Department of Defense
Legacy Resource Management Program

PROJECT 07-346

FINAL

Department of Defense Strategy to Support a Multi-Agency Bat Conservation Initiative within the State of Utah

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Department of Defense Strategy to Support a Multi-Agency Bat Conservation Initiative within the State of Utah

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I. ACKNOWLEDGEMENTS

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This project was supported in part by an appointment to the Postgraduate Environmental Participation Program at the U.S. Army Environmental Command (USAEC) administered by the Oak Ridge Institute for Science and Education (ORISE) through an interagency agreement between the US Department of Energy and USAEC.

Great thanks are extended to Utah Department of Wildlife Resources (UDWR) State Sensitive Species Biologists Adam Kozlowski and Kimberly Asmus and UDWR Heritage Program Database Zoologist Ben Sutter and Program Manager Carmen Bailey for their assistance, expertise, and professionalism during every step of this project.

Thanks to the support of General Dynamics and their Information Technology division for working so closely with project leads on the creation of the database.

Finally, great thanks and appreciation goes out to the Department of Defense Natural Resource Managers, Environmental Program Managers, US Army, U.S. Air Force, U.S. National Guard, and Installation Commanders for their current and continued support of this project and their visionary, pro-active approach to the sustainability of military land for the sole purpose of supporting our nation's war fighters.

II. EXECUTIVE SUMMARY

A total of 18 species of bat are known to occur in Utah; 6 or 30% are considered Utah Species of Concern. Very little information is known about the distribution or population status of bats in the state. Prior to this project, bat inventory data for Utah was scattered within private, state, and federal holdings and were not collectively available for resource managers. Lack of such information presents difficultly to identify and address statewide management issues related to the conservation of bats. With five Department of Department (DoD) facilities in Utah, whose management authority extends over 1.8 million acres, it was crucial to identify distribution and frequency of occurrence to prevent encroachment and listing issues related to the lack of conservation management of bat species in Utah.

This Legacy Program funded project has consolidated the majority of known collected bat data in the state of Utah with the promise of receipt of many other data from various sources. A web-based geodatabase has been created to allow entry, storage, and queries of old, new and future data for any and all contributing partners and land managers with restricted access to other interested parties. Strict data use agreements, similar to those in place for current data holdings by the Utah Department of Wildlife Resources (UDWR) Heritage Program, are in place to protect data. The collaboration on this project was far-reaching and extensive and allowed for the huge successes that were accomplished. U.S. Army Dugway Proving Ground (DPG) and the UDWR led this effort – coordinating with the Utah Bat Conservation Cooperative (UBCC) that consists of 14 other federal, state and private stakeholders – to expand the current bat knowledge in the state from just over 2,300 records to over 21,000 bat records, a 900% increase!

III. INTRODUCTION

A. Status of Bats in Utah and on DoD installations

In recognition of the importance of DoD lands to the conservation of bats throughout the nation, a memorandum of understanding (MOU) was signed in October of 2006 to "develop a policy of cooperation and coordination between the DoD and Bat Conservation International (BCI)". Within the spirit and intent of this MOU this 2007 Legacy Project was applied for and funded which brings together five DoD Command Groups – DPG, Hill Air Force Base (HAFB), Utah National Guard (UNG) - Camp Williams and Washington County, Deseret Chemical Depot (DCD), and Tooele Army Depot (TEAD).

A recent exhaustive review of bat research indicates that little information is available regarding the basic ecology of Utah's bat species, including data on population dynamics and trends, roost site selection, foraging behavior, reproduction, and migration (Oliver 2000). Existing data on habitat selection and resource use were, until recently, poorly consolidated and scattered among federal, state, private and university information holdings making it difficult to identify and address statewide management issues related to the conservation of bats (Fenton 1997). Sound statewide management and conservation of bats in Utah requires a comprehensive, range-wide baseline of known bat populations. With five DoD facilities in Utah, including DPG, HAFB and Utah Test and Training Range North and South, (UTTRN and UTTRS)], UNG, DCD, and TEAD, whose management authority extends over 1.8 million acres, it is essential to identify distribution and frequency of occurrence to prevent encroachment and listing issues related to the lack of conservation management of all bat species in Utah.

In addition to the management and conservation problems created by sparse data, there is the potential for significant amounts of habitat loss resulting from human population growth and land development. The census, conducted by the U.S. Census Bureau in 2000, identified Utah as having the fourth fastest growing population in the nation, increasing by almost 30 percent between the years 1990 and 2000 (http://www.census.gov/population/cen2000/phc-

t2/tab03.pdf). This population explosion may be creating island oases for Utah bats on remote DoD installations and surrounding lands as natural, native habitat is lost to developing cities and expanding human populations. Utah's rapid development combined with the high species diversity in the state has created a situation where six of the eighteen bat species (30%) are listed as Utah Species of Concern. Currently, Endangered Species Act (ESA) listed bat species do not occur in Utah, however, the fact that 30 percent of Utah bats species are of sensitive status creates considerable concern for DoD land managers as well as state wildlife managers. Instituting proactive conservation actions and planning measures at this time is essential and will prevent the need for more economically, politically, and biologically costly solutions in the future.

Before Legacy Project 07-346, the Utah Natural Heritage Program (UNHP) database served as the only centralized source of accessible bat data statewide (Figure1). However, UNHP tracks only Utah Species of Concern, which includes six (Townsend's big-eared bat, *Corynorhinus townsendii,* Allen's big-eared bat, *Idionycteris phyllotis*, Big free-tailed bat, *Nyctinomops macrotis*, Western red bat, *Lasiurus blossevillii*, Spotted bat, *Euderma maculatum*, and Fringed myotis, *Myotis thysanodes*) of the 18 species that occur in Utah. Consequently, little data (i.e., eight records) recorded on military bases were contained within the UNHP database. To identify all unknown data and help prevent listing of any Utah bat, data involving all 18 species were tracked and compiled with Legacy Project 07-346 funding.

B. Approach

The minimal research efforts involving bat ecology in Utah as well as difficulties in accessing existing data may likely contribute to population declines and possible future listings. To address conservation concerns for Utah bat species, the UDWR is writing a Utah specific Bat Conservation Strategy and creating, with The Nature Conservancy (TNC), a critical bat

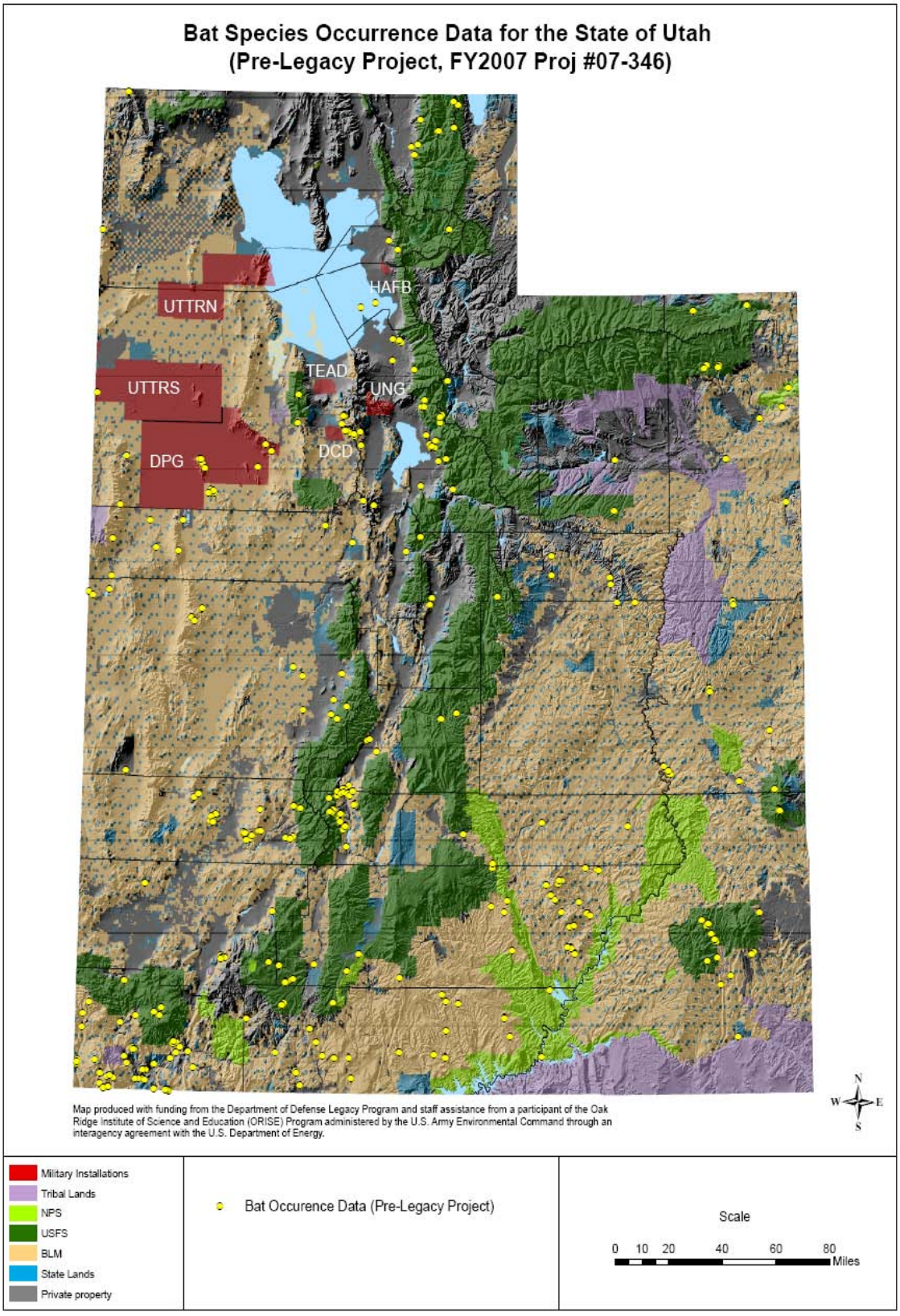


Figure 1. Bat Species Occurrence Data for the State of Utah (Pre-Legacy Project, FY2007 #07-346). Data shown was held in the Natural Heritage Program (UNHP). Map shows the six largest landowners in the state of Utah. An "occurrence" includes data for at least one individual bat, but may include information for multiple individuals and/or multiple species.

habitat suitability model (Important Bat Habitat Model). Subsequently, Legacy Project 07-346 is a critical element needed to support and validate these projects to complete a statewide effort to manage Utah bats at a sufficient level to ensure stable populations. Legacy Project 07-346 has:

1. Identified distribution, quantity, and quality of existing data on suitable bat habitat in Utah within the AOR of the Utah Bat Conservation Cooperative (UBCC) (i.e. federal, state, and private land holdings totaling about 54 million acres).
2. Developed a geodatabase (subsequently called the Utah BatBase) with federal, state, and private land managers that will hold all existing bat data, provide a centralized location for all future bat data to be held, and allow state-wide access to data in order to further a state-wide, regional approach to management that ignores ownership boundaries. This database will identify what data exists and, in so doing, allowing resource and land managers to work collaboratively to target and address data gaps.
3. Serve as a foundation for future cooperative bat research and management efforts in the state of Utah.
4. Collect bat species occurrence data within the 1.8 million acres of DoD managed lands. High priority areas identified by the *Important Bat Habitat Model* will direct this approach and range sustainment initiatives will tier within modeled habitat hot spots.

The identification of existing data has entailed an exhaustive search for information held by federal and state agencies, universities, local contractors, private researchers, and non-profit groups located in Utah. All data sets obtained through this process have been entered into the Utah BatBase designed specifically for these datasets. The database is characterized by data masks and filters to ensure data quality, customizable user queries to facilitate data sorting and extraction, and is web enabled. The completed database will reside within and be maintained in perpetuity by the UDWR's UNHP. In addition to providing a central location for partners to access and update Utah's bat inventory data beyond the life of this initiative, housing the database within the UNHP will provide formidable data protection measures to prevent sensitive aspects of the data set from being released inadvertently. Without the BatBase, future research

would suffer from a lack of understanding and knowledge of Utah habitat distribution and the problem of data scatter among federal, state, and university research groups would only worsen. The database will be used as a foundation for future bat conservation efforts in Utah and provide context for historical datasets collected across a diversity of temporal and spatial scales. Although the geodatabase is a completely functional product on its own, through this project, it will be nested within a much farther reaching conservation effort encompassing DoD installations as well as other public and private lands in Utah.

C. Partnerships

Through the Bonneville Basin Conservation Cooperative (B2C2, a DoD led regional group), Legacy Project 07-346 brings together five DoD facilities within the State of Utah to form a collaborative partnership supporting the initiatives of the state's bat working group (UBCC), which in turn, is comprised of 14 other federal, state and private stakeholders. Members of the UBCC represent numerous federal, state and private agencies to include the U.S. Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, National Park Service, U.S.D.A. Natural Resources Conservation Service (NRCS), UT Division of Wildlife Resources (UDWR), UT Division of Oil, Gas, and Mining (UDOGM), UT Division of Parks and Recreation (UTDPR), Utah State University (USU), The Nature Conservancy (TNC), Southern Utah University (SUU), Rocky Mountain Power, Kennecott Utah Copper, and SWCA Environmental Consultants. The results of this extensive collaborative effort will benefit the military test and training ranges and will support sound and timely development and implementation of stewardship initiatives within the state of Utah on DoD lands. These collaborative partnerships also ensure that all land managers in Utah will be actively and collaboratively managing bat species in the state of Utah and will thus help prevent any unequal pressure on military lands. Beyond these immediate tangible benefits to the military, these partnerships ensure the continued coordination and involvement of all parties. The widespread acceptance and use of the database and the management assistance it provides is derived in large part from the efforts

spent to involve all stakeholders in collaboratively developing technology- and communication-based solutions to target their individual information shortfalls. Work on the Legacy Project 07-346 has directly stimulated communication and collaboration that in turn has resulted in a tool that will further enhance participation groups' effectiveness and will progressively become more valuable as time passes. Recent outside interest in expanding the collaborative partnership/database model to include other species (Pat Ormsbee of the USFS Pacific Northwest Region) and areas adjacent to Utah further demonstrates the systemic need for the process as well as the products that have made the Legacy Project 07-346 a success among its partners.

D. Benefit to Military

The DoD military lands in Utah comprise several different specific missions but all depend on the availability and sustainability of testing and training lands. DPG (798,214 acres) is a major range and testing facility and the primary chemical and biological defense testing center under the Reliance Program. TEAD (23,610 acres) provides America's joint fighting forces with munitions and ammunition equipment in support of military missions before, during and after any contingency. DCD's main mission is to destroy 45% of the US stockpile of chemical weapons and the Utah National Guard at CW (28,000 acres) provides quality training lands for the Utah National Guard and others. Finally, HAFB (968,774 acres) is home to many operational and support missions with Ogden Air Logistics Center, who provides worldwide engineering and logistics management. These five DoD partners control a substantial amount of land in Utah. Together they comprise 1,818,958 acres that contain significant bat habitat where little research has been carried out to determine the extent of use by bats or the ecology and biology patterns within the Great Basin. As a result, DoD land managers do not have a good idea of what bat species exist on their training and testing lands or what potential issues may develop.

The DoD is a major user of west desert test and evaluation lands within the state of Utah. DoD requires continued access to those lands to maintain mission readiness. These lands support biological and chemical test and evaluation operations, munitions testing, deployment of weapon systems, and combat training exercises. The Utah Test and Training Range supports the evaluation of missile weapon systems and utilizes the largest joint contiguous CONUS airspace block to train pilots on air-based weapons systems. National Guard units conduct live fire exercises on Camp Williams and DPG ranges. In addition, these desert climates are utilized by large, mechanized, mobile training units to simulate real-time battle conditions. Throughout these lands specific landscape characteristics and intrinsic natural features are crucial to military readiness as many parts of DPG and HAFB look very much like cold desert high elevation countries throughout the Middle East. As Utah DoD land managers strive to deal with the challenges of balancing land and air resources within a very high operational tempo, an understanding of the biological status on 18 species of bat is critical. Further, the overall collaborative efforts we have facilitated with 14 key stakeholders will enhance military readiness and overall training needs to prepare the finest war fighters anywhere to meet mission needs and objectives.

Conservation efforts ensure that training environments are not degraded over time and that DoD has continued access to west desert testing ranges, impact areas, and testing grids. This legacy project directly supports this end through a sound set of biologically based initiatives designed to enhance the sustainability and usability of training and testing lands within the state of Utah. The effectiveness of this project is highlighted by the inclusion of every single military command in Utah with over 1.8 million acres of test and training lands (98% of DoD land holdings in Utah). Extensive efforts have occurred to secure this support. We believe this regional approach to managing bats within the State of Utah and specifically understanding regional trends and patterns on DoD land 100% supports stewardship objectives and goals fundamental to sound land management policies within the DoD. More importantly, this project has a tangible benefit. It will benefit the military through the identification and description of

needed data for Utah bats. Through the future analysis of data gaps identified from the Legacy Project 07-346 created BatBase, extensive knowledge will be gained about what is unknown and what needs to be known in order to manage and prevent the listing of any of the 18 species of Utah bats. This information will yield invaluable information and will allow the continued use of DoD training ranges through the pro-active, early detection of any decline in populations of Utah bats. Most importantly, management of declining bat populations on surrounding lands will help improve Mission usability of bat habitat on DoD lands. If known existing bat habitat adjacent to military lands is known to house state sensitive species then mission essential tasks will not be limited by existing habitat on DoD lands. By collaboratively managing bats, DoD land managers can be assured that the BLM, USFS, UDWR, and other land holders surrounding military lands are doing their part to manage for species that could affect mission and essential testing and training activities on DoD lands. If all agencies manage for species that could effect mission readiness then military land managers can be assured that at some point in the future, DoD property will NOT be the sole location and oasis for Endangered Species Act threatened and endangered species that so many DoD installations throughout the United States have become.

IV. RESULTS

A. The Utah BatBase

The Utah BatBase has been created with contract assistance (General Dynamics, Inc. IT; GDIT). It is in the process of going through several revisions but is in final draft form. A final version will most likely not be completed until all partners have had a chance to review and comment on the database. However, the database is fully functional and will be populated with the collected data from this project over the first six months of 2008.

GDIT used Visual Studio 2005 ASP.NET to develop the webpage with web based database access tools. The webpage is currently hosted on a GD web server, a Windows Server 2003 machine and will be transferred to the UDWR in the future once real data has been added. The current location of the BatBase is https://www.utahbats.org. The database currently uses a SQL server 2005 service pack 2 on a Windows Server 2003 machine (2 processors, 2 GB RAM, 250GB hard disk space).

GDIT uses ASP.NET memberships to do authentication. A requirement for the web site is to allow only some members (authenticated users) to see certain pages. Access to forms and pages is based on login credentials. ASP.NET membership gives you a built-in way to validate and store user credentials. ASP.NET membership therefore helps you manage user authentication in your Web sites. The BatBase provides a login form for each user to log in. Each time the user requests a protected page, ASP.NET Forms authentication checks whether the user is authenticated and then either allows the user to view the page or redirects the user to the login page. By default, the authentication cookie remains valid for the user's session. The database can be edited or displayed using our custom input forms, FormViews and GridViews with live connections to the database using ADO.NET with validation.

Four accounts exist to provide varying levels of access: an anonymous account for WWW users; a viewer account for users to do queries from the database; a data editor account that allows changes and additions to the database; and a power user account that enables all

functions and deletion of records and modification of the domain tables, gives permissions to new users, and modifies existing permissions. User schema was chosen and setup to allow seamless access to web-based GIS (ArcGIS by ESRI) maps once implemented.

Adam Kozlowski, UDWR Sensitive Species Biologist provided the webpage layout, the database design, data dictionaries, the Domain Values (allowed data entry values for validation for the fields) and the actual instructions for data entry based on the type of survey. Ben Sutter, UDWR Heritage Program Database Zoologist and his department provided some initial data for database design and testing of the web based editing and reporting environment.

GDIT worked closely with Adam to approve and improve the design of the database. The field definitions were set up and the database layout documented. The data base was actually created in SQL Server. The webpage portion of the project is in continuous development. The web page portion will ultimately meet Legacy project lead's design requirements and be the instrument for web-based entry and retrieval.

The database consist of many tables, the main parent table is the Site Table, all other tables are sub tables that contain information about and data collected at site visits during surveys. The database also includes Domain look up tables so that user input will be restricted when required and so that the database will have valid attributes. Additionally validation will is done programmatically with ASP.NET on the client side and on the server. See appendix B for database layout and design in flow-chart form.

All individuals wishing to access the data entry or data query portions of the website will be required to register. Registration will be sent to the UNHP as a request to access the data within the database. Received approval from UNHP will allow the user full access to the database, data, and query functions. The BatBase involves a user-friendly online interface and will provide access to data for all regional land managers and those that contribute data upon registration. Over 20,000 records previously lost to the bat research community at large were obtained and will be used to populate the BatBase. Organizations that have or will contribute data and support the BatBase and its mission of data consolidation for the better management

of sensitive bat species throughout the State include - UDWR (5 of 5 regions), Utah Division of Oil, Gas, and Mining (UDOGM), the USFS (Spanish Fork Ranger District, Sawtooth NF, Wasatch-Cache NF, Fish Lake NF, Dixie NF, and Manti-LaSal NF), BLM (10 of 10 Field Offices and the Grand Staircase Escalante National Monument), contracting/consulting firms (SWCA and JBR), academics/researchers (Utah State University, Southern Utah University, Weber State University, Brigham Young University, and University of Utah' s Natural History Museum), and 5 DoD installations. Data use agreements are in place to protect sensitive data from exploitation but allows for the use and meta-analysis of data by all parties.

This database, although a functional product on its own, can serve a much greater function with an analysis of its content (funded FY 2008 Legacy Proposal project). This analysis will provide direction to bat management and allow for the greater use and applicability of the database.

B. DoD Progress

Due to the extensive list of partners willing to support this project, all existing bat records (both historical and current) have been gathered on DoD installations in Utah. Overall, bat data available to DoD managers increased 18 fold (Figure 2); however, new bat data was not obtained for each installation (Figure 3). For example TEAD, DCD, and HAFB contained no data within their boundaries; nonetheless, significant amounts of data were gathered just outside their borders. Data collected on land adjacent to military lands is extremely useful to land managers as well and can help 1) determine if sensitive species are an issue on military land and 2) direct bat research on DoD lands if needed. Summaries for each military installation are presented on maps in Figures 4 through 10 and include bat data before and after Legacy funded efforts including species lists, number of sites, and relative occurrence rank of species observed (i.e., rank of most observed to least observed species). One occurrence includes data for at least one individual bat, but may include information for multiple individuals and/or multiple species. Bat data acquired within 10 miles of each facility was included in the analysis to

compare bat abundance and diversity in (on site) and around (off site) each installation. This increased coverage will likely help discern possible influence of military activities beyond property boundaries. Boundaries of the five largest landowners in Utah (Tribal Lands, National Park Service, U.S. Forest Service, Bureau of Land Management, and State Lands) are also presented in Figures 4 through 10 to illustrate potential partners in bat management efforts for each installation.

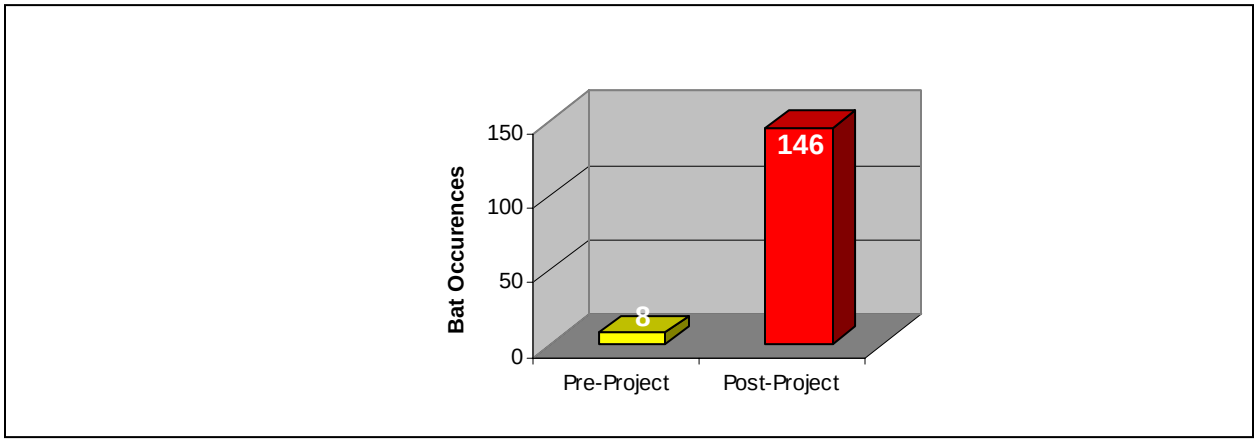


Figure 2. **Military Bat Data Before and After Legacy Project 07-346.** Bat occurrence data before and after Legacy Project 07-346 on Military Installations in Utah.

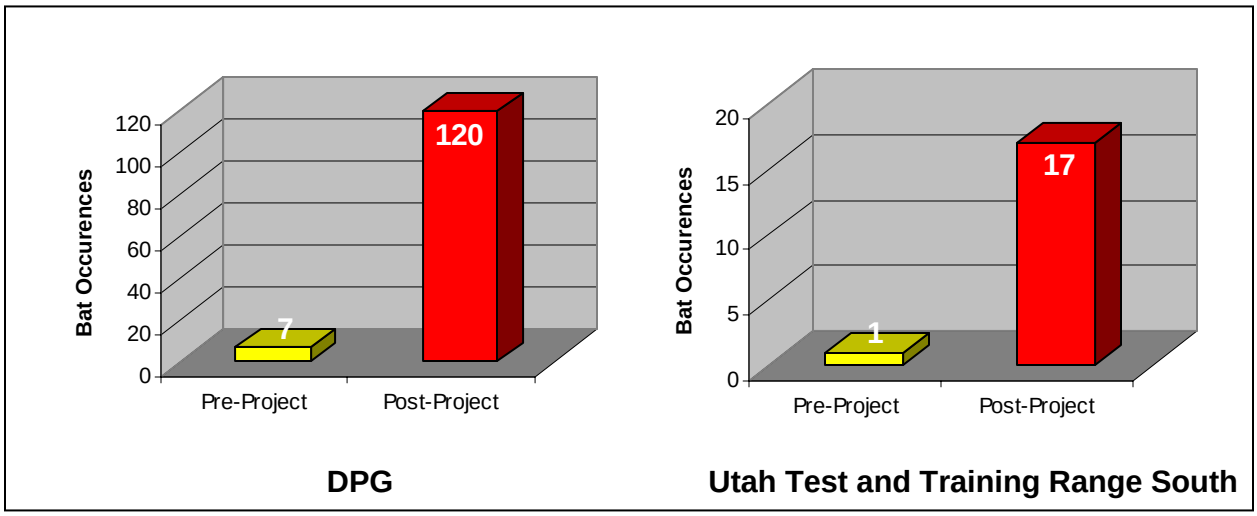


Figure 3. Military Bat Data by Installation Before and After Legacy Project 07-346. Bat occurrence data on each Utah DoD installation before and after Legacy Project 07-346.

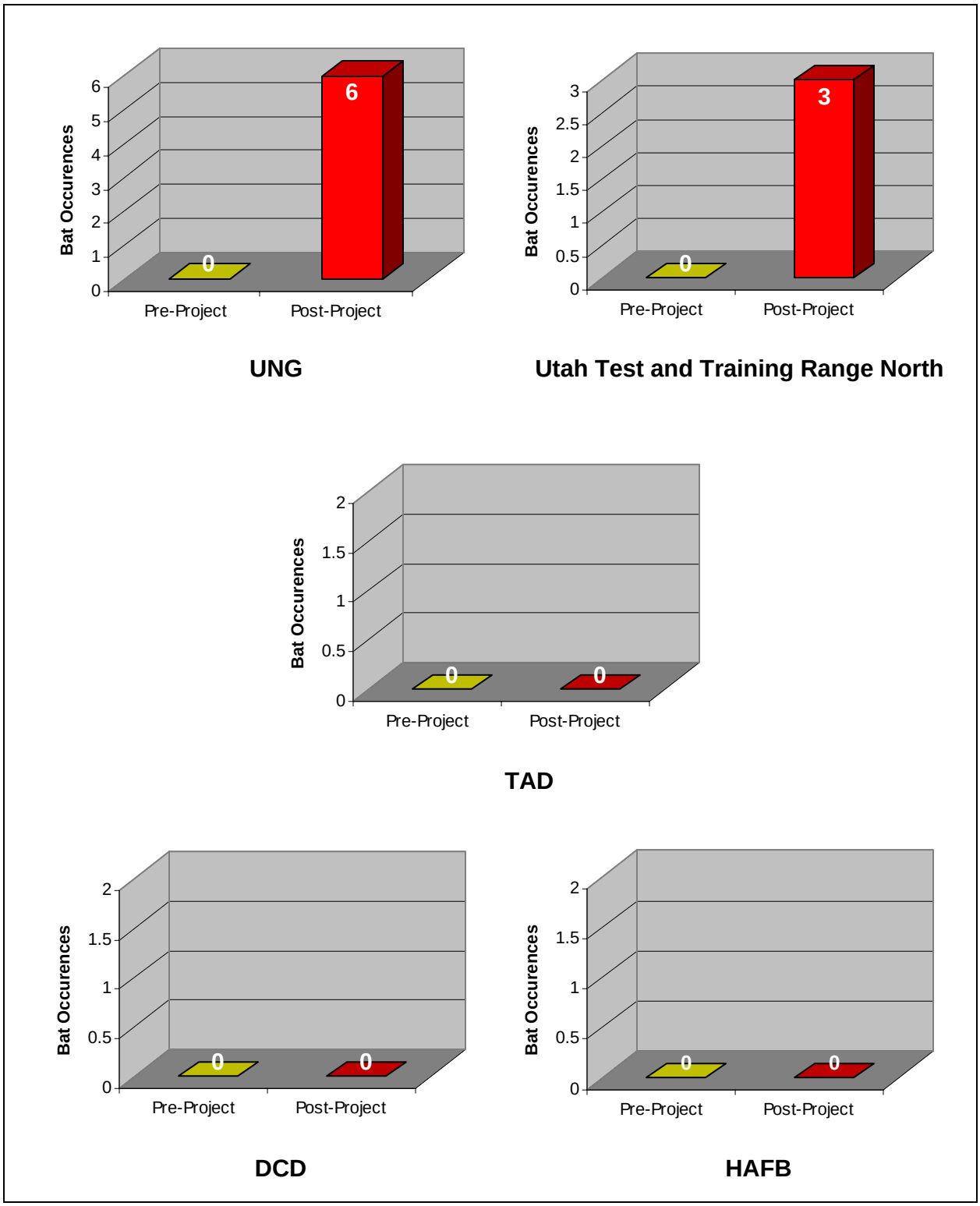
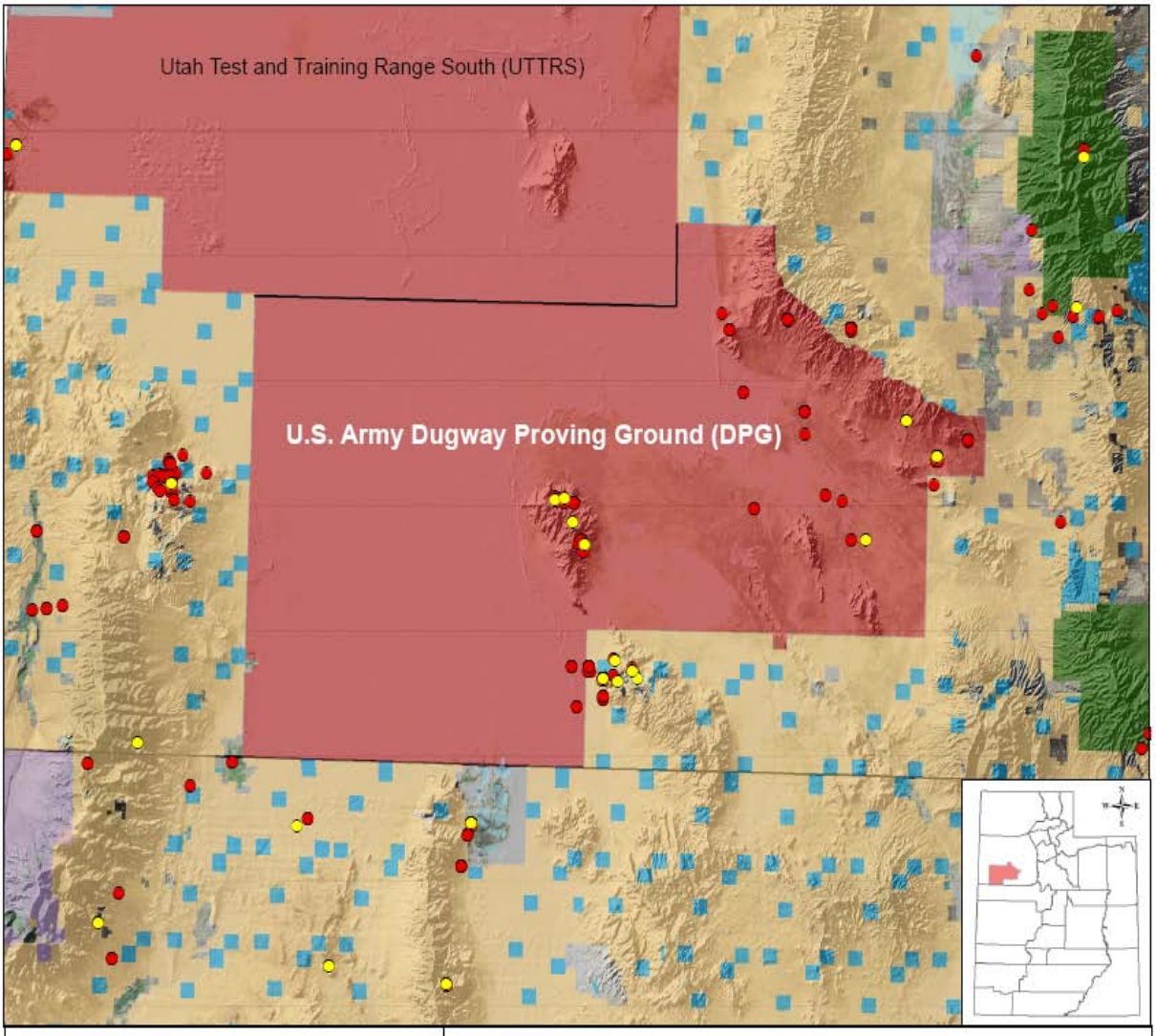


Figure 3 (continued). **Military Bat Data by Installation Before and After Legacy Project 07-346.** Bat occurrence data on each Utah DoD installation before and after Legacy Project 07-346.

Bat Species Occurrence Data for U.S. Army Dugway Proving Ground (Post-Legacy Project, FY2007 Proj #07-346)



Dugway Proving Ground
USFS
State Lands
BLM
Private property
Bat Occurence Data (Pre-Legacy Project)
Bat Occurrence Data (Post-Legacy Project)

Scale
0 3 6 12 18 24 Miles

Observed Species Summary for Dugway Proving Ground

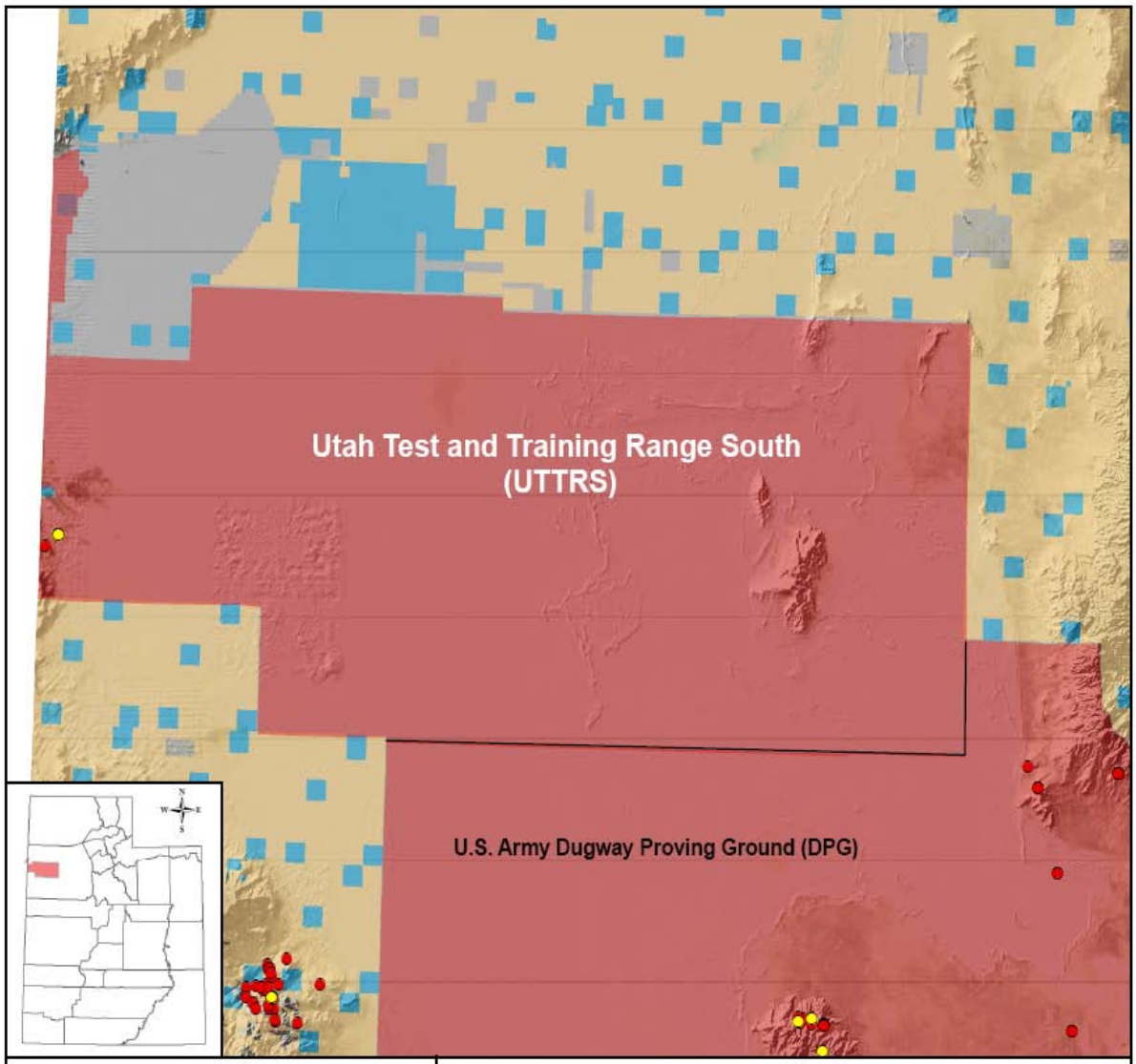
Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	30	10	1
Western small-footed myotis	4	5	3
Long-legged myotis	5	1	4
Fringed myotis(1)	5	0	5
Big brown bat	5	0	5
Yuma myotis(2)	1	0	10
Pallid bat	9	4	2
California myotis	0	9	3
Western pipestrelle	2	3	5
Silver-haired bat	1	0	9
Brazilian free-tailed bat	0	4	6
Hoary bat	1	1	8
Long-eared myotis	2	1	7
Total # of Species	**Total # of Sites**	**Total # of Sites**	
13	65	38	

1 - Utah State Sensitive Species (Tier II)
2 - Utah State Sensitive Species (Tier III)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 4. **Bat Species Occurrence Data for U.S. Army Dugway Proving Ground (Post-Legacy Project, FY2007 #07-346).** Bat occurrence data before and after Legacy Project 07-346 on DPG including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Utah Test and Training Range South (Post-Legacy Project, FY2007 Proj #07-346)



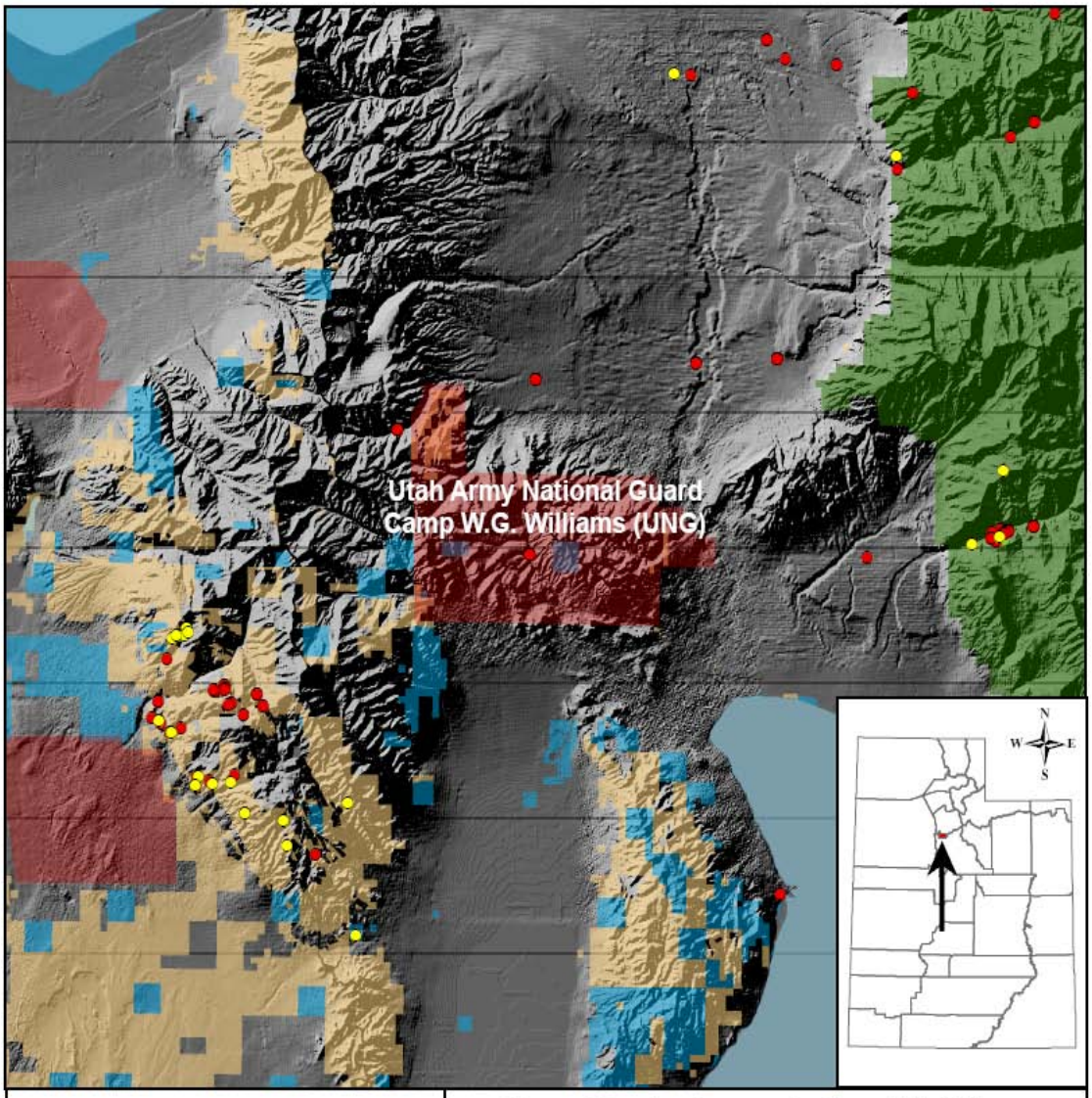
Observed Species Summary for UTTRS

Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Pallid bat	4	1	1
California myotis	3	0	2
Western pipestrelle	2	0	3
Brazilian free-tailed bat	0	1	4
Total # of Species	Total # of Sites	Total # of Sites	
4	9	2	

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 5. Bat Species Occurrence Data for Utah Test and Training Range South (Post-Legacy Project, FY2007 #07-346). Bat occurrence data before and after Legacy Project 07-346 on UTTRS including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Camp W.G. Williams (Post-Legacy Project, FY2007 Proj #07-346)



Camp W.G. Williams
USFS
State Lands
BLM
Private property

Bat Occurence Data (Pre-Legacy Project)
Bat Occurrence Data (Post-Legacy Project)

Scale

0 1.5 3 6 9 12 Miles

Observed Species Summary for Camp W.G. Williams

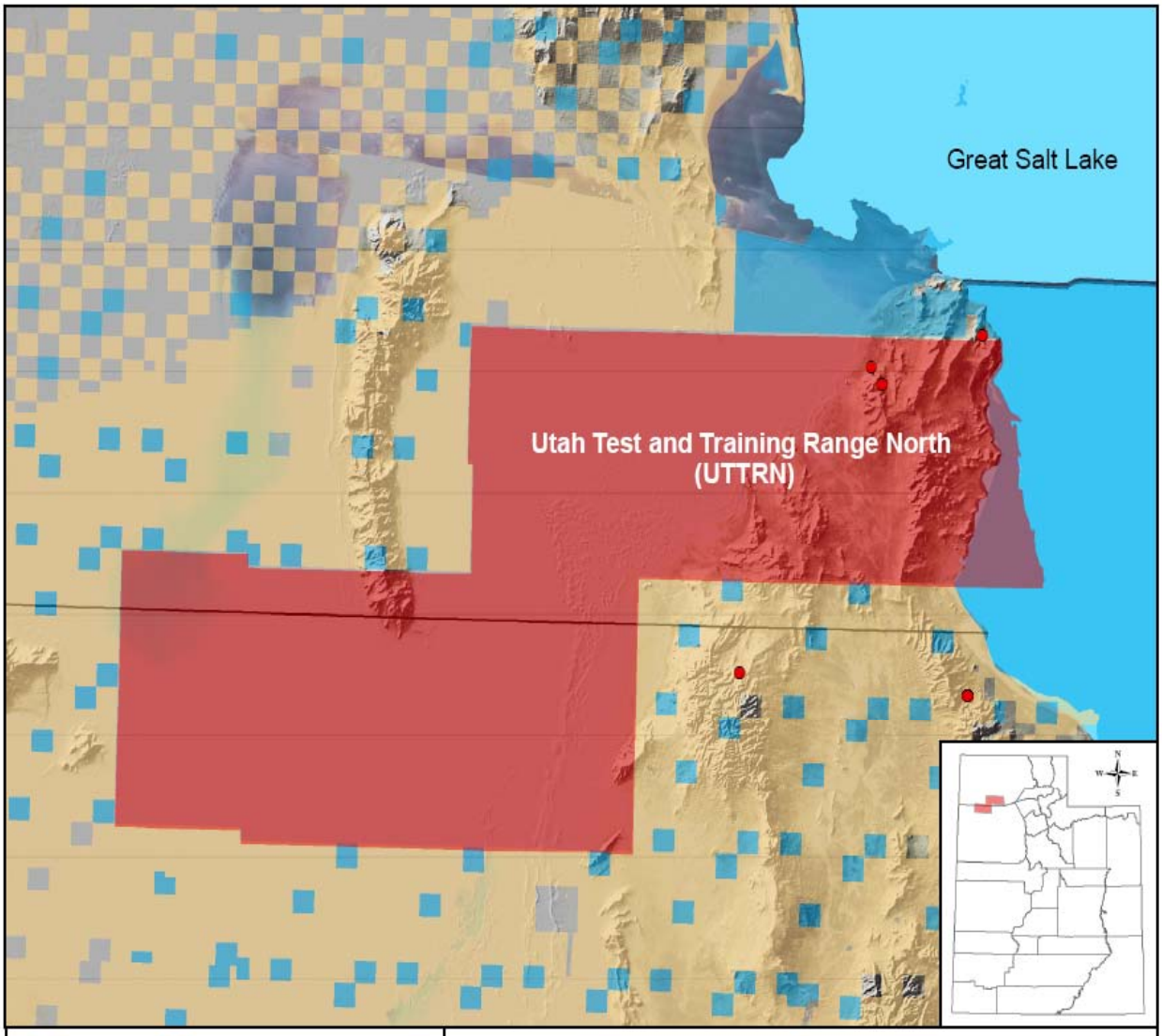
Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	25	0	1
Long-legged myotis	6	0	3
Big brown bat	5	0	4
California myotis	0	1	6
Silver-haired bat	1	0	6
Little Brown myotis	3	0	5
Hoary bat	1	0	6
Long-eared myotis	9	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
8	50	1	

1 - Utah State Sensitive Species (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 6. **Bat Species Occurrence Data for Camp W.G. Williams (Post-Legacy Project, FY2007 #07-346).** Bat occurrence data before and after Legacy Project 07-346 on UNG including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Utah Test and Training Range North (Post-Legacy Project, FY2007 Proj #07-346)



UTTRN
State Lands
BLM
Private property

Bat Occurrence Data (Post-Legacy Project)

Scale

0 1.5 3 6 9 12 Miles

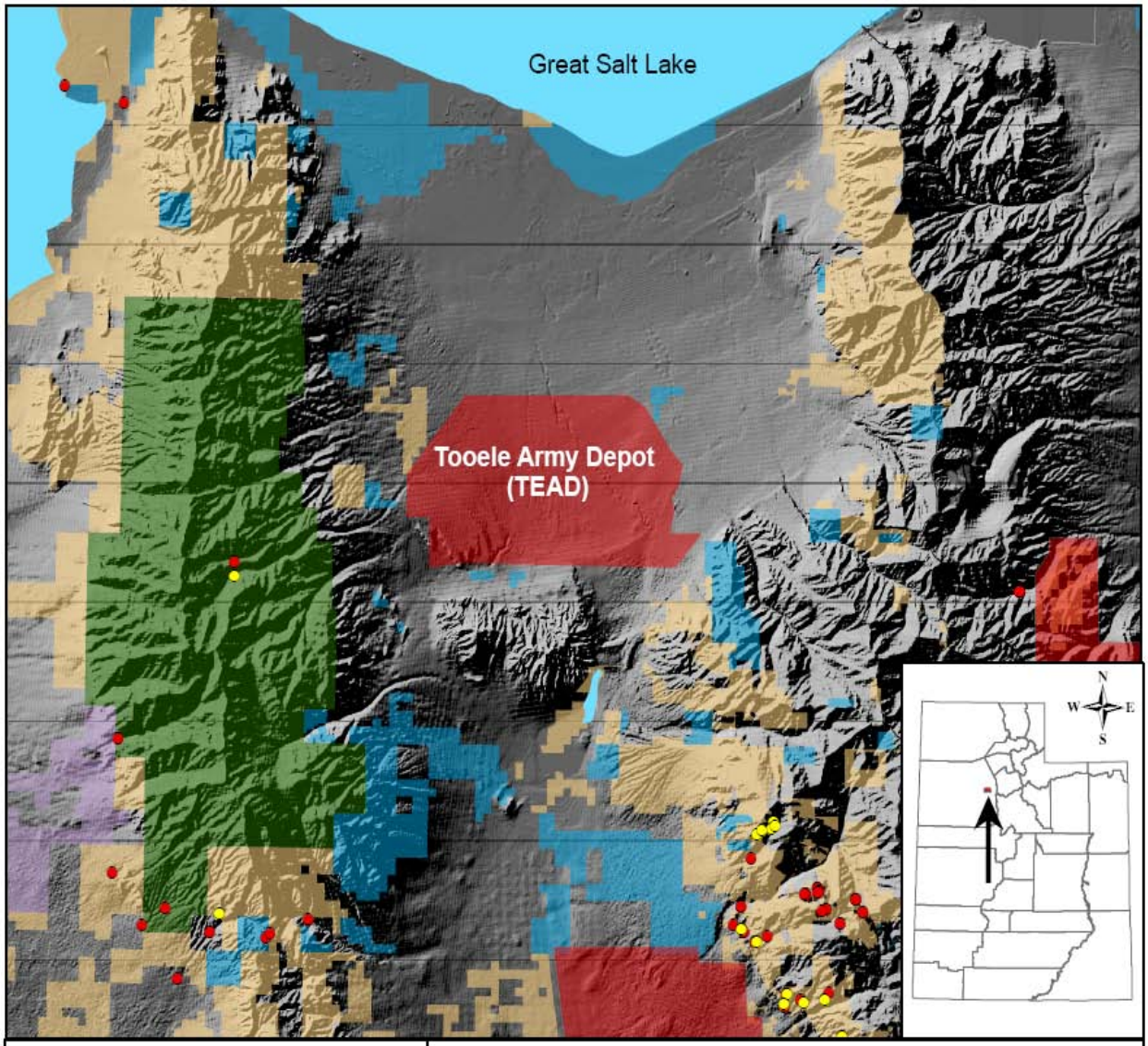
Observed Species Summary for UTTRN

Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Western small-footed myotis	2	2	1
California myotis	1	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
2	3	2	

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 7. **Bat Species Occurrence Data for Utah Test and Training Range North (Post-Legacy Project, FY2007 #07-346).** Bat occurrence data before and after Legacy Project 07-346 on UTTRN including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Tooele Army Depot (Post-Legacy Project, FY2007 Proj #07-346)



Tooele Army Depot
Tribal Lands
USFS
State Lands
BLM
Private property
Bat Occurence Data (Pre-Legacy Project)
Bat Occurrence Data (Post-Legacy Project)

Scale
0 1.25 2.5 5 7.5 10 Miles

Observed Species Summary for Tooele Army Depot

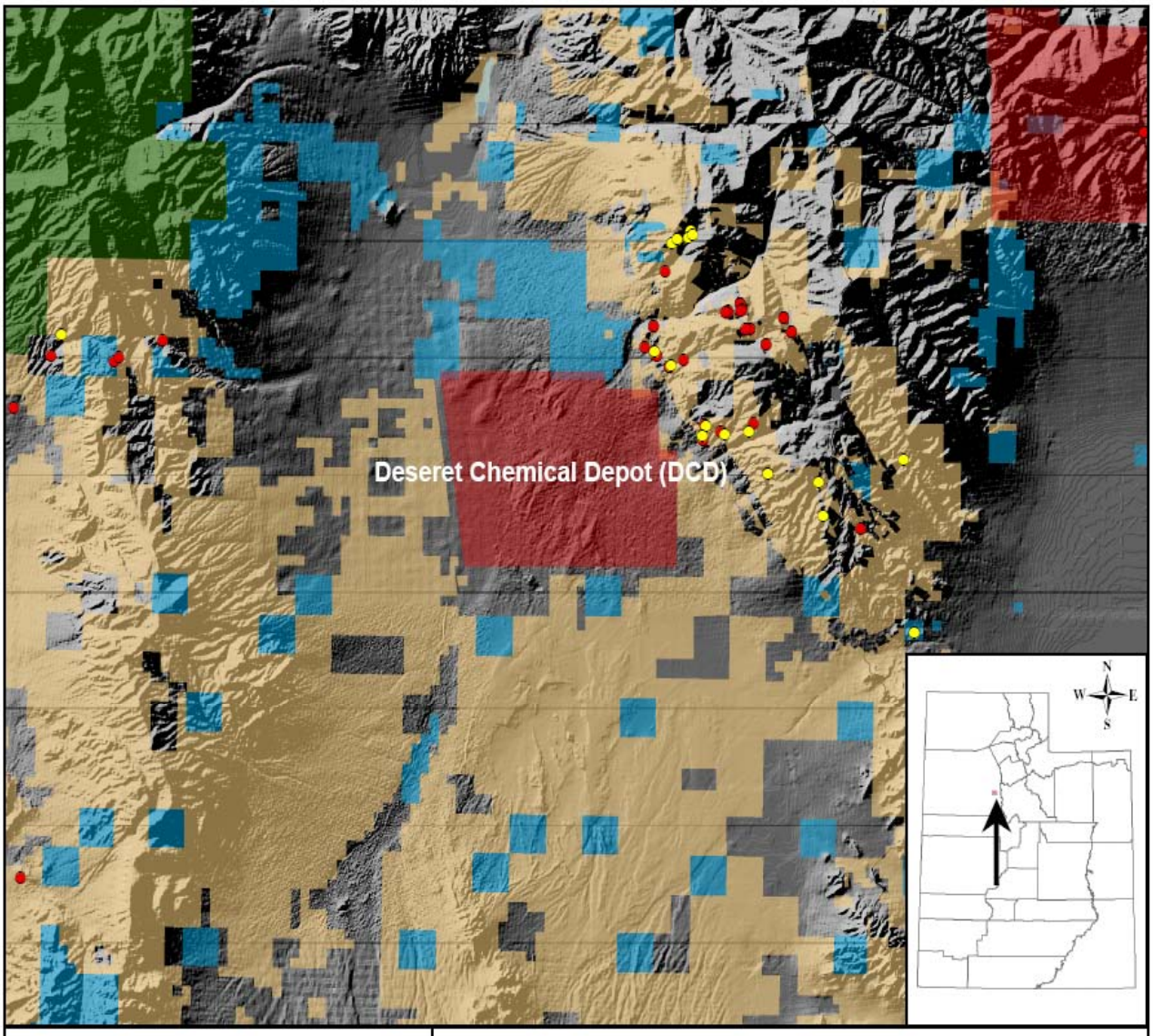
Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	7	0	1
Western small-footed myotis	1	0	2
Total # of Species	**Total # of Sites**		
2	8		

1 - Utah State Sensitive Species (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 8. **Bat Species Occurrence Data for Tooele Army Depot (Post-Legacy Project, FY2007 #07-346).** Bat occurrence data before and after Legacy Project 07-346 on TAD including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Deseret Chemical Depot (Post-Legacy Project, FY2007 Proj #07-346)



Deseret Chemical Depot
USFS
State Lands
BLM
Private property
Bat Occurence Data (Pre-Legacy Project)
Bat Occurrence Data (Post-Legacy Project)

Scale
0 1 2 4 6 8 Miles

Observed Species Summary for Deseret Chemical Depot

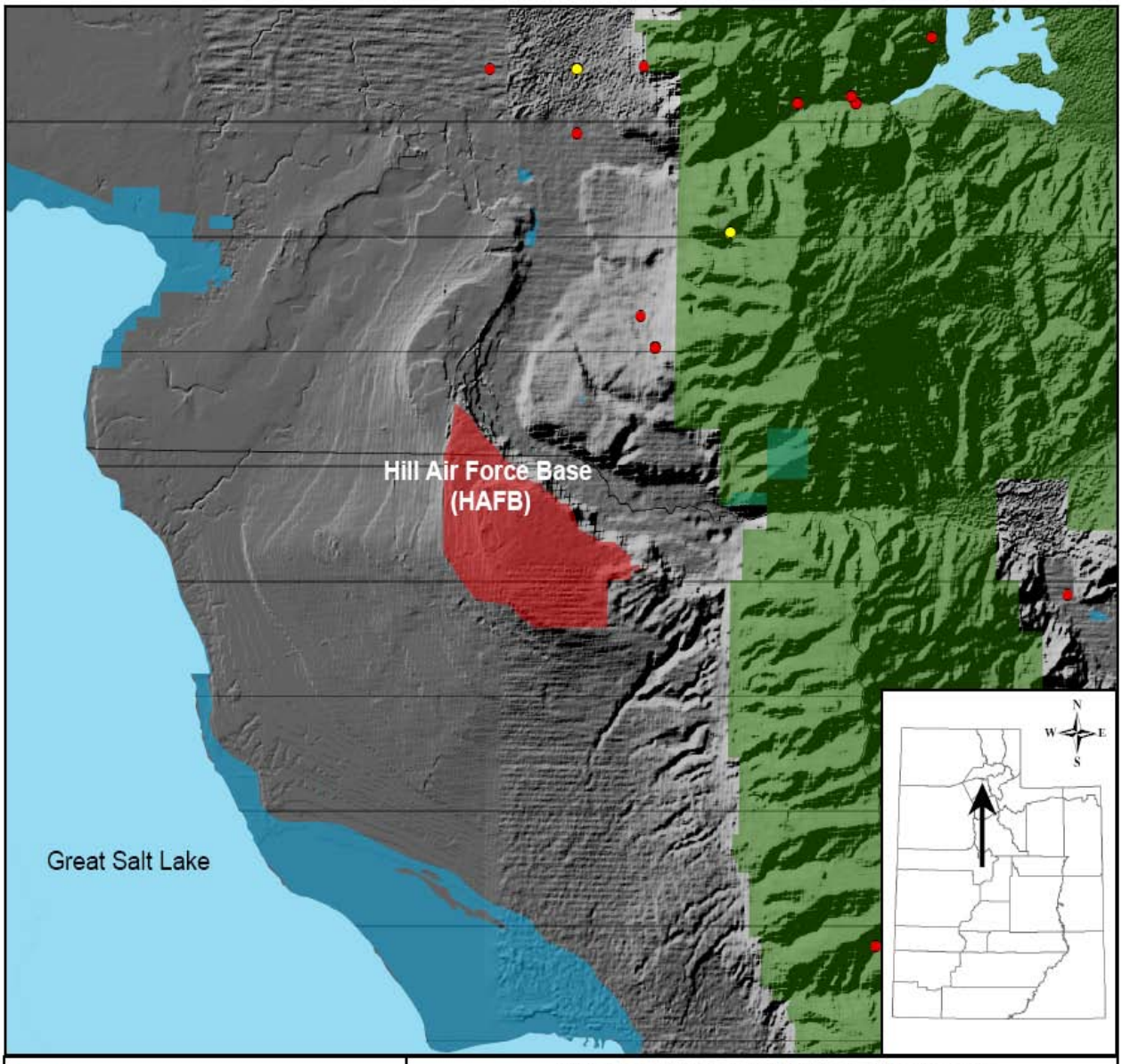
Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	27	0	1
Long-legged myotis	7	0	2
Big brown bat	1	0	4
Silver-haired bat	1	0	4
Western small-footed myotis	6	0	3
Little Brown myotis	1	0	4
Hoary bat	1	0	4
Long-eared myotis	7	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
8	51	0	

1 - Utah State Sensitive Species (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 9. **Bat Species Occurrence Data for Deseret Chemical Depot (Post-Legacy Project, FY2007 #07-346).** Bat occurrence data before and after Legacy Project 07-346 on DCD including species summaries, number of sites, and relative occurrence rank.

Bat Species Occurrence Data for Hill Air Force Base (Post-Legacy Project, FY2007 Proj #07-346)



HAFB
USFS
State Lands
Private property

Bat Occurence Data (Pre-Legacy Project)
Bat Occurrence Data (Post-Legacy Project)

Scale
0 0.5 1 2 3 4 Miles

Observed Species Summary for Hill Air Force Base

Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	1	0	3
Long-legged myotis	1	0	3
Big brown bat	3	0	1
Yuma myotis(2)	1	0	3
Western pipestrelle	1	0	3
Silver-haired bat	1	0	3
Brazilian free-tailed bat	2	0	2
Little Brown myotis	2	0	2
Hoary bat	1	0	3
Long-eared myotis	1	0	3
Total # of Species	**Total # of Sites**	**Total # of Sites**	
10	14	0	

1 - Utah State Sensitive Species (Tier II)
2 - Utah State Sensitive Species (Tier III)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 10. Bat Species Occurrence Data for Hill Air Force Base (Post-Legacy Project, FY2007 #07-346). Bat occurrence data before and after Legacy Project 07-346 on HAFB including species summaries, number of sites, and relative occurrence rank.

In addition to obtaining existing records, data was collected on two of the five DoD installations in the 2007 field season on bat populations. The extent of data collected was limited by several factors discussed in the report presented in Appendix E. The report was created as a deliverable and submitted for this Legacy project. It is presented in its entirely in Appendix E. This new data is not integrated into the figures and tables in this final report due to several factors: location of collection (12 miles from DPG property instead of 10 miles, the cut off for inclusion in the maps), negative data collection (no bats caught), and inconclusive species identification (Anabat file analysis). Negative data will however be included in the BatBase and used for data analyses as this data is just as important as positive (successful bat catching) data.

C. State of Utah Progress

Due to the implementation of this Legacy Project, and the extensive list of supporting partners, nearly all existing bat records (both historical and current) have been gathered for the state of Utah. Overall, bat data available to federal and state managers (i.e., BLM, USFS, NPS, State Lands, and Tribal Lands) increased 25 fold (Figure 11). Table one presents sources of data acquired, number of observed species, number of Utah Species of Concern observed, number of bat occurrences on DoD installations and total number of individuals per data source. Data sources, directly or indirectly, may include data from federal and state agencies, universities, museums, and private contractors and citizens. For example, the UNHP database alone contains data acquired from all data sources listed above. Appendix D contains the separate deliverable containing Table One and introductory information.

Notable partners that are currently absent from this list are the USDI Bureau of Land Management (BLM) and USDA Forest Service (USFS). Although records from BLM and USFS are not currently gathered, representatives from both agencies have agreed to participate in this project and contribute data. BLM personnel are currently searching archives within each field

office in Utah and the lead scientist for the state of Utah has strongly encouraged all BLM biologists to participate. In addition, data collected from six National Forests (Ashley, Sawtooth, Wasatch-Cache, Fish Lake, Dixie, and Manti-LaSal) and one Ranger District (Spanish Fork Ranger District) have been committed to this project. USFS biologists are currently compiling their existing data.

Although data from a few important partners are not currently presented, many records have now been gathered originating on federal, state, and private lands. Bat occurrence data before and after Legacy funding efforts for the five largest landowners as well as military installations in Utah are presented below in Figure 12.

D. Important Bat Habitat Model

In Utah, recent discussions among state and federal agencies have recognized the identification of important bat habitat in Utah as core information necessary to coordinate and prioritize statewide efforts and provide perspective to historical datasets (UBCC, personal comm). With five DoD facilities in Utah it remains crucial to prioritize efforts to identify important bat habitat to direct conservation management within DoD installations. As a critical element of a statewide Bat Conservation Strategy, UDWR and The Nature Conservancy (TNC) developed a habitat suitability model to identify important bat habitat in Utah. This model:

1. Identifies distribution, quantity, and quality of suitable bat habitat in Utah.
2. Allows federal, state, and military land managers to identify landscape characteristics that promote or limit potential use by bats.
3. Serves as a foundation for future cooperative bat research and management efforts in the state.
4. Provides a process template other Western states can implement to identify and manage their important bat habitat.

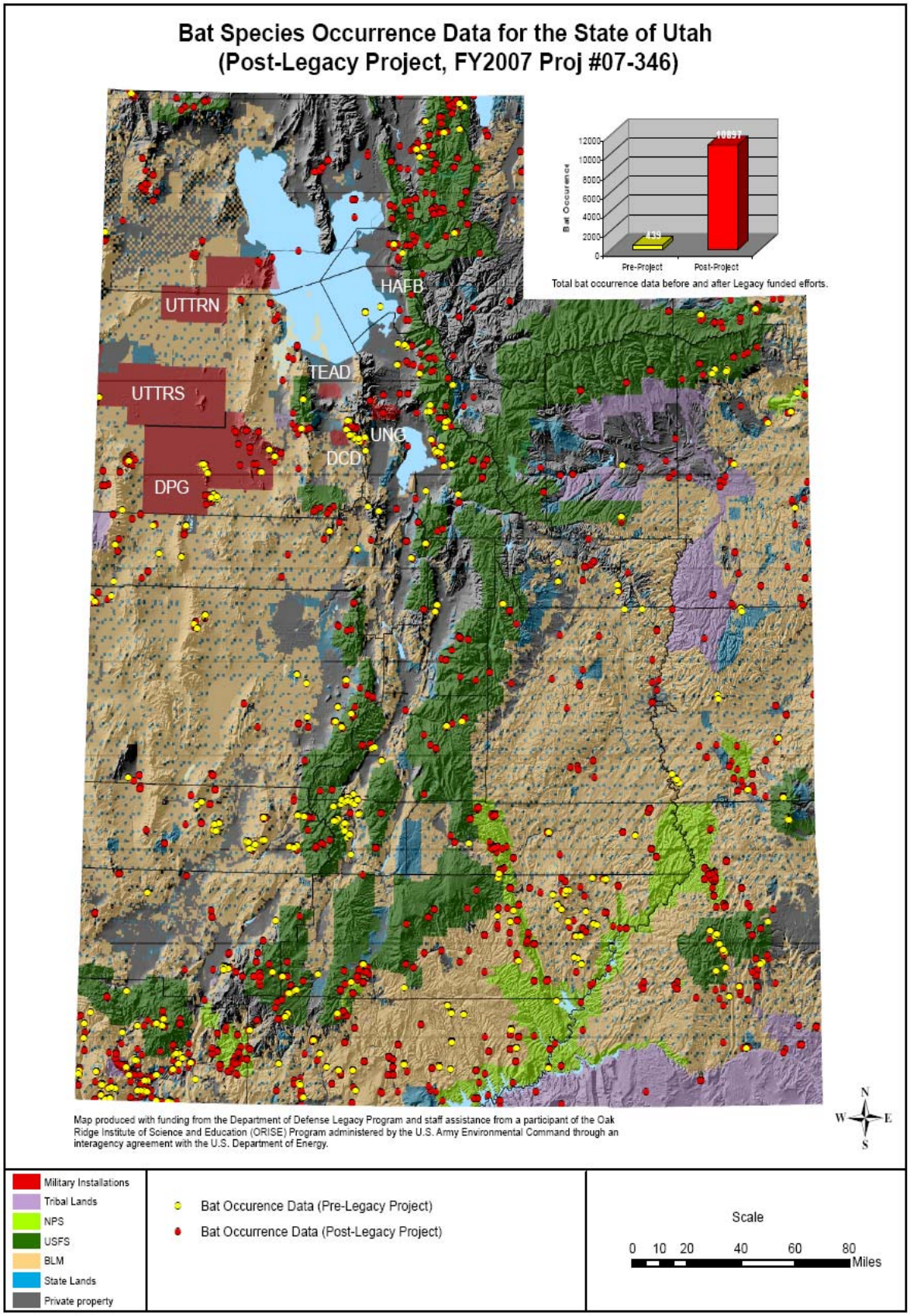


Figure 11. Bat Species Occurrence Data for the State of Utah (Post-Legacy Project, FY2007 #07-346). Bat occurrence data before and after Legacy Project 07-346 with the six largest landowners represented in the state of Utah. One occurrence includes data for at least one individual bat, but may include information for multiple individuals and/or multiple species.

Table 1. **Inventory for Consolidated Bat Data Post-Legacy Project 07-346.** Data sources, description of data acquired, and numbers of individual bats recorded. Dates range from the earliest record to the most recent for each data source.

Data Source	Dates	Number of Species	Number of Utah Species of Concern	Number of Occurrences on DoD lands	Number of Individuals
Pre-Legacy Project					
Utah Natural Heritage Program	1933-2007	6	6	8	**2373**
Post-Legacy Project					
Private Contractor / Joel and Gabby Diamond	2002	4	0	0	128
Ageiss Environmental, INC. / DPG-U.S. Army	1995-1996	10	2	8	148
JBR Environmental Consultants	2002	9	0	0	acoustic detections
Chicago Field Museum	1910-1940	2	0	0	2
LSU Museum of Natural History	1964	1	0	0	1
Royal Ontario Museum	1935-1936	1	1	0	4
L.A. County Museum of Natural History	1965-1978	4	0	0	4
Michigan State University	1935	1	1	0	2
Univ. of Michigan Museum of Zoology	1936-1999	2	1	0	14
Brigham Young University	1998	1	1	0	1
Utah Division of Wildlife Resources	1987-2007	17	6	1	3988
Private Contractor / Brad Lengas	1891-1997	18	6	113	7325
Utah State University		4	0	1	11
Southern Nevada Water Authority	2005	12	1	0	acoustic detections
Certificate of Registration Data (COR)	1995-2006	16	4	2	514
Certificate of Registration Data (COR)	2006	3	0	0	8
Certificate of Registration Data (COR)	1997	1	0	0	2
Certificate of Registration Data (COR)	1998	2	0	0	5
Certificate of Registration Data (COR)	1997	3	0	0	5
Certificate of Registration Data (COR)	1995-1996	10	1	0	53
Certificate of Registration Data (COR)	1998-2001	9	3	0	31
Certificate of Registration Data (COR)	1996	10	2	0	222
Certificate of Registration Data (COR)	1996	6	0	0	30
Certificate of Registration Data (COR)	1995	4	1	0	45
Certificate of Registration Data (COR)	1996-1998	8	3	0	113
Certificate of Registration Data (COR)	1999	5	1	0	74
Certificate of Registration Data (COR)	1999	7	2	0	21
Certificate of Registration Data (COR)	2004	4	4	0	16
Certificate of Registration Data (COR)	2003-2005	11	2	0	304
Certificate of Registration Data (COR)	1999	6	3	0	46
Publication	1998	8	3	0	54
Publication	1998	12	4	0	534
Publication	1999	9	4	0	166
Publication	1999	10	4	0	260
Publication	1997	15	5	0	300
Publication	1997	16	5	0	611
Publication	1997	15	5	0	555
Utah Division of Oil, Gas, and Mining	1996-2003	5	1	0	668
Utah State University	1999	1	0	0	3
Utah Division of Oil, Gas, and Mining		7	3	0	51
National Park Service	2001-2005	17	5	0	2735
Hill Air Force Base, U.S. Air Force		5	0	13	104
Total		**18**	**6**	**146**	**21,531**

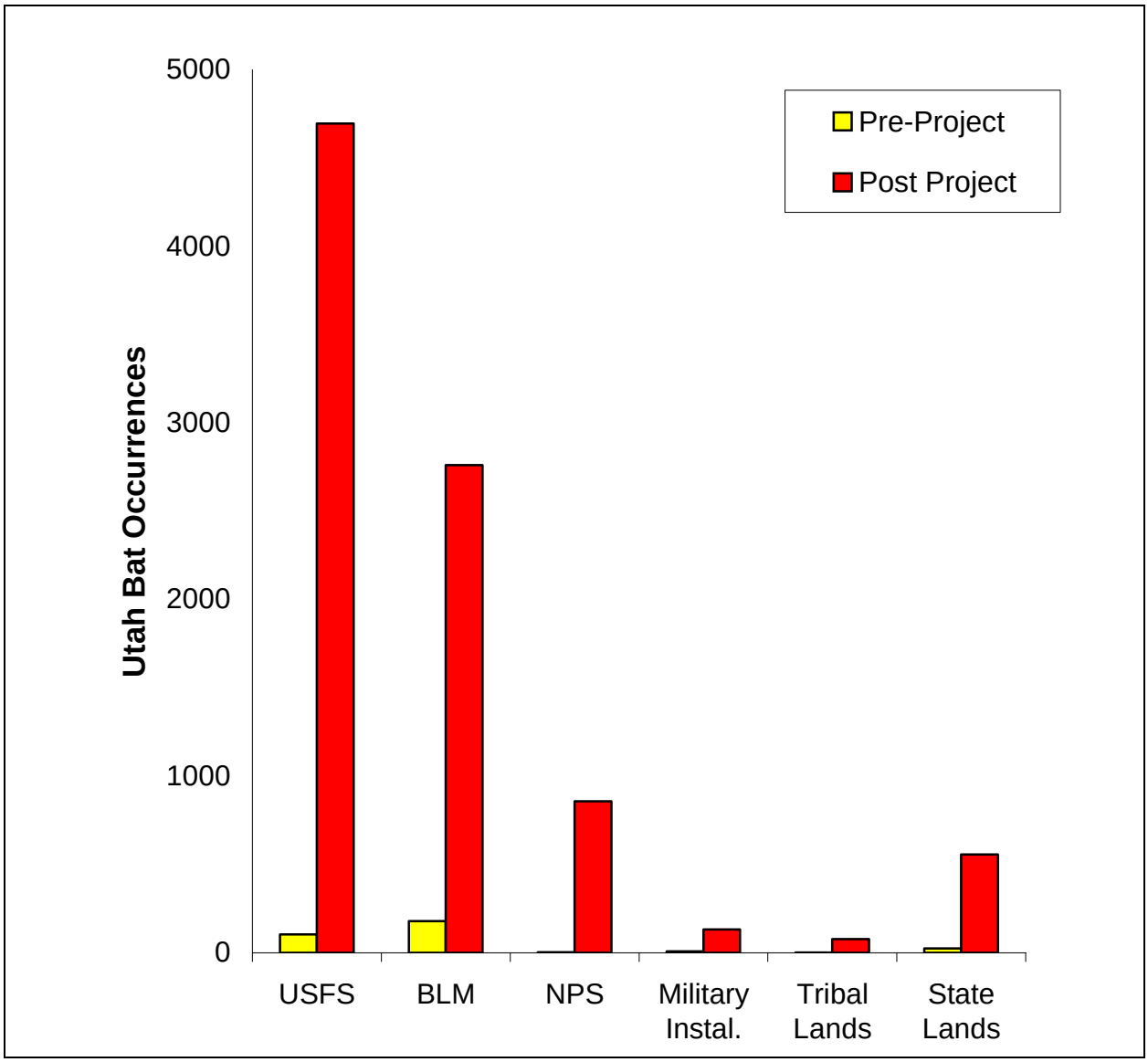


Figure 12. Legacy Project 07-346 Contribution to Bat Data in Utah by Land Owner. Bat occurrence data before and after Legacy Project 07-346 by the six largest landowners in the state of Utah.

The UBCC representing 14 public agencies and private organizations, has identified this effort as imperative for defining habitat resource values of Utah's bats and the key factor around which future statewide inventory and monitoring efforts will be conducted.

Furthermore the development of the *Important Bat Habitat Model*, in addition to positively influencing the future of bat conservation and research in Utah, also supports the priority research actions identified in the North American Bat Conservation Partnership (NABCP) Strategic Plan and will contribute significantly to Utah's Statewide Bat Conservation Strategy and DoD monitoring protocols that will be developed with a FY2008 Legacy grant. Specifically, the model is designed to identify and rank roosting and foraging habitat based on the suitability of key resources for bats, thereby allowing land managers to identify the biotic and abiotic characteristics affecting an area's potential use. We believe that identifying the magnitude and character of limiting factors will lead to more efficient use of Utah's conservation resources.

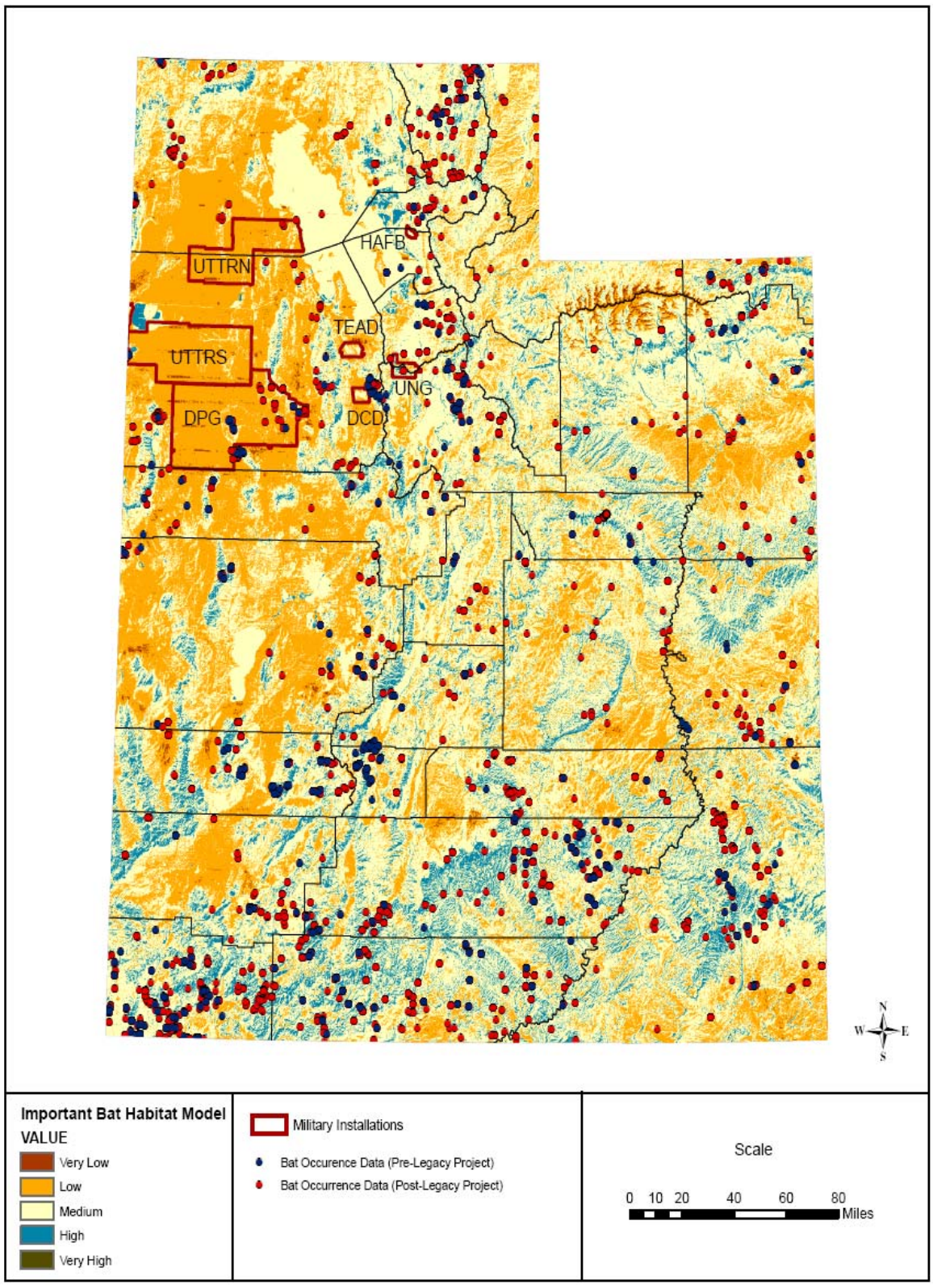
In addition to the direct benefits of the model, indirect effects of the model's development are expected to be far reaching. The *Important Habitat Model* will provide a vital base layer against which to analyze past and future inventory and monitoring surveys, quantify the effects of current land management practices and disturbances on bats, and provide Utah and all of its cooperators with a data model upon which to set priorities, collaborate on objectives, and emphasize system health. Additionally, the model and its process will be eminently portable and scalable, facilitating the expansion of the modeling effort into neighboring states, forests, or districts. Review and refinement of this model are still on-going; the FY2008 Legacy funded project from DPG contains this model as a deliverable once real data (collected with this current grant) has been integrated into it.

The habitat suitability model identifying important bat habitat throughout Utah was constructed following the methods of Keinath (2004). To start, all geographically referenced electronic data delineating six key resources for bats were collected and compiled for analysis in a Geographic Information System (GIS). As identified by Keinath (2004), key landscape level

resources important to bats include wetland distribution, vegetative land cover, bedrock geology, elevation, and topographic relief (slope and aspect). After acquisition, raster (grid) coverages were generated from each key resource layer to facilitate the scoring and weighting of each 100 m x 100 m cell. An algorithm was used to compile scores and weights into a final value of habitat suitability for bats within every 100 m cell in Utah. The higher the suitability value of the cell, the more likely it contains habitat characteristics that support a healthy community of bats. A proven tool, this method has already been used successfully to develop an inventory of bat species in the Greater Yellowstone Region (Keinath 2001, 2004). Project outputs include an ArcGIS shapefile ranking the suitability of bat habitat in Utah (Figure 13) including for each Utah military installation (Figure 14). All bat occurrence data gathered for Legacy Project 07-346 is presented to illustrate previous bat research that has occurred within different habitat qualities.

According to the *Important Bat Habitat Model*, 64% of DoD land in Utah could be described as having low quality habitat for bats (Figure 15). In contrast, values vary across installations (Figure 16) with up to 26% of UNG land ranked high for bat habitat quality. DCD, HAFB, and UNG contain significantly higher medium habitat values within their boundaries. However, with FY 2008 Legacy funding, bat occurrence data obtained from FY 2007 will be used to test and validate the *Important Bat Habitat Model* to verify habitat values for each DoD installation as well as for the entire state of Utah.

Construction of the Important Bat Habitat Model by UDWR and TNC was facilitated by already existing partnerships within the UBCC and this Legacy funding. Members of this group include USFWS, USFS, BLM, DoD, National Park Service, USDA NRCS, UDOGM, UTDPR, Utah Energy Office, TNC, Rocky Mountain Power, and Kennecott Copper, USU, and SUU. Backed by such mutual support, this model will become an integral part of the Utah Bat Conservation Strategy and DoD bat monitoring protocols.



Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Figure 13. Important Bat Habitat Model for the State of Utah. Important Bat Habitat Model for the State of Utah and bat occurrence data before and after Legacy Project 07-34.

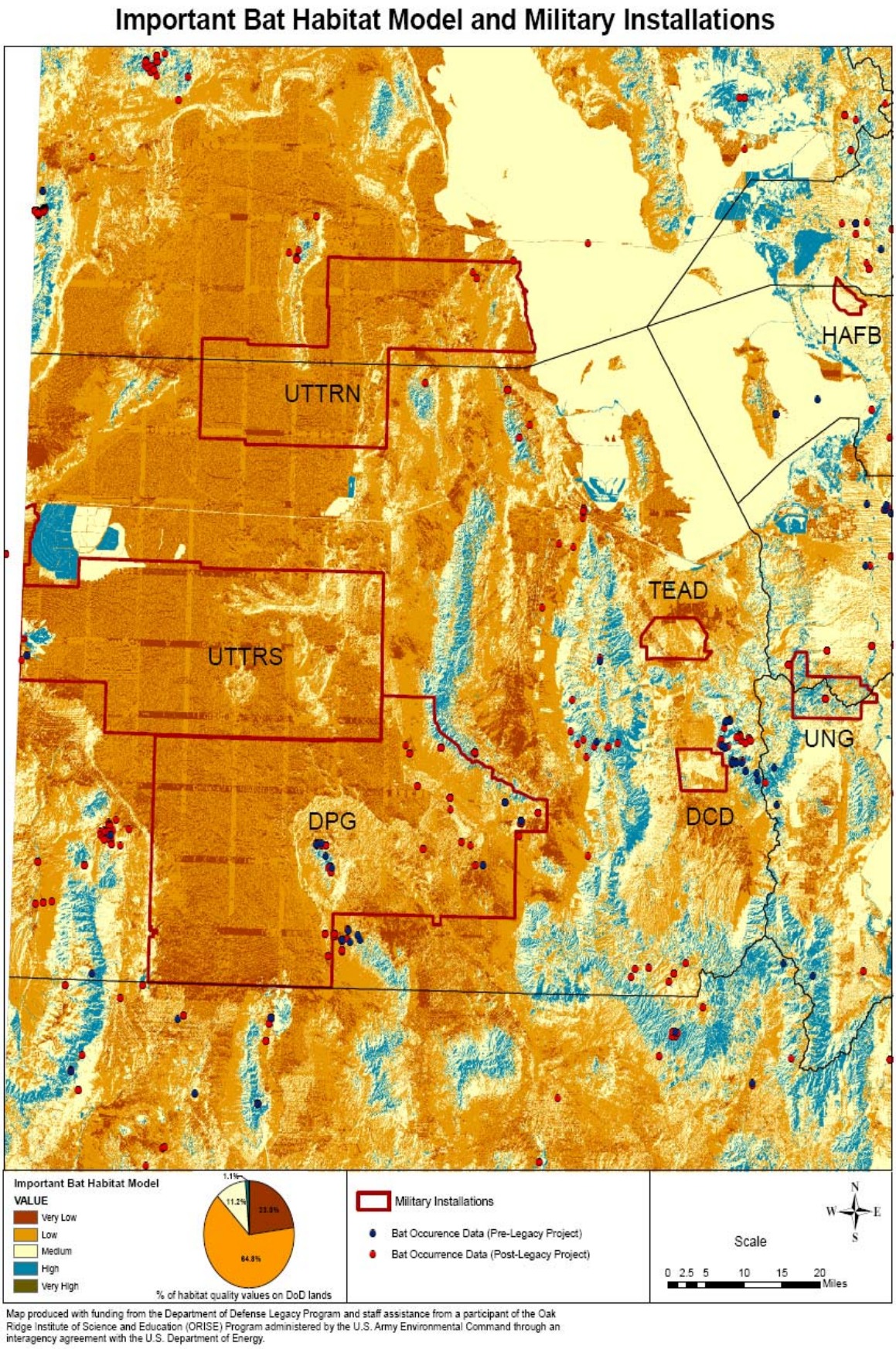


Figure 14. **Important Bat Habitat Model and Military Installations.** Important Bat Habitat Model for Utah DoD installations and bat occurrence data before and after Legacy Project 07-346.

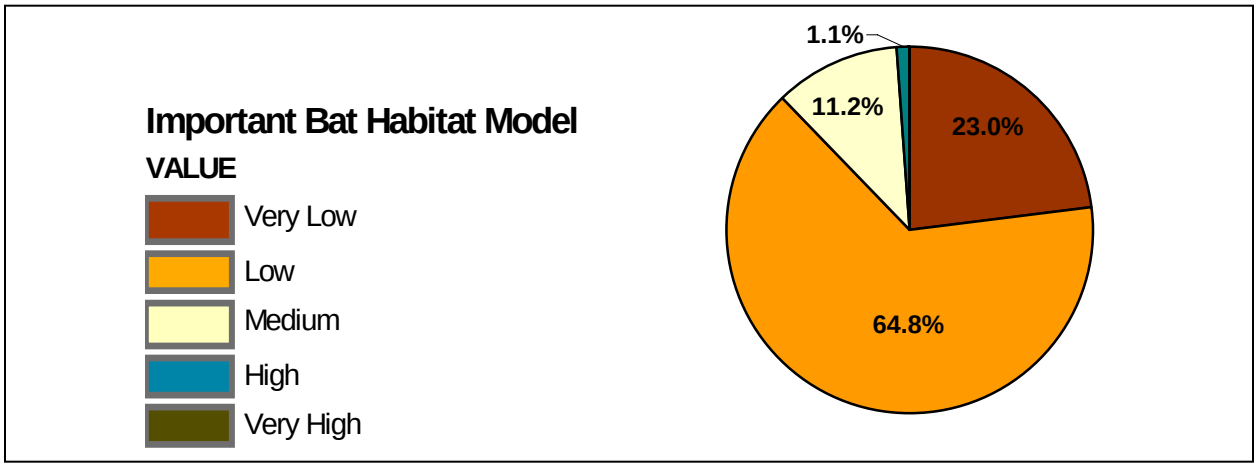


Figure 15. Important Bat Habitat Model Value Percentages for Military Installations in Utah. Total percentage of habitat values from the Important Bat Habitat Model on all DoD installations in Utah.

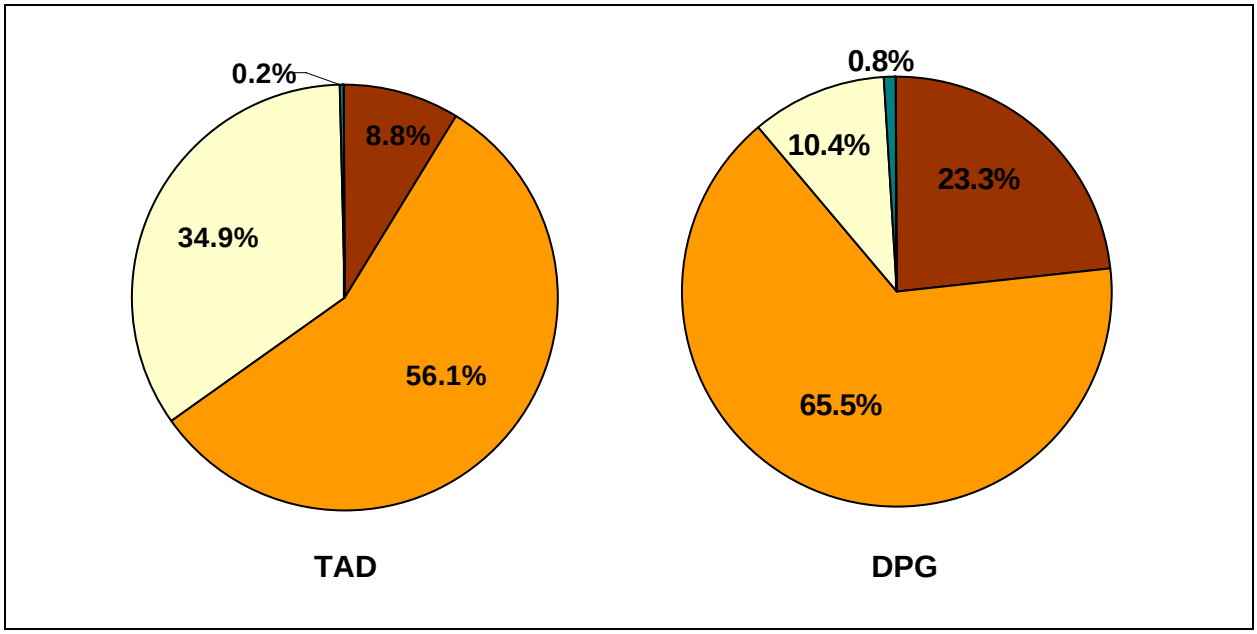


Figure 16. Important Bat Habitat Model Value Percentages for Individual Military Installations in Utah. Percentage of habitat values from the Important Bat Habitat Model on each DoD installation in Utah.

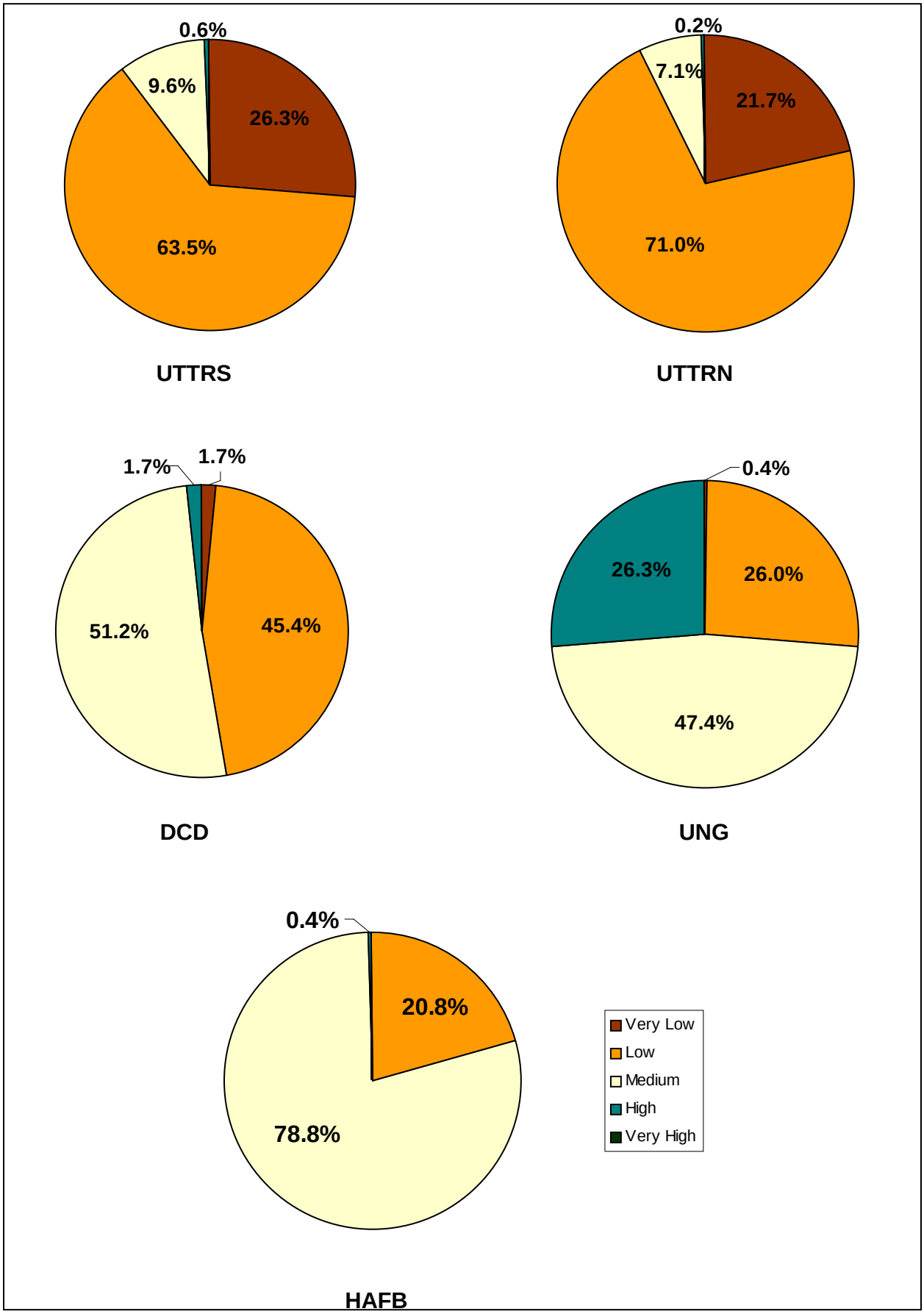


Figure 16 (continued). Important Bat Habitat Model Value Percentages for Individual Military Installations in Utah. Percentage of habitat values from the Important Bat Habitat Model on each DoD installation in Utah.

V. NEXT STEPS

Through the B2C2 and UBCC this group of partners coordinated extensively to complete Legacy Project 07-346 that created the Utah BatBase and the *Important Bat Habitat Model*.

Future action to be coordinated through these groups is the integration of conservation objectives and plans over all the land managing agencies. With the funded FY08 Legacy project (submitted by DPG), these groups will work together to integrate existing Integrated Natural Resource Management Plan (INRMP) and State Wildlife Action Plan (WAP) goals and objectives throughout the state to ensure coverage for all 18 species of Utah's bats and in particular its 6 sensitive bat species. Integrated goals and objectives would be incorporated within existing INRMPs as part of the Sikes Act mandated 1-year update process. This 2008 proposal will serve as the second year of an ongoing collaborative partnership effort to cooperatively manage 18 species of bats at state-wide level, 100% inclusive of all DoD lands within the State of Utah. Cumulative benefits of the analysis of the BatBase's contents and its application to state cooperative efforts include the greater use, applicability, and therefore long-term value of the BatBase deliverable from 2007.

The next steps funded in FY2008 are to:

1. Work with regional and state-wide partners to integrate existing INRMPs and the State WAP goals and objectives throughout the state to facilitate mutually beneficial aspects for all 18 species of bat,
2. With the help of national bat experts, create a statistically-defensible data collection protocol based on conservation objectives (currently lacking) that will be implemented in all regions of the state to standardize bat data collection, improve usability and comparability of data, and address future listing concerns,

3. Create measurable conservation objectives to address data vulnerabilities identified during the data gap analysis of the Legacy funded Utah BatBase and the risk and threats assessment in Utah' s WAP,
4. Conduct an analysis of the populated BatBase to identify data gaps potentially inhibiting development of conservation strategies for Utah's 18 species of bats,
5. Update and improve upon the state's existing *Important Bat Habitat Model* (v 2.0, BHM) to incorporate data stored in the BatBase, and
6. Cooperate with the State in integrating INRMP Range and Test Grid sustainability and management objectives within a jointly funded Utah Bat Conservation Plan (started by the UDWR already but held up by a lack of funding). This document will be approved by the state Wildlife Board and RAC process and will contain conservation objectives, protocol, and an innovative State of Bats report that addresses all known information and data vulnerabilities for each species based on the UBD data gap analysis.

This six-step project will continue the work started by this project (Legacy 07-346), will enhance DoD's understanding of the status of 18 species of bats in Utah, will lead the way in creating measurable conservation objectives for the 6 species currently designated as state sensitive, and provide the funding to work with national experts and regional working groups to provide Utah partners with standardized survey protocols. An understanding of bat population status coupled with established, statistically based data collection protocols and a state-wide database for data consolidation will allow DoD land managers to make educated decisions about command liability without extensive, exhaustive, and expensive surveys. Regional and state-wide knowledge of population health will allow DoD managers to approve and support testing and training activities with minimal input or survey work for bats with increasing or stable populations. For those species whose populations are declining, early detection, action and management of species on DoD lands will allow the continued use of testing and training areas

without restrictions. If declining populations are managed on a state-wide level, DoD activities will not have a significant impact on population stability with proper coordination with state and federal agencies and members of the B2C2 and UBCC.

APPENDICES

VI. a. APPENDIX A: Legacy Project 07-346 Fact Sheet

Department of Defense Strategy to Support a Multi-Agency Bat Conservation Initiative Within the State of Utah

Project # 07-346

Background:

A total of 18 bat species are known from Utah, 6 or 30% are considered state sensitive species. Very little information was known on the distribution or population status of bats in the state, and the information that did exist was widely scattered and often inaccessible. That lack of information made it difficult to identify and address statewide management issues related to the conservation of bats. With five Department of Defense (DoD) facilities in Utah, whose management authority extends over 1.8 million acres, it was crucial to identify distribution, frequency of occurrence and gross-level timing to prevent encroachment and listing issues related to the lack of conservation management of bats in Utah.

Objective:

The DoD, as part of a collaborative partnership of 14 individual public, private, state, federal, and commercial organizations sought to identify the distribution, quantity, and quality of existing data on bats in Utah. That goal was a critical step in achieving the overarching objective of ensuring the conservation and management of bats in Utah. Currently no species of bat is considered threatened or endangered and it is hoped that through sound science and conservation measures federal listing can be precluded. Additionally, a firm understanding of occurrence on DoD lands augments sustainable range initiatives through DoD.

Photo by Kimberly Asmus, State Biologist

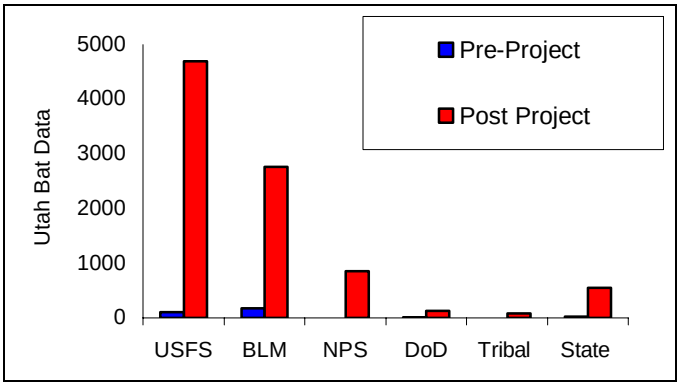
State Sensitive Fringed Myotis (*Myotis thysanodes*) caught 12 miles from Dugway Proving Ground.

Summary of Approach:

With funding from the Legacy Resource Management Program, a biologist was hired to conduct an exhaustive search for bat data held by federal and state agencies, universities, contractors, and non-profit groups within Utah. A programmer was also contracted to produce a web-compatible database which could store and manage all known bat data. Expert opinion workshops were held to build a GIS habitat model which was then used to help guide data collection efforts on DoD lands.

Benefit:

Identification and description of state-wide data yielding invaluable trends and patterns throughout DoD training ranges and state and private recreation lands benefited all collaborators. It substantially benefited the military through better understanding of the biological needs of bats, which directly promotes sound stewardship initiatives developed cooperatively between State wildlife and DoD land managers.



Available data for the six largest landowners within Utah before and after data consolidation efforts.

Accomplishments:

A comprehensive, mineable geodatabase was created that is capable of both storing all known historic bat data as well as facilitating the coordination of future data management. To date this database has been populated with data on over 20,000 individual bats. Records of bats captured on or near DoD facilities were identified and further acoustic and mist-netting surveys occurred on military installations. Additionally, with the support of numerous partners, an *Important Bat Habitat* GIS model was created which identifies high-quality bat sites. Together, these steps serve as a foundation for future cooperative bat research and management efforts within Utah targeting DoD testing and training lands.

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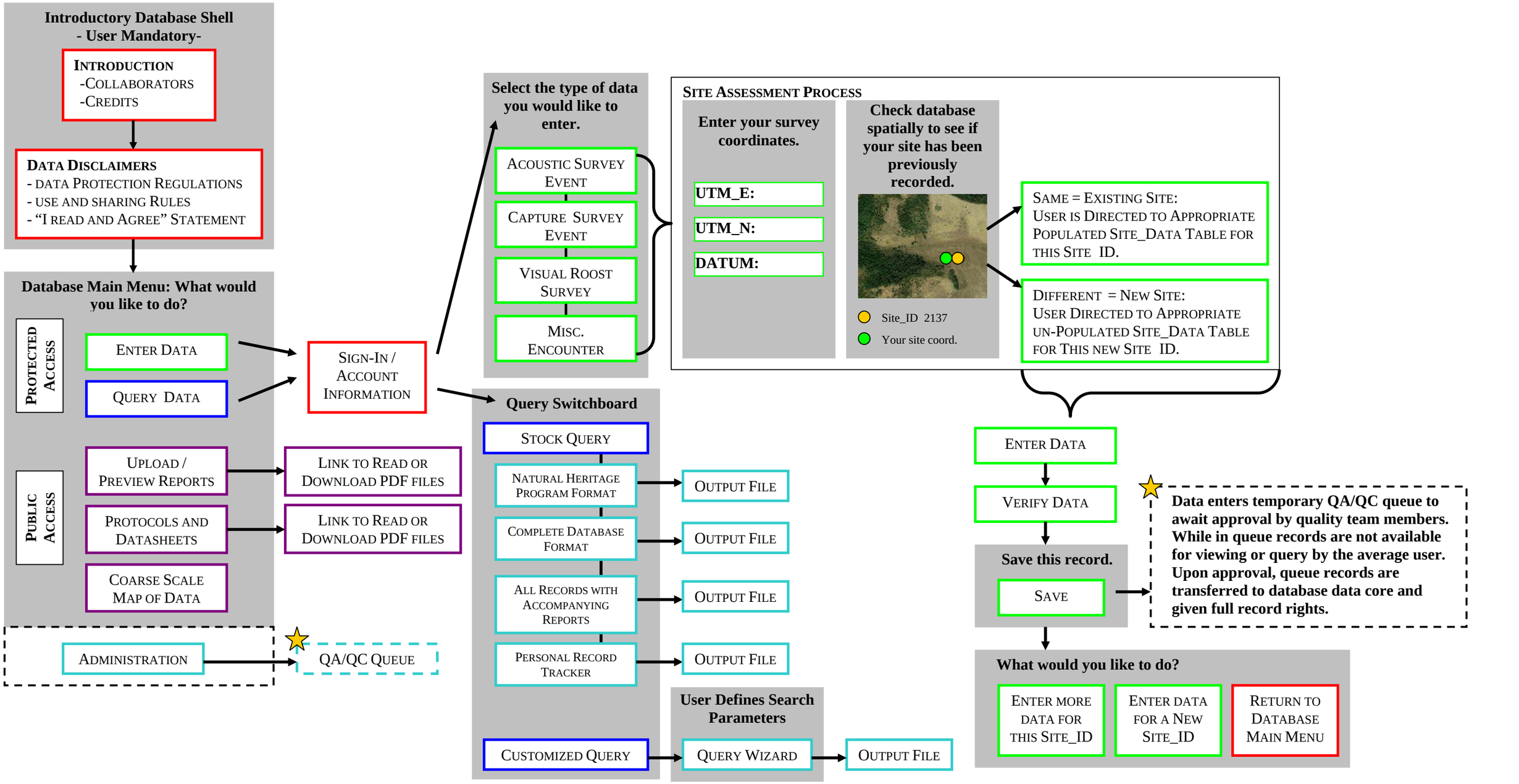
VI. b. APPENDIX B: Database Framework, Relationships and Outline

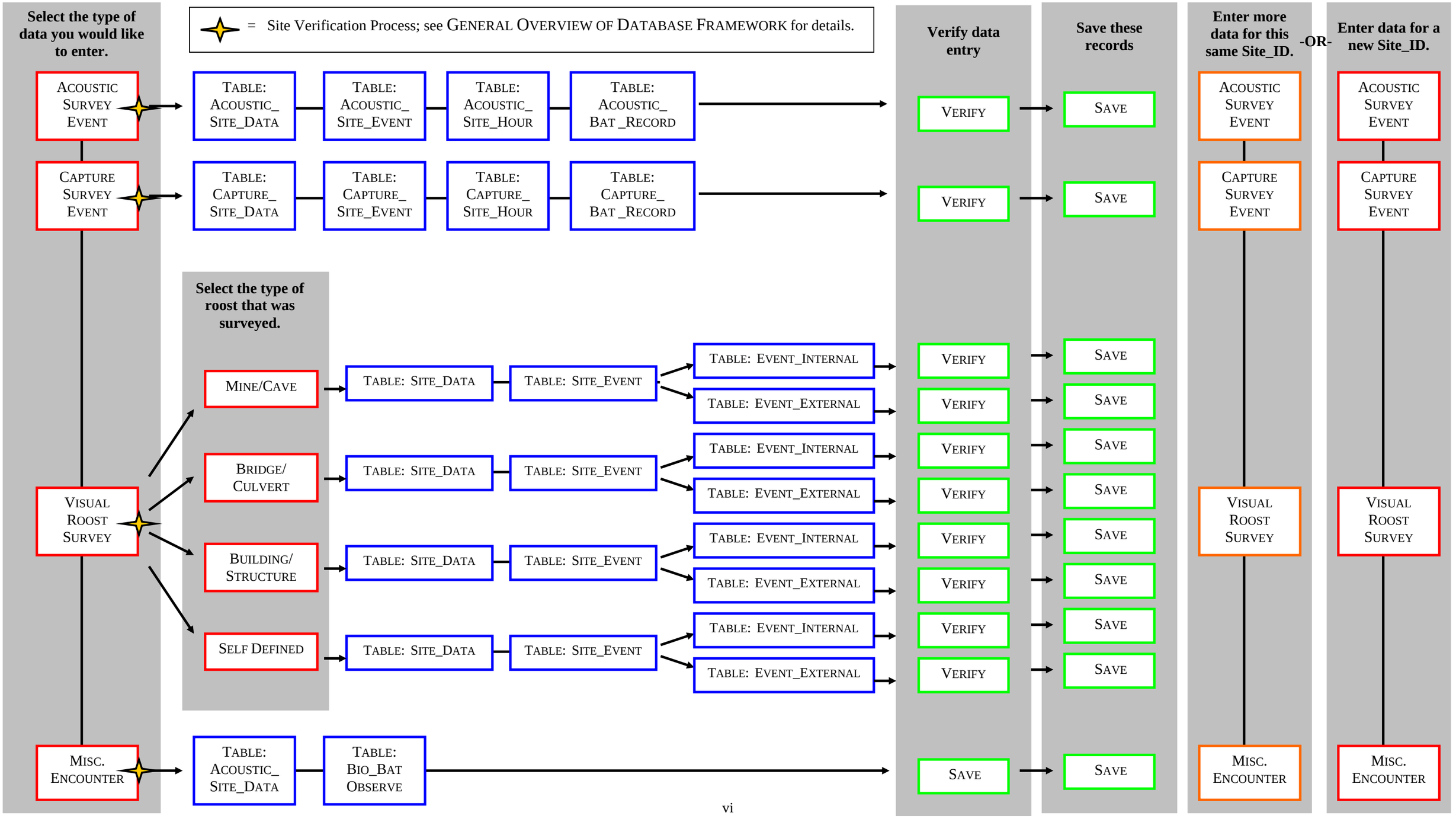
UTAH BATS DATABASE: GENERAL OVERVIEW OF FRAMEWORK

Purpose: This diagram represents a site map of the Utah Bat Database and role of the database user in navigating through them.
Grey areas and their headings represent areas where users will be asked for input to facilitate their navigation through the database.
More detail on the inter-relationships of the Database's survey forms (Acoustic, Capture, Roost, and Misc.) can be found on the Form and Table Relationship General Overview.
Detailed descriptions of the forms, their tables, and in turn their fields are available in the Form Outline and Data Dictionary documents.

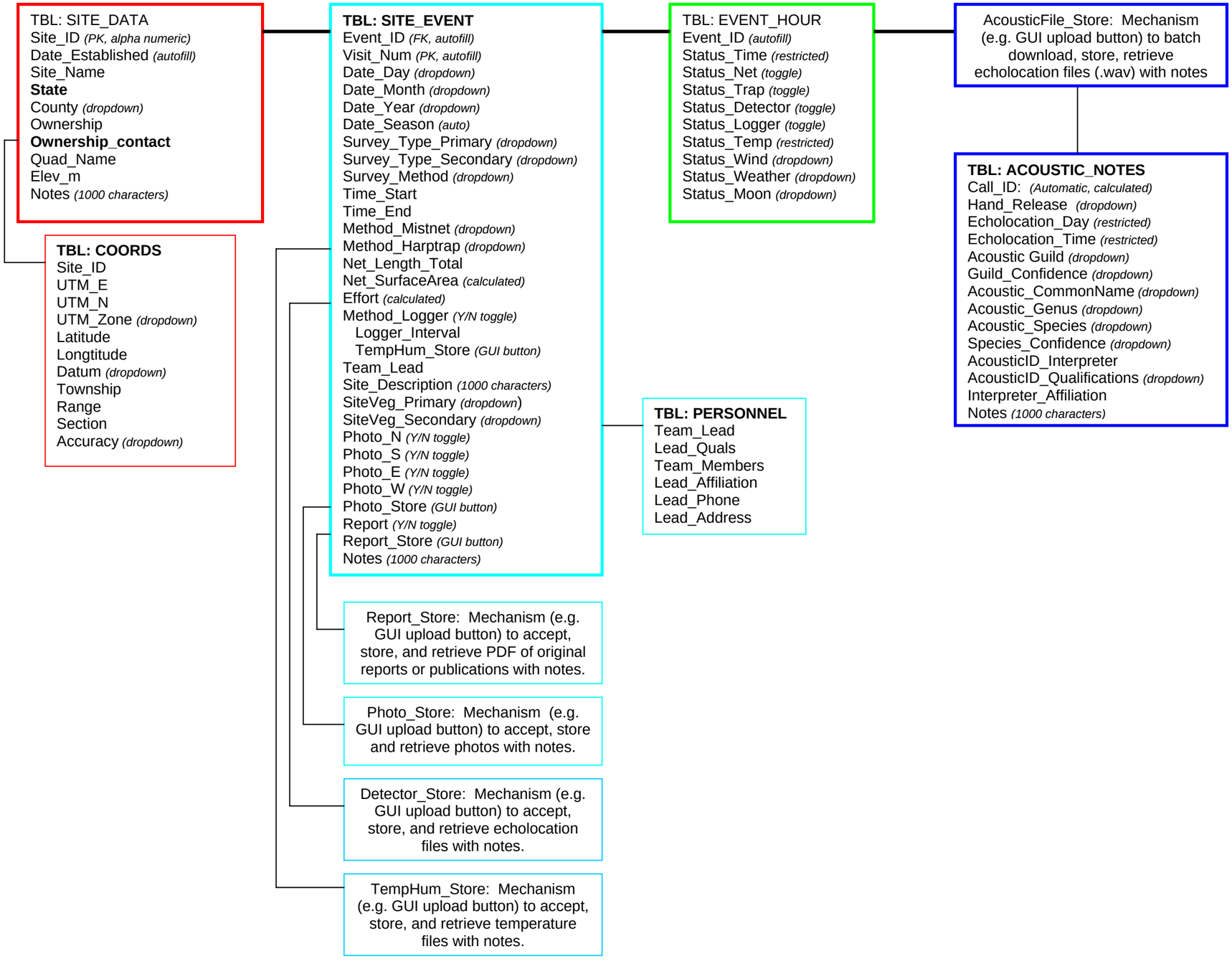


Utah Bats Database: Form and Table Relationship General Overview

Purpose: This diagram represents the inter-relationships of the Utah Bat Database's survey forms (Acoustic, Capture, Roost, and Misc) and role of the database user in navigating through them.
Grey areas and their headings represent areas where users will be asked for input to facilitate the forms and tables that are presented for data entry.
Detailed descriptions of the forms, their tables, and in turn their fields are available in the Form Outline and Data Dictionary documents.



FORM OUTLINE: ACOUSTIC SURVEY EVENT



FORM OUTLINE: CAPTURE SURVEY EVENT

TBL: SITE_DATA
Site_ID *(PK, alpha numeric)*
Date_Established *(autofill)*
Site_Name
State
County *(dropdown)*
Ownership
Ownership_contact
Quad_Name
Elev_m
Notes *(1000 characters)*

TBL: COORDS
Site_ID
UTM_E
UTM_N
UTM_Zone *(dropdown)*
Latitude
Longtitude
Datum *(dropdown)*
Township
Range
Section
Accuracy *(dropdown)*

TBL: SITE_EVENT
Event_ID *(FK, autofill)*
Visit_Num *(PK, autofill)*
Date_Day *(dropdown)*
Date_Month *(dropdown)*
Date_Year *(dropdown)*
Date_Season *(auto)*
Survey_Type_Primary *(dropdown)*
Survey_Type_Secondary *(dropdown)*
Survey_Method *(dropdown)*
Time_Start
Time_End
Method_Mistnet *(dropdown)*
Method_Harptrap *(dropdown)*
Net_Length_Total
Net_SurfaceArea *(calculated)*
Effort *(calculated)*
Method_Logger *(Y/N toggle)*
  Logger_Interval
  TempHum_Store *(GUI button)*
Team_Lead
Site_Description *(1000 characters)*
SiteVeg_Primary *(dropdown)*
SiteVeg_Secondary *(dropdown)*
Photo_N *(Y/N toggle)*
Photo_S *(Y/N toggle)*
Photo_E *(Y/N toggle)*
Photo_W *(Y/N toggle)*
Photo_Store *(GUI button)*
Report *(Y/N toggle)*
Report_Store *(GUI button)*
Notes *(1000 characters)*

Report_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve PDF of original reports or publications with notes.

Photo_Store: Mechanism (e.g. GUI upload button) to accept, store and retrieve photos with notes.

Detector_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve echolocation files with notes.

TempHum_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve temperature files with notes.

TBL: EVENT_HOUR
Event_ID *(autofill)*
Status_Time *(restricted)*
Status_Net *(toggle)*
Status_Trap *(toggle)*
Status_Detector *(toggle)*
Status_Logger *(toggle)*
Status_Temp *(restricted)*
Status_Wind *(dropdown)*
Status_Weather *(dropdown)*
Status_Moon *(dropdown)*

BatPhoto_Store: Mechanism (e.g. GUI upload button) to accept, store and retrieve photos with notes of the captured bat.

TBL: PERSONNEL
Team_Lead
Lead_Quals
Team_Members
Lead_Affiliation
Lead_Phone
Lead_Address

TBL: BAT_BIO_HANDLE
Bat_ID *(autofill)*
Bat_Number
Capture_Time *(restricted)*
Capture_Temp *(restricted)*
Capture_CommonName *(dropdown)*
Capture _Genus *(auto, dropdown)*
Capture_Species *(auto, dropdown)*
Bat_FA *(restricted)*
Bat_Ear *(restricted)*
Bat_Tragus *(dropdown)*
Bat_Keel *(dropdown)*
Bat_Gender *(dropdown)*
Bat_ReproductiveStatus *(dropdown)*
Bat_Age *(dropdown)*
Bat_Weight *(restricted)*
Bat_Photo *(toggle)*
Bat_PhotoStore *(GUI button)*
Collect_Specimen *(toggle)*
  Specimen_ID *(50 character)*
  Specimen_Destination *(50 character)*
  Specimen_ City *(50 character)*
  Specimen_State *(2 character)*
Collect_Tissue *(toggle)*
  Tissue_ID *(50 character)*
  Tissue_Destination *(50 character)*
  Tissue_City *(50 character)*
  Tissue_State *(2 character)*
Collect_Feces *(toggle)*
  Feces_ID *(50 character)*
  Feces_Destination *(50 character)*
  Feces_City *(50 character)*
  Feces_State *(2 character)*
Bat_MarkPrevious *(toggle)*
  Bat_MarkPreviousMethod *(dropdown)*
  Bat_PreviousID *(150 character)*
Bat_MarkNew *(toggle)*
  Bat_MarkNewMethod *(dropdown)*
  Bat_NewID *(150 character)*
Bat_MarkType *(dropdown)*
Notes *(1000 character)*

FORM OUTLINE: MISCELANEOUS BAT RECORD

TBL: SITE_DATA
Site_ID *(PK, alpha numeric)*
Date_Established *(autofill)*
Site_Name
State
County *(dropdown)*
Ownership
Ownership_contact
Quad_Name
Elev_m
Notes *(1000 characters)*

TBL: COORDS
Site_ID
UTM_E
UTM_N
UTM_Zone *(dropdown)*
Latitude
Longtitude
Datum *(dropdown)*
Township
Range
Section
Accuracy *(dropdown)*

TBL: SITE_EVENT
Event_ID *(FK, autofill)*
Visit_Num *(PK, autofill)*
Date_Day *(dropdown)*
Date_Month *(dropdown)*
Date_Year *(dropdown)*
Date_Season *(auto)*
RecordType *(dropdown)*
Team_Lead
Site_Description *(1000 characters)*
SiteVeg_Primary *(dropdown)*
SiteVeg_Secondary *(dropdown)*
Photo_N *(Y/N toggle)*
Photo_S *(Y/N toggle)*
Photo_E *(Y/N toggle)*
Photo_W *(Y/N toggle)*
Photo_Store *(GUI button)*
Report *(Y/N toggle)*
Report_Store *(GUI button)*
Notes *(1000 characters)*

TBL: PERSONNEL
Team_Lead
Lead_Quals
Team_Members
Lead_Affiliation
Lead_Phone
Lead_Address

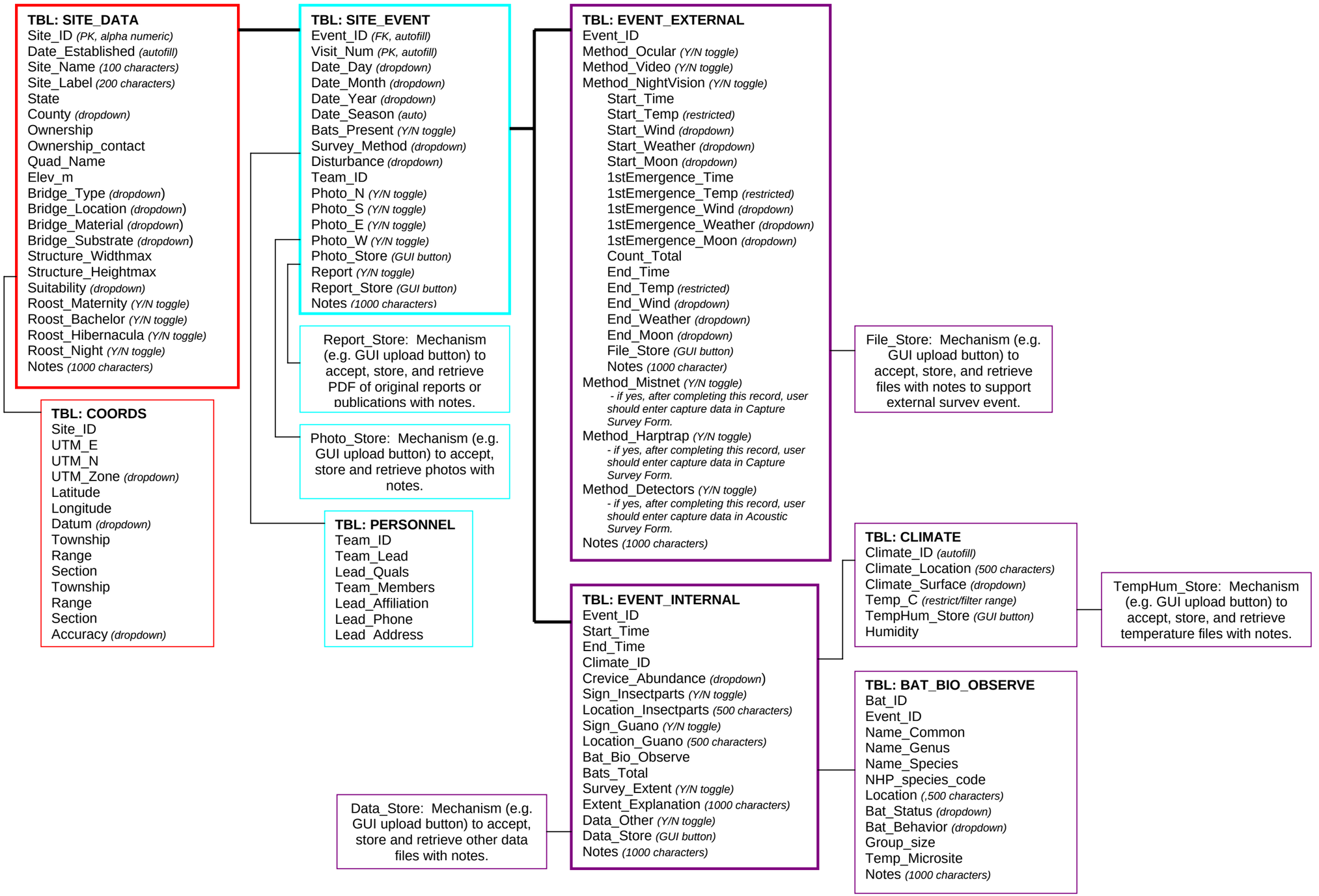
Report_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve PDF of original reports or publications with notes.

Photo_Store: Mechanism (e.g. GUI upload button) to accept, store and retrieve photos with notes.

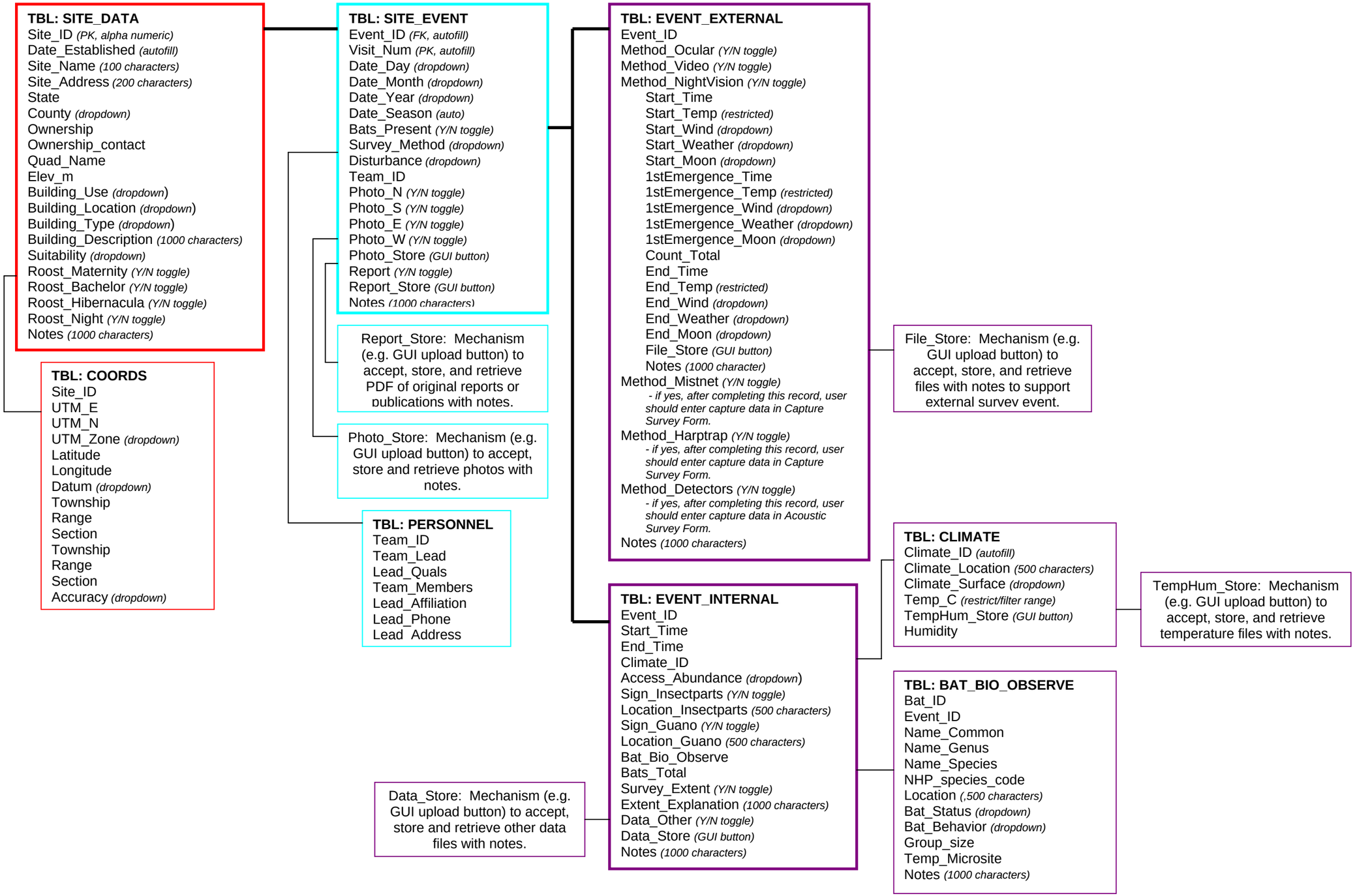
TBL: BAT_BIO_HANDLE
Bat_ID *(autofill)*
Bat_Number
Bat_CommonName *(dropdown)*
Bat _Genus *(auto, dropdown)*
Bat_Species *(auto, dropdown)*
Bat_FA *(restricted)*
Bat_Ear *(restricted)*
Bat_Tragus *(dropdown)*
Bat_Keel *(dropdown)*
Bat_Gender *(dropdown)*
Bat_ReproductiveStatus *(dropdown)*
Bat_Age *(dropdown)*
Bat_Weight *(restricted)*
Bat_Status *(dropdown)*
Bat_Photo *(toggle)*
BatPhoto_Store *(GUI button)*
Collect_Specimen *(toggle)*
  Specimen_ID *(50 character)*
  Specimen_Destination *(50 character)*
  Specimen_ City *(50 character)*
  Specimen_State *(2 character)*
Collect_Tissue *(toggle)*
  Tissue_ID *(50 character)*
  Tissue_Destination *(50 character)*
  Tissue_City *(50 character)*
  Tissue_State *(2 character)*
Bat_MarkPrevious *(toggle)*
  Bat_MarkPreviousMethod *(dropdown)*
  Bat_PreviousID *(150 character)*
Bat_MarkNew *(toggle)*
  Bat_MarkNewMethod *(dropdown)*
  Bat_NewID *(150 character)*
Bat_MarkType *(dropdown)*
Notes *(1000 character)*

BatPhoto_Store: Mechanism (e.g. GUI upload button) to accept, store and retrieve photos with notes of the captured bat.

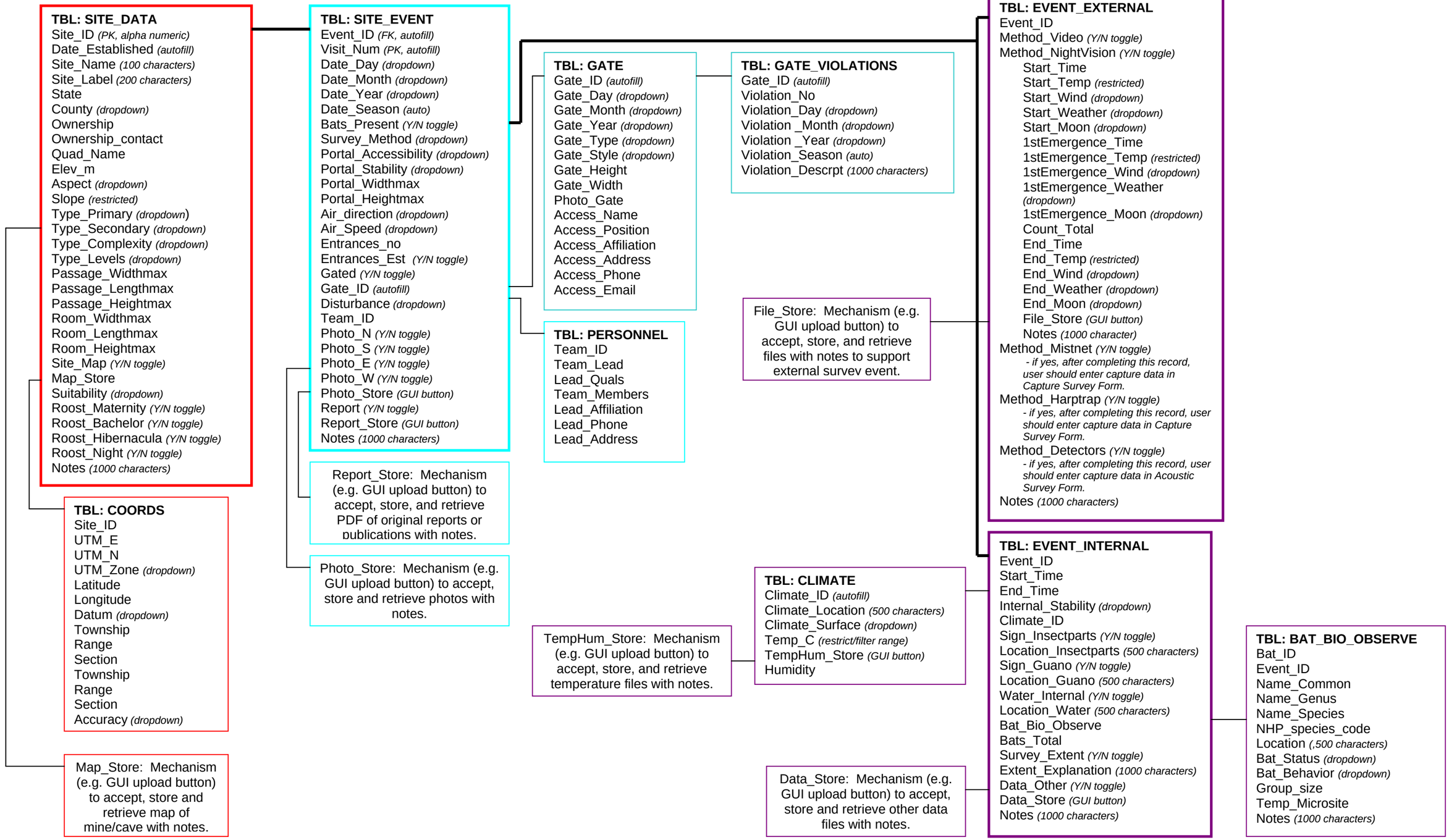
FORM OUTLINE: ROOST SURVEY EVENT (BRIDGE)



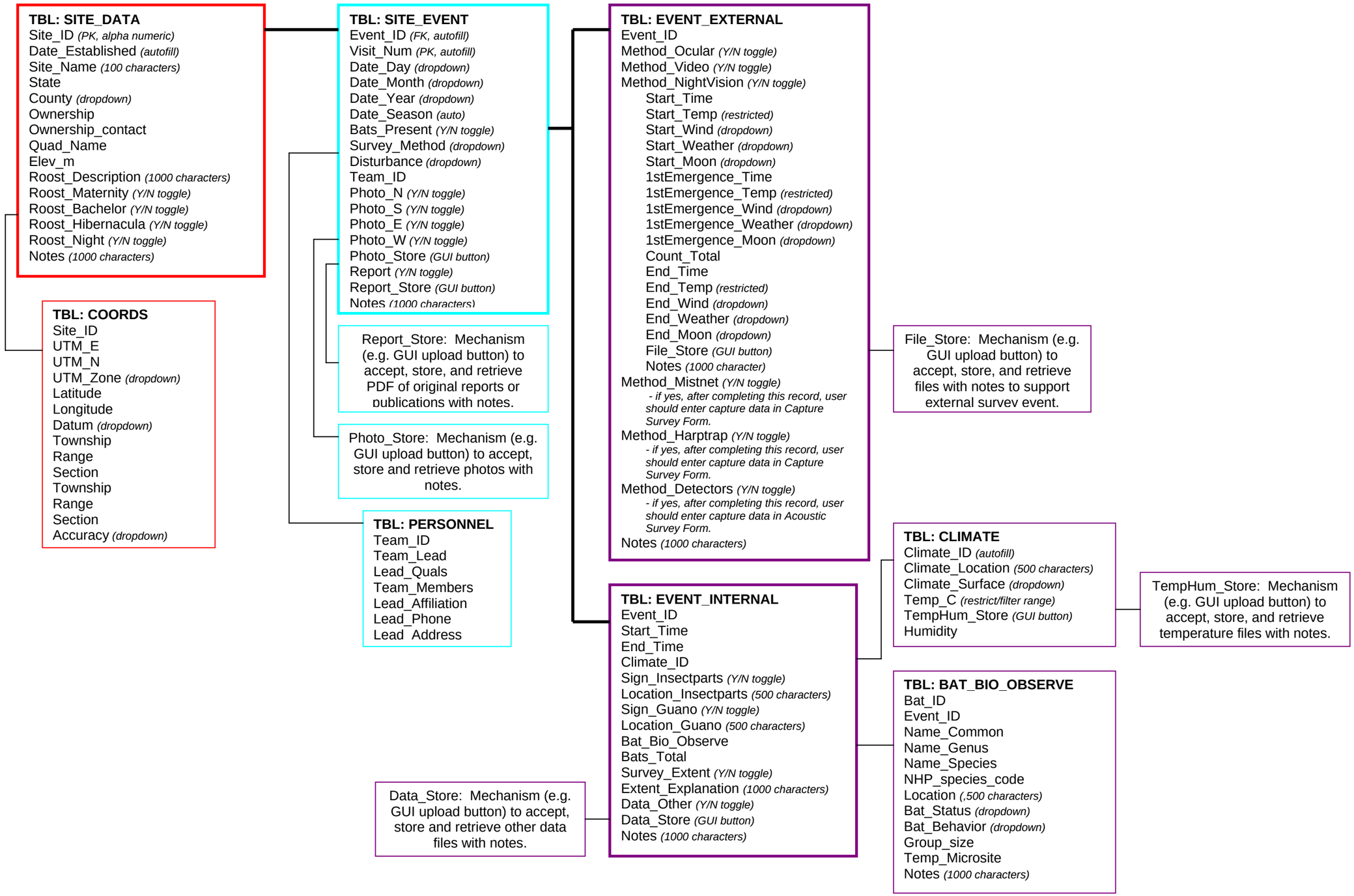
FORM OUTLINE: ROOST SURVEY EVENT (BUILDING)



FORM OUTLINE: ROOST SURVEY EVENT (MINE/CAVE)



FORM OUTLINE: ROOST SURVEY EVENT (SELF DEFINED)



VI. c. APPENDIX C: Database Dictionary of Entry Fields and Terms

FORM: ACOUSTIC SURVEYS

TABLE: ACOUSTIC_NOTES

Call_ID: A unique numeric identifier for this echolocation record. This field acts as a primary key and is calculated automatically by the database by combining Site_ID, Echolocation_Day, and Echolocation Time values into a string.

Hand_Release: Field used to indicate if the echolocation record was recorded from a hand released/known identity bat or from a free flying/unknown identity bat. A dropdown menu for the type of call (hand release; free flying) is available to populate this field. Field will accept other entries and is not restricted to these values.

Echolocation_Day: The year, month, day (YYYYMMDD) that the echolocation call was recorded. Entries are restricted to 8 digit values where YYYY > 1950; 01 ≤ MM ≥ 12; and 01 ≤ DD ≥ 31.

Echolocation_Time: The exact time (HHMMSS) the echolocation call was recorded. Entries are restricted to 6 digit values where 00 ≤ HH ≥ 23; 01 ≤ MM ≥ 59; and 01 ≤ SS ≥ 59.

Acoustic Guild: Acoustic guild as determined by the minimum frequency in kHz. A dropdown menu of bat acoustic guilds (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Guild	F_{min} (kHz)	Species
Audible, Low	~6-12	EUMA
Audible, High	~12-16	NYMA, IDPH
Hoary	~16-25	LACI
25k Bat	~25	EPFU, LANO
30k Bat	~25-35	MYTH, MYEV, COTO, ANPA, TABR
40k Myotis	~40	MYLU, MYVO, MYCI
50k Bat	~45-50	MYYU, MYCA, PIHE, LABL

Guild_Confidence: A self-assessment scale to rank the confidence of the researcher in assigning a particular call to its proper guild. A dropdown menu of confidence values (1-4) is available to populate this field.

Score	Description
1	Highly Confident, 95% sure.
2	Very Confident, 80% sure.
3	Somewhat Confident, 60% sure.
4	Not confident, <50% sure.

Acoustic_CommonName: Field used to record the common name of the bat call recorded. Refer to local key or call library to assist with identification. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Acoustic_Genus: Field used to record the scientific species name of the bat call recorded. Field is populated automatically when common name or species name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Acoustic_Species: Field used to record the scientific species name of the bat call recorded. Field is populated automatically when common name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Common Name	Genus	Species
Unknown Species	Unknown	Unknown
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

Species_Confidence: A self-assessment scale to rank the confidence of the researcher in assigning a particular call to its proper species. A dropdown menu of confidence values (0-4) is available to populate this field. Field is restricted to these values.

Score	Description
0	Record not identified to species.
1	Highly Confident, 95% sure.
2	Very Confident, 80% sure.
3	Somewhat Confident, 60% sure.
4	Not confident, <50% sure.

AcousticID_Interpreter: First and last name of individual interpreting the echolocation calls.

AcousticID_Qualifications: The qualifications of the observer to accurately assess the echolocation call and identify to guild or species. A drop down menu of qualifications (Experienced, Limited Experience, No Experience, Unknown) is available to populate this field. Field is restricted to these values.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Interpreter_Affiliation: Professional affiliation of person conducting the echolocation interpretations.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Event_ID.

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary key and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge)targeted for data collection. Six (6) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Dropdown menu for zone (11; 12; unknown) is available to populate this field. Entries are restricted to these values.

Latitude: A coordinate measured in decimal degrees measuring an angular distance north or south from the earth's equator representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-90°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Longitude: A coordinate measured in decimal degrees measuring an angular distance from the Prime Meridian representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-360°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 Conus or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude and Longitude are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude or Longitude are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.
<300 m	Coordinate determined from USGS topomap.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_HOUR

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Status_Time: Actual time (T_a), noted in local 24 hour format, that the 'Status' fields are recorded. 'Status' fields should be recorded at the start of the survey period and each consecutive 60 minutes after until the use of all survey methods employed is ended. Data entry range restricted (0000 - 2359).

Status_Net: A toggle that is used to record if mist nets are "Open" or "Not in Use" at time T_a.

Status_Trap: A toggle that is used to record if harp traps are "Open" or "Not in Use" at time T_a.

Status_Detector: A toggle that is used to record whether an ultrasonic detector is 'Active' or 'Not in Use' at time T_a. Value of this field defaults to 'Not in Use' when value of field SURVEY_METHOD in table SITE_EVENT equals 'Capture Only'.

Status_Logger: A toggle that is used to record whether a data logger is 'Active' or 'Not in Use' at time T_a.

Status_Temp: Temperature recorded in degrees Celsius at time T_a. Data entry range restricted (-20° < t < 43°).

Status_Wind: Speed of wind recorded at time T_a. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Status_Weather: Record of the dominant weather category (1-4) over the last hour since T_{a-1}. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Status_Moon: Record of the phase of moon (1-5) at T_a. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Team_Lead: First and last name of individual identified as survey lead.

Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.

Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.
Lead_Affiliation: Professional affiliation of person named in Team_Lead field.
Lead_Phone: Telephone number of person named in Team_Lead field.
Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.
Site_Name: A 100 character field to be used to record the name of the site commonly used to refer to it (if available).
State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.
County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.
Ownership: The agency/private owner who owns the land on which this site is located. Dropdown menu of ownership (Private, Forest Service, BLM, Indian Reservation, State, Department of Defense, Nature Conservancy, Unknown, Other) is available to populate this field. Entries are restricted to these values.
Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)
Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.
Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).
Date_Day: This field indicates the day the survey was conducted and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.
Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.
Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.
Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall

Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September - October

SiteType_Primary: Field used to record dominant type of site. Dropdown menu of the site type (Pond/Spring, Stream/River, Trough, Mine, Cave, Bridge, Building, Trail/Edge/Open) is available to populate this field. Entries are restricted to these values.

SiteType_Secondary: Field used to record secondary type of site found within 200 m of capture site that could reasonably expected to affect capture results. This is filled out only if appropriate to survey effort (e.g. netted small pond near abandoned building). Dropdown menu of the site type (Pond/Spring, Stream/River, Trough, Mine, Cave, Bridge, Building) is available to populate this field. Entries are restricted to these values. *Note Trail/Edge/Open is not a valid entry for Type_Secondary due to its ubiquitous nature on the landscape.

Survey_Method: Used to indicate whether the survey conducted was capture only (researchers only collected the data with nets/traps) or capture with acoustic (researchers collected data with nets/taps and recorded acoustic activity). Dropdown menu of survey type (Capture only; Capture with Acoustic) is available to populate this field. Entries are restricted to these values.

Time_Start: The start time of the survey in local 24-hour time.

Time_End: The end time of the survey in local 24-hour time.

Method_Mistnet: A field to record the number of mist nets observers used to conduct surveys at this site. Dropdown field offers values 0-10 but will accept additional values. Field value defaults to '0' and is unavailable for data entry when SURVEY_METHOD field value is entered as 'Acoustic Only'.

Method_Harptrap: A field to record the number of harp traps observers used to conduct surveys at this site. Dropdown field offers values 0-10 but will accept additional values. Field value defaults to '0' and is unavailable for data entry when SURVEY_METHOD field value is entered as 'Acoustic Only'.

The following 3 fields are available if the value entered for either the fields Method_Mistnet or Method_Harptrap was greater than zero (>0). If both fields are answered with zeros then these 3 fields are calculated but 'grayed out'.

Net_Length_Total: If mist nets are being used, record the total length of all nets used in meters. Field defaults to zero and is unavailable for data entry unless SURVEY_METHOD field value was either entered as 'capture' or 'capture with acoustic'.

Net_SurfaceArea: Calculated field expressing total surface area of nets at survey site in square meters [Net_SurfaceArea = 2.6 x Net_Length_Total]

Effort: Field used to calculate net hours, a standardized indices of survey effort, in square meters hours. [Effort = (Time_End – Time Start) x Net_SurfaceArea]

Method_Logger: A Y/N toggle to record whether the observer(s) used temperature/humidity data loggers to conduct surveys at this site.

The following 2 fields are available if Method_Logger field value entered as Yes. If answered No or Unknown then these are 'grayed out'.

Logger_Interval: Field used to record intervals (in minutes) at which data logger was set to collect data (ex. 0.5 minutes = 30 seconds)

TempHum_Store: Mechanism to accept, store and retrieve temperature and/or humidity files for this survey with notes.

Team_Lead: First and last name of individual identified as survey lead.

Site_Description: Short, simple description (1000 characters) of surroundings and dominant vegetation within one mile of survey site. Description should also include the characteristics that caused the site to be selected (ex. presence of a stock pond, mine shaft, roost, etc.).

SiteVeg_Primary: Primary vegetation community present within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

SiteVeg_Secondary: Secondary vegetation community within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

ID	Habitat Type	Code	Vegetation Community	Primary Vegetation
1.1.0	Forested	PIJU	Pinyon/Juniper Mix	
1.2.0		JUNI	Juniper	
1.2.1		UTJU	Juniper	Utah Juniper
1.2.2		RMJU	Juniper	Rocky Mountain Juniper
1.2.3		COJU	Juniper	Common Juniper
1.3.0		PINY	Pinyon	
1.3.1		PIPI	Pinyon	Pinyon Pine
1.3.2		SIPI	Pinyon	Silverleaf Pinyon
1.4.0		FIR	Fir	
1.4.2		DOFI	Fir	Douglas Fir
1.4.3		WHFI	Fir	White Fir
1.4.4		ALFI	Fir	Alpine Fir
1.4.5		SPRU	Spruce	
1.4.6		ENSP	Spruce	Engelman Spruce
1.4.7		BLSP	Spruce	Blue Spruce
1.5.0		SPFI	Spruce/Fir Mix	
1.6.0		PINE	Pine	
1.6.1		POPI	Pine	Ponderosa Pine
1.6.2		LIPI	Pine	Limber Pine
1.6.3		LOPI	Pine	Lodgepole Pine
1.6.4		BRPI	Pine	Bristlecone Pine
1.7.0		MXCO	Conifer Mix	
1.8.0		ASPE	Aspen	Aspen
1.9.0		MXFO	Mixed Forest (Conifer and deciduous mix)	
2.1.0	Scrub or Mountain Brush	MOSH	Mountain Shrub	
2.1.1		SCOA	Mountain Shrub	Scrub Oak
2.1.2		MAPL	Mountain Shrub	Maple
2.1.3		CLRO	Mountain Shrub	Cliffrose
2.1.4		BITT	Mountain Shrub	Bitterbrush
2.1.5		MOMA	Mountain Shrub	Mountain Mahogany
2.1.6		SERV	Mountain Shrub	Serviceberry
2.1.7		SQUA	Mountain Shrub	Squawbush
2.1.8		CEAN	Mountain Shrub	Ceanothus
2.1.9		CHCH	Mountain Shrub	Choke Cherry

3.1.0	Herbs - Shrubs	DESH	Desert Shrub	
3.1.1		SAGE	Desert Shrub	Sagebrush
3.1.2		SAMX	Desert Shrub	Sage/Grass Mix
3.1.3		BLAC	Desert Shrub	Blackbrush
3.1.4		BLMX	Desert Shrub	Blackbrush w/ PJ or Grass Mix
3.1.5		CREO	Desert Shrub	Creosotebush
3.1.6		BURS	Desert Shrub	Bursage
3.2.0		SDSH	Salt Desert Shrub	
3.2.1		GREA	Salt Desert Shrub	Greasewood
3.2.2		SHAD	Salt Desert Shrub	Shadescale
3.2.3		MAAT	Salt Desert Shrub	Mat-atriplex
3.2.4		CVCL	Salt Desert Shrub	Castle Valley Clover
3.2.5		RABB	Salt Desert Shrub	Rabbitbrush
3.2.6		RUTH	Salt Desert Shrub	Russian Thistle
3.2.7		HORS	Salt Desert Shrub	Horsebrush
3.2.8		PICK	Salt Desert Shrub	Pickleweed
3.2.9		HALO	Salt Desert Shrub	Halogeton
3.2.10		WINT	Salt Desert Shrub	Winterfat
3.2.11		MOTE	Salt Desert Shrub	Mormon Tea
3.3.0		SDMX	Salt Desert Shrub Mix (w/grass)	
3.4.0		OTSH	Other Shrub or Forb	
3.4.1		SNAK	Other Shrub or Forb	Snakeweed
3.4.2		PRPE	Other Shrub or Forb	Prickly Pear
3.4.3		BUFF	Other Shrub or Forb	Buffaloberry
3.4.4		SIAS	Other Shrub or Forb	Singleleaf Ash
3.4.5		FRMA	Other Shrub or Forb	Fremont Mahonia
3.4.6		JOTR	Other Shrub or Forb	Joshua Tree
3.5.0		MEDO	Mountain Meadow (grassy clearing in forest)	
3.5.1		WEME	Mountain Meadow (grassy clearing in forest)	Wet Meadow
3.5.2		DRME	Mountain Meadow (grassy clearing in forest)	Dry Meadow
3.6.0		MOFO	Mountain Forb (herbaceous opening in forest)	
3.7.0		ALTU	Alpine Tundra	
4.1.0	Grasses - Sedges	GRAS	Grass	
4.1.1		CHEA	Grass	Native
4.1.2		INRI	Grass	Non-native
4.1.3		DROP	Grass	Invasive
4.2.0		GRMX	Grass Mix (w/SAGE, SDSH, BLAC, PIJU)	
4.3.0		YUCC	Yucca	
4.4.0		SEDG	Sedges	
5.1.0	River Bottom or Riparian	RIPA	Riparian	
5.1.1		STRM	Riparian	Stream (<10m wide)
5.1.2		RIVR	Riparian	River (>10m wide)
5.2.0		COTT	Cottonwood	

5.3.0		WILL	Willow	
5.4.0		TAME	Tamarisk	
5.5.0		RUOL	Russian Olive	
5.6.0		BOEL	Box Elder	
5.7.0		SABA	Sand Bar (no vegetation)	
6.1.0	Marsh/Wetland	WETL	Marsh/Wetland	
6.2.0		MUFL	Mud Flat	
6.3.0	Open Water	AQOP	Open Water	
6.3.1		AQSA	Open Water	Saline
6.3.2		AQSM	Open Water	Small (<.01 acres or 30m diam.)
6.3.3		AQME	Open Water	Medium (.01-100 acres)
6.3.4		AQLA	Open Water	Large (>100 acres)
7.1.0	Barren Areas	ROCK	Rocky Outcrops	
7.2.0		CLIF	Cliffs	
7.3.0		SAND	Sand Dunes	
7.4.0		ALKI	Alkali Flats	
7.5.0		CAVE	Caves	
7.6.0		TALU	Talus Slopes	
8.1.0	Urban	URBN	Urban	
8.1.1		RESI	Urban	Residential
8.1.2		COMM	Urban	Commercial
8.1.3		PARK	Urban	Park
9.1.0	Agricultural	AGRI	Agricultural	
9.1.1		CROP	Agricultural	Cropland
9.1.2		PAST	Agricultural	Pasture
9.1.3		HEDG	Agricultural	Hedgerow/Shelterbelt
9.2.0	Other	OTHR	Other (explain in remarks)	

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether a E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos with notes.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Event_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Event_ID.

FORM: CAPTURE SURVEYS

TABLE: BAT_BIO_HANDLE

Bat_ID: A unique alpha numeric identifier for this bat record. This field acts as a primary key and is filled automatically by the database to reduce chance of redundancy error.

Bat_Number: Number of the bat in the order that it was caught (ex. 1, 2, 3 …).

Capture_Time: Actual time, noted in local 24 hour format, that the bat was caught, not when it was being processed. Data entry range restricted (0000 - 2359).

Capture_Temp: The temperature in degrees Celsius when the bat was caught, not when it was being processed. Data entry range restricted (-20° < t < 43°).

Capture_CommonName: Field used to record the common name of the bat captured. Use a dichotomous bat key for the area the survey is being conducted to help identify bats to species. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

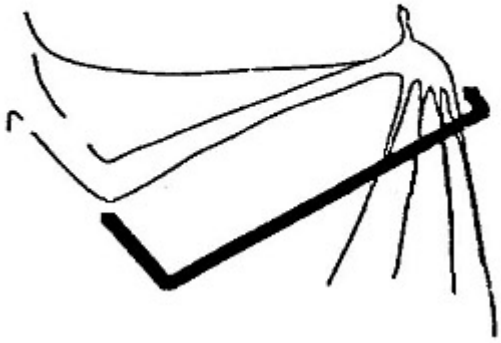
Capture _Genus: Field used to record the scientific species name of the bat captured. Field is populated automatically when common name or species name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Capture_Species: Field used to record the scientific species name of the bat captured. Field is populated automatically when common name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

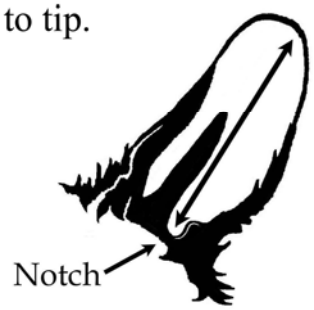
Bat_FA: Field used to record the length of the forearm in millimeters. The forearm is defined as the length between the elbow and the distal side of the wrist (Figure 1). Data entry range restricted (20mm < FA < 70mm). No decimals allowed.

Figure 1: Forearm length, elbow to wrist.



Bat_Ear (mm): The length of the ear in millimeters. The ear length is measured from the notch on the base of the ear to the ear's tip (Figure 2). Data entry range restricted (5mm < Ear < 55mm).

Figure 2: Earlength is measured from notch to tip.



Bat_Tragus: The shape of the tragus (Figures 3a and 3b). A dropdown menu of tragus shape (Long and pointed; Short and rounded; Not Applicable) is available to populate this field. Field is restricted to these values.

Figure 3a: Tragus is long, pointed, and straight.

Figure 3b: Tragus is short, blunt, rounded, and curved.

Bat_Keel: Record the presence or absence of a keel - a flap of skin hanging loose off the posterior edge of the calcar (Figure 4a & b). A dropdown menu of keel status (Present; Poor; Absent; Not Applicable) is available to populate this field. Field is restricted to these values.

Figure 4a: Calcar keel not present or poorly developed.

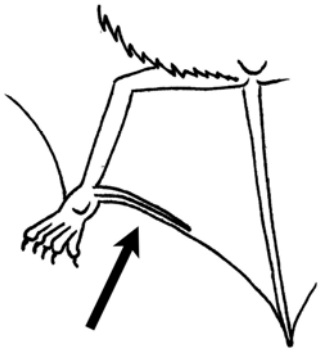
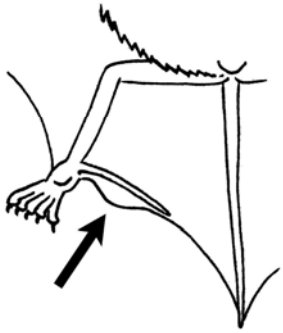


Figure 4b: Calcar keel is present and well developed.



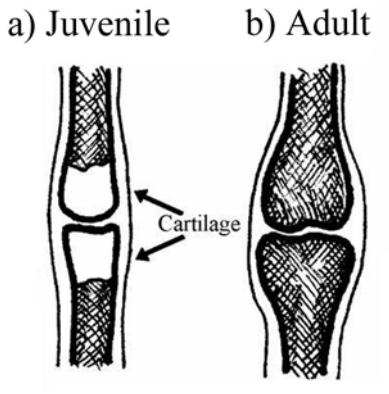
Bat_Gender: Record the sex of the bat captured. Evidence of gender is best obtained from the genitalia, with the males possessing a well developed penis. A dropdown menu of gender (Male, Female, Unknown) is available to populate this field. Field is restricted to these values.

Bat_ReproductiveStatus: Record the reproductive status of the bat captured. A dropdown menu of reproductive status values (see table below) is available to populate this field. Field is restricted to these values.

Gender	Status	Description
Male	1) Reproductive	One or both testes have descended.
	2) Non-reproductive	Neither testes are descended.
Female	1) Lactating	Nipples are pink and enlarged; hair surrounding the nipple is worn away.
	2) Post-Lactating	Nipples dark, wrinkly; hair surrounding the nipple has often started growing back.
	3) Pregnant	Presence of unborn fetus evident.
	4) Non-reproductive	Nipples very small and well haired; no sign of pregnancy.
Unknown	Unknown	Reproductive status was not determined.

Bat_Age: Record the age of the bat as based on the calcification of the phalangeal joints (Figure 5). Best observed by shining the joints from behind with a head lamp. A dropdown menu of reproductive status values (Adult, Juvenile, Unknown) is available to populate this field. Field is restricted to these values.

Figure 5: Cartilage in juvenile pharangeal joints transmits light; glows white when backlit.



Bat_Weight: The total weight of the bat minus the weight of the bag in grams. Data entry range restricted (2 grams < Mass < 40 grams.

Bat_Photo: A Y/N toggle to indicate whether a photograph was taken of the bat. Combine with mechanism to accept, store, and retrieve photos.

BatPhoto_Store: Mechanism to accept, store, and retrieve photo files (JPG, TIFF, GIFF, etc.) stored to record the bat represented by this Bat_ID.

Collect_Specimen: A Y/N/Unknown toggle to indicate whether the bat was collected as a specimen.

Following 4 fields are available if Collect_Specimen field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

- **Specimen_ID:** A 50 character text field used to record the unique identifier for this specimen to link it back to its Bat_ID.
- **Specimen_Destination:** A 50 character text field used to record name of museum, office, school, etc. where the specimen will be kept.
- **Specimen_ City:** A 50 character text field used to record name of the city where the specimen will be kept.
- **Specimen_State:** A two character text field used to record the two letter abbreviation of the state where the specimen will be kept. A dropdown menu of state abbreviation and full names is available to populate this field. Field is restricted to these values.

Collect_Tissue: A Y/N/Unknown toggle to indicate whether tissue (wing biopsy, etc.) was collected from the bat.

Following 4 fields are available if Collect_Tissue field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

- **Tissue_ID:** A 50 character text field used to record the unique identifier for this sample to link it back to its Bat_ID.
- **Tissue_Destination:** A 50 character text field used to record name of museum, office, school, etc. where the sample will be kept.
- **Tissue_City:** A 50 character text field used to record name of the city where the sample will be kept.
- **Tissue_State:** A two character text field used to record the two letter abbreviation of the state where the sample will be kept. A dropdown menu of state abbreviation and full names is available to populate this field. Field is restricted to these values.

Collect_Feces: A Y/N/Unknown toggle to indicate whether tissue (wing biopsy, etc.) was collected from the bat.

Following 4 fields are available if Collect_Feces field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

- **Feces_ID:** A 50 character text field used to record the unique identifier for this sample to link it back to its Bat_ID.

Feces_Destination: A 50 character text field used to record name of museum, office, school, etc. where the sample will be kept.

Feces_City: A 50 character text field used to record name of the city where the sample will be kept.

Feces_State: A two character text field used to record the two letter abbreviation of the state where the sample will be kept. A dropdown menu of state abbreviation and full names is available to populate this field. Field is restricted to these values.

Bat_MarkPrevious: A Yes/No/Unknown toggle to indicate whether the bat showed signs of being previously marked.

Following 2 fields are available if Bat_MarkPrevious field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

Bat_MarkPreviousMethod: A field used to record the type of mark observed on the bat. A dropdown menu of previous marking methods (Magic marker/Paint, Paper marker, Band, Freeze brand, Tattoo, Wing punch, PIT tag, Radio-telemetry, Light tag) is available to populate this field. Additional write-in values will be accepted.

Bat_PreviousID: A 150 character text field use to describe previous mark including unique identifier if available (i.e. type, number, color, material, writing, etc.).

Bat_MarkNew: A Yes/No/Unknown toggle to indicate whether the bat showed signs of being previously marked.

Following 2 fields are available if Bat_MarkNew field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

Bat_MarkNewMethod: A field used to record the type of mark placed on the bat. A dropdown menu of new marking methods (Magic marker/Paint, Paper marker, Band, Freeze brand, Tattoo, Wing punch, PIT tag, Radio-telemetry, Light tag) is available to populate this field. Additional write-in values will be accepted.

Bat_NewID: A 150 character text field use to describe previous mark including unique identifier if available.

Bat_MarkType:

Mark Type	Description
New	Bat doesn't have a mark; Bat is given a mark.
None	Bat doesn't have a mark; Bat is left unmarked.
Existing	Bat was previously marked; Bat is left with original mark.
Additional	Bat was previously marked; Bat is given additional new mark.
Replacement	Bat was previously marked; Old mark is replaced with new mark.
Removed	Bat was previously marked; Old mark was removed.

Notes: A 1000 character text field used to record observations or actions of this particular bat not accounted for by the data sheet (ex. parasite load, marking method, injuries, etc.)

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary key and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge)targeted for data collection. Six (6) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Dropdown menu for zone (11; 12; unknown) is available to populate this field. Entries are restricted to these values.

Latitude: A coordinate measured in decimal degrees measuring an angular distance north or south from the earth's equator representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-90°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Longitude: A coordinate measured in decimal degrees measuring an angular distance from the Prime Meridian representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-360°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 Conus or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude and Longitude are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude or Longitude are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.
<300 m	Coordinate determined from USGS topomap.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_HOUR

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Status_Time: Actual time (T_a), noted in local 24 hour format, that the 'Status' fields are recorded. 'Status' fields should be recorded at the start of the survey period and each consecutive 60 minutes after until the use of all survey methods employed is ended. Data entry range restricted (0000 - 2359).

Status_Net: A toggle that is used to record if mist nets are "Open" or "Not in Use" at time T_a.

Status_Trap: A toggle that is used to record if harp traps are "Open" or "Not in Use" at time T_a.

Status_Detector: A toggle that is used to record whether an ultrasonic detector is 'Active' or 'Not in Use' at time T_a. Value of this field defaults to 'Not in Use' when value of field SURVEY_METHOD in table SITE_EVENT equals 'Capture Only'.

Status_Logger: A toggle that is used to record whether a data logger is 'Active' or 'Not in Use' at time T_a.

Status_Temp: Temperature recorded in degrees Celsius at time T_a. Data entry range restricted (-20° < t < 43°).

Status_Wind: Speed of wind recorded at time T_a. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.

3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Status_Weather: Record of the dominant weather category (1-4) over the last hour since T_{a-1}. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Status_Moon: Record of the phase of moon (1-5) at T_a. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Team_Lead: First and last name of individual identified as survey lead.
Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.
Lead_Affiliation: Professional affiliation of person named in Team_Lead field.
Lead_Phone: Telephone number of person named in Team_Lead field.
Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.

Site_Name: A 100 character field to be used to record the name of the site commonly used to refer to it (if available).

State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.

County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.

Ownership: The agency/private owner who owns the land on which this site is located. Dropdown menu of ownership (Private, Forest Service, BLM, Indian Reservation, State, Department of Defense, Nature Conservancy, Unknown, Other) is available to populate this field. Entries are restricted to these values.

Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)

Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.

Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).

Date_Day: This field indicates the day the survey was conducted and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.

Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.

Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.

Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September - October

SiteType_Primary: Field used to record dominant type of site. Dropdown menu of the site type (Pond/Spring, Stream/River, Trough, Mine, Cave, Bridge, Building, Trail/Edge/Open) is available to populate this field. Entries are restricted to these values.

SiteType_Secondary: Field used to record secondary type of site found within 200 m of capture site that could reasonably expected to affect capture results. This is filled out only if appropriate to survey effort (e.g. netted small pond near abandoned building). Dropdown menu of the site type (Pond/Spring, Stream/River, Trough, Mine, Cave, Bridge, Building) is available to populate this field. Entries are restricted to these values. *Note Trail/Edge/Open is not a valid entry for Type_Secondary due to its ubiquitous nature on the landscape.

Survey_Method: Used to indicate whether the survey conducted was capture only (researchers only collected the data with nets/traps) or capture with acoustic (researchers collected data with nets/taps and recorded acoustic activity). Dropdown menu of survey type (Capture only; Capture with Acoustic) is available to populate this field. Entries are restricted to these values.

Time_Start: The start time of the survey in local 24-hour time.

Time_End: The end time of the survey in local 24-hour time.

Method_Mistnet: A field to record the number of mist nets observers used to conduct surveys at this site. Dropdown field offers values 0-10 but will accept additional values. Field value defaults to '0' and is unavailable for data entry when SURVEY_METHOD field value is entered as 'Acoustic Only'.

Method_Harptrap: A field to record the number of harp traps observers used to conduct surveys at this site. Dropdown field offers values 0-10 but will accept additional values. Field value defaults to '0' and is unavailable for data entry when SURVEY_METHOD field value is entered as 'Acoustic Only'.

The following 3 fields are available if the value entered for either the fields Method_Mistnet or Method_Harptrap was greater than zero (>0). If both fields are answered with zeros then these 3 fields are calculated but 'grayed out'.

Net_Length_Total: If mist nets are being used, record the total length of all nets used in meters. Field defaults to zero and is unavailable for data entry unless SURVEY_METHOD field value was either entered as 'capture' or 'capture with acoustic'.

Net_SurfaceArea: Calculated field expressing total surface area of nets at survey site in square meters [Net_SurfaceArea = 2.6 x Net_Length_Total]

Effort: Field used to calculate net hours, a standardized indices of survey effort, in square meters hours. [Effort = (Time_End – Time Start) x Net_SurfaceArea]

Method_Logger: A Y/N toggle to record whether the observer(s) used temperature/humidity data loggers to conduct surveys at this site.

The following 2 fields are available if Method_Logger field value entered as Yes. If answered No or Unknown then these are 'grayed out'.

Logger_Interval: Field used to record intervals (in minutes) at which data logger was set to collect data (ex. 0.5 minutes = 30 seconds)

TempHum_Store: Mechanism to accept, store and retrieve temperature and/or humidity files for this survey with notes.

Team_Lead: First and last name of individual identified as survey lead.

Site_Description: Short, simple description (1000 characters) of surroundings and dominant vegetation within one mile of survey site. Description should also include the characteristics that caused the site to be selected (ex. presence of a stock pond, mine shaft, roost, etc.).

SiteVeg_Primary: Primary vegetation community present within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

SiteVeg_Secondary: Secondary vegetation community within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

ID	Habitat Type	Code	Vegetation Community	Primary Vegetation

1.1.0	Forested	PIJU	Pinyon/Juniper Mix	
1.2.0		JUNI	Juniper	
1.2.1		UTJU	Juniper	Utah Juniper
1.2.2		RMJU	Juniper	Rocky Mountain Juniper
1.2.3		COJU	Juniper	Common Juniper
1.3.0		PINY	Pinyon	
1.3.1		PIPI	Pinyon	Pinyon Pine
1.3.2		SIPI	Pinyon	Silverleaf Pinyon
1.4.0		FIR	Fir	
1.4.2		DOFI	Fir	Douglas Fir
1.4.3		WHFI	Fir	White Fir
1.4.4		ALFI	Fir	Alpine Fir
1.4.5		SPRU	Spruce	
1.4.6		ENSP	Spruce	Engelman Spruce
1.4.7		BLSP	Spruce	Blue Spruce
1.5.0		SPFI	Spruce/Fir Mix	
1.6.0		PINE	Pine	
1.6.1		POPI	Pine	Ponderosa Pine
1.6.2		LIPI	Pine	Limber Pine
1.6.3		LOPI	Pine	Lodgepole Pine
1.6.4		BRPI	Pine	Bristlecone Pine
1.7.0		MXCO	Conifer Mix	
1.8.0		ASPE	Aspen	Aspen
1.9.0		MXFO	Mixed Forest (Conifer and deciduous mix)	
2.1.0	Scrub or Mountain Brush	MOSH	Mountain Shrub	
2.1.1		SCOA	Mountain Shrub	Scrub Oak
2.1.2		MAPL	Mountain Shrub	Maple
2.1.3		CLRO	Mountain Shrub	Cliffrose
2.1.4		BITT	Mountain Shrub	Bitterbrush
2.1.5		MOMA	Mountain Shrub	Mountain Mahogany
2.1.6		SERV	Mountain Shrub	Serviceberry
2.1.7		SQUA	Mountain Shrub	Squawbush
2.1.8		CEAN	Mountain Shrub	Ceanothus
2.1.9		CHCH	Mountain Shrub	Choke Cherry
3.1.0	Herbs - Shrubs	DESH	Desert Shrub	
3.1.1		SAGE	Desert Shrub	Sagebrush
3.1.2		SAMX	Desert Shrub	Sage/Grass Mix
3.1.3		BLAC	Desert Shrub	Blackbrush
3.1.4		BLMX	Desert Shrub	Blackbrush w/ PJ or Grass Mix
3.1.5		CREO	Desert Shrub	Creosotebush
3.1.6		BURS	Desert Shrub	Bursage
3.2.0		SDSH	Salt Desert Shrub	
3.2.1		GREA	Salt Desert Shrub	Greasewood
3.2.2		SHAD	Salt Desert Shrub	Shadescale
3.2.3		MAAT	Salt Desert Shrub	Mat-atriplex
3.2.4		CVCL	Salt Desert Shrub	Castle Valley Clover

3.2.5		RABB	Salt Desert Shrub	Rabbitbrush
3.2.6		RUTH	Salt Desert Shrub	Russian Thistle
3.2.7		HORS	Salt Desert Shrub	Horsebrush
3.2.8		PICK	Salt Desert Shrub	Pickleweed
3.2.9		HALO	Salt Desert Shrub	Halogeton
3.2.10		WINT	Salt Desert Shrub	Winterfat
3.2.11		MOTE	Salt Desert Shrub	Mormon Tea
3.3.0		SDMX	Salt Desert Shrub Mix (w/grass)	
3.4.0		OTSH	Other Shrub or Forb	
3.4.1		SNAK	Other Shrub or Forb	Snakeweed
3.4.2		PRPE	Other Shrub or Forb	Prickly Pear
3.4.3		BUFF	Other Shrub or Forb	Buffaloberry
3.4.4		SIAS	Other Shrub or Forb	Singleleaf Ash
3.4.5		FRMA	Other Shrub or Forb	Fremont Mahonia
3.4.6		JOTR	Other Shrub or Forb	Joshua Tree
3.5.0		MEDO	Mountain Meadow (grassy clearing in forest)	
3.5.1		WEME	Mountain Meadow (grassy clearing in forest)	Wet Meadow
3.5.2		DRME	Mountain Meadow (grassy clearing in forest)	Dry Meadow
3.6.0		MOFO	Mountain Forb (herbaceous opening in forest)	
3.7.0		ALTU	Alpine Tundra	
4.1.0	Grasses - Sedges	GRAS	Grass	
4.1.1		CHEA	Grass	Native
4.1.2		INRI	Grass	Non-native
4.1.3		DROP	Grass	Invasive
4.2.0		GRMX	Grass Mix (w/SAGE, SDSH, BLAC, PIJU)	
4.3.0		YUCC	Yucca	
4.4.0		SEDG	Sedges	
5.1.0	River Bottom or Riparian	RIPA	Riparian	
5.1.1		STRM	Riparian	Stream (<10m wide)
5.1.2		RIVR	Riparian	River (>10m wide)
5.2.0		COTT	Cottonwood	
5.3.0		WILL	Willow	
5.4.0		TAME	Tamarisk	
5.5.0		RUOL	Russian Olive	
5.6.0		BOEL	Box Elder	
5.7.0		SABA	Sand Bar (no vegetation)	
6.1.0	Marsh/Wetland	WETL	Marsh/Wetland	
6.2.0		MUFL	Mud Flat	
6.3.0	Open Water	AQOP	Open Water	
6.3.1		AQSA	Open Water	Saline
6.3.2		AQSM	Open Water	Small (<.01 acres or 30m diam.)
6.3.3		AQME	Open Water	Medium (.01-100 acres)
6.3.4		AQLA	Open Water	Large (>100 acres)

7.1.0	Barren Areas	ROCK	Rocky Outcrops	
7.2.0		CLIF	Cliffs	
7.3.0		SAND	Sand Dunes	
7.4.0		ALKI	Alkali Flats	
7.5.0		CAVE	Caves	
7.6.0		TALU	Talus Slopes	
8.1.0	Urban	URBN	Urban	
8.1.1		RESI	Urban	Residential
8.1.2		COMM	Urban	Commercial
8.1.3		PARK	Urban	Park
9.1.0	Agricultural	AGRI	Agricultural	
9.1.1		CROP	Agricultural	Cropland
9.1.2		PAST	Agricultural	Pasture
9.1.3		HEDG	Agricultural	Hedgerow/Shelterbelt
9.2.0	Other	OTHR	Other (explain in remarks)	

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether a E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos with notes.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Event_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Event_ID.

FORM: MISCELLANEOUS ENCOUNTERS

TABLE: BAT_BIO_HANDLE

Bat_ID: A unique alpha numeric identifier for this bat record. This field acts as a primary key and is filled automatically by the database to reduce chance of redundancy error.

Bat_Number: Number of the bat in the order that it was caught (ex. 1, 2, 3 …).

Capture_CommonName: Field used to record the common name of the bat captured. Use a dichotomous bat key for the area the survey is being conducted to help identify bats to species. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

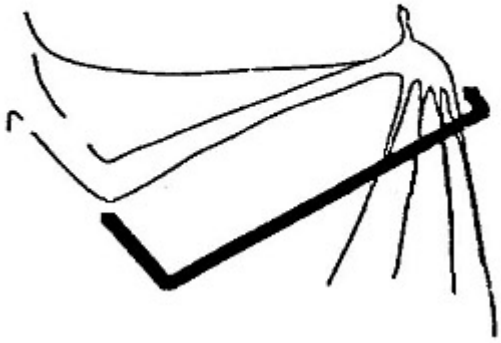
Capture _Genus: Field used to record the scientific species name of the bat captured. Field is populated automatically when common name or species name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Capture_Species: Field used to record the scientific species name of the bat captured. Field is populated automatically when common name is provided. A dropdown menu of bat species (see table below) is available to populate this field. Field will accept other entries and is not restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

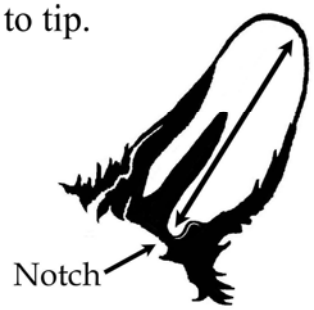
Bat_FA: Field used to record the length of the forearm in millimeters. The forearm is defined as the length between the elbow and the distal side of the wrist (Figure 1). Data entry range restricted (20mm < FA < 70mm). No decimals allowed.

Figure 1: Forearm length, elbow to wrist.



Bat_Ear (mm): The length of the ear in millimeters. The ear length is measured from the notch on the base of the ear to the ear's tip (Figure 2). Data entry range restricted (5mm < Ear < 55mm).

Figure 2: Earlength is measured from notch to tip.



Bat_Tragus: The shape of the tragus (Figures 3a and 3b). A dropdown menu of tragus shape (Long and pointed; Short and rounded; Not Applicable) is available to populate this field. Field is restricted to these values.

Figure 3a: Tragus is long, pointed, and straight.

Figure 3b: Tragus is short, blunt, rounded, and curved.

Bat_Keel: Record the presence or absence of a keel - a flap of skin hanging loose off the posterior edge of the calcar (Figure 4a & b). A dropdown menu of keel status (Present; Poor; Absent; Not Applicable) is available to populate this field. Field is restricted to these values.

Figure 4a: Calcar keel not present or poorly developed.

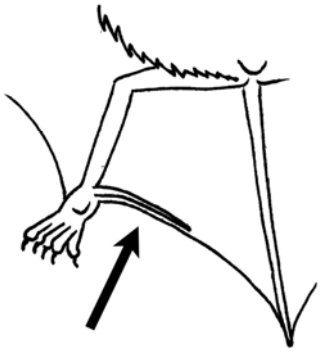
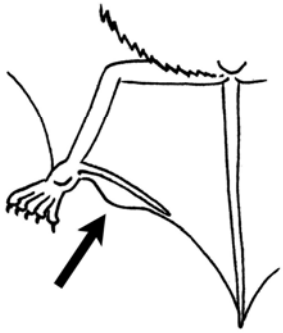


Figure 4b: Calcar keel is present and well developed.



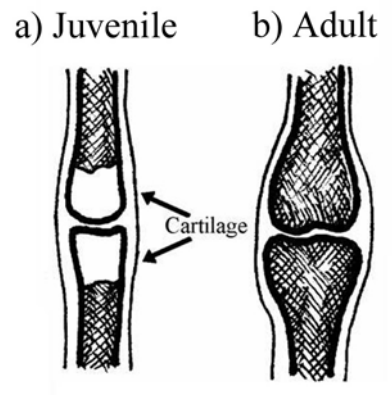
Bat_Gender: Record the sex of the bat captured. Evidence of gender is best obtained from the genitalia, with the males possessing a well developed penis. A dropdown menu of gender (Male, Female, Unknown) is available to populate this field. Field is restricted to these values.

Bat_ReproductiveStatus: Record the reproductive status of the bat captured. A dropdown menu of reproductive status values (see table below) is available to populate this field. Field is restricted to these values.

Gender	Status	Description
Male	1) Reproductive	One or both testes have descended.
	2) Non-reproductive	Neither testes are descended.
Female	1) Lactating	Nipples are pink and enlarged; hair surrounding the nipple is worn away.
	2) Post-Lactating	Nipples dark, wrinkly; hair surrounding the nipple has often started growing back.
	3) Pregnant	Presence of unborn fetus evident.
	4) Non-reproductive	Nipples very small and well haired; no sign of pregnancy.
Unknown	Unknown	Reproductive status was not determined.

Bat_Age: Record the age of the bat as based on the calcification of the phalangeal joints (Figure 5). Best observed by shining the joints from behind with a head lamp. A dropdown menu of reproductive status values (Adult, Juvenile, Unknown) is available to populate this field. Field is restricted to these values.

Figure 5: Cartilage in juvenile pharangeal joints transmits light; glows white when backlit.



Bat_Weight: The total weight of the bat minus the weight of the bag in grams. Data entry range restricted (2 grams < Mass < 40 grams.

Bat_Status: Used to denote if bat(s) observed is alive, dead, or injured/sick. Dropdown menu of species (Alive-Healthy; Alive-Sick/Injured; Dead) is available to populate this field. Entries are restricted to these values.

Bat_Photo: A Y/N toggle to indicate whether a photograph was taken of the bat. Combine with mechanism to accept, store, and retrieve photos.

BatPhoto_Store: Mechanism to accept, store, and retrieve photo files (JPG, TIFF, GIFF, etc.) stored to record the bat represented by this Bat_ID.

Collect_Specimen: A Y/N/Unknown toggle to indicate whether the bat was collected as a specimen.

Following 4 fields are available if Collect_Specimen field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

- **Specimen_ID:** A 50 character text field used to record the unique identifier for this specimen to link it back to its Bat_ID.
- **Specimen_Destination:** A 50 character text field used to record name of museum, office, school, etc. where the specimen will be kept.
- **Specimen_ City:** A 50 character text field used to record name of the city where the specimen will be kept.
- **Specimen_State:** A two character text field used to record the two letter abbreviation of the state where the specimen will be kept. A dropdown menu of state abbreviation and full names is available to populate this field. Field is restricted to these values.

Collect_Tissue: A Y/N/Unknown toggle to indicate whether tissue (wing biopsy, etc.) was collected from the bat.

Following 4 fields are available if Collect_Tissue field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

- **Tissue_ID:** A 50 character text field used to record the unique identifier for this sample to link it back to its Bat_ID.
- **Tissue_Destination:** A 50 character text field used to record name of museum, office, school, etc. where the sample will be kept.
- **Tissue_City:** A 50 character text field used to record name of the city where the sample will be kept.
- **Tissue_State:** A two character text field used to record the two letter abbreviation of the state where the sample will be kept. A dropdown menu of state abbreviation and full names is available to populate this field. Field is restricted to these values.

Bat_MarkPrevious: A Yes/No/Unknown toggle to indicate whether the bat showed signs of being previously marked.

Following 2 fields are available if Bat_MarkPrevious field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

Bat_MarkPreviousMethod: A field used to record the type of mark observed on the bat. A dropdown menu of previous marking methods (Magic marker/Paint, Paper marker, Band, Freeze brand, Tattoo, Wing punch, PIT tag, Radio-telemetry, Light tag) is available to populate this field. Additional write-in values will be accepted.

Bat_PreviousID: A 150 character text field use to describe previous mark including unique identifier if available (i.e. type, number, color, material, writing, etc.).

Bat_MarkNew: A Yes/No/Unknown toggle to indicate whether the bat showed signs of being previously marked.

Following 2 fields are available if Bat_MarkNew field value entered as Yes. If answered No or Unknown then these are 'grayed out' or not shown.

Bat_MarkNewMethod: A field used to record the type of mark placed on the bat. A dropdown menu of new marking methods (Magic marker/Paint, Paper marker, Band, Freeze brand, Tattoo, Wing punch, PIT tag, Radio-telemetry, Light tag) is available to populate this field. Additional write-in values will be accepted.

Bat_NewID: A 150 character text field use to describe previous mark including unique identifier if available.

Bat_MarkType:

Mark Type	Description
New	Bat doesn't have a mark; Bat is given a mark.
None	Bat doesn't have a mark; Bat is left unmarked.
Existing	Bat was previously marked; Bat is left with original mark.
Additional	Bat was previously marked; Bat is given additional new mark.
Replacement	Bat was previously marked; Old mark is replaced with new mark.
Removed	Bat was previously marked; Old mark was removed.

Notes: A 1000 character text field used to record observations or actions of this particular bat not accounted for by the data sheet (ex. parasite load, marking method, injuries, etc.)

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary key and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge)targeted for data collection. Six (6) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Calculated and recorded automatically if the fields Latitude and Longitude or Township, Range, and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Dropdown menu for zone (11; 12; unknown) is available to populate this field. Entries are restricted to these values.

Latitude: A coordinate measured in decimal degrees measuring an angular distance north or south from the earth's equator representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-90°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Longitude: A coordinate measured in decimal degrees measuring an angular distance from the Prime Meridian representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Entries are restricted to values between (0-360°). Calculated and recorded automatically if the fields UTM_N and UTM_E or Township, Range, and Section are entered.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 Conus or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude and Longitude are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E or Latitude or Longitude are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Calculated and recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.
<300 m	Coordinate determined from USGS topomap.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Team_Lead: First and last name of individual identified as survey lead.

Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.

Lead_Affiliation: Professional affiliation of person named in Team_Lead field.

Lead_Phone: Telephone number of person named in Team_Lead field.

Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.

Site_Name: A 100 character field to be used to record the name of the site commonly used to refer to it (if available).

State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.

County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah,

Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.

Ownership: The agency/private owner who owns the land on which this site is located. Dropdown menu of ownership (Private, Forest Service, BLM, Indian Reservation, State, Department of Defense, Nature Conservancy, Unknown, Other) is available to populate this field. Entries are restricted to these values.

Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)

Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.

Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).

Date_Day: This field indicates the day the survey was conducted and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.

Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.

Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.

Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September - October

RecordType: Field used to document dominant type of record. Dropdown menu of the record type (Random Occurrence, Nuisance, Specimen, Other) is available to populate this field. Entries are not restricted to these values.

Team_Lead: First and last name of individual identified as survey lead.

Site_Description: Short, simple description (1000 characters) of surroundings and dominant vegetation within one mile of survey site. Description should also include the characteristics that caused the site to be selected (ex. presence of a stock pond, mine shaft, roost, etc.).

SiteVeg_Primary: Primary vegetation community present within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

SiteVeg_Secondary: Secondary vegetation community within 200 meters of the capture site. A dropdown menu of vegetation types (See table below) is available to populate this field. Entries are restricted to these values.

ID	Habitat Type	Code	Vegetation Community	Primary Vegetation
1.1.0	Forested	PIJU	Pinyon/Juniper Mix	
1.2.0		JUNI	Juniper	
1.2.1		UTJU	Juniper	Utah Juniper
1.2.2		RMJU	Juniper	Rocky Mountain Juniper
1.2.3		COJU	Juniper	Common Juniper
1.3.0		PINY	Pinyon	
1.3.1		PIPI	Pinyon	Pinyon Pine
1.3.2		SIPI	Pinyon	Silverleaf Pinyon
1.4.0		FIR	Fir	
1.4.2		DOFI	Fir	Douglas Fir
1.4.3		WHFI	Fir	White Fir
1.4.4		ALFI	Fir	Alpine Fir
1.4.5		SPRU	Spruce	
1.4.6		ENSP	Spruce	Engelman Spruce
1.4.7		BLSP	Spruce	Blue Spruce
1.5.0		SPFI	Spruce/Fir Mix	
1.6.0		PINE	Pine	
1.6.1		POPI	Pine	Ponderosa Pine
1.6.2		LIPI	Pine	Limber Pine
1.6.3		LOPI	Pine	Lodgepole Pine
1.6.4		BRPI	Pine	Bristlecone Pine
1.7.0		MXCO	Conifer Mix	
1.8.0		ASPE	Aspen	Aspen
1.9.0		MXFO	Mixed Forest (Conifer and deciduous mix)	
2.1.0	Scrub or Mountain Brush	MOSH	Mountain Shrub	
2.1.1		SCOA	Mountain Shrub	Scrub Oak
2.1.2		MAPL	Mountain Shrub	Maple
2.1.3		CLRO	Mountain Shrub	Cliffrose
2.1.4		BITT	Mountain Shrub	Bitterbrush
2.1.5		MOMA	Mountain Shrub	Mountain Mahogany
2.1.6		SERV	Mountain Shrub	Serviceberry
2.1.7		SQUA	Mountain Shrub	Squawbush
2.1.8		CEAN	Mountain Shrub	Ceanothus
2.1.9		CHCH	Mountain Shrub	Choke Cherry
3.1.0	Herbs - Shrubs	DESH	Desert Shrub	
3.1.1		SAGE	Desert Shrub	Sagebrush
3.1.2		SAMX	Desert Shrub	Sage/Grass Mix
3.1.3		BLAC	Desert Shrub	Blackbrush
3.1.4		BLMX	Desert Shrub	Blackbrush w/ PJ or Grass Mix
3.1.5		CREO	Desert Shrub	Creosotebush
3.1.6		BURS	Desert Shrub	Bursage
3.2.0		SDSH	Salt Desert Shrub	

3.2.1		GREA	Salt Desert Shrub	Greasewood
3.2.2		SHAD	Salt Desert Shrub	Shadescale
3.2.3		MAAT	Salt Desert Shrub	Mat-atriplex
3.2.4		CVCL	Salt Desert Shrub	Castle Valley Clover
3.2.5		RABB	Salt Desert Shrub	Rabbitbrush
3.2.6		RUTH	Salt Desert Shrub	Russian Thistle
3.2.7		HORS	Salt Desert Shrub	Horsebrush
3.2.8		PICK	Salt Desert Shrub	Pickleweed
3.2.9		HALO	Salt Desert Shrub	Halogeton
3.2.10		WINT	Salt Desert Shrub	Winterfat
3.2.11		MOTE	Salt Desert Shrub	Mormon Tea
3.3.0		SDMX	Salt Desert Shrub Mix (w/grass)	
3.4.0		OTSH	Other Shrub or Forb	
3.4.1		SNAK	Other Shrub or Forb	Snakeweed
3.4.2		PRPE	Other Shrub or Forb	Prickly Pear
3.4.3		BUFF	Other Shrub or Forb	Buffaloberry
3.4.4		SIAS	Other Shrub or Forb	Singleleaf Ash
3.4.5		FRMA	Other Shrub or Forb	Fremont Mahonia
3.4.6		JOTR	Other Shrub or Forb	Joshua Tree
3.5.0		MEDO	Mountain Meadow (grassy clearing in forest)	
3.5.1		WEME	Mountain Meadow (grassy clearing in forest)	Wet Meadow
3.5.2		DRME	Mountain Meadow (grassy clearing in forest)	Dry Meadow
3.6.0		MOFO	Mountain Forb (herbaceous opening in forest)	
3.7.0		ALTU	Alpine Tundra	
4.1.0	Grasses - Sedges	GRAS	Grass	
4.1.1		CHEA	Grass	Native
4.1.2		INRI	Grass	Non-native
4.1.3		DROP	Grass	Invasive
4.2.0		GRMX	Grass Mix (w/SAGE, SDSH, BLAC, PIJU)	
4.3.0		YUCC	Yucca	
4.4.0		SEDG	Sedges	
5.1.0	River Bottom or Riparian	RIPA	Riparian	
5.1.1		STRM	Riparian	Stream (<10m wide)
5.1.2		RIVR	Riparian	River (>10m wide)
5.2.0		COTT	Cottonwood	
5.3.0		WILL	Willow	
5.4.0		TAME	Tamarisk	
5.5.0		RUOL	Russian Olive	
5.6.0		BOEL	Box Elder	
5.7.0		SABA	Sand Bar (no vegetation)	
6.1.0	Marsh/Wetland	WETL	Marsh/Wetland	
6.2.0		MUFL	Mud Flat	
6.3.0	Open Water	AQOP	Open Water	
6.3.1		AQSA	Open Water	Saline

6.3.2		AQSM	Open Water	Small (<.01 acres or 30m diam.)
6.3.3		AQME	Open Water	Medium (.01-100 acres)
6.3.4		AQLA	Open Water	Large (>100 acres)
7.1.0	Barren Areas	ROCK	Rocky Outcrops	
7.2.0		CLIF	Cliffs	
7.3.0		SAND	Sand Dunes	
7.4.0		ALKI	Alkali Flats	
7.5.0		CAVE	Caves	
7.6.0		TALU	Talus Slopes	
8.1.0	Urban	URBN	Urban	
8.1.1		RESI	Urban	Residential
8.1.2		COMM	Urban	Commercial
8.1.3		PARK	Urban	Park
9.1.0	Agricultural	AGRI	Agricultural	
9.1.1		CROP	Agricultural	Cropland
9.1.2		PAST	Agricultural	Pasture
9.1.3		HEDG	Agricultural	Hedgerow/Shelterbelt
9.2.0	Other	OTHR	Other (explain in remarks)	

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether a E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos with notes.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Event_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Event_ID.

FORM: ROOST - BRIDGE

TABLE: BAT_BIO_OBSERVE

Bat_ID: A unique alpha numeric identifier for this bat sighting. This field is filled automatically by the database to reduce chance of redundancy error.

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Name_Common: The common name of the bat being observed. Dropdown menu of common names is available to populate this field. Entries restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

Name_Genus: The genus of the bat being observed. Dropdown menu of genus (Antrozous, Eptesicus, Eurderma, Idionycteris, Lasionycteris, Lasiurus, Myotis, Nyctinomops, Pipistrellus, Plecotus, Tadarida) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

Name_Species: The species of the bat being observed. Dropdown menu of species (blossevillii, brasiliensis, californicus, ciliolabrum, cinereus, evotis, fuscus, hesperus, lucifugus, macrotes, maculatum, noctivagans, pallidus, phyllotis, thysanodes, townsendii, volans, yumanensis) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

NHP_Speciescode: The Natural Heritage Program species code of the bat being observed. This field will fill automatically when a value for Name_Common, Name_Genus, or Name_Species is filled.

Bat_Location: Verbal description (500 characters) of where bat was found.

Bat_Status: Used to denote if bat(s) observed is alive, dead, or injured/sick. Dropdown menu of species (Alive-Healthy; Alive-Sick/Injured; Dead) is available to populate this field. Entries are restricted to these values.

Bat_Behavior: Field used to record the behavior of the bat being observed. Dropdown menu of species (Roosting-Asleep, Roosting-Stirring, Roosting-Awake, Flying, Foraging, Circling) is available to populate this field. Entries are restricted to these values.

Group_Size: Numerical field used to denote if bats are part of a cluster or group. A cluster is defined as two or more bat as touching. This field can also be used for flying bats that need to be considered as a group.

Temp_Microsite: Temperature in degrees Celsius of area immediately surrounding bat or cluster. Field values are limited (-20° < t <43°).

Notes: A 1000 character field to be used to record notes or comments made by the observer regarding this Bat_ID.

TABLE: CLIMATE

Climate_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Climate_Location: Verbal description (500 characters) of where climate data was recorded. Description should indicate distance from roost entrance/location.

Climate_Surface: Field used to identify what objects climate data was taken for at this location. Dropdown menu of surfaces (Air; Rock/Substrate; Bat) is available to populate this field. Entries are restricted to these values.

Temp_C: Temperature taken in degrees Celsius at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Humidity: Percent humidity recorded at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Temp/Humidity Logger: A Y/N toggle to indicate whether a data file with either temperature or humidity data from a data logger has been stored to describe this bridge/culvert.

TempHum_Store: Mechanism to accept, store and retrieve temperature and humidity files for this survey.

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Six (6) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Only zone 11 and 12 are found in Utah. Dropdown menu for zone (11, 12; unknown) is available to populate this field. Entries are restricted to these values.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 CONUS or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.

<300 m	Coordinate determined from USGS topographic map.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_EXTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Method_Video: A Y/N toggle to record whether the observer used IR Video to observe the bridge/culvert.

Method_NightVision: A Y/N toggle to record whether the observer(s) used night vision goggles to observe the bridge/culvert.

Method_Ocular: A Y/N toggle to record whether the observer just used their unaided eye to observe the bridge/culvert.

The following 19 fields are available if METHOD_VIDEO or METHOD_NIGHTVISION or METHOD_OCULAR field values were entered as Yes. If answered No then these are 'grayed out' or not shown.

Start_Time: The start time of the survey in local 24-hour time.

Start_Temp: Temperature recorded in degrees Celsius at survey start time. Data entry range restricted (-20° < t < 43°).

Start_Wind: Speed of wind recorded at survey start time. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Start_Weather: Record of the dominant weather category (1-4) at survey start time. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Start_Moon: Record of the phase of moon (1-5) at survey start time. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit

5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

1stEmergence_Time: The time of the 1st bat emergence in local 24-hour time.

1stEmergence_Temp: Temperature recorded in degrees Celsius at time of 1st Emergence. Data entry range restricted (-20° < t < 43°).

1stEmergence_Wind: Speed of wind recorded at time of 1st Emergence. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

1stEmergence_Weather: Record of the dominant weather category (1-4) at time of 1st Emergence. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

1stEmergence_Moon: Record of the phase of moon (1-5) at time of 1st Emergence. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

Count_Total: Total number of bats recorded exiting the cave/mine.

End_Time: The end time of the survey in local 24-hour time.

End_Temp: Temperature recorded in degrees Celsius at time of survey's end. Data entry range restricted (-20° < t < 43°).

End_Wind: Speed of wind recorded at time of survey's end. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.

3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

End_Weather: Record of the dominant weather category (1-4) at time of survey's end. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

End_Moon: Record of the phase of moon (1-5) at time of survey's end. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

File_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support external survey event.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this mine/cave.

Method_Mistnet: A Y/N toggle to record whether the observer(s) used mist net(s) to conduct surveys outside the bridge/culvert. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Harptrap: A Y/N toggle to record whether the observer(s) used harp trap(s) to conduct surveys outside the bridge/culvert. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Detectors: Field used to record if echolocation detectors were used during this Event_ID and what type. Dropdown menu of the detector types (zero crossing, full spectrum, none) is available to populate this site. Entries are restricted to these values. If value entered is not 'NONE' then after completing this entire record, user should enter acoustic data in ACOUSTIC SURVEY FORM.

Detector Type: A 100 character field to be used to record the brand and model number of the echolocation device.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: EVENT_INTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Start_Time: The start time of the survey in local 24-hour time.

End_Time: The end time of the survey in local 24-hour time.

Climate: Table: Climate should be inserted as a sub-form in this place.

Crevice_Abundance: A field used to indicate the relative number of 2-3 cm cracks available for use by day roosting bats. A dropdown menu of abundances (Absent, Limited, Abundant) is available to populate this field. Entries are restricted to these values.

Sign_Insectparts: A Y/N toggle to record whether the internal surveyor observed insect parts (wings, wing cases) that would indicate the presence of bat use of the bridge/culvert.

Location_Insectparts: Verbal description (500 characters) of where insect parts were found.

Sign_Guano: A Y/N toggle to record whether the surveyor observed guano or staining that would indicate the presence of bat use of the bridge/culvert.

Location_Guano: Verbal description (500 characters) of where bat guano/staining was found.

Bat_Bio: Table: Bat_Bio should be inserted as a sub-form in this place. It is available for data entry when the field Bats_Present is populated with a 'YES'.

Bats_Total: Total number of bats observed during the extent of the survey.

Survey_Extent: A Y/N toggle to record whether the observer was able to survey entire bridge/culvert.

Extent_Explanation: An explanation (1000 characters) as to why the entire bridge/culvert could not be surveyed.

Data_Other: A Y/N toggle to indicate whether other data files (additional photos, recordings, etc.) have been stored for this Internal Survey Event.

Data_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support this Internal Survey Event.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this bridge/culvert.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Team_Lead: First and last name of individual identified as survey lead.

Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.

Lead_Affiliation: Professional affiliation of person named in Team_Lead field.

Lead_Phone: Telephone number of person named in Team_Lead field.

Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.

Site_Name: A 100 character field to be used to record the name of bridge commonly used to refer to it (if available).

Site_Label: A 200 character field to be used to record any numeric code/label associated with the bridge (i.e. Utah Department of Transportation ID, miscellaneous numeric label found at site or on map, etc.).

State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.

County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.

Ownership: The agency/private owner who owns the land on which this site is located. Dropdown menu of ownership (Private, Public) is available to populate this field. Entries are restricted to these values.

Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)

Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.

Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.

Bridge_Type: Field used to record dominant use or style of bridge/culvert. Dropdown menu of the bridge use (Road Bridge, Train Bridge, Foot Bridge, Wildlife Crossing, Box Culvert, Pipe Culvert) is available to populate this field. Entries are restricted to these values.

Bridge_Location: Field used to record general location of the roost site. Dropdown menu of location classes (Urban, Suburban, Rural) is available to populate this field.

Bridge_Material: Field used to record dominant type of building material of bridge/culvert. Dropdown menu of the bridge material (Concrete, Stone, Steel, Wood, Earthen) is available to populate this field.

Bridge_Substrate: Field used to record the substrate the bridge was built to span. Dropdown menu of the substrate being spanned (Perennial water, Intermittent water, Railroad, Paved Road, Unpaved-motorized, Unpaved-non motorized, Wildlife Corridor) is available to populate this field. Entries are restricted to these values.

Structure_Widthmax: Maximum width (measured perpendicular long axis of bridge) of opening formed by bridge or culvert and the ground in meters.

Structure_Heightmax: Maximum height of opening formed by bridge or culvert and the ground in meters.

Suitability: This field records the potential suitability of the bridge/culvert for bats. Dropdown menu of levels (Suitable, Possibly Suitable, Likely Suitable, Unsuitable, Unknown) is available to populate this field. Entries are restricted to these values. Suitability score for this field automatically changes to "Suitable" for this Site_ID if values in Table: Site_Event; Field Bats_Present = Y.

Human Disturbance Level	Description
0 – Negligible Disturbance	Foot or vehicular traffic in immediate vicinity of roost occurring les than once a month.
1 – Limited Disturbance	Monthly foot or vehicular traffic in immediate vicinity of roost.
2 – Occasional Disturbance	Weekly foot or vehicular traffic in immediate vicinity of roost.
3 – Regular Disturbance	Daily foot or vehicular traffic in immediate vicinity of roost.
4 – Intensive Disturbance	Hourly foot or vehicular in immediate vicinity of roost.

Roost_Maternity: A Yes/No/Unknown toggle that indicates if a maternity colony has been detected at this site. Details should be recorded under Notes.

Roost_Bachelor: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Hibernacula: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Night: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).

Date_Day: This field indicates the day the survey was initiated and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.

Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.

Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.

Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September – October

Bats_Present: A Y/N toggle to record whether bats or their sign was present during this survey event at this survey site.

Survey_Method: Used to indicate whether the survey conducted was internal (researchers collected the data in close proximity to the roost) or external (researchers restricted site investigation to collecting external characteristics or conducting exit count surveys). Dropdown menu of survey type (Internal; External) is available to populate this field. Entries are restricted to these values.

Disturbance: Estimate of human disturbance in immediate vicinity of roost site. Dropdown menu of disturbance categories (0 - Limited disturbance; 1 – Occasional; 2 – Regular; 3 - Intensive) is available to populate this field. Entries are restricted to these values.

Human Disturbance Level	Description
0 – Limited Disturbance	Less than one Between 0 and 1 internal visit a year.
1 – Occasional Disturbance	Monthly Quarterly internal visits a year.
2 – Regular Disturbance	Daily foot or vehicular traffic above or below roost.
3 – Intensive Disturbance	Hourly foot or vehicular traffic above or below roost.

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether an E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos.
Report: A Y/N toggle to indicate whether reports have been stored for this site event.
Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Site_ID.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

FORM: ROOST – BUILDING/STRUCTURE

TABLE: BAT_BIO_OBSERVE

Bat_ID: A unique alpha numeric identifier for this bat sighting. This field is filled automatically by the database to reduce chance of redundancy error.

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Name_Common: The common name of the bat being observed. Dropdown menu of common names is available to populate this field. Entries restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

Name_Genus: The genus of the bat being observed. Dropdown menu of genus (Antrozous, Eptesicus, Eurderma, Idionycteris, Lasionycteris, Lasiurus, Myotis, Nyctinomops, Pipistrellus, Plecotus, Tadarida) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

Name_Species: The species of the bat being observed. Dropdown menu of species (blossevillii, brasiliensis, californicus, ciliolabrum, cinereus, evotis, fuscus, hesperus, lucifugus, macrotes, maculatum, noctivagans, pallidus, phyllotis, thysanodes, townsendii, volans, yumanensis) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

NHP_Speciescode: The Natural Heritage Program species code of the bat being observed. This field will fill automatically when a value for Name_Common, Name_Genus, or Name_Species is filled.

Bat_Location: Verbal description (500 characters) of where bat was found.

Bat_Status: Used to denote if bat(s) observed is alive, dead, or injured/sick. Dropdown menu of species (Alive-Healthy; Alive-Sick/Injured; Dead) is available to populate this field. Entries are restricted to these values.

Bat_Behavior: Field used to record the behavior of the bat being observed. Dropdown menu of species (Roosting-Asleep, Roosting-Stirring, Roosting-Awake, Flying, Foraging, Circling) is available to populate this field. Entries are restricted to these values.

Group_Size: Numerical field used to denote if bats are part of a cluster or group. A cluster is defined as two or more bat as touching. This field can also be used for flying bats that need to be considered as a group.

Temp_Microsite: Temperature in degrees Celsius of area immediately surrounding bat or cluster. Field values are limited (-20° < t <43°).

Notes: A 1000 character field to be used to record notes or comments made by the observer regarding this Bat_ID.

TABLE: CLIMATE

Climate_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Climate_Location: Verbal description (500 characters) of where climate data was recorded. Description should indicate distance from roost entrance/location.

Climate_Surface: Field used to identify what objects climate data was taken for at this location. Dropdown menu of surfaces (Air; Material/Substrate; Bat) is available to populate this field. Entries are restricted to these values.

Temp_C: Temperature taken in degrees Celsius at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Humidity: Percent humidity recorded at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Temp/Humidity Logger: A Y/N toggle to indicate whether a data file with either temperature or humidity data from a data logger has been stored to describe this building/structure.

TempHum_Store: Mechanism to accept, store and retrieve temperature and humidity files for this survey.

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Six (6) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Only zone 11 and 12 are found in Utah. Dropdown menu for zone (11, 12; unknown) is available to populate this field. Entries are restricted to these values.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 CONUS or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.

<300 m	Coordinate determined from USGS topographic map.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_EXTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Method_Video: A Y/N toggle to record whether the observer used IR Video to observe the building/structure.

Method_NightVision: A Y/N toggle to record whether the observer(s) used night vision goggles to observe the building/structure.

Method_Ocular: A Y/N toggle to record whether the observer just used their unaided eye to observe the building/structure.

The following 19 fields are available if METHOD_VIDEO or METHOD_NIGHTVISION or METHOD_OCULAR field values were entered as Yes. If answered No then these are 'grayed out' or not shown.

Start_Time: The start time of the survey in local 24-hour time.

Start_Temp: Temperature recorded in degrees Celsius at survey start time. Data entry range restricted (-20° < t < 43°).

Start_Wind: Speed of wind recorded at survey start time. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Start_Weather: Record of the dominant weather category (1-4) at survey start time. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Start_Moon: Record of the phase of moon (1-5) at survey start time. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit

5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

1stEmergence_Time: The time of the 1st bat emergence in local 24-hour time.

1stEmergence_Temp: Temperature recorded in degrees Celsius at time of 1st Emergence. Data entry range restricted (-20° < t < 43°).

1stEmergence_Wind: Speed of wind recorded at time of 1st Emergence. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

1stEmergence_Weather: Record of the dominant weather category (1-4) at time of 1st Emergence. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

1stEmergence_Moon: Record of the phase of moon (1-5) at time of 1st Emergence. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

Count_Total: Total number of bats recorded exiting the cave/mine.

End_Time: The end time of the survey in local 24-hour time.

End_Temp: Temperature recorded in degrees Celsius at time of survey's end. Data entry range restricted (-20° < t < 43°).

End_Wind: Speed of wind recorded at time of survey's end. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.

3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

End_Weather: Record of the dominant weather category (1-4) at time of survey's end. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

End_Moon: Record of the phase of moon (1-5) at time of survey's end. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

File_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support external survey event.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

Method_Mistnet: A Y/N toggle to record whether the observer(s) used mist net(s) to conduct surveys outside the building/structure. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Harptrap: A Y/N toggle to record whether the observer(s) used harp trap(s) to conduct surveys outside the building/structure. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Detectors: Field used to record if echolocation detectors were used during this Event_ID and what type. Dropdown menu of the detector types (zero crossing, full spectrum, none) is available to populate this site. Entries are restricted to these values. If value entered is not 'NONE' then after completing this entire record, user should enter acoustic data in ACOUSTIC SURVEY FORM.

Detector Type: A 100 character field to be used to record the brand and model number of the echolocation device.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this mine/cave

TABLE: EVENT_INTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Start_Time: The start time of the survey in local 24-hour time.

End_Time: The end time of the survey in local 24-hour time.

Climate: Table: Climate should be inserted as a sub-form in this place.

Access_Abundance: A field used to indicate the relative number of access points bats have to the interior of the building/strucutre. A dropdown menu of abundances (Absent, Limited, Abundant) is available to populate this field. Entries are restricted to these values.
Sign_Insectparts: A Y/N toggle to record whether the internal surveyor observed insect parts (wings, wing cases) that would indicate the presence of bat use of the building/structure.
Location_Insectparts: Verbal description (500 characters) of where insect parts were found.
Sign_Guano: A Y/N toggle to record whether the surveyor observed guano or staining that would indicate the presence of bat use of the building/structure.
Location_Guano: Verbal description (500 characters) of where bat guano/staining was found.
Bat_Bio: Table: Bat_Bio should be inserted as a sub-form in this place. It is available for data entry when the field Bats_Present is populated with a 'YES'.
Bats_Total: Total number of bats observed during the extent of the survey.
Survey_Extent: A Y/N toggle to record whether the observer was able to survey entire building/structure.
Extent_Explanation: An explanation (1000 characters) as to why the entire building/structure could not be surveyed.
Data_Other: A Y/N toggle to indicate whether other data files (additional photos, recordings, etc.) have been stored for this Internal Survey Event.
Data_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support this Internal Survey Event.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this building/structure.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Team_Lead: First and last name of individual identified as survey lead.
Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.
Lead_Affiliation: Professional affiliation of person named in Team_Lead field.
Lead_Phone: Telephone number of person named in Team_Lead field.
Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.
Site_Name: A 100 character field to be used to record the name of the building/structure commonly used to refer to it (if available).
Site_Address: A 200 character field to be used to record any alpha numeric address associated with the building/structure (i.e. U.S. Postal, label found at site or on map, etc.).

State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.

County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.

Ownership: The agency/company/individual who owns the land on which this site is located. Dropdown menu of ownership (Private, Public) is available to populate this field. Entries are restricted to these values.

Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)

Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.

Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.

Building_Use: Field used to record dominant use or style of building. Dropdown menu of the building use (Commercial, Residential, Industrial, Agricultural, Abandoned) is available to populate this field. Entries are restricted to these values.

Building_Location: Field used to record general location of roost site. Dropdown menu of location classes (Urban, Suburban, Rural) is available to populate this field.

Building_Type: Field used to record dominant type of structure's building material. Dropdown menu of the bridge material (Brick/Block, Stone, Steel, Wood) is available to populate this field.

Building_Description: A 1000 character field to be used to describe the building during their visit to this Site_ID. Description should note major structural characters of building (number of stories, approximation of square footage, level of upkeep).

Suitability: This field records the potential suitability of the building for bats. Dropdown menu of levels (Suitable, Possibly Suitable, Likely Suitable, Unsuitable, Unknown) is available to populate this field. Entries are restricted to these values. Suitability score for this field automatically changes to "Suitable" for this Site_ID if values in Table: Site_Event; Field Bats_Present = Y.

Suitability	Description
Suitable	As demonstrated by the presence of bats or their sign.
Possibly Suitable	No sign observed, but conditions otherwise seem suitable (crevices).
Likely Unsuitable	No sign observed, conditions likely unsuitable.
Unsuitable	No sign observed and conditions definitively determined to be unsuitable to support bats needs.
Unknown	Unable to determine.

Roost_Maternity: A Yes/No/Unknown toggle that indicates if a maternity colony has been detected at this site. Details should be recorded under Notes.

Roost_Bachelor: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Hibernacula: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Night: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).

Date_Day: This field indicates the day the survey was initiated and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.

Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.

Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.

Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September – October

Bats_Present: A Y/N toggle to record whether bats or their sign was present during this survey event at this survey site.

Survey_Method: Used to indicate whether the survey conducted was internal (researchers collected the data within the walls of the structure) or external (researchers restricted site investigation to collecting external characteristics or conducting exit count surveys). Dropdown menu of survey type (Internal; External) is available to populate this field. Entries are restricted to these values.

Disturbance: Estimate of human disturbance in immediate vicinity of roost site. Dropdown menu of disturbance categories (0 - Limited disturbance; 1 – Occasional; 2 – Regular; 3 - Intensive) is available to populate this field. Entries are restricted to these values.

Human Disturbance Level	Description
0 – Negligible Disturbance	Foot or vehicular traffic in immediate vicinity of roost occurring les than once a month.
1 – Limited Disturbance	Monthly foot or vehicular traffic in immediate vicinity of roost.
2 – Occasional Disturbance	Weekly foot or vehicular traffic in immediate vicinity of roost.
3 – Regular Disturbance	Daily foot or vehicular traffic in immediate vicinity of roost.
4 – Intensive Disturbance	Hourly foot or vehicular in immediate vicinity of roost.

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether an E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Site_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

FORM: ROOST - MINE AND CAVE

TABLE: BAT_BIO_OBSERVE

Bat_ID: A unique alpha numeric identifier for this bat sighting. This field is filled automatically by the database to reduce chance of redundancy error.

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Name_Common: The common name of the bat being observed. Dropdown menu of common names is available to populate this field. Entries restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

Name_Genus: The genus of the bat being observed. Dropdown menu of genus (Antrozous, Eptesicus, Eurderma, Idionycteris, Lasionycteris, Lasiurus, Myotis, Nyctinomops, Pipistrellus, Plecotus, Tadarida) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

Name_Species: The species of the bat being observed. Dropdown menu of species (blossevillii, brasiliensis, californicus, ciliolabrum, cinereus, evotis, fuscus, hesperus, lucifugus, macrotes, maculatum, noctivagans, pallidus, phyllotis, thysanodes, townsendii, volans, yumanensis) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

NHP_Speciescode: The Natural heritage Program species code of the bat being observed. This field will fill automatically when a value for Name_Common, Name_Genus, or Name_Species is filled.

Bat_Location: Verbal description (500 characters) of where bat was found. Description should indicate distance from entrance and note whether location was indicated on the map.

Bat_Status: Used to denote if bat(s) observed is alive, dead, or injured/sick. Dropdown menu of species (Alive-Healthy; Alive-Sick/Injured; Dead) is available to populate this field. Entries are restricted to these values.

Bat_Behavior: Field used to record the behavior of the bat being observed. Dropdown menu of species (Roosting-Asleep, Roosting-Stirring, Roosting-Awake, Flying, Foraging, Circling) is available to populate this field. Entries are restricted to these values.

Group_Size: Numerical field used to denote if bats are part of a cluster or group. A cluster is defined as two or more bat as touching. This field can also be used for flying bats that need to be considered as a group.

Temp_Microsite: Temperature in degrees Celsius of area immediately surrounding bat or cluster. Field values are limited (-20° < t <43°).

Notes: A 1000 character field to be used to record notes or comments made by the observer regarding this Bat_ID.

TABLE: CLIMATE

Climate_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Climate_Location: Verbal description (500 characters) of where climate data was recorded. Description should indicate distance from entrance and note whether location was indicated on the map.

Climate_Surface: Field used to identify what objects climate data was taken for at this location. Dropdown menu of surfaces (Air; Rock/Substrate; Bat) is available to populate this field. Entries are restricted to these values.

Temp_C: Temperature taken in degrees Celsius at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Humidity: Percent humidity recorded at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Temp/Humidity Logger: A Y/N toggle to indicate whether a data file with either temperature or humidity data from a data logger has been stored to describe this mine/cave.

TempHum_Store: Mechanism to accept, store and retrieve temperature and humidity files for this survey.

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Six (6) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Only zone 11 and 12 are found in Utah. Dropdown menu for zone (11, 12; unknown) is available to populate this field. Entries are restricted to these values.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 CONUS or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.

<300 m	Coordinate determined from USGS topographic map.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_EXTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Method_Video: A Y/N toggle to record whether the observer used IR Video to observe the mine/cave.

Method_NightVision: A Y/N toggle to record whether the observer(s) used night vision goggles to observe the mine/cave.

Method_Ocular: A Y/N toggle to record whether the observer just used their unaided eye to observe the bridge/culvert.

The following 19 fields are available if METHOD_VIDEO or METHOD_NIGHTVISION or METHOD_OCULAR field values were entered as Yes. If answered No then these are 'grayed out' or not shown.

Start_Time: The start time of the survey in local 24-hour time.

Start_Temp: Temperature recorded in degrees Celsius at survey start time. Data entry range restricted (-20° < t < 43°).

Start_Wind: Speed of wind recorded at survey start time. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Start_Weather: Record of the dominant weather category (1-4) at survey start time. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Start_Moon: Record of the phase of moon (1-5) at survey start time. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.

6) Unknown	Moon status unknown or not recorded.

1stEmergence_Time: The time of the 1st bat emergence in local 24-hour time.

1stEmergence_Temp: Temperature recorded in degrees Celsius at time of 1st Emergence. Data entry range restricted (-20° < t < 43°).

1stEmergence_Wind: Speed of wind recorded at time of 1st Emergence. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

1stEmergence_Weather: Record of the dominant weather category (1-4) at time of 1st Emergence. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

1stEmergence_Moon: Record of the phase of moon (1-5) at time of 1st Emergence. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

Count_Total: Total number of bats recorded exiting the cave/mine.

End_Time: The end time of the survey in local 24-hour time.

End_Temp: Temperature recorded in degrees Celsius at time of survey's end. Data entry range restricted (-20° < t < 43°).

End_Wind: Speed of wind recorded at time of survey's end. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.

4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

End_Weather: Record of the dominant weather category (1-4) at time of survey's end. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

End_Moon: Record of the phase of moon (1-5) at time of survey's end. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

File_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support external survey event.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this mine/cave.

Method_Mistnet: A Y/N toggle to record whether the observer(s) used mist net(s) to conduct surveys outside the mine/cave. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Harptrap: A Y/N toggle to record whether the observer(s) used harp trap(s) to conduct surveys outside the mine/cave. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Detectors: Field used to record if echolocation detectors were used during this Event_ID and what type. Dropdown menu of the detector types (zero crossing, full spectrum, none) is available to populate this site. Entries are restricted to these values. If value entered is not 'NONE' then after completing this entire record, user should enter acoustic data in ACOUSTIC SURVEY FORM.

Detector Type: A 100 character field to be used to record the brand and model number of the echolocation device.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: EVENT_INTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Start_Time: The start time of the survey in local 24-hour time.

End_Time: The end time of the survey in local 24-hour time.

Internal_Stability: Field used to assess mine/cave's average internal stability. Dropdown menu of gate types (Stable, Minor debris, Unstable) is available to populate this field. Entries are restricted to these values.

Stability	Description
Stable	Passageway is open and clear. No rock debris on floor from ceiling or walls.
Minor Debris	Passageway is open with only small amounts of debris on floor.
Unstable	Large amounts of rock and debris on passageway floor. Rotten timbers may be present. Portions of passage may be collapsed. Unsafe.

Climate: Table: Climate should be inserted as a sub-form in this place.
Sign_Insectparts: A Y/N toggle to record whether the internal surveyor observed insect parts (wings, wing cases) that would indicate the presence of bat use in the mine/cave.
Location_Insectparts: Verbal description (500 characters) of where insect parts were found. Description should indicate distance from entrance and note whether location was indicated on the map.
Sign_Guano: A Y/N toggle to record whether the internal surveyor observed guano or staining that would indicate the presence of bat use in the mine/cave.
Location_Guano: Verbal description (500 characters) of where bat guano/staining was found. Description should indicate distance from entrance and note whether location was indicated on the map.
Water_Internal: A Y/N toggle to record whether the internal surveyor encountered subterranean pooling water.
Location_Water: Verbal description (500 characters) of where pooling water was found. Description should indicate distance from entrance and note whether location was indicated on the map.
Bat_Bio: Table: Bat_Bio should be inserted as a sub-form in this place. It is available for data entry when the field Bats_Present is populated with a 'YES'.
Bats_Total: Total number of bats observed during the extent of the survey.
Survey_Extent: A Y/N toggle to record whether the observer was able to survey entire mine/cave.
Extent_Explanation: An explanation (1000 characters) as to why the entire mine/cave could not be surveyed.
Data_Other: A Y/N toggle to indicate whether other data files (additional photos, recordings, etc.) have been stored for this Internal Survey Event.
Data_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support this Internal Survey Event.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this mine/cave

TABLE: GATE

Gate_ID: A unique identifier for this gate.
Gate_Day: This field indicates the day the gate was constructed and should be entered only when the exact day of the construction is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.
Gate_Month: This field indicates the month the gate was constructed and should be entered only when the exact month of the construction is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.
Gate_Year: This field indicated the year the gate was constructed and should be filled only when the exact year of the construction is known. Filter is applied to restrict entries to 4 digits.
Gate_Type: Description of the construction type of the gate. Dropdown menu of gate types (Wall; Cage; Culvert; Grate) is available to populate this field. Entries are restricted to these values.
Gate_Style: Description of the construction style of the gate. Dropdown menu of the gate styles (iron bars - round in cross section; iron bands – rectangular in cross section; angle iron) is available to populate this field. Entries are restricted to these values.
Gate_Height: Height of gate at tallest point in meters.
Gate_Width: Width of gate at widest point.

Photo_Gate: A field to indicate whether a photo was taken of the gate. Combine with mechanism to accept, store, and retrieve photos.
Access_Name: Field to store the name of the person to contact for access to the gate.
Access_Position: Field to store the position title of the person to contact for access to the gate.
Access_Affiliation: Field to store the agency affiliation of the person to contact for access to the gate.
Access_Address: Field to store the address of the person to contact for access to the gate.
Access_Phone: Field to store the phone number of the person to contact for access to the gate.
Access_Email: Field to store the email address of the person to contact for access to the gate.

TABLE: GATE_VIOLATIONS

Gate_ID: A unique identifier for this gate.
Violation_No: A numeric field indicating how many times this gate has been broken into. This field fills automatically by summing up records already entered for this Gate_ID (n), including the one currently being entered (n+1).
Violation_Day: This field indicates the day the gate was constructed and should be entered only when the exact day of the construction is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.
Violation_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.
Violation_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.
Violation_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September - October

Violation_Descript: A 1000 character field to be used to record details of gate breach/violation event related to this Gate_ID.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Team_Lead: First and last name of individual identified as survey lead.
Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.
Lead_Affiliation: Professional affiliation of person named in Team_Lead field.
Lead_Phone: Telephone number of person named in Team_Lead field.
Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.
Site_Name: A 100 character field to be used to record the name of mine/cave commonly used to refer to it (if available).
Site_Label: A 200 character field to be used to record any numeric code/label associated with the cave/mine (i.e. claim number, Utah Division of Oil Gas and Mining number, miscellaneous numeric label found at site or on map, etc.).
State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.
County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.
Ownership: The agency/private owner who owns the land on which this site is located. Dropdown menu of ownership (Private, Forest Service, BLM, Indian Reservation, State, Department of Defense, Nature Conservancy, Unknown, Other) is available to populate this field. Entries are restricted to these values.
Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)
Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.
Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.
Aspect: Dropdown menu of aspects (North, Northeast, East, Southeast, South, Southwest, West, Northwest) is available to populate this field. Entries are restricted to these values.
Slope: Predominant slope found in the area of this site. Entries should be restricted to allow only entries between 0-90°
Type_Primary: Field used to record dominant type of site. Dropdown menu of the site type (Mine-Shaft; Mine-Adit; Mine-45 degree, Open Pit; Cave) is available to populate this field. Entries are restricted to these values.
Type_Secondary: Field used to record secondary type of site. Dropdown menu of the site type (Mine-Shaft; Mine-Adit; Mine-45 degree, Open Pit; Cave) is available to populate this field. Entries are restricted to these values.
Type_Complexity: Field used to record cave/mine architecture. Dropdown menu of complexities (Simple; Moderate; Complex) is available to populate this field. Entries are restricted to these values.

Complexity	Description
Simple	Main passage with non-branching side tunnels
Moderate	Simple + branching side passages and/or multiple (>1 but <3) levels
Complex	Moderate + multi-branching side tunnels and/or multiple levels

Type_Levels: Number of horizontal levels in mine/cave. Dropdown menu of levels (Single level; Multi-level, Unknown) is available to populate this field. Entries are restricted to these values.
Passage_Widthmax: Maximum width of passage, in meters.
Passage_Lengthmax: Maximum length of travel from opening (includes vertical sections), in meters.

Passage_Heightmax: Maximum height of passage (include vertical sections), in meters.
Room_Widthmax: Widest point of largest room, in meters.
Room_Lengthmax: Longest horizontal distance of largest room, in meters.
Room_Heightmax: Tallest point from floor f largest room, in meters.
Site_Map: A Y/N toggle to indicate whether a map has been stored to describe this mine/cave.
Map_Store: Mechanism to accept, store and retrieve map of mine/cave.
Suitability: This field records the potential suitability of the site for bats. Dropdown menu of levels (Suitable, Possibly Suitable, Likely Suitable, Unsuitable, Unknown) is available to populate this field. Entries are restricted to these values. Suitability score for this field automatically changes to "Suitable" for this Site_ID if values in Table: Site_Event; Field Bats_Present = Y.

Suitability	Description
Suitable	As demonstrated by the presence of bats or their sign.
Possibly Suitable	No sign observed, but conditions otherwise seem suitable.
Likely Unsuitable	No sign observed, conditions likely unsuitable.
Unsuitable	No sign observed and conditions definitively determined to be unsuitable to support bats needs (ex. opening collapsed, overgrown, too shallow, bad air, etc.)
Unknown	Unable to determine.

Roost_Maternity: A Yes/No/Unknown toggle that indicates if a maternity colony has been detected at this site. Details should be recorded under comments and marked on Site_Map.
Roost_Bachelor: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under comments and marked on Site_Map.
Roost_Hibernacula: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under comments and marked on Site_Map.
Roost_Night: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).
Date_Day: This field indicates the day the survey was conducted and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.
Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.
Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.
Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description

Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September - October

Bats_Present: A Y/N toggle to record whether the internal surveyor observed any bats during their survey.

Survey_Method: Used to indicate whether the survey conducted was internal (researchers collected the data from within the mine or cave) or external (researchers restricted site investigation to collecting external characteristics or conducting external surveys). Dropdown menu of survey type (Internal; External) is available to populate this field. Entries are restricted to these values.

Portal_Accessibility: Indicates ability of researchers to enter the mine/cave. Dropdown menu of accessibility values (Open/Safe; Inaccessible/Unsafe, Closed/Collapsed, Gated/Grated) is available to populate this field. Entries are restricted to these values.

Portal_Stability: Indicates condition of entrance at time of this site visit. Dropdown menu of stability values (Stable; Partially Filled; Collapsed/Closed) is available to populate this field. Entries are restricted to these values.

Portal_Widthmax: Width, in feet, of the primary entrance portal at its widest point. The primary entrance is the entrance for which coordinates (fields UTM_E and UTM_N) were collected to define this record.

Portal_Heightmax: Height, in feet, of the primary entrance portal at its tallest point. The primary entrance is the entrance for which coordinates (fields UTM_E and UTM_N) were collected to define this record.

Air_direction: Direction of air flow at primary cave/mine entrance. Dropdown menu of air directions (Intaking, Outflowing) is available to populate this field.

Air_speed: Wind speed assessed at entrance to mine/cave. Dropdown menu of MPH categories of air speeds (0-1, 1-3, 4-7, 8-12, 13-18) is available to populate this field.

Wind Speed	Description
0-1 mph	Calm; smoke rises vertically
1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes
4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind
8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
13-18 mph	Raises dust and loose paper; small branches are moved

Entrances_no: Number of functional external entrances to this site. Functional entrances are those entrances that could be used by bats.

Entrances_est: A toggle to indicate whether the data recorded in Entrances_no field was known or estimated.

Gated: A Y/N toggle to indicate whether the primary entrance has been gated. When populated with a value of "YES' then the sub-table GATE should be made available for data entry.

Gate: Table: GATE should be inserted as a sub-form in this place. It is available for data entry when the field Gated is populated with a 'YES'.

Disturbance: Estimate of recent human disturbance to internal portions of the cave and mine. Dropdown menu of disturbance categories (0 - No disturbance; 1 – Occasional; 2 – Regular; 3 - Intensive) is available to populate this field.

Human Disturbance Level	Description
0 – No Disturbance	Between 0 and 1 internal visit a year.
1 – Occasional Disturbance	Quarterly internal visits a year.
2 – Regular Disturbance	Monthly internal visits a year.
3 – Intensive Disturbance	Weekly internal visits a year.

Team_Lead: First and last name of individual identified as survey lead.

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether a E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Site_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

FORM: ROOST – SELF DEFINED

TABLE: BAT_BIO_OBSERVE

Bat_ID: A unique alpha numeric identifier for this bat sighting. This field is filled automatically by the database to reduce chance of redundancy error.

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Name_Common: The common name of the bat being observed. Dropdown menu of common names is available to populate this field. Entries restricted to these values.

Common Name	Genus	Species
Pallid Bat	Antrozous	pallidus
Big Brown Bat	Eptesicus	fuscus
Spotted Bat	Eurderma	maculatum
Allen's Big-eared Bat	Idionycteris	phyllotis
Silver-haired Bat	Lasionycteris	noctivagans
Western Red Bat	Lasiurus	blossevillii
Hoary Bat	Lasiurus	cinereus
California Myotis	Myotis	californicus
W.Small-footed Myotis	Myotis	ciliolabrum
Long-eared Bat	Myotis	evotis
Little Brown Bat	Myotis	lucifugus
Fringed Myotis	Myotis	thysanodes
Long-legged Bat	Myotis	volans
Yuma Myotis	Myotis	yumanensis
Big Free-tailed Bat	Nyctinomops	macrotis
Western Pipistrelle	Pipistrellus	hesperus
Towsend's Big-eared Bat	Plecotus	townsendii
Brazilian Free-tailed Bat	Tadarida	brasiliensis

Name_Genus: The genus of the bat being observed. Dropdown menu of genus (Antrozous, Eptesicus, Eurderma, Idionycteris, Lasionycteris, Lasiurus, Myotis, Nyctinomops, Pipistrellus, Plecotus, Tadarida) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

Name_Species: The species of the bat being observed. Dropdown menu of species (blossevillii, brasiliensis, californicus, ciliolabrum, cinereus, evotis, fuscus, hesperus, lucifugus, macrotes, maculatum, noctivagans, pallidus, phyllotis, thysanodes, townsendii, volans, yumanensis) is available to populate this field. Entries are restricted to these values. This field will fill automatically when a value for Name_Common is entered.

NHP_Speciescode: The Natural Heritage Program species code of the bat being observed. This field will fill automatically when a value for Name_Common, Name_Genus, or Name_Species is filled.

Bat_Location: Verbal description (500 characters) of where bat was found.

Bat_Status: Used to denote if bat(s) observed is alive, dead, or injured/sick. Dropdown menu of species (Alive-Healthy; Alive-Sick/Injured; Dead) is available to populate this field. Entries are restricted to these values.

Bat_Behavior: Field used to record the behavior of the bat being observed. Dropdown menu of species (Roosting-Asleep, Roosting-Stirring, Roosting-Awake, Flying, Foraging, Circling) is available to populate this field. Entries are restricted to these values.

Group_Size: Numerical field used to denote if bats are part of a cluster or group. A cluster is defined as two or more bat as touching. This field can also be used for flying bats that need to be considered as a group.

Temp_Microsite: Temperature in degrees Celsius of area immediately surrounding bat or cluster. Field values are limited (-20° < t <43°).

Notes: A 1000 character field to be used to record notes or comments made by the observer regarding this Bat_ID.

TABLE: CLIMATE

Climate_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Climate_Location: Verbal description (500 characters) of where climate data was recorded. Description should indicate distance from roost entrance/location.

Climate_Surface: Field used to identify what objects climate data was taken for at this location. Dropdown menu of surfaces (Air; Material/Substrate; Bat) is available to populate this field. Entries are restricted to these values.

Temp_C: Temperature taken in degrees Celsius at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Humidity: Percent humidity recorded at the location indicated in Temp_Location field. Data entry range restricted (-20° < t < 43°).

Temp/Humidity Logger: A Y/N toggle to indicate whether a data file with either temperature or humidity data from a data logger has been stored to describe this roost.

TempHum_Store: Mechanism to accept, store and retrieve temperature and humidity files for this survey.

TABLE: COORDS

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

UTM_E: Universal Transverse Mercator (UTM) System easting coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Six (6) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_N: Universal Transverse Mercator (UTM) System northing coordinate in meters representing the approximate center of the survey site or a feature (cave, bridge) targeted for data collection. Seven (7) whole number digits must be entered. Recorded automatically if the fields Township; Range; and Section are entered.

UTM_Zone: Universal Transverse Mercator (UTM) zone. Only zone 11 and 12 are found in Utah. Dropdown menu for zone (11, 12; unknown) is available to populate this field. Entries are restricted to these values.

Datum: Geometric reference surface. Original Site Location datum is defined by user's map datum; e.g. NAD27 CONUS or NAD83.

Township: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Range: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Section: Township associated with a legal location (Public Land Survey System) for survey site. Recorded automatically if the fields UTM_N and UTM_E are entered.

Accuracy: Field used to record the accuracy of the coordinates recorded for this site. Dropdown menu for accuracy (<30m; <300m; <3km; unknown) is available to populate this field. Entries are restricted to these values.

Accuracy	Description
<30 m	Coordinate determined from GPS unit.

<300 m	Coordinate determined from USGS topographic map.
<3 km	Coordinate determined from vague description, historical data, or TRS.
Unknown	Unable to assess accuracy of coordinate recorded.

TABLE: EVENT_EXTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Method_Video: A Y/N toggle to record whether the observer used IR Video to observe the building/structure.

Method_NightVision: A Y/N toggle to record whether the observer(s) used night vision goggles to observe the building/structure.

Method_Ocular: A Y/N toggle to record whether the observer just used their unaided eye to observe the building/structure.

The following 19 fields are available if METHOD_VIDEO or METHOD_NIGHTVISION or METHOD_OCULAR field values were entered as Yes. If answered No then these are 'grayed out' or not shown.

Start_Time: The start time of the survey in local 24-hour time.

Start_Temp: Temperature recorded in degrees Celsius at survey start time. Data entry range restricted (-20° < t < 43°).

Start_Wind: Speed of wind recorded at survey start time. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

Start_Weather: Record of the dominant weather category (1-4) at survey start time. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

Start_Moon: Record of the phase of moon (1-5) at survey start time. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit

5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

1stEmergence_Time: The time of the 1st bat emergence in local 24-hour time.

1stEmergence_Temp: Temperature recorded in degrees Celsius at time of 1st Emergence. Data entry range restricted (-20° < t < 43°).

1stEmergence_Wind: Speed of wind recorded at time of 1st Emergence. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.
3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

1stEmergence_Weather: Record of the dominant weather category (1-4) at time of 1st Emergence. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

1stEmergence_Moon: Record of the phase of moon (1-5) at time of 1st Emergence. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

Count_Total: Total number of bats recorded exiting the cave/mine.

End_Time: The end time of the survey in local 24-hour time.

End_Temp: Temperature recorded in degrees Celsius at time of survey's end. Data entry range restricted (-20° < t < 43°).

End_Wind: Speed of wind recorded at time of survey's end. Use MPH categories as determined from the Beaufort Wind Scale. A dropdown menu of wind speeds [1) 0-1 MPH; 2) 1-3 MPH; 3) 4-7 MPH; 4) 8-12 MPH; 5) 13-18 MPH; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Wind Speed	Description
1) 0-1 mph	Calm; smoke rises vertically.
2) 1-3 mph	Direction of wind shown by smoke drift, but not by wind vanes.

3) 4-7 mph	Wind felt on face, leaves rustle, ordinary vane moved by wind.
4) 8-12 mph	Leaves and small twigs in constant, gentle motion; wind extends light flag.
5) 13-18 mph	Raises dust and loose paper; small branches are moved.
6) Unknown	Wind speed unknown or not recorded.

End_Weather: Record of the dominant weather category (1-4) at time of survey's end. A dropdown menu of weather categories [1) Clear: 0-10%; 2) Partly: 10%-50%; 3) Cloudy: 50%-100%; 4) Precipitation; 5) Unknown] is available to populate this field. Entries are restricted to these values.

Weather	Description
1) Clear	0-10% cloud cover.
2) Partly Cloudy	10%-50% cloud cover.
3) Cloudy	50%-100% cloud cover.
4) Precipitation	Some amount of precipitation fell during the last hour.
5) Unknown	Weather unknown or not recorded.

End_Moon: Record of the phase of moon (1-5) at time of survey's end. A dropdown menu of moon phases [1) None; 2) Crescent; 3) Half; 4) Full; 5) Obscured; 6) Unknown] is available to populate this field. Entries are restricted to these values.

Moon	Description
1) None	Either a new moon, not risen, or just set.
2) Crescent	Moon is 0-25% lit
3) Half	Moon is 25-75% lit
4) Full	Moon is 75-100% lit
5) Obscured	Moon is obscured by cloud cover.
6) Unknown	Moon status unknown or not recorded.

File_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support external survey event.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

Method_Mistnet: A Y/N toggle to record whether the observer(s) used mist net(s) to conduct surveys outside the roost. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Harptrap: A Y/N toggle to record whether the observer(s) used harp trap(s) to conduct surveys outside the roost. If YES then after completing this entire record, user should enter capture data in CAPTURE SURVEY FORM.

Method_Detectors: Field used to record if echolocation detectors were used during this Event_ID and what type. Dropdown menu of the detector types (zero crossing, full spectrum, none) is available to populate this site. Entries are restricted to these values. If value entered is not 'NONE' then after completing this entire record, user should enter acoustic data in ACOUSTIC SURVEY FORM.

Detector Type: A 100 character field to be used to record the brand and model number of the echolocation device.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this roost.

TABLE: EVENT_INTERNAL

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Start_Time: The start time of the survey in local 24-hour time.

End_Time: The end time of the survey in local 24-hour time.

Climate: Table: Climate should be inserted as a sub-form in this place.

Sign_Insectparts: A Y/N toggle to record whether the internal surveyor observed insect parts (wings, wing cases) that would indicate the presence of bat use of the roost.
Location_Insectparts: Verbal description (500 characters) of where insect parts were found.
Sign_Guano: A Y/N toggle to record whether the surveyor observed guano or staining that would indicate the presence of bat use of the roost.
Location_Guano: Verbal description (500 characters) of where bat guano/staining was found.
Bat_Bio: Table: Bat_Bio should be inserted as a sub-form in this place. It is available for data entry when the field Bat_Present is populated with a 'YES'.
Bats_Total: Total number of bats observed during the extent of the survey.
Survey_Extent: A Y/N toggle to record whether the observer was able to survey entire roost.
Extent_Explanation: An explanation (1000 characters) as to why the entire roost could not be surveyed.
Data_Other: A Y/N toggle to indicate whether other data files (additional photos, recordings, etc.) have been stored for this Internal Survey Event.
Data_Store: Mechanism (e.g. GUI upload button) to accept, store, and retrieve files with notes to support this Internal Survey Event.
Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this roost.

TABLE: PERSONNEL

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Team_Lead: First and last name of individual identified as survey lead.
Lead_Quals: The qualifications of the lead observer to accurately assess the site's value and to identify the correct species of bats associated with the observation or detection. Education and field experience generally define the level.

Qualifications	Description
Experienced	A person who has extensive field experience with the species detected.
Limited Experience	A person with limited field experience with the species detected. Capable of making positive identifications among similar species.
No Experience	A person with no field experience identifying the wildlife species.
Unknown	The experience level of the observer is unknown.

Team_Members: First and last names of other observers present.
Lead_Affiliation: Professional affiliation of person named in Team_Lead field.
Lead_Phone: Telephone number of person named in Team_Lead field.
Lead_Address: Address of person named in Team_Lead field.

TABLE: SITE_DATA

Site_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.
Date_Established: Date that this site was first known to be investigated. This field fills automatically with the earliest date entered into this Site_ID's fields of Date_Day, Date_Month, Date_Year.
Site_Name: A 100 character field to be used to record the name of the building/structure commonly used to refer to it (if available).
State: The state within which this site is located. This field should autofill with 'Utah', but accept other entries.
County: The county within which this site is located. Dropdown menu of counties (Beaver, Box Elder, Cache, Carbon, Dagget, Davis, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, Salt lake, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Wasatch, Washington, Wayne, Weber) is available to populate this field. Entries are restricted to these values.

Ownership: The agency/company/individual who owns the land on which this site is located. Dropdown menu of ownership (Private, Public) is available to populate this field. Entries are restricted to these values.

Ownership_contact: Name and address of the individual responsible for granting access to this site (100 characters)

Quad_Name: Name of the 1:24,000 USGS topographic map that corresponds with the Coord_ID entered.

Elev_m: Elevation of this site, specifically where coordinates were taken, to the nearest meter.

Roost_Description: A 1000 character field to be used to describe the roost during the visit to this Site_ID. Description should note major structural characters necessary to identify the roost on subsequent surveys.

Roost_Maternity: A Yes/No/Unknown toggle that indicates if a maternity colony has been detected at this site. Details should be recorded under Notes.

Roost_Bachelor: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Hibernacula: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Roost_Night: A Yes/No/Unknown toggle that indicates if a bachelor colony has been detected at this site. Details should be recorded under Notes.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

TABLE: SITE_EVENT

Event_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Visit_Num: A numeric field indicating how many times this site has been visited. This field fills automatically by summing up records already entered for this Site_ID (n), including the one currently being entered (n+1).

Date_Day: This field indicates the day the survey was initiated and should be entered only when the exact day of the survey is known. Dropdown menu of days (1-31) is available to populate this field. Entries are restricted to these values.

Date_Month: This field indicates the month the survey was conducted and should be entered only when the exact month of the survey is known. Dropdown menu of months (January-December) is available to populate this field. Entries are restricted to these values.

Date_Year: This field indicated the year the survey was conducted and should be filled only when the exact year of the survey is known. Filter is applied to restrict entries to 4 digits.

Date_Season: This field indicates the season the survey was conducted and is auto-filled by the database when data for the Date_Month field is available. This field's value is determined by the following rule: Winter (Nov-Mar); Summer (June – Aug); Spring Migration (Apr-May); Fall Migration (Sept-Oct). Dropdown menu of seasons (Winter, Summer, Spring Migration, Fall Migration) is available to populate this field. Entries are restricted to these values. Field can also be filled by selecting from drop-down menu under the circumstance that the month of the survey is unknown, but the season is.

Season	Description
Winter	November – March
Spring Migration	April – May
Summer	June – August
Fall Migration	September – October

Bats_Present: A Y/N toggle to record whether bats or evidence of their sign was present during this survey event at this survey site.

Survey_Method: Used to indicate whether the survey conducted was internal (researchers collected the data within the confines of the structure) or external (researchers restricted site investigation to

collecting external characteristics or conducting exit count surveys). Dropdown menu of survey type (Internal; External) is available to populate this field. Entries are restricted to these values.

Disturbance: Estimate of human disturbance in immediate vicinity of roost site. Dropdown menu of disturbance categories (0 - Limited disturbance; 1 – Occasional; 2 – Regular; 3 - Intensive) is available to populate this field. Entries are restricted to these values.

Human Disturbance Level	Description
0 – Negligible Disturbance	Foot or vehicular traffic in immediate vicinity of roost occurring les than once a month.
1 – Limited Disturbance	Monthly foot or vehicular traffic in immediate vicinity of roost.
2 – Occasional Disturbance	Weekly foot or vehicular traffic in immediate vicinity of roost.
3 – Regular Disturbance	Daily foot or vehicular traffic in immediate vicinity of roost.
4 – Intensive Disturbance	Hourly foot or vehicular in immediate vicinity of roost.

Team_ID: A unique alpha numeric identifier for this site. This field acts as a primary field and is filled automatically by the database to reduce chance of redundancy error.

Photo_N: A Y/N toggle to indicate whether a N aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_S: A Y/N toggle to indicate whether a S aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_E: A Y/N toggle to indicate whether an E aspect photo was taken from the site coordinate. Combine with mechanism to accept, store, and retrieve photos.

Photo_W: A Y/N toggle to indicate whether a W aspect photo was taken from the site coordinates. Combine with mechanism to accept, store, and retrieve photos.

Photo_Store: Mechanism to accept, store and retrieve photos.

Report: A Y/N toggle to indicate whether reports have been stored for this site event.

Report_Store: Mechanism to accept, store, and retrieve PDF of original reports or publications that are stored in this database for this Site_ID.

Notes: A 1000 character field to be used to record notes or comments made by the observer during their visit to this Site_ID.

VI. d. APPENDIX D: Inventory

DELIVERABLE: Inventory

State of Utah Bat Data: Summary Report

A total of 18 species of bat are known to occur in Utah, of which, 6 or 30% are considered Species of Concern. Very little information is known about the distribution or population status of bats in the state. Prior to this project, bat inventory data for Utah was scattered within private, state, and federal holdings and were not collectively available for resource managers. Lack of such information creates difficultly in identifying and addressing statewide management issues related to the conservation of bats. With five Department of Defense (DoD) facilities in Utah, whose land ownership encompasses over 1.8 million acres, it was crucial to identify distribution and frequency of occurrence to prevent encroachment and listing issues related to the lack of conservation management of bat species in Utah. While full data is not available to those ends, a solid start is in place as a result of this project.

Originally, the Utah Natural Heritage Program (UNHP) database was the only centralized source of accessible bat data statewide. However, UNHP tracks only Utah Species of Concern, which includes six (Townsend's big-eared bat, *Corynorhinus townsendii,* Allen's big-eared bat, *Idionycteris phyllotis*, Big free-tailed bat, *Nyctinomops macrotis*, Western red bat, *Lasiurus blossevillii*, Spotted bat, *Euderma maculatum*, and Fringed myotis, *Myotis thysanodes*) of the 18 species that occur in Utah. Since the initiation of this Legacy funded effort, large portions of existing records (both historical and current) for all 18 species found in Utah have been gathered (Table 1). Further data consolidation efforts remain underway.

Table one illustrates sources of data acquired, number of observed species, number of Utah Species of Concern observed, number of occurrences on DoD installations (i.e., one occurrence includes data for at least one individual bat but may include information for multiple individuals and/or multiple species), and total number of individual bats per data source. Sources, directly or indirectly, may include data from federal and state agencies, universities, museums, and private contractors and citizens. For example, the UNHP database alone contains data acquired from all data sources listed above. Although numbers of individual bats are presented for each source, values instead represent approximations. Specifically, data from several sources included estimations of the number of bats present, not exact numbers. Such an example would include roost site counts where approximate numbers of individuals were provided.

Notable partners that are currently absent from this list are the U.S. Department of the Interior (USDI) Bureau of Land Management (BLM) and U.S. Department of Agriculture (USDA) Forest Service (USFS). Although records from BLM and USFS are not currently gathered, representatives from both agencies have agreed to participate in this project and contribute data. BLM personnel are currently searching archives within each field office in Utah and Steve Madsen, the lead scientist for the state of Utah, has strongly encouraged all BLM biologists to participate. USFS biologists are currently compiling their existing data. All available records are anticipated from the BLM and USFS. In addition, data collected from six National Forests (Ashley, Sawtooth, Wasatch-Cache, Fish Lake, Dixie, and Manti-LaSal) and one Ranger District (Spanish Fork Ranger District) have been committed for this project but have yet to be received.

Although data from a few important partners are not currently presented, many records have now been gathered originating on federal, state, and private lands. Figure one illustrates UNHP occurrences representing all data available before Legacy Project 07-346 funding. Bat

Table 1. **Inventory for Consolidated Bat Data Post-Legacy Project 07-346.** Data sources, description of data acquired, and numbers of individual bats recorded. Dates range from the earliest record to the most recent for each data source.

Data Source	Dates	Number of Species	Number of Utah Species of Concern	Number of Occurrences on DoD lands	Approximate Number of Individuals
Pre-Legacy Project					
Utah Natural Heritage Program	1933-2007	6	6	8	**2373**
Post-Legacy Project					
Private Contractor / Joel and Gabby Diamond	2002	4	0	0	128
Ageiss Environmental, INC. / DPG-U.S. Army	1995-1996	10	2	8	148
JBR Environmental Consultants	2002	9	0	0	acoustic detections
Chicago Field Museum	1910-1940	2	0	0	2
LSU Museum of Natural History	1964	1	0	0	1
Royal Ontario Museum	1935-1936	1	1	0	4
L.A. County Museum of Natural History	1965-1978	4	0	0	4
Michigan State University	1935	1	1	0	2
Univ. of Michigan Museum of Zoology	1936-1999	2	1	0	14
Brigham Young University	1998	1	1	0	1
Utah Division of Wildlife Resources	1987-2007	17	6	1	3988
Private Contractor / Brad Lengas	1891-1997	18	6	113	7325
Utah State University		4	0	1	11
Southern Nevada Water Authority	2005	12	1	0	acoustic detections
Certificate of Registration Data (COR)	1995-2006	16	4	2	514
Certificate of Registration Data (COR)	2006	3	0	0	8
Certificate of Registration Data (COR)	1997	1	0	0	2
Certificate of Registration Data (COR)	1998	2	0	0	5
Certificate of Registration Data (COR)	1997	3	0	0	5
Certificate of Registration Data (COR)	1995-1996	10	1	0	53
Certificate of Registration Data (COR)	1998-2001	9	3	0	31
Certificate of Registration Data (COR)	1996	10	2	0	222
Certificate of Registration Data (COR)	1996	6	0	0	30
Certificate of Registration Data (COR)	1995	4	1	0	45
Certificate of Registration Data (COR)	1996-1998	8	3	0	113
Certificate of Registration Data (COR)	1999	5	1	0	74
Certificate of Registration Data (COR)	1999	7	2	0	21
Certificate of Registration Data (COR)	2004	4	4	0	16
Certificate of Registration Data (COR)	2003-2005	11	2	0	304
Certificate of Registration Data (COR)	1999	6	3	0	46
Publication	1998	8	3	0	54
Publication	1998	12	4	0	534
Publication	1999	9	4	0	166
Publication	1999	10	4	0	260
Publication	1997	15	5	0	300
Publication	1997	16	5	0	611
Publication	1997	15	5	0	555
Utah Division of Oil, Gas, and Mining	1996-2003	5	1	0	668
Utah State University	1999	1	0	0	3
Utah Division of Oil, Gas, and Mining		7	3	0	51
National Park Service	2001-2005	17	5	0	2735
Hill Air Force Base, U.S. Air Force		5	0	13	104
Total		**18**	**6**	**146**	**21,531**

occurrence data before and after Legacy funding efforts for the six largest landowners in Utah are presented in Figure one as well. Total occurrences (i.e., one occurrence includes data for at least one individual bat but may include information for multiple individuals and/or multiple species) recorded for the state of Utah after Legacy funded efforts, for the six state of concern species have increased **25 fold (i.e. pre-project = 439; post-project = 10,897)** and total occurrences recorded for military installations have increased **18 fold (i.e. pre-project = 8; post-project = 146)** (Table 2).

Table 2. **Summary of Consolidated Bat Data Pre and Post-Legacy Project 07-346.** Description of data acquired, total occurrences (see text for definition), and numbers of individual bats recorded. Dates range from the earliest record to the most recent for each data source.

Data Source	Dates	Number of Species	Occurrences	Occurrences on DoD Lands	Approximate Number of Individuals
Pre-Legacy Project	1933-2007	6	439	8	2,373
Post-Legacy Project	1891-2007	18	10,867	146	21,531
Total Percent Increase		300%	2475%	1825%	907%

MILITARY BENEFITS

An 18-fold increase in bat occurrence data on or near military lands is a substantial gain. The gathered data offers enhanced knowledge and will dramatically increase the efficiency of Utah's military bases to manage operational areas in a way that minimizes potential impacts to bats. Assessment of impacts to bats and bat habitat through the National Environmental Policy Act (NEPA) review process will now occur more quickly and efficiently once the database is fully up, functional, and populated with gathered data. This efficiency and the enhancement of an accurate impact assessment can only benefit mission essential projects that occur on the five DoD installations in Utah. This new 21,000 + record statewide database will greatly improve understanding of regional trends and patterns on DoD lands and better facilitate stewardship

goals and objectives set out in Integrated Natural Resources Management Plans (INRMPs) on individual installations.

Now that we have a more comprehensive dataset, with current funding, DoD *will*:

1. Continue to collect new bat species occurrence data within the 1.8 million acres of DoD managed lands supported by the Utah Bat Conservation Cooperative;
2. Have increased understanding of Utah bat issues that may pose encroachment problems within DoD training lands and limit ability to meet mission requirements;
3. Encourage and take a pro-active approach to any encroachment or sensitive bat species issues that may be identified (none to date); and
4. Have a better understanding of the biological needs of bats, which directly promotes sound stewardship initiatives developed cooperatively between UDWR and DoD land managers and contained within INRMPs.

Now that we have a more comprehensive dataset, with further funding, DoD *can* 1) introduce real data into the Important Bat Habitat Model, a geospatial database – created with federal, state, and private land managers, housed with the Utah Division of Wildlife Resources (UDWR) – that will track suitability of landscape characteristics that promote or limit potential use by bats and 2) identify what data exists and what data is lacking thereby allowing land managers to collaboratively work together to target data gaps.

As Utah DoD land managers strive to deal with the challenges of balancing land and air resources within a very high operational tempo, an understanding of the biological status on 18 species of bat is critical. Further, the overall collaborative efforts we have facilitated with 14 key stakeholders will enhance military readiness and overall training needs to prepare the finest war fighters anywhere to meet mission needs and objectives.

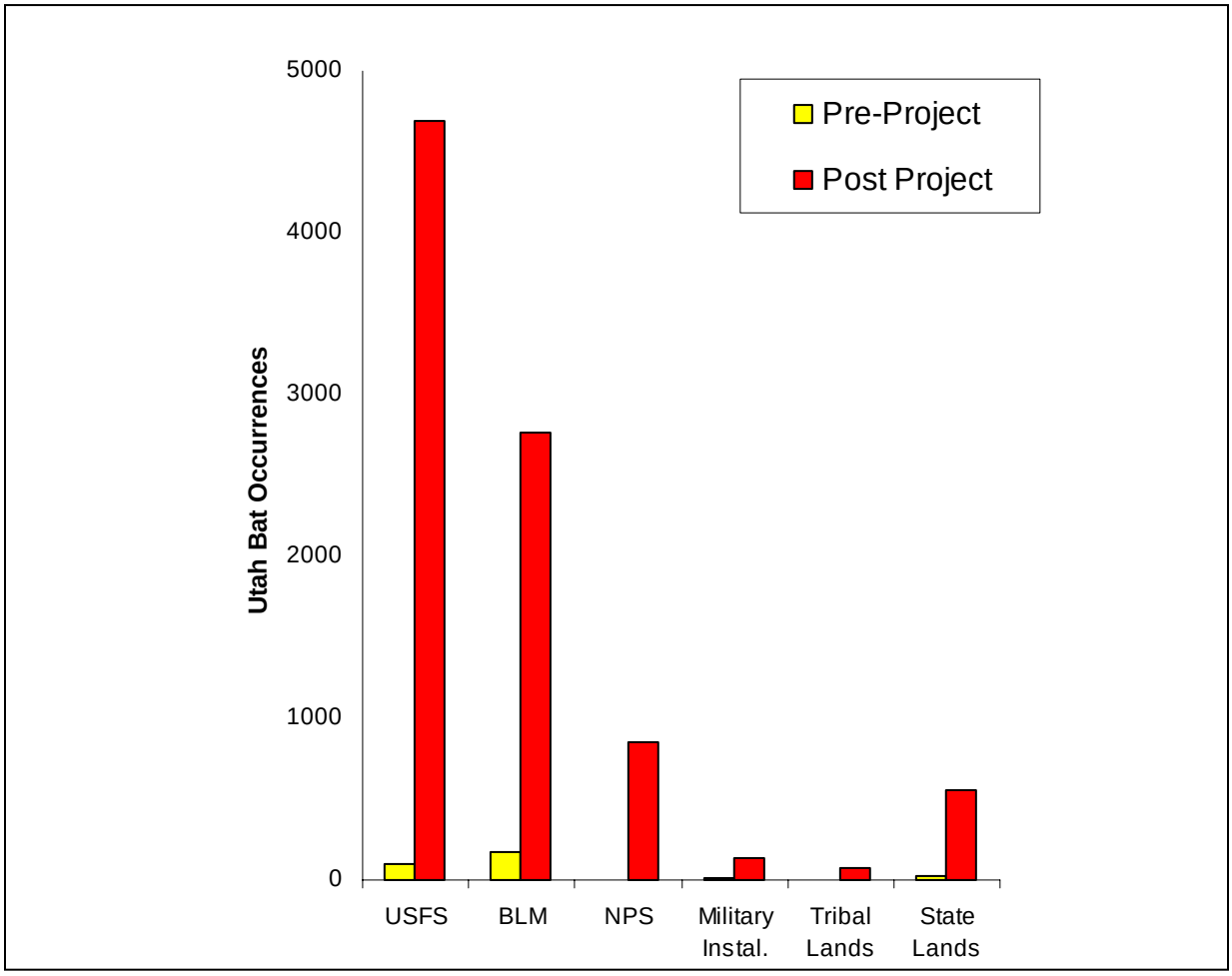


Figure 1. Legacy Project 07-346 Contribution to Bat Data in Utah by Land Owner. Bat occurrence data before and after Legacy Project 07-346 by the six largest landowners in the state of Utah. Comparison of available data before (March 2007) and after (November 2007) Legacy funded efforts.

VI. e. APPENDIX E:
SURVEY RESULTS: Bat Data Collection on Department of Defense Installations in Utah

DELIVERABLE: Monitoring Results

SURVEY RESULTS: Bat Data Collection on Department of Defense Installations in Utah

Executive Summary

One of the main objectives of this 2007 Legacy Project was to collect bat data on the five Department of Defense (DoD) installations in Utah: U.S Army Dugway Proving Ground (DPG), Hill Air Force Base (HAFB), Air Force Utah Test and Training Range (UTTR N & S), Deseret Chemical Depot (DCD), Tooele Army Depot (TEAD), and Utah Army National Guard at Camp W. G Williams (CW). This report discusses survey effort and results of the DoD based bat surveys. Because of several factors discussed in this report, very limited collection took place. Four surveys were completed using two different techniques outlined in this report and in the appendices. This report contains a listing of what species exist on five DoD installations in Utah if known, bat habitat known on these installations, and results of the surveys.

Introduction

Background:

A recent exhaustive review of bat research indicates that little information is available regarding the basic ecology of Utah's bat species, including data on population dynamics and trends, roost site selection, foraging behavior, reproduction, and migration (Oliver 2000).

Existing data on habitat selection and resource use were poorly consolidated and scattered among federal, state, private and university information holdings making it difficult to identify and address statewide management issues related to the conservation of bats (Fenton 1997). In addition to the management and conservation problems created by sparse data is the potential for significant amounts of habitat loss resulting from human population growth and land development. The census, conducted by the U.S. Census Bureau in 2000, identified Utah as having the fourth fastest growing population in the nation, increasing by almost 30 percent between the years 1990 and 2000. This population explosion may be creating island oases for Utah bats on remote DoD installations and surrounding lands as natural, native habitat is taken over by developing cities and expanding human populations.

With a proactive approach to problem solving and strong support for the sustainability of military testing and training lands, DPG NR Manager Robbie Knight sought out partners to address bat conservation. DoD Headquarters has also recognized the importance of DoD lands to the conservation of bats throughout the nation, and signed a memorandum of understanding (MOU) in October of 2006 to "develop a policy of cooperation and coordination between the DoD and Bat Conservation International (BCI)." Within the spirit and intent of this MOU DPG developed this 2007 Legacy Program funded project bringing together five DoD Command Groups – DPG, HAFB, CW, DCD, and TEAD.

For this project, DPG and this group of DoD land managers has coordinated with the U.S. Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), UT Division of Wildlife Resources (UDWR), UT Division of Oil, Gas, and Mining (DOGM), UT Division of Parks and Recreation, Utah State University (USU), The Nature Conservancy (TNC), Southern Utah State University (SUU), Rocky Mountain Power, and Kennecott Utah Copper. Through the Bonneville Basin Conservation Cooperative (B^2C^2) and Utah Bat Conservation Cooperative (UBCC) this group of partners has coordinated extensively to complete this FY2007 Legacy Proposal.

Utah's rapid development combined with the high species diversity of bats has certainly created a situation where six of the eighteen bat species, or 30 percent, are listed as state of Utah species of concern. Currently, Endangered Species Act (ESA) listed bat species do not occur in Utah, however the fact that 30 percent of Utah bats species are of sensitive status creates a large concern for not only the state but DoD land managers. It is this group's belief that instituting proactive conservation actions and planning measures *now* will prevent more economically, politically, and biologically costly solutions in the future.

Military Installations in Utah:

The DoD military lands in Utah comprise several different specific missions, but all depend on the availability and sustainability of testing and/or training lands. DPG (798,214 acres) is a major range and testing facility and the primary chemical and biological defense testing center under the Reliance Program. TEAD (23,610 acres) provides America's joint fighting forces with munitions and ammunition equipment in support of military missions before, during and after any contingency. DCD's main mission is to destroy 45% of the US stockpile of chemical weapons and the Utah National Guard at CW (28,000 acres) provides quality training lands for the Utah National Guard and others. Finally, HAFB and the UTTR (968,774 acres) are home to many operational and support missions with Ogden Air Logistics Center, who provides worldwide engineering and logistics management and operates in the Military Operating Area (MOA) with approximately 10,723,079 acres of airspace.

These five DoD partners control a substantial amount of land in Utah. Together they comprise 1,818,958 acres that contain bat habitat where little research has been carried out to determine the extent of use by bats or the ecology and biology patterns within the Great Basin. As a result, DoD land managers do not have a good idea of what bat species exist on their training and testing lands. This project was focused on the usability and sustainability of DoD's testing and training lands to support our country's war fighters in all times of need.

Bat Habitat on DoD Installations in Utah:

DPG covers an area just under 800,000 acres and is located on the northeastern edge of the Great Basin ecosystem. Half of the base is primarily playa or mud flats with extremely limited habitat for wildlife except during a brief time in the spring when standing water may exist and brine shrimp appear to feed migrating water fowl. Limited plant species exist here as well and bat habitat is primarily non-existent, except perhaps in the spring if standing water exists. Of the remaining approximately 400,000 acres, Dugway consists of several isolated mountains dominated by juniper habitat that containing numerous mines, caves, rock overhangs, and cliffs; flat desert areas with greasewood, shadscale or sagebrush dominated vegetation; and sand dunes teaming with endemic plants and over 200 bee species. Several of the caves and mines were surveyed in the only bat study to be conducted on Dugway (study completed in the mid-1990's by AGEISS Environmental) and were found to contain bats.

Several natural springs occur within Dugway's boarders and contain at least some water year round (although the amount of open water can be extremely limited in these areas). Cane and North Stagecoach Springs are surrounded by juniper habitat, rock outcrops and cliffs and may attract feeding bats on Granite Peak and the Cedar Mountains, respectively. Orr and Mustang Springs on the Cedar Mountains and Cheriat Pond and Overflow Ponds (from sewage lagoons) in the flats hold varying levels of water through at least part of the year. Redden Springs on the extreme west side of the installation has varying levels of water also, although the water rights are held by a farmer that boarders the installation; when water is re-routed by pipes, the extent of water on DPG property goes dry. This location was trapped for one night in the AGEISS study and resulted in no bat capture. Black's Pond is located in the flats within a depression of playa like soil with primarily Salt Cedar exotic vegetation. A large number of insects appear in this area because of the Salt Cedar. Cane and North Stagecoach have not

been mist-netted or acoustically tested. Several springs (Can, Orr, Mustang, and Cheriate Pond) are located within training areas on range.

The only other water sources on DPG are 1) intermittent, unnamed or unfound springs in the higher portions of some of the mountains, especially Granite Peak Mountain, 2) the sewage lagoons that serve each of the 5 cantonment areas or towns on Dugway, and 3) wildlife guzzlers that cater to large game and game bird species. The English Village sewage lagoon was mist-netted in the AGEISS study – three species of bat were caught with mist nests. Bats were detected here this year during Legacy funded survey efforts as well; these are described later in the report. The English Village Sewage Lagoon is surrounded by the White Sage training area; the other sewage lagoons are not located in active testing or training locations but do effect the use of facilities where mission essential tasks take place.

Buildings within the towns on Dugway also provide day roosts for bats as Natural Resources staff has removed bats from buildings and gotten several reports of roosting bats on the sides of buildings in at least two of the towns.

On first glance, DPG does not seem to have an extensive amount of bat habitat but upon closer examination, numerous man-made open water sources, natural springs, extensive cave and mine structures, and cliff/rock outcrop dominated mountains may provide a much better habitat then on previous examination. The *Important Bat Habitat Model*, created in part by this Legacy grant, shows DPG with limited suitable habitat which may be a result of the unmapped man-made water sources, unfound springs, and undocumented cave and mine structures. The extent of use by bats of DPG will need to be more closely examined next year as funding and equipment delays limited the amount of sampling conducted this year on DPG.

HAFB covers approximately 968,000 acres on four different properties: Hill AFB proper where most of the headquarters and office buildings sit, Utah Test and Training Range (UTTR) North, UTTR South, and a small area near Wendover, NV. HAFB proper has many ponds that

could potentially attract bats in the evening for feeding. Bats have been found on the runway as well.

The north range has a sewage treatment pond that has been sampled for bats in the past. The North and South ranges have a few other ponds as well. Other small water pockets exist that were excavated to capture ground water to use for transient dust control and other needs on the range for non-potable water. The Little Mountain complex has a small pond that could support some bats if they are utilizing the area. Blue Lake probably has the best chance for large numbers and variety of bats because of its location adjacent to large rocky outcrops and at least one cave. It is unknown if bats utilize buildings on the range, but some reports have come in from buildings on base. A survey has also been conducted at the Carter Creek Recreation Area in the Uintah Mountains.

The terrain on Air Force property is rocky in the montane areas with plenty of cave like features that were left from the forces of Lake Bonneville. We do not know the exact number of caves on HAFB lands because we are not allowed much time in some areas due to mission requirements. We know we have two caves that are well documented on the north range. One is called Cathedral and is a big cavern with a high ceiling. The other is called Homestead and is not very deep. Owls inhabit this cave. Other cave-like features exist all around the range including Wildcat Mountain on the South Range and on the extreme south end of the Newfoundland Mountains there is a good sized cave. Snoopy, which is near Wendover, has several small caves which have produced some relative success with some bat species (Pallid Bat, Western Pipistrelle, and the Small-footed Myotis). Other potential sites exist, but have not been explored yet. Water is the limiting factor. About 20% of the discussed bat habitat occurs in training or testing areas (mainly around the Blue Lake Wetland Complex) and is not consistently monitored because of closure due to training activities. At this time, the NR staff at HAFB is unaware of any listed species occurring on HAFB property. The *Important Bat Habitat Model* shows the majority of HAFB land ranks at the medium level (5 categories: Very Low,

Low, Medium, High, and Very High) and most of the land on UTTR North and South ranges ranking at the low level for suitable bat habitat.

Deseret Chemical Depot (DCD) covering approximately 19,000 acres of land contains little bat habitat or feeding ground. DCD is located in the flats east of the Stansbury Mountains, south of Tooele, Utah. One stock pond provides the only habitat for feeding bats measuring about 300 m by 100 m. A wash runs through a central part of the DCD but is dry part of the year and is surrounded by willow and cottonwood trees with little open water. The *Important Bat Habitat Model* shows that bat habitat value on DCD is ranked at the Low and Medium values only.

Tooele Army Depot (TEAD) has limited knowledge and habitat for bats because survey work on TEAD is non-existent. The cantonment areas are scheduled for demolition in the near future and will no longer provide the limited daily roost sites that they provide currently. The only possible rousting areas would be the ledges of a seldom-used gravel pit area or along the edges of Box Elder Wash that runs through TEAD. These areas are not so much a "cliff" but more of a 10 to 20 foot ledge.

The only open water sources on TEAD are cattle troughs. They are operational during the grazing season but very few are left on year round for the purpose of animals living or visiting the installation. No caves or mines exist on property. The only possible area that could be effected by the listing of a bat species under the ESA would be the DEMIL and the Test and Firing Range. However, bat habitat is very limited and thus the potential for sensitive bat species to occur on the installation is small.

CW covers an area of approximately 28,000 acres. They have only limited cliff wall habitat, but extensive steep hill slopes. Bats only rarely use areas within the cantonment (that

have been noticed). Several shallow mine excavations and numerous rock outcrops exist on post that bats could use.

The majority of bat habitat on CW is probably located around several water systems located on the property. Hidden Valley – a seven acre parcel with about two acres of wetlands, is located several miles north of the cantonment along the Jordan River. It is adjacent to the Jordan River and an irrigation canal. Hidden Valley is within the floodplain and is surrounded by hills and taller, older cottonwoods. Lower Beef Hollow is a perennial water source with low flow that runs about a half a mile; it has a filled-in stock pond that is marshy.

Tickville Springs is the largest wetland on the main installation and flows about a mile from several springs. It is on the border of the impact area, mainly disturbed by trespassing cattle. It is surrounded by low hills to the west and higher hills to the east. Wetlands total about two acres in a linear strip. Oak Springs is a small stream on the western edge of the Impact Area originating from perennial springs. The spring is a small fenced marshy area surrounded by mature Gambel oak trees. The head waters of Rose Canyon are at the northwest of the installation and have several hundred yards of stream on the property. CW has just under eight acres of wetlands. There are several ephemeral, relict stock ponds scattered around as well.

No known caves exist on CW as the geology is probably insufficient to support cave structures larger then cracks. Two shallow exploratory mine shafts exist on property however, but bats have not been observed in either during rare visits.

The main water sources and wetlands are either in isolated parcels (e.g., Hidden Valley and Rose Canyon), are in drinking water protection zones (e.g., Lower Beef Hollow), or in the Impact Buffer area, which restricts use (e.g., Tickville and Oak Springs). NR staff is rarely out at night; the few bats observed have been around the cantonment, probably attracted by the bugs around the lights.

Most bat habitat on CW is protected from impacts and therefore, any finding of sensitive bat species would not interfere with testing or training activities as no activity can occur in

impact buffer zones or drinking water protection zones. The *Important Bat Habitat Model* ranks CW land as medium (73%) to low (26%) with respect to bat habitat quality.

Bat Surveys on DoD Installations:

One of the main objectives of this Legacy project was to start collecting bat data on Utah DoD installations throughout the state. This report and deliverable will describe the data that was collected this field season. As discussed in the Legacy Progress Report submitted on 25 July 2007, because of delayed funding, availability and delay in equipment purchase, ANTABAT field apparatus construction, and scheduling issues, new bat data collection has been limited. ANTABAT devices had to be ordered from Australia and shipped to Utah. ANTABAT field apparatus was delayed because actual ANTABAT devices and accompanying materials were needed for construction.

ANABAT devices were received in August and field apparatus set-ups were completed in September. Equipment deployment and data collection began in early September 2007 in one location on DPG and on CW. Data collection ended by late September with the beginning of the winter season (based on falling temperatures) and will resume in early spring 2008.

Methods & Locations

Methods:

Data collected for this Legacy project was collected according to the existing UDWR guidelines and methods. See Appendix I: *Bat Survey Field Methods & Guidelines* for descriptions of these methods to include site evaluation and timing, procedure for mist netting, capture and handling bats, data collection, list of materials, and acoustic surveys. Appendix II: *Data Form and Field Descriptions* includes the currently used data forms and description of all collected information. Appendix III contains the dichotomous key created specifically for species ID of Utah bats.

Four surveys were completed by DPG staff and UDWR partners during the fall season with limited time and equipment due to funding delays. Mist net surveys took place at 8-Mile Spring adjacent to the Cedar Mountains (11.9 miles from the DPG boundary) and the Cannon Mine Complex on the north end of Granite Peak Mountain located on DPG property. Automated acoustic surveys were completed at English Village Sewage Lagoon on DPG and on the Lower Beef Hollow on CW. Acoustic surveys were completed with ANABAT SDI CF Bat Detectors or ANABAT II Bat Detectors made by Titley Electronics. Files were analyzed according to the following rules. Files were deleted and considered junk if the file did not look like a bat call or if the call, possibly a bat, could not be categorized into the larger, broader categories of 10K, 16K, 25K, 30K, 40K, or 50K. Bats calls can be grouped by their minimum frequency and then further distinguished and speciated within these Fmin (kHz) groups. My references and Fmin category breakdown by bat species are listed in Table 1. No specific ANABAT acoustic key or document has yet been created in Utah or for Utah bats. It is believed that species specific calls may vary based on geographic location.

Location Descriptions:

The English Village Sewage Lagoon is a series of three large sewage ponds surrounded by gravel roads and a vegetation community consisting of sagebrush, greasewood, juniper and invasive plant species (Cheat grass & Russian Thistle). Numerous waterfowl, native birds, and insects use the area to feed.

The Lower Beef Hollow – an extension of the main Beef Hollow canyon - is a short, narrow canyon in a drinking water protection zone located near the entrance to the training center by State Road 68.

8-Mile Spring is frequented by feral horses and is dominated by rabbit brush and invasive plant species. Numerous bird and insect species also use the area located on the

Table 1. Bat Species and Fmin Categories: identifies source for ANABAT call references, state sensitive species, and Fmin category for each of the 18 species of bat in Utah.

Abbreviation	Common Name	Fmin Category	Short Description of Call
TABR*	Brazilian Free-Tailed Bat	25K	Tailed calls can be flat or upright & irregular between 25 & 30 or 25 & 60
NYMA*	Big Free-Tailed Bat	10K	11-18K tailed calls, gentle curving - no hockey stick
EUMA	Spotted Bat	10K	
ANPA	Pallid Bat	30K	
IDPH*	Allen's Big Eared Bat	10K	12-25K steep calls; or oscillating line between 20 and 25K
COTO	Townsend's Big-Eared Bat	30K	
LACI	Hoary Bat	16K	
LANO	Silvered Haired Bat	25K	
LABL*	Western Red Bat	40K	Tailed Call starting between 40 and 50K; short not above 60K
EPFU	Big Brown Bat	25K	
PIHE	Western Pipistrelle	50K	
MYEV	Long-Eared Myotis	30K	
MYTH	Fringed Myotis	30K	
MYVO	Long-Legged Myotis	40K	
MYYU	Yuma Myotis	50K	
MYLU	Little Brown Myotis	40K	
MYCA	California Myotis	50K	
MYCI	Western Small-Footed Myotis	40K	

Green designates species listed on the State Sensitive Species List, last updated October 17, 2006

Source: Anabat Call Key for the Greater Yellowstone Ecosystem, Douglas Keinath, Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY

*Source: Museum of Southwestern Biology (University of New Mexico), BATCAL: Acoustic Call Library & Species Accounts (http://www.msb.unm.edu/mammals/batcall/html/speciesaccounts.html)

eastern base of the Cedar Mountains in Skull Valley, Tooele County, Utah. This spring is located 11.6 miles from DPG's eastern boarder.

The Cannon Mine Complex contains a historic mine shaft active between approximately 1890 and 1917. It consists of a slanting hillside shaft shored up with timbers and an associated tailings pile. The ability of bats to use the mine as a day roost is questionable due to the extreme slope and mostly collapsed mine entrance. Located in a northern canyon of Granite

Peak Mountain, an isolated mountain on DPG, the mine entrance is near the North Stagecoach Spring and sits at an elevation of approximately 4,850 ft above sea level (UTM WGS-84 Zone 12N 304675 mE 4447580 mN). The habitat in this area is sagebrush and juniper dominated with extensive rock faces and outcrops.

Results

Camp Williams Survey Results:

No mist net surveys were conducted at CW due to a lack of equipment, personnel, and adequate time before fall weather arrival.

One automated acoustic survey took place at CW from 06 September 2007 through 21 September 2007. Device set-up and assistance were completed by DPG Natural Resources personnel, UDWRs Central Region State Sensitive Species Biologist Kim Asmus, the CW Natural Resources Manager Doug Johnson, and CW ITAM Coordinator Sean Hammond. ANABAT files were recorded from 06 September 2007 to 12 September 2007. Short battery life

Table 2: Camp Williams ANABAT Data Analysis Results.

Installation: Utah National Guard at Camp Williams **Location:** Lower Beef Hollow			
Date	**Total Bat Files**	**Fmin Group**	**Number in Each Group**
9/6/2007	2	EPFU (25K)	1
		30K	1
9/7/2007	47	25K	33
		EPFU (25K)	8
		30K	2
		40K	4
9/8/2007	8	LACI	2
		25K	3
		30K	3
9/9/2007	14	25K	9
		30K	5
9/10/2007	6	25K	4
		30K	2
9/11/2007	6	25K	5
		40K	1
9/12/2007	1	30K	1
	84		**84**

limited the length of data recording and did not allow data collection over the last nine days of the survey. All files recorded at Camp Williams were analyzed because of their limited number. Of the 200+ files analyzed, only 84 of the files (about 40%) were categorized as bat calls according to the procedures listed in the *Methods* section. See Table 2 for a break down of call by Fmin category. Of the 84 bat calls recorded 63 or 75% were 25K bats, none of which are state sensitive species.

Dugway Proving Ground Survey Results:

Two locations on or near Dugway Proving Ground were mist netting for bats: Cannon Mine Complex and 8-Mile Spring. The Cannon Mine Complex survey was conducted on 25 September 2007 by Maggie Peters (DPG Contract Field Biologist, Select Engineering Services, Inc.) and Lauren Wilson (DPG Natural Resources Intern, Oak Ridge Institute for Science and Education). No bats were captured. Bats were not seen in the area and the mine was determined not to be a likely day roost for bats. Because of this, the survey was only run for three hours and 15 minutes (20:00 to 23:12). This area was netted due to previous sightings of bats in this canyon and in the general vicinity of the mine. This negative data will be added to the database created by this Legacy-funded project.

An 8-Mile Spring (12 miles from DPG boundary) mist net survey was completed on 11 September 2007 with Kim Asmus, Maggie Peters, and Lauren Wilson. Six bats were captured: three Fringed Myotis (*Myotis thysanodes*), a State Sensitive Species; one Hoary Bat (*Lasiurus cinereus*); and two Western Small-Footed Myotis (*Myotis ciliolabrum*). Three nets were open measuring 6m, 9m, and 12m from 2030 to 0025 military time (approximately 4 hours). This is at least the 6th site that the State Sensitive Fringed Myotis has been found in the area surrounding DPG. It has not however been captured on DPG property.

One automated acoustic survey took place on DPG from 10 September 2007 to 25 September 2007. Anabat files were only recorded from 10 September to 15 September due to technical difficulties – a small mammal chewed through the wires of the microphone projection cord disconnecting the recording device from the microphone. Even with the limited length of this survey, an enormous amount of data was collected. About 6,400 files were recorded in 6 days. As an automated Anabat call analysis has not yet been developed and an unlimited amount of staff time and expertise is unavailable, only 10% of the calls were analyzed. To analyze a random group of files, we choose to analyze 50 files from each hour of the night beginning at 1800 and ending at 0700. Files analyzed for hours 1800 & 1900 were first taken from the records on 9/10/2007, hours 2000 & 2100 from 9/11/07, hours 2200 & 2300 from 9/12/07, hours 0000, 0100, & 0200 from 9/13/07, 0300 & 0400 from 9/14/07, and 0500 & 0600 from 9/15/07. If 50 files did not exist in the date assigned, additional files for that time frame were taken from later dates sequentially until 50 files were assembled. Times needing more files after 9/15 were taken from 9/10, 9/11 and so on. Fifty files existed for all time frames but 1800 where only 34 files existed. A total of 634 files were analyzed. Analysis procedures were identical to those of the CW analysis. Of the 634 files analyzed, 410 of the files (about 64%) were categorized as bat calls according to the procedures listed in the *Methods* section. See Table 3 for a break down of call by Fmin category. Of the 410 calls, 243 or 59% of the calls were 40K bats only one of which is a state of concern species, the Western Red Bat. The call of this species is fairly distinctive from the other 40K bat calls and none were identified during analysis. The Western Red Bat (*Lasiurus blossevillii*) has not been documented on DPG to date. Seventy-five out of 410 or 18% of the calls were 25K bats, none of which are state of concern species. It is therefore concluded that at least 78% of calls could not have come from state sensitive species.

Bat Species Known on DoD Lands in Utah:

Table 3. Dugway Proving Ground Anabat Data Analysis Results.

Installation: U.S. Army Dugway Proving Ground **Location:** English Village Sewage Lagoon, West Side of North Pond				
Hour	**Original Files**	**Bat Files**	**Fmin Group**	**Number in Each Group**
1800	34	1	40K	1
1900	50	39	25K	2
			30K	5
			40K	30
			50K	2
2000	50	45	25K	1
			40K	38
			50K	6
2100	50	39	25K	8
			40K	31
2200	50	38	25K	1
			30K	1
			40K	26
			50K	10
2300	50	45	25K	4
			40K	40
			50K	1
0000	50	29	25K	6
			30K	1
			40K	21
			50K	1
0100	50	33	25K	19
			30K	5
			40K	9
0200	50	28	25K	15
			30K	9
			40K	3
			50K	1
0300	50	36	25K	2
			30K	17
			40K	11
			50K	6
0400	50	38	25K	10
			30K	20
			40K	6
			50K	2
0500	50	17	25K	3
			30K	2
			40K	10
			50K	2
0600	50	22	25K	4
			40K	17
			50K	1
			25K	**75**
			30K	**60**
			40K	**243**
			50K	**32**
TOTAL	634	410		410

Table 4. Species Occurrence on Military Lands in Utah. Y is yes. DCD and TEAD have never been sampled for bats.

Common Name	Scientific Name	DPG	HAFB	DCD	TEAD	CW
Little Brown Myotis	*Myotis lucifugus*					
Yuma Myotis	*Myotis yumanensis*					
Long-eared Myotis	*Myotis evotis*	Y				
Fringed Myotis*	*Myotis thysanodes*					
Long-legged Myotis	*Myotis volans*	Y				
Townsend's Big-eared Bat*	*Corynorhinus townsendii*	Y				
Western Small-footed Myotis	*Myotis ciliolabrum*	Y	Y			
California Myotis	*Myotis californicus*	Y				Y
Silver-haired Bat	*Lasionyceris noctivagans*					
Big Brown Bat	*Eptesicus fuscus*					
Hoary Bat	*Lasiurus cinereus*	Y				
Western Pipistrelle	*Pipistrellus hesperus*	Y				
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Y	Y			
Pallid Bat	*Antrozous pallidus*	Y	Y			
Western Red Bat*	*Lasiurus blossevillii*					
Spotted Bat*	*Euderma maculatum*					
Allen's Big-eared Bat*	*Idionycteris phyllotis*					
Big Free-tailed Bat*	*Nyctinomops macrotis*					

*State Sensitive Species List; Last updated October 17, 2006

Table 4 lists the bat species known to occur on military lands in Utah. This species list is based on data received for consolidation in the Legacy Utah Bat Database (UBD) and survey efforts discussed above. Integrated Natural Resources Management Plans for some installations (DPG and HAFB) list more species then are listed in Table 4 but actual data can not be found on these occurrences; these species are not identified as occurring on military lands in Table 4. No data has ever been collected on DCD or TEAD. Table 5 lists species that have been identified within 10 miles of military land boundaries. Data supporting this list comes from the consolidation efforts of this project and will be located in the UBD for use by local land managers.

Discussion:

Further data collection efforts will take place in the 2008 field season. Mist net surveys as well as automated acoustic surveys are planned for DPG, HAFB, UTTR, DCD and TEAD. Surveys will be completed by DPG Natural Resources (NR) staff and State sensitive species biologists and field technicians with some assistance from the NR managers at the individual installations.

Sewage Lagoons and in general, man-made water sources and surrounding areas may be a significant location for bat use and will be looked at closely on installations.

Table 5. Species Occurring on Lands Surrounding Military Lands. Y is yes.

Common Name	Scientific Name	DPG	HAFB	DCD	TEAD	CW
Little Brown Myotis	*Myotis lucifugus*		Y	Y		Y
Yuma Myotis	*Myotis yumanensis*	Y	Y			
Long-eared Myotis	*Myotis evotis*	Y	Y	Y		Y
Fringed Myotis*	*Myotis thysanodes*	Y				
Long-legged Myotis	*Myotis volans*	Y	Y	Y		Y
Townsend's Big-eared Bat*	*Corynorhinus townsendii*	Y	Y	Y	Y	Y
Western Small-footed Myotis	*Myotis ciliolabrum*	Y	Y	Y	Y	
California Myotis	*Myotis californicus*		Y			
Silver-haired Bat	*Lasionyceris noctivagans*	Y	Y	Y		Y
Big Brown Bat	*Eptesicus fuscus*	Y	Y	Y		Y
Hoary Bat	*Lasiurus cinereus*	Y	Y	Y		Y
Western Pipistrelle	*Pipistrellus hesperus*	Y	Y			
Brazilian Free-tailed Bat	*Tadarida brasiliensis*		Y			
Pallid Bat	*Antrozous pallidus*	Y	Y			
Western Red Bat*	*Lasiurus blossevillii*					
Spotted Bat*	*Euderma maculatum*					
Allen's Big-eared Bat*	*Idionycteris phyllotis*					
Big Free-tailed Bat*	*Nyctinomops macrotis*					

*State Sensitive Species List; Last updated October 17, 2006

As seen from Tables 4 and 5, there is a large difference between what is known about bat populations adjacent to military lands and bat populations on military installations. As a result of this Legacy project, survey work has been initiated and equipment funded to close this gap of knowledge. Sensitive bat species (Townsend's Big-eared Bat and Fringed Myotis) have only been captured on one military installation (Townsend's only). However, the Townsend's has been captured on lands adjacent to all five DoD lands; the Fringed Myotis has been captured adjacent to one. This Legacy project has helped and will continue to help close the knowledge gap that exists and will help to pro-actively support the sustainability of military testing and training ranges.

APPENDIX I

Bat Survey Field Protocols and Guidelines

Bat Survey Field Protocols and Guidelines

Site Evaluation and Timing

If possible, use a bat detector on the previous night to see where the most bat activity occurs. Usually the highest bat activities are around isolated watering sites, still water with long fly ways, ridgetops, restricted roosts (caves, mines, houses), and food sources (cactus, insects, gardens, lights).

Bats are capable of recognizing and avoiding nets. Set nets in locations and arrangements to trick the bats. Placement can be at restrictions in fly corridors where the net covers the only way through. Nets can be placed around blind bends in stream corridors. Nets can also be set in rows whereby bats avoid the first net and are captured in the second.

Bats possess good eyesight and are capable of seeing a moonlit net. If possible, conduct mist net surveys on moonless nights or in areas shaded from the moon.

Bat activity tends to increase with temperature. In Utah, surveys are generally most productive between June and mid-September. High winds can also affect bat activity and cause troubles with nets.

Procedure for Mist Netting

1. Generally, at least two people are needed to run a mist net station. If a high capture rate is expected, make sure there are an adequate number of trained personnel to efficiently run the station.

2. Use two people to set up the mist nets. One person can hold the pole and net while the other places the pre-arranged, end-loops over the pole and anchors the pole with cord. Tie the cord to any nearby object stout enough to hold both the pole and net, or to stakes driven into the ground for that purpose.

3. When anchoring the poles that hold the net, the top three end-loops should be placed above the anchor cord, and the bottom two loops below the anchor cord. Occasionally, the terrain may warrant more net area below the anchor cord (such as across a small ravine, where the poles are on slopes). Under these conditions, three panel end-loops are placed below the anchor cord.

4. Spread the nets taunt enough so that a 2.5-cm (1-in) bag droop occurs in each of the net's panels. The net itself should be stretched tight. As the evening progresses, the rise in humidity will cause the net to droop, so make periodic adjustments to keep the net taut.

5. Open nets just before dark or when bats are first observed flying. Keep net sets closed until that time to minimize the chance of capturing birds.

6. The nets should be checked as often as every 5 min. The longer bats are left in the nets the more tangled they become, increasing the bat's chance of injury.

7. When placing nets over water needs, special consideration is need to ensure that bats don't drown in the nets.

8. Keep nets open until 1am. Much of the bat activity at water sources occurs in the first half of the night.

9. To close a net, push all the panel end-loops together at the anchor cord on the pole. One end of the net can then be taken off the pole and folded toward the other end. When the net is completely folded, place the tied end-loops together and stuff the net into a bag for safe-keeping.

10. If conducting surveys at a mine opening or other small, enclosed space, harp trap can be used to efficiently capture bats. The harp net catches the bats and stores them in a large bag from which they are then removed. Otherwise, the protocol for capture and handling remains the same.

Capturing and Handling Bats

Due to the risk of Rabies, all field crew members handling bats should have full pre-rabies exposure vaccinations. Also, to protect hands from bat teeth, wear thin leather gloves whenever handling bats.

In the intervals between checking the nets, bat extraction, and data collection, flashlights should be off, and noise levels kept to a minimum avoid scaring off bats.

When a bat is caught in the net, quickly move to extract it before it can escape or become further entangled. Determine from which side of the net the bat entered. Immobilize the bat with a gloved hand and carefully remove the net strands from head, body, and wings. Be especially careful with the fragile wing membrane and bones. A toothpick is a useful tool to pinpoint and remove individual mist-net strands.

After removing the bat from the net, place it in a cloth bag for transfer to the processing station. Hang the cloth bag from a branch in a sheltered spot. Process and release all bats as quickly as possible, especially lactating females, or any females caught during the maternity season. On colder evenings, the stress of capture and handling may render some bats unable to fly away. If that occurs, put the bat back into the cloth bag and place it in a warm spot (e.g. inside of a coat or in a warm vehicle). Check on the bat periodically and release it when it regains the energy to fly.

Data Collection

Record site, weather, and morphometric data on the Bat Survey Data Form (Appendix II).

For each survey event, record the following information on the datasheet:

1. **Page__ of __:** Fill in the first blank with the current page number and the second blank with the total number of pages used during the survey period (ex. Page 2 of 3).
2. **Date:** The Day, Month, and 4 digit Year the survey was conducted (23 June 2005).
3. **Capture Location:** The 'common' name of the site being surveyed (ex. Nirvana Pond or Selman's Ranch House).
4. **County/State:** The County and State in which the survey is being conducted (ex. Box Elder County, UT).
5. **Habitat/Site Description:** Short, simple description of surroundings and dominant vegetation within one mile of survey site. Description should also include the characteristics that caused the site to be selected (ex. presence of a stock pond, mine shaft, roost, etc.)
6. **Photographs:** Take one photograph in each cardinal direction (N,S,E,W) from the location the Coordinates were recorded (see #7). Note number of photograph if digital and applicable. Future photographs should always be taken from the same location to simplify historical comparisons.

7. **UTM Coordinates:** Record easterly (6 digit) and northerly (7 digit) UTM coordinates of the survey site using a GPS unit set to collect data in the North American Datum 1983 (NAD83).
8. **Elevation (m):** Use a GPS unit to record the Elevation at the same location the site's Coordinates were taken (see #7). Record elevation in meters.
9. **Team Members:** Record the first and last names of the individuals conducting the survey. Record professional affiliations if applicable (ex. USFWS, USFS, TNC, etc.)
10. **Recorder:** Record the full name of the individual most often recording the data; insuring that questions about what was written can be directed to the right person.
11. **Methods Used:** Mark Yes (Y) for all the methods that were used during the current survey and No (N) for those not used. If mist nets are being used, calculate and record their surface area in square meters [surface area = height (m) x sum length of all nets open (m)]. If a data logger is being used, note the type of data it is collecting (ex. temperature, humidity, barometric pressure) and the intervals to which it is set to collect data (ex. 5 min.). Use the Other category to record other methods employed during the survey period.

For each hour the survey is conducted, record the following weather data:

12. **Start; Hour 1…:** The status of Fields 13-20 should be recorded at the Start of the survey period and each consecutive 60 minutes after until the end of the survey. Uneven starting or ending times of either the nets, data loggers, or ultrasonic detectors should be recorded in the Hour column closest to the event. The actual time for each event will be recorded in Field 13.
13. **Time:** Actual time that the statuses of Fields 14 thru 20 are recorded.
14. **Net Status:** Record whether nets are 'Open' or 'Closed' at time in Field 13.
15. **Detector Status:** Recorded whether an ultrasonic detector is 'Active' or 'Not Active' at time in Field 13.
16. **Logger Status:** Recorded whether a data logger is 'Active' or 'Not Active' at time in Field 13.
17. **Temp (°C):** Record the temperature in degrees Celsius at time in Field 13.
18. **Wind:** Use MPH categories as determined from the Beaufort Wind Scale. 1) *0-1 MPH*: Calm; smoke rises vertically. 2) *1-3* MPH: Direction of wind shown by smoke drift, but not by wind vanes. 3) *4-7* MPH: Wind felt on face, leaves rustle, ordinary vane moved by wind. 4) *8-12* MPH: Leaves and small twigs in constant, gentle motion; wind extends light flag. 5) *13-18* MPH: Raises dust and loose paper; small branches are moved. In most situations winds in categories 3, 4, and 5 will not be conducive to operating mist nets.
19. **Weather:** Record the dominant weather over the last hour: 1*) Clear*: 0-10% cloud cover. 2) *Partly*: 10%-50% cloud cover. 3) Cloudy: 50%-100% cloud cover. 4) *Precip:* some amount of precipitation fell during this hour.
20. **Moon:** Record phase of moon as: 1) *None*: Either a new moon, just risen, or just set. 2) *Crescent*: 0-25% lit. 3) *Half:* 25-75% lit. 4) *Full*: 75-100% lit. 5) *Obscured*: Obscured by cloud cover.

For each individual bat caught and processed, record the following data:

21. **Bat No.:** Number the bats as they are caught (ex. 1, 2,3 …).
22. **Time (24 hr):** The time the bat *was caught*, not the time it was processed (ex. 2234).
23. **Temp (°C):** The temperature in degrees Celsius when the bat *was caught*, not when it was being processed.

24. **Species:** Use a dichotomous bat key (Appendix III) for the area the survey is being conducted to help identify bats to species. It is likely that characters in addition to the Fields below will be needed for proper identification.
25. **FA (mm):** The length of the forearm in millimeters. The forearm is defined as the length between the elbow and the distal side of the wrist (Figure 1).
26. **Ear (mm):** The length of the ear in millimeters. The ear length is measured from the notch on the base of the ear to the ear's tip (Figure 2).
27. **Tragus Shape:** Note the shape of the tragus as either 1) Long and Pointed (Figure 3a) or 2) Short and Rounded (Figure 3b). Especially useful to determine identification of Pipestrelles.
28. **Keel:** Note the 1) Presence or 2) Absence of a flap of skin hanging loose off the posterior edge of the calcar (Figure 4a & b).
29. **Sex:** Record the sex of the bat as 1) Male or 2) Female. Evidence of sex is best obtained from the genitalia, with the males possessing a well developed penis.
30. **Reproductive Status:** Record the reproductive status of the Males as either 1) Reproductive – one or both testes have descended or 2) Non-reproductive – neither testes are descended. For the Female note evidence of 1) Lactating – nipples are pink and enlarged, hair surrounding the nipple is worn. 2) Post-lactating – nipples wrinkly and dark hair has often grown back. 3) Pregnant – presence of unborn fetus evident. 4) Non-reproductive – nipples very small and well haired.
31. **Age:** Record the age of the bat as either 1) Juvenile or 2) Adult based on the calcification of the phalangeal joints. Best observed by shining the joints from behind with a head lamp (Figure 5).
32. **Photo?:** Record whether a photograph was taken of the bat with a Yes (Y) or (N). Note number of photograph if digital and applicable.
33. **Mark?:** Record whether the animal was marked before release with a Yes (Y) or No (N). Note method of marking in the Notes (ex. Marker, band, tattoo, freeze brand, etc.)
34. **Weight:** The total weight of the bat minus the weight of the bag in grams.
35. **Notes:** To be used to record observations or actions of this particular bat not accounted for by the data sheet (ex. parasite load, marking method, injuries, capture method, etc.)

List of Materials

The following materials are required for mist netting of bats:

Mist nets (4)	2.6m x 2.6m, 2.6m x 9m, 2.6m x 12m, and 2.6m x 18m; 38mm mesh, 50 denier/2 ply nylon http://www.avinet.com/avi6_page.taf?fs=1&view=home Scroll down to nets for bats.
Poles (8)	Two 1.5-m (5-ft) segments joined by a sleeve are needed at each end of the net. These can be built easily enough from two different diameters of electrical conduit so that they fit together. A small bolt through the smaller diameter pole near its end keeps it from sliding all the way through (sword and scabbard design)
Anchor cord for poles	Strong string or cord.
Stakes (16)	The type used for tents.
Millimeter ruler (2)	Flexible plastic, 150 mm (6 in) is sufficient. Cut the end off so it is even with the "0" mark makes for easier use.

Scales (2)	50 gm (3.5 oz) (Pesola spring scale recommended).
Zip-lock storage bags	For containing bats while weighing. Safe for the short time the bats will spend in them. Quart capacity will suffice for most bats.
Cloth bags (~12)	For holding bats after removing from net. Should have string or cloth ties.
Headlamp (3-4)	This frees both hands for handling bats.
Leather gloves (3-4)	Light-weight. Deerskin gloves are very good, with the exception of handling large *Eumops* spp. Baseball batting or golf gloves work excellent.
Wooden Toothpicks	Useful for the delicate job of getting the bats out of the net; also disposable.
Watch/ Travel Alarm Clock (1)	To note the time of capture.
Clipboard	For holding data forms.
Data forms	Standardized data sheet.
Bat Key	Dichotomous Utah key.
Pencils	To complete data forms.
Permanent markers (2)	For temporarily marking bats to identify same-night recaptures.
Camera, film, & flash (1)	For voucher pictures.
GPS Unit (1)	For recording the UTM location and elevation of the survey and/or finding your way back to a historical survey site.
Thermohygrometer (1)	Portable, (Recommend the Kestrel 3000; displays data on temperature, humidity, and windspeed.)
Data Logger (1)	Automatically records ambient temperatures and humidity throughout the night at 5 minute intervals. (Recommend Hobo Pro Data Logger Temp/RH Model H08-032-08 and Boxcar Software; http://www.onsetcomp.com/Products/Product_Pages/HOBO_H08/hobo_pro_family_loggers.html)
Simple fanny pack (1)	Keeps hands free and gear out of water when tending the nets.
Simple, clear	

Tackle organizer (1)	Useful to help coordinate batteries, toothpicks, markers, pencils, pencil lead, knife, etc. Clear design makes it easy to take inventory after each survey.
Dufflebag (1)	Holds all the gear so you can just pick it up and go.

Acoustic Surveys

Acoustic surveys record ultrasonic bat echolocations and are used to document bat activity and in some case identify species present. Currently, two systems are predominately used by biologist: Anabat, produced by Titley Electronics. Acoustic surveys can be divided into to supervised and unsupervised survey types. Supervised surveys generally coincide with and are used to augment mist net surveys. Acoustic data is either collected passively where a detector is placed in a fixed location and records the ultrasonic calls of bats passing by or actively where specific bats are targeted for detection. Calls of bats captured during mist-net surveys can be recorded at release to build a local library of Anabat echolocation calls and to help confirm species identification.

During unsupervised surveys, weatherproofed acoustic detectors are left at a site to passively record bat echolocations. The duration of the survey depends on specific site protocol and/or the limitations of batteries and file storage.

Identifying bat species based on call characteristics can be tricky. Many bat species have similar calls and individual species may change their calls depending on their behaviors and surroundings. The main methods for identifying calls are studying the frequency range and forms of the calls.

APPENDIX II

Bat Survey Data Form
and
Field Descriptions for Bat Survey Data Form

Bat Survey Data Form

2. Date: _____ 3. Capture Location:_____ 4. County/State: _____

5. Habitat/Site Description: _____ 6. Photographs: N ____ S_____ E ____ W _____

7. UTM Coordinates (Datum: NAD27): | | | | | | | E | | | | | | | N, Zone (ex. 12T): | | | 8. Elevation (m): _____

9. Team Members: _____ 10. Recorder: _____

11. Methods Used (Mark all that apply): a) Mist Nets (Y/N)____ (surface area in m^2)_____ b) Harp Net (Y/N)____ c) Anabat (Y/N)____ d) Other _____

e) Data logger (data type) _____ (interval in minutes) _____

12.	Start	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Total
13. Time (24 hr):												
14. Net Status:												
15. Detector Status:												
16. Logger Status:												
17. Temp (°C):												
18. Wind:												
19. Weather:												
20. Moon:												

21. Bat No.	22. Time (24 hr)	23. Temp (°C)	24. Species	25. FA (mm)	26. Ear (mm)	27. Tragus Shape	28. Keel (Y/N)	29. Sex (M/F)	30. Reproductive Status	31. Age (Ad/Juv)	32. Photo? (Y/N/#)	33. Mark? (Y/N)	34. Weight (g) *Tared*	35. Notes

ARE ALL THE FIELDS FILLED OUT COMPLETELY? PLEASE INITIAL:_____

Field Descriptions for Bat Survey Data Form

36. **Page__ of __:** Fill in the first blank with the current page number and the second blank with the total number of pages used during the survey period (ex. Page 2 of 3).
37. **Date:** The Day, Month, and 4 digit Year the survey was conducted (23 June 2005).
38. **Capture Location:** The 'common' name of the site being surveyed (ex. Nirvana Pond or Selman's Ranch House).
39. **County/State:** The County and State in which the survey is being conducted (ex. Box Elder County, UT).
40. **Habitat/Site Description:** Short, simple description of surroundings and dominant vegetation within one mile of survey site. Description should also include the characteristics that caused the site to be selected (ex. presence of a stock pond, mine shaft, roost, etc.)
41. **Photographs:** Take one photograph in each cardinal direction (N,S,E,W) from the location the Coordinates were recorded (see #7). Note number of photograph if digital and applicable. Future photographs should always be taken from the same location to simplify historical comparisons.
42. **UTM Coordinates:** Record easterly (6 digit) and northerly (7 digit) UTM coordinates of the survey site using a GPS unit set to collect data in the North American Datum 1927 (NAD27).
43. **Elevation (m):** Use a GPS unit to record the Elevation at the same location the site's Coordinates were taken (see #7). Record elevation in meters.
44. **Team Members:** Record the first and last names of the individuals conducting the survey. Record professional affiliations if applicable (ex. USFWS, USFS, TNC, etc.)
45. **Recorder:** Record the full name of the individual most often recording the data; insuring that questions about what was written can be directed to the right person.
46. **Methods Used:** Mark Yes (Y) for all the methods that were used during the current survey and No (N) for those not used. If mist nets are being used, calculate and record their surface area in square meters [surface area = height (m) x sum length of all nets open (m)]. If a data logger is being used, note the type of data it is collecting (ex. temperature, humidity, barometric pressure) and the intervals to which it is set to collect data (ex. 5 min.). Use the Other category to record other methods employed during the survey period.
47. **Start; Hour 1…:** The status of Fields 13-20 should be recorded at the Start of the survey period and each consecutive 60 minutes after until the end of the survey. Uneven starting or ending times of either the nets, data loggers, or ultrasonic detectors should be recorded in the Hour column closest to the event. The actual time for each event will be recorded in Field 13.
48. **Time:** Actual time that the statuses of Fields 14 thru 20 are recorded.
49. **Net Status:** Record whether nets are 'Open' or 'Closed' at time in Field 13.
50. **Detector Status:** Recorded whether an ultrasonic detector is 'Active' or 'Not Active' at time in Field 13.
51. **Logger Status:** Recorded whether a data logger is 'Active' or 'Not Active' at time in Field 13.
52. **Temp (°C):** Record the temperature in degrees Celsius at time in Field 13.
53. **Wind:** Use MPH categories as determined from the Beaufort Wind Scale. 1) *0-1 MPH*: Calm; smoke rises vertically. 2) *1-3* MPH: Direction of wind shown by smoke drift, but not by wind vanes. 3) *4-7* MPH: Wind felt on face, leaves rustle, ordinary vane moved by wind. 4) *8-12* MPH: Leaves and small twigs in constant, gentle motion; wind extends light flag. 5) *13-18* MPH: Raises dust and loose paper; small branches are moved. In most situations winds in categories 3, 4, and 5 will not be conducive to operating mist nets.
54. **Weather:** Record the dominant weather over the last hour: 1*) Clear*: 0-10% cloud cover. 2) *Partly*: 10%-50% cloud cover. 3) Cloudy: 50%-100% cloud cover. 4) *Precip:* some amount of precipitation fell during this hour.
55. **Moon:** Record phase of moon as: 1) *None*: Either a new moon, just risen, or just set. 2) *Crescent*: 0-25% lit. 3) *Half:* 25-75% lit. 4) *Full*: 75-100% lit. 5) *Obscured*: Obscured by cloud cover.
56. **Bat No.:** Number the bats as they are caught (ex. 1, 2,3 …).
57. **Time (24 hr):** The time the bat *was caught*, not the time it was processed (ex. 2234).
58. **Temp (°C):** The temperature in degrees Celsius when the bat *was caught*, not when it was being processed.
59. **Species:** Use a dichotomous bat key for the area the survey is being conducted to help identify bats to species. It is likely that characters in addition to the Fields below will be needed for proper identification.
60. **FA (mm):** The length of the forearm in millimeters. The forearm is defined as the length between the elbow and the distal side of the wrist (Figure 1).
61. **Ear (mm):** The length of the ear in millimeters. The ear length is measured from the notch on the base of the ear to the ear's tip (Figure 2).
62. **Tragus Shape:** Note the shape of the tragus as either 1) Long and Pointed (Figure 3a) or 2) Short and Rounded (Figure 3b). Especially useful to determine identification of Pipestrelles.
63. **Keel:** Note the 1) Presence or 2) Absence of a flap of skin hanging loose off the posterior edge of the calcar (Figure 4a & b).
64. **Sex:** Record the sex of the bat as 1) Male or 2) Female. Evidence of sex is best obtained from the genitalia, with the males possessing a well developed penis.
65. **Reproductive Status:** Record the reproductive status of the Males as either 1) Reproductive – one or both testes have descended or 2) Non-reproductive – neither testes are descended. For the Female note evidence of 1) Lactating – nipples are pink and enlarged, hair surrounding the nipple is worn. 2) Post-lactating – nipples wrinkly and dark hair has often grown back. 3) Pregnant – presence of unborn fetus evident. 4) Non-reproductive – nipples very small and well haired.
66. **Age:** Record the age of the bat as either 1) Juvenile or 2) Adult based on the calcification of the phalangeal joints. Best observed by shining the joints from behind with a head lamp (Figure 5).
67. **Photo?:** Record whether a photograph was taken of the bat with a Yes (Y) or (N). Note number of photograph if digital and applicable.
68. **Mark?:** Record whether the animal was marked before release with a Yes (Y) or No (N). Note method of marking in the Notes (ex. Marker, band, tattoo, freeze brand, etc.)
69. **Weight:** The total weight of the bat minus the weight of the bag in grams.
70. **Notes:** To be used to record observations or actions of this particular bat not accounted for by the data sheet (ex. parasite load, marking method, injuries, capture method, etc.)

Figure 1:
Forearm =elbow to wrist

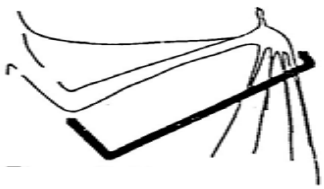


Figure 2:
Ear = notch bottom to tip

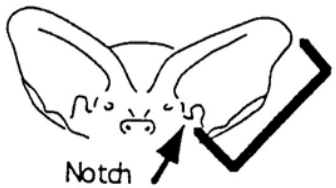


Figure 3: Tragus shape
a) long, pointed b) short, rounded

Figure 4: Keeled calcar
a) Present b) Absent

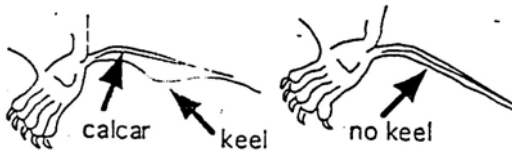
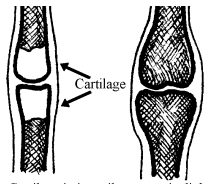


Figure 5: Age
a) Juvenile b) Adult



Cartilage in juveniles transmits light; appears whitish when backlit.

APPENDIX III

Dichotomous Key
for the
Bats of Utah

DICHOTOMOUS KEY FOR THE BATS OF UTAH

Authored by: Chris Witt, Adam Kozlowski, and George Oliver
Figures by: Adam Kozlowski
Last edited: 25 July 2007

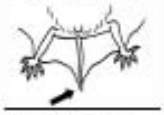
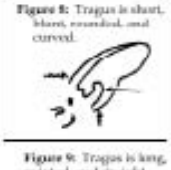
FIGURE	STEP	DIAGNOSTIC
 Figure 1: Tail extends >5 mm beyond uropatagium.	1	a. Tail extends beyond rear edge of uropatagium (interfemoral membrane) by more than 5 mm [Figure 1]. GO TO: 2 FAMILY: **Molossidae** b. Tail does not extend beyond rear edge of uropatagium or only slightly (≤5 mm) [Figure 2]. GO TO: 3 FAMILY: **Vespertilionidae**
 Figure 2: Tail does not extend more than 5 mm beyond uropatagium.	2	a. Ears do not join at the base, small bumps are present along the ear's front edge. Ears barely extend past the shout when laid forward. Tail generally does not extend >25 mm past interfemoral membrane; usually extends ~19 mm. Fur is generally uni-colored, darkish gray/brown, species often exudes strong, musty odor. **BRAZILIAN FREE-TAILED BAT** *(Tadarida brasiliensis)* b. Ears join at the base, small bumps along the front edges of the ear are not present [Figure 3]. Ears extend well beyond the snout when laid forward. Tail generally extends at least 25 mm past interfemoral membrane. Fur is bi-colored, almost white at its base, distal color ranges from reddish-brown to black. **BIG FREE-TAILED BAT** *(Nyctinomops macrotis)*
 Figure 3: Small bumps present along leading edge of ears.	3	a. Ears longer than 25 mm [Figure 4]. GO TO: 4 b. Ears shorter than 25 mm. GO TO: 7
 Figure 4: Ear length is measured from notch to tip.	4	a. Three conspicuous white spots present on back, one on each shoulder and one on lower back; [Figure 5]. Ears are pink. **SPOTTED BAT** *(Euderma maculatum)* b. Three dorsal spots not present. GO TO: 5
 Figure 5: Spotted bat's dorsal markings.	5	a. Ears clearly separated at base; dorsal pelage is light brown to yellow, hairs lighter at base. **PALLID BAT** *(Antrozous pallidus)* b. Ears joined at base. GO TO: 6
 Figure 6: Lappets, flaps of skin, extending from base of each ear toward snout.	6	a. Each ear has lappet (flap of skin) near its base anteriorly, which extends forward toward snout [Figure 6]. Muzzle does not have well-defined dermal glands [Figure 7]. **ALLEN'S BIG-EARED BAT** *(Idionycteris phyllotis)* b. Ears do not have basal lappets (flaps of skin) extending anteriorly. Muzzle does have a well-defined pair dermal glands. **TOWNSEND'S BIG-EARED BAT** *(Corynorhinus townsendii)*
 Figure 7: Muzzle with well defined dermal glands.	7	a. Uropatagium (interfemoral membrane) heavily furred dorsally. GO TO: 8 b. Uropatagium (interfemoral membrane) not heavily furred dorsally. GO TO: 10
 Figure 8: Tragus is short, blunt, rounded, and curved.	8	a. Weight is generally greater than 20 g; Light colored ears distinctly edged in black. Dorsal pelage pale yellow/brown at base, black/dark brown in middle and white/cream at tip. **HOARY BAT** *(Lasiurus cinereus)* b. Weight is generally less than 20 g. Dorsal pelage is not pale yellow/brown at base, black/dark brown in middle and white/cream at tip. GO TO: 9
	9	a. Fur color is dark brown to black with silver/white tips, giving a frosted appearance. **SILVERED-HAIRED BAT** *(Lasionyceris noctivagans)* b. Fur color is not dark brown to black with silver/white tips, rather it is brick red to rust on upperparts with pale undersides. **WESTERN RED BAT** *(Lasiurus blossevillii)*
 Figure 9: Tragus is long, pointed, and straight.	10	a. Tragus short (<6 mm), blunt, rounded, and curved [Figure 8]. GO TO: 11 b. Tragus long (>6 mm), pointed, and straight [Figure 9]. GO TO: 12

Figure 10: Uropatagium has conspicuous fringe of hairs on its posterior edge.

11 a. Forearm >40 mm (42 – 52); ears extend outward; mass greater than 11 g.
BIG BROWN BAT *(Eptesicus fuscus)*

b. Forearm <40 mm (28 – 33); mass less than 11 g.
WESTERN PIPISTRELLE *(Pipistrellus hesperus)*

12 a. Ears blackish and extend 4mm or more past end of snout when pressed forward.
LONG-EARED MYOTIS *(Myotis evotis)*

b. Ears extend less than 4 mm past end of snout when pressed forward.
GO TO: 13

Figure 11: Underside of wing has long, dense fur extending outward from body.

13 a. Uropatagium (interfemoral membrane) has conspicuous fringe of hairs on its posterior edge; [Figure 10]. Fringe often accompanied by lighter skin pigmentation on uropatagium's trailing edge.
FRINGED MYOTIS *(Myotis thysanodes)*

b. Uropatagium (interfemoral membrane) does not have conspicuous fringe of hairs (but may be very sparsely haired).
GO TO: 14

Figure 12: Calcar keel not present or poorly developed.

14 a. Underside of wing has long, dense fur extending outward from body to a line between elbow and knee [Figure 11]. Tibia is ≥ 2.5X the length of the hind foot.
LONG-LEGGED MYOTIS *(Myotis volans)*

b. Underside of wing does not have long, dense fur between elbow and knee.
GO TO: 15

15 a. Calcar keel is not well developed or is absent [Figure 12].
GO TO: 16

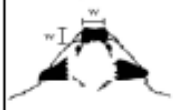
b. Calcar keel is present and well developed [Figure 13].
GO TO: 17

Figure 13: Calcar keel is present and well developed.

16 a. Fur of dorsal region is dull.
Forearm is generally less than 36 mm.
No keel on calcar.
Skull rises more abruptly from snout.
Ventral hairs black at base, light cream at tips.
YUMA MYOTIS *(Myotis yumanensis)*

b. Fur of dorsal region is glossy and long, longest dorsal hairs ~10 mm.
Forearm length 34 – 41mm.
May have poorly developed keel on calcar.
Snout to skull transition gradual.
Hairs on toes project beyond claws.
LITTLE BROWN MYOTIS *(Myotis lucifugus)*

Figure 14: Naked part of snout top is as wide (w) as it is long (square).



17 a. Naked part of snout top is as wide as it is long (square) [Figure 14].
Tail does not extend beyond uropatagium.
Forehead rises steeply and abrubtly from rostrum.
Face, ears, and wings are not black and do not contrast sharply with pelage color.
CALIFORNIA MYOTIS *(Myotis californicus)*

Figure 15: Naked part of snout top is 1.5X the nostril width (rectangular).

b. Naked part of snout top is 1.5X the nostril width (rectangular) [Figure 15].
Tail often extends 1.5-2.5 mm beyond uropatagium.
Forehead rises gradually from rostrum.
Face, ears, and wings are black, often contrastingsharply with pale pelage.
WESTERN SMALL-FOOTED MYOTIS *(Myotis ciliolabrum)*

CHARACTERS USEFUL IN DISTINGUISHING UTAH'S SPECIES OF *MYOTIS*

Species	Body Mass (g)	Forearm (mm)	Ear (mm)	Keel on Calcar	Special Characteristics
californicus	3 – 6	29 – 36	9 – 15	Well developed	See step 17 to differentiate.
ciliolabrum	4 – 6	30 – 36	13 – 21	Well developed	See step 17 to differentiate.
yumanensis	4 – 7	32 – 36	12 –15	None	See step 16 to differentiate.
lucifugus	5 – 7	34 – 41	11 – 15	None	See step 16 to differentiate.
evotis	5 – 8	37 – 40	20 – 24	Poor	Ear length is distinctive among *Myotis*.
thysanodes	5 – 7	39 – 46	16 – 20	Poor to None	Short, dense hairs on trailing edge of tail.
volans	6 – 10	37 – 42	10 – 15	Well developed	Fur on wing between elbow and knee. Tibia is ≥2.5X the length of the hind foot.

VI. f. APPENDIX F: Maps & GIS Information

DELIVERABLE: MAPS

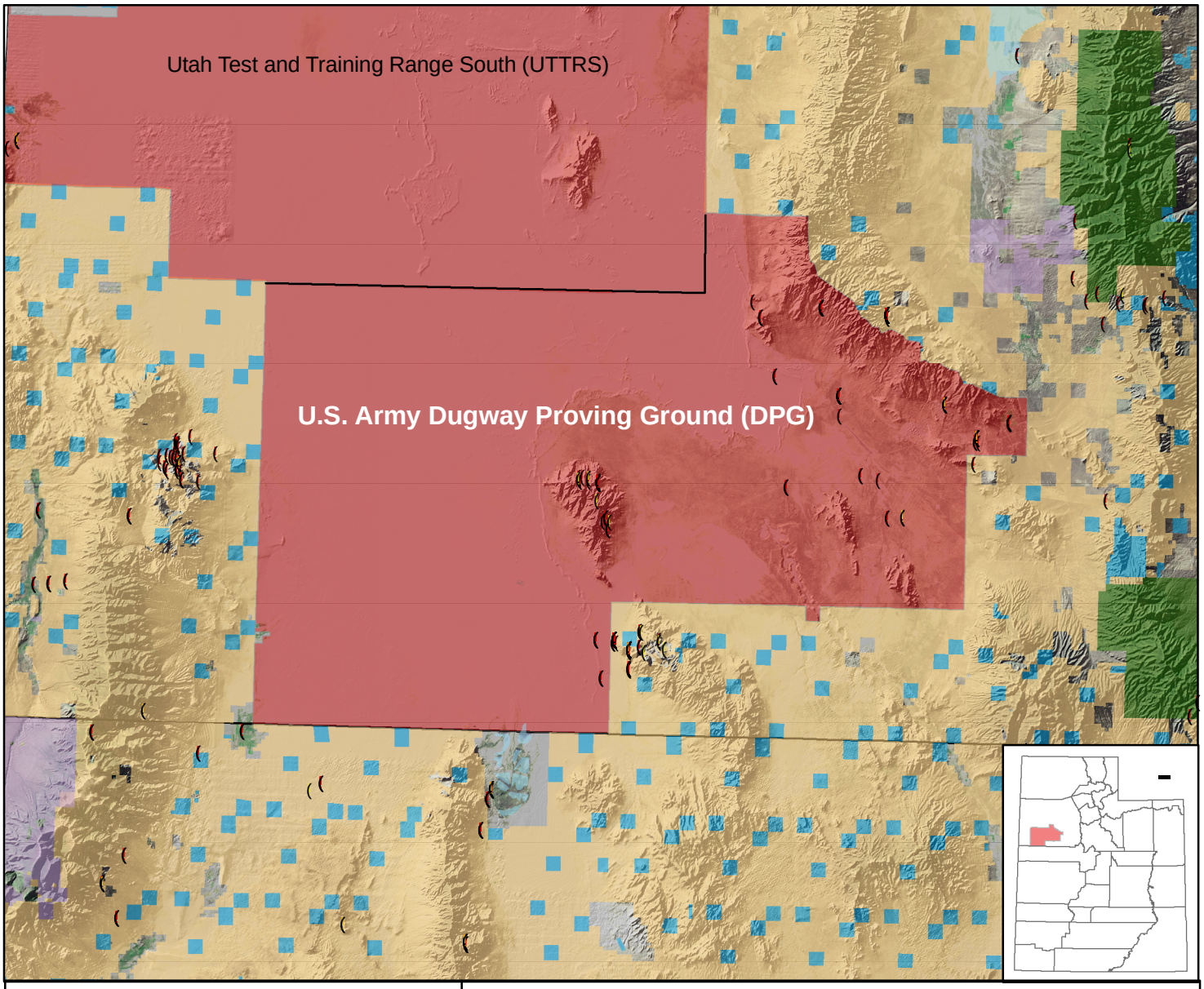
DELIVERABLE: GIS DATA

Maps and GIS Information for Bat Occurrence Data on Department of Defense Land and in the State of Utah:

Before and After Legacy Funded Efforts

CONTENTS

Bat Species Occurrence Data for U.S. Army Dugway Proving Ground (Post-Legacy Project, FY2007 Proj #07-346)



Dugway Proving Ground
USFS
State Lands
BLM
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale

0 3 6 12 18 24 Miles

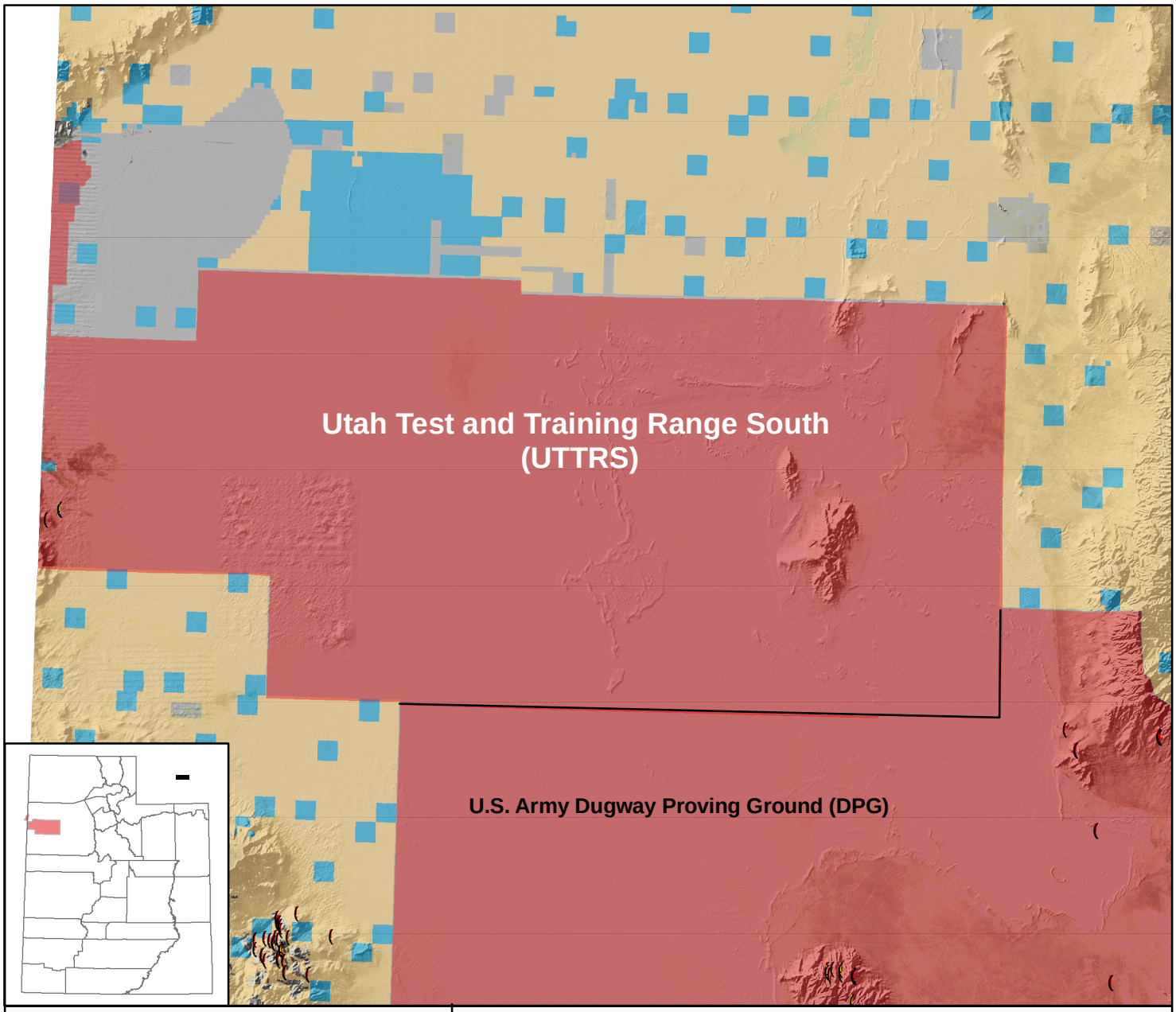
Observed Species Summary for Dugway Proving Ground

Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	30	10	1
Western small-footed myotis	4	5	3
Long-legged myotis	5	1	4
Fringed myotis(1)	5	0	5
Big brown bat	5	0	5
Yuma myotis(2)	1	0	10
Pallid bat	9	4	2
California myotis	0	9	3
Western pipestrelle	2	3	5
Silver-haired bat	1	0	9
Brazilian free-tailed bat	0	4	6
Hoary bat	1	1	8
Long-eared myotis	2	1	7
Total # of Species	**Total # of Sites**	**Total # of Sites**	
13	65	38	

1 - Utah State Sensitive Species (Tier II)
2 - Utah State Sensitive Species (Tier III)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Utah Test and Training Range South (Post-Legacy Project, FY2007 Proj #07-346)



UTTRS
State Lands
BLM
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale

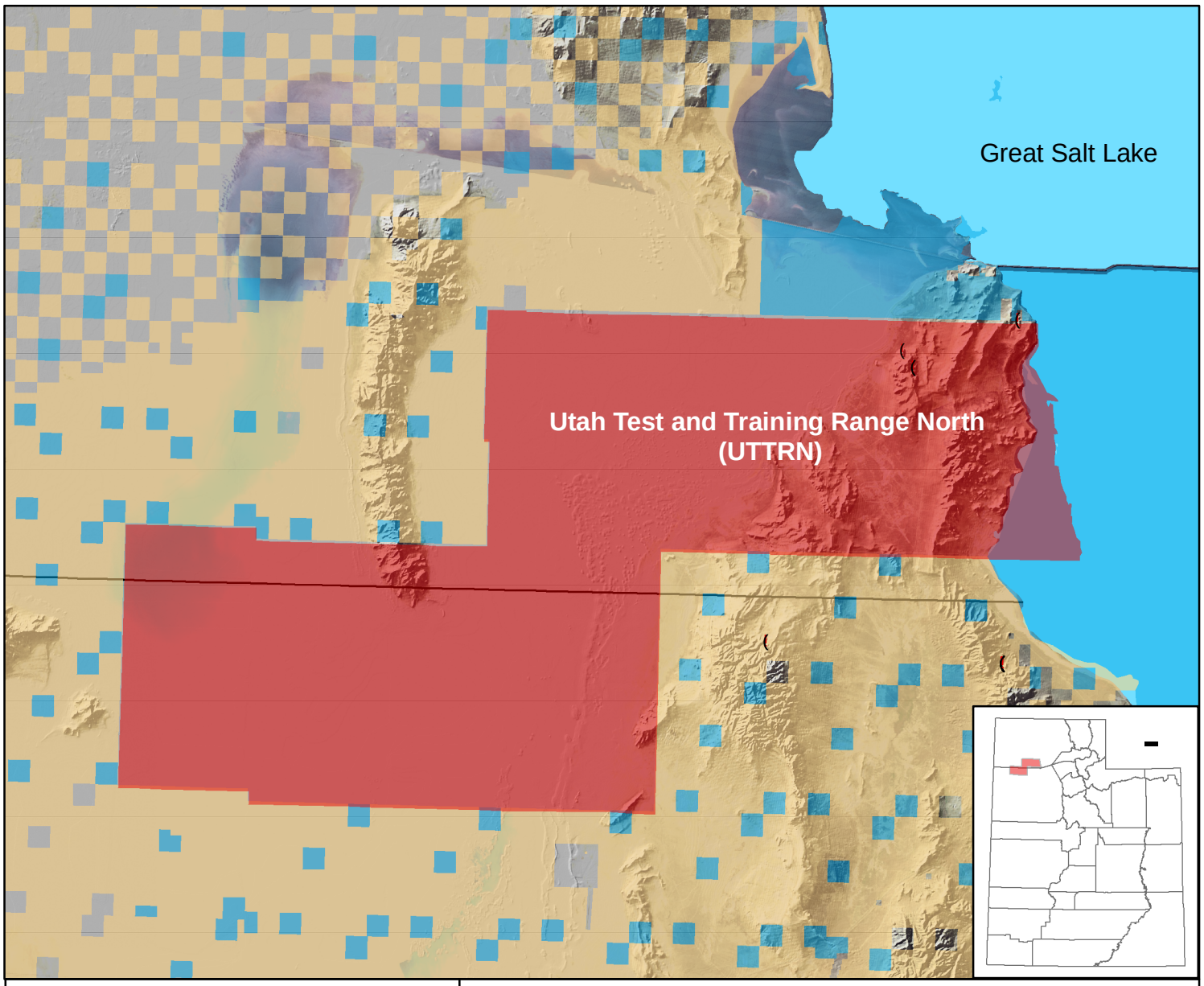
0 2 4 8 12 16 Miles

Observed Species Summary for UTTRS

Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Pallid bat	4	1	1
California myotis	3	0	2
Western pipestrelle	2	0	3
Brazilian free-tailed bat	0	1	4
Total # of Species	**Total # of Sites**	**Total # of Sites**	
4	9	2	

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Utah Test and Training Range North (Post-Legacy Project, FY2007 Proj #07-346)



UTTRN
State Lands
BLM
Private property

(Bat Occurrence Data (Post-Legacy Project)

Scale

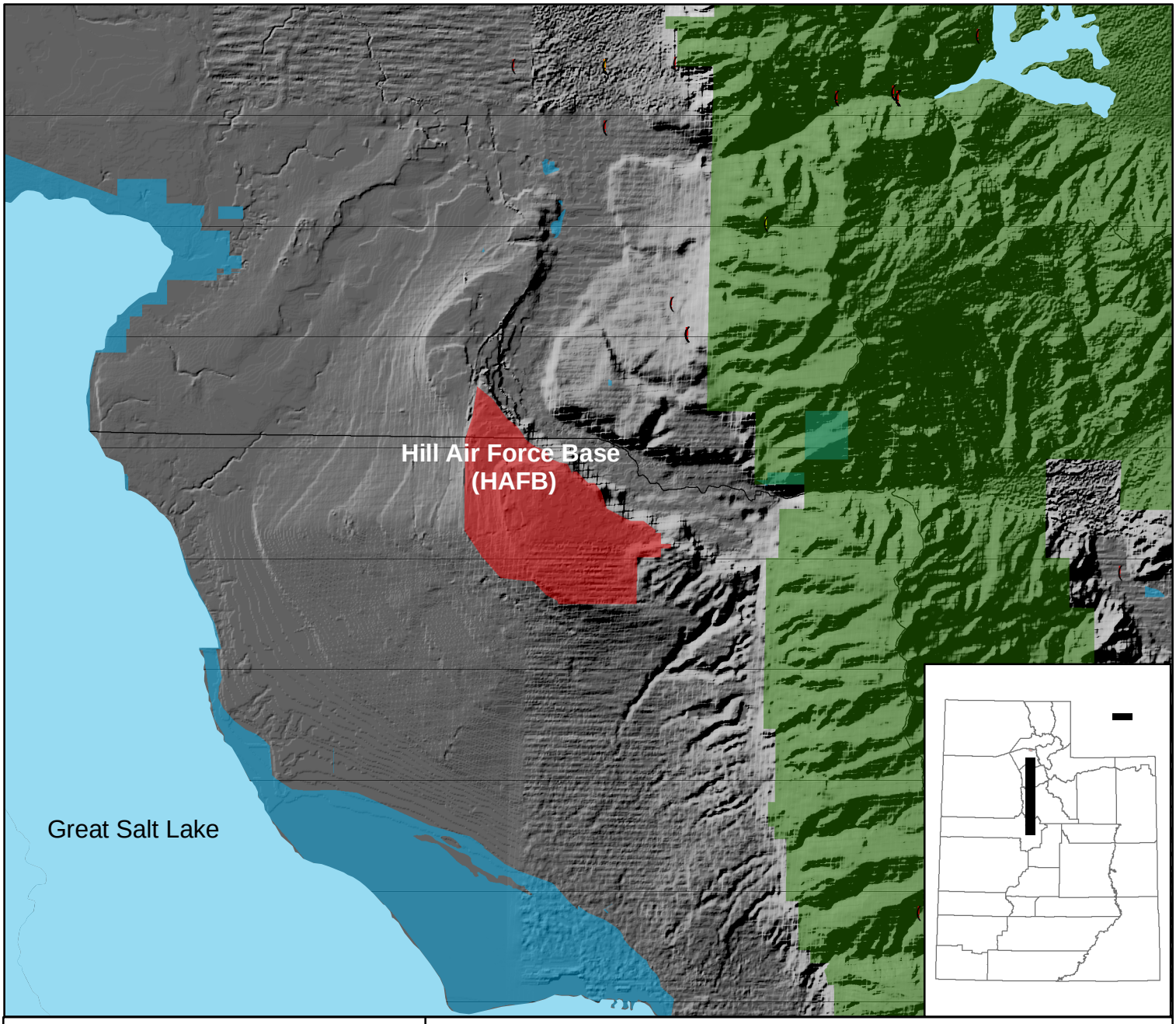
0 1.5 3 6 9 12
Miles

Observed Species Summary for UTTRN

Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Western small-footed myotis	2	2	1
California myotis	1	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
2	3	2	

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Hill Air Force Base (Post-Legacy Project, FY2007 Proj #07-346)



HAFB
USFS
State Lands
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale
0 0.5 1 2 3 4 Miles

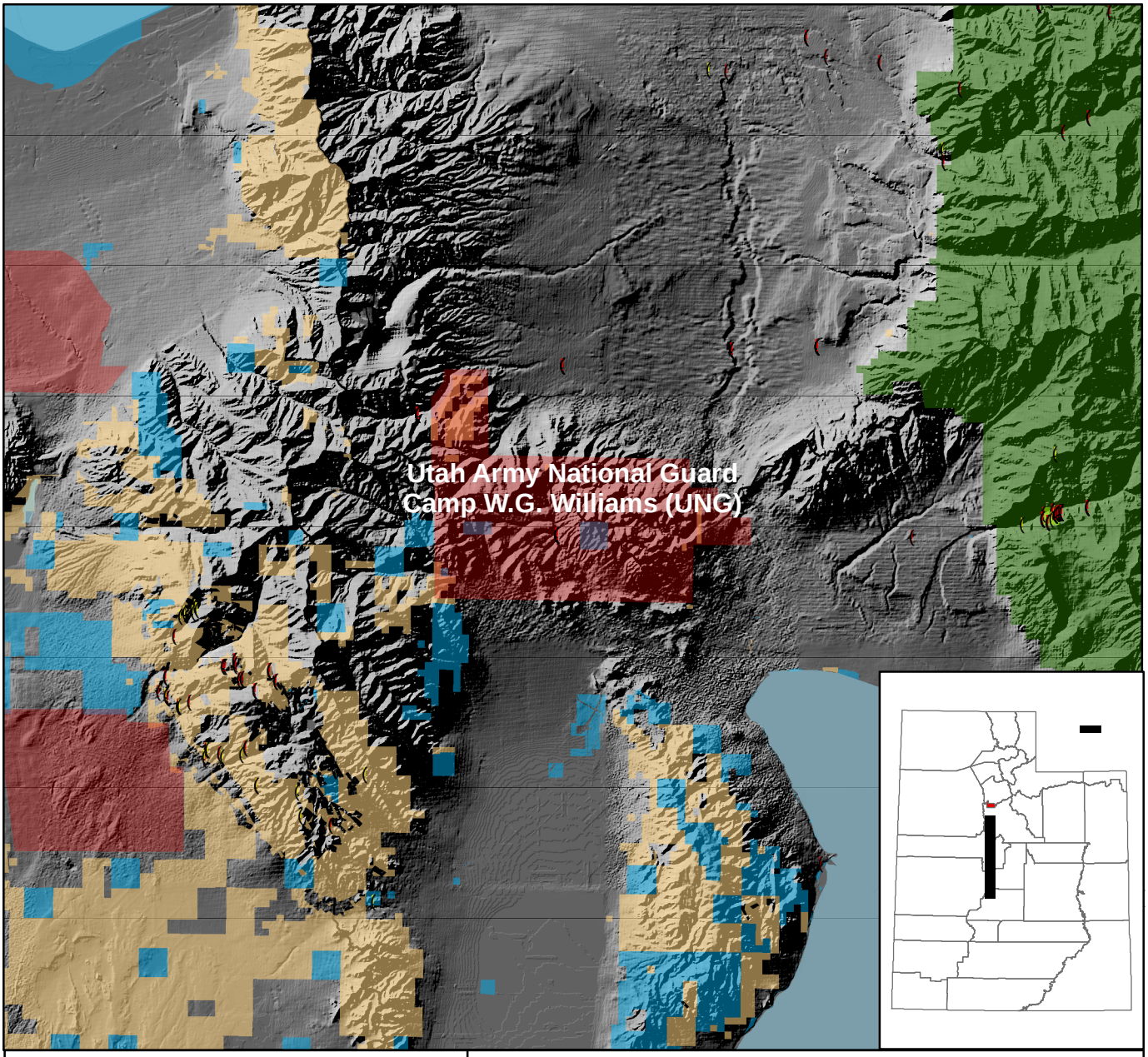
Observed Species Summary for Hill Air Force Base

Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	1	0	3
Long-legged myotis	1	0	3
Big brown bat	3	0	1
Yuma myotis(2)	1	0	3
Western pipestrelle	1	0	3
Silver-haired bat	1	0	3
Brazilian free-tailed bat	2	0	2
Little Brown myotis	2	0	2
Hoary bat	1	0	3
Long-eared myotis	1	0	3
Total # of Species	**Total # of Sites**	**Total # of Sites**	
10	14	0	

1 - Utah State Sensitive Species (Tier II)
2 - Utah State Sensitive Species (Tier III)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Camp W.G. Williams (Post-Legacy Project, FY2007 Proj #07-346)



Camp W.G. Williams
USFS
State Lands
BLM
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale

0 1.5 3 6 9 12 Miles

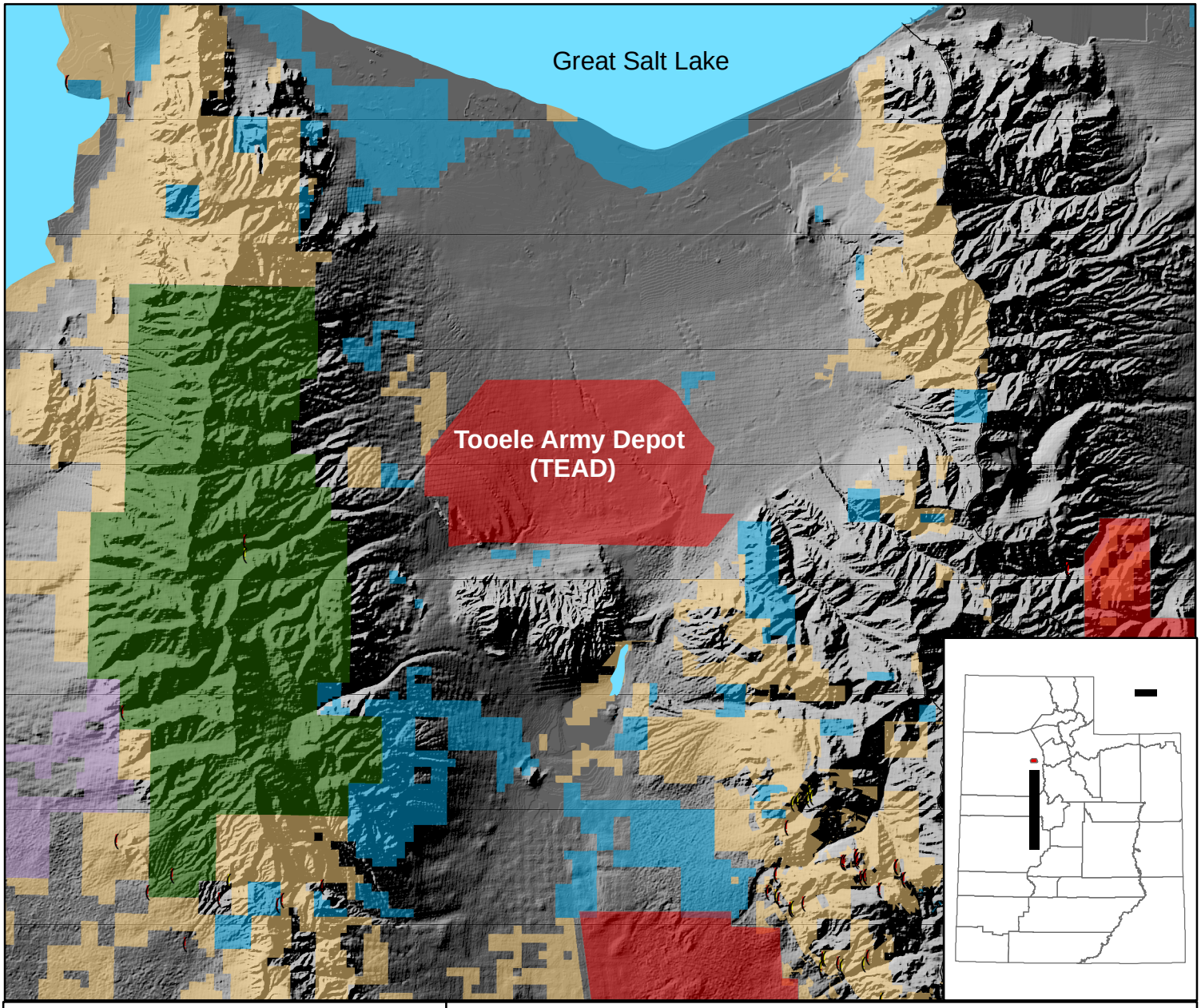
Observed Species Summary for Camp W.G. Williams

Species	# of Sites where species were recorded (offsite)	# of Sites where species were recorded (onsite)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	25	0	1
Long-legged myotis	6	0	3
Big brown bat	5	0	4
California myotis	0	1	6
Silver-haired bat	1	0	6
Little Brown myotis	3	0	5
Hoary bat	1	0	6
Long-eared myotis	9	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
8	50	1	

1 - Utah Species of Concern (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Tooele Army Depot (Post-Legacy Project, FY2007 Proj #07-346)



Tooele Army Depot
Tribal Lands
USFS
State Lands
BLM
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale

0 1.25 2.5 5 7.5 10 Miles

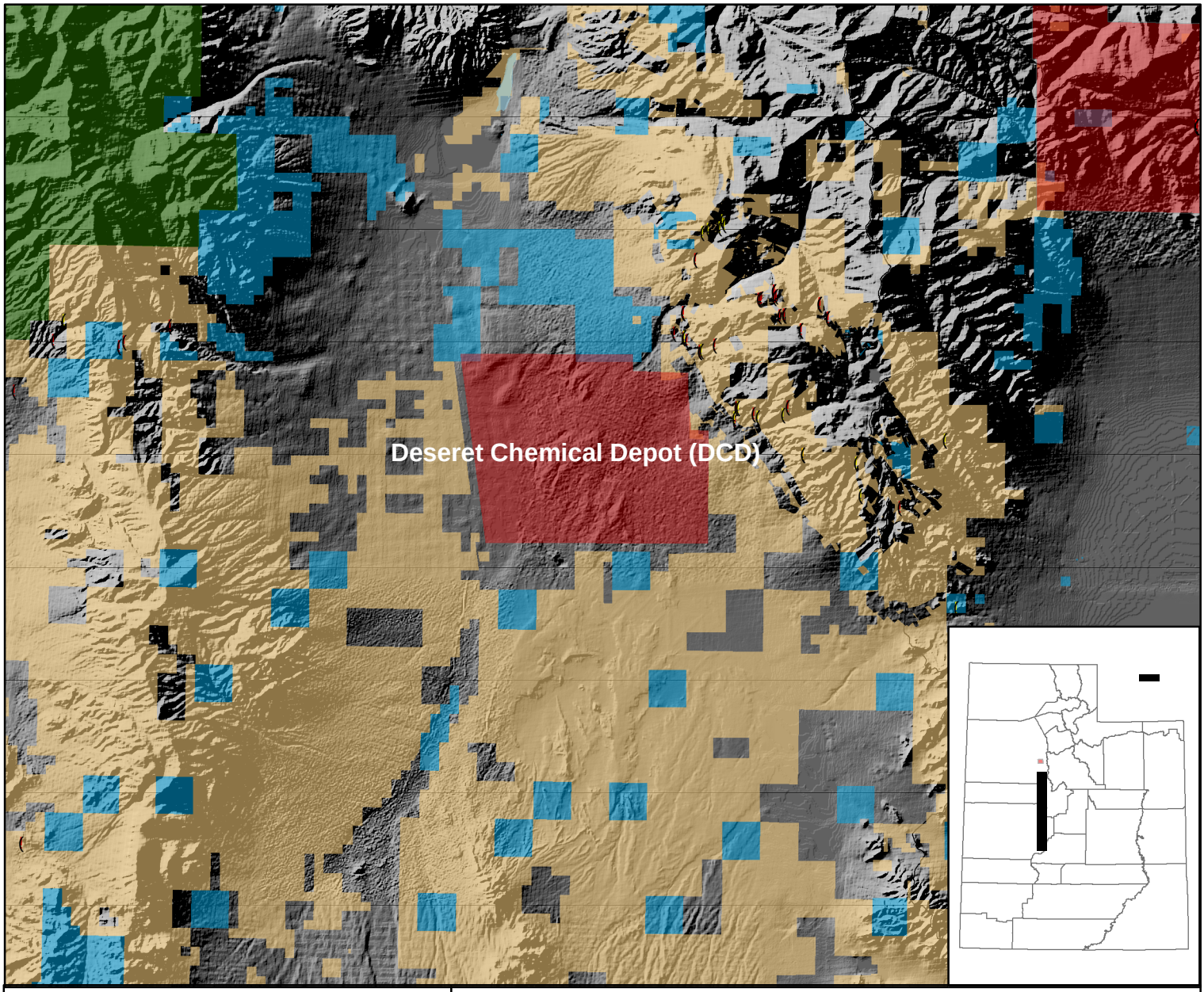
Observed Species Summary for Tooele Army Depot

Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	7	0	1
Western small-footed myotis	1	0	2
Total # of Species	**Total # of Sites**		
2	8		

1 - Utah State Sensitive Species (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for Deseret Chemical Depot (Post-Legacy Project, FY2007 Proj #07-346)



Deseret Chemical Depot
USFS
State Lands
BLM
Private property

(Bat Occurence Data (Pre-Legacy Project)
(Bat Occurrence Data (Post-Legacy Project)

Scale

0 1 2 4 6 8 Miles

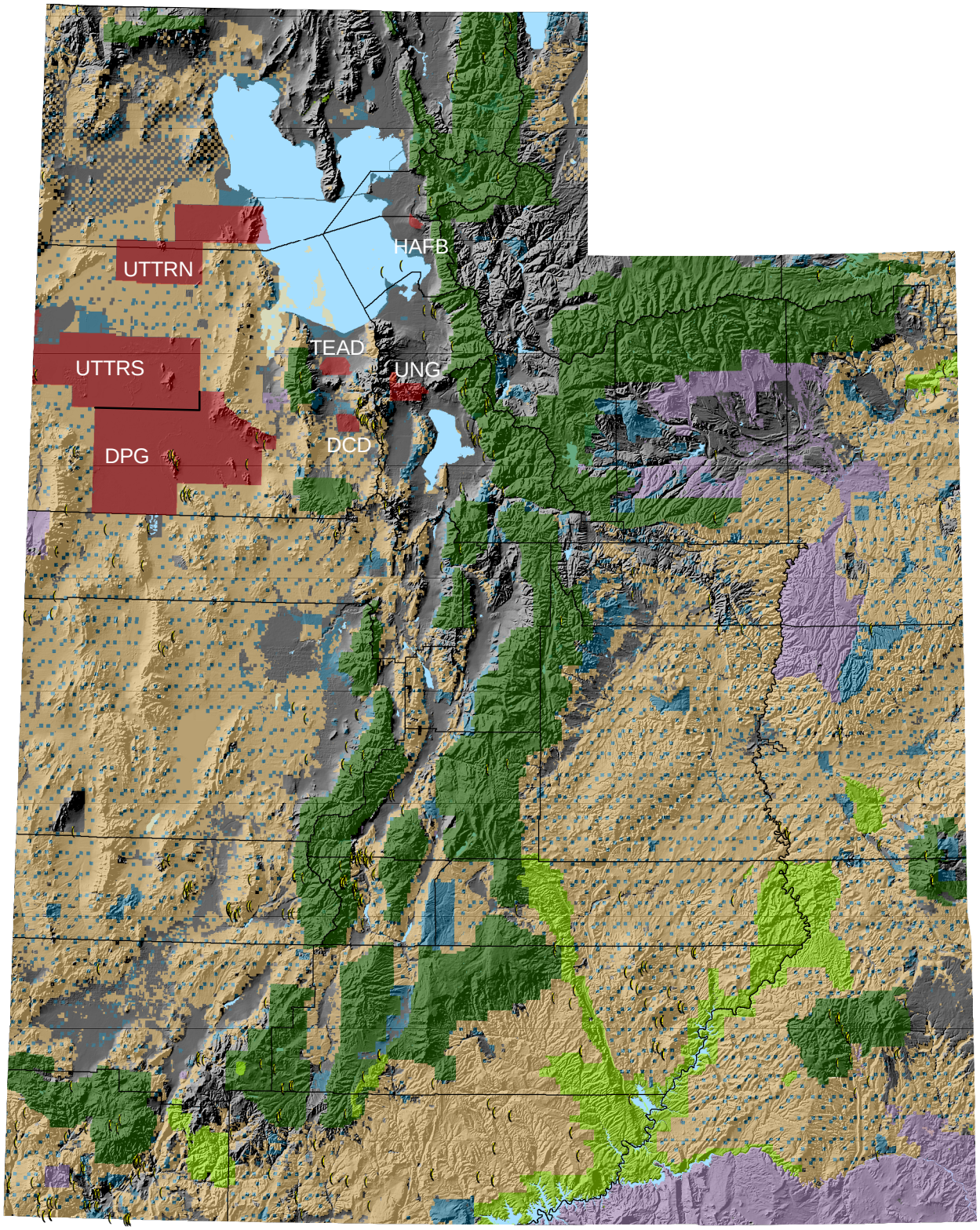
Observed Species Summary for Deseret Chemical Depot

Species	# of Sites where species were recorded (off site)	# of Sites where species were recorded (on site)	Relative Occurrence Rank
Townsend's Big-eared bat(1)	27	0	1
Long-legged myotis	7	0	2
Big brown bat	1	0	4
Silver-haired bat	1	0	4
Western small-footed myotis	6	0	3
Little Brown myotis	1	0	4
Hoary bat	1	0	4
Long-eared myotis	7	0	2
Total # of Species	**Total # of Sites**	**Total # of Sites**	
8	51	0	

1 - Utah State Sensitive Species (Tier II)

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Bat Species Occurrence Data for the State of Utah
(Pre-Legacy Project, FY2007 Proj #07-346)



Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

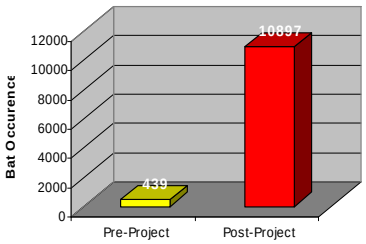
- Military Installations
- Tribal Lands
- NPS
- USFS
- BLM
- State Lands
- Private property

Bat Occurence Data (Pre-Legacy Project)

Scale

0 10 20 40 60 80 Miles

Bat Species Occurrence Data for the State of Utah
(Post-Legacy Project, FY2007 Proj #07-346)



Total bat occurrence data before and after Legacy funded efforts.

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

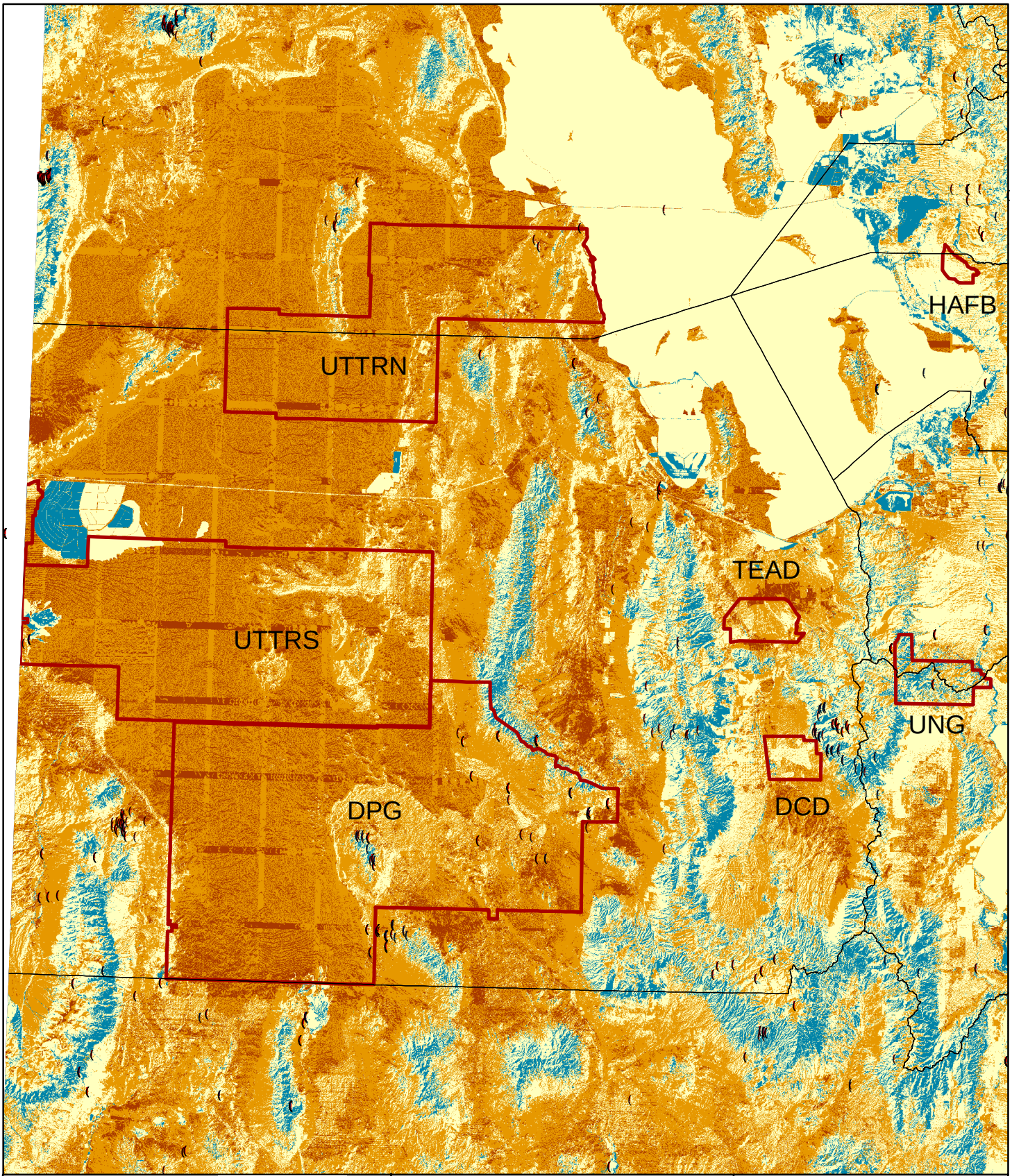
- Military Installations
- Tribal Lands
- NPS
- USFS
- BLM
- State Lands
- Private property

- Bat Occurence Data (Pre-Legacy Project)
- Bat Occurrence Data (Post-Legacy Project)

Scale

0 10 20 40 60 80 Miles

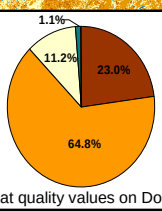
Important Bat Habitat Model and Military Installations



Important Bat Habitat Model

VALUE

- Very Low
- Low
- Medium
- High
- Very High



% of habitat quality values on DoD lands

Military Installations

(Bat Occurence Data (Pre-Legacy Project)

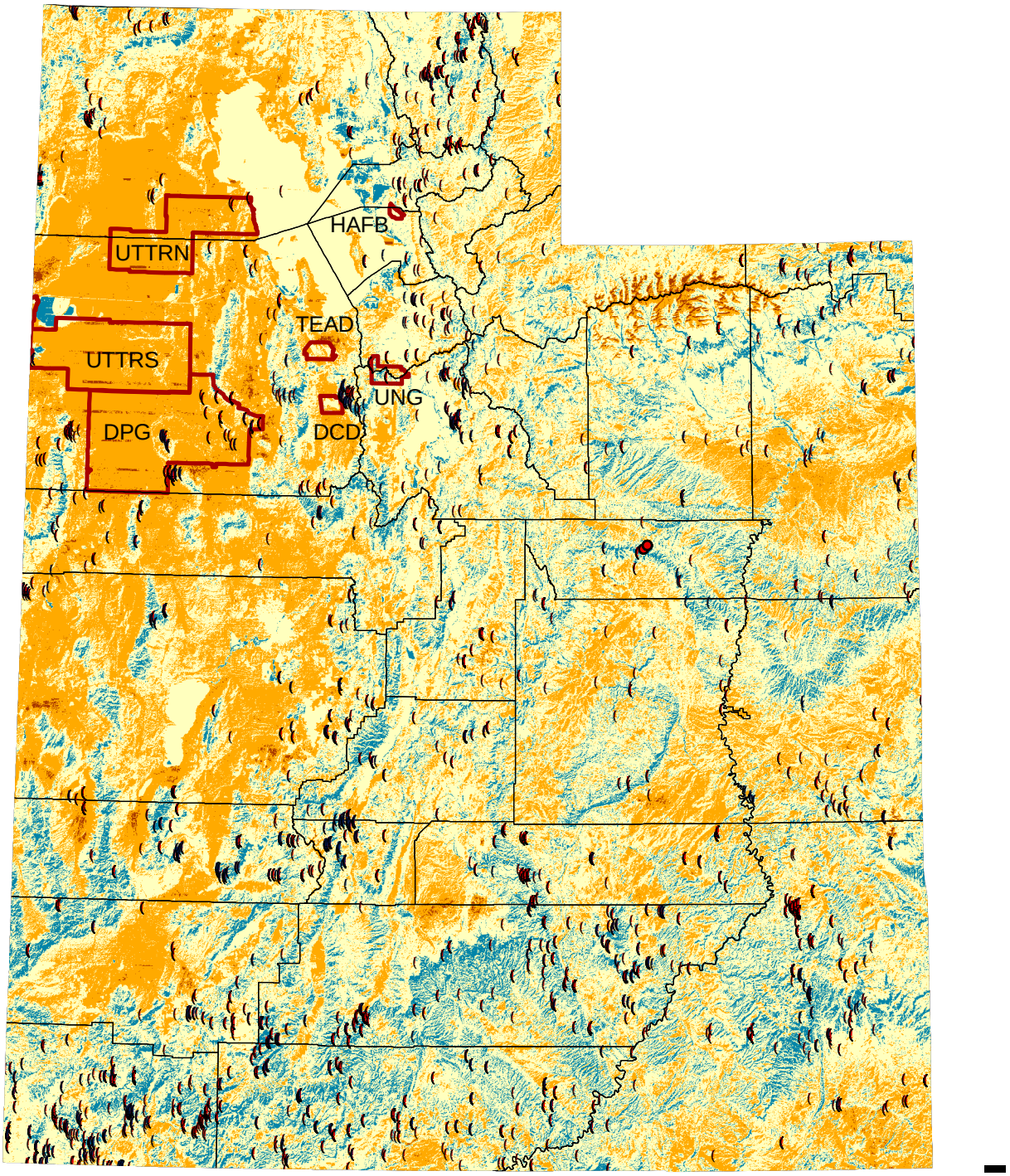
(Bat Occurrence Data (Post-Legacy Project)

Scale

0 2.5 5 10 15 20 Miles

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

Important Bat Habitat Model for the State of Utah



Important Bat Habitat Model

VALUE

- Very Low
- Low
- Medium
- High
- Very High

- Military Installations
- Bat Occurence Data (Pre-Legacy Project)
- Bat Occurrence Data (Post-Legacy Project)

Scale

0 10 20 40 60 80 Miles

Map produced with funding from the Department of Defense Legacy Program and staff assistance from a participant of the Oak Ridge Institute of Science and Education (ORISE) Program administered by the U.S. Army Environmental Command through an interagency agreement with the U.S. Department of Energy.

VI. g. APPENDIX G: How to Access the Utah Bat Database

DELIVERABLE: SOFTWARE

Instructions on Accessing the Utah Bat Database

We are in the final developing stages and have provided a single user account to view the website and database.

Website Access:

https://www.utahbats.org

Temporary Database Access While Test Data is Still Present:
User: guest
Password: Password1!

When real data is placed into the database, individuals will be required to register and create a unique user name and password to access the data entry and query portions of the online geodatabase. Both data entry and query access will require approval by the Utah Natural Heritage Program (UNHP). Individuals registration will be sent to the UNHP where approval will be voted on by a select group from the Legacy project team and Utah Bat Conservation Cooperative (UBCC). Public pages on the website are available without log-in access and include the following pages: Home, About us, Partners, Outreach, Documents (partial public access), and Contacts.

The application uses the new ASP.NET 2.0 Membership, Role Management and Login Controls. A registration page has been developed that allows cooperating partners to register and request a username and password (Figure 1).

Authenticated web-users will be able to add, preview, and edit new information and then submit the data to a staging area for acceptance by the database administrator (QAQC function). The administrator can grant or revoke permissions to users to determine which pages they are allowed to access.

Figure 1. Example of the registration page users will have to fill out in order to access the secure database.