NORTH ATLANTIC LANDSCAPE CONSERVATION COOPERATIVE GRANT PROGRESS REPORT

Second semi-annual report: 15th January 2016

Award Number and Title: F14AC00965 "Tidal wetlands after Hurricane Sandy: baseline restoration assessment and future conservation planning (part of Decision support for Hurricane Sandy restoration and future conservation to increase resiliency of tidal wetland habitats and species in the face of storms and sea level rise, DOI# 24)"

Organization: University of Connecticut, University of Maine, University of Delaware, SUNY-ESF

Project Leader: Chris Elphick (co-investigators: Brian Olsen, Greg Shriver, Jonathan Cohen)

Abstract: This project is using the Saltmarsh Habitat and Avian Research Program's (SHARP) platform to assess the efficacy of restoration activities and to provide planning guidance to enhance the future resiliency of natural coastal assets. Specifically, SHARP will: (1) Collect baseline data in 2015-16 to enable quantification of the efficacy of Hurricane Sandy restoration projects using a standardized set of protocols that allow both integration with similar work already planned for many NWRs and comparison with the larger regional SHARP data set (a network of >1500 locations sampled annually in 2011-14). (2) Collect detailed, high resolution, marsh elevation data in association with the existing sampling network and at new study sites associated with restoration evaluation. (3) Generate a detailed, ground-truthed vegetation map for tidal marshes throughout the region in order to facilitate both the evaluation of restoration work and future resiliency planning. And, (4) integrate SHARP's work with that of other LCC and Hurricane Sandy resiliency partners in order to conduct coordinated regional conservation planning.

Were planned goals/objectives achieved last quarter? Yes

Number of veterans and youth (17-25) employed as a result of this agreement: 0 and 10, respectively

Progress Achieved:

Task A: Collect baseline data in 2015-16 to enable quantification of the efficacy of Hurricane Sandy restoration projects using a standardized set of protocols that allow both integration with similar work underway at many National Wildlife Refuges and comparison with SHARP's regional data set (a network of >1500 locations sampled annually in 2011-14).

- In 2015, we monitored restoration projects at nine NFWF-funded sites and three additional restoration sites (i.e., state or private partnerships in CT and NJ) in addition to our ongoing survey assessments of marsh restoration efforts on federal lands with existing USFWS partners. All restoration sites were associated with nearby control points (Table 1).

- 2015 baseline data collection is complete, with bird and vegetation data collected at 216 new restoration and control points to complement >700 points associated with refuge restoration projects.
- 2015 data is entered and proofing is nearly complete.

Table 1. *Number of sites (constituting restoration and control/reference points) surveyed in 2015, further delineated by restoration type.*

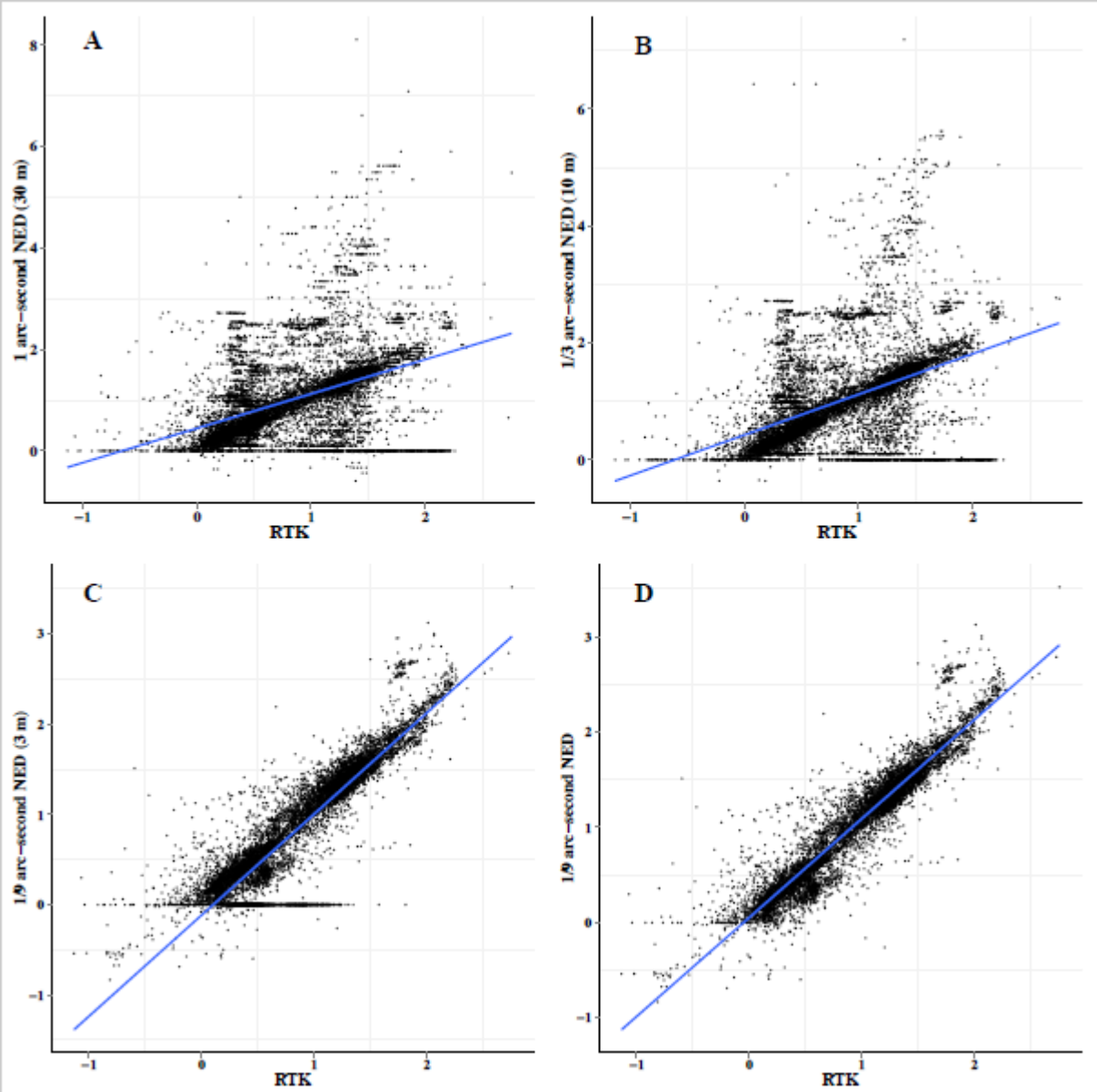
Type	NFWF*		USFWS*		Other	
	Points (Rest/Control)	Sites	Points (Rest/Control)	Sites	Points (Rest/Control)	Sites
Living Shoreline	1/1	1	123/73	7	4/6	1
Sediment Deposition	58/60	7	224/55	5	10/8	1
Change Hydrology	67/48	7	357/156	9	0	0
Marsh Migration	0/0	0	3/14	1	0/0	0
Invasive Species Removal	0/0	0	243/68	6	0/0	0
Vegetation Planting	5/6	2	7/8	1	2/1	1
Pole Removal	0/0	0	28/16	1	0/0	0

*there is some overlap between/among NFWF and USFWS control points (n = 15)

Task B: Collect detailed, high resolution, marsh elevation data in association with the existing sampling network and at new study sites associated with restoration evaluation.

- In the summer of 2015 two teams of technicians visited 651 points in marshes within the SHARP study area to collect elevation data using Real-Time Kinematic (RTK) units. These points were distributed across the entire geographic extent of the SHARP study range.
- At RTK locations, we also obtained 2-6 polygon (>5 x 5 m) delineations of tidal marsh habitats, according to four broad marsh categories (low marsh, high marsh, mixed marsh, *Phragmites australis*). This information will be used to improve models of marsh habitat using remote sensing.
- We compared these highly accurate and precise field measurements to elevation measurements collected remotely through the public-access National Elevation Dataset (NED) using mixed-effects linear models (Figure 1). We found the 1/9 arc-second (~3 m resolution) dataset predicted RTK measurements very well ($Rm^2 = 0.9$), while the 1 and 1/3 arc-second datasets predicted RTK elevation less well. Since 1/9 arc-second elevation data are available for nearly all of the SHARP study area, we suggest that this dataset is an adequate substitute for future analyses involving sites for which RTK elevation measurements are not available.

Figure 1. *Results of linear mixed model regressions comparing elevation measurements of tidal marshes using Real-Time Kinematic (RTK) units and measurements from the National Elevation Dataset (NED) at the 1 arc-second (~30 m resolution) (A), 1/3 arc-second (~10 m resolution) (B), and 1/9 arc-second (~3 m resolution) with (C) and without (D) measurement of zero elevation points from the NED.*



Task C: Generate a detailed, ground-truthed vegetation map for tidal marshes throughout the region in order to facilitate both the evaluation of restoration work and future resiliency planning.

- Work towards the creation of a comprehensive high/low marsh community layer is well underway. Field collection of training and evaluation data in marshes between Maine and Virginia this summer resulted in the delineation of >1000 patches of marsh vegetation communities.

- We have hired a GIS Analyst, Wouter Hanston (started Nov 6), who is developing the vegetation community layer using a combination of classification trees and random forest methods. A chart of our planned progress on this task is shown in Figure 2.

Figure 2. *Planned processing for Task C; the development of a comprehensive layer of tidal marsh communities from Maine to Virginia.*

	November	December	January	February	March	April
Literature review						
Salt Marsh Vegetation	v					
RS of Salt Marshes		v				
Advanced RS classifiers		v	v			
Training data selection		v	v			
DEM						
DEM preprocessing	v					
DEM Validation	v					
Tidal amplitude Modelling			v	v		
Imagery						
Image preprocessing	v					
Indices processing		v				
Relationship between indices & environmental parameters			v			
Development of classification (local)						
Development		v	v	v		
Accuracy assessment			v	v	v	
Discussion / Evaluation				v	v	
Include tidal in classification					v	
From local to regional classification						
Fine tuning of classifier					v	v
Accuracy assessment					v	v
Discussion / Evaluation						v
Final classification						
Run classification						v
Accuracy assessment						v
Create (online?) map						v

Task D: Integrate their work with that of other LCC partners in order to improve regional conservation planning.

- PIs, postdocs, and many affiliated SHARP researchers participated in a full day meeting focused on Hurricane Sandy research at the USFWS offices in Hadley, MA, on 10th December 2015.
- SHARP team has worked closely with USFWS staff to make all survey vegetation data available online through DOI Connect. All vegetation data sheets, except those for Long Island, have been scanned and uploaded.
- Online database and data entry portal for SHARP bird data has been created and is undergoing final checks and revisions. We are also in the process of publishing the raw bird survey data via an online depository so that it is freely accessible.
- Postdoc has created a comprehensive GIS layer for conservation planning that delimits current spatial extent of tidal marsh patches and reflects current levels of protection, estimates of avian focal species density, and the estimated value (in dollars) of unprotected area of each patch.
- GIS layer has been used with systematic conservation planning software to determine highest priority sites (that minimize cost) across the region for saltmarsh sparrow and clapper rail conservation given current conditions.

- Postdoc is working with partners to develop a saltmarsh conservation elicitation to estimate relative value of alternative conservation objectives as identified by refuge managers, agency biologists, and NGOs.

Difficulties Encountered: RTK data collection proved more time consuming to collect than anticipated, in part because of efforts to match data collection to that being done and/or needed by others. Consequently, fewer points were sampled than expected. High correlation between RTK elevation estimates and those derived from NED sources, however, suggests that field measurements at all sites may be unnecessary. Moreover, we are in the process of planning additional RTK data collection for 2016, prioritizing sites where extrapolation from other data sources is impossible.

Activities Anticipated Next Quarter:

- Produce 1 page summaries of 2015 data collection for each NFWF project.
- Contact additional NFWF project leaders to evaluate potential for data collection at additional sites in 2016, focusing on sites that have not begun restoration.
- Develop plan for field survey effort in 2016, hire field crews, and begin data collection (likely in April or early May).
- GIS analyst will (a) complete high/low marsh isolation using NED 1/9 arc-second layer and NAIP imagery using classification trees, (b) complete classification of secondary cover classes (terrestrial border, mudflat, pools/pannes/channels, *Phragmites*) using similar methods, and (c) develop local support vector machine classifications of high and low marsh within isolated boundaries.
- Post-doc will (a) complete region-wide conservation prioritization scenarios for focal avian species based on current conditions, (b) begin analyses that incorporate effects of sea level rise on present area of salt marsh, and (c) conduct an expert elicitation developed to evaluate trade-offs among alternative saltmarsh conservation goals to inform planning activities.

Expected End Date: October 31, 2016

Total expenses since last report: $248,064.97 (233,658.86 direct)

Total life to date expenses: $298,564.41 ($279,046.13 direct)

Total Approved Budgeted Funds: $820,000 ($787,439 direct costs)

Are you within the approved budget plan and categories: Yes

Signature:

Date: 15 January 2016