Final Report for FY 2015 funding

Date: April 19, 2017
Reporting period: March 2, 2016-Feburary 29, 2017
Project title: Building capacity for *Phragmites* control and wetland conservation in the Great Salt Lake Ecoregion

IWJV Project Number: CG 2015 USU-2 / US-IM-5-1
Project Location by County: Box Elder, Weber, Davis, Salt Lake
Project State: Utah
Congressional District: 1 and 2
Bird Conservation Region: Great Basin (#9)
Bird Habitat Conservation Area: Great Salt Lake (#3)

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Project objectives and need

One of the biggest threats to wetland conservation in the Great Salt Lake (GSL) Ecoregion is the invasion of *Phragmites australis*. Across the continent and in Utah, managers seek effective tools for controlling *Phragmites* and reestablishing critical migratory bird habitat. The **purpose** of this project is to improve *Phragmites*-invaded wetland habitat for the millions of migratory birds in the Central and Pacific Flyways that use GSL wetlands. Our project **goal** is to develop effective techniques for *Phragmites* control and wetland habitat restoration in GSL wetlands. The two **specific objectives** of this project were to (1) evaluate the effectiveness of different herbicide and mowing treatments for *Phragmites* removal and native plant reestablishment and (2) evaluate the effectiveness of different means for reestablishing bulrushes in wetland sites.

Project activities and accomplishments

Objective 1: evaluate the effectiveness of different herbicide and mowing treatments for Phragmites removal and native plant reestablishment.

Quantitative measures

Effectiveness is being evaluated in terms of reduction of *Phragmites* cover and increase in native vegetation cover (particularly for the three bulrush species: *Bolbschoenus maritimus* (alkali bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Schoenoplectus americanus* (threesquare bulrush)).

These measurements were taken in two experiments: the **large stand experiment** with 3 acre treatment plots (summer imazapyr application, winter mow; summer glyphosate application, winter mow; fall imazapyr application, winter mow; fall glyphosate application, winter mow; untreated control) at 4 Great Salt Lake sites and the **small patch study** with 0.25 acre treatment plots at 6 Great Salt Lake sites (summer glyphosate application, winter mow; summer imazapyr application, winter mow; fall glyphosate application, winter mow; summer mow, fall glyphosate application; summer mow, cover with heavy-duty black plastic; untreated control).

Activities

- We applied the final year of the three year (2012-2014) *Phragmites* control treatment sequence to the experimental plots in summer and fall 2014.
- We documented changes in *Phragmites* cover and native plant recovery in the experimental plots through summer/fall 2016
- We are currently analyzing the data and present the latest results here.

Significant findings

- We found that all herbicide treatments (glyphosate and imazapyr) and treatment timing (summer vs. fall application) were equally effective at reducing the cover of *Phragmites* for the first three years (2012-2014; see **Figure 1** below). *Phragmites* cover was greatly reduced from 80% pre-treatment to 5-35% post-treatment.
- However, in both experiments, *Phragmites* cover increased dramatically in the summer herbicide plots in 2015 and 2016, after the last herbicide applications were applied (see **Figure 1** below).

- Only treatments that involved mowing or herbicide application in the *summer* greatly reduced the ability of *Phragmites* to produce inflorescences vs. fall-only treatments (see **Figure 2** below). But this finding is only relevant for the first year of *Phragmites* control since by the second year, *Phragmites* cover had been reduced so substantially that inflorescence production was minimal.
- We found that the return of native, habitat-forming bulrushes was limited through 2016 (**Figure 3**). Therefore, it will be essentially to actively reintroduce these species to foster their establishment and to prevent *Phragmites* from reinvading.

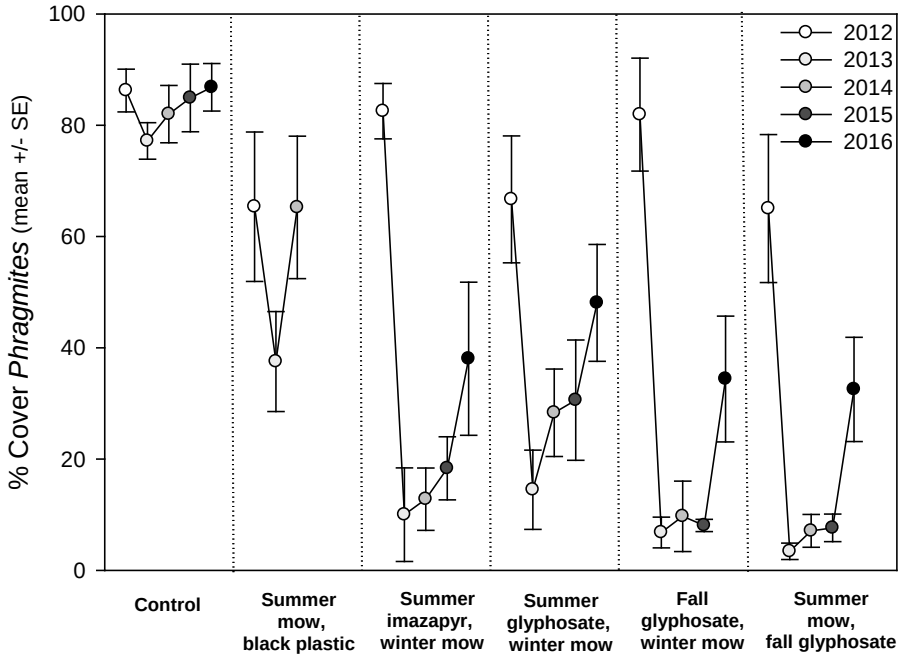

Figure 1. Changes in *Phragmites* cover in the small patch study (0.25 acre treatment plots; Christine Rohal Ph.D. dissertation research). Similar findings occurred in the large stand study.

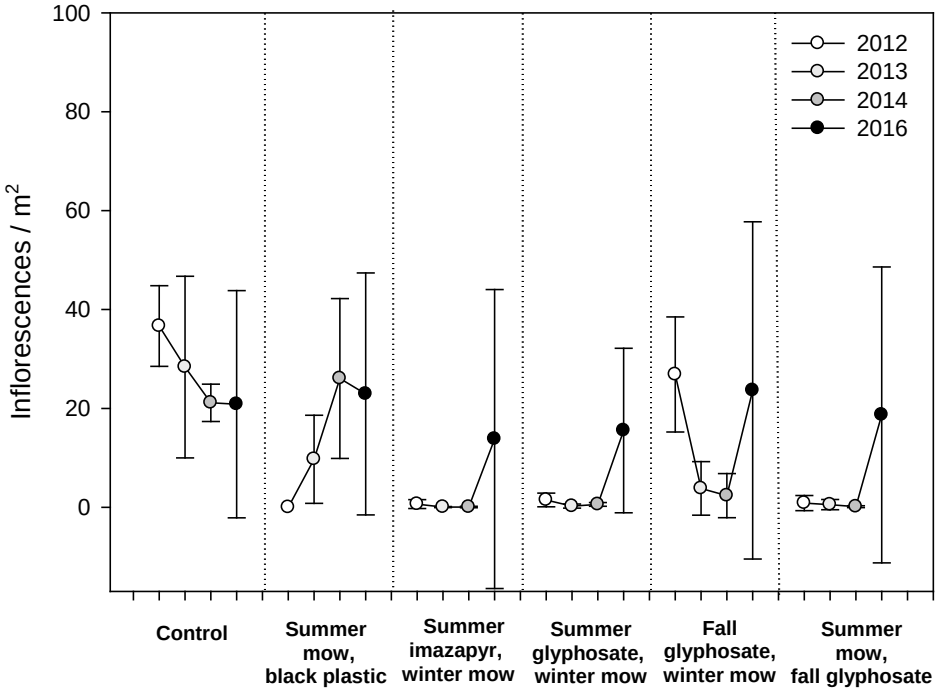

Figure 2. Changes in *Phragmites* inflorescence density in the small patch study (0.25 acre treatment plots; Christine Rohal Ph.D. dissertation research).

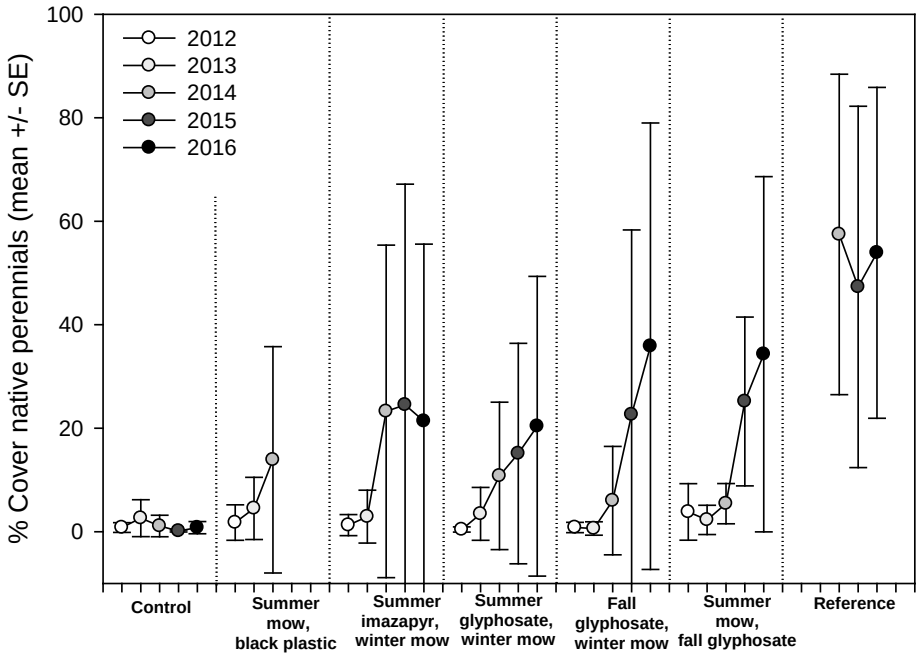

Figure 3. Changes in the cover of native perennials in the small patch study (0.25 acre treatment plots; Christine Rohal Ph.D. dissertation research).

Objective 2: evaluate the effectiveness of different means for reestablishing bulrushes in wetland sites.

Quantitative measures

Effectiveness is being evaluated in terms of percent cover and biomass (a measure of productivity) of the three bulrush species in experiment plots.

Activities

- We established a large-scale field experiment at the Bear River Migratory Bird Refuge in summer 2015 and monitored plots through 2016.
- The bulrush treatments were seeding (low and high density), planting seedling plugs, staking vegetation mats, and transplanting rhizome masses.
- The treatments were installed in 26 - 4m*16m strips in each of two wetland units at the Bear River Migratory Bird Refuge.

Significant findings

- The plugs, mats, and rhizome transplants all had moderate establishment success (40-50% survival) after one month of installation, but by the end of the 2015 growing season almost all of the plants had completely died. Over the winter of 2015-2016, ice scouring disrupted the remaining plants.
    - Despite the failure of these treatments, we were able to evaluate the logistics of implementation of these treatments for large-scale Great Salt Lake wetland restorations. The consensus among managers we communicated with, was that these treatments are not logistically feasible to implement on any broad scale, especially given the high probability of failure.
- Given much higher than predicted water levels, the seeded treatments lost almost all of their seeds and seedling emergence was negligible.
    - Despite the failure of the seeding, we gained valuable insights into additional steps that need to be taken to ensure success for logistically-feasible, seed-based restoration for Great Salt Lake wetland plants. We have since spent significant time and effort evaluating the potential for a tackifier (adhesive substance mostly used in terrestrial restoration) for keeping seeds in place under moist or flooded conditions. Based on results from three greenhouse experiments (David England M.S. project), we are now preparing to evaluate these treatments in field plots at Farmington Bay (summer 2017; Emily Martin M.S. project).

Additional considerations

Project benefit to priority bird species and priority habitats

Given the critical importance of Great Salt Lake wetland habitat (a priority area in the IWJV 2013 Implementation Plan) to priority bird species (see below), developing techniques to control invasive *Phragmites* and restore lost wetland habitat is essential. Chapter 4 of the IWJV 2013 Implementation Plan explicitly identifies *Phragmites* as a primary factor negatively impacting avian and wetland habitat quality at Great Salt Lake. Our research results are a positive step towards meeting those habitat needs of wetland birds. Effective treatment of *Phragmites* and

restoration of habitat-forming native plants will provide valuable foraging or breeding habitat for numerous priority species identified by the IWJV including, but not limited to: Northern Pintail, Cinnamon Teal, White-faced Ibis, American Avocet, Black-necked Stilt, and Marbled Godwit. Significant proportions (>15%) of each of these populations annually use the GSL wetlands (J. Vest personal communication).

Relationship between project and anticipated goals to regional and/or continental bird plans
The Great Salt Lake is identified as a continentally or hemispherically important landscape for wetland birds in the North American Waterfowl Management Plan, Western Hemispheric Shorebird Reserve Network, Intermountain West Shorebird Conservation Plan, Intermountain West Waterbird Conservation Plan, and, accordingly, in the IWJV Implementation Plans (1995, 2005, 2013). *Phragmites* has been identified as a primary factor negatively impacting avian habitat quality at Great Salt Lake (IWJV 2013 Implementation Plan). Our research will directly inform management actions at Great Salt Lake to restore and sustain quality wetland habitat for migratory birds. Our research project has tightened linkages among wetland managers on the Great Salt Lake who work for state and federal agencies, as well as NGOs and private duck clubs. This highly collaborative project, with its strengthened partnerships among regional constituencies, will benefit broad goals of increasing migratory bird habitat in the Great Salt Lake Ecoregion.

Other results that were not anticipated
We were surprised by two things from this year of research. First, the rapid rebound of *Phragmites* just two years after herbicide application ceased underscores the need for continued maintenance of *Phragmites* patches as well as the need to rapidly restore native plant communities that can help resist the return of *Phragmites*. We were also surprised at how unsuccessful all our revegetation treatments were, including the non-seed ones that we expected to have high establishment success. These findings highlight how incredible difficult it will be to get these native species established across varying environmental conditions (especially hydrology and salinity fluctuations). Furthermore, these findings clarified how much more we need to figure out to ensure that logistically feasible seed-based restoration is successful.

Changes in capacity needs since the proposal was developed
There have been no major changes in capacity needs.

The single most important step as a result of the project and next steps
The most important step as part of this was being able to provide science-backed recommendations to managers based on our research findings. This was particularly important given that our recommendations changed between 2014 and 2016 due to differences in response to *Phragmites* control treatments. It was important for managers to see the scientific process "in action" (i.e., results can change year-to-year) and that our research has no agenda other than to provide sound recommendations to improve their management efforts. Next steps will be to see if our recently developed (FY 2016) seed-based techniques perform well in the field.

Duration of the project benefits
The research benefits will extend as long as *Phragmites* control and native plant revegetation is occurring in this region. Our research results can guide these control and revegetation efforts into the future.

Monitoring success of the project from this point on
The *Phragmites* and bulrush revegetation research plots were monitored through the 2016 field season. At the regional scale, we will be able to assess the effects our research results have on management through our on-going outreach / extension efforts. We will be able to see if research results are resulting in change in management practices and if those "best practices" are followed by managers over the years to come.

Project transferability

- In previous years, we suggested that there was no difference in spraying *Phragmites* in the summer vs. fall, but the most recent experimental results suggest that fall spraying is more effective for controlling *Phragmites*, particularly when dealing with large stands of *Phragmites*. A summer spray might still be preferred in the first year of a three year control sequence to prevent additional seed production, but then shifting to a fall spray is better for longer-term *Phragmites* control. We have communicated these findings and recommendations to managers this winter as we have given a number of outreach presentations including to the Southshore Duck Clubs, the UDWR fall wrap-up meeting, and the Great Salt Lake Technical Team. We are also in constant contact with UDWR wetland managers (three of which are Kettenring's former/current students).
- Given the challenges of getting bulrushes to establish in the field, we hope to shortly have for managers field-tested seed-based restoration techniques.
- ***Major upcoming milestones that will drive transferability.*** David England will defend his thesis in summer/fall 2017 and Christine Rohal will defend her dissertation in fall 2017. Their work (partially funded by this grant) will be presented in a public seminar and their thesis/dissertation will be published online and be freely available to the public. As these students wrap up, there will be additional opportunities for peer reviewed publications (to disseminate findings to the academic scientific community), outreach presentations to managers and landowners throughout Utah, and development of formal restoration guidance documents based on research findings.

SUMMARY (add fields if necessary)		
Number	**Description/Unit**	**Comments**
	Partner Biologist Position Established	N/A
	Total Acres Protected	N/A
	Total Acres Restored	Large stand study: 4 sites * 4 treated plots per site * 3 acres per plot = 48 acres Small patch study: 6 sites * 4 treated plots per site * 0.25 acre per plot = 6 acres
	Total Acres Enhanced	N/A
	Conservation Easements Acquired	N/A
	Conservation Plans/Contracts Developed	N/A
	Landowner Visits	N/A
	Partnering Organizations Involved	**Federal**: Howard Browers, US Fish and Wildlife Service, Bear River Migratory Bird Refuge. **State**: Randy Kaufman and Laura Vernon, Utah Division of Forestry, Fire & State Lands, Sovereign Lands. Val Bachman, Randy Berger, Rich Hansen, Chad Cranney, Jason Jones, Arlo Wing, Utah Division of Wildlife Resources. **NGO**: Chris Brown, The Nature Conservancy, Great Salt Lake Shorelands Preserve. **Private**: Ann Neville, Kennecott Utah Copper, Inland Sea Shorebird Reserve
	Meetings/Work Groups Facilitated	N/A
	Field Tours Hosted	N/A
	Grant Proposals Written & Funded	Utah Division of Wildlife Resources, Utah Division of Forestry, Fire & State Lands, U.S. Fish and Wildlife Service, Utah Division of Water Quality, South Davis Sewer District, Utah Wetlands Foundation, Delta Waterfowl Foundation, Community Foundation of Utah
	Other (OUTREACH presentations)	Great Salt Lake Technical Team meeting, Salt Lake City, UT Southshore Wetlands & Wildlife Management, Inc. annual meeting, Salt Lake City, UT Utah Division of Wildlife Resources, Salt Lake City, UT

		Utah Wetlands Foundation, Salt Lake City, UT
BY PROJECT* (add fields if necessary)		
Number	**Description/Unit**	**Comments**
Property/Project Name:		Location (GPS Waypoint or Nearest Town):
	Acres Protected	N/A
	• Wetland Acres	
	• Riparian Acres	
	• Upland Acres	(Specify Habitat Type)
	Acres Restored	
54	• Wetland Acres	
	• Riparian Acres	
	• Upland Acres	(Specify Habitat Type)
	Acres Enhanced	
	• Wetland Acres	
	• Riparian Acres	
	• Upland Acres	(Specify Habitat Type)