Acquiring LiDAR imagery for Benton Lake National Wildlife Refuge, Montana

FY14

PROJECT DESCRIPTION

Benton Lake wetland topography has been significantly altered since the early 1960s. The wetland basin was originally a single, large wetland of approximately 5,600 acres. Starting in the early 1960s, the FWS has made significant alterations to the wetland basin including constructing several dikes to create eight units, installing water control structures, creating small ditches and islands and other various topographic changes have been made to the basin (Heitmeyer *et al.* 2009, refuge annual reports). Some of these changes are readily visible and could be located and measured by existing refuge staff and equipment, however, many of the smaller alterations such as shallow ditches and small islands are not as easy to detect.

The staff began working on a Habitat Management Plan for the refuge this year. During this planning effort, it has become clear that several decisions about management strategies would significantly benefit from detailed, topographic and elevation data such as that provided by light detection and ranging (LiDAR) data.

OBJECTIVES AND ALTERNATIVES

The objective of this project is to acquire LiDAR imagery for Benton Lake refuge. LiDAR will assist with restoring hydrological function, increasing water efficiency, reducing contamination and managing vegetation as the new management direction described in the recent Benton Lake NWR Complex CCP is implemented (USFWS 2012).

METHODS AND PROTOCOLS

LiDAR imagery was collected over Benton Lake refuge during August 2014 by Woolpert Inc..

Minimum specifications for the imagery follow those described by the US Geological Survey (USGS) (Heidemann 2012). During discussions with the contractor in pre-planning meetings, the contractor indicated that the minimum specifications (point density of 1-2 points/m2) would be exceeded at no additional cost. Thus the contractor agreed to acquire the LiDAR at a point density upward of 10 points per square meter. This increased point density will improve the resolution (and accuracy) of the derived products and expand the application of the data in meeting refuge needs. A detailed description of the methodology will be provided by the contractor in their final report. Once the final products are completed by the vendor, the data (and derived products) will be sent to staff at the USGS Geospatial Technical Operations Center in Rolla Missouri. USGS staff will perform a detailed Quality Assurance and Quality Check on the data to ensure the data meets the contract specifications before providing to the refuge.

DATA ANALYSIS / MODELS

The LiDAR data will be provided by the contractor in a format that is compatible with ArcMAP GIS software. Once the data has been imported into a GIS, a variety of analyses can be conducted. At the simplest level, the imagery can be viewed, with visual enhancements if necessary, to identify topographic features such as ditches, islands and overall basin elevations. The Natural Resources Conservation Service (NRCS) has developed a toolset that allows users to more easily create elevation contours from LiDAR as well as modeling water flow paths across the wetland basin. The data will also be used to create and/or update bathymetric models of each wetland unit. Depending on the unit, the current models are 30-50 years old. It is likely that sedimentation over this time period has altered the volume of the units.

A current vegetation community map will also be overlaid with the LiDAR to explore patterns of invasion by the non-native Garrison creeping foxtail. This plant has created extensive, monotypic stands in the wetland basin. Using the LiDAR data may help us determine if this invasive is limited to certain elevations (and associated hydrologic regimes) within the wetland basin.

DATA MANAGEMENT

Data entry, generation of the geo-referenced elevation data, accuracy assessment, quality assurance and error-checking will be performed by the contractor and documented in the final report.

Once the data is received by the Benton Lake refuge, the LiDAR data and report will be stored on the shared refuge server. If FGDC compliant metadata for the spatial files is not provided by the contractor, refuge staff will create it and store it with the data. The refuge server is regularly backed up by the Regional Office. In addition, Mike Artmann, in the Regional I&M office will have a copy of all materials, as will the contractor, which can serve as backups in the event of a catastrophic event at the refuge. In addition, a copy of the final products (including the report) will be uploaded into ServCat.

SOURCES OF SUPPORT

The Region 6 I&M program provided all of the funding for this project. Mike Artmann, has been especially helpful in establishing the contract and working with the contractors to complete the project.

CURRENT STATUS

The imagery and ground-control points were collected in August and September. The data and final report are expected later this winter.

CHALLENGES

Refuge staff worked with the contractor to time the LiDAR flight when the water on the refuge would be at its lowest. Unfortunately, an unusual, heavy rainfall event occurred in late August just before the LiDAR was flown. This resulted in more of the refuge being flooded with water than was expected.

MORE INFORMATION

Vanessa Fields, Refuge Biologist, 406-727-7400 x219; Vanessa_Fields@fws.gov

Mike Artmann, Regional I&M Biologist, 303-236-4381; Mike_Artmann@fws.gov

LITERATURE CITATION

Heidemann, HK. 2012. Lidar base specification version 1.0, U.S. Geological Survey Techniques and Methods, book 11, chap. B3, p. 63.

Heitmeyer, ME, VL Fields, M Artmann and LH Frederickson. 2009. An evaluation of ecosystem restoration and management options for Benton Lake National Wildlife Refuge. Greenbrier Wetland Services. Advance, MO. 59pp.

U.S. Fish and Wildlife Service. 2012. Comprehensive Conservation Plan, Benton Lake National Wildlife Refuge Complex, Montana. Lakewood, CO: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 305p