

Table 10. Number of acres seeded or treated by field.

Field	Size	Standing			Plow Down/		Herbicide.	
		Winter Wht	Barley	Oats	Winter Wht		Roundup	MCPA
Dahl N.	32			20	12		20	20
Dahl S.	30	14			16			14
John's	25	15			10			15
Golden V.	28	14			14		14	14
Goose Pen	42	32	10					42
East 80	73	25	20		28			45
TOTAL	230	100	30	20	80		34	150

5. Grasslands

The primary purpose of the grassland management program at Agassiz is to achieve refuge objectives identified in the Master Plan. Two of the four highest priority objectives related to grasslands are: 1) increase dabbler production in accordance with Regional Strategies for National Species of Special Emphasis, and 2) provide habitat and maintenance requirements for migratory birds.

In 1988, rotary-mowing, hydro-mowing, haying and prescribed burning were the management tools used to maintain refuge grasslands.

Hydro-mowing of dense woody vegetation began in January and terminated in February. The regions hydro-mower removed 60 acres of brush from three units: 20 acres East 80 unit, 20 acres Johns field, 20 acres Elm Lake unit. Seventy acres of brush were removed with the rotary-mower from 2 pools during November and December: 40 acres in Pool 21, 30 acres in Golden Valley.

Haying was done to reduce invading brush and to rejuvenate the grasslands. Approximately 111 tons were removed from 178 acres (Section F.8).

Prescribed burning was done to rejuvenate the grasslands, to set back invading brush and to consume debris remaining from mowing. Approximately 2,820 acres were burned in the spring. This included grasslands in 6 different burn blocks. No summer or fall burning was conducted due to extremely dry and volatile conditions (Section F.9).

Grasslands are found in 21 units ranging in size from 565 acres in Unit 18B to 20 acres in Unit 8B, comprising a total of 4,175 acres. A total of 36 species of grasses and forbs have been identified. Grass diversity is limited to 9 cool season grasses. The only warm season grasses found (Big Bluestem and Switch grass) have been planted in recent years but have not expanded. The most dominate cool season species are smooth brome (Bromus inermis), Kentucky bluegrass (Poa pratensis), Timothy (Phleum pratense) and Redtop (Agrostis alba).

8. Haying

The 1988 haying program objectives focused on maintenance of openings by removal of litter and brush control, and reduction of refuge force account roads/trail maintenance. Maintaining openings contributes to the primary refuge objective of waterfowl production. Actual haying wasn't allowed until after 15 July to minimize destruction of ground nesting birds.

There were a total of nine units identified for haying (see table 11). A news release describing the program was sent on 17 June to local newspapers. A separate notice went to previous bidders.

During early June considerable interest was received about haying on the refuge. This was mostly due to the drought conditions causing a shortage in hay. However, the high demand ended one week prior to receiving of bids when ASCS opened up CRP lands to haying. As a result, only 3 bids were received. Bids were received on units 3, 8 and one covering parts of units 5, 7 and 9.

The following table summarizes the 1988 haying program.

Table 11. Haying 1988.

Unit	Permittee	Acres hayed	Estimated yield (ton)	Bid Amount (\$)
1	no bid	-	-	-
2	no bid	-	-	-
3	Clifford Jorland	38	18	50.00
4	no bid	-	-	-
5 (partial)	Clifford Larson	100	60	50.00
6	no bid	-	-	-
7 (partial)	Clifford Larson	*	*	*
8	Doug Kilen	40	33	150.00
9 (partial)	Clifford Larson	*	*	*

*Data included in unit 5.

Units 3 and 8 were essentially mowed the same as in 1987, however only parts of units 5, 7 and 9 were mowed. Approximately 9 miles of road/dikes were mowed as part of the haying permits.

Again as in the two previous years the bid system worked well. This was the second year for full payment prior to haying. No negative feedback was received.

A major concern of the haying program is the lack of bidders. This in turn requires more force-account work to maintain openings. Some of the units are very rough, lacked hay quality or were brushy. This makes them undesirable except under extreme conditions.

9. Fire Management

In conjunction with water level management, the major tool used to set back emergent vegetation succession is prescribe burning. The first recorded prescribed burn on Agassiz Refuge was in 1959 when 1,000 acres of Phragmites was burned. Since then approximately 128,000 acres have been burned for the benefit of wildlife. The highest year being 1987, with approximately 8,715 acres. Table 13 summarizes the units burned in 1988.

Ideal burning conditions did not occur until April. Early April was very windy and cool. The lack of winter moisture and a dry spring changed conditions rapidly for ideal burning resulting in good litter consumption and top kill of brush in all six units. The continuation of the drought, however made conditions extremely dry making firebreaks unreliable. On the Webster Lake burn, extra discing of the firebreaks during the burn was needed to keep the fire under control. Conditions became so explosive that the State imposed a fire ban from 2 May through 20 May.

Due to extreme drought conditions there were no late summer/fall prescribed burns. The decision was based on the extreme dryness of firebreaks and the need to prevent peat fires.

Table 12. Five year summary of prescribe burns, Agassiz NWR.

Year	# of burns	Acres burned	Cost (\$)	Cost/acre (\$)
1988	6	2820	2851.00	1.01
1987	12	8715	4003.00	.45
1986	4	3202	1548.00	.48
1985	11	6176	3037.00	.49
1984	14	7700	*	*

* Cost estimate was not recorded for this year.

Table 13. Summary of 1988 prescribed burns, Agassiz NWR.

Date Burned	Unit Number	Unit Name	Unit Acreage	Acres Burned	Cost (\$)	Cost/Acre (\$)
21 April	18A	Rodahl Triangle	635	460	315.00	.68
27 April	14	East Pool	1260	1060	535.00	.50
27 April	15B	Maintenance Ctr	600	90	87.00	.96
28 April	9D	Goose Pen	560	340	433.00	1.26
29 April	5	Webster Lake	725	670	1090.00	1.62
25 May	10	Madsen Pool	2025	200	391.00	1.95
Totals				2820	2851.00	1.01

10. Pest Control

Table 14 is a summary of the pesticides used in 1988 on the refuge.

Table 14. Pesticides applied in 1988 on Agassiz NWR.

Herbicide Common Name	Herbicide Trade Name	Gallons or Pounds of Product Applied	Pounds of Active Ingredient	Number of Acres Treated
2,4-D Amine (Weedar MCPA)	2,4-D Amine, others	12.0	48	142.0
Picloram	Tordon 22k	1.5	3	1.5
Pramitol 5PS	Prometon	100.0	96	1.0
Roundup	Glyphosate	13.0	52	34.0
Weedone 170 brush killer	2,4-D and 2,4-DP	0.0	0	0.0
Totals			199	178.5

Winter wheat was sprayed using .25 pounds active ingredient of MPCA on 4 June. Mustard was killed at this dosage rate but several of the hardier weed species such as Canada thistle, cowcockle, marestail (horseweed), pepperweed (peppergrass) and field pennycress seemed almost untouched. A higher application rate or a combination of sprays will be used in 1989.

Barley and oats were sprayed using .50 pounds active ingredient of MCPA on 13 June and 1 July, respectively. Mustard, morning glory, sow thistle and Canada thistle were controlled but the weed species mentioned above looked like they were not affected. In 1989, a higher application rate or a combination of herbicides will be used.

Roundup was sprayed on 22 May on the west 20-acre field of North Dahl at an application rate of 1.5 pounds of active ingredient per acre. An excellent kill was observed on quackgrass and Canada thistle 4 days later when the field was tilled and seeded to 2.5 bushels oats per acre. An excellent stand of oats was produced on this field.

Approximately 1.5 acres of leafy spurge in 19 locations were treated in June and July. Four sites required no treatment and two sites were not checked. Application of 3 pounds active ingredient or 1.5 gallons of Tordon 22k liquid was effective in killing the plants. Leafy spurge has been greatly reduced the past years with the use of Tordon.

Normally, Weedone 170 brush spray is ground sprayed along roadsides and dikes to control invasion of woody vegetation. Due to Farm Bill activities no spraying of Weedone 170 was completed this year.

Pramitol 5P, a soil sterilant, was used in the Maintenance Center boneyard area and in the Maintenance Center courtyard.

On 31 August 1987, two areas of dense cattails totalling 36 acres within Northwest Pool were aerially sprayed with RODEO and four acres of brush on Deadman's Island were sprayed as test plots. Five gallons of mixed solution consisting of 1.5 quarts (1.5 lbs. A.I.) RODEO, 4.6 gallons water and surfactant were applied to each acre.

Purpose of spraying the cattail areas was to provide openings for waterfowl courtship, feeding and loafing. An evaluation of the two cattail plots treated with RODEO in 1987 was difficult because of the dry conditions in 1988. However, it appeared that cattail growth within the treated plots was not different from the control areas. It is possible that the cattail had already translocated nutrients to the roots in response to dry conditions just prior to application on 31 August 1987, thus precluding an adequate kill.

Purpose of spraying Deadman's Island was to suppress woody vegetation and increase grass species for waterfowl nesting habitat. The area is a 4 acre island located in Agassiz Pool that was logged off in the winter of 1984-85. Woody vegetation consisted of elm, cottonwood, ash and willow. Logs and slash were burned in the springs of 1985 and 1986. Dominant woody vegetation since logging has been mainly common chokecherry along with some ash. On several inspections in 1988 some killing of chokecherry and ash was observed. Height of woody vegetation is approaching 10 feet. No nest searching was completed on the island this year.

12. Wilderness and Special Areas

Agassiz manages a 4,000 acre spruce/tamarac bog wilderness area. The area which lies in the northcentral portion of the refuge was designated wilderness on October 19, 1976 by Public Law 94-557.

G. Wildlife

1. Wildlife Diversity

The wildlife diversity of Agassiz NWR is among the highest of any comparably sized area (96mi²) in mid continent North America. Situated in the prairie-forest ecotone, the refuge's 40,000 wetland acres and 22,000 acres of aspen, mixed hardwoods, grassland and coniferous forest are a haven for nesting and migratory birds as well as mammals and other wildlife. A total of 277 bird species have been recorded, of which 143 are known to nest. In most years, 200 bird species are recorded. Of Minnesota's 81 mammal species, 49 (59%) have been recorded at the refuge.

Eighteen water impoundments, from 100 to 10,000 acres in size, are manipulated to provide a continuum of mudflat to deep marsh habitats. Fire, water and mechanical brush management are the principal elements used to maintain species diversity.

2. Endangered and Threatened Species

Peregrine falcons were recorded 7 times between 9-22 May. No fall sightings were recorded.

A few bald eagles were present from March through May. For the first time in 28 years, a pair of eagles attempted to nest on the refuge. In mid April, a pair of adults were seen carrying grasses/sedges to a lone elm situated about 150 meters from the hairpin turn along the auto drive. For a few days they attempted to combat 30-40 mph winds, but the wind kept blowing the fine materials from the rather meager crotch. The auto drive was closed during that time to avoid disturbance, but alas, the pair gave up and no further evidence of nest building was reported in the spring. However, a deer hunter reported seeing 2 eagles carrying material to a lone aspen near the southwest corner of the wilderness area in November. The tree was viewed from the air in January 1989 and did appear to be a possible eagle nest. The tree is visible from the Pool 8 dike (0.75 mi.) and will be monitored during spring 1989. Adult eagles were seen on 2 occasions during the summer. A peak of 30-40 eagles was present in mid October.



Photo 18. This is the first known bald eagle nesting attempt on the refuge since 1960. 4/88 JPM

A timber wolf rendezvous site was located at an earthen mound on the west end of the East 80 field. This is the same site used in 1987. Two pups and 2 adults were seen and heard on several occasions during May and June.

3. Waterfowl

A. Ducks



Photo 19. Duck production was low due to drought but shallow feeding areas were abundant. May JPM

Mallards were first to arrive on 22 March. By 8 April, 20 duck species were accounted for.

The breeding pair survey was done on 20 May. Survey conditions were considered excellent. Indicated pairs were up 44 percent from 1987 using the Wildlife Inventory Plan procedure.

Table 15. Total indicated breeding pairs, Agassiz NWR, 1988.

Species	Indicated Pairs
Mallard	1377
Gadwall	472
Shoveler	275
Pintail	70
Widgeon	65
Blue-winged teal	1948
Green-winged teal	55
Wood duck	25
Black duck	5
Redhead	210
Canvasback	135
Ring-necked duck	276
Lesser scaup	45
Ruddy	45
Bufflehead	5
TOTAL	5008

An estimated 11,671 ducklings were produced according to the Wildlife Inventory Plan methodology. This represents an increase over 1987 of 7,537 ducklings. Although the 1988 survey actually observed 111 broods, compared to only 39 in 1987, this increase largely is due to broods being concentrated in more visible open water areas in response to extreme drought conditions. In most pools, emergent vegetation was either dry or very shallowly flooded, providing poor brood cover.

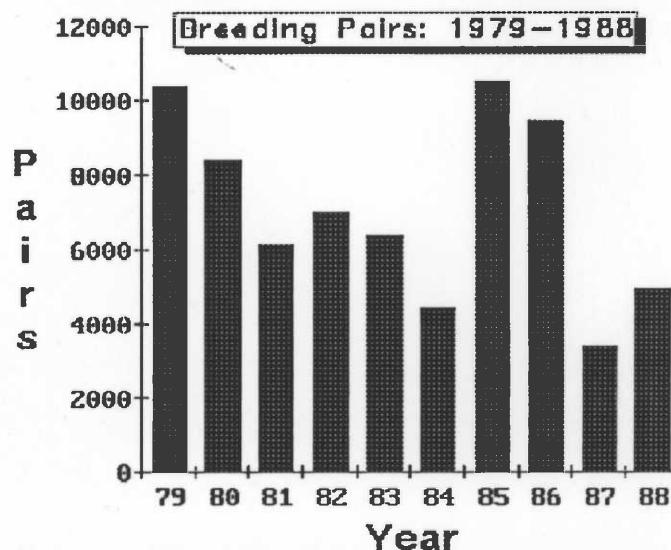


Figure 3. Ten-year breeding pair summary.

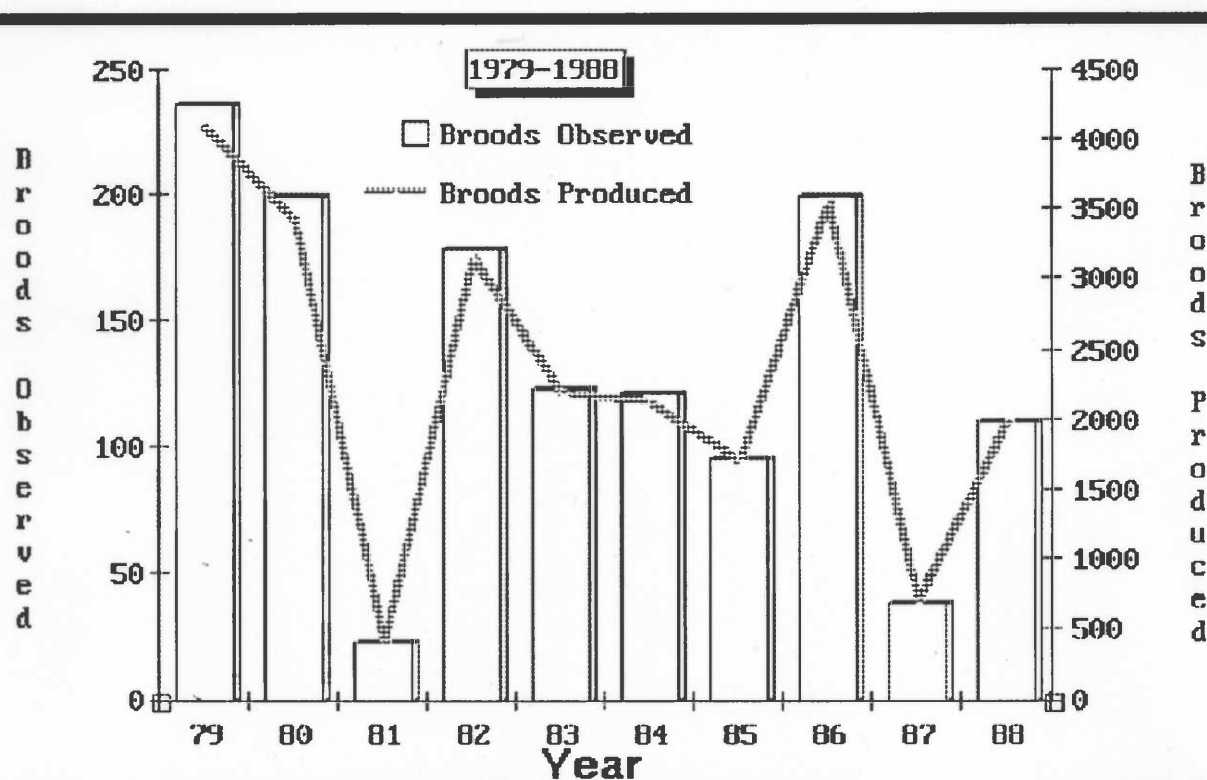


Figure 4. Ten-year summary comparing broods observed on survey with number of broods estimated using Wildlife Inventory Plan procedure.

Duck numbers peaked in early October at 98,000, of which 50,000 were mallards. In spite of the lack of water and the nearly total absence of crop residue on private agricultural lands, off-refuge feeding by ducks occurred in CRP and other set aside fields to the southwest during most of the fall period.

An immature surf scoter was observed 6 October at Webster Pool.

B. Geese

Canada geese arrived on 10 March. Numbers of breeding pairs appeared to be normal.



Photo 20.

JPM

The goose production survey was done on 16 June. Most dikes and roads were surveyed by vehicle. One hundred and fifty goslings were counted compared to 206 in 1987. The number observed is assumed to be 80 percent of the total; thus, 150 divided by .80 equals 188 goslings produced - a poor reproductive year. Goose production is generally highest in years when muskrat houses, preferred nesting sites, are most abundant. In 1986, a record 606 goslings were produced and muskrat numbers (and houses) were at record high levels. In 1987, muskrats and houses declined and were scarce by 1988.

Fall use by Canada geese was 188,000 use-days, compared to the 10-year average of 400,000. Fall peak population was 12,000 birds during late September-early October.

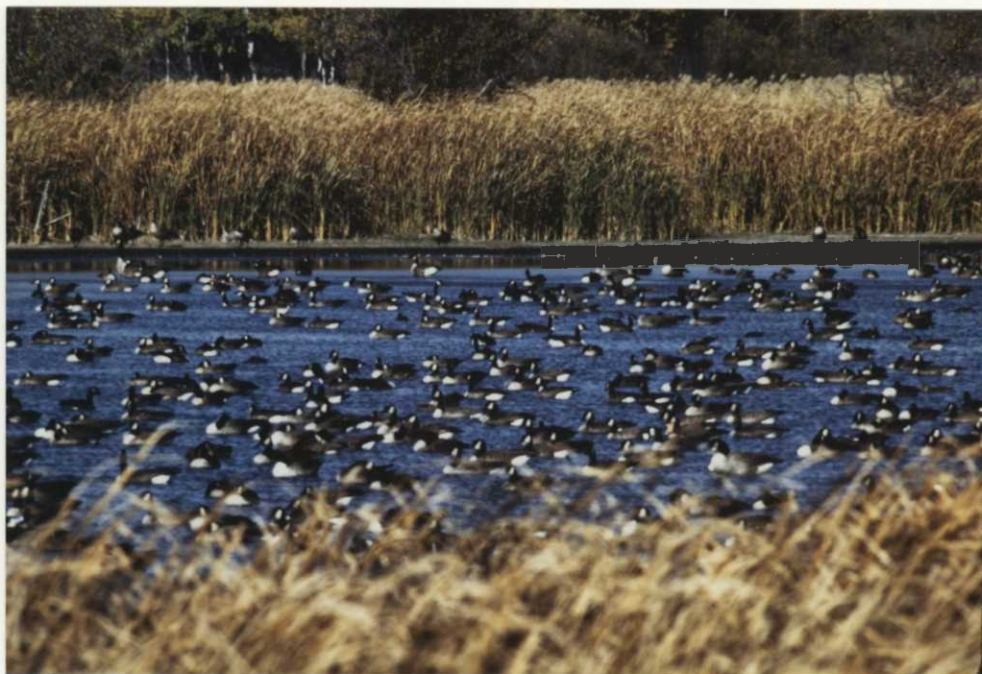


Photo 21. Geese in Blue Grove pothole. 10/88 JPM

An unusually large flock (100) of white-fronted geese was present on Northwest Pool on 6 April. Only 1 individual was recorded in the fall.

A total 20,050 snow goose use-days was recorded in the fall. A peak of 600 snows were counted in October.

From the Goose Oddity Department, an adult swan goose (aka Chinese goose, aka Anser cygnoides) was seen feeding amidst a flock of Canada geese in Golden Valley on 20 September. The bird was unmarked and quite wary. A quick phone call to the Winnipeg Zoo (125 miles to the north) determined that a juvenile bird of this species had apparently escaped 2 years previously. Thus, this individual is assumed to have immigrated not from its native Asia, but rather from nearby Manitoba.

C. Swans

A peak of 75 tundra swans was recorded on 10 October. There appeared to be a high percentage of juveniles in the population.

D. Coots

Coot numbers were down dramatically from recent years. A peak of 13,000 occurred in July, whereas fall numbers peaked at only about 5,000.

4. Marsh and Water Birds

For the first time in nine consecutive years, snowy egrets were not recorded at the ditch 11 control, or elsewhere on the refuge.

The great blue heron colony in the wilderness area remained at about 100 active nests. No great egrets were observed in the colony during the May duck breeding pair count. Normally 5-10 egret nests are observed in the colony. Egret numbers increased in August, with 90 being observed in the Hairpin curve ditch on 16 August.

About 50-60 nests of double-crested cormorants again were present in the willows along the Ditch 11 spoil in Agassiz Pool. White pelicans peaked at about 1000 during July and August, down from 2000 in recent years.

Approximately 45 pairs of sandhill cranes nest in the refuge based on a graduate study conducted in 1985-86. Migrant numbers peaked in late September at about 3,000.

A colony of about 75 eared and 10 western grebe nests was found in Agassiz Pool in June. Efforts were not made to inventory grebe colonies this year; therefore this is probably a very conservative estimate.



Photo 22. Western grebe on nest in Agassiz Pool.

JPM

5. Shorebirds, Gulls, Terns and Allied Species

Twenty-seven species of shorebirds were recorded. Although mud flats were abundant, shorebird numbers were lower than usual, presumably because of the abundance of extensive shallow conditions throughout the mid-continental region. Shorebird use was most extensive in the open bays in the northeast portion of Madsen Pool. Marbled godwits were present in this area during all of May and most of June.



Photo 23. Will this drought ever end?!!!!

JPM

A single upland sandpiper was seen periodically along Airport Road between County Road 7 and the maintenance center. Willows in this area were winter mowed and burned in the spring. This species has not been recorded for several years but appears to be increasing somewhat in northwest Minnesota, probably in response to the increase in set aside acres.



Photo 24. Upland sandpiper in snag along Airport Road.
Only the second refuge sighting since 1980. 6/88 JPM

Franklin's gull nesting was extremely reduced from the mid-1980's when estimates were as high as 25,000 nests in Agassiz Pool. At best, only a few hundred nests were initiated in 1988. The thinned condition of emergent vegetation in Agassiz Pool combined with the lack of suitable habitat in other refuge pools due to the drought has resulted in poor nesting habitat conditions for this species.

6. Raptors

Single golden eagles were recorded in January and March and 3 were seen in October. The only osprey was sighted on 16 September.

Short-eared owls were recorded on several occasions reflecting the state-wide increase in this species. For the first time in many years, no snowy owls were reported on the refuge.

Unique this year was the abundance of merlin sightings both on and off the refuge. This also reflected a state-wide increase in sightings of this species.

7. Other Migratory Birds

A common gallinule, occasional at Agassiz, was observed in Upper MCCC on 1 June.

A male mountain bluebird, rare at Agassiz, was present at the intersection of County Road 7 and Airport Road on 30 March.

The first documented nesting in many years of eastern bluebird occurred at the Airport Road gate on County Road 7 and also in the maintenance center bird feeder! The first nest was found in a hollow, 8 inch welded extension of the west gate post. An examination of the east gate post, also with a welded extension, revealed an old nest from a previous year. A second active nest was built in the maintenance center bird feeder which was only 10 feet from the main door and was frequently subjected to disturbance (Photo 24). This nest successfully fledged 4 young. Now that's wildlife management!



Photo 25. Typical eastern bluebird nest site? 6/88 JPM

A loggerhead shrike, rare at Agassiz, was seen perched on a wire along County Road 7 on 11 May.

On 22 May, Biologist Mattsson inventoried yellow rails calling at night (10-11 pm) along the auto drive. In one area near Mukstad Grove, at least 12 rails were heard, 6 were observed, and one was caught by Mattsson with his baseball cap (nice grab). Mattsson also flushed a single yellow rail at the Upper MCCC outlet on 5 October.

In 1988, dickcissels staged a record eruption in Minnesota and were found in all the northwestern counties including Marshall. Several singing males were present in a stand of sweetclover in the north portion of Goose Pen. This represents the first record of dickcissel for the refuge.



Photo 26. One of at least 5 male dickcissels in Goose Pen. This is the first refuge record of the species. 6/88 JPM

8. Game Mammals

Game mammals on the refuge include moose, white-tailed deer, black bear, red fox, coyote, bobcat, fisher, otter, mink, muskrat, raccoon, badger, beaver, snowshoe hare, Eastern cottontail, white-tailed jackrabbit, gray and fox squirrels. Winter conditions were favorable for big game making the 1987-1988 winter the ninth consecutive winter without any noted die-off. Deer movements were slightly restricted most of the winter. By mid-March some deer appeared stressed. ON 1 April, the 1987-88 cumulative winter severity index (WSI) was 101. Deer losses can be expected when the cumulative WSI approaches 125.

WSI methodology was changed for the winter of 1988-89 by the MDNR. Instead of using the Michigan methods (penetrometer and snow depths along with katathermometer readings measuring kilowatt hours) the simplified Wisconsin method (number of days with 0°F or less plus number of days with 18 inches or more of snowpack) is being used. The Wisconsin method gives a lower total score than the Michigan method. Changing the method came about because many of the katathermometer kettles were becoming old and undependable and there was concern about their safety. Wisconsin method WSI numbers are being

regressed to calculate Michigan method WSI numbers. On 31 December Wisconsin method WSI was 16 and Michigan method WSI was 32.

The aerial winter big game census was flown on 18 February with excellent visibility and a snow depth of 11 inches. One-half of the refuge and adjacent State Wildlife Management Areas are censused in alternating quarter mile wide east-west transects. The survey was flown at 250 feet above ground at 80-85 knots. Sightability factors used were .50 and .90 for deer and moose, respectively. Two additional surveys were flown, 15 January and 31 March, to obtain improved estimates of moose numbers which have been declining since 1982. Visibility was excellent in January but poor in March due to snow melt.

A. Moose

A decline of the moose population has occurred annually since the high moose population of 437 in 1982. Moose were aerielly surveyed 3 times to better assess the population status. The estimated moose population was 320 in January, 237 in February and 222 in March. The February population of 237 compares to 217 in 1987, indicating moose numbers have stabilized.

Moose classification began in 1966. The moose classification flight was flown on 17 November. Snow accumulation of 3 inches, which fell 2 days previous, provided good visibility. A total of 135 moose were classified, compared to the 1972-87 average of 114. Thirty-one of the 135 moose observed were calves, a net productivity rate of 23.0 percent. This compares with the 1972-1987 average productivity of 24.5 (Table 16).

Table 16. MOOSE CLASSIFICATION SURVEY

Year	Ad.M	Yrl.M	Cow	C w/1 calf	C w/2 calves	Lone Calf	Unk.	TOTAL Moose	Total Calves	Total Cows	Product. Rate	Calves/ Cow
1972	38		47					115	32		0.278	
1973	29		11	11	2			68	15	24	0.221	0.625
1974	25	1	11	17	4	1	1	84	26	32	0.310	0.813
1975	26	14	34	26	3		18	153	32	63	0.209	0.508
1976	21	4	27	15	1	1		86	18	43	0.209	0.419
1977	19	10	28	46		2		105	48	74	0.457	0.649
1978	23	8	32	22	2		1	114	26	56	0.228	0.464
1979	27	14	26	23	3			122	29	52	0.238	0.558
1980	23	13	18	20	4	1		107	29	42	0.271	0.690
1981	31	20	51	35	6	1		191	48	92	0.251	0.522
1982	18	17	34	18				105	18	52	0.171	0.346
1983	24	7	44	32	6			157	44	82	0.280	0.537
1984	27	5	30	14	1	1		94	17	45	0.181	0.378
1985	24	3	26	16		2		87	18	42	0.207	0.429
1986	26	3	29	24	3	1		116	31	56	0.267	0.554
1987	27	18	41	16				118	16	57	0.136	0.281
1988	24	15	42	21	2	6		135	31	65	0.230	0.477



Photo 27. Moose respond quickly to greenup in burned area along Airport Road. JPM

B. White-tailed Deer

The February survey estimated 1,172 deer ($10.9/\text{mi}^2$) compared to 1,223 ($11.3/\text{mi}^2$) in 1987 and the 1969-1988 average of 1,947 ($18/\text{mi}^2$). The MDNR deer model estimated the pre-hunt population to be 2,000-2,200, or 19-20/sq. mi. for the 108 square miles of deer habitat within antlerless permit area 203 comprised of the refuge and adjacent State lands. A winter carrying capacity of 14-16 deer per square mile is the objective for this area.



Photo 28.

Deer survival was high due to mild winter.

JPM

C. Black Bear

Three sightings of black bear were observed either by refuge staff or by visitors. On 6 May a sow with 2 cubs was observed along County Road 7 near Airport Road by a high school biology class.

D. Canids

Coyote sign and observations were very infrequent in 1988. The population has been low since the establishment of a gray wolf pack in 1981.

Red fox numbers increased with several family groups frequently observed.



Photo 29. This fox den was located 100 ft. near intersection of Airport Road and north Dahl Field. JPM

E. Furbearers

The refuge did not complete the Minnesota Department of Natural Resources Predator Scent Post Survey due to other higher priority work items.

Low water levels resulted in a drastic decrease in the muskrat population from 1987. The 1987 fall population was estimated at 20,000. The 1988 summer population was estimated at 14,000 and by fall the population was estimated at 3,000. Due to this decline muskrat trapping was not allowed in 1988.

A beaver population, estimated at 300, remained stable despite the dry conditions. Beaver had to seek out the deeper parts of pools such as dugged ponds and drainage ditches. No beaver trapping was allowed in the fall of 1988.

F. Bobcats

Bobcats can be found throughout the refuge. No sightings were made this year. No bobcat hunting or trapping is allowed in the refuge.

G. Otter

An estimated 40-50 otter (35-40 in 1987), inhabit the refuge mainly in the ditch and river systems. Sightings were more frequent and widely distributed than in 1987. Otter trapping is not permitted on the refuge. One otter was found dead in a leghold trap. The otter was donated to the Minnesota Department of Natural Resources and will be mounted for office display.

H. Fisher

No fisher were sighted on the refuge this year. Several sets of tracks were observed on the refuge. Their population is estimated at 10 animals. No fisher trapping is allowed on the refuge.

I. Mink

Mink decreased significantly from about 2,000 in 1987 to 1,000 in 1988. Their decrease paralleled the drastic drop in water levels throughout the area.

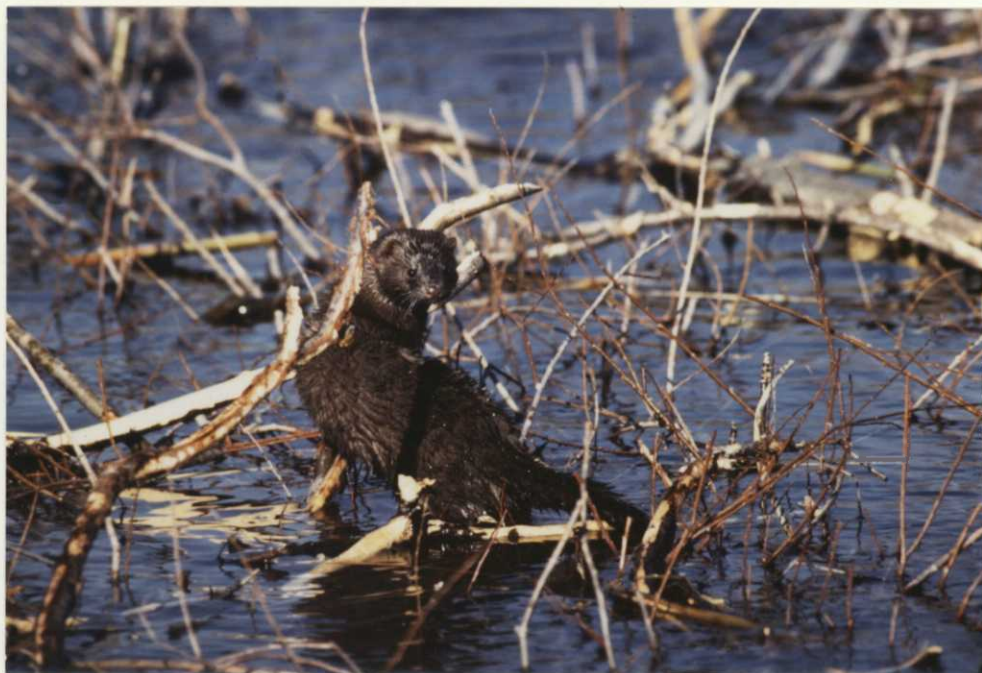


Photo 30. Mink numbers declined as wetlands dried during the summer.
Submitted by Don Enger

J. Raccoon

Raccoon observations were more frequent than in 1987. The 1988 summer population was estimated to be 550.

K. Snowshoe Hare

Snowshoe hare sightings have increased the past 2 years, but their numbers are still low.

10. Other Resident Wildlife

A. Ruffed Grouse

Two drumming count routes were run on the refuge on 29 April in cooperation with the Minnesota Department of Natural Resources (MDNR) annual survey. Results of the two surveys indicate a 160 percent increase in 1988. According to other MDNR surveys in northwest Minnesota the population decreased by 19 percent. All other areas in the state showed population increases. Peak population on the refuge was estimated at 300 birds in July. Roosting conditions have been excellent the past three winters.



Photo 31. Ruffed grouse population is on the rise. JPM

B. Sharp-tailed Grouse :

No official census was completed for sharp-tailed grouse on the refuge. Occasional sightings indicated a slight increase in population. Minnesota DNR reported a 16 percent increase from 1987 in northwest Minnesota. Conservation Reserve Program (CRP) lands, seeded down with legumes and grasses, have greatly increased sharp-tailed grouse nesting habitat.

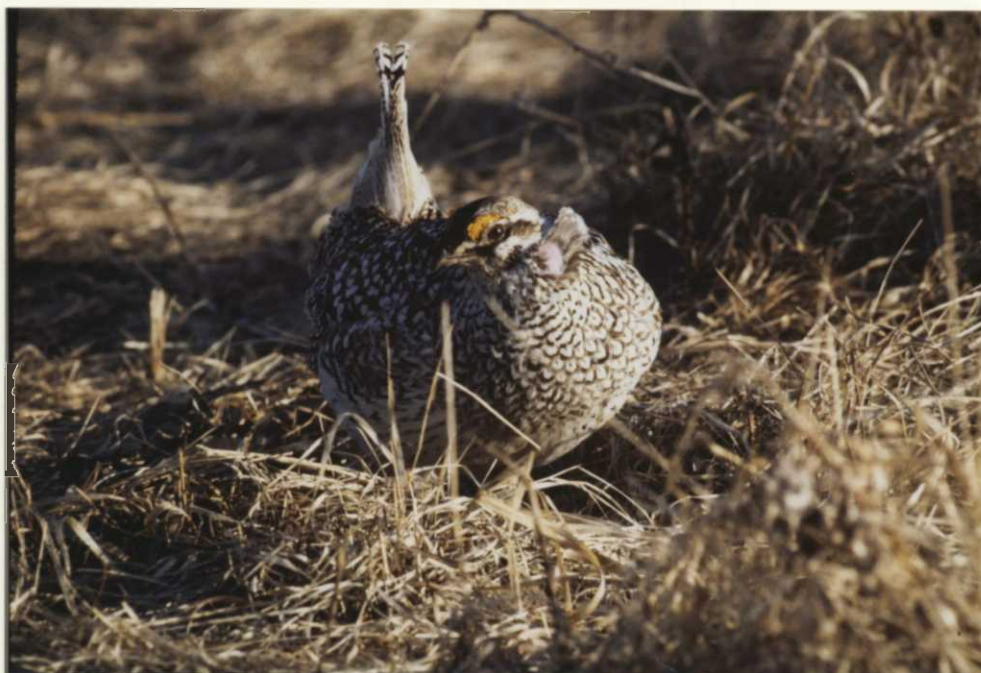


Photo 32. Sharp-tailed grouse increased slightly following several years of steady decline.

JPM

C. Prairie Chicken

Prairie chickens were not sighted this year.

11. Fisheries Resources

Refuge pools are too shallow to support any game or rough fish. Mud minnows and sticklebacks survive year round in some pools and ditches providing a food resource for marsh and water birds. White sucker, freshwater drum and northerns sometimes frequent the refuge in the spring via the Thief River and West Ditch 11. Due to low water in the spring and throughout the year, none were observed this year.

Fisheries personnel from Ashland Office of Fisheries Assistance visited Agassiz in August to determine the status of fishery resources and habitat. Manager Kotok presented a briefing on the aquatic habitat and ongoing water management practices on the refuge. Because of the drought, only one area was deep enough (5 ft.) to permit sampling. One 125 ft. gillnet, set overnight,

produced only a few mudminnows. A list of species and their distribution on the refuge was provided to the Ashland Office by the refuge staff.

15. Animal Control

There was only one depredation complaint in 1988. The problem consisted of ducks and blackbirds in small grain fields. Three exploders and tanks were loaned out from 27 July through 23 September.

Drought conditions resulted in early harvest and low yields. There was very little water to hold birds in the area during migration and CRP lands helped to reduce the total acres of tillage for cereal grain production.

Significant changes were made in the refuge depredation program in 1986. Most important was the transfer of responsibility for wildlife depredations on private property from the Fish and Wildlife Service to the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), St. Paul office. Also transferred to APHIS was the refuge's inventory of propane exploders and tanks. APHIS has left 10 exploders and tanks at Agassiz. The refuge is a facilitator for APHIS in getting out exploders to depredation complainants.

16. Marking and Banding

The refuge has a pre-season mallard banding quota of 250 AHYM, 250 AHYF, 250 HYM and 250 HYF. Three rocket-net sites, Mud River, Parker and Tamarack Pools were baited with oats and barley beginning on 23 August and were equipped with double-nets to increase capture efficiency. Six shots were made between 14 September and 4 October. Age and sex of mallards are as follows: 400 AHYM, 250 AHYF, 250 HYM and 250 HYF, for a total of 1,150. AHYM and AHYF quotas were quickly met, but the HYM and HYF quotas required more effort. One-fourth each of 400 AHYM, 200 AHYF and 100 HYF birds were banded with reward bands, a total of 175 birds. This was done in cooperation with the Office of Migratory Birds. Eight black ducks (2 AHYM, 4 AHYF, 1 HYM and 1 U-U) were also banded.

In conjunction with the diving duck study (Section D.5.) ducklings were banded as follows: canvasback 15, redhead 31, and ring-necked duck 52. Nightlighting was done 8 nights from 21 July to 25 August.

In cooperation with a MVP Canada goose study conducted by the Wisconsin Cooperative Wildlife Research Unit, 469 collar readings were obtained (quota of 400), in a total of 37 hours. This is the refuge's fifth consecutive year assisting with this phase of the study. The study is directed at migration and survival of MVP geese.

H. PUBLIC USE

1. General

In 1988, Agassiz was selected as one of 100 best wildlife viewing areas in the United States by the National Wildlife Federation. This exemplifies the special quality a remote refuge with relatively low public use can contribute to the National Wildlife Refuge System. The public use program at Agassiz has always strived to provide a safe, enjoyable and educational nature experience. The refuge not only provides a self-guided auto tour and several contact points, visitors can on request explore nature in the remote areas of the refuge.

Public use maintenance and improvement projects accomplished in 1988 included replacing and painting worn steps on Parker Tower, printing additional copies of the Mammal and Checklist For Kids leaflets, painting Ditch 11 structure guard rails, mowing the foot trail, roadsides, lawn and the areas around information and entrance signs, and replacement of the office entrance side walk to accommodate wheel chair use. Also information in Kiosk displays were replaced at least quarterly.

For the third year in a row the Thief River Falls Chamber of Commerce sponsored bus tours of the refuge. An informational brochure developed by the Chamber of Commerce was given to participants. The interest has tapered off from the first two year, but new comers to the area enjoy the tour. Table 17 summarizes the use of the bus tour for the last three years.

Table 17. Bus Tour Data.

Year	# of Tours	# of Participants
1988	8	99
1987	13	170
1986	14	223

The first tour began on 16 June and ended on 29 September. The lack of water reduced the attractiveness of the refuge for birds and directly reduced the public use.

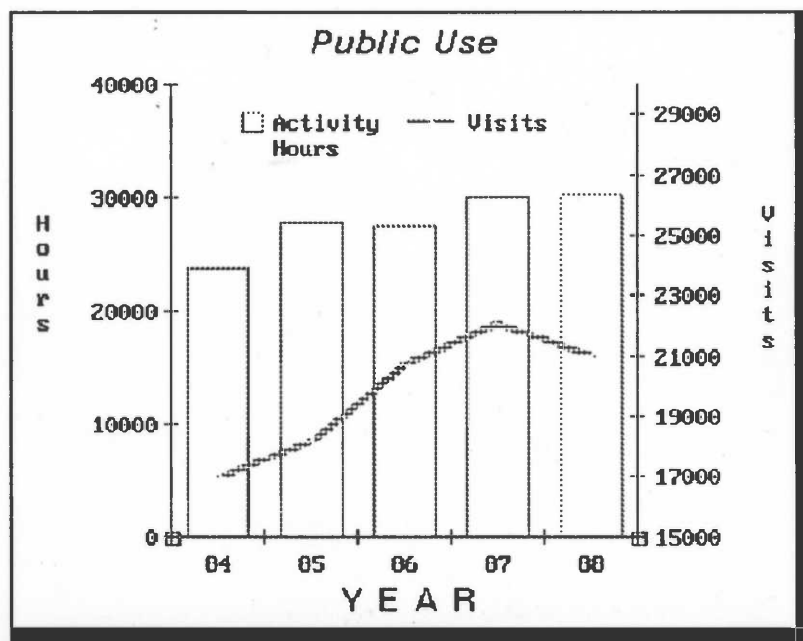


Figure 5. Comparison of refuge public use for the past five years. This years visitors log contained entries from 25 states and 4 countries.

2. Outdoor Classrooms-Students

The outdoor classroom program functions on a demand basis. Most EE participants are returning teachers/schools who require minimal refuge staff input. Refuge policy is to provide assistance to teachers on their first visit. On subsequent visits a brief talk and directions to desired field locations usually is all that is necessary.

School group use occurs in spring and fall. In 1988 we recorded 447 visits and 1512 activity hours by 17 groups.



Photo 33. Local school groups make annual pilgrimage to view refuge wildlife. JPM

4. Interpretive Foot Trails

There is a one-quarter mile foot trail at Station No. 6 of the auto tour route that received approximately 345 visits.

5. Interpretive Tour Routes

Presently we have a four-mile, self-guided auto tour which gives visitors an introduction to the refuge. Eight interpretive stops along the route provide visitors with information on refuge history, management and wildlife.

The auto tour route opens in the spring when weather permits and closes just before deer season in early November. Approximately 5,647 visitors spent 3,289 activity hours using the auto tour.

County Road No. 7 bisects the refuge for 11 miles and provides excellent opportunity for visitors to see a cross section of the refuge. Visitors facilities located along the county road include the refuge headquarters which has a controlled access, 100-foot observation tower, and the Parker Pool observation area which has a 14-foot observation deck and kiosk.

6. Interpretive Exhibits/Demonstrations

The headquarters office serves as an excellent interpretive contact point featuring mounted wildlife specimens. A variety of leaflets are dispensed from several locations at the refuge headquarters. Kiosks with several displays are maintained at refuge headquarters and Parker observation deck.

Approximately 1223 visitors viewed the office and kiosk displays in 1988.

An off-refuge exhibit was again set up at the Thief River Falls Regional Public Library in March and featured the National Wildlife Week theme "Forest's Are More Than Trees." Six programs were given to 1146 students in a variety of elementary grades at schools in Goodridge, Newfolden, Thief River Falls and Viking, by Assistant Refuge Managers Bennett and Tischer.



Photo 34. Rocket net banding was demonstrated to local school group. GT

7. Other Interpretive Programs

Radio interviews over the telephone between refuge personnel and local AM Station KTRF were held periodically throughout the year. These interviews increase to once weekly during the fall waterfowl and deer hunting seasons and dealt with wildlife population estimates, hunter success and related information.

Two leaflets were revised and reprinted in 1988: Mammals and Checklist for Kids.

The following table summarizes all other refuge programs given in 1988.

Table 18. Other Refuge Programs, 1988.

Date	Group	# in Group	Subject	By
1/18	Webelos-Pack 199	30	Agassiz	Tischer
4/06	Warren Senior Citizens	50	Agassiz	Tischer
5/02	Newfolden Hunter Safety	20	NWRS	Bennett
5/21	Bagley Historical Society	10	Agassiz	Tischer
5/22	Newfolden Federated Women	22	Agassiz	Tischer
7/14	Red Lake SWCD	100	Agassiz	Mattsson
8/29	1988 Project Leaders Mtg	55	Agassiz	Mattsson
9/13	Marshall Co. Con. Day	205	Wildlife	Tischer
9/16	Lower Red River Watershed Board	40	Agassiz	Mattsson
9/28	ND State University	30	Ecology	Mattsson

8. Hunting

Waterfowl hunting is not permitted on the refuge but is provided on over 23,000 acres of adjacent state wildlife lands. The refuge and Minnesota DNR cooperatively manage a controlled hunt zone (CHZ) at the southeast boundary of the refuge. The CHZ consists of a parking lot and 22 hunting stations on DNR land with a 75 yard retrieving zone into the refuge. Instructional signs and brochures make the CHZ self regulating.

Data collected on a periodic basis at the CHZ by Minnesota DNR showed 18 Canada geese were bagged during 116 hunter use days. This is .10 goose per man hour or .16 geese bagged per hunter use day. A 32 percent crippling loss remained the same as in 1987.

Data was periodically collected by the Minnesota DNR elsewhere on the Elm Lake and Eckvoll WMA's. No figures were available from the MDNR. An unlimited number of shells is allowed in the CHZ and the uncontrolled areas.

The 1988 deer season ran from Saturday, 5 November through Sunday, 13 November. Antlerless permit area 203, in zone 2 of Minnesota, includes Agassiz NWR, Elm Lake, Eckvoll and Mud Lac wildlife management areas (WMA's). One-hundred and eight square miles of the 136 square miles are considered suitable deer habitat. Two closed areas, each approximately 1 square mile in size, surround the Office Headquarters and the Maintenance Center.

Seven-hundred and seventy-four applications were received by the Minnesota DNR for the 500 antlerless permits. Twenty-six permits were issued to firearm safety certificate holders. All applicants in preference level 3-5 were awarded antlerless permits and a drawing was held at preference level 2 to fill the remaining available antlerless permits. Two-hundred and twenty-four preference level 1 applicants were not entitled to a chance at an antlerless permit.

Antlerless permits were decreased from 1,350 in 1986 to 500 in 1987 and 500 in 1988. The reduction in antlerless permits was aimed at stabilizing the pre-fawn population at approximately 15 deer/mi² following 3 years of heavy harvest in years 1984-1986. A total of 431 deer were harvested (Table 19).

Table 19. Deer harvest composition for 1984-1988 in permit area 203, Agassiz NWR, Eckvöll, Elm Lake and Mud Lac WMA's.

Year	<u>Age Composition and Percentage</u>								Total
	AM	(%)	AF	(%)	FM	(%)	FF	(%)	
1988	204	(47)	125	(29)	60	(14)	42	(10)	431
1987	223	(47)	149	(33)	45	(11)	36	(9)	473
1986	189	(29)	225	(35)	109	(17)	124	(19)	647*
1985	284	(41)	245	(35)	84	(12)	79	(12)	692**
1984	223	(37)	204	(34)	105	(17)	70	(12)	602

*Total number of deer harvested actually is 711. Composition breakdown is not available for the additional 64 deer not shown in the figures, although it is known that 208 adult males were harvested.

**Total number of deer harvested actually is 753. Three-hundred and seven were adult males (41%). Composition breakdown for the other age/sex categories was not available.

Temperatures were mild ranging from 18°F to 44°F. Light snow fell twice accumulating approximately 2 inches which quickly melted over the next couple of days. Ice was unsafe throughout most of the season with 1 inch at the beginning and less than 2 inches at the end of the season. Although ice conditions restricted access to many areas, dry conditions permitted walking in many wetlands.

Medical emergency equipment was borrowed from the Midwest Ambulance Service in Thief River Falls, Minnesota for the deer hunting season. No serious accidents were reported. An incident of a hunter who thought he heard "Help, I've been shot," actually turned out to be "Help, anybody, fire a shot." A young hunter who had become disoriented, during the snowfall, wanted someone to fire a shot so he could find his way out of the woods.

Based on refuge aerial and ground car counts, 2,803 hunter use days were estimated for 1,078 individual hunters. An additional 25 percent of hunters utilize adjacent state WMA's. Hunter success rate is calculated to be 28 percent, compared to 34 percent in 1987.

10. Trapping

The refuge was divided into eight units for the 1988 trapping program, as in 1987. The season ran from 21 October through 31 December 1988. A minimum of seven trapping days prior to the opening of deer hunting season again was required to increase harvest of raccoon, mink and red fox. Species authorized to trap included mink, raccoon, skunk and fox. All unauthorized species that were caught and could not be released were turned over the refuge.

Drought conditions resulted in a very low muskrat and reduced beaver populations. Therefore they were not authorized.

The total harvest by unit is summarized in table 20. Also included is the visits and hours spent by each trapper. An eleven year tally of species harvested is summarized in table 21. The significant decrease in harvest (except fox), can be contributed to low populations and low fur prices. The low populations are directly related to the drought and low water levels. The two Units (A & F) contributing to increased fox harvest are both on the west boundary. The west portion of the refuge maybe subject to fox dispersal from adjacent CRP lands.

Low prices for fur also contributed to reduced efforts by trappers. As shown in table 22, only mink maintained prices from 1987. The total receipts collected were \$2284.81, compares to \$4,069.53 in 1987 and \$2636.50 in 1986.

Table 20. Harvest by Units.

Trapping Unit	Mink	Skunk	Raccoon	Fox	Catch/Release	# of Visits	Trapping Hours
A	9	0	3	10	1-otter	35	110
B	21	1	3	2	2-otter	40	94
C	16	2	4	0	0	26	69
D	20	1	12	0	3-musk rats	12	56
E	8	8	4	4	1-coyote 1-wolf	37	97
F	14	6	13	13	2-musk rats	43	139
G	13	0	3	0	0	32	147
H	9	4	6	6	0	26	62
Season Totals	110	22	48	35		251	774

Table 21. Fall Fur Harvest 1978-89.

Year	Mink	Muskrat	Skunk	Raccoon	Beaver	Fox	Coyote
1978	103	*	29	25	*	*	9
1979	121	*	43	48	*	*	4
1980	188	2813	35	26	*	*	4
1981	126	*	27	33	*	*	4
1982	148	683	26	35	8	26	0
1983	99	1689	4	23	*	3	*
1984	72	4076	13	18	*	12	3
1985	44	4656	12	19	5	8	*
1986	117	6206	22	53	12	17	*
1987	266	3157	44	61	37	22	*
1988	110	*	22	48	*	35	*

*not permitted

Table 22. Fur Prices (maximum).

	<u>1988</u>	<u>1987</u>	<u>1986</u>
Fox	\$15.00	\$20.00	\$28.00
Raccoon	8.00	15.00	30.00
Mink (male)	55.00	60.00	48.00
Mink (female)	30.00	30.00	23.00
Muskrat	1.80	3.60	3.25
Beaver	25.00	25.00	35.00

11. Wildlife Observation

Due to Agassiz's remoteness, visitors usually travel great distances and are specifically interested in the refuge wildlife. Vacationing outdoor enthusiasts and bird watchers prevail among spring, summer and early fall visitors. Hunters dominate our fall visitation group and have variable interests. School groups and most local residents drive through the refuge for more casual observation of waterfowl, deer, moose and other wildlife. An estimated 5,610 wildlife observation visits were recorded in 1988.

17. Law Enforcement

Most law enforcement activity at Agassiz occurs during waterfowl, deer and moose firearms seasons. Waterfowl enforcement involves patrolling the controlled hunt zone (CHZ), refuge boundary, adjacent state lands, and nearby private lands. Big game enforcement is restricted to the refuge.

Three refuge staff members had law enforcement authority in 1988.

Table 23. Summary of Violations.

Date	Violation	Disposition(\$)	Court
10/10/88	Early shoot-waterfowl	38.00	State
10/10/88	Early shoot-waterfowl	38.00	State
10/10/88	Early shoot-waterfowl	38.00	State
10/10/88	Unplugged gun	60.00	State
10/13/88	Over bag - goose	115.00	State
10/18/88	Unplugged gun	60.00	State
10/19/88	No state license	115.00	State
10/19/88	No state waterfowl stamp	49.00	State
10/19/88	No federal mig. bird stamp	49.00	State
11/06/88	Transfer deer license	117.50	State
11/13/88	Transfer deer license	117.50	State
11/13/88	Wanton waste - deer	227.50	State
11/13/88	Take deer-no license	337.50	State

On special request, assistance was given to local state wardens on writing 5 citations on an adjacent state wildlife management area involving hunting deer from a permanent tree stand. Also numerous verbal warnings were given.

Also involving the refuge, Special Agent Duncan cited three individuals in October. One overbag violation (\$125.00), one no federal stamp/unplugged gun (\$50/\$50), and one uncased gun (\$60.00). Special Agent Duncan also investigated and filed an Information on a Lacey Act-Refuge Act violation in February involving illegal take of moose from the refuge. Two individuals from the Red Lake Indian Reservation pleaded guilty in a December trial. Sentencing is pending.

I. EQUIPMENT AND FACILITIES

1. New Construction

The Elm Lake development is a joint project involving Fish and Wildlife Service, Minnesota Department of Natural Resources (MDNR), Red Lake Watershed District (RLWD) and Ducks Unlimited (DU) to restore the drained basin and impound approximately 2360 acres. The project is designed to meet three major objectives: 1) downstream flood control, 2) improvement of existing upstream drainage facilities, and 3) marsh habitat enhancement.



Photo 35. Elm Lake restoration included 7,700 ft. on Elm Lake WMA and 3,300 ft. on Agassiz. View looking west. Elm Lake WMA on left, refuge on right of Ditch 200.
GDT

In January 1987, a public hearing was conducted by the RLWD at Thief River Falls. Although most of the testimony was opposed to the project, the watershed board voted 4-3 in favor of proceeding with the project. In 1988, the townships appealed the project to district court at Warren, Minnesota, before District Judge Warren Saetre. The project was upheld and again the project was re-appealed to Minnesota Circuit Court and again was upheld. In September, 1988, DU awarded 2 construction phases to Ron Davidson Construction of Holt, MN, to build 11,300 feet of perimeter dike. That phase of the work was completed in November, 1988.

The 1989 construction plans are to complete all the perimeter dike work totaling 7.5 miles. The targeted completion date for this project is late 1991 at an estimated total cost of 1.7 million dollars.

2. Rehabilitation

Melvie Trucking of Viking, Minnesota, was awarded a gravel contract for the delivery of 5,352 tons for \$18,999.60. Due to various conflicts delivery of gravel will not begin until spring 1989.

Four miles of Ditch 194 dike and road inslopes were seeded down in June. The Seed mix was comprised of the following: Reed Canary (5#/ac), Blue Grass (3.5#/ac), Timothy (3.5#/ac), Birdsfoot Treefoil (2.5#/ac), Alsike Clover (2.5#/ac), White Dutch Clover (2#/ac).

3. Major Maintenance

Approximately 7000 feet of dike-core work was completed along the west embankment of the Thief River, extending north from the southeast corner of Tamarack Pool. The cored segment included that portion of Tamarack Pool normally inundated with water. Michael Dyrdahl of Gully, Minnesota, was awarded the contract at a total project cost of \$19,994.80.



Photo 36. Shows 7,000 ft. segment of dike core work along east boundary of Tamarack Pool. 1 Nov. 1988 GDT

The cleanout of Berg Ditch began at the confluence of the North/South section and the East/West section. Approximately 1.25 miles of ditch was excavated moving west to West Olson Lake, facilitating improved water distribution. Additional benefits from this project will be the use of the new ditch as a fire break to conduct prescribed burning in that unit. Approximately 1/4 mile of fire break was constructed in late December to prepare the unit for a spring burn.



Photo 37. Berg ditch clean out. 1 Nov. 1988 GDT

The contract was awarded to Emmett McDonagh of Grygla Minnesota. The low bid for the dragline work was \$29.00/hr. Total contract amount was \$4,785. Construction began on 15 August, 1988 and ended on 26 September, 1988. Leveling, shaping and seed down of the spoil bank is scheduled for FY89.

4. Equipment Utilization and Replacement

A D6 dozer was borrowed from Fergus Falls Wetland Management District. The dozer has wide low pressure pads enabling it to operate in wet soil conditions. For the first time at Agassiz mechanical equipment could be used in select wetlands where it was never before possible. Section F.2 covers in detail areas that were treated.

5. Communications Systems

In May, Agassiz started using a long distance service in an attempt to lower costs. Agassiz's Merlin System was programmed with The Thief River Falls Long Distance Telephone Service, a utility company who rents lines from AT&T. An estimated 8 cents/minute has been saved using this service.

The station installed the Compuserve System in December.

6. Computer Systems

On 29 June Agassiz received a PS/2 Model 60 IBM micro computer, and a Hewlett Packard LasserJet series II printer. Almost immediately the staff went to work getting it set up and putting it to work. It didn't take long to find out that a staff of six trying to use one computer doesn't work!

Hopefully in the near future CGS will obtain contracts with companies dealing with IBM compatible micro computers. For a reasonable cost a station could set up a computer network with four or five work stations, greatly increasing office efficiency.

7. Energy

A 1989 Dodge Ram pickup was received 28 September. It replaced the fuel inefficient 1977 Dodge Club Cab.

Following is an accumulative comparison of fuel allocations, usage and costs for FY87 and FY88.

<u>FY</u>	<u>Allocation</u>	<u>Usage</u>	<u>Cost</u>	<u>Miles Driven</u>
1987	14,000	10,507	\$7926.00	48,889
1988	11,700	11,468	\$9531.00	65,123

J. OTHER ITEMS

1. Cooperative Programs

<u>Federal Programs</u>	<u>Cooperator</u>	<u>Date(s) Completed</u>
Official Weather Station	NOAA-NWS	Daily
Snowpack/Water Content	NOAA-NWS	Feb. 22-April 11
Woodcock Singing Count	FWS-MBM	May 5
Gypsy Moth Trap Monitoring	FS	June 1-Sept. 15
Mallard Banding	FWS-BBL	Sept. 14-Oct. 4
Canada Goose Neck Band Obser.	WCWRU	Sept. 20-Oct. 26
Summer Youth Employment	YGC-SYEP-OJT	June 6-Aug. 11

State Programs. MnDNR

Ruffed Grouse Drumming Census	April 29
Sharp-tailed Grouse Census (April)	not completed
Duck Breeding Pair Count	May 20
Canada Goose Brood Count	June 16

State Programs, MnDNR (cont.)Date(s) Completed

Non-Game Wildlife Observations	All year
- Colonial Nesting Birds	Summer
- Non-Colonial Nesting Birds	Summer
- Sandhill Crane Populations	Fall
- Loon Observations	Spring-Fall
Waterfowl Brood Count	July 8 & Aug. 16
Fall Waterfowl Population Reports	Sept. 23-Nov. 10
Controlled Hunting Zone	Oct. 1-Nov. 9
Moose Production/Classification Census	November
Winter Severity Index for Deer Survival	Jan. 1-April and Nov. 30-Dec. 31

State Programs-Other

Minn. Environmental Quality Board	Summer
-----------------------------------	--------

Private and/or local Programs

Mo. degree-heating-day information	Goodridge School	Oct-June
Quarterly Bird Observation	MN Ornith. Union	Quarterly
Fall Color Information	MN Tourism	Sept.-October
Fall Weekly Waterfowl Pops.	KTRF Radio	Sept.-November

4. Credits

The following individuals were responsible for various sections of this report:

Kotok: D 2-4;
 Rauen: A; F 2-5; H 17; I 1-4, 6;
 Mattsson: D 5; G 1-7;
 Bennett: C 3; E 1, 3-4; F 8-9, 12; H 1-2, 4-7;
 Tischer: B; E 2; F 10; G 8, 10-11, 16; H 8, 10-11; J 1;
 Wikstrom: E 5-6, 8; I 5, 7; J 4;

The entire staff input drafts, edited and assembled this report.

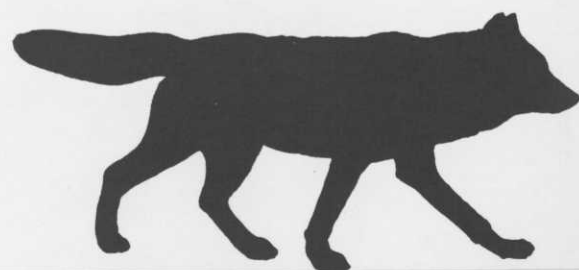
Agassiz National Wildlife Refuge

Minnesota



A Vital Link

Agassiz National Wildlife Refuge, nestled in a picturesque bay on prehistoric Lake Agassiz, is located in the northwestern corner of Minnesota. The evolution of Agassiz serves as a symbol of people's ambitions to bend nature to their wills, and of their compassionate efforts to restore a part of the environment to its natural state. This area, once vast grassland scattered with hardwood groves, lakes and potholes, was a paradise for waterfowl and other wildlife during presettlement times. In 1909, a very extensive and costly attempt was made to drain the area now occupied by the refuge. By 1933, the area became so tax delinquent and expensive to maintain that the lands were purchased by the state. It was later turned over to the Bureau of Biological Survey, now the U. S. Fish and Wildlife Service, and developed as a vital link in the chain of National Wildlife Refuges in the Mississippi Flyway.



Revitalized Wetlands

In 1937, a major program began to restore the wetland heritage of this area. A dike system created sixteen pools abounding in diverse plant life: cattails, bulrush, reed, grass, white top, spikerush, pond weed, smartweed, watermilfoil, duck weed and other emergent plants. Almost 4,000 acres of mature conifers, mainly black spruce and white spruce, remain in the north-central area of the refuge which was not drained. Approximately 36,400 acres of open water and marsh revitalized the prehistoric paradise—Agassiz.












Wildlife

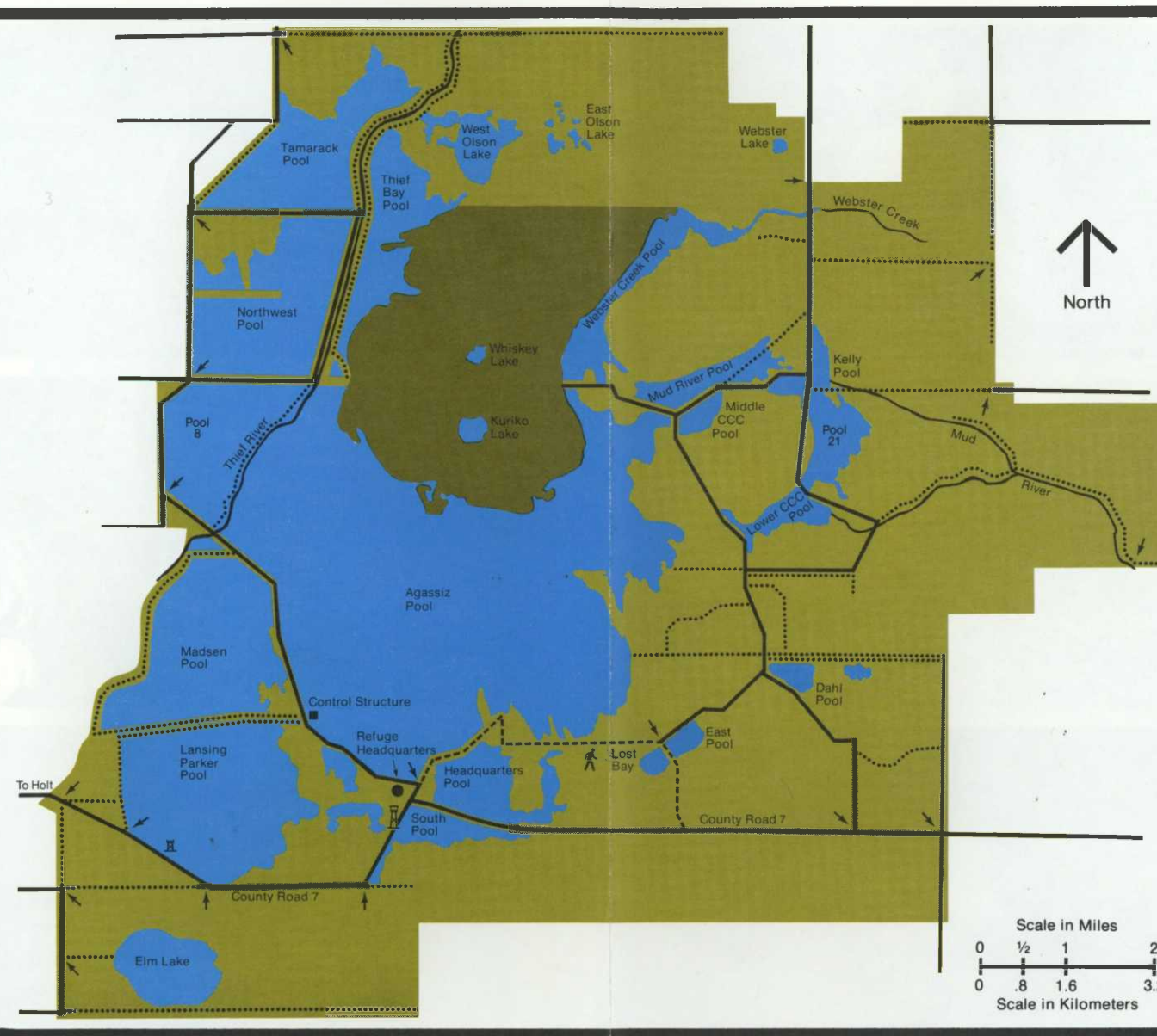
The rich and diverse resources of Agassiz Refuge provide a haven for over 265 species of migratory and upland game birds, as well as 49 species of resident mammals. Glimpses of their lives may be obtained if you are quiet...patient...sensitive...observant.

With the first buds of spring in early March, migrating waterfowl gray the skies over Agassiz. Later in April and May, songbirds migrate, leaving marsh, water and shorebirds to conduct their courtship rituals. Ruffed Grouse drumming, squawking Franklin's Gulls in a breeding colony of up to 25,000 birds, and majestic flights of white pelicans affirm the promise of life which comes with spring.



Legend

- | | | | |
|--------------------------|---|-------------------|---|
| Refuge Wetlands |  | Control Structure |  |
| Refuge Uplands |  | Observation Deck |  |
| Wilderness Area |  | Observation Tower |  |
| All Season Gravel Roads |  | Foot Trail |  |
| Seasonal Roads |  | Refuge Gates |  |
| Lost Bay Auto Tour Route |  | | |



The dense vegetation of summer provides excellent protection for molting waterfowl and maturing ducklings and goslings. After a restful summer in the sun, they are strong enough to migrate south, beginning in late September. By November, only 13 species of birds will remain for the winter.

Some animals may be seen year round. Perhaps one of the greatest attractions of Agassiz is the opportunity to view a moose in the wild. The best time to view moose is in the early morning hours and at dusk during late summer and fall. The refuge moose population is estimated to be 250, inclusive of adjoining wildlife management areas.

White-tailed deer are abundant and may be observed at many locations during the year.

Agassiz is the only national wildlife refuge in the lower 48 states to have a resident pack of eastern grey wolves. The pack travels the entire refuge during the winter, but is primarily restricted to the uplands of the east side during the rest of the year.

Maintaining a Balance

In order to maintain balance in the diverse habitats of Agassiz, a variety of management practices are used which will benefit all fish and wildlife species found here.

Water control provides for year round water levels which influence the growth of aquatic and emergent vegetation in each of the eighteen pools.

Controlled burning combined with *winter brush mowing* improves and maintains the brush and timber areas for management of moose and deer. Checking natural succession provides an "edge" effect which enhances the quality of habitat for all wildlife.

Level ditches and *potholes* at Station #5, Lost Bay Auto Drive, have been developed to attract breeding pairs of ducks in the spring and to provide brood ponds during summer. The earthen spoils are excellent loafing sites for birds during spring, summer and fall.

Wilderness Area

Approximately 4,000 acres of conifers, mainly black spruce and tamarac, are located in the north-central portion of the refuge. This block of habitat is managed as part of the National Wilderness Preservation System.

Visiting the Refuge

"Lost Bay Drive," a self-guided auto tour, with foot trail provides you with an opportunity to visit the refuge for nature study, wildlife photography or sightseeing from early spring to late fall. Tour guide leaflets, refuge leaflets and bird lists are available at refuge headquarters. A one-hundred-foot tower and deck are also available for observation.



University classes and other groups may be given conducted tours if arrangements are made with the Refuge Manager *in advance*.

Camping is not allowed. Primitive camping sites are available on nearby state wildlife management areas. The nearest motel accommodations are available in Thief River Falls, 23 miles southwest of the refuge on State Highway #32.

Headquarters is located 11 miles east of Holt on County Road 7. Refuge Manager, Middle River, Minnesota 56737.
Phone: (Holt) 218/449-4115

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



Department of the Interior
U.S. Fish and Wildlife Service

Agassiz National Wildlife Refuge



A Checklist For Kids



A Checklist For Kids

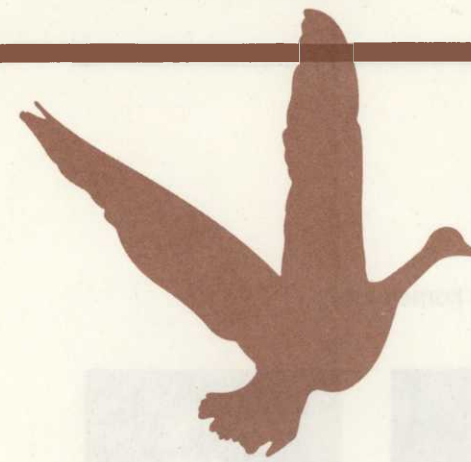


☐ Duck

Check the wildlife you
have seen!



☐ Hawk



☐ Canada
goose



☐ Blackbird



☐ Insect



☐ Frog



☒ Snake

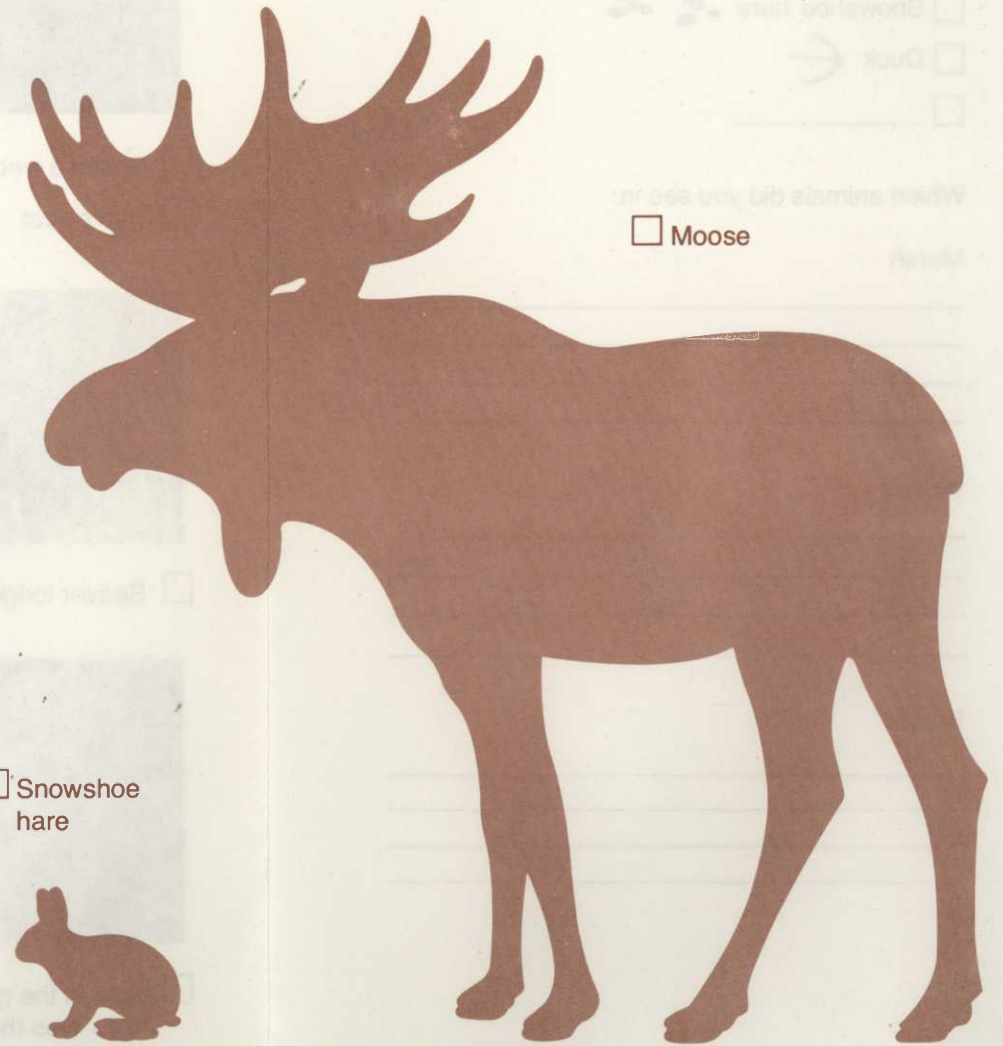


☐ Deer



☐ Great
blue heron


☐ Snowshoe
hare





☐ Moose

Sometimes we don't see the wildlife, but we see their_____.

Have you seen any today?

☐ Deer 

☐ Snowshoe hare 

☐ Duck 

☐ _____

Which animals did you see in:

Marsh

Woods

Brush

Look for wildlife homes too!



☐ Spider's web



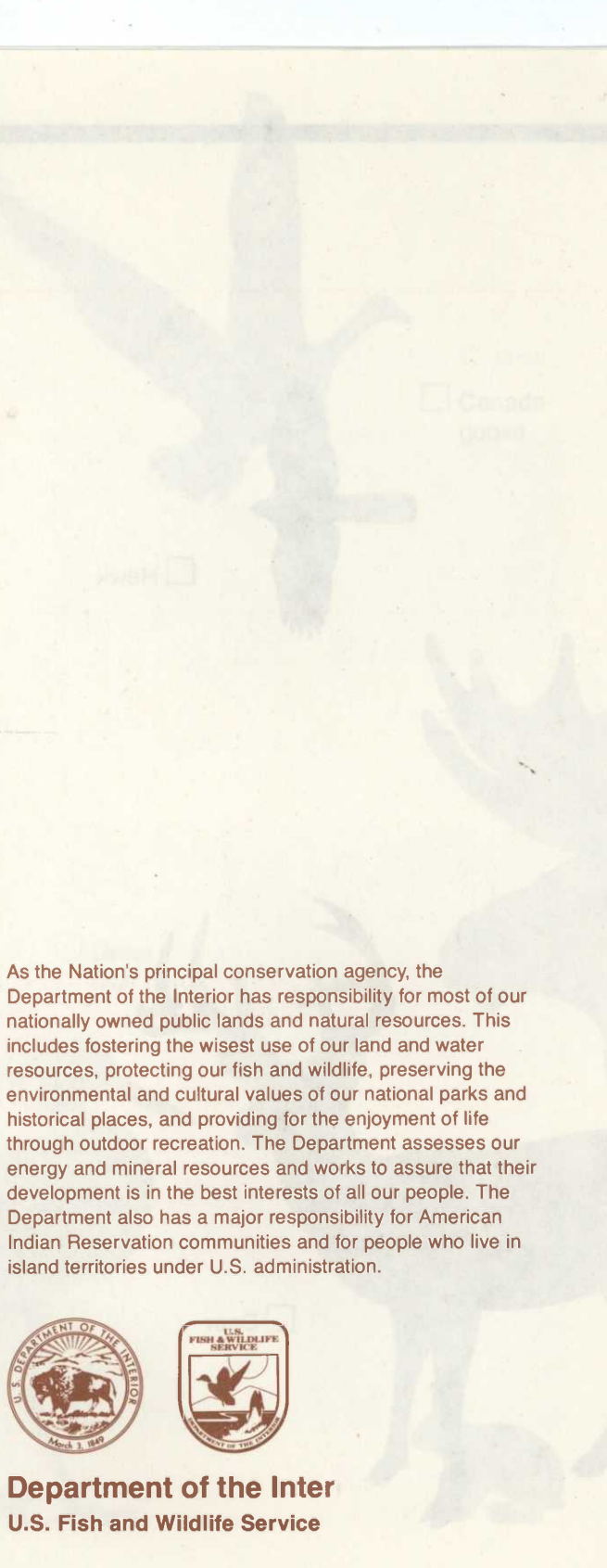
☐ Bird's nest



☐ Beaver lodge



☐ Hole in the ground
Who lives there?



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Department of the Interior
U.S. Fish and Wildlife Service

The Moose and Where He Lives

AGASSIZ NATIONAL WILDLIFE REFUGE, MINNESOTA



Department of the Interior
U.S. Fish and Wildlife Service

The moose is a comparative latecomer in the historic origin of North American big-game species. This hoofed mammal drifted from Asia to Alaska during the Pleistocene—the glacial epoch or Ice Age. Ocean waters shifted to the polar ice cap and sea level was lowered, uncovering the jutting straits of the Bering Sea. This land link served as a bridge for emigrating animals.

Moose are found today in northern reaches of the European and North American continents. The principal domain of American moose stretches across Canada, much of Alaska, and sectors of the Yukon and Northwest Territories.

These huge herbivores are still found in Maine, Minnesota, Michigan, Wyoming, Montana, and Idaho. Incidental sightings have been reported in other states.

Limited hunting of established moose populations in Minnesota, Wyoming, Idaho, and Montana was allowable in 1975 under fixed license quota programs. As the major moose herds in the lower 48 states today, these populations have premium value in any assessment of North American wildlife. Development of the herds occurred in the recent past; moose being rare in the states at the turn of the century.

Natural and man-made changes in habitats contributed to the development of Minnesota's moose herd. Abandoned farmsteads near the state's Red River Valley declined in quality and reverted to marsh, willow and aspen tracts, thus creating suitable habitat to sustain moose.

Controlled burning of rank and woody vegetation at the Agassiz National Wildlife Refuge, northeast of Thief River Falls, Minnesota, encouraged new growth of willow—the major preferred food of moose. Moreover, waterfowl management programs carried out by the U. S. Fish and Wildlife Service at the Agassiz National Wildlife Refuge created broader bases for the development of aquatic plants relished by these amphibious herbivores.

To the west, Shiras moose (a subspecies) established a bastion along the willow-lined rivers and

tributary marshes in western Wyoming, and portions of Montana and Idaho. Though moose are inhabitants of marsh, bog, and river environments, they have the versatility to exist, to some extent, in the flat farm regions of northern Minnesota and on mountainous dry slopes in seeming elk habitat of the West.

The moose is the largest and perhaps the most unorthodox member of the deer family. The enormous amount of meat available from a harvested adult moose and the trophy-like palmate antlers of bulls have attracted widespread attention from hunters.

The privilege to hunt a moose is rated by many hunters as the greatest opportunity a sportsman can receive.

The popular value of this splendid game animal works in strange ways, however. In some areas poachers take as many—or more—moose than bonafide sportsmen harvest during legitimate hunting seasons. This practice effects management of moose populations and limits opportunities to develop and maintain moose herds where poaching is excessive.

The moose is not a herding animal; rather it is solitary, seldom grouping with more than a few of its own kind. Cows are protective of calves—the females keeping the young with them in full watchful custody.

Compared to other members of the deer family, the moose is ungainly. But this long-legged deer can negotiate swamp and boggy areas where other animals would flounder. Moose are able swimmers and they take to water regularly. The nostrils of a moose contain a V-shaped valve that allows the animal to feed on aquatic roots with its massive head submerged for several minutes. Both sexes have a "bell" attached to the throat—a pendant flap of skin and hair—that serves no apparent functional value.

These anatomical peculiarities, coupled with the enormous value of this relatively scarce game animal, make the moose an elite member of North America's wildlife community.

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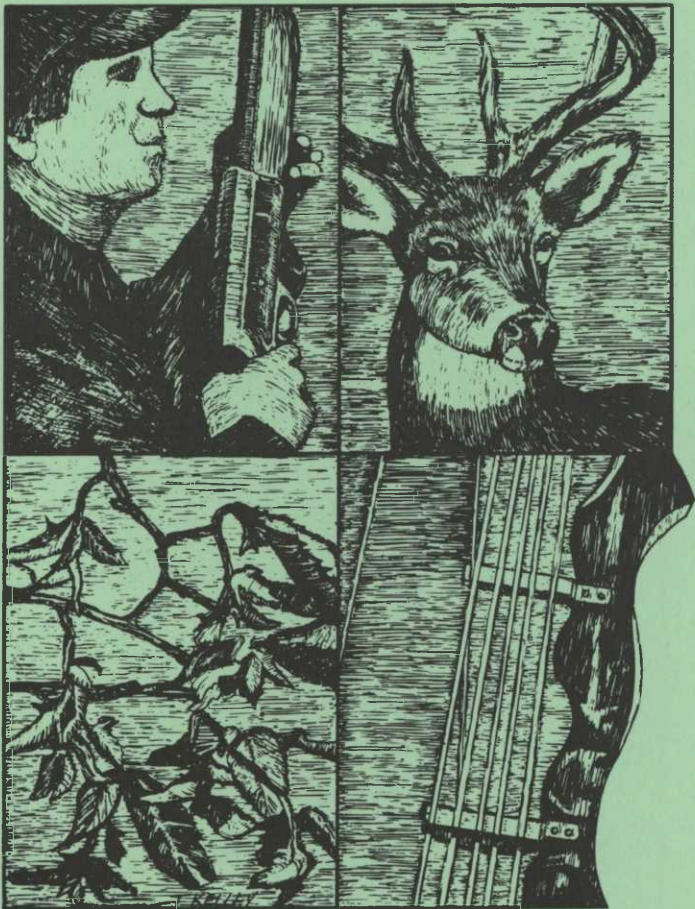


Department of the Interior
U.S. Fish and Wildlife Service

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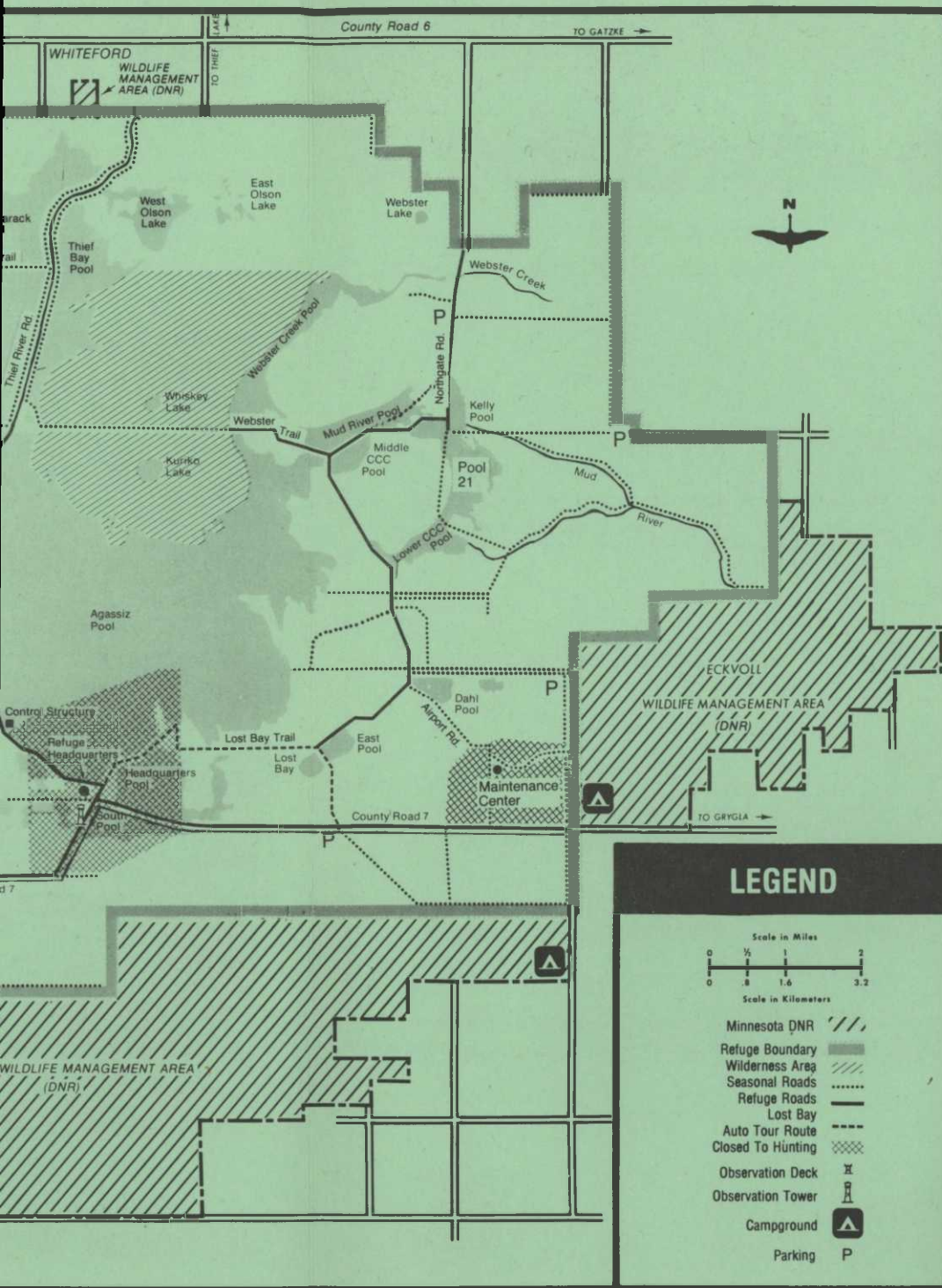
HUNTING

MAP & REGULATIONS



AGASSIZ

National Wildlife Refuge/MN



Hunting Map

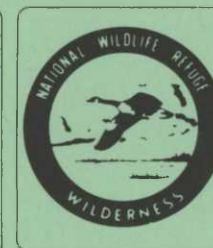


REGULATIONS ON BACK SIDE OF MAP

REFUGE SIGNS — KNOW THEIR MEANING



REFUGE BOUNDARY
SIGN —



HUNTING PERMITTED



SANCTUARY AREA —
OFF LIMITS TO
THE PUBLIC UNLESS
OTHERWISE SPECIFIED —
NO HUNTING

Hunting Regulations

BIG GAME

Deer (Gun)

SEASON DATES

State season for appropriate zone

SPECIAL CONDITIONS

- The Agassiz National Wildlife Refuge is open *only* to the hunting of deer in accordance with all applicable State regulations and as posted. Note Refuge Headquarters areas are closed to hunting.
- All other wildlife species are protected and may *NOT* be killed.
- Hunters will not be allowed to enter the refuge before 6:00 AM and must leave the refuge by dark each day.
- Vehicles must remain on designated roads and parking areas.
- All-terrain vehicles and snowmobiles are prohibited. Trail bikes and motorcycles will confine themselves to designated roads and parking areas as required of other vehicles. Travel by any conveyance off designated roads will constitute a violation.
- Overnight camping and open fires are *NOT* permitted on the refuge. Primitive camping sites are available on nearby State Wildlife Management Areas.
- All injuries or accidents occurring on the refuge must be reported immediately to the Refuge Headquarters, Agassiz National Wildlife Refuge, Middle River, Minnesota 56737. Phone Number 218/449-4115



**QUALITY HUNTING DEPENDS ON YOU
PLEASE RESPECT ALL REGULATIONS**



JULY 1982

Agassiz National Wildlife Refuge BIRDS



The following bird list contains 274 species (248 regular and 26 accidental) which have been identified on the refuge since 1937.

Seasonal occurrence and abundance are coded as follows:

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

a— abundant—common species that is very numerous

c— common—usually found in suitable habitat

u— uncommon—present but not certain to be seen

o— occasional—seen at intervals of 2 to 5 years

r— rare—seen less often than every 5 years

(E)— Endangered

*nesting documented or highly probable.

MINNESOTA

Agassiz National Wildlife Refuge

Agassiz National Wildlife Refuge occupies part of the bed of glacial Lake Agassiz in northwestern Minnesota. Containing over 61,000 acres, it is a unit in a chain of national wildlife refuges in the Mississippi Flyway extending from Canada to Mexico. It was established in 1937.

State Aid Highway 7 passes through the southern portion of the refuge and provides an excellent cross-section of the local habitat types. The terrain is flat with an average of only 1 foot of change in elevation per mile. Open water and freshwater marshes occupy 36,000 acres. On higher ground extensive areas of willows, open grasslands, and scattered stands of hardwoods comprised of aspen, elm, oak, and ash are conspicuous. Two spruce-tamarack bogs with associated bog lakes comprise a wilderness area within the refuge.

The restored shallow water marshes contain interspersed open water and emergent plants and attract 17 kinds of breeding ducks each year. An established flock of giant Canada geese also nests on the refuge. The primary management objective of Agassiz Refuge is to provide optimum habitat conditions for duck production.

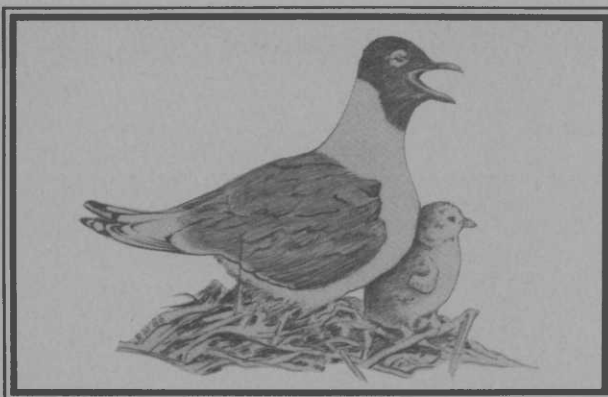
SPECIES	Sp	S	F	W
Common Loon	o	r	o	
Red-necked Grebe*	c	c	c	
Horned Grebe*	c	o	c	
Eared Grebe*	o	u	o	
Western Grebe*	c	c	c	
Pied-billed Grebe*	a	a	a	
White Pelican	c	c	c	
Double-crested Cormorant*	c	c	c	
Great Blue Heron*	c	c	c	
Green-backed Heron*	u	u	u	
Cattle Egret	r	r	r	
Great Egret*	u	u	u	
Snowy Egret	r	r		
Black-crowned Night Heron*	c	c	c	
Yellow-crowned Night Heron	r			

SPECIES	Sp	S	F	W
Little Blue Heron	r			
Least Bittern*	u	u	u	
American Bittern*	c	c	c	
Tundra Swan	c		c	
Canada Goose*	c	c	c	
Greater White-fronted Goose	o		r	
Snow Goose	u		c	
Mallard*	a	a	a	
Black Duck*	o	o	u	
Gadwall*	c	c	c	
Pintail*	c	u	a	
Green-winged Teal*	c	u	a	
Blue-winged Teal*	a	a	a	
American Wigeon*	c	c	a	
Northern Shoveler*	c	c	c	
Wood Duck*	u	u	u	
Redhead*	c	c	c	
Ring-necked Duck*	c	c	c	
Canvasback*	c	c	u	
Greater Scaup	u		u	
Lesser Scaup*	c	u	a	
Common Goldeneye*	c	r	u	
Bufflehead*	c	r	u	
Oldsquaw	r		r	
White-winged Scoter	o	r	o	
Ruddy Duck*	c	c	c	
Hooded Merganser*	c	u	u	
Common Merganser	c		o	
Red-breasted Merganser	o			
Turkey Vulture	r	r	r	
Northern Goshawk*	o	u	o	u
Sharp-shinned Hawk*	u	u	u	
Cooper's Hawk*	o	o	o	
Broad-winged Hawk*	u	o	u	
Swainson's Hawk			r	
Rough-legged Hawk	c		c	u
Ferruginous Hawk	r			
Golden Eagle	u	r	u	o
Bald Eagle	u	o	u	o
Marsh Hawk*	c	c	c	
Osprey		r	r	
Peregrine Falcon (E)	o		o	
Merlin	o		o	
American Kestrel*	u	u	u	
Red-tailed Hawk*	c	c	c	
Ruffed Grouse*	c	c	c	c
Sharp-tailed Grouse*	u	u	u	u
Gray Partridge*	o	o	o	o

SPECIES

Sp S F W

Greater Prairie Chicken	r	r		
Sandhill Crane*	c	u	c	
Virginia Rail*	c	c	c	
Sora Rail*	c	c	c	
Yellow Rail*	u	u		
American Coot*	a	a	a	
Common Moorhen	r	r		
Semipalmated Plover	c	c	c	
Piping Plover*	r	r		
Killdeer*	c	c	c	
Lesser Golden-Plover	o	r	o	
Black-bellied Plover	o		o	
Ruddy Turnstone	u	r	r	
American Woodcock*	u	u	u	
Common Snipe*	c	c	c	
Upland Sandpiper*	o	o		
Spotted Sandpiper*	c	c	c	
Solitary Sandpiper	u	u	u	
Greater Yellowlegs	c	c	c	
Lesser Yellowlegs	c	c	c	
Willet	r	r		
Pectoral Sandpiper	c	c	c	
White-rumped Sandpiper	o	r	o	
Baird's Sandpiper	o	o	o	
Least Sandpiper	c	c	c	
Dunlin	u		o	
Semipalmated Sandpiper	c	c	u	
Western Sandpiper			r	
Sanderling	o		o	
Long-billed Dowitcher	c	o	c	
Short-billed Dowitcher	u	o	u	
Stilt Sandpiper	u	u	u	
Buff-breasted Sandpiper	r		r	
Marbled Godwit*	u	u		
Hudsonian Godwit	u			
Wilson's Phalarope*	c	u	u	
Red-necked Phalarope	u		u	
American Avocet*	o	r		
Herring Gull	u		u	
Ring-billed Gull	c	u	c	
Franklin's Gull*	a	a	c	
Bonaparte's Gull	u	o	u	
Forster's Tern*	c	c	o	
Common Tern	o	r	r	
Caspian Tern	o	o	o	
Black Tern*	c	c	o	
Mourning Dove*	c	c	c	



SPECIES

Sp S F W

Rock Dove	r	r	r	
Black-billed Cuckoo*	u	u	u	
Eastern Screech-Owl	r			
Great Horned Owl*	c	c	c	c
Snowy Owl	o			
Barred Owl	r		r	r
Great Gray Owl	c			r
Short-eared Owl*	o		o	o
Long-eared Owl	r			
Northern Saw-whet Owl*	r	r		r
Whip-poor-will*	u	u		
Common Nighthawk*	u	o	u	
Chimney Swift	r	r		
Ruby-throated Hummingbird*	u	u	u	
Belted Kingfisher*	u	o	u	
Northern Flicker*	c	c	c	
Pileated Woodpecker*	r	r	r	r
Red-headed Woodpecker	o	o	o	
Yellow-bellied Sapsucker	u		u	
Hairy Woodpecker*	u	u	u	u
Downy Woodpecker*	c	c	c	c
Black-backed Woodpecker	r	r	r	r
Eastern Kingbird*	c	c	o	
Western Kingbird	u	o		
Great Crested Flycatcher*	u	u	o	
Eastern Phoebe*	u	u	u	
Yellow-bellied Flycatcher		r		
Alder Flycatcher*	u	u		
Least Flycatcher*	c	c	u	

SPECIES	Sp	S	F	W
Eastern Wood Pewee*	c	c	u	
Olive-sided Flycatcher	r			
Horned Lark*	u	u	u	u
Tree Swallow*	c	c	u	
Bank Swallow	u	u	o	
Northern Rough-winged Swallow		r		
Barn Swallow*	c	c	c	
Cliff Swallow*	c	a	u	
Purple Martin*	u	u		
Gray Jay*	r	r	r	o
Blue Jay*	u	u	u	
Black-billed Magpie*	u	u	u	u
Common Raven*	u	r	u	c
American Crow*	c	c	c	
Black-capped Chickadee*	c	c	c	c
Boreal Chickadee			r	r
White-breasted Nuthatch*	u	o	u	o
Red-breasted Nuthatch	o		o	
Brown Creeper	o		o	
House Wren*	u	c	u	
Winter Wren*	r	o	r	
Marsh Wren*	a	a	u	
Sedge Wren*	u	c	u	
Northern Mockingbird	r			
Gray Catbird*	u	c	u	
Brown Thrasher*	u	u		
American Robin*	c	c	c	
Hermit Thrush	u		u	
Swainson's Thrush	u		o	
Gray-cheeked Thrush	o		o	
Veery*	u	c	o	
Eastern Bluebird	o			
Golden-crowned Kinglet*	c	u	c	
Ruby-crowned Kinglet*	c	u	c	
Water Pipit	o		u	
Bohemian Waxwing	r		r	o
Cedar Waxwing*	u	c	u	
Northern Shrike	o		u	c
European Starling*	u	u	u	
Yellow-throated Vireo*	o	u	o	
Solitary Vireo	o		o	
Red-eyed Vireo*	u	u	u	
Philadelphia Vireo	o		o	
Warbling Vireo*	u	c	u	

SPECIES	Sp	S	F	W
Black-and-white Warbler	u	u	u	
Tennessee Warbler	c	c	c	
Orange-crowned Warbler	u	r	u	
Nashville Warbler*	o	c	u	
Northern Parula	u		u	
Yellow Warbler*	c	c	u	
Magnolia Warbler	u			
Cape May Warbler	u	u	u	
Yellow-rumped Warbler	a	u	a	
Black-throated Green Warbler	u		o	
Blackburnian Warbler*	r	r		
Chestnut-sided Warbler*	o	o		
Bay-breasted Warbler	o		o	
Blackpoll Warbler	c		c	
Palm Warbler	c	o	c	
Ovenbird*	u	u	o	
Northern Waterthrush	u	u	u	
Connecticut Warbler*		r		
Mourning Warbler	o	o		
Common Yellowthroat*	c	c	c	
Wilson's Warbler	u	u	o	
Canada Warbler	o	o		
American Redstart*	u	u	u	
Bobolink*	u	c	o	
Western Meadowlark*	c	c	c	
Yellow-headed Blackbird*	c	c	c	
Red-winged Blackbird*	c	c	c	
Orchard Oriole	r			
Northern Oriole*	c	c	o	
Rusty Blackbird	u		c	
Brewer's Blackbird*	u	u	u	
Common Grackle*	c	u	c	
Brown-headed Cowbird*	c	c	c	
Scarlet Tanager	r	r		
Rose-breasted Grosbeak*	u	c	o	
Indigo Bunting	r	r		
Rufous-sided Towhee	r	r		
Savannah Sparrow*	u	c	u	
Grasshopper Sparrow		r		
LeConte's Sparrow*	a	a	u	
Sharp-tailed Sparrow*	r	u		
Vesper Sparrow*	u	u	u	
Dark-eyed Junco	c	o	c	
American Tree Sparrow	c		c	
Chipping Sparrow*	u	u	u	
Clay-colored Sparrow*	u	c	u	
Harris' Sparrow	u		u	
White-crowned Sparrow	u		u	
White-throated Sparrow*	c	u	c	

SPECIES	Sp	S	F	W
Fox Sparrow	c		c	
Lincoln's Sparrow	u		u	
Swamp Sparrow*	u	c	u	
Song Sparrow*	u	c	u	
Lapland Longspur	u		u	
Snow Bunting	u		c	c
Evening Grosbeak	u		u	u
Purple Finch*	u	u		
Pine Grosbeak	o		o	u
Hoary Redpoll	o			o
Common Redpoll	c		u	c
Pine Siskin	u	r	u	r
American Goldfinch*	c	c	c	
Red Crossbill		r	o	o
White-winged Crossbill		r	o	o
House Sparrow*	u	u	u	u

Accidental Birds

These 26 additional species are considered accidentals; they have been observed on the refuge only about 5 times.

Lousiana Heron	King Rail	Sage Thrasher
White-faced Ibis	Ross' Gull	Sprague's Pipit
Brant	California Gull	Loggerhead Shrike
Surf Scoter	Whimbrel	Prothonotary Warbler
Cinnamon Teal	Red Knot	Golden-winged
European Wigeon	Northern Hawk-Owl	Warbler
Red-shouldered Hawk	Boreal Owl	Western Tanager
Gyr Falcon	Mountain Bluebird	Field Sparrow
Prairie Falcon	Wood Thrush	Ruff

Sighting Notes

Time in Field _____ Date _____

Weather _____

Observers _____

Species Total _____

Location _____

For Further Information Contact:

Refuge Manager
U.S. Fish & Wildlife
Agassiz National Wildlife Refuge
Middle River, MN 56737
Phone (218) 449-4115



DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
RF-3-32510-2-3/86



Agassiz National Wildlife Refuge



Your Guide To Agassiz National Wildlife Refuge



Your Guide To Agassiz National Wildlife Refuge

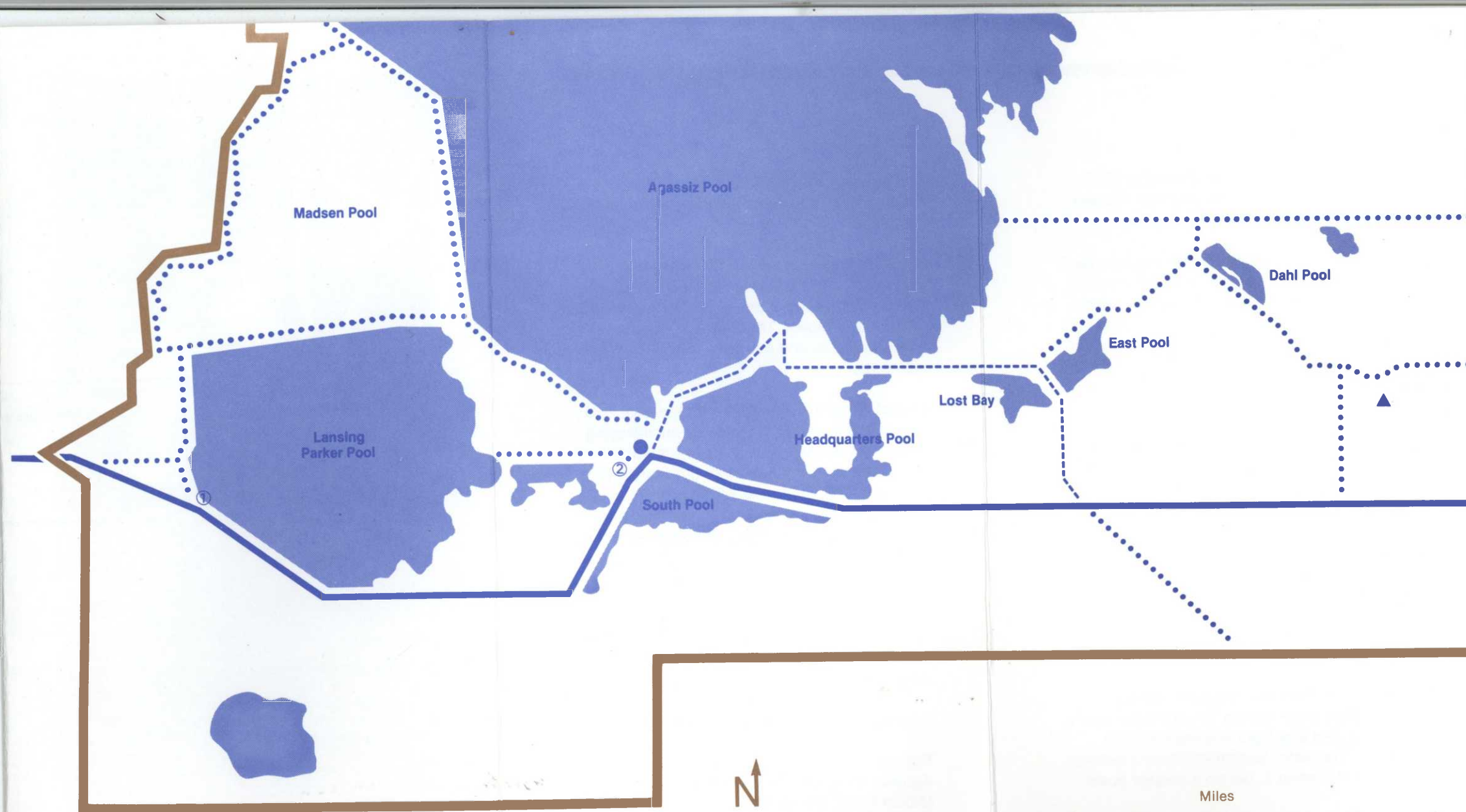
Agassiz National Wildlife Refuge is one of nearly 400 refuges in the United States. It was established in 1937 primarily for migratory waterfowl.

Visitors are welcome at Agassiz to view the wildlife and to learn about the wildlife management activities.

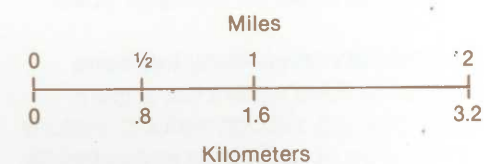
What is there to do?

	Spring	Summer	Fall	Winter
Refuge Headquarters	●	●	●	●
Auto Drive	●	●	●	
Wildlife Observation	●	●	●	
Hiking	●	●	●	●
Birdwatching	●	●	●	
Photography	●	●	●	

You are invited to look, listen and enjoy. Please remember to "take only pictures and leave only footprints." If you need more information, contact the refuge manager at refuge headquarters.



County Road 7 and Auto Tour Map
South ½ of Refuge Only



- ① **Lansing Parker Observation Area:** An observation platform will introduce you to the marsh community.
- ② **Observation Tower:** Climb 100 feet for a panoramic view of the refuge.
- **Auto Tour Route:** Numbered sign posts refer to descriptions in this leaflet.
- ▲ **Maintenance Complex:** Closed to visitors. Shop facilities for refuge maintenance purposes.
- **County Road 7**
- **Refuge Service Roads**
- **Refuge Headquarters**

Lost Bay Trail

The four mile long Lost Bay Trail will give you an introduction to the refuge. Numbered signposts refer to the descriptions that follow. The auto drive is open during daylight hours in spring, summer and fall.

1. The flat topography and mineral soils of northwestern Minnesota tell us that Glacial Lake Agassiz once covered most of this area. The trees growing here indicate that the land is a little higher in elevation than the surrounding marsh. The refuge headquarters is actually located on a small island. Watch for other islands of trees as you drive.

2. At Agassiz, water management is the most important tool that refuge managers use. This water control structure enables water to flow from Headquarters Pool on the right to Agassiz Pool on the left. The dike you are driving on forms the barrier between the pools.

Water levels determine vegetation types. Managers manipulate water levels to encourage a desirable interspersed of plant growth and open water. This provides better habitat for waterfowl, especially for duckling broods.

3. Agassiz Pool is the largest refuge pool. Its average depth is only about three feet. Pelicans and cormorants use this pool extensively during the summer, and it is very important as a waterfowl brood rearing and molting area. Rafts of migrating ducks congregate in the fall.

Historically Agassiz Pool was known as Mud Lake. In the early 1900's, the lake was drained and its bottom opened to homesteading.

4. "Prescribed burning" is another management tool used to improve wildlife habitat. Controlled fires have periodically swept through this area killing the tops of mature willow and matted grasses. Re-sprouted willow shrubs are tender and nutritious food for deer and moose. The lush new grass and forbs are excellent nesting cover for ducks.

5. Upland nesting areas are as important to ducks as water. The dense vegetation provides secure nesting cover. Combined with the small potholes and level ditches in this area, it has become ideal spring and summer waterfowl habitat.

6. A one quarter mile foot trail begins here. Park the car and stretch your legs while you explore and look for birds, deer and other wildlife in this small upland.

The top level of this dike has been raised to provide better water control. Higher water levels will restore Lost Bay Pool and improve it for waterfowl. The water control structure is similar to the one at Station 2, but on a smaller scale.

7. Agassiz's wetlands serve many functions. They absorb spring flood waters like a giant sponge. Water passing through wetland areas is cleansed by filtration of sediments and nutrients. This keeps the marsh a very rich community.

Wildlife diversity in wetlands includes much more than waterfowl. Many marsh and shorebirds such as great blue herons, Franklin's gulls and black terns can be seen, and muskrats

and beavers also live in the marsh. Marsh management maintains the diversity of bird and animal life.

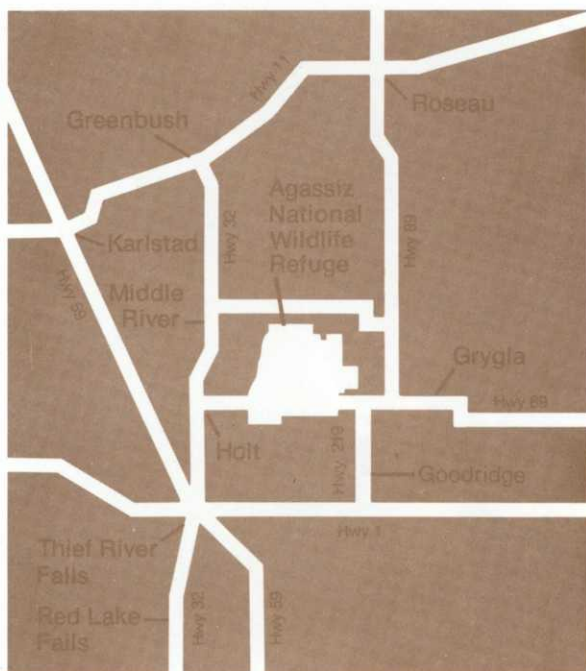
8. In this transition area, where the trees meet the marsh, wildlife managers refer to the "edge effect." Where two types of habitat meet, wildlife benefits are higher. There is more food and cover available and therefore wildlife diversity is increased.

One of the goals in wildlife management is to create and maintain diversity by encouraging "edge." At Agassiz, this is often accomplished during the winter months with bulldozers. By shearing off over-mature willow, natural succession is interrupted. Young willow and other types of vegetation grow creating "edges" along older willow.

You have driven through just a small portion of the vast wetland complex at Agassiz National Wildlife Refuge. Wildlife and people will continue to benefit from the management and preservation of areas like Agassiz.

Additional information may be obtained from:

Refuge Manager
Agassiz National Wildlife Refuge
Middle River, MN 56737
(218) 449-4115



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Department of the Interior
U.S. Fish and Wildlife Service

Complete Mammal List

Masked shrew (<i>Sorex cinereus</i>)	Deer mouse (<i>Peromyscus maniculatus</i>)
Water shrew (<i>Sorex palustris</i>)	Gapper's red-backed vole
Arctic shrew (<i>Sorex arcticus</i>)	(<i>Clethrionomys gapperi</i>)
Pygmy shrew (<i>Microsorex hoyi</i>)	Meadow vole (<i>Microtus pennsylvanicus</i>)
Short-tailed shrew (<i>Blarina brevicauda</i>)	Muskrat (<i>Ondatra zibethicus</i>)
Star-nosed mole (<i>Condylura cristata</i>)	House mouse (<i>Mus musculus</i>)
Little brown myotis (<i>Myotis lucifugus</i>)	Meadow jumping mouse (<i>Zapus hudsonius</i>)
Big brown bat (<i>Eptesicus fuscus</i>)	Porcupine (<i>Erethizon dorsatum</i>)
Red bat (<i>Lasiurus borealis</i>)	Coyote (<i>Canis latrans</i>)
Hoary bat (<i>Lasiurus cinereus</i>)	Gray wolf (<i>Canis lupus</i>)
Eastern cottontail (<i>Sylvilagus floridanus</i>)	Red fox (<i>Vulpes vulpes</i>)
Snowshoe hare (<i>Lepus americanus</i>)	Gray fox (<i>Urocyon cinereoargenteus</i>)
White-tailed jackrabbit (<i>Lepus townsendii</i>)	Black bear (<i>Ursus americanus</i>)
Eastern chipmunk (<i>Tamias striatus</i>)	Raccoon (<i>Procyon lotor</i>)
Woodchuck (<i>Marmota monax</i>)	Fisher (<i>Martes pennanti</i>)
Thirteen-lined ground squirrel	Ermine (Short-tailed weasel) (<i>Mustela erminea</i>)
(<i>Spermophilus tridecemlineatus</i>)	Least weasel (<i>Mustela nivalis</i>)
Franklin's ground squirrel	Long-tailed weasel (<i>Mustela frenata</i>)
(<i>Spermophilus franklinii</i>)	Mink (<i>Mustela vison</i>)
Gray squirrel (<i>Sciurus carolinensis</i>)	Badger (<i>Taxidea taxus</i>)
Fox squirrel (<i>Sciurus niger</i>)	Striped skunk (<i>Mephitis mephitis</i>)
Red squirrel (<i>Tamiasciurus hudsonicus</i>)	River otter (<i>Lutia canadensis</i>)
Northern flying squirrel (<i>Glaucomys sabrinus</i>)	Bobcat (<i>Lynx rufus</i>)
Plains pocket gopher (<i>Geomys bursarius</i>)	American elk (<i>Cervus elaphus</i>)
Beaver (<i>Castor canadensis</i>)	White-tailed deer (<i>Odocoileus virginianus</i>)
White-footed mouse (<i>Peromyscus leucopus</i>)	Moose (<i>Alces alces</i>)

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Department of the Interior
U.S. Fish and Wildlife Service

Reprinted: May, 1988

Agassiz National Wildlife Refuge



Mammals



Mammals



Moose



Deer



Coyote



Bobcat



Beaver



Porcupine



Muskrat



Mink



Snowshoe Hare



Squirrel



Skunk



Meadow Vole

Marsh

The marsh community is a wet area without trees. Plants vary with the amount of water — some grow underwater, some have floating leaves, and some emerge through the surface. Cattails are a typical marsh plant. Mammals that use the marsh must be adapted to a wet environment.

Lowland

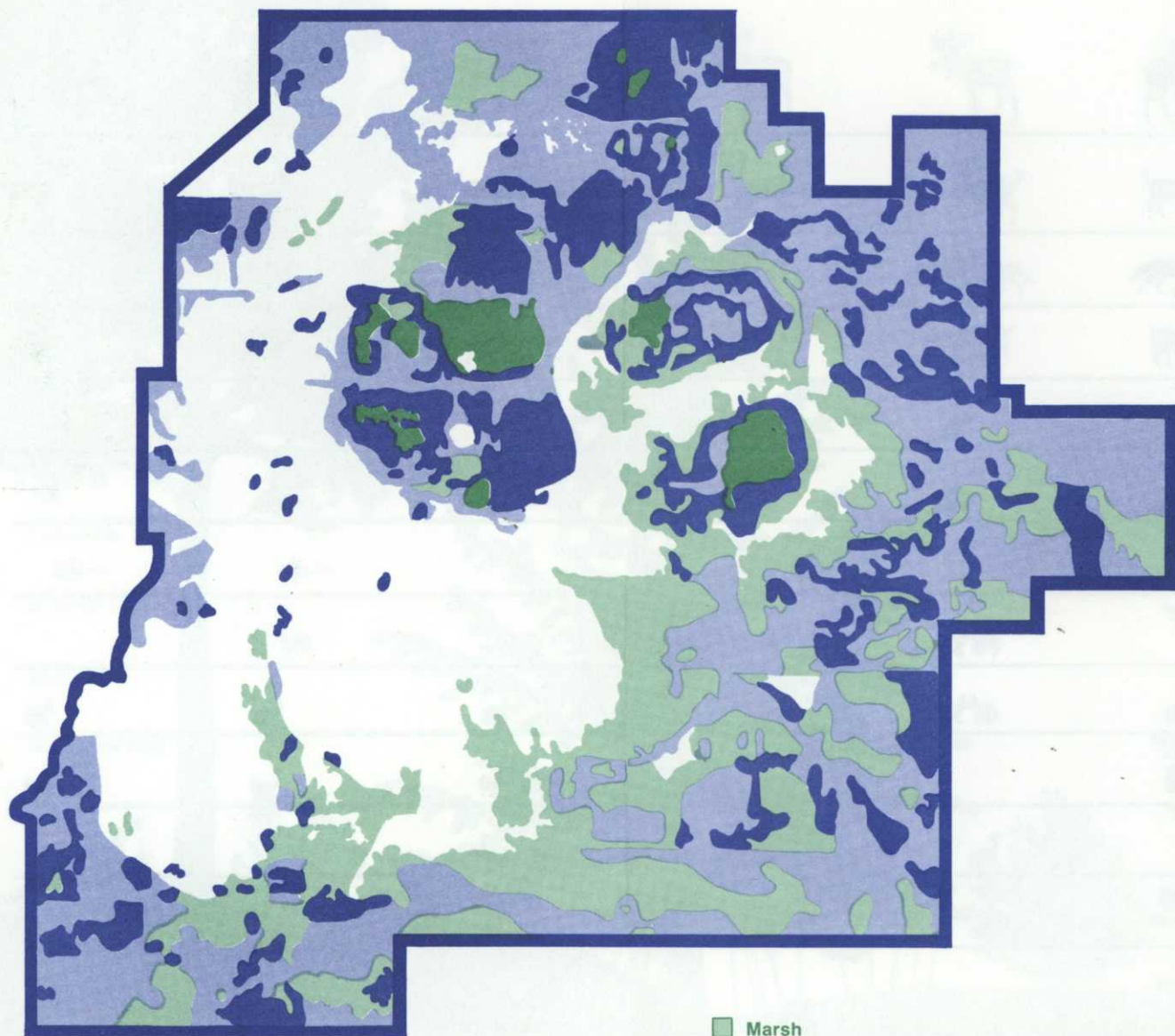
The area between the marsh and the upland is referred to as lowland. Willow and sedges are the primary plants. Many types of mammals use this area throughout the year.

Bog

A bog is a unique area with very acid soil. Plants form a floating mat at the edges of a small pond and eventually support tree growth. Black spruce and tamarack trees are indicators of a bog, as is sphagnum moss. The bog vegetation provides good shelter for some mammals, especially in winter.

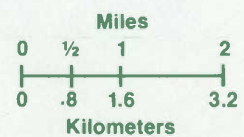
Upland

The uplands include both meadows and forest. They are drier than bog or lowlands. Aspen groves and plants such as goldenrod and sweet clover characterize the uplands. A variety of mammals frequent the upland areas because of the plant diversity.



Wildlife Habitats

- Marsh
- Lowland
- Bog
- Upland



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