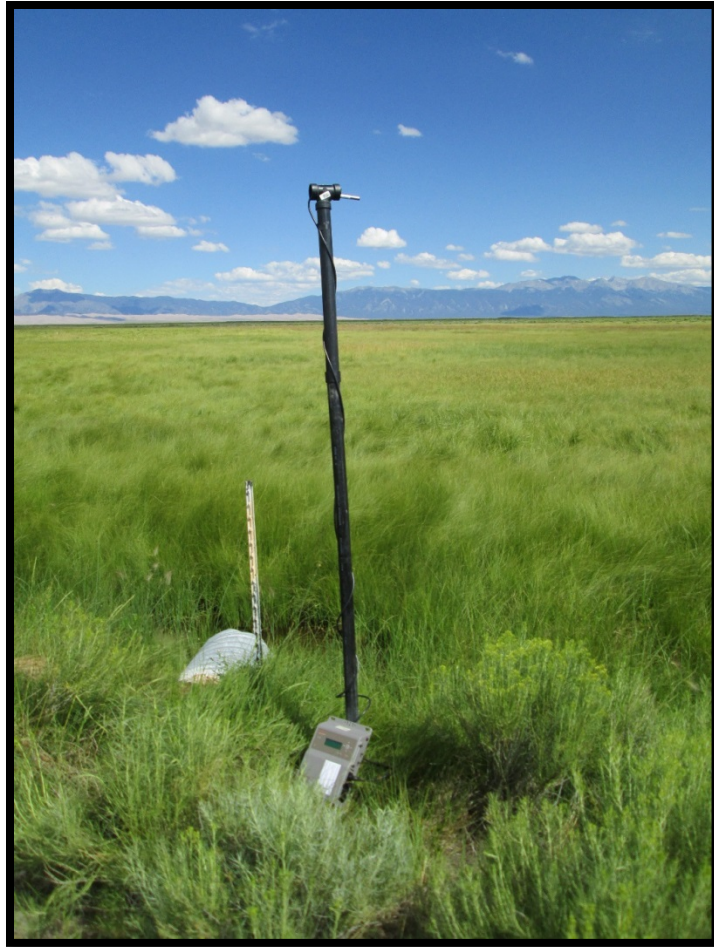


NABat 2014 Survey Results

Baca National Wildlife Refuge



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The North American Bat Monitoring Program (NABat) is a national program to monitor bats and provide data to aid in conservation of bat populations across the continent. The program will use four approaches to gather the monitoring data to assess changes in bat distributions and abundances: these include winter hibernaculum counts, maternity colony counts, mobile acoustic surveys along road transects, and acoustic surveys at stationary points. The summer of 2014 was the pilot effort for initiation of the surveys nationally, and here in Colorado. The Colorado Natural Heritage Program (CNHP) was tasked with the planning and coordination of the acoustic surveys, and conducting some surveys around the state in partnership with Colorado Parks and Wildlife (CPW).

Within the NABat sampling scheme, sample grids are 10 x 10 km (100 km²) cells, ordered using a randomized sampling approach. CNHP conducted the selection process of the grid cells to be used in the pilot effort, which included an evaluation of the ordered list of all grids in the state based on accessibility, roads, and landownership. The grid priority list was provided by the NABat program, and because it was only available late in the survey season, landownership was a significant factor in the evaluation and grid selection process. Survey of selected sample grids was conducted by CPW and CNHP for both stationary and mobile acoustic surveys.

Grid cell 2797 was one of the selected grids for use in the 2014 NABat survey in Colorado. This grid falls mostly on the Baca National Wildlife Refuge, with a portion of the eastern edge of the grid on lands managed by the Great Sand Dunes National Park, in the San Luis Valley of south-central Colorado. This grid represents an excellent survey location for the NABat program, because of the ownership, access and vandalism issues are not concerns for deployment of equipment and data protection. Additionally, Baca NWR personnel are supportive and assisted in the deployment and take down of the equipment, and providing supporting information regarding the survey sites and weather conditions during the survey period.

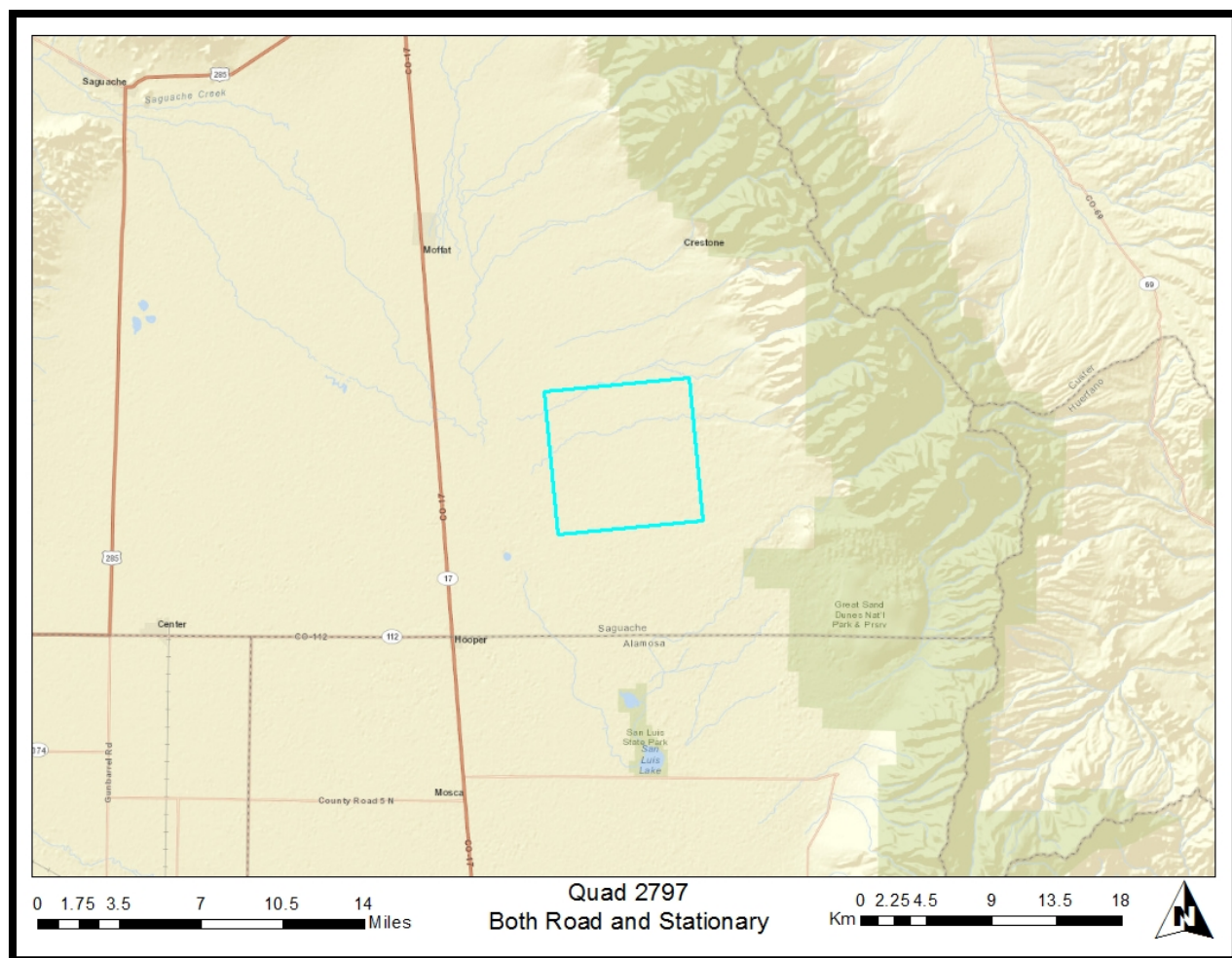
The 2797 grid was also used in the 2015 survey effort for the NABat program, and remains in the program for Colorado. Analysis of that data is still underway.

Further information regarding the NABat program can be found in the US Forest Service General Technical Report by Loeb et al. (2015). (<https://www.fort.usgs.gov/products/23886>)

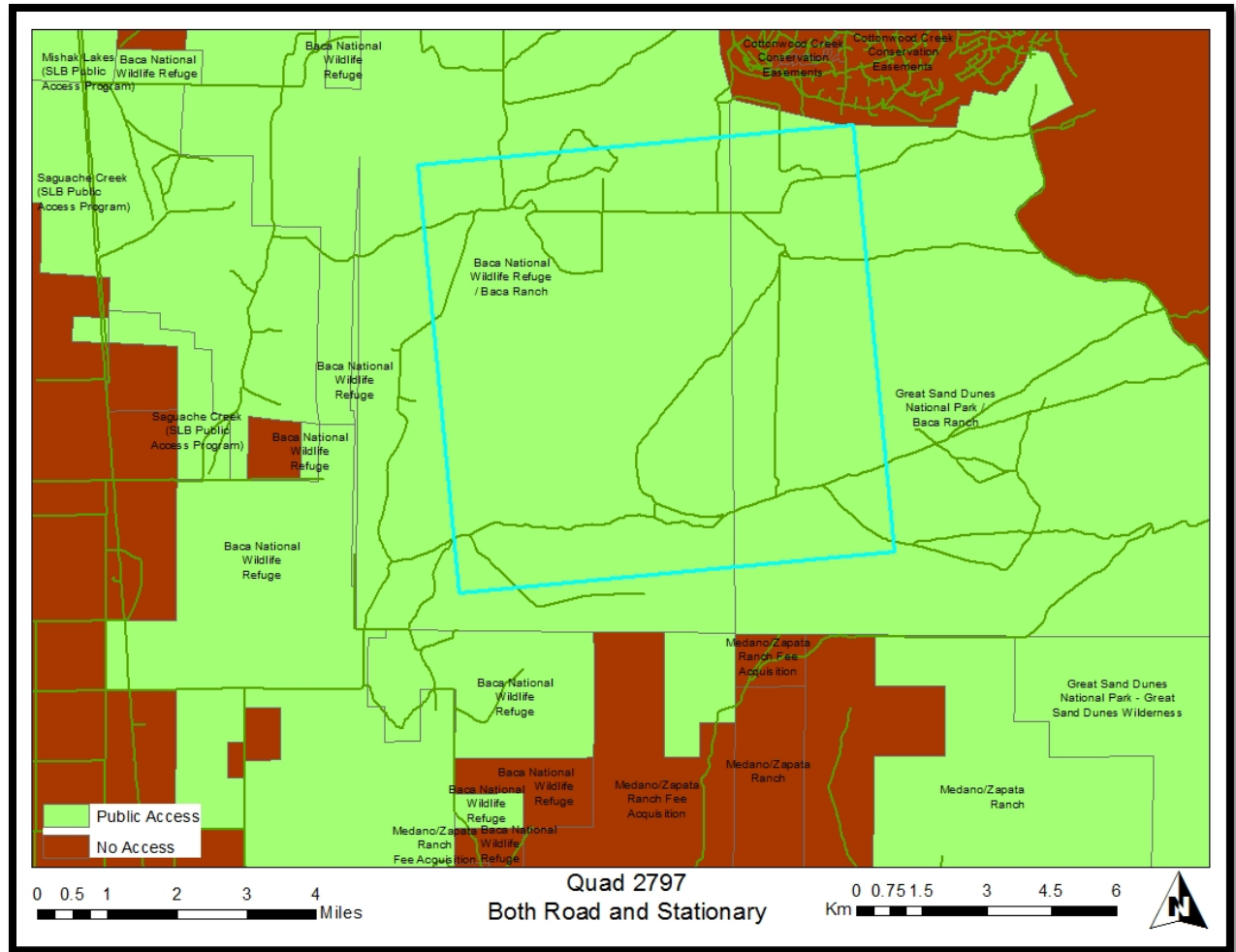
Grid Cell 2797 – Baca NWR

The grid was evaluated and based on GIS acquired information, had potential for both stationary and mobile acoustic surveys. The survey effort was initiated on August 20, 2014, and with the assistance of refuge biologist Corinna Hanson, detector locations were selected within 3 of the 4 quadrates of the 2797 grid. Three SM2 bat detectors/recorders were deployed, using the program schedule in use for Colorado NABat surveys for stationary points. The Baca refuge has sufficient roads to provide the required protocols for conducting a mobile survey, but because the roads are very sandy and at risk of flooding during the preferred survey time periods, it was determined that mobile transects would not be conducted on this grid. Additionally, the eastern edge of the grid cell fall on lands managed by the Great Sand Dunes National Park, and the process to acquire permission would not allow access to that property in the time constraints in place, therefore, a forth detector was not deployed. Consideration for future deployment of a detector in this area of the grid will be part of the 2797 grid survey development.

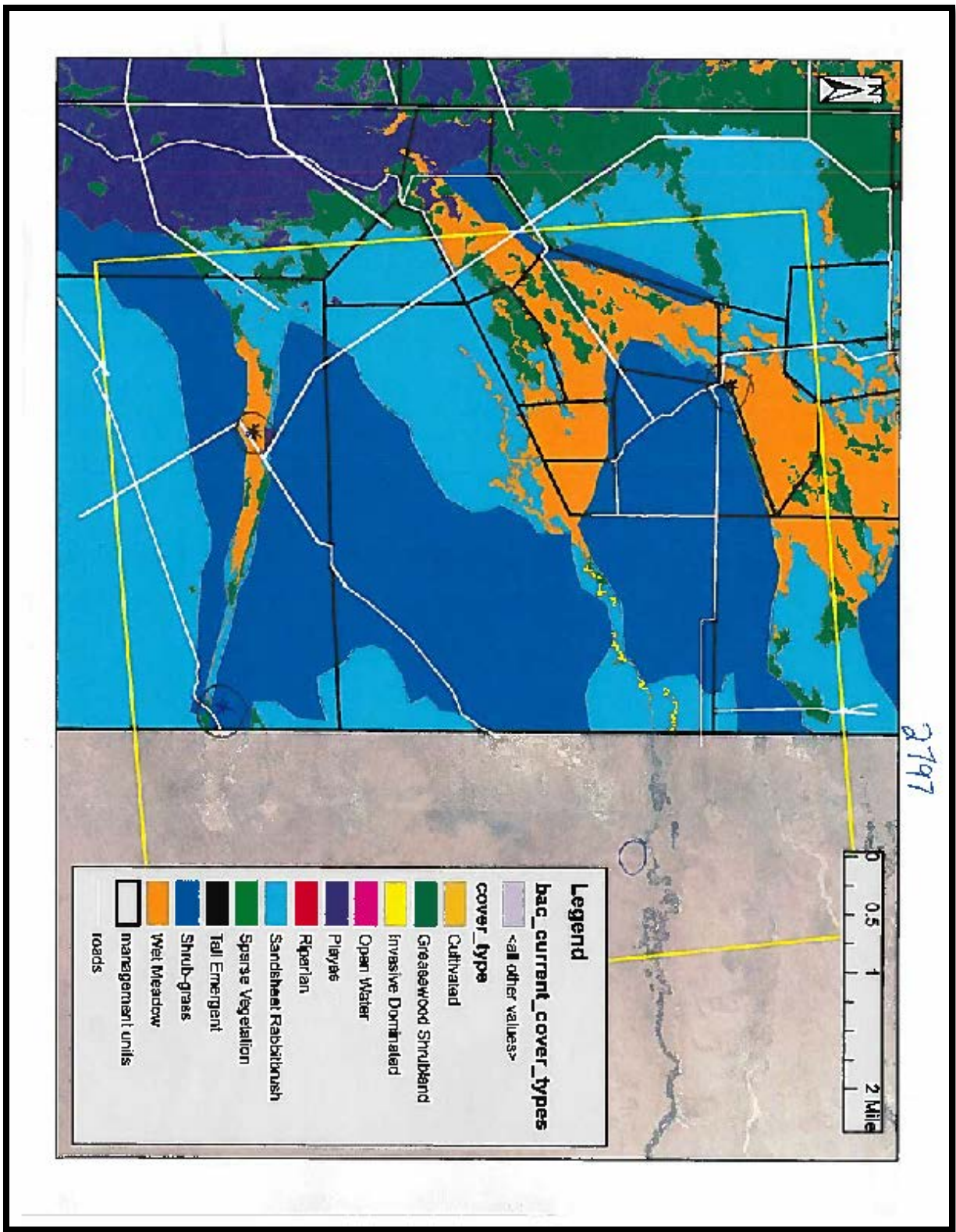
Survey locations were selected in the NW, SW, and SE quadrats, and attempted to cover the various habitat types available on the refuge within the grid 2797 cell. Conditions were dry, as expected at this time of the season on the refuge. SM2 bat detectors were mounted on PVC pipes and T-posts, with SMX-US microphones attached approximately 8-10 ft. above the ground. The detectors were programed to start recording 15 minutes prior to civil sunset, and shut down 15 minutes after sunrise. Detector settings conformed with NABat and Colorado guidelines.



Grid 2797



Land Ownership in Grid 2797



Habitats on Baca NWR

Detector **D1** – NW quad

Latitude – 3753668

Longitude – 105 47003

Habitat – Wet Meadow/Greasewood

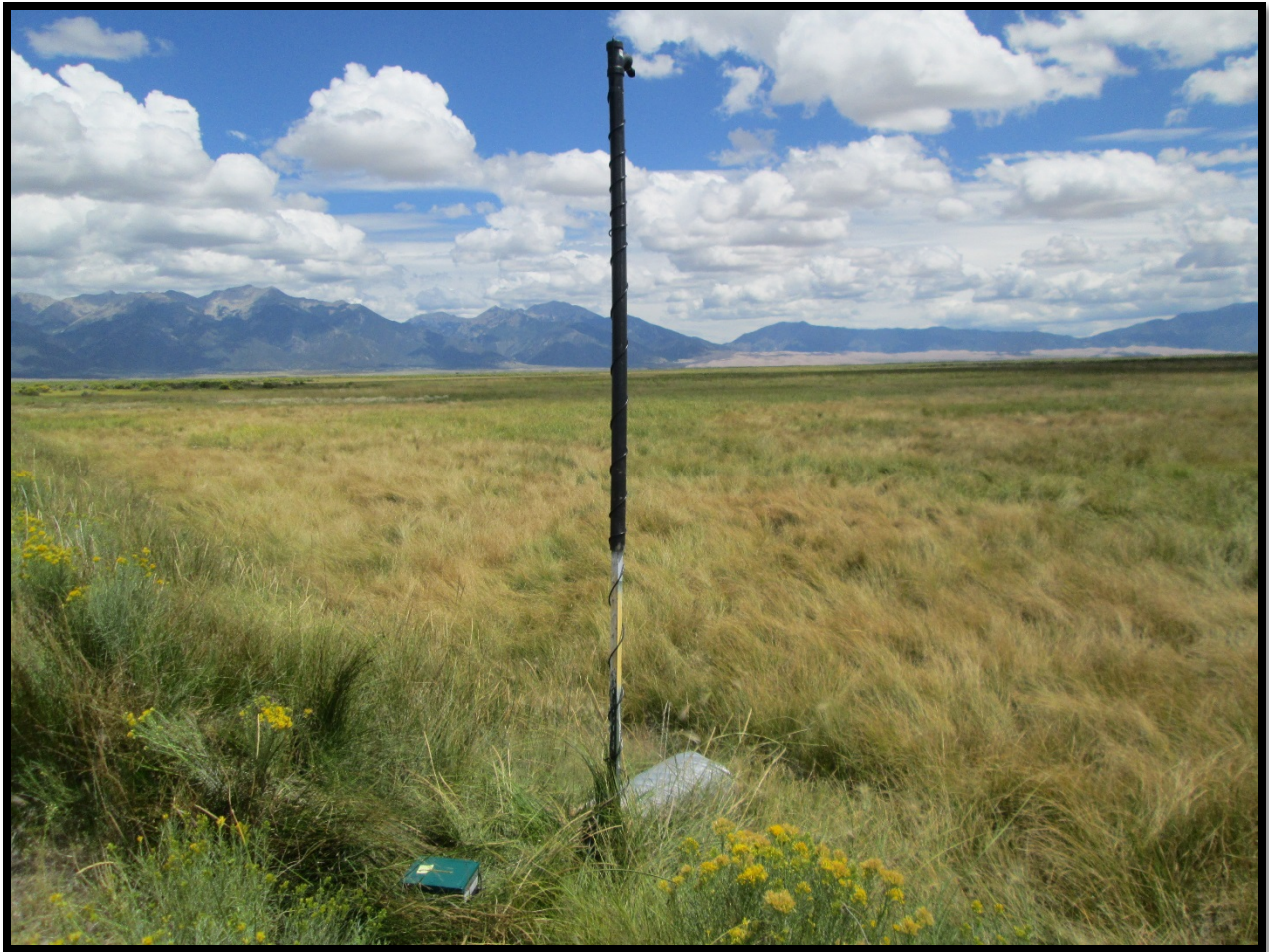


Detector **D2** – SW quad

Latitude – 3750165

Longitude – 105 46315

Habitat – Wet Meadow

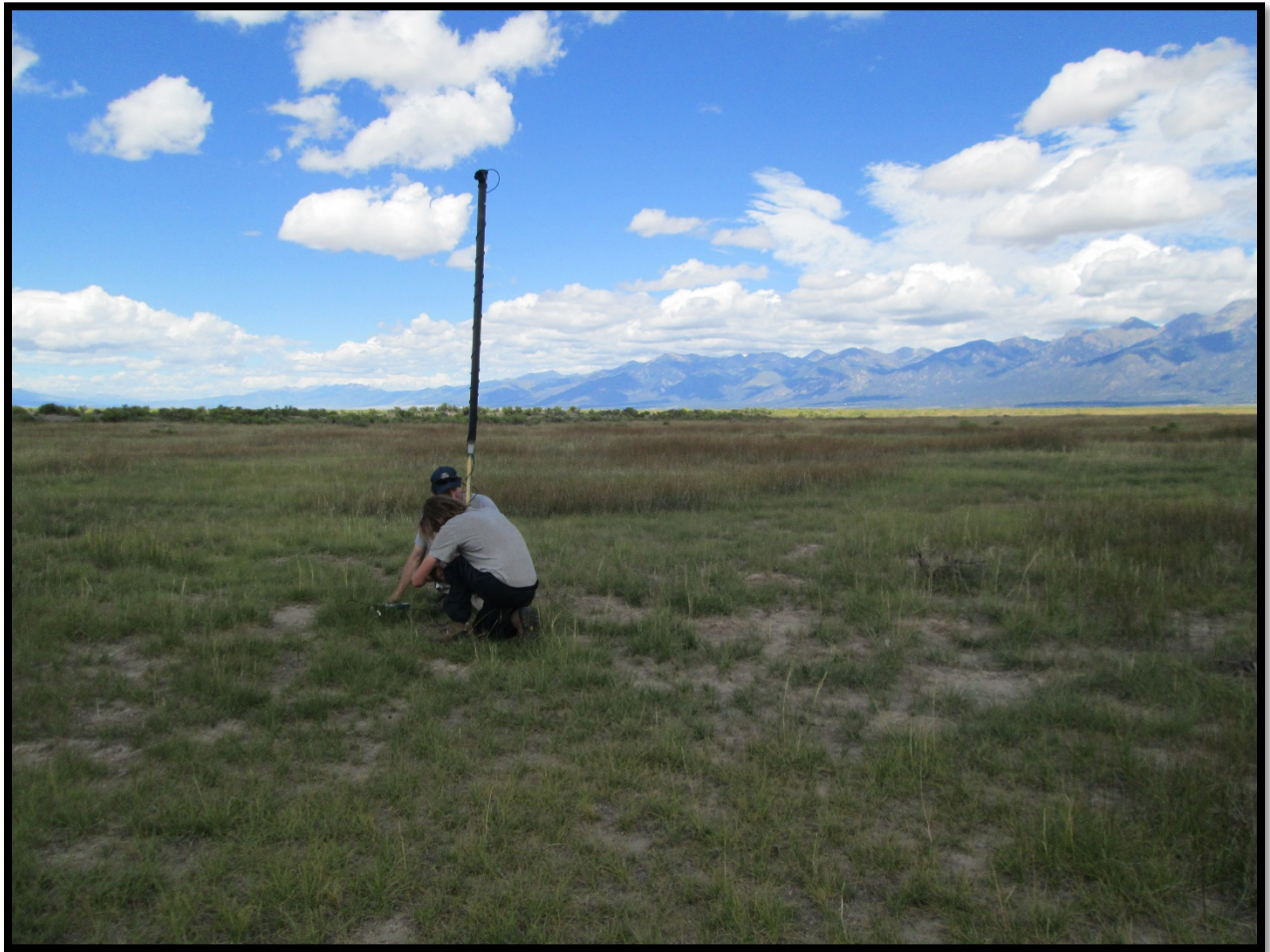


Detector **D3** – SE quad

Latitude – 3749761

Longitude – 105 43932

Habitat – Dry Meadow/Sand Sheet Rabbit Brush



METHODS

All detectors started recording on August 20, and shut down on August 25, providing 6 nights of bat call recordings. All calls were processed and analyzed using Sonobat3 auto-classification software, and a subset of the calls were manually reviewed to confirm the species identification and presence on the refuge.

SM2 ultrasonic acoustic detectors (Model SM2BAT, Wildlife Acoustics, Inc., Concord, MA) were deployed to record bat vocalizations. Recordings were analyzed using SonoBat 3.2.1 (SonoBat, Arcata, CA) auto-classification option. Manual review of selected vocalizations were compared to reference bat calls from the Great Basin bat call library (SonoBat, Arcata, CA), and reviewed by selected parameters for species, as identified by Joe Szewczak, Humboldt State University Bat Lab, March 2011. Call analysis parameters were set to use discriminant probability threshold of 0.9 and an acceptable call quality of 0.8 with a maximum of 8 calls. The discriminant probability refers to the probability of a call sequence falling within the centroid of the multi-dimensional data space for reference calls for a species. Two outputs result from the analysis for assessing the likelihood of a call sequence matching reference calls form a particular species. The “sequence classification by vote” identifies the species by requiring that the species with the greatest number of calls classified be at least twice as prevalent as the sum of the 2nd and 3rd most abundant species classifications. The second output, the “mean sequence classification” is based on the mean parameter values of the most prevalent classification group then uses these mean values (minimum of two calls) through a decision tree engine. When both these criteria meet the threshold, the call is classified as “consensus”, and when enabled, the species code is appended to the file. If the values fall below the minimum threshold for a classification group, the call is not attributed to that group, but instead is displayed with the species groups that sum to the thresholds for the last decision tree step attained. The call file is tallied as a bat pass.

All recorded call files were processed using a moderate setting and had species codes appended to the files for consensus approved identifications. Approximately 25% of these calls were then manually vetted to confirm agreement on the species identifications of TABR, and other species based on the auto-classification. Output results from Sonobat are provided in 2 formats; a summary of the classification analysis, and a text file of all call files with associated parameter

results. Both outputs were then converted into spreadsheets, and are provided for future reference and use in monitoring efforts by CPW and the Baca NWR.

RESULTS

A total of 1,927 bat passes were documented over the survey period on the refuge (Table 1). Of these recorded calls, a total of 1,326 calls were classified to species by Sonobat software. Bat activity was distributed over the entire night/early morning hours at all 3 survey locations. The D1 detector, located in the NW quadrat, had the most bat activity recorded over the sampling period (754 passes) and the most calls classified to species (502).

Based on auto-classification results, 11 species were documented, with the Mexican free-tailed bat, *Tadarida brasiliensis* (TABR), the most frequent bat pass documented across all survey locations. This was expected, as the large colony of Mexican free-tailed bats that reside in the Orient Mine in the northern San Luis Valley (SLV), have been documented foraging over various parts of the valley, over agricultural fields and wetlands. Of the 11 species, manual review of call files confirmed the identification of 5 species, and 3 were considered to be “possible”, based on known range and call characteristics. Three species were considered to be unlikely, because the SLV is out of the known distribution in the state (MYYU, MYCA, and LABL). However, although a specimen has not been documented in the San Luis Valley, the Yuma myotis (MYYU) has an acoustic record reported. An acoustic survey conducted for the BLM in 2011 did report an acoustic call record for this species in the southern end of the SLV. Additional work in the SLV is warranted to determine the status of this species in the SLV and the Baca NWR. The other 2 species, the California myotis (known only from the western part of the state) and the western red bat (not yet documented in Colorado) are considered unlikely.

The species documented by auto-classification in each sampling unit are presented in pages 13 – 15, and species codes used in this report and software analysis are provided in table 2. Table 3 provides a summary of the manual review results of 319 of the 1,326 acoustic calls classified from Sonobat auto-classification software.

Table 1

Grid 2797 – Baca NWR	D1	D2	D3	Totals
Calls classified to Species	502	448	376	1,326
Total Bat Passes	754	595	578	1,927

Figure 1

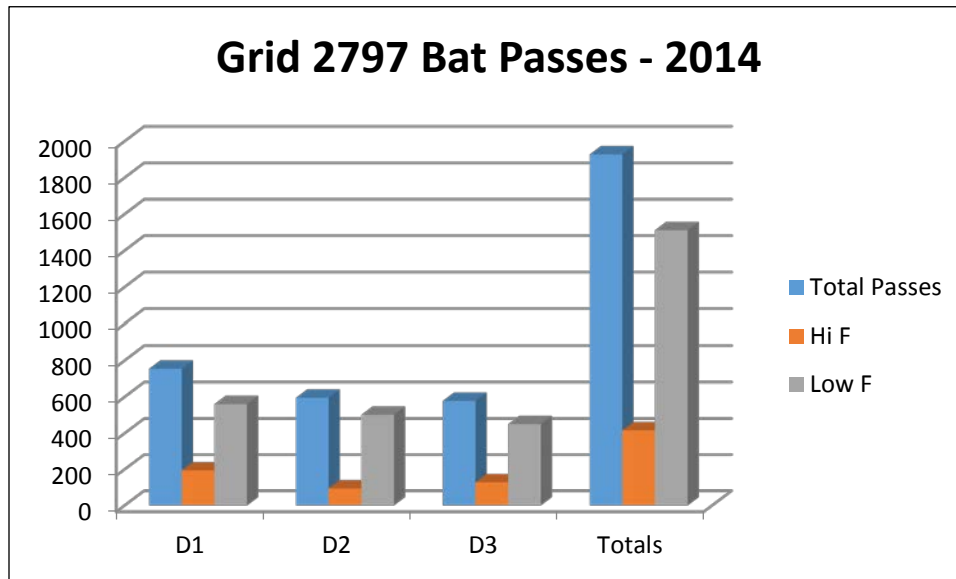
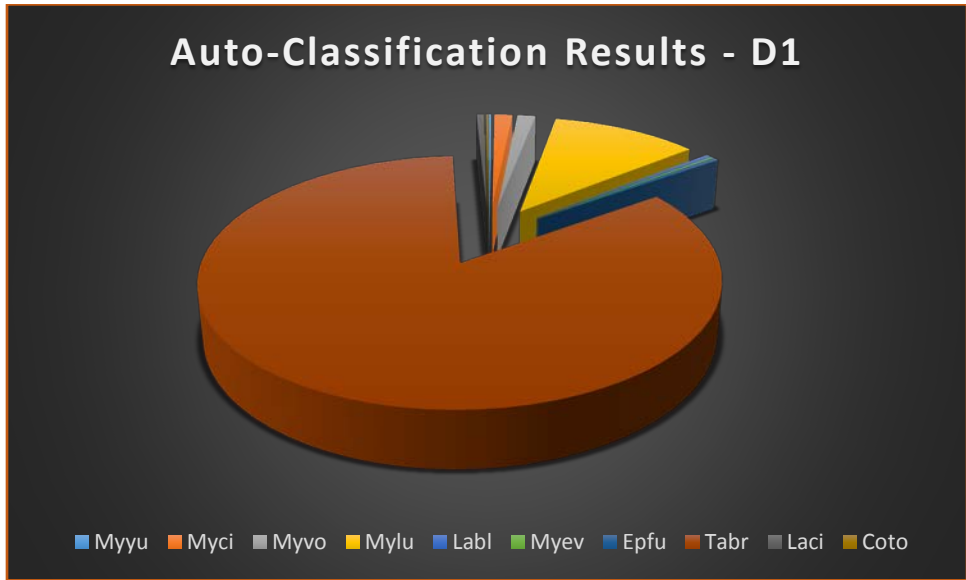


Table 2

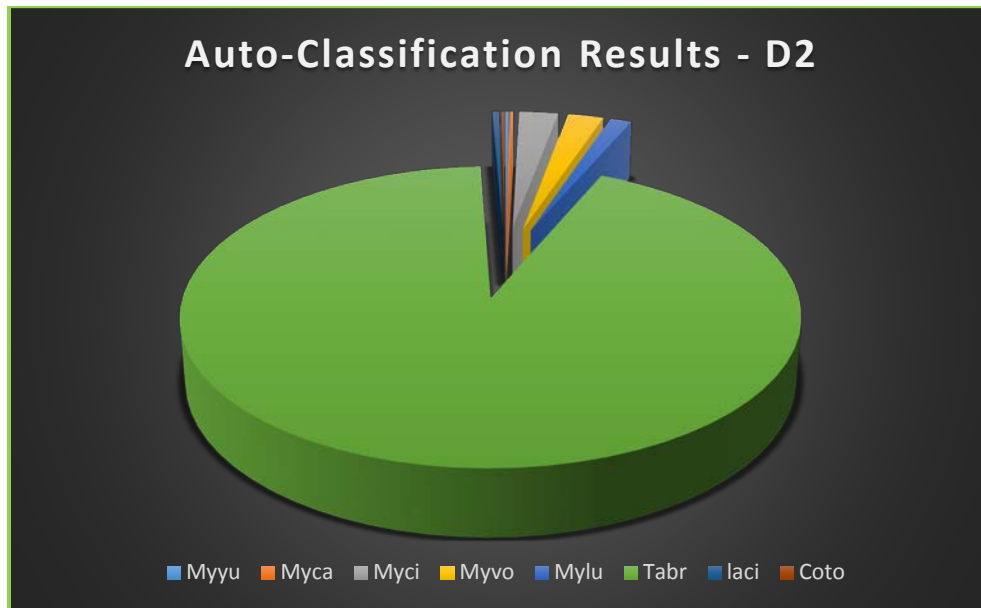
Scientific Name	Four Letter Code	Common Name	Manual Review Decision	Frequency
Corynorhinus townsendii	COTO	Townsend's big-eared bat	Confirmed	Low
Eptesicus fuscus	EPFU	Big brown bat	Confirmed	Low
Lasiurus blossevilli	LABL	Western red bat	Unlikely	Hi
Lasiurus cinereus	LACI	Hoary Bat	Possible	Low
Myotis californicus	MYCA	California Myotis	Unlikely	Hi
Myotis ciliolabrum	MYCI	Western small-footed myotis	Confirmed	Hi
Myotis evotis	MYEV	Long-eared myotis	Possible	Hi
Myotis lucifugus	MYLU	Little brown bat	Confirmed	Hi
Myotis volans	MYVO	Long-legged myotis	Possible	Hi
Myotis yumanensis	MYYU	Yuma myotis	Unlikely	Hi
Tadarida brasiliensis	TABR	Brazilian free-tailed bat	Confirmed	Low

D1 - Baca NWR	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	1	0	7	7	56	0	2	1	0	2	0	0	422	3	1	0
Corrected count	0	0	5	6	54	0	0	1	0	0	0	0	418	0	0	0
est. likelihood of presence	0.184	0	0.968139	0.929022	1	0	0.364	0.374311	0	0.45	0	0	1	0.64	0.2425	0
ByVote count	2	0	7	7	64	0	2	1	0	2	1	0	423	3	2	0
MeanClsn count	4	1	15	8	85	1	2	1	0	3	2	0	424	3	1	0
HiF sum	194															
LoF sum	560															
total est. passes	754															



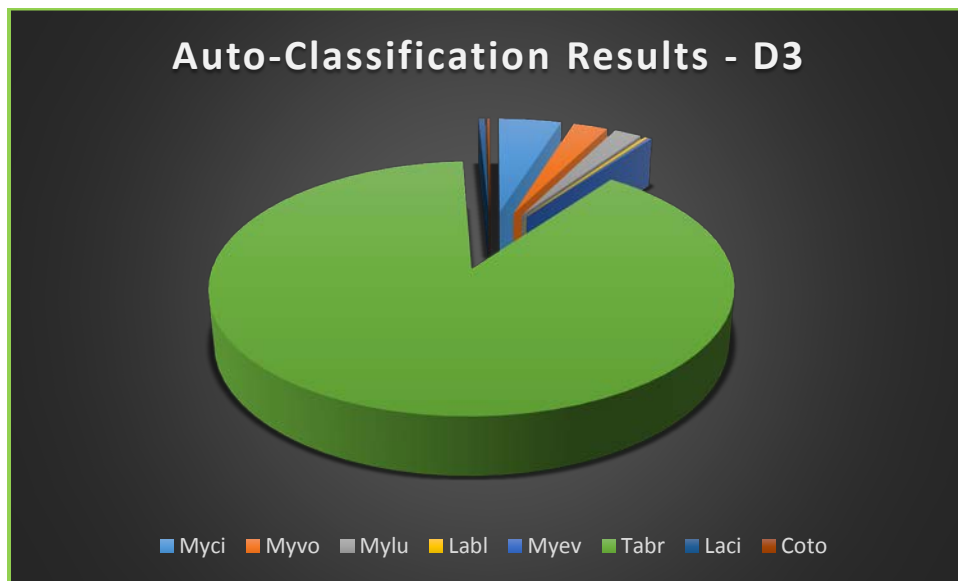
Auto-Classification ID	
Myyu	1
Myci	7
Myvo	7
Mylu	56
Labl	2
Myev	1
Epfu	2
Tabr	422
Laci	3
Coto	1

Baca - D2	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	1	1	11	10	6	0	0	0	0	0	0	0	416	2	1	0
Corrected count	0	0	10	8	4	0	0	0	0	0	0	0	413	0	0	0
est. likelihood of presence	0.184	0.184	0.999413	0.966999	0.96	0	0	0	0	0	0	0	1	0.64	0.2425	0
ByVote count	1	1	12	10	6	0	0	0	0	0	1	0	416	2	1	0
MeanClssn count	2	2	15	16	9	0	1	0	0	0	1	0	416	2	1	0
HiF sum	94															
LoF sum	501															
total est. passes	595															



Auto-Classification ID	
Myyu	1
Myca	1
Myci	11
Myvo	10
Mylu	6
Tabr	416
laci	2
Coto	1

Baca - D3	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	0	0	18	10	8	0	1	1	0	0	0	0	335	2	1	0
Corrected count	0	0	17	7	6	0	0	1	0	0	0	0	332	0	1	0
est. likelihood of presence	0	0	0.999998	0.915698	0.991138	0	0.182	0.374311	0	0	0	0	1	0.64	0.552786	0
ByVote count	0	0	18	11	8	1	2	1	1	0	2	0	336	2	1	0
MeanClssn count	0	2	31	22	13	1	3	1	0	3	2	0	335	2	2	0
HiF sum	128															
LoF sum	450															
total est. passes	578															



Auto-Classification ID	
Myci	18
Myvo	10
Mylu	8
Labl	1
Myev	1
Tabr	335
Laci	2
Coto	1

Table 3

Survey Quad	Review Status	Number	Species
D1 132 Reviewed	Confirmed	32	MYCI MYLU TABR EPFU COTO
	Possible	92	LACI MYVO MYEV
	Out of Known Range	2	LABL MYYU
	Misidentified	6	TABR MYLU MYYU
	Unknown – Not Reviewed	370	
D2 86 Reviewed	Confirmed	17	TABR MYCI MYLU COTO
	Possible	65	MYVO LACI
	Out of Known Range	2	MYCA MYYU
	Misidentified	2	TABR
	Unknown – Not Reviewed	362	
D3 101 Reviewed	Confirmed	32	TABR MYCI COTO
	Possible	66	MYVO MYLU MYEV LACI
	Out of Known Range	1	LABL
	Misidentified	2	TABR LACI
	Unknown – Not Reviewed	275	

Confirmed – Based on call attributes considered diagnostic for species. **Possible** – call fits species frequency, but not confirmed.

Out of Known Range – species not documented in the part of state. **Misidentified** – Call not within frequency of species.

Unknown – Calls not reviewed for confirmation