BATS OF WYOMING

2018 Project Report

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Introduction

Bats are an important component of biodiversity and ecosystems worldwide. They are integral in many ecosystem services as pollinators and seed-dispersers for many plant species. Bats prey on insects, many of which cause significant agricultural losses and threaten human health (Kunz and Parsons 2009). Bats prevent an estimated $3.7 billion in damage to agricultural resources each year in North America alone (Boyles et al. 2011). Many bat species have undergone large population declines and are faced with increasing risks of extinction. For example, of the 47 bat species known to occur in the United States, six are currently listed as "Endangered" and one is listed as "Threatened" under the Endangered Species Act (ESA) and two other species are under active petitions for ESA protections (Harvey et al. 2011, Kunz and Reichard 2011, United States Fish and Wildlife Service 2011, 2013, Center for Biological Diversity and Defenders of Wildlife 2016). Observed population declines across the globe have many causes including habitat loss and alteration, disease, and renewable energy development.

Arguably, the most prevalent threat to bats in North America today is White-nose Syndrome (WNS). Caused by the fungal pathogen *Pseudogymnoacus destructans* (formerly *Geomyces destructans*; Pd), the disease affects hibernating bats (O'Keefe and Loeb 2017). First documented in New York in the winter of 2005 – 2006, the disease has killed at least several million bats (Froschauer and Coleman 2012). In affected areas, mortality rates of up to 100% have been documented (Frick et al. 2010). The disease continues to spread west from the eastern and southeastern US. In 2015, Pd made a large geographical advancement to Washington (whitenosesyndrome.org 2017). In the winter of 2017 – 2018, significant changes in distribution of Pd and WNS were documented. Specifically, Pd was detected in bats at Badlands National Park and at Fort Laramie National Historic Site and WNS was confirmed at Jewel Cave National Monument. These detections included two western species, western small-footed myotis and long-legged myotis respectively (Abernethy 2018). It is likely that the range of the disease will continue to expand across Wyoming in the near future.

In Wyoming, 18 bat species have been documented (Hester and Grenier 2005) and comprise approximately 15% of Wyoming's mammal species making the group an important component of the state's biodiversity. A large proportion of bat species found in Wyoming are considered special status species by land and wildlife agencies in the state. Specifically, the Wyoming Game and Fish Department (WGFD) considers 10 of these as Species of Greatest Conservation Need (SGCN) and the Bureau of Land Management (BLM) includes 4 on their Sensitive Species list. Despite the relatively large proportion of bat species with some level of special conservation status, bats have been poorly studied in Wyoming. However, in light of realized ecosystem services and large declines from persecution, habitat loss, and disease, bat specific research has increased globally and in Wyoming.

A number of ecoregions intersect in northeastern Wyoming resulting in an area of high biological diversity. Plant and animal species typical of the Rocky Mountains, Great Basin, eastern deciduous forest, boreal forest, and southern Great Plains bioregions are found across this region (Knight et al. 2014). The landscape is heterogeneous in topography, geology, and vegetation structure and composition. Much of the region is dominated by ponderosa pine (*Pinus pondersa*) forest and mixed grass prairie (Knight et al. 2014). Bur oak (*Quercus macrocarpa*) are interspersed with ponderosa pine in forested areas and dominate low-lying areas and portions of some flood plains (Knight et al. 2014).

Large plains cottonwood (*Populus deltoides*) are found along ephemeral and permanent streams. This biological diversity coupled with diverse habitat types and landscape features allows for uniquely diverse bat species assemblages.

While at least 11 bat species are known to occur in the region, we focused specifically on Northern Long-eared Bat (*Myotis sepetentironalis*; hereafter NLEB). The species is a small vespertilionid bat, medium in size among bats in the genus *Myotis*. Dorsally, the pelage is dull yellow-brown and ventral pelage is pale gray. Wing and tail membranes are translucent and light brown (Bogan et al. 2005). The calcar often, but not always, has a slight keel. The ears are relatively long (16-19 mm; generally ~16mm in Wyoming) and have a distinct long, pointed tragus (Caceres and Barclay 2000). NLEB is widely distributed across central and eastern Canada and the Midwestern and eastern United States. It is generally considered an eastern species and is thought to be quite rare in the western portions of its distribution. Wyoming marks the extreme western edge of the species range and the species has only been documented in the northeastern corner of the state in the vicinity of the Bear Lodge Mountains and Black Hills.

NLEB was petitioned for listing under the Endangered Species Act in 2010. The primary factor threating the species listed in the petition was the impact of WNS to the species throughout a large portion of its range in eastern North America. In 2011, the United States Fish and Wildlife Service (USFWS) issued a positive 90-day finding indicating substantial evidence was presented within the 2010 petition. A 12-month status review was initiated in 2011 (United States Fish and Wildlife Service 2011). In 2013, USFWS published the results of this status review and proposed the species be listed as endangered under the ESA (United States Fish and Wildlife Service 2013). In April of 2015, USFWS determined the species warranted threatened species status. The threatened status indicates that the species is in imminent danger of becoming endangered to the threat of extinction throughout a significant portion or its entire range. The USFWS also implemented a 4(d) rule for areas where WNS does not currently affect the species. Prior to 2018, this included all areas where the species occurs in Wyoming. The 4(d) rule exempts lawful incidental take of the species in these areas and is intended to provide flexibility for activities that may affect the species in the area covered under this rule (United States Fish and Wildlife Service 2015). As specified in the original petition, WNS is the primary threat to the persistence of NLEB in North America.

Basic knowledge of habitat use and associations of NLEB in Wyoming is limited. Across its range, NLEB is strongly associated with forested habitats. In Wyoming, the species is only known from areas dominated by ponderosa pine forest. The species frequents a wide variety of day roosts during the summer with trees are most frequently used as roosts. Specifically, tall, large diameter trees are preferred across the species range though maternity colonies may also include roosts such as human-made structures and buildings (Caceres and Barclay 2000). In the Black Hills of South Dakota, pregnant and lactating female NLEB typically roosted in large, highly decayed snags (Cryan et al. 2001). In the Bearlodge Mountains of Wyoming, pregnant NLEB roosted in large, live ponderosa pine trees with cavities and lactating NLEB roosted in large, highly decayed snags (Abernethy 2017). NLEB hibernates in caves and abandoned mines during the winter (Caceres and Barclay 2000). To date, there are no known hibernacula used by the species in Wyoming but they are known to hibernate in South Dakota. Within the hibernacula, NLEB

often cluster in deep crevices. Evidence suggests that summer habit is generally fairly close to winter hibernacula (less than 56 km) (Caceres and Barclay 2000).

This interim report summarizes activities conducted in 2018 to enhance our understanding of of NLEB in Wyoming. The current lack of knowledge challenges land managers attempting to identify important areas and management techniques that can influence the persistence of NLEB in the region. Ultimately, enhanced understanding of distribution and habitat associations of NLEB will help land management agencies in planning current management actions leading to preservation of this and other bat species, management actions that are aligned with Endangered Species Act protections and upcoming Recovery Plans, and management actions in the more distant future under possible influence of (WNS).

Objectives

This project was developed and implemented to meet shared objectives of the BLM and the Wyoming Natural Diversity Database (WYNDD). The primary objective of this cooperative project was to clarify distribution and habitat associations of NLEB in Wyoming. More specifically, BLM is in the planning phase of several forest treatment projects on BLM managed lands in northeast Wyoming. To date, no bat inventories have been conducted within the project areas (Abernethy et al. 2015). Furthermore, both BLM and WYNDD have a specific interest in better understanding the distribution of sensitive species including those listed as Sensitive by BLM and SGCN by WGFD. This project was also developed to meet objectives identified by the Wyoming State BLM Office and the Newcastle Field Office. The Newcastle Field Office is within the currently accepted range of NLEB. Because NLEB is listed as Threatened under the Endangered Species Act (United States Fish and Wildlife Service 2015), inventory data is needed to appropriately plan any future management projects. The species is known from a number of locations across the field office and suitable habitat exists on BLM Surface in portions of the field office. Limited information on the distribution and relative abundance of the species limits the agency's ability to evaluate land use proposals in the presence of this ESA protected species. Finally, because WNS is the largest threat to bat populations in North America, the final objective was document any evidence of WNS infected bats across the study area.

Ultimately, enhanced understanding of species distribution fulfils WYNDD's core mission of collecting and disseminating information on rare and sensitive species and aids BLM in developing guidance documents, making management decisions, and in facilitating permitting processes by better understanding the distribution of sensitive bat species in Wyoming.

Methods

Study Area

We identified areas within the Newcastle Field Office that may undergo some form of forest management action in the future with input from the Newcastle Field Office wildlife biologist. From these, we identified areas of BLM surface that were publicly accessible (Figure 1). Within these areas, we targeted habitat suitable for NLEB. Because NLEB is a forest obligate and only known from ponderosa pine forests in Wyoming (Abernethy et al. 2015, Abernethy and Keinath 2015), we specifically targeted areas dominated by ponderosa pine.

Acoustic Surveys

We recorded bat echolocation calls using Wildlife Acoustics Song Meter SM2BAT+ full-spectrum recording equipment (http://www.wildlifeacoustics.com/). We placed a single detector at randomly selected locations within forested habitats within the proposed forest management areas described above (Figures 2 – 7). Detectors were allowed to run for three consecutive nights, with units operating from one half hour before civil sunset to one half hour after civil sunrise. Microphones were suspended approximately 2 m above the ground on poles with the detector secured in a weather-tight container at the base. All calls were analyzed using the Sonobatch automated call analysis algorithm in SonoBat 4.2.2 (https://sonobat.com/). We used the Northeastern Wyoming Species Package and used an acceptable call quality threshold of 0.70 and a discriminant probability threshold of 0.90. To guard against false detections of species at sites, we visually assessed all recordings where the number of detections for a species at a site was less than three. For visually-assessed recordings, we evaluated the assigned species identification by assessing the quality of the recording and, if the recording was of sufficient quality, manually comparing bat calls to known reference calls. Recordings deemed unreliable as a result of this visual examination were not included in species or site tallies.

Mistnet Surveys

We captured bats using mist nets deployed in single-high arrays. We focused capture efforts in areas likely to concentrate bats such as water sources and travel corridors (Figures 2 – 7). A subset of sites were identified prior to field surveys using aerial imagery while a number of others were located by surveyors as they placed acoustic detectors. All captured bats were measured (forearm length, ear length), weighed, sexed, aged, and identified to species. Following processing, captures were released at the capture location. Survey methods also conformed to recommended guidelines (e.g., Kunz and Parsons 2009, Sikes et al. 2011) and followed recommendations in the "Wyoming Bat Conservation Plan" (Hester and Grenier 2005) for documentation and followed WNS protocols presented in the "Wyoming WNS Strategic Plan" (Abel and Grenier 2011). All equipment was decontaminated following the "National White-Nose Syndrome Decontamination Protocol Version 04.12.2016".

Results

Acoustic Surveys

We placed acoustic recorders at 65 sites. Detectors at three sites malfunctioned during deployment and results here are from the 62 sites with fully functioning detectors (Figures 2 – 7). We obtained 186 detector nights of recordings and made a total of 18,764 bat passes in 2018. Of these, 8,168 were classified to species resulting in the identification of 11 different bat species from acoustic recordings (Table 4).

A total of 42 recordings were classified as NLEB. We detected NLEB at 14 acoustic sites within four of the proposed project areas: Goldie, TL2, Upnorth, and WYSF3 (Figures 1, 3, 5, 6, and 7). It is important to note that NLEB were detected near two additional proposed project areas, the N Stateline2 and Sherwood 2 project areas (Table 4, Figure 4).

We detected three BLM Sensitive Species through acoustic surveys: Townsend's Big-eared Bat, Long-eared Myotis, and Fringed Myotis. Eight species listed as SGCN by WGFD were recorded in 2018:

Townsend's Big-eared Bat, Eastern Red Bat, Western Small-footed Myotis, Long-eared Myotis, Little Brown Myotis, NLEB, Fringed Myotis, and Long-legged Myotis (Table 4).

Mistnet Surveys

We captured a total of 13 bats representing 5 species over 5 nights of mist-netting. Overall we observed a male sex bias, with 9 males and 4 females captured (Table 3). We captured females with evidence of reproduction including pregnant and post-lactating individuals for a number of species. These included Hoary Bat, Big Brown Bat, and Little Brown Myotis. We captured 5 individuals that were determined to be juveniles based on evaluation of the phalangeal epiphyseal plates (Kunz and Anthony 1982). No NLEB were captured on BLM surface in 2018.

We captured only one BLM Sensitive Species, Fringed Myotis, during mistnet surveys in 2018. We captured three species listed as SGCN by WGFD: Little Brown Myotis, Fringed Myotis, and Long-legged Myotis (Table 3).

No bats were incidentally or intentionally killed in 2018 and all captures were released at the site of capture in good condition. Evaluation of the tail and wing membranes revealed no evidence of WNS infection (Reichard and Kunz 2009, Reichard 2010).

Discussion

A small number of NLEB recordings were made at a number of different project areas. These detections are critical in informing management decisions. The limited number of detections is not surprising. NLEB echolocation is typically of low magnitude, meaning an individual must fly relatively close to the ultrasonic microphone to be recorded and identified. Evidence from previous acoustic monitoring studies indicate that the detection probability of NLEB is low, estimated at around 10%, even in areas where the species is relatively abundant (Abernethy and Keinath 2015). This suggests that an intensive survey effort would be required to detect the species, especially in areas that may support a low density of this species.

We were only able to complete 5 mist-net surveys in 2018. The primary focus of surveys in 2018 was in placing acoustic equipment which did not allow many nights of mistnetting. Also, there were relatively few suitable capture sites within or around the proposed project area boundaries.

Evaluation of the wing membranes of all captured bats did not reveal any evidence of WNS infection. The distribution of WNS has increased rapidly across the North American Continent since it was first documented in New York in 2006. As noted above, WNS was detected in far western South Dakota and Pd was detected in eastern Wyoming in 2018 (Abernethy 2018). Neither WNS nor Pd has been documented within our study areas but it is critical to continue WNS surveillance in unaffected areas so that land and wildlife managers can implement any proactive measures to limit the spread of this disease.

We documented 11 bat species through acoustic detections but only 5 through mist net captures. It is important to note that acoustic monitoring data should be viewed with caution as the possibility for species misidentification exists. To ameliorate this, we carefully placed acoustic equipment in areas with limited clutter which leads to more diagnostic calls. Additionally, we used the appropriate species identification algorithms for the species assemblages we expected within the Newcastle Field Office. Finally, we manually verified any species assignments where fewer than three detections were made at

that site. Mist net captures provide accurate species identification and allow for determination of demographic parameters such as age, reproductive status, and sex for local bat populations. However, mist netting is time and labor intensive and is subject to environmental conditions like moon phase, wind, precipitation, among others. The combination of acoustic monitoring and mist netting allows for a comprehensive evaluation of local bat populations.

Because one of the focuses of this project was to enhance our understanding of the distribution of, and determine if NLEB, acoustic detections should be confirmed with mistnet captures. As noted above, this may be difficult due to lack of suitable capture sites such as surface water.

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Tables

Table 1. Bat species codes, scientific names, and common names of bats captured or recorded in 2018.

Species Code	Scientific Name	Common Name
COTO	*Corynorhinus townsendii*	Townsend's Big-eared Bat
EPFU	*Eptesicus fuscus*	Big Brown Bat
LABO	*Lasiurus borealis*	Eastern Red Bat
LACI	*Lasiurus cinereus*	Hoary Bat
LANO	*Lasionycteris noctivagans*	Silver-haired Bat
MYCI	*Myotis ciliolabrum*	Western Small-footed Myotis
MYEV	*Myotis evotis*	Long-eared Myotis
MYLU	*Myotis lucifugus*	Little Brown Myotis
MYSE	*Myotis septentrionalis*	Northern Long-eared Myotis
MYTH	*Myotis thysanodes*	Fringed Myotis
MYVO	*Myotis volans*	Long-legged Myotis

Table 2. Mistnet survey information for activities conducted in northeast Wyoming in 2018.

Site	Survey Date	Locality	x	y
Independence Puddle	7/4/2018	Summit Ridge	-104.057	43.8513
Mn4	7/7/2018	Elk Mountain	-104.062	43.69093
Mn7	8/7/2018	Landing Strip Draw	-104.743	44.82254
Mn11	8/10/2018	Little Missouri Road	-104.823	44.86172
Mn11	8/11/2018	Little Missouri Road	-104.823	44.86168

Table 3. Bats captured during mistnet surveys in northeast Wyoming in 2018.

Site	Date	Species	Sex	Age	Reproductive Status
Mn4	7/7/2018	EPFU	Male	Adult	Nonreproductive
Mn4	7/7/2018	MYVO	Male	Adult	Nonreproductive
Mn4	7/7/2018	EPFU	Male	Adult	Nonreproductive
Mn4	7/7/2018	LACI	Female	Adult	Pregnant
Mn4	7/7/2018	MYTH	Male	Adult	Nonreproductive
Mn4	7/8/2018	EPFU	Female	Adult	Pregnant
Mn11	8/11/2018	EPFU	Male	Juvenile	Nonreproductive
Mn11	8/10/2018	MYLU	Female	Adult	Nonreproductive
Mn11	8/10/2018	MYLU	Male	Juvenile	Nonreproductive
Mn11	8/11/2018	MYLU	Female	Adult	Post-lactating
Mn11	8/11/2018	MYLU	Male	Juvenile	Nonreproductive
Mn11	8/11/2018	MYLU	Male	Juvenile	Nonreproductive
Mn11	8/11/2018	MYLU	Male	Juvenile	Nonreproductive

Table 4. Bat species detected via acoustic monitoring at sites in northeast Wyoming in 2018.

Site	COTO	EPFU	LABO	LACI	LANO	MYCI	MYEV	MYLU	MYSE	MYTH	MYVO	Site Total
A10	1	0	4	3	0	0	0	1	0	0	0	**9**
A100	1	58	246	13	12	141	18	60	0	6	15	**570**
A101	0	37	11	26	22	4	3	3	0	0	0	**106**
A102	0	13	18	21	12	15	25	21	0	3	2	**130**
A104	1	77	125	23	26	29	26	209	1	12	17	**546**
A105	3	141	120	24	36	38	248	132	1	160	17	**920**
A107	1	57	295	39	28	45	20	36	0	1	21	**543**
A11	0	10	7	5	4	2	1	0	0	0	1	**30**
A111	0	53	28	39	15	16	22	30	0	16	3	**222**
A112	0	26	30	30	15	11	10	72	0	12	3	**209**
A113	2	67	502	61	35	7	13	5	0	2	0	**694**
A118	0	10	5	70	112	10	0	10	0	0	0	**217**
A119	0	9	21	12	100	8	4	16	2	2	8	**182**
A120	0	6	27	10	38	14	3	18	0	0	6	**122**
A122	0	9	36	12	101	13	2	3	1	0	1	**178**
A123	0	23	13	7	52	16	4	3	6	1	9	**134**
A124	0	3	0	6	22	3	0	0	0	0	0	**34**
A125	0	18	22	10	56	19	11	3	18	2	3	**162**
A126	0	9	1	100	22	0	0	0	1	2	1	**136**
A127	2	6	8	36	27	1	3	1	0	1	1	**86**
A128	0	5	2	9	3	2	1	0	0	0	1	**23**
A13	1	38	3	14	16	8	0	0	0	2	0	**82**
A130	1	4	4	32	29	6	3	0	0	3	1	**83**
A131	0	4	23	12	7	25	1	14	4	0	58	**148**
A132	0	0	0	2	3	0	1	0	0	0	0	**6**
A133	0	0	5	7	10	4	0	0	1	0	0	**27**
A14	0	0	2	0	0	1	0	0	0	0	0	**3**
A17	0	4	5	2	1	0	0	0	0	0	0	**12**
A18	0	28	0	16	22	0	0	2	0	4	0	**72**
A2	0	4	1	6	1	2	0	0	0	2	0	**16**
A23	0	12	8	10	7	6	0	4	0	0	6	**53**
A3	0	17	30	9	12	2	0	1	0	0	0	**71**
A4	5	34	5	23	54	2	0	1	0	5	0	**129**
A43	0	1	2	2	1	0	0	0	0	0	0	**6**
A5	4	14	20	6	8	2	0	0	0	12	0	**66**
A54	0	13	3	10	4	0	0	0	0	1	1	**32**
A55	2	8	24	11	10	1	2	3	0	5	1	**67**
A56	1	102	5	50	36	1	0	1	0	1	1	**198**
A57	0	0	0	0	0	0	0	0	0	0	0	**0**
A58	0	50	0	2	6	0	0	8	0	0	0	**66**

Site	COTO	EPFU	LABO	LACI	LANO	MYCI	MYEV	MYLU	MYSE	MYTH	MYVO	Site Total
A59	1	11	3	11	6	1	0	0	0	0	0	**33**
A6	0	4	7	1	7	1	0	1	0	3	1	**25**
A61	0	2	2	3	6	0	0	0	0	0	1	**14**
A62	0	66	18	22	42	10	0	5	1	17	1	**182**
A63	0	30	78	12	18	0	0	32	0	2	0	**172**
A64	0	2	0	0	7	0	0	0	0	0	0	**9**
A65	0	9	7	9	5	1	0	1	0	0	1	**33**
A66	0	0	11	5	4	2	0	0	0	0	0	**22**
A67	0	3	3	1	0	0	1	0	0	0	0	**8**
A7	0	0	0	1	0	0	0	0	0	0	0	**1**
A70	0	5	9	25	12	9	0	0	0	1	0	**61**
A73	0	1	4	4	6	0	0	0	0	1	0	**16**
A74	2	16	69	81	89	14	4	16	2	2	7	**302**
A78	0	0	4	0	0	2	0	0	0	0	0	**6**
A80	1	9	2	8	8	4	0	1	1	2	1	**37**
A83	0	0	24	5	2	2	0	0	0	1	0	**34**
A87	0	53	35	13	12	16	26	31	1	7	10	**204**
A9	0	32	18	19	40	4	0	2	0	3	1	**119**
A94	3	67	57	15	13	14	34	14	0	15	10	**242**
A95	0	14	20	17	12	1	1	5	0	3	2	**75**
A96	0	50	8	18	13	20	2	12	2	1	5	**131**
A97	0	3	22	13	9	3	0	1	0	0	1	**52**
Species Total	**32**	**1347**	**2062**	**1053**	**1276**	**558**	**489**	**778**	**42**	**313**	**218**	**8168**

Figures

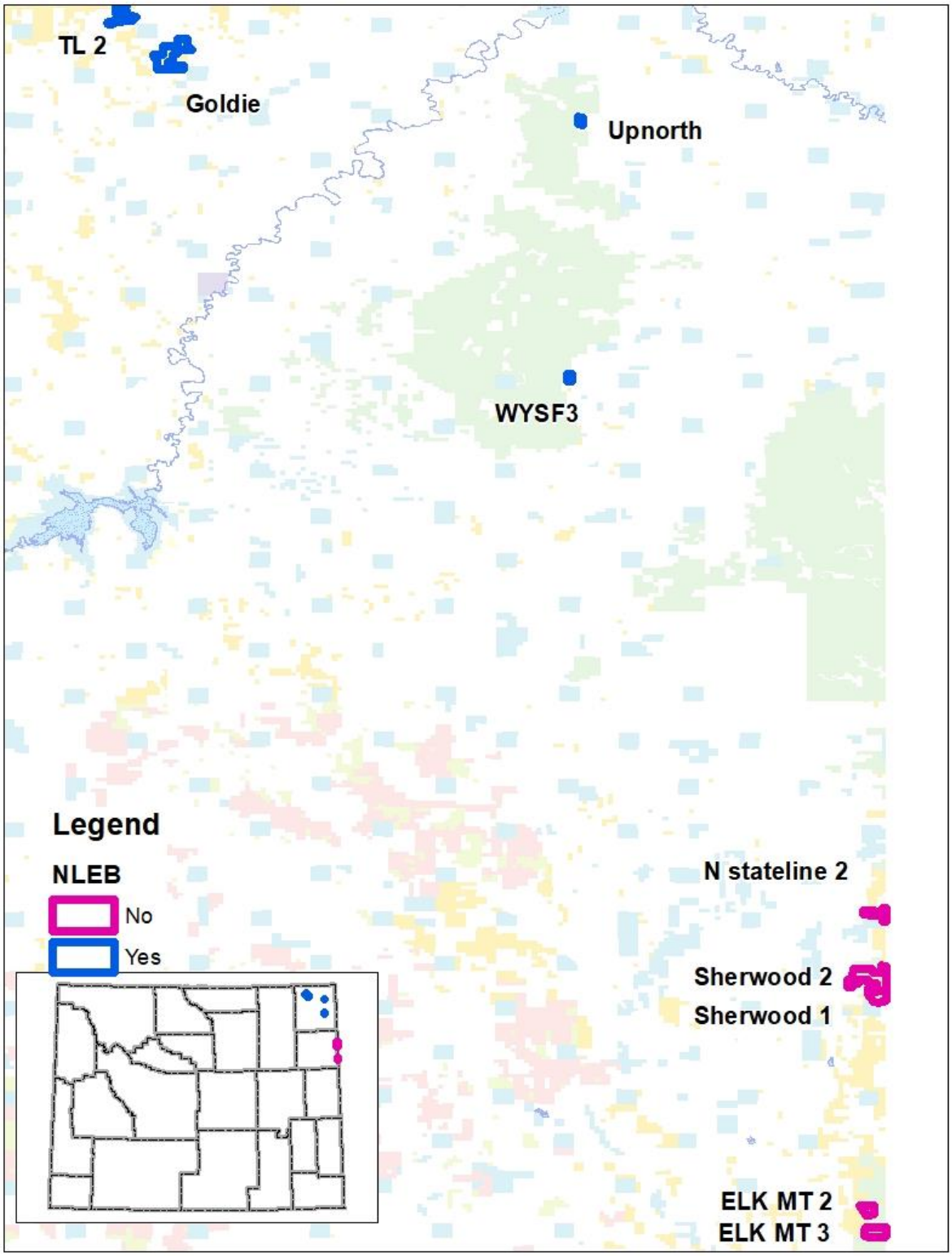

Figure 1. Potential timber management areas inventoried for bats and if NLEB were detected within the treatment area or not in the Newcastle Field Office in 2018.

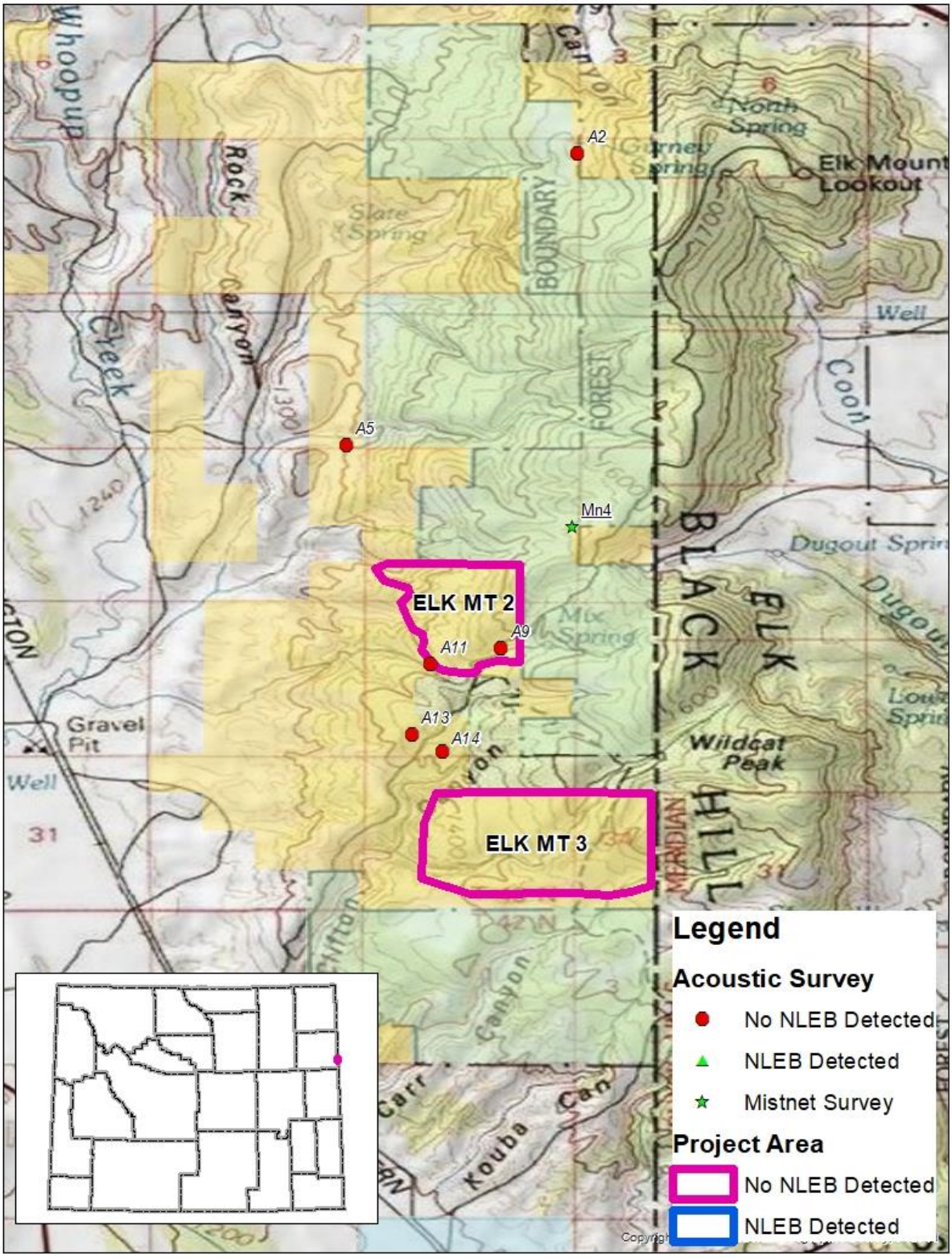

Figure 2. Project area boundaries for the Elk Mountain 2 and 3 timber treatment areas, acoustic survey locations, and mistnet survey locations sampled in 2018.

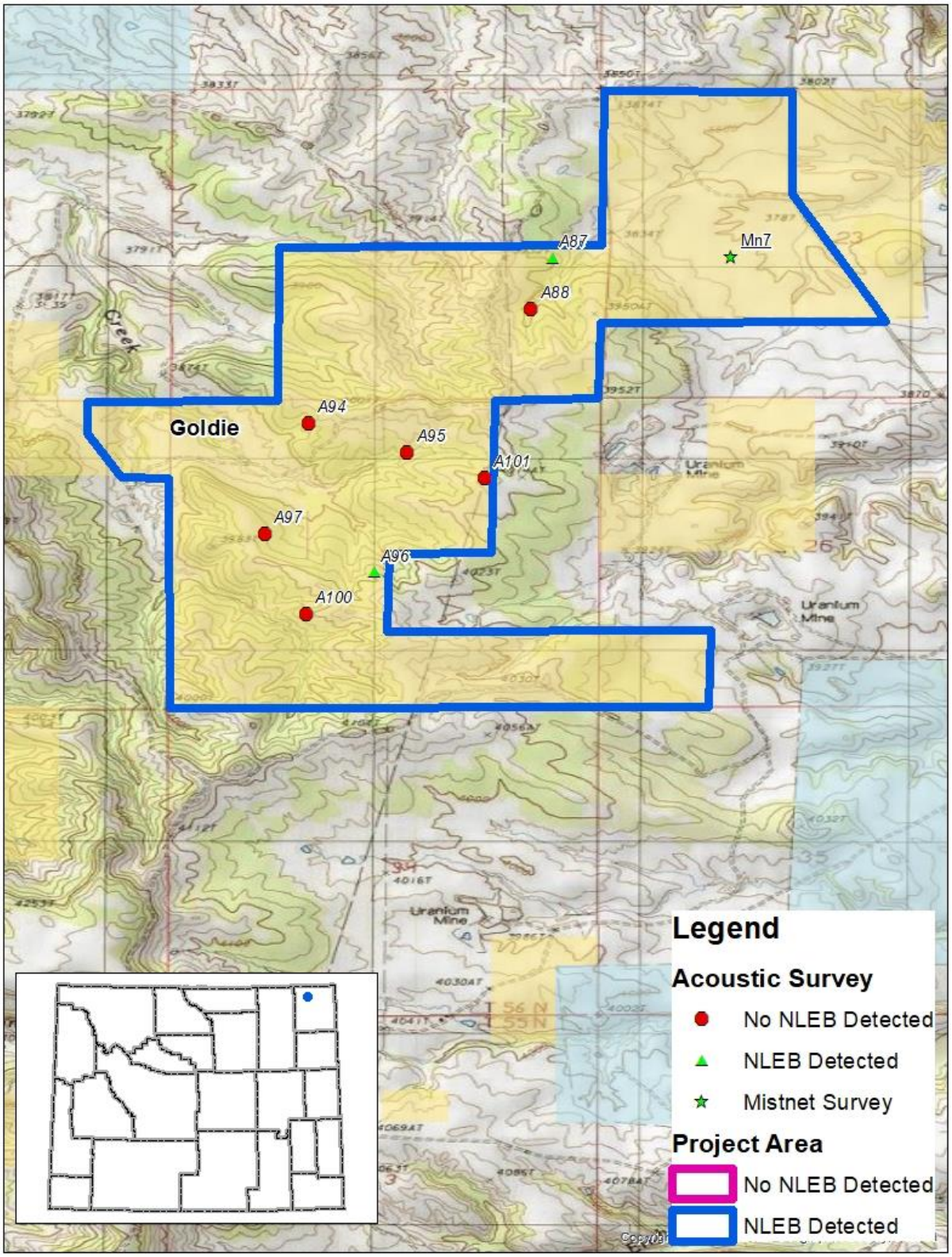

Figure 3. Project area boundary for the Goldie timber treatment area, acoustic survey locations, and mistnet survey locations sampled in 2018.

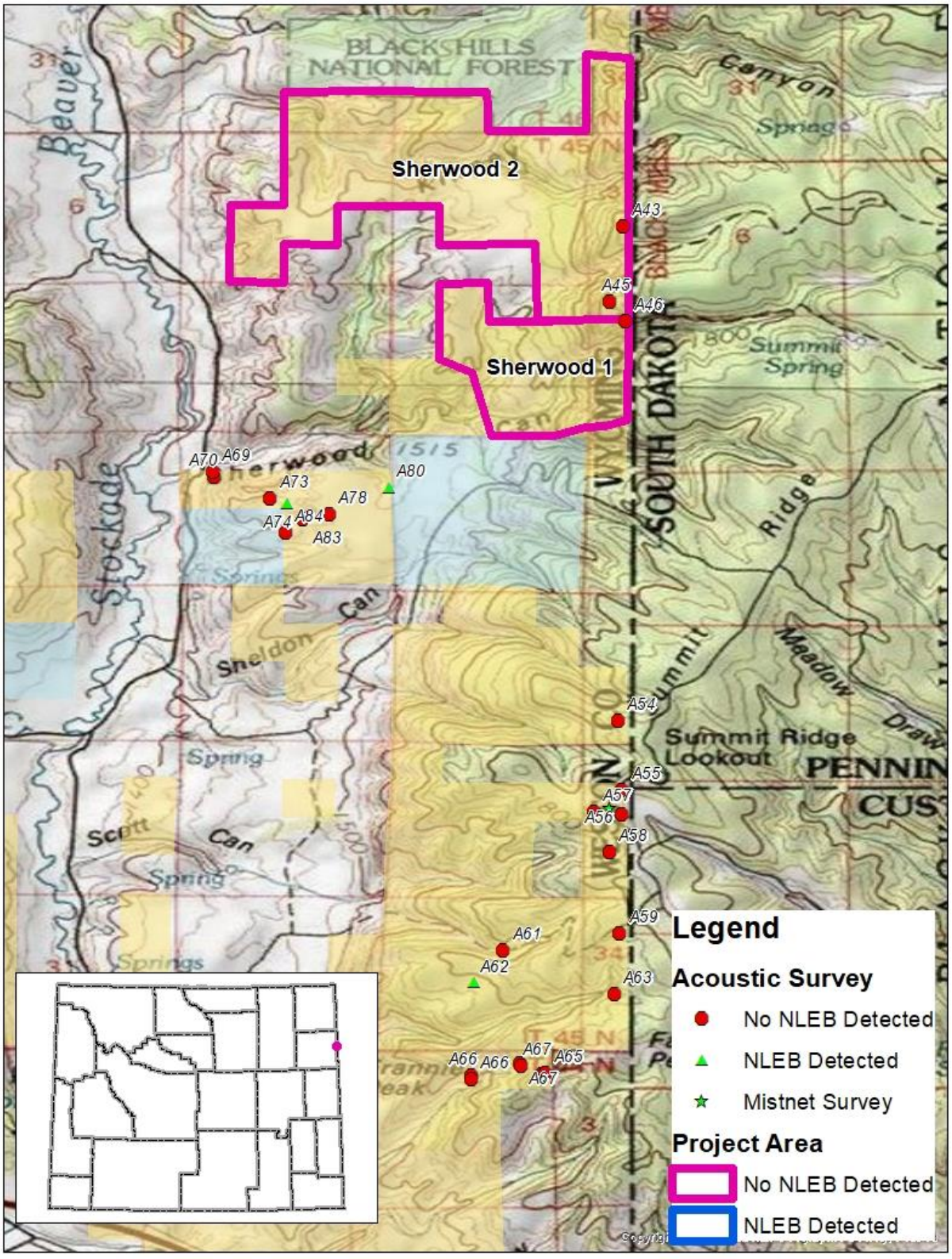

Figure 4. Project area boundaries for the Sherwood 1 and 2 timber treatment areas, acoustic survey locations, and mistnet survey locations sampled in 2018.

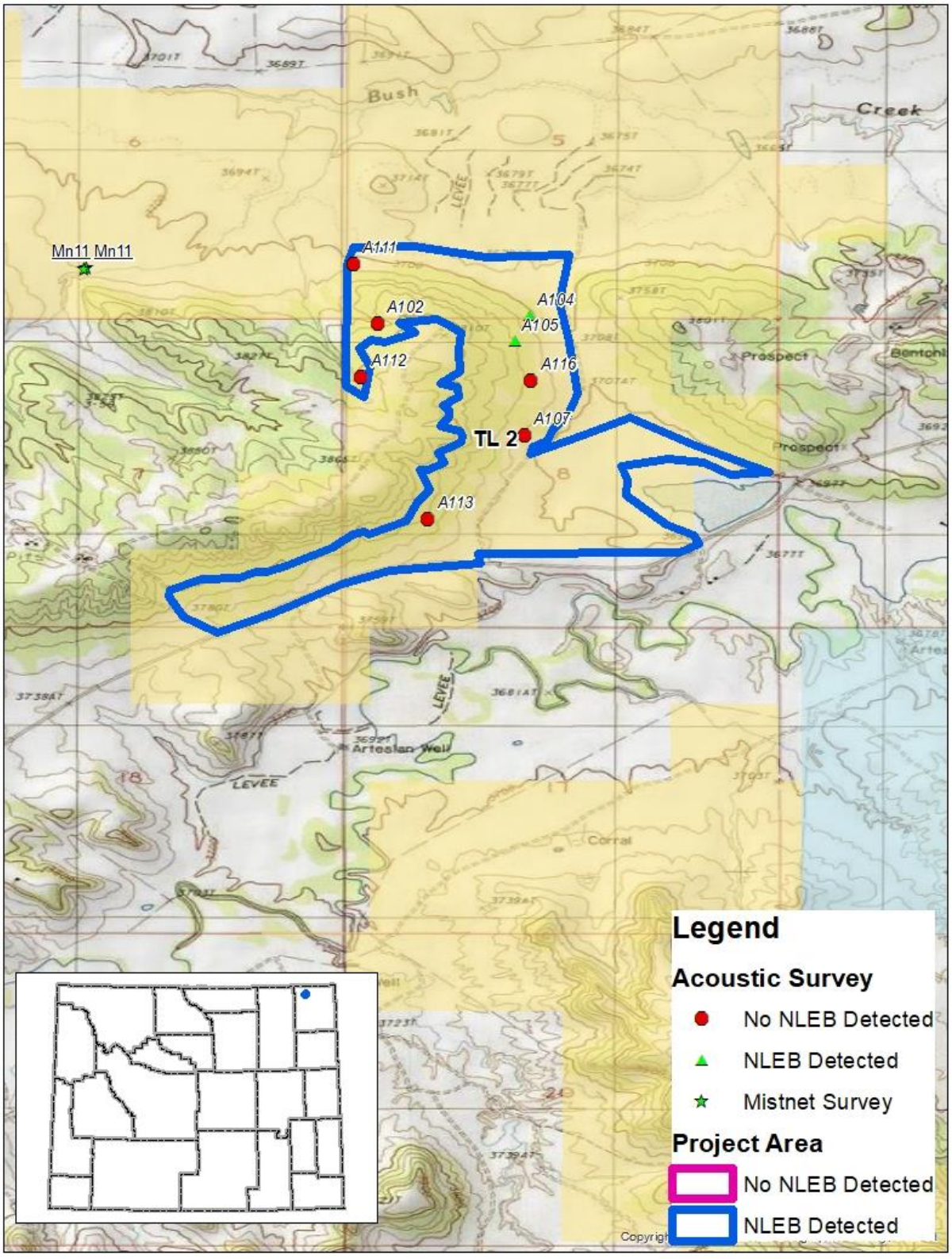

Figure 5. Project area boundary for the TL 2 treatment area, acoustic survey locations, and mistnet survey locations sampled in 2018.

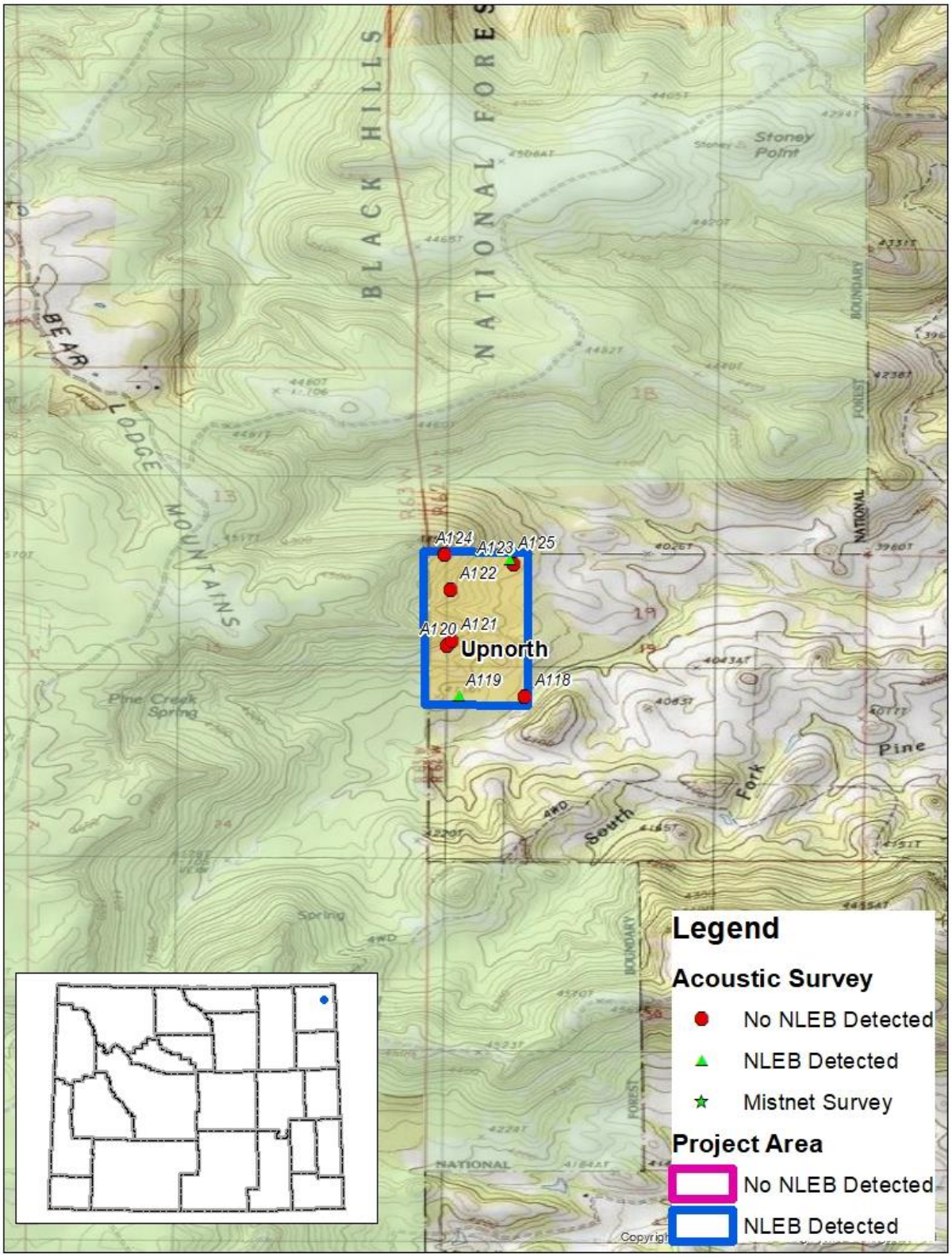

Figure 6. Project area boundary for the Upnorth timber treatment area, acoustic survey locations, and mistnet survey locations sampled in 2018.

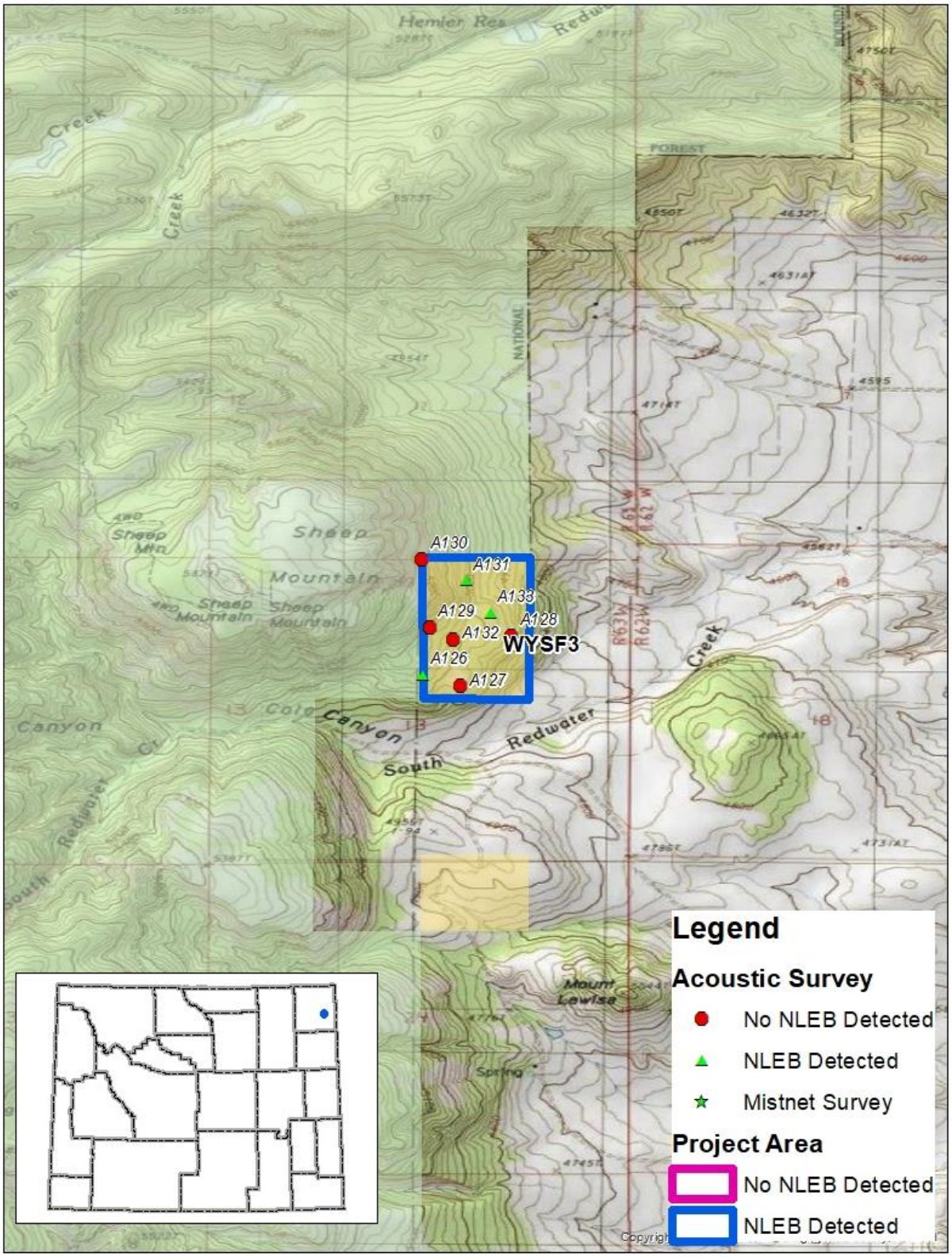

Figure 7. Project area boundary for the WYSF3 timber treatment area, acoustic survey locations, and mistnet survey locations sampled in 2018.