Browns Park National Wildlife Refuge Monitoring Projects
Project Report Summaries
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In 2005, faculty at the University of Wyoming, in collaboration with the USFWS, initiated a study to provide valid baseline information of non-forested upland habitat (grassland and shrubland) at Browns Park National Wildlife Refuge (BPNWR) using sampling methodologies that can be adapted for long-term monitoring by BPNWR staff. In 2007, an additional project "Bottomland Assessment for Browns Park National Wildlife Refuge- A research proposal submitted to BPNWR" was initiated to provide a valid baseline inventory of the bottomland habitat in the refuge. Included with the bottomland assessment inventory was a research project to measure and quantify changes in vegetation structure in greasewood systems.

This report summarizes the projects conducted at BPNWR between 2005-2010. At the end of this report is a list of all of the project deliverables. These projects resulted in significant and valuable baseline data for the refuge, maps and spatial data layers, presentations at professional meetings and numerous publications including a PhD Dissertation and a M.S. Thesis. The upland and bottomland project results, data, publications, documents and photos, are in the accompanying set of CDs.

Baseline Inventory Monitoring:

Both projects used similar sampling methods and approaches to develop baseline inventories. The habitat and site characteristics were monitored using "standard" rangeland monitoring methods (Herrick et al. 2003). In addition, modified monitoring methods (Shrub Gap and Shrub belt density) were used to measure and quantify vegetative structure. Line-point intercept was used to measure type and amount of cover (dead and live vegetation by species, litter, biological crust, bare ground, and rock) and top canopy height intercepted at 50 points (100 cm spacing) along each transect. Gap intercept measured spaces (> 20 cm) between bases and canopies of two groups: all plants (annuals, perennials, and shrubs) and shrubs. Shrub gaps were distinguished from all plants to characterize horizontal shrub structure. To capture vertical shrub structure, height of intersecting shrub canopies was measured to the nearest cm. Basal and canopy gaps were calculated separately as the percentage of line covered in gaps 20 to 50, 51 to 100, 101 to 200, and > 200 cm in length. Shrub density (shrubs·ha^{-1}) was measured in a 2 x 50 m belt on each line transect in the plot. Shrubs within the belt transect were grouped by species into four height classes (< 10, 10 to 50, 51 to 100, and > 100 cm).

Vegetation cover was monitored using both line-point intercept and Grant's methods on 3 plots in the Bottomland Greasewood alliance and 3 plots in the

Smooth Brome alliance in the bottomland plots. Grant's method was also used to monitor vegetation cover on 101 upland plots (1 transect per plot) in 2007. Grant's method measured floristic characteristics on each 50 m line transect in a 0.1 x 0.5 m belt. A plant species was documented if it had greater than 10 % abundance in each quadrat. Vegetation was recorded as frequency of occurrence and more than one species could be recorded in a quadrat. When no species had 10 % or greater abundance within a quadrat, we recorded the quadrat as sparsely vegetated. More detailed description of the method is available (Grant et al., 2004). Vegetation cover was monitored using both line-point intercept and Grant's methods on 3 plots in the Bottomland Greasewood alliance and 3 plots in the Smooth Brome alliance. Grant's method measured floristic characteristics on each 50 m line transect in a 0.1 x 0.5 m belt. A plant species was documented if it had greater than 10 % abundance in each quadrat. Vegetation was recorded as frequency of occurrence and more than one species could be recorded in a quadrat. When no species had 10 % or greater abundance within a quadrat, we recorded the quadrat as sparsely vegetated. More detailed description of the method is available (Grant and others 2004).

Songbirds were surveyed in each of the monitoring plots during the breeding season using fixed-radius (100 m) point sampling methods (Bibby et al. 2000; Buckland et al. 2001). One observer located at the plot center (same individual) surveyed songbirds between 0600 to 1000 hours on days with no precipitation and wind speeds less than 20 $km \cdot h^{-1}$. Following a 1 to 2 min settling period, locations of all singing male songbirds were identified within 100-m radius from center of each plot for 5 min. Distances from the plot center were estimated using a laser range finder.

Upland Habitat Project:

Site characteristics were measured on 107, 100 m radius plots (3.14 ha) stratified by ecological sites at ≥ 250 m apart. Characteristics were measured one time on the plots between May and August in 2006 and 2007. Songbirds were surveyed on all 107 plots in 2006 and 2007; survey dates were 6 – 11 and 26 – 31 May 2006 and 6–11 and 23 – 27 May 2007. During the project, upland ecological sites were identified; measured site characteristics were summarized by both plot and ecological site. The four ecological sites are: Loamy (26 plots), Saline lowland (11 plots) Sandy (31 plots) and Sandy Skeletal (39 plots.) All of the data, data summaries and publications from the upland inventory project are included in the accompanying CDs.

Bottomland Habitat Project:

Site characteristics were measured on 39 – 55 m 100 m radius plots (3.14 ha) circular plots located on identified bottomland alliances on the refuge, spaced at least 250 m apart. Soil and vegetation characteristics were measured on three 50 m line transects arranged in a spoke design originating 5 m from the center of the plot. An azimuth direction (1° to 360°) for the first transect was chosen from a random number table and subsequent transects were placed at 120° intervals from the first transect. The six alliances monitored in the bottomlands at BPNWR include: alkali

sacaton (*Sporobolus airoidies*) and inland saltgrass (*Distichlis spicata*) 5 plots, needlegrass (*Stipa spp*) -greasewood mix, 2 plots, wheatgrass mix (*Elymus spp*) 6 plots, rabbitbrush mix, 10 plots, bottomland black greasewood dominated areas, 13 plots and smooth brome (*Bromus inermis*) 3 plots. Songbirds were surveyed by J. Scott Dieni (contracted by FWS) on all 39 plots in May 2007 and 2008.

All of the data, data summaries and publications from the bottomland inventory project are included in the accompanying CDs. A summary table of the bird and habitat data for the Bottomlands is being finalized. It will be sent in a separate file.

Bottomland Greasewood Study
Herbicide, mowing and reseeding manipulative treatments were implemented on greasewood-dominated plots in bottomlands adjacent to the Green River. We monitored vegetation structure, cover, biomass production and seedling recruitment on three treatments: mowing coupled with 1) herbicide removal of greasewood, 2) seeding of native grasses and forbs, or 3) combined seeding and herbicide. Within greasewood (*Sarcobatus vermiculatus*) alliances we randomly selected twelve circular 0.78 ha plots to examine changes associated with the three treatments. All plots were mowed to 15.2 cm in height in March 2008. One-third of each plot was assigned to one of the three treatments. Seedings included two grass species alkali sacaton (*Sporobolus airoides*), and basin wildrye (*Leymus cinereus*), and one herbaceous dicot, common gaillardia (*Gaillardia aristata*). We monitored shrub and basal gap, canopy height, structure, canopy cover, and collected herbaceous biomass along three 50 m line transects placed at 120 degree azimuth intervals. Shrub density and distribution was documented within a 2 x 50 m belt adjacent to each transect.

Bottomland seeding and monitoring status:
Results from seeding efforts were resampled in August 2009 and May 2010. Seedling recruitment was limited to non-existant due to unusually wet spring resulting in excessive biomass of invasive annual grass (*Bromus tectorum*, cheatgrass). Potential to conduct an additional seeding in FY 2011, however, would require herbicide application to control *Bromus tectorum* in spring followed by a fall seeding. Currently, we do not have fiscal or personnel support for additional reclamation efforts.

Sampling Method References:
Bibby, C. J., N. D. Burgess, D. A. Hill, and S. H. Mustoe. 2000. Bird census techniques. London, United Kingdom: Academic Press. 257 p.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. New York, NY, USA: Oxford University Press. 432 p.

Grant, Todd A.; Madden E.M.; Murphy, R.K.; Smith, K.A.; Nenneman, M.P. 2004. Monitoring native prairie vegetation: the belt transect method. Ecological Restoration. 22:106-112.

Herrick, J.E.; Van Zee, J.W.; Havstad, K.M.; Burkett, L.M.; Whitford, W.G. 2005b. Montitoring manual for grassland, shrubland, and savanna ecosystems. Volume II: Design, supplementary methods and interpretation. USDA-ARS Jornada Experimental Range, Las Cruces, NM. 200 p.http://usda-ars.nmsu.edu/monit_assess/monitoring.php

BPNWR Project Deliverables:

Set of CDs with all of the monitoring data (site characteristics and bird surveys of georeferenced points), data summaries, publications, maps, and photo points. All of the data and photo points are georeferenced for integration into the Refuge Spatial Database.

Publications:
Bridging the Gap: Monitoring of Shrub-steppe Ecological Sites for Wildlife Habitat. Williams, M.I., PhD Dissertation, University of Wyoming, May 2010, Laramie, WY.

Structural Changes in Greasewood Systems Following Vegetation Management in a Riparian Floodplain of the Green River. Church, M.M., M.S. Thesis, University of Wyoming, May 2009, Laramie, WY.

Williams, M.I., G.B. Paige, T.L. Thurow, A.L. Hild, and K.G. Gerow. Songbird Relationships to Shrub-Steppe Ecological Site Characteristics. Journal of Rangeland Management *(accepted).*

Williams, M.I., T L. Thurow, G.B. Paige, A.L. Hild and K. Gerow. 2009. Sagebrush-Obligate Passerine Response to Ecological Site Characteristics. Proceedings of the 15th Wildland Shrub Symposium, June 17-29, 2008, Boseman, MT. (In press)

Church, M.M., M.I. Williams, A.L. Hild, and G.B. Paige. 2009. Comparing Vegetation Monitoring Methods in Shrublands: How Valuable is Grant's Methods in Shrub Communities? Proceedings of the 15th Wildland Shrub Symposium, June 17-29, 2008, Boseman, MT. (In press)

Presentations:
Williams, M.I., T L. Thurow, G.B. Paige, and A.L. Hild. 2010 Spatial relationships in shrub steppe habitat: refining how we quantify structure. Society for Range Management 62nd Annual Meeting. Feb 7-11, 2010, Denver, CO. *oral paper*

Williams, M.I., T L. Thurow, G.B. Paige, and A.L. Hild. 2008. Shrubland passerine bird density patterns in relation to ecological sites. 15th Wildland Shrub Symposium. June, 17-29, 2008, Boseman, MT. *oral paper*

Church, M.M., M.I. Williams, A.L. Hild, and G.B. Paige. 2008 Comparing Vegetation Monitoring Methods in Shrublands: How Valuable is Grant's Methods in Shrub Communities? 15th Wildland Shrub Symposium. June 17-29, 2008, Boseman, MT. *oral paper*

Williams, M.I.,, G.B. Paige, A.L. Hild, and T.L. Thurow. 2008. Use of ecological site indicators to describe upland passerine habitat . Society for Range Management 61st Annual Meeting. Jan 27- Feb 2, 2008, Louisville, KY. *oral paper*

Church, M.M., M.I. Williams, A.L. Hild, and G.B. Paige. 2008. Impacts of removal and seeding treatments on vegetative structure in greasewood (Sarcobatus vermiculatus) and smooth brome (Bromus inermis) dominated bottomlands. Society for Range Management 61st Annual Meeting. Jan 27- Feb 2, 2008, Louisville, KY. *poster paper*

Williams, M.I., G.B. Paige, A.L. Hild,. and T.L. Thurow. 2007. Linking ecological site indicators to upland bird density and diversity. WY Society for Range Management Annual meeting. Nov. 26-28, 2007, Lander WY. *oral paper*

Williams, M.I., G.B. Paige, A.L. Hild,. T.L. Thurow and R. Laubhan. 2007. Linking ecological site monitoring techniques to upland breeding bird habitat. Society for Range Management Annual meeting. Feb 12-16, Reno, NV. *poster paper*

Additional Information:
Summary 2007 and 2008- Bottomland Breeding Bird Survey at Browns Park National Wildlife Refuge, Colorado. J. Scott Dieni. Contracted by FWS.
Report of results provided.