Brief Summary and expenditures in FY06

Wetland processes: a 10-20 year study to improve wetland management capabilities of the National Wildlife Refuge System through integration of research, continuing education, and adaptive management.

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Larry R. Anderson /USFWS

Growing season burn in Pool 8, Agassiz NWR, 22 Aug. 2006.

In the conterminous United States, many wetlands on National Wildlife Refuges (NWR) are embedded within a larger landscape that has been greatly modified by past land use and management. Among these modifications are the installation of numerous levees, ditches, diversion channels, wells, and water control structures to manipulate the flow and direction of surface and ground waters both within and outside NWR boundaries, for purposes of agricultural production, flood storage, navigation, and wildlife habitat improvement.

Hydrologic changes in impounded wetlands typically alter ecosystem processes that determine wetland structure (i.e., extensive organic mats) and function (i.e., ability to achieve dry phase). Unfortunately, many of these challenges often are not recognized until vegetation can no longer be managed successfully using traditional techniques, or habitat and wildlife goals can no longer be attained.

Currently, common wetland issues in the northern portion of the United States often includes thick, organic layers and the encroachment of robust, perennial vegetation. Of the NWRs participating in this cattail (*Typha* spp.) study, and many more that were visited in the initial stage of this project, distribution and biomass have increased in some wetlands to an extent that they have been attributed to declines in the diversity and abundance of local waterbirds. Identifying ecological changes that have resulted in reduced effectiveness of existing cattail control strategies is an important step in adaptive management. The primary processes that have been altered on these NWRs are hydrology and nutrient dynamics, both of which function at the watershed scale and are interrelated. Furthermore, National Wildlife Refuges represent an ideal location because management actions such as water-level manipulations and prescribed burning, conducted to

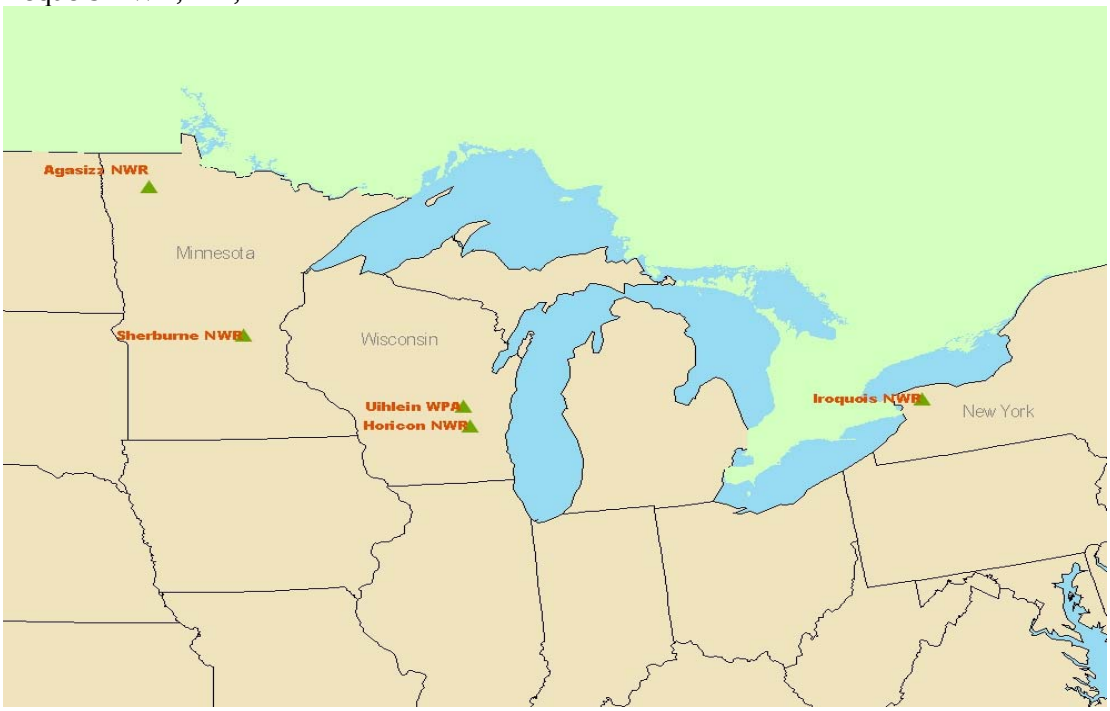
improve wildlife habitats, offer valuable opportunities to conduct scientific experiments (MacNab 1983, Sinclair 1991).

Goals and Objectives

The overarching goal of this multi-refuge study is to provide the information necessary to improve fire planning by quantifying the effect of fire in relation to different abiotic factors (e.g., hydrology, soils) to facilitate development of more effective management strategies. The working hypothesis of the study is based on the assumption that nutrients sequestered in above- and below-ground portions of live cattail, accumulated cattail litter, and organic substrates limit nutrients available for other primary and secondary producers important in wetland food webs. Currently, most prescribed fires implemented on NWR wetlands are surface burns conducted during the dormant season. Although fire often results in increased evaporation, water and substrate temperatures, and changes in soil and water chemistry (nutrients and conductivity; Auclair 1977, Diiro 1982, Faulkner and de la Cruz 1982), surface disturbances probably release only a small portion of nutrients from this large biomass pool because root systems are relatively unaffected. Further, many of the nutrients released likely are recaptured the following growing season in new cattail growth. Thus, by assessing the effects of dormant season and growing season fires on nutrient cycling and cattail in relation to abiotic conditions, the study will assist in understanding efficient and effective applications of fire, development of long-term monitoring protocols, and establishment of an adaptive management process to examine the use of fire in wetland management on NWRs.

Study Sites

Two impoundments were selected at each of the following NWR's: Agassiz NWR, MN; Sherburn NWR, MN; Horicon NWR, WI; Uihlein WPA (Leopold Wetland Management District), WI; Iroquois NWR, NY;



Methods

Contact Soch Lor for study plan.

Progress in 2005

The principal investigators met with USFWS staff (regional office, refuge managers/biologists, and fire branch) to discuss concerns regarding the application of fire in wetlands. The two primary issues

addressed were: 1) the inability to adequately dewater refuge impoundments to achieve a dry marsh phase necessary to control cattail with prescribed fire, and 2) the counteracting issue that achieving the dry marsh phase would result in an increased fire hazard that potentially would be unsafe to implement on an practical basis. These issues, which were originally identified during FY 2004, were resolved using a combination of continuing education efforts, initiating drawdowns on numerous wetlands to evaluate water discharge capabilities, and evaluating fire behavior on sites similar to those selected for this study that were burned during 2005. Continuing education activities included meetings, conference calls, and site visits to refuges. Information synthesized from previous research studies were used to stimulate discussions regarding 1) the importance of evaluating fire, soils, and hydrology simultaneously, 2) the ability and value of conducting prescribed fires during the growing season to control cattail, and 3) identifying the potential risks and benefits of conducting prescribed fires when environmental conditions would result in more intense fires. Attempts to dewater some impoundments during FY 2005 indicate that drying marsh sediments to the desired extent may be possible but may require multiple years in some cases. In addition, USFWS fire branch staff evaluated the behavior of fires conducted on sites similar to those selected for the study during 2005 and determined that potential risks associated with ignition of soil material, fire intensity, and the ability to control and extinguish fires were within acceptable limits.

Kari Ranallo/USFWS

Water table after drawdown at Horicon NWR

Progress in 2006

Climatic conditions permitted only two of the five refuges to conduct growing season burns, where selected wetland units were sufficiently dry to meet study criteria. Galaxie Marsh at Iroquois NWR was burned on time with cattail phenology (7 July) and burned well and better than expected with primarily a flank fire, flame lengths reached ca.15 ft.; fire temperatures from Hobo probes, placed at approx. 4-6 cm below surface, ranged from 37°C – 128°C.

Larry R. Anderson /USFWS

Sea of cattail (*Typha x glauca*) in Pool 8, Agassiz NWR prior to fire reaching it during prescribed burn on 22 Aug. 2006 (notice smoke in background).

Pool 8 at Agassiz NWR: the first round of pre-burn data collection was on time with cattail phenology (12 July), but conditions were not favorable for burn at this time. The actual growing season burn occurred on 22 Aug., approximately one month later than the optimal time for cattail phenology, but we decided to go ahead with the burn for benefits of gaining additional insights to cattail response to fire at this later stage of the growing season (while some energy or carbohydrates are still above the rhizome/ground) to compare to optimal growing season and dormant season burns. Approval from the Regional Office Fire Branch and the National Interagency Fire Center in Boise, ID had to be obtained to burn because of the PL 5 status at that time. Another round of pre-burn data collection was conducted prior to the burn, followed by post-burn data collection. The burn went very well and yielded a controlled and a more complete burn compared to dormant season (spring and fall) burns because it did not roar through the dead vegetation. Live vegetation "tempered" the fire, allowing a more complete burn. The burn was a combination of backing and flank fire, with flame lengths of up to 30+ ft. tall and fire temperatures at the plots ranging from 37°C – 318.4°C.

Larry R. Anderson/USFWS

Post-burn in Pool 8, Agassiz NWR, at one of the six study plots, 22 Aug. 2006.

Pre-burn, burn, and post-burn data collection were conducted at both refuges and biomass and soil nutrient analyses are in progress, as a contract with University of WI-Stevens Point, with Dr. Bryant Browne.

A conference call was held on 9.19.06 with refuge, fire, and USGS staffs to update and discuss the progress of the study. We are all just waiting for climatic conditions to cooperate with the burn plan!

Plot set-up in the dormant season burn units are almost complete and will be completed prior to the burns, which are scheduled to begin from early Oct. through Nov. 2006.

Plans for FY 2007

Refuges will continue drawdown activities to create specified environmental conditions in study wetlands and fire personnel will develop prescribed burn plans. When dry conditions are met, prescribed fire will be implemented during the appropriate time frame and collect pre- and post-fire data during FY2007. Preliminary data analyses will be conducted and reported in a progress report, which will be distributed to all involved parties by end of March 2007.

Expected Outcome/Products

- Short-term
  - Asses initial vegetation responses to seasonal burns (growing vs. dormant).
  - Develop a better understanding of fire and smoke behavior during dormant vs. growing season burns.
  - Develop effective management techniques to dry impounded wetlands.
  - Preliminary data analysis and progress report from the 2006 growing season and dormant season burn.

- Long-Term
  - Provide clearer insights into most effective time and conditions to control cattail and other similar vegetation.
  - Determine soil conditions (moisture, temp.) that result in the most effective cattail control.
  - Provide biologists with practical monitoring protocols for adaptive management projects.
  - Preliminary data will provide further refinements for a long-term adaptive management project and will be yield a stronger proposal for further funding to continue the project.

Project Staff Time and Costs FY06

The USGS fund expenditures was approximately $47,000 for FY06, which was similar to expenditures during FY04 and FY05.

The NWRS expenditures are calculated in terms of refuge staff time and costs incurred by the individual refuge above normal refuge operations for participating in the Fire Wetland Study (Table 1).

Table 1. Staff hours and expenditures on five National Wildlife Refuges and one state area for participating in the multi-refuge Fire Wetland Study during FY06.

REFUGE	TOTAL Hours	Bio. Tech (Handke)* Hours	Refuge/State Staff Hours**	Fire Staff Hours***	Contractor Hours*	Volunteers	Refuge Costs****
Agassiz	166	183	57	109	0		$3,300
Horicon	372	21.5	372		0	9	$2,725
Iroquois	267.5		451.5	284.0	203		$3,057
Leopold	170	21.5	85	85	0	9	0
Sherburne	170	22.5	85	85	0	0	0
Tonawanda WMA (NYSDEC)	24		0		0		0
BMT (Ranallo)	684						
BMT/RRB (Lor)	512						
RO Fire Branch/FMOs	10						
TOTAL	**2375.5**	**248.5**	**1050.5**	**563**	**203**	**18**	**$9,082**
AVERAGE per Refuge	**475.1**						

*Biological Technician time was paid by Region 3 Refuge Program funds (Nita).
Contractor time was paid by R5 Refuge Program funds (Tony).

**Refuge/state staff hours (biologist, bio.tech, maintenance, and volunteer staff): site inspections, evaluations of wetland conditions to meet study criteria, coordination with research team, fire staff to prepare and conduct prescribed burn).

NOTE: one refuge did not respond, in which case the same estimate from another, similar refuge was used.

***Fire Staff hours: These include fire staff stationed at the refuge and fire staff from other stations within the region who assisted with burning the study unit.

****Refuge costs are expenditures incurred by the refuge to prepare site to meet study criteria, such as fuel for pumping water; amount is above what the refuge incurred if they were not participating in the study.