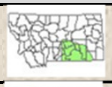
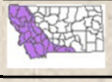
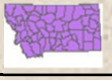
Montana Efforts to Monitor Year-Round Bat Activity Patterns and Roost Habitats

Update through June 1st, 2013

Montana Natural Heritage Program (Bryce Maxell, Susan Lenard, Paul Hendricks)
Northern Rocky Mountain Grotto (Daryl Greaser, Carl Bakker, Bob Bastasz, Ian Chechet, James Cummins, Mike McEachern)
Big Fork Cave Club (Hans Bodenhamer, Big Fork High School students)
Montana Fish Wildlife and Parks (Lauri Hanauska-Brown, Kristi DuBois, Allison Begley, Rhea Armstrong, Lynette Kemp, Gene Davenport)
U.S. Forest Service (Amie Shovlain, Beth Hahn, Don Sasse, Courtney Frost, Jennie Holifield, Steve Johnsen, Allison Kolbe, Barb Pitman, Erich Pfalzer, Dan Seifert, Andrea Shortsleeve)
Bureau of Land Management (Jake Chaffin, Katie Iverson, Matt Comer, Chris Rye, Jo Christensen)
Montana Department of Environmental Quality (Mike Glenn, Chris Yde, Warren McCullough)
Fort Peck Tribal Office of Environmental Protection (Jeanne Spaur)
U.S. Fish and Wildlife Service (Christopher Servheen)
MPG Ranch (Kate Stone, Debbie Leick)
National Park Service (Lisa Bate)
Confederated Salish Kootenai Tribes (Janene Lichtenberg)
ABR Inc. (Nathan Schwab)

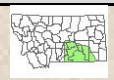
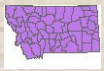
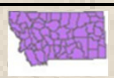
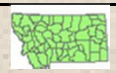
Bats of Montana

- 5 Species of Concern
- 4 Potential Species of Concern

Common Name	Scientific Name	4-Code	MT Range/No. Recs
Pallid Bat	*Antrozous pallidus*	**ANPA**	 44
Townsend's Big-eared Bat	*Corynorhinus townsendii*	**COTO**	 261
Big Brown Bat	*Eptesicus fuscus*	**EPFU**	 773
Spotted Bat	*Euderma maculatum*	**EUMA**	 50
Silver-haired Bat	*Lasionycteris noctivagans*	**LANO**	 1,037
Eastern Red Bat	*Lasiurus borealis*	**LABO**	 21
Hoary Bat	*Lasiurus cinereus*	**LACI**	 828
California Myotis	*Myotis californicus*	**MYCA**	 159
Western Small-footed Myotis	*Myotis ciliolabrum*	**MYCI**	 636
Long-eared Myotis	*Myotis evotis*	**MYEV**	 820
Little Brown Myotis	*Myotis lucifugus*	**MYLU**	 1,165
Northern Myotis	*Myotis septentrionalis*	**MYSE**	? 2
Fringed Myotis	*Myotis thysanodes*	**MYTH**	 113
Long-legged Myotis	*Myotis volans*	**MYVO**	 316
Yuma Myotis	*Myotis yumanensis*	**MYYU**	 23

Major Bat Conservation Issues

Wind Turbine Impacts Documented **White-Nose Syndrome and Wind Turbine Impacts Documented**

Common Name	Scientific Name	4-Code	MT Range/No. Recs
Pallid Bat	*Antrozous pallidus*	**ANPA**	 44
Townsend's Big-eared Bat	*Corynorhinus townsendii*	**COTO**	 261
Big Brown Bat	*Eptesicus fuscus*	**EPFU**	 773
Spotted Bat	*Euderma maculatum*	**EUMA**	 50
Silver-haired Bat	*Lasionycteris noctivagans*	**LANO**	 1,037
Eastern Red Bat	*Lasiurus borealis*	**LABO**	 21
Hoary Bat	*Lasiurus cinereus*	**LACI**	 828
California Myotis	*Myotis californicus*	**MYCA**	 159
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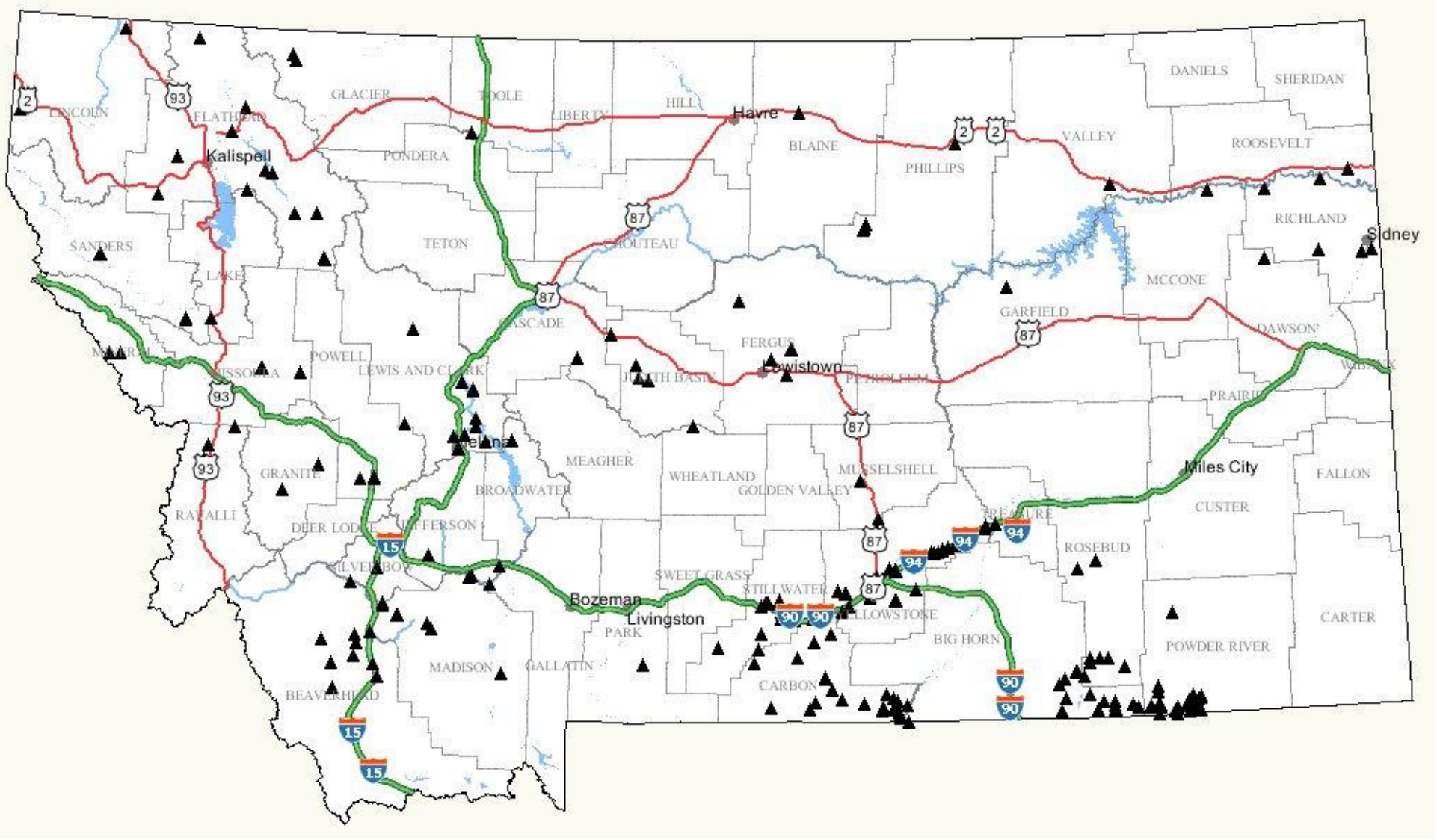
Fringed Myotis	*Myotis thysanodes*	**MYTH**	 113
Long-legged Myotis	*Myotis volans*	**MYVO**	 316
Yuma Myotis	*Myotis yumanensis*	**MYYU**	 23

Information Needs/Objectives

- Centralization of winter and summer roost site data
- Overwintering locations and temperature and relative humidity of roosting areas
- Baseline activity levels within and outside of hibernacula
- Timing, routes, and other correlates of migration
- Focal studies at wind energy facilities
- Year-round spatial use of landscapes
- Year-round status information (occupancy rates, sizes of roost aggregations, activity levels)

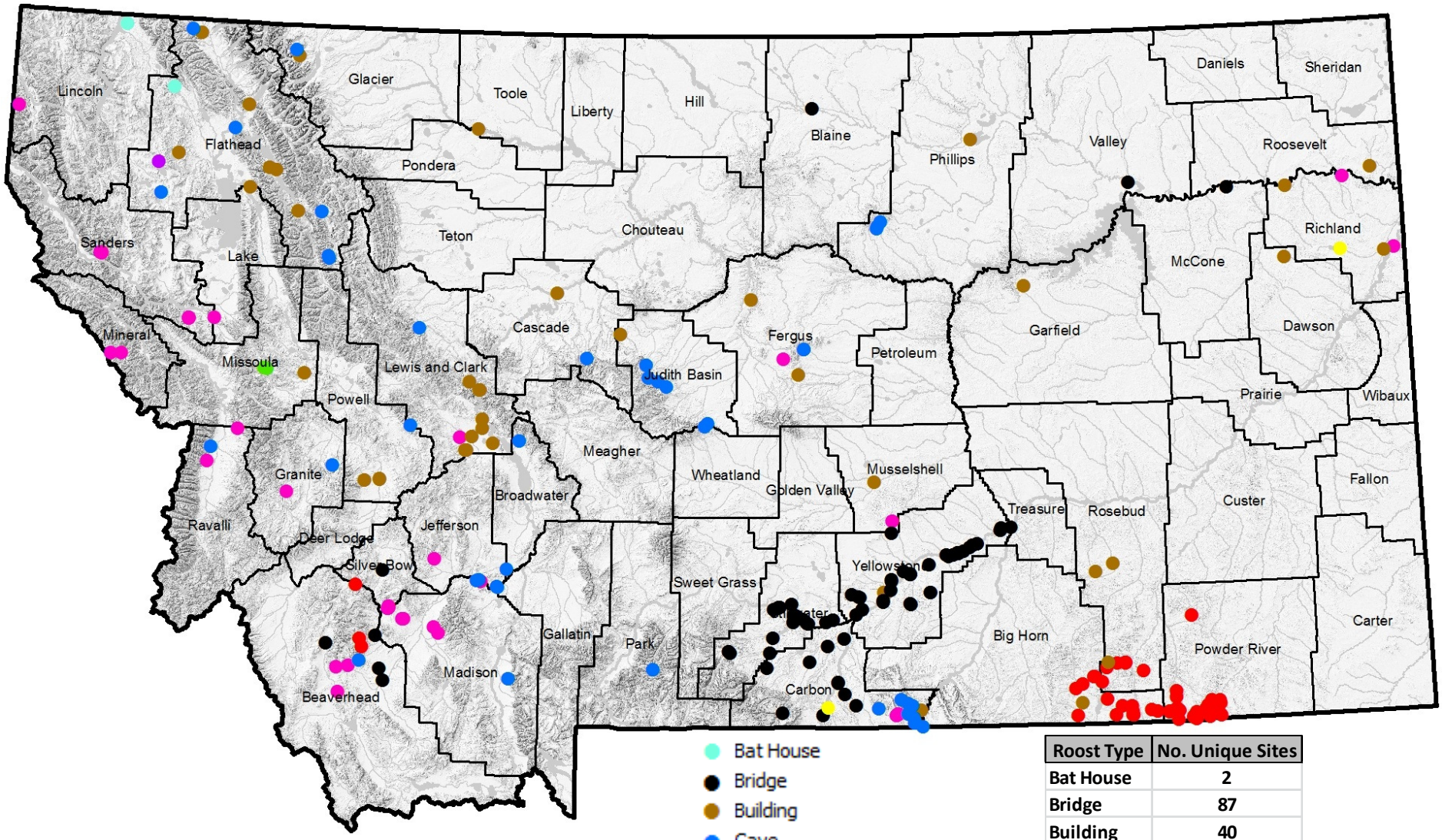
Documentation of Roost Site Characteristics

Montana Bat Roosts



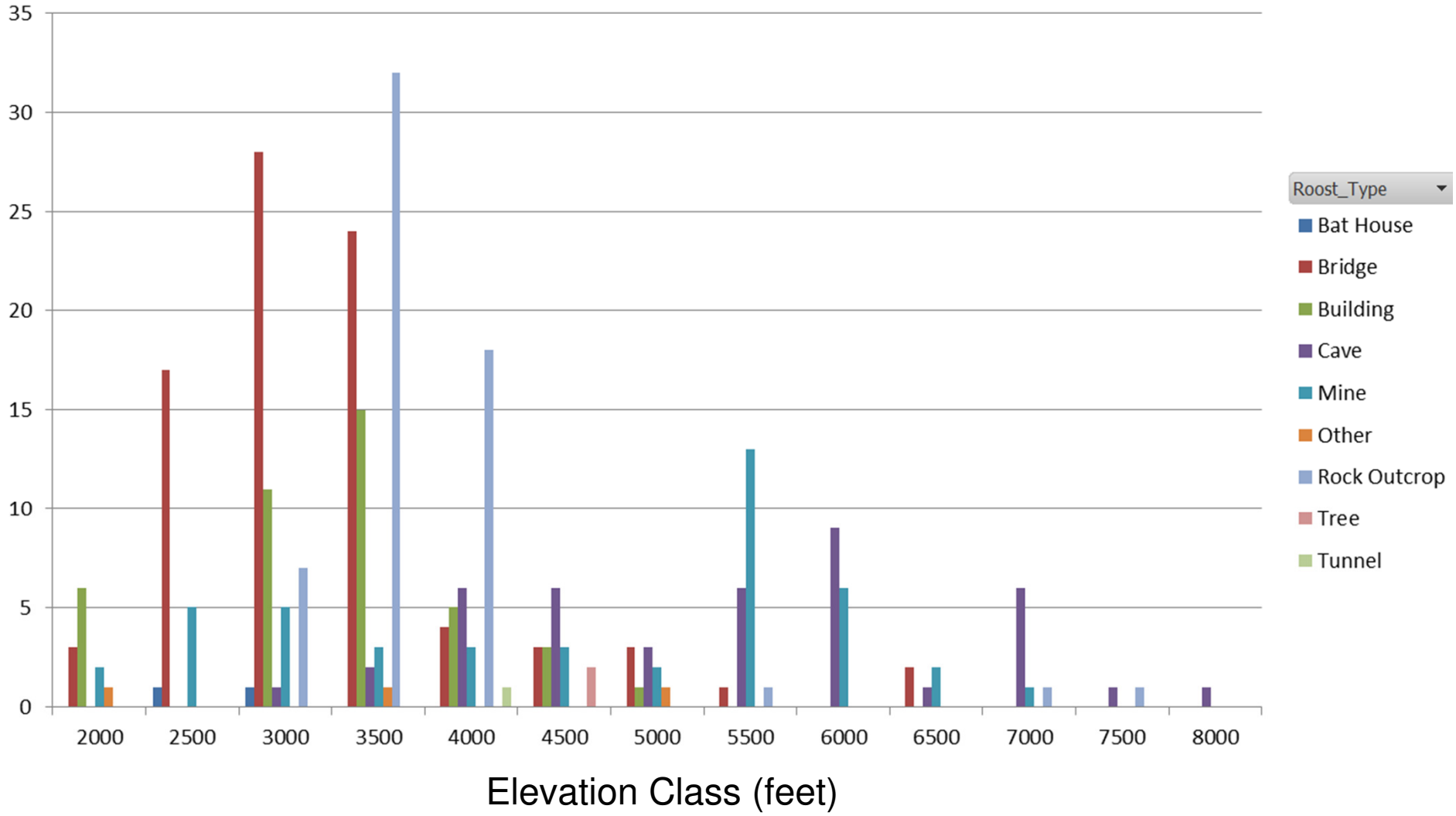
*Available through Natural Heritage Tracker http://mtnhp.org/Tracker/

Overview of Known Montana Bat Roosts

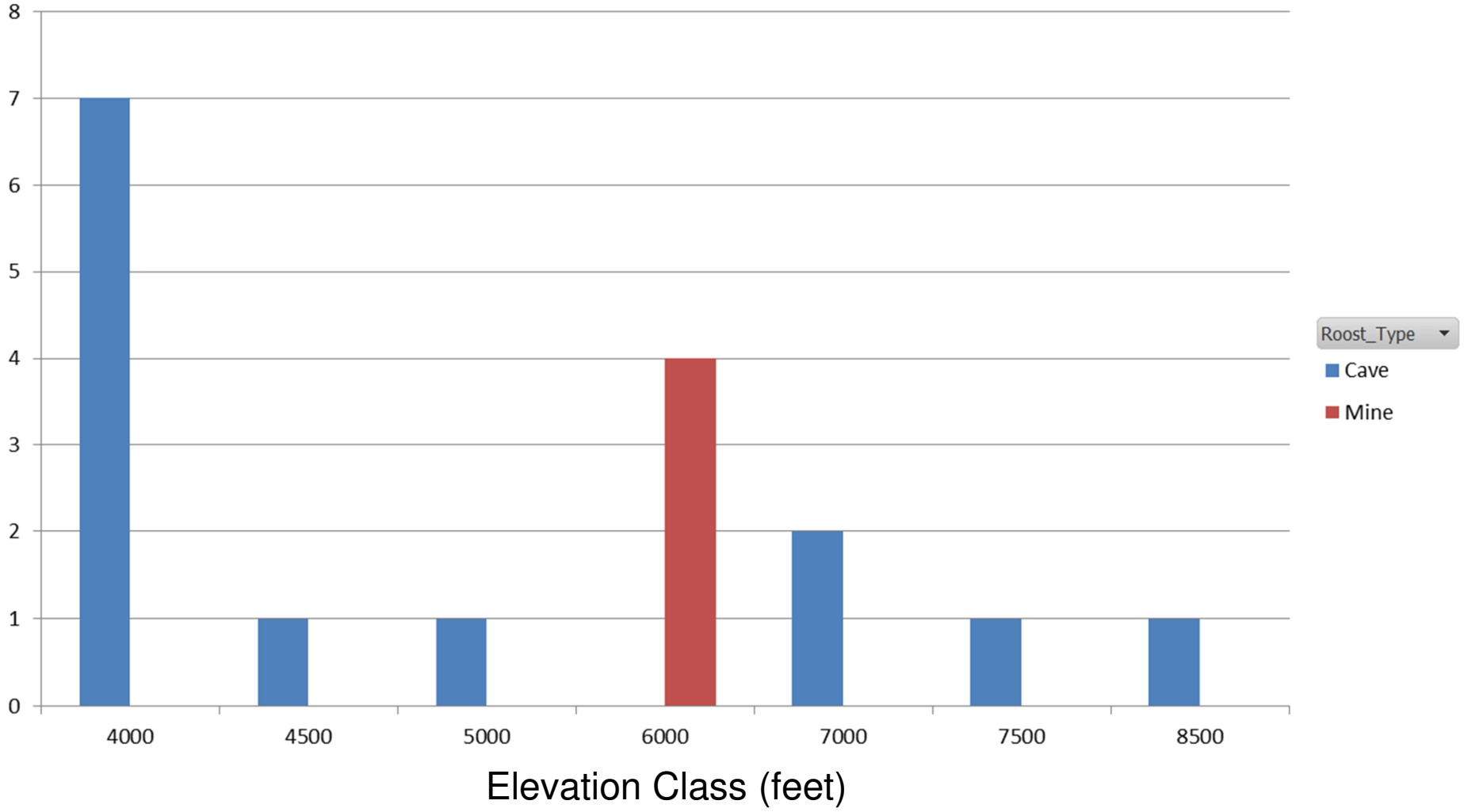


Roost Type	No. Unique Sites
Bat House	2
Bridge	87
Building	40
Cave	54
Mine	52
Other	2
Rock	60
Tree	2
Tunnel	1

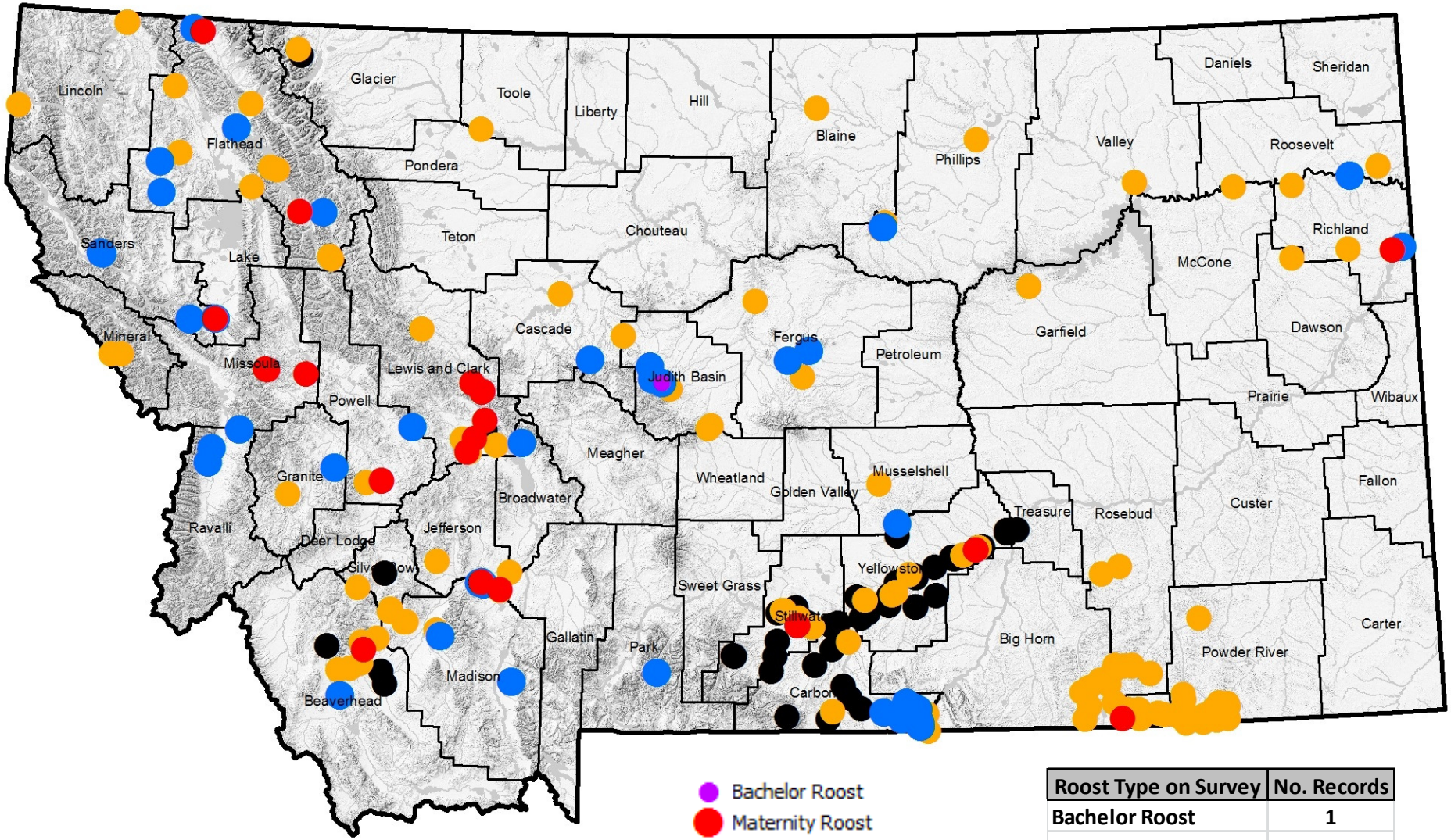
Elevation Class Frequencies of Known MT Bat Roosts



Elevation Class Frequencies of Caves and Mines Negative For Bats

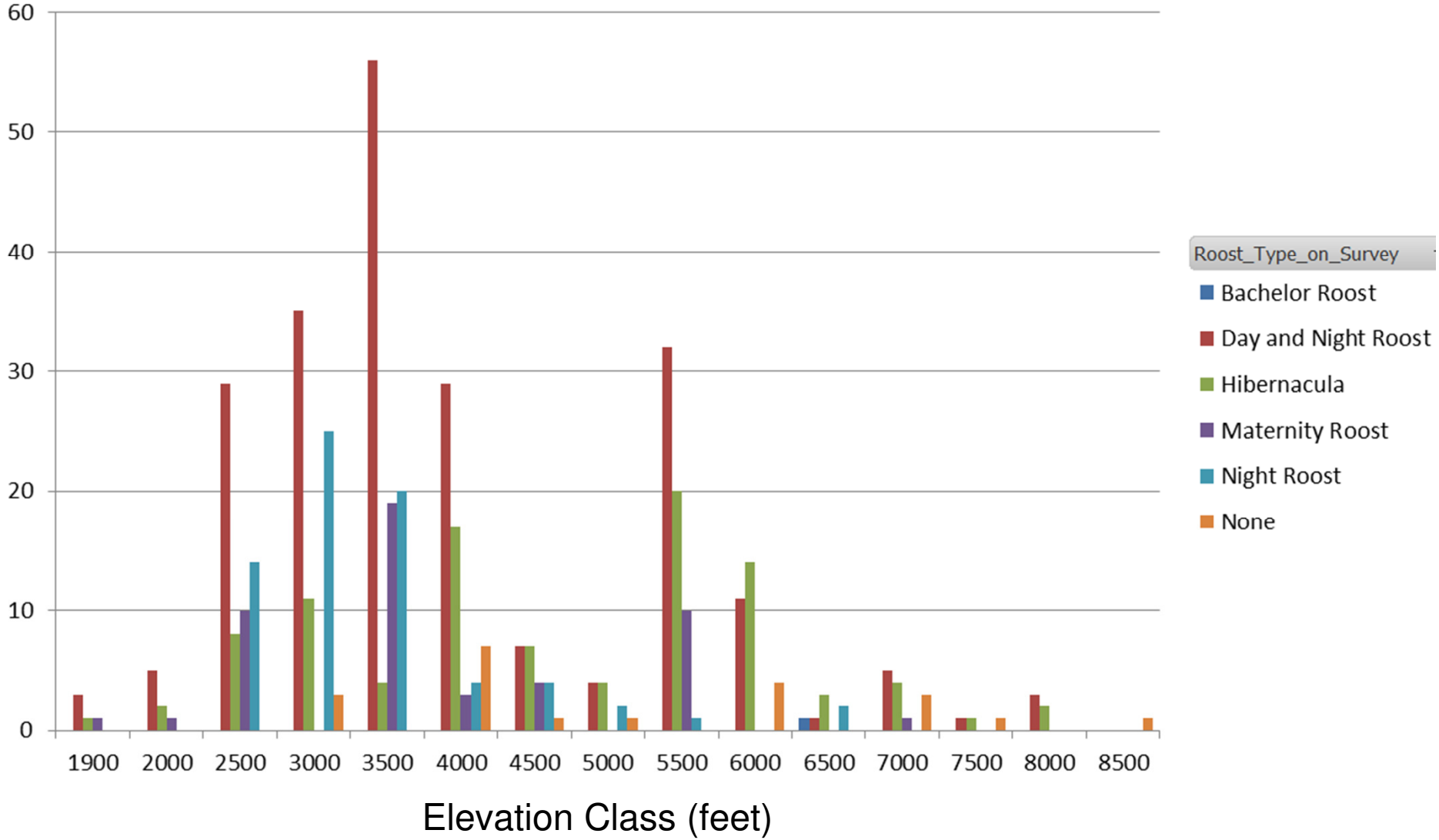


Overview of Montana Bat Roost Use Types

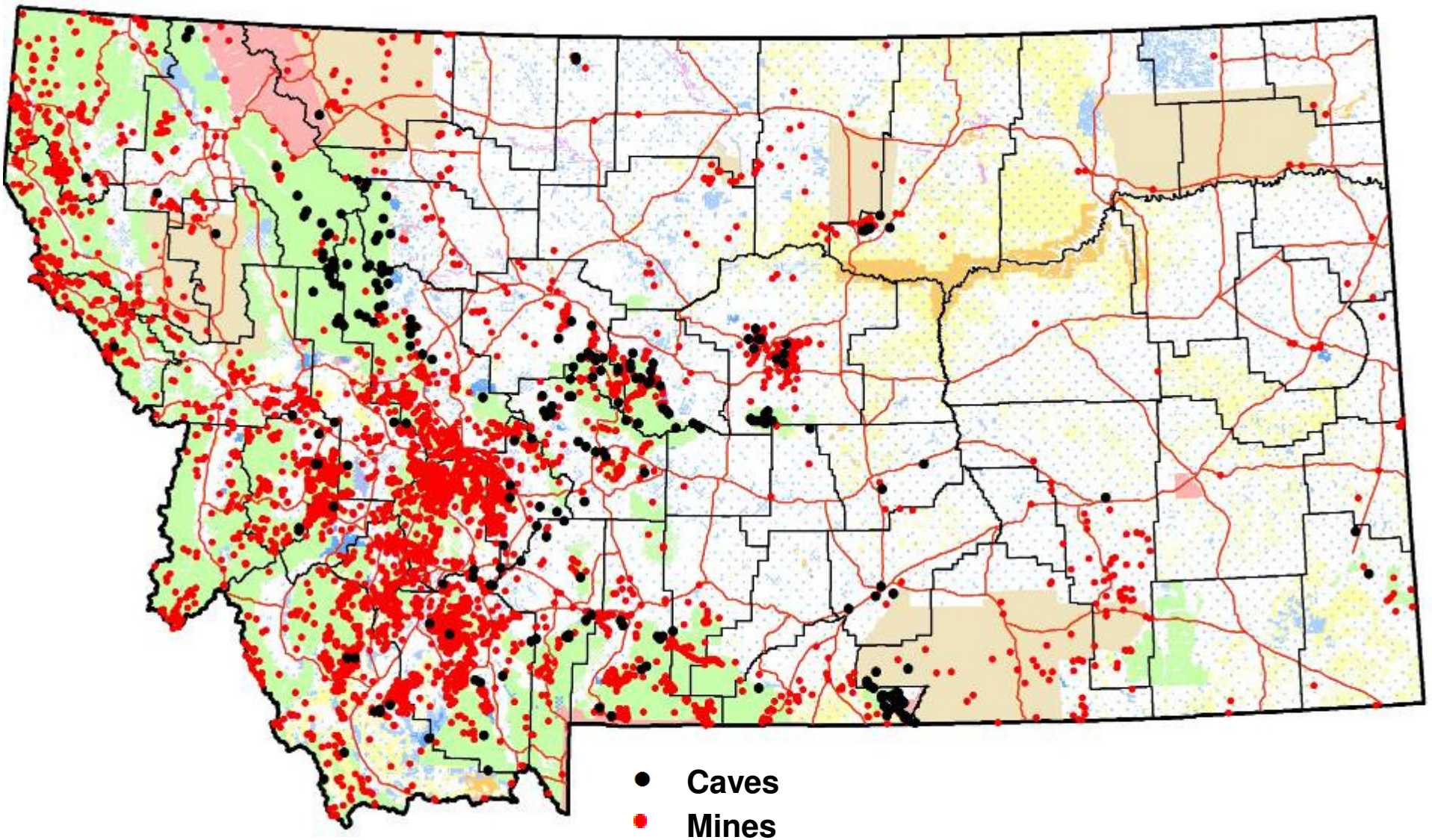


Roost Type on Survey	No. Records
Bachelor Roost	1
Maternity Roost	45
Hibernacula	98
Day and Night Roost	225
Night Roost	72

Elevation Class Frequencies of Bat Roost Use Types



Montana Caves and Abandoned Lode Mines



Lots of potential roost habitat has not be surveyed!

Bats and Rock Outcrops

Bats detected in day roosts at 10% of rock outcrops – bat poops at most

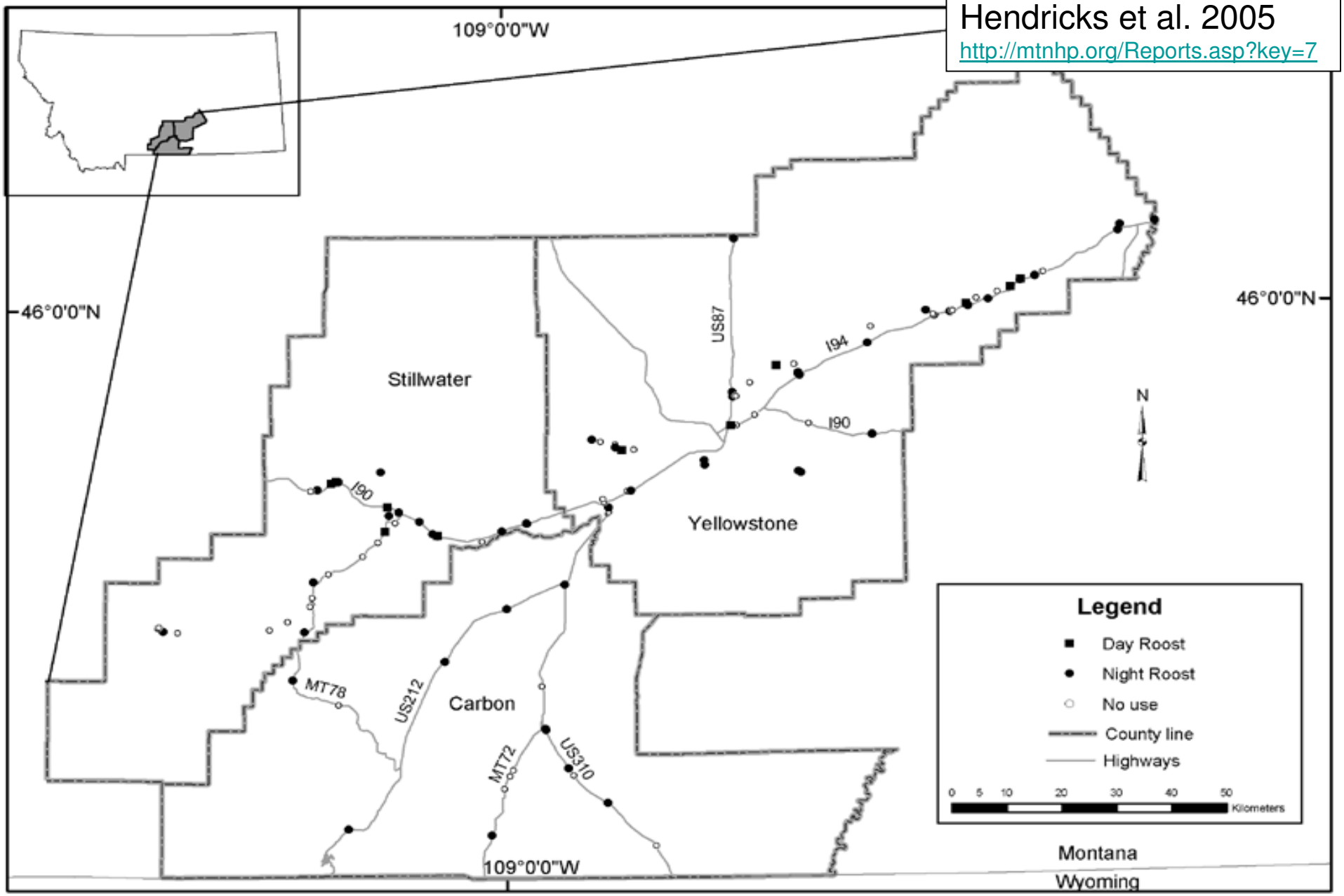
Pallid Bat, Big Brown Bat, Long-eared Myotis, Western Small-footed Myotis

Pallid Bat

Western Small-footed Myotis

Bat Use of Bridges: Yellowstone River example

Hendricks et al. 2005
http://mtnhp.org/Reports.asp?key=7



Bats = Day Roost

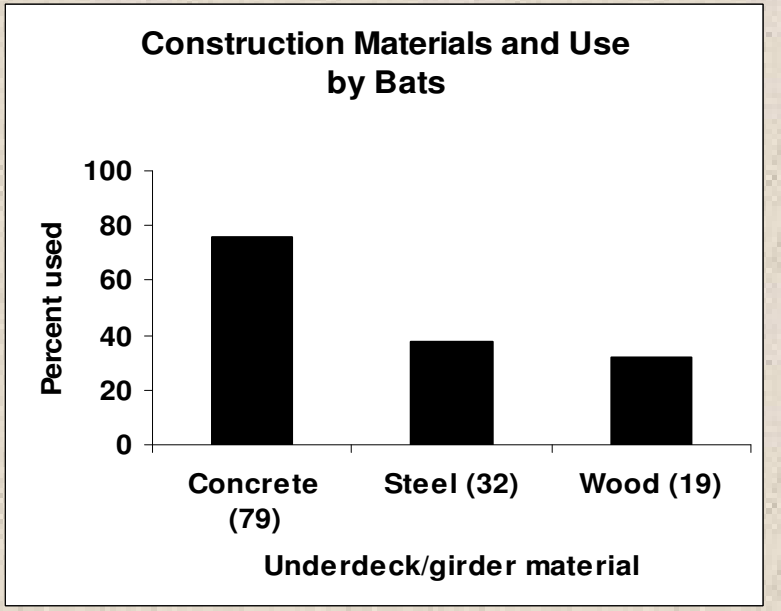
Paul Hendricks

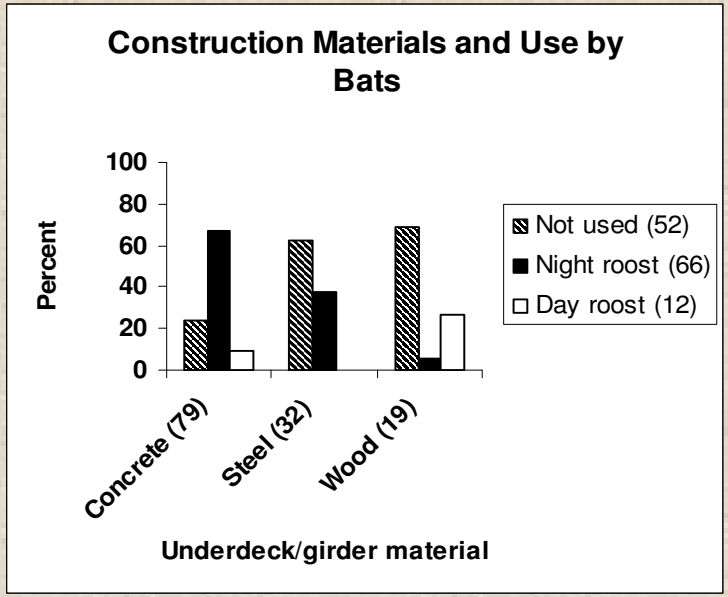
Droppings Only = Night Roost

Amie Shovlain (What a great poop photo!)

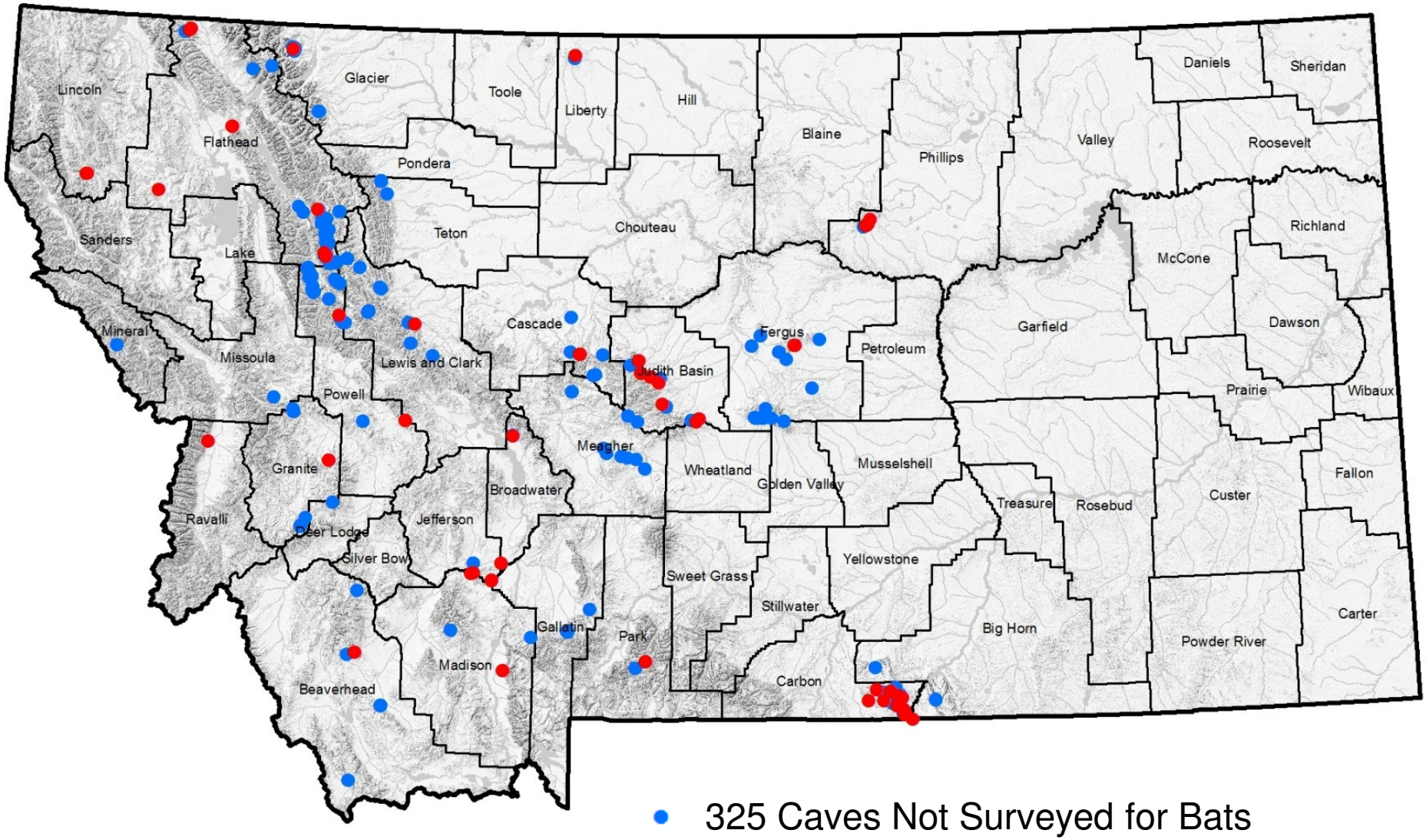
Bridge Materials

Hendricks et al. 2005
http://mtnhp.org/Reports.asp?key=7



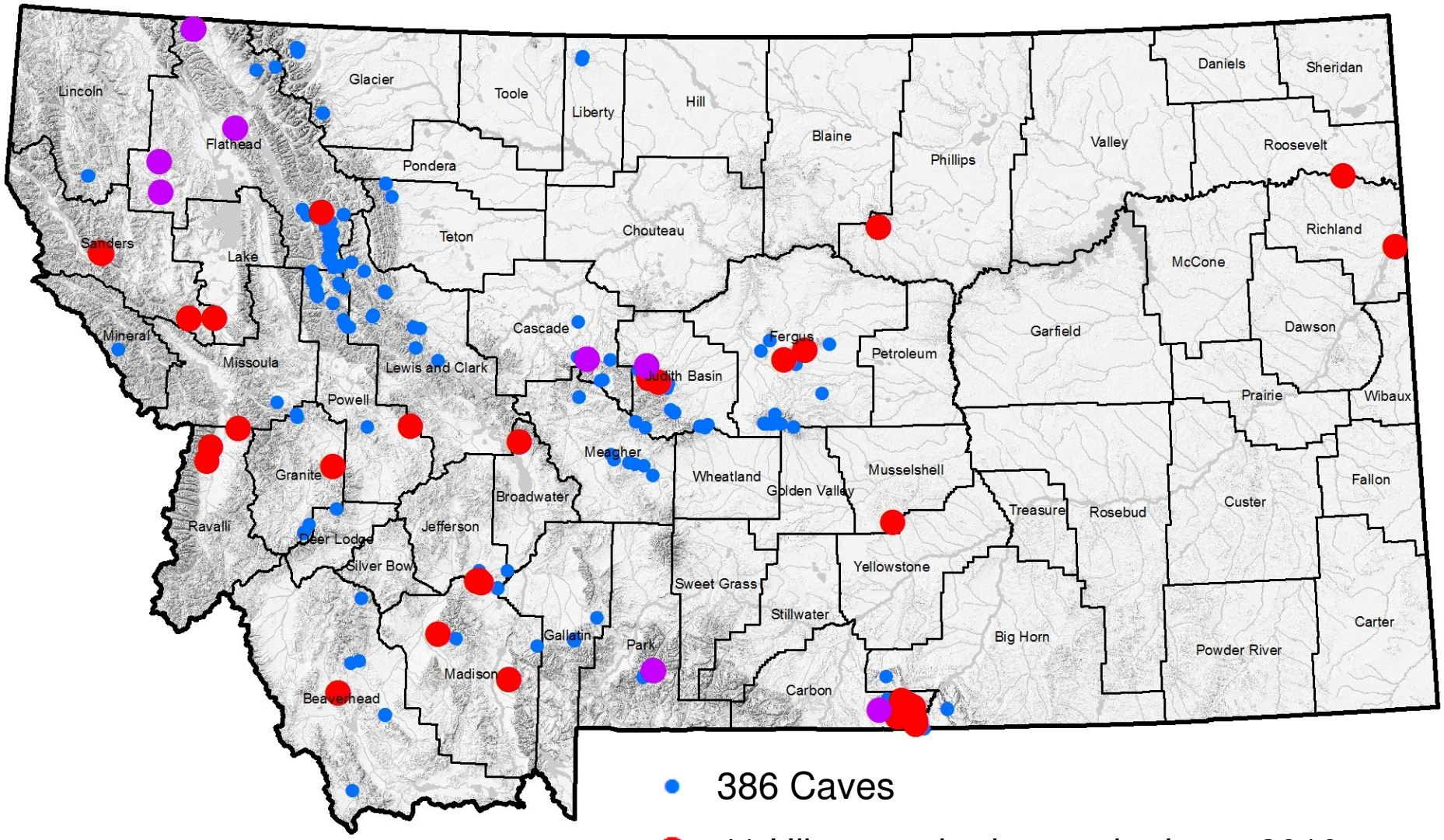


Bat Surveys of Montana Caves



- 325 Caves Not Surveyed for Bats
- 61 Caves Surveyed for Bats

Montana Caves and Known Bat Hibernacula

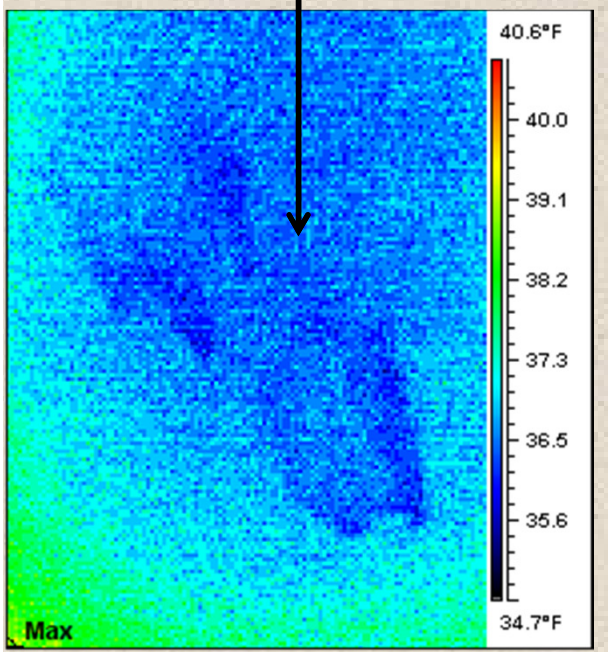


- 386 Caves
- 41 Hibernacula detected prior to 2010
- 8 Hibernacula detected since 2010

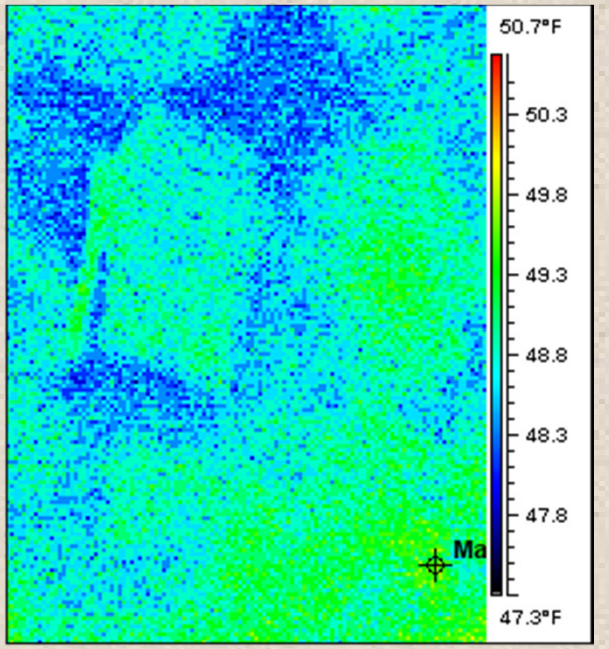
Working with Grotto Members to Record Bats and Bat Sign

Thermal Images of Bats at Winter Roosts
from James Cummins

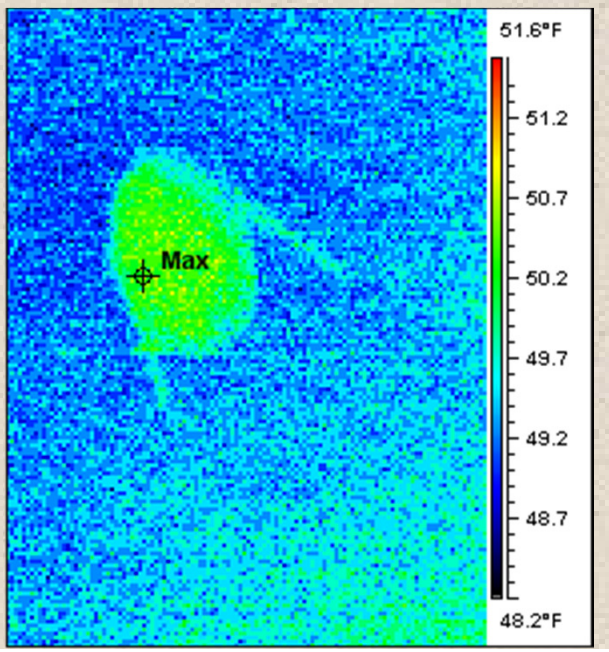
Townsend's Big-eared Bats



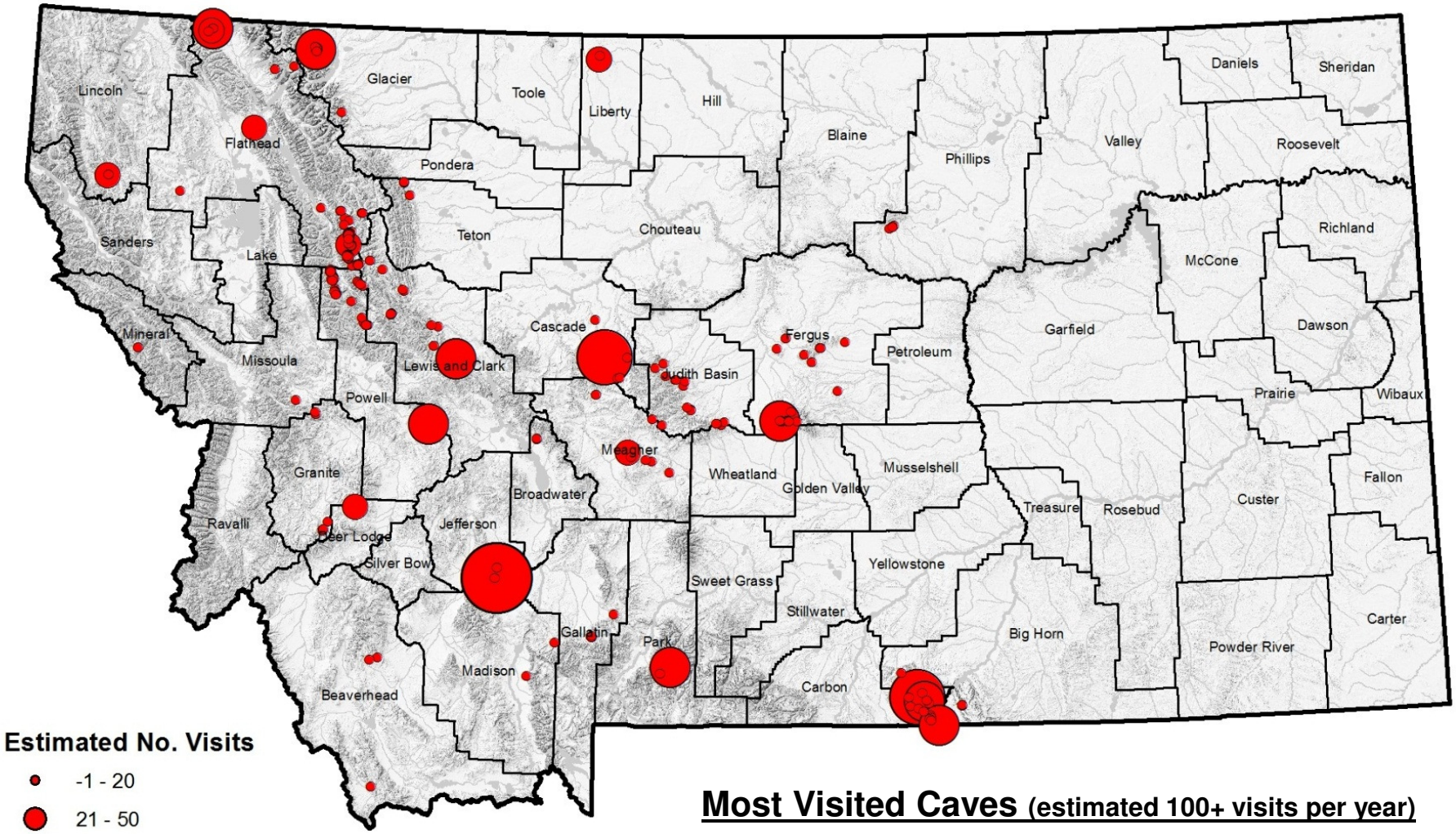
Unidentified Myotis



Western Small-footed Myotis



Annual Estimates of Cave Visitation



Estimated No. Visits

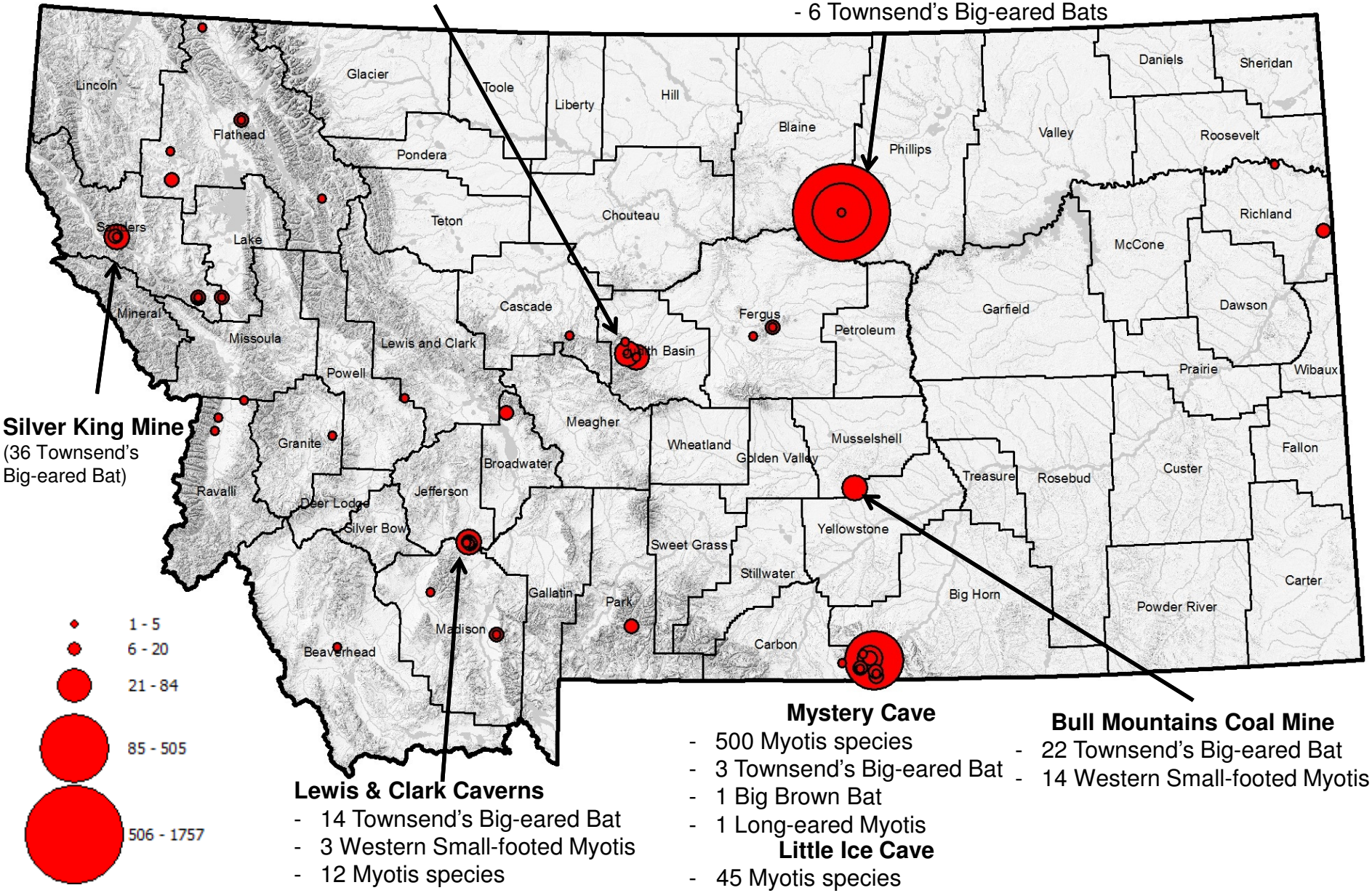
- -1 - 20
- 21 - 50
- 51 - 200
- 201 - 5000
- 5001 - 55000

Most Visited Caves (estimated 100+ visits per year)

Lewis and Clark Caverns*
Lick Creek Cave*
Big Ice Cave*
Poia Lake Cave*
Mill Creek Crystal Cave*
Ophir Cave*
Bighorn Caverns*
Snowy Mountain Ice Cave
Yakinikak Creek Cave #1
Yakinikak Creek Cave #2
Blacktail Ranch Cave

*** Bat Use Documented**

Numbers of Bats at Montana Hibernacula



Whitaker Sink
- 84 Myotis species

Old Dry Wolf Station
- 63 Unidentified bats

Azure Cave
- 1751 Myotis species
- 6 Townsend's Big-eared Bats

Silver King Mine
(36 Townsend's Big-eared Bat)

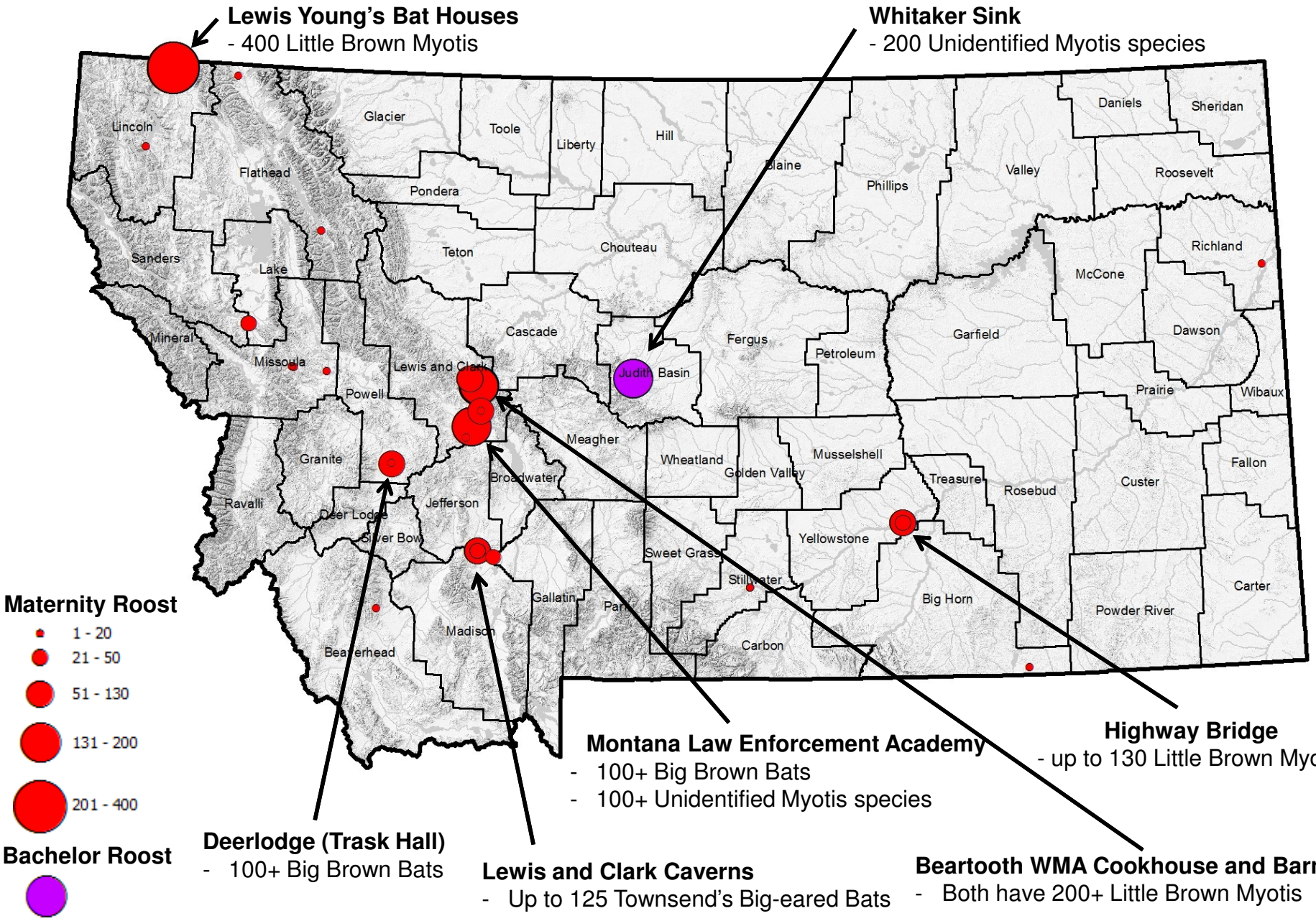
Lewis & Clark Caverns
- 14 Townsend's Big-eared Bat
- 3 Western Small-footed Myotis
- 12 Myotis species

Mystery Cave
- 500 Myotis species
- 3 Townsend's Big-eared Bat
- 1 Big Brown Bat
- 1 Long-eared Myotis

Little Ice Cave
- 45 Myotis species

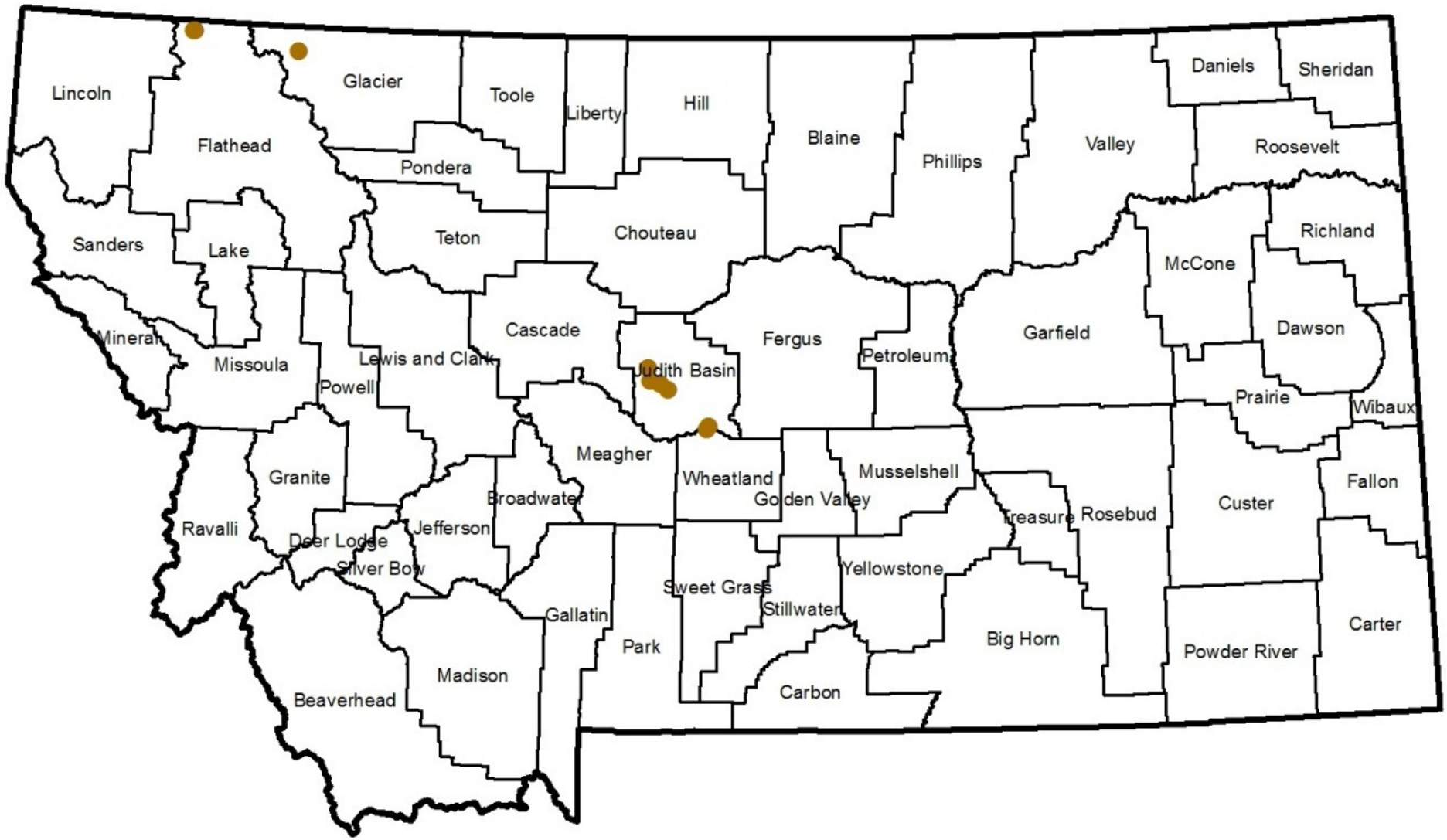
Bull Mountains Coal Mine
- 22 Townsend's Big-eared Bat
- 14 Western Small-footed Myotis

Numbers of Bats at Maternity and Bachelor Roosts

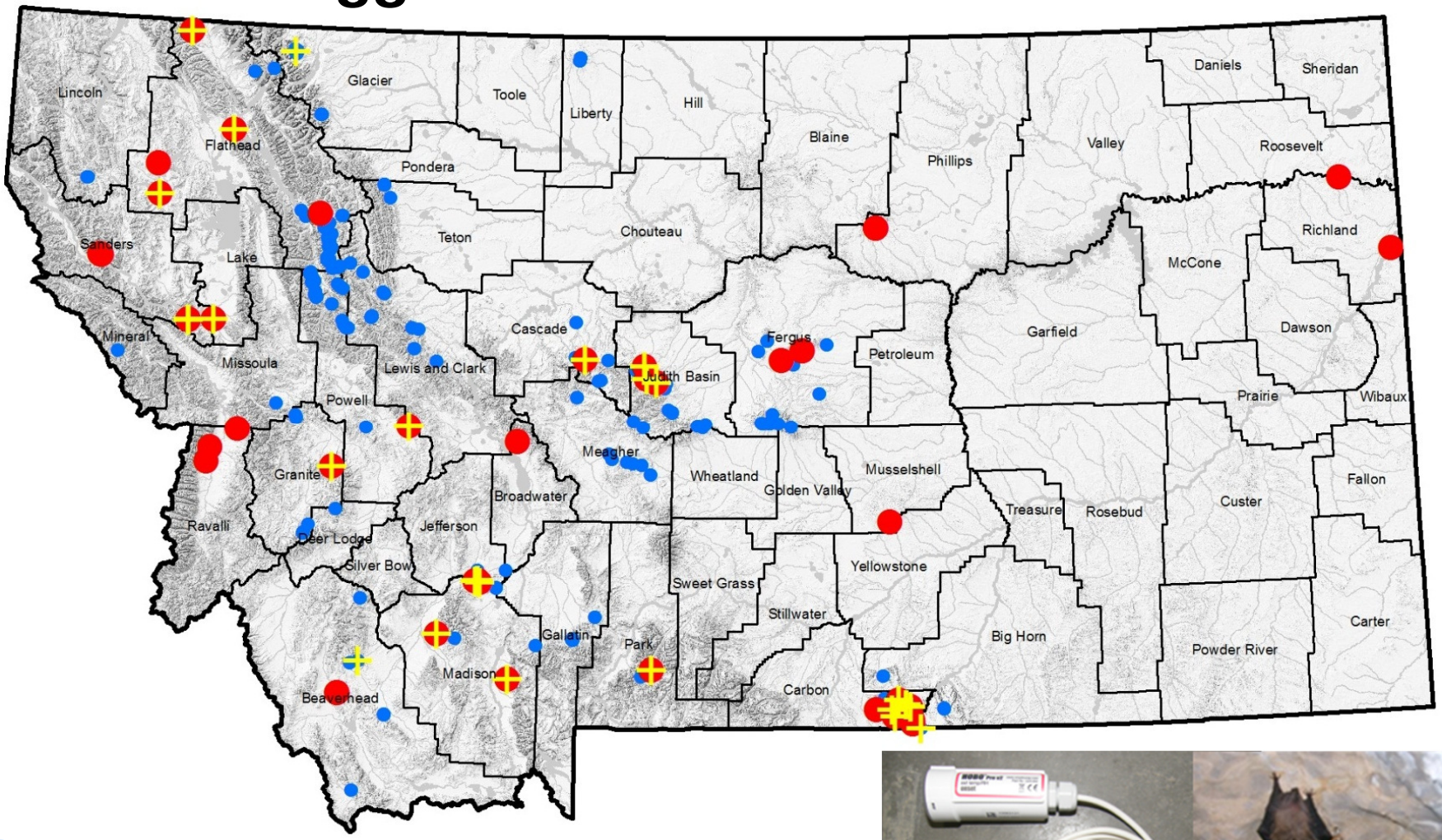


Soil Sampling for *Geomyces destructans*

February 28th, 2013



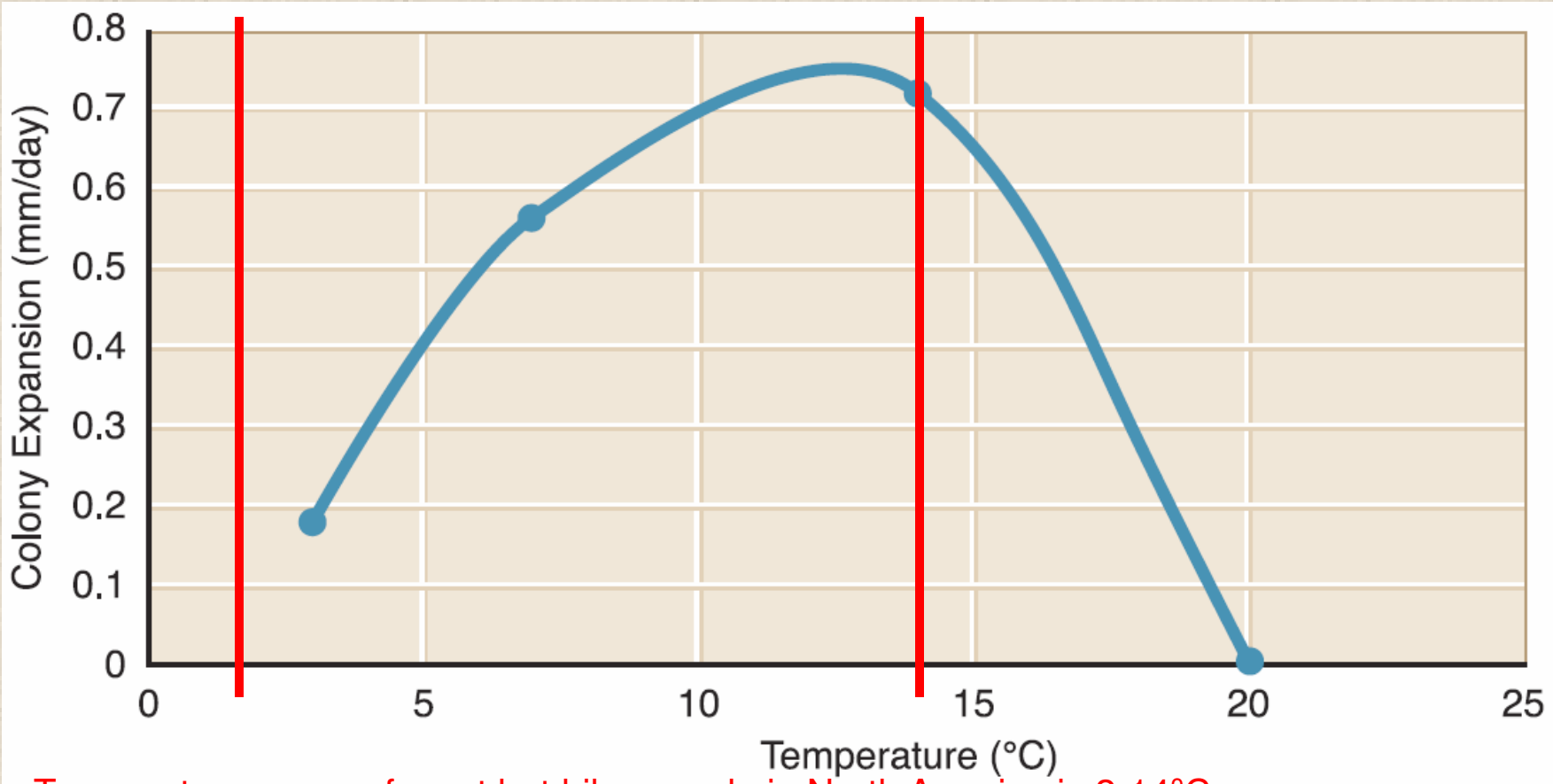
Deployment of Temperature and Relative Humidity Data Loggers in Montana Bat Hibernacula



- Caves
- Known Bat Hibernacula In Caves or Mines
- HOBO Data Logger Deployed

G. destructans growth and Hibernacula Temps

- Of 45 bat species in U.S., at least 6 of the 25 that hibernate have been documented with WNS

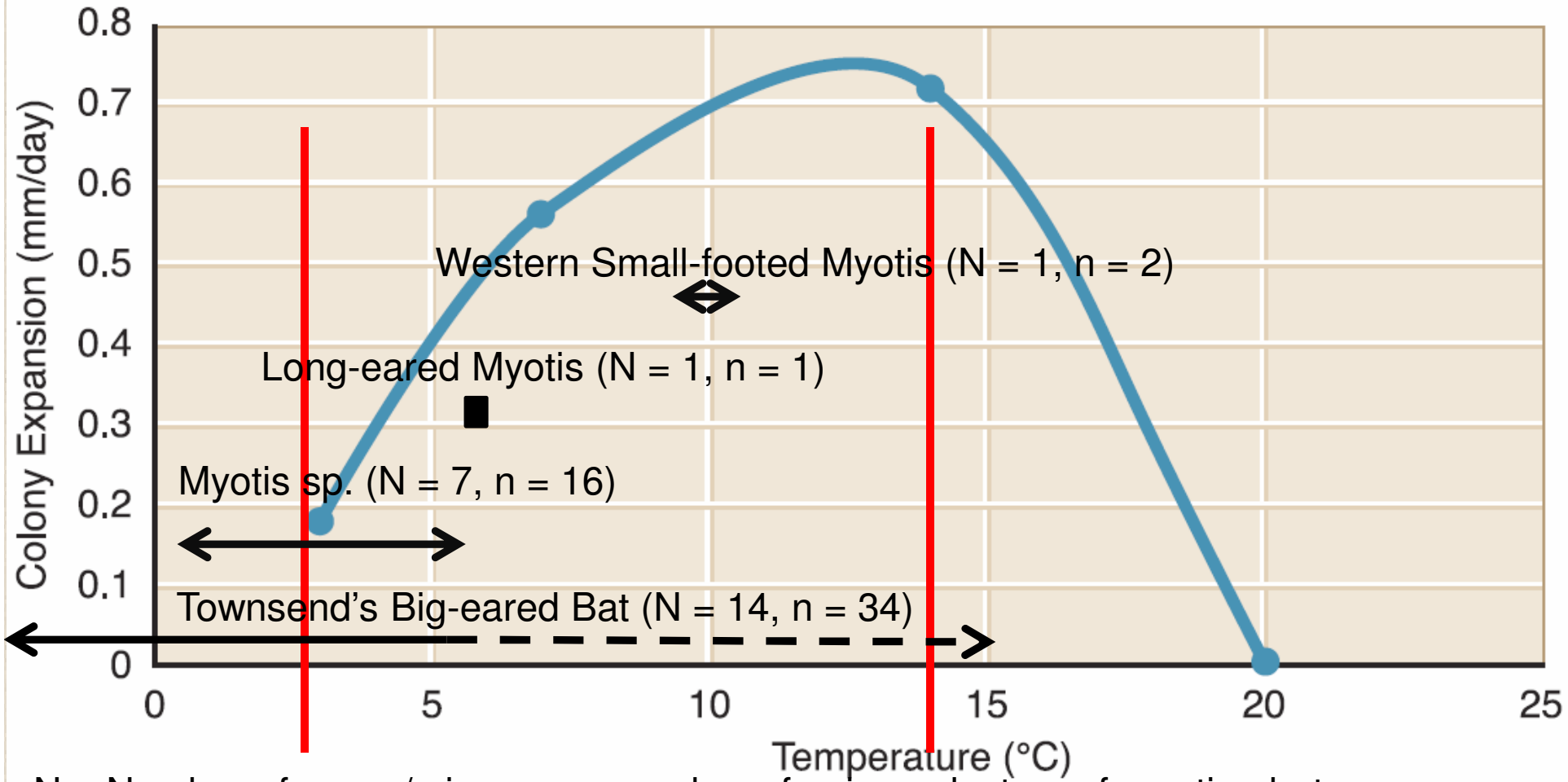


Temperature range of most bat hibernacula in North America is 2-14ºC.

Colony expansion rates of *Geomyces destructans* when grown on cornmeal agar at 3, 7, 14, and 20°C. The trend line estimates colony expansion rates at temperatures ranging from 3–20°C.

Blehert et al. 2007 Microbe 6(6): 267-273.

Montana Bat Winter Roost Temperatures



N = Number of caves/mines , n = number of unique clusters of roosting bats

Colony expansion rates of *Geomyces destructans* when grown on cornmeal agar at 3, 7, 14, and 20°C. The trend line estimates colony expansion rates at temperatures ranging from 3–20°C.

Blehert et al. 2007 Microbe 6(6): 267-273.

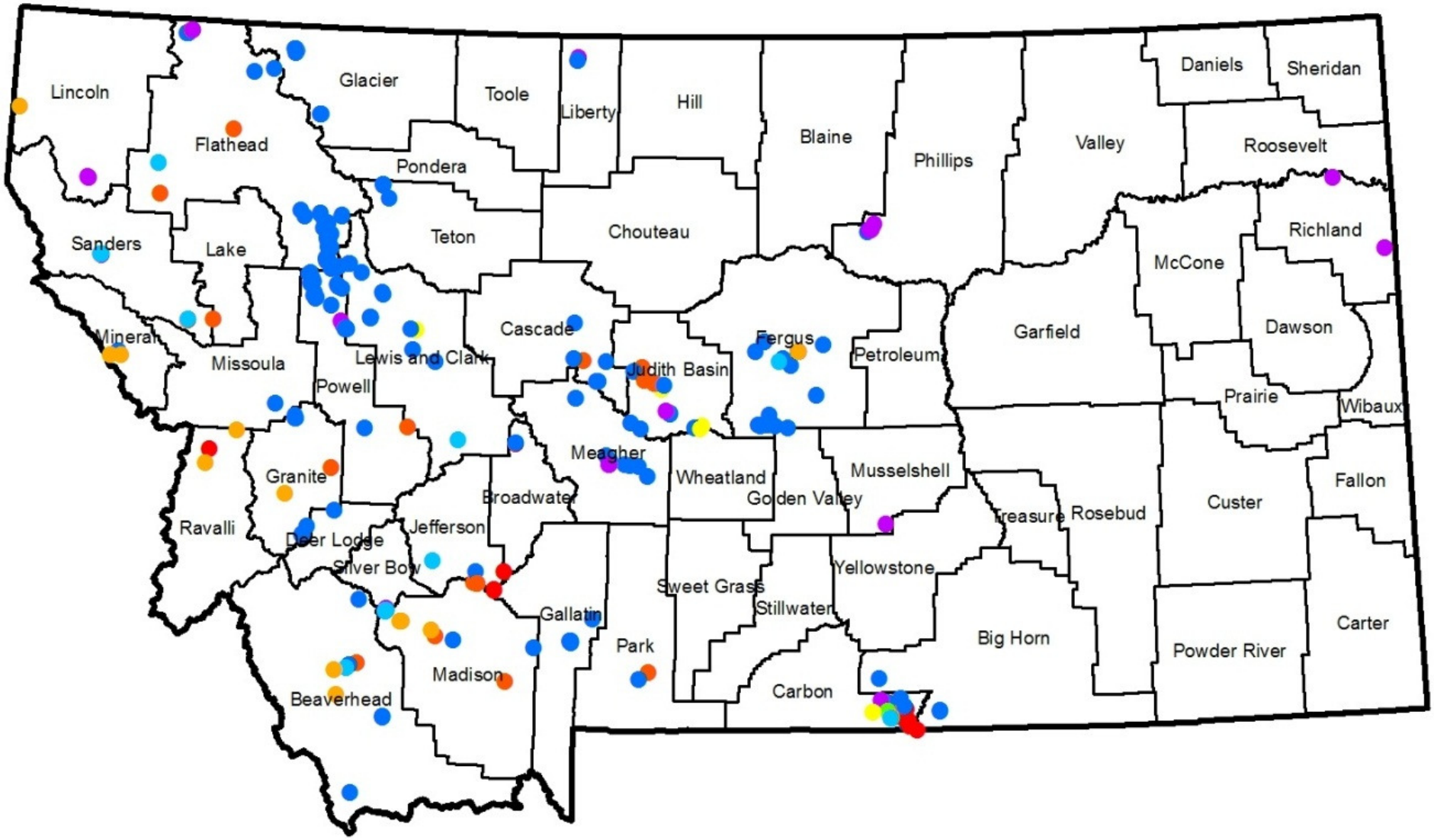
Prioritization of Future Roost Surveys

(see roost survey prioritization spreadsheet)

1. Caves with previous bat use documented, but no recent survey
2. Caves/mines with data loggers deployed
3. Mines with previous bat use documented, but no recent survey
4. Caves recently surveyed with some sign of bat use, but needing additional survey
5. Mines recently surveyed with some sign of bat use, but needing additional survey
6. Caves with no previous bat surveys
7. Mines with no previous bat surveys
8. ***Bridges, buildings, rock outcrops and trees that may serve as active season roosts**
9. Caves and mines previously surveyed with no sign of bat activity
10. Caves and mines presenting unacceptable hazards to surveyors or closed to human access. Or other temporary roosts not worth follow up survey.

* While cave and mine surveys may require specific climbing, rope, or other skills, surveys of potential bridge, building, rock outcrop, and tree roosts during the active season can often be easily completed during the course of other job duties without any special skill beyond the ability to identify bat droppings, patiently study cracks and crevices, and take photos of any bats that are observed.

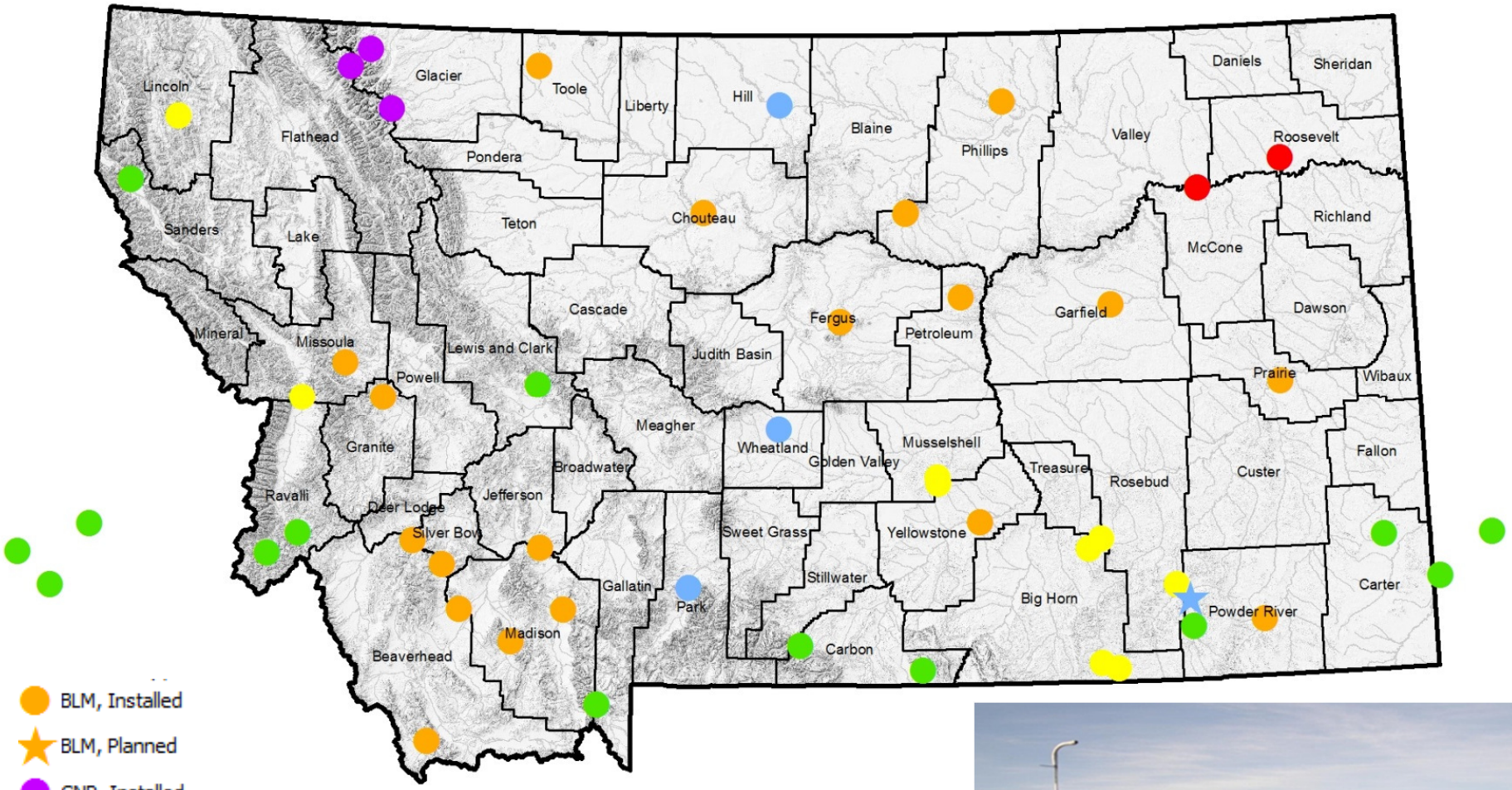
Spatial Prioritization of Cave/Mine Roost Surveys



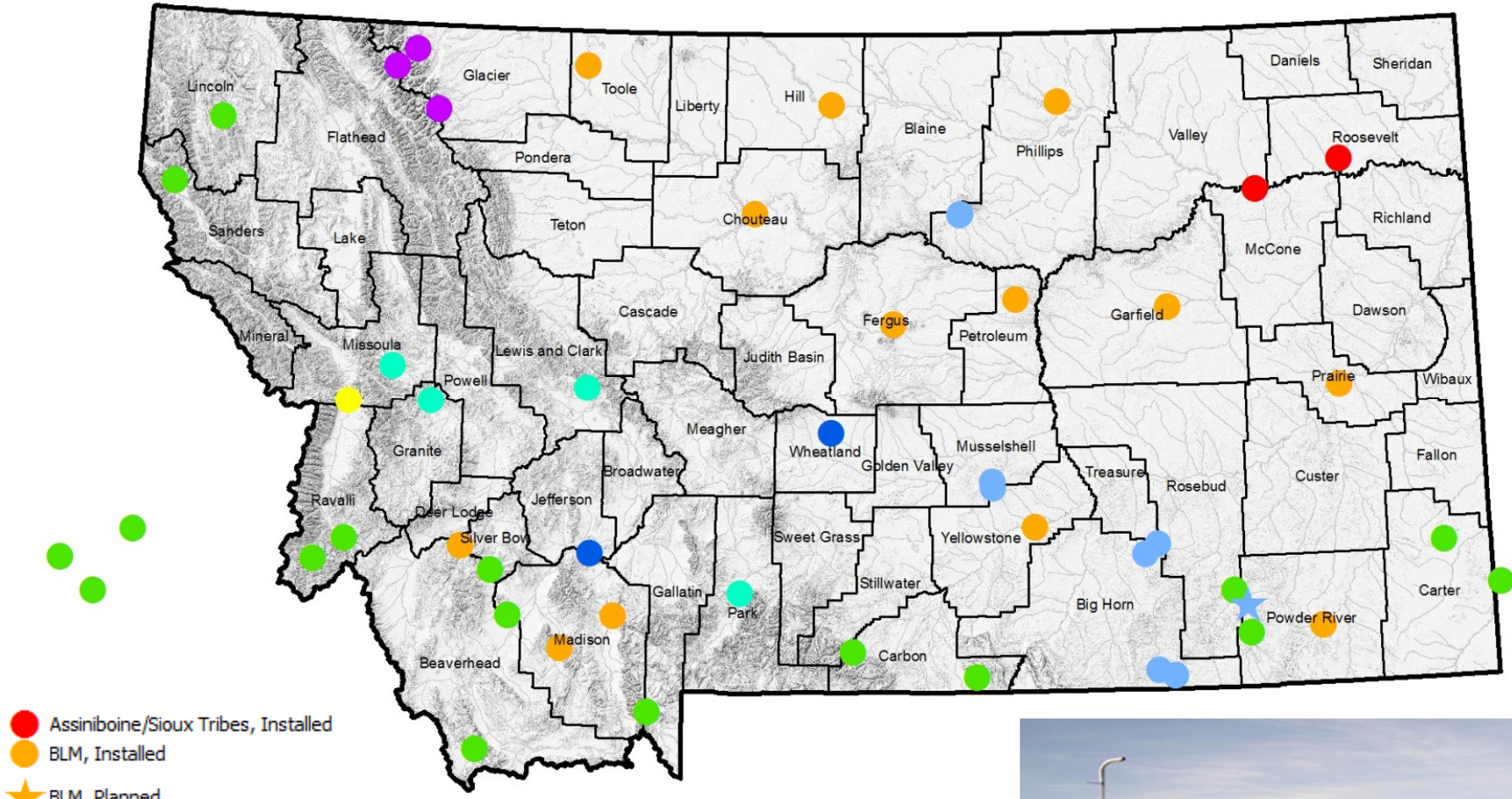
Warmer colors indicate higher prioritization for survey.

Year-round Statewide Acoustic Monitoring of Bats

Land Ownership of Long-term Bat Acoustic Monitoring Stations



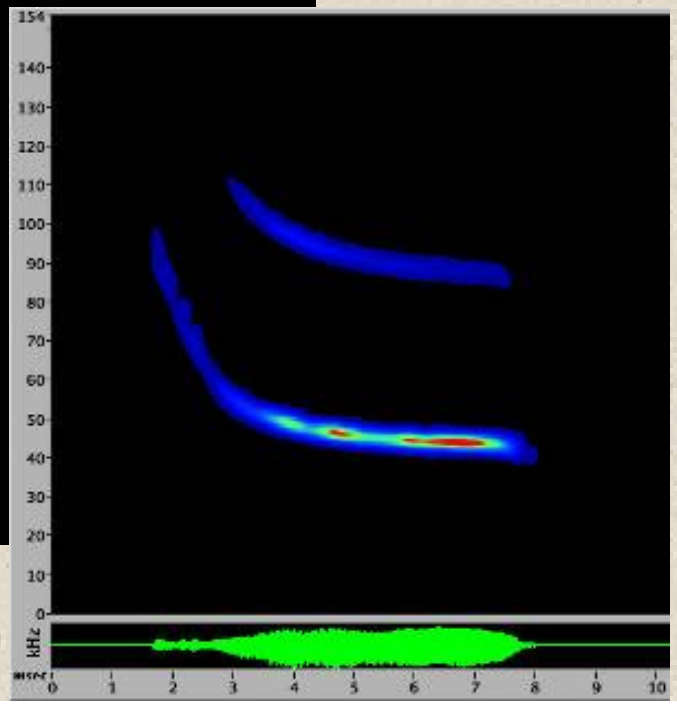
Funders of Long-term Bat Acoustic Monitoring Stations



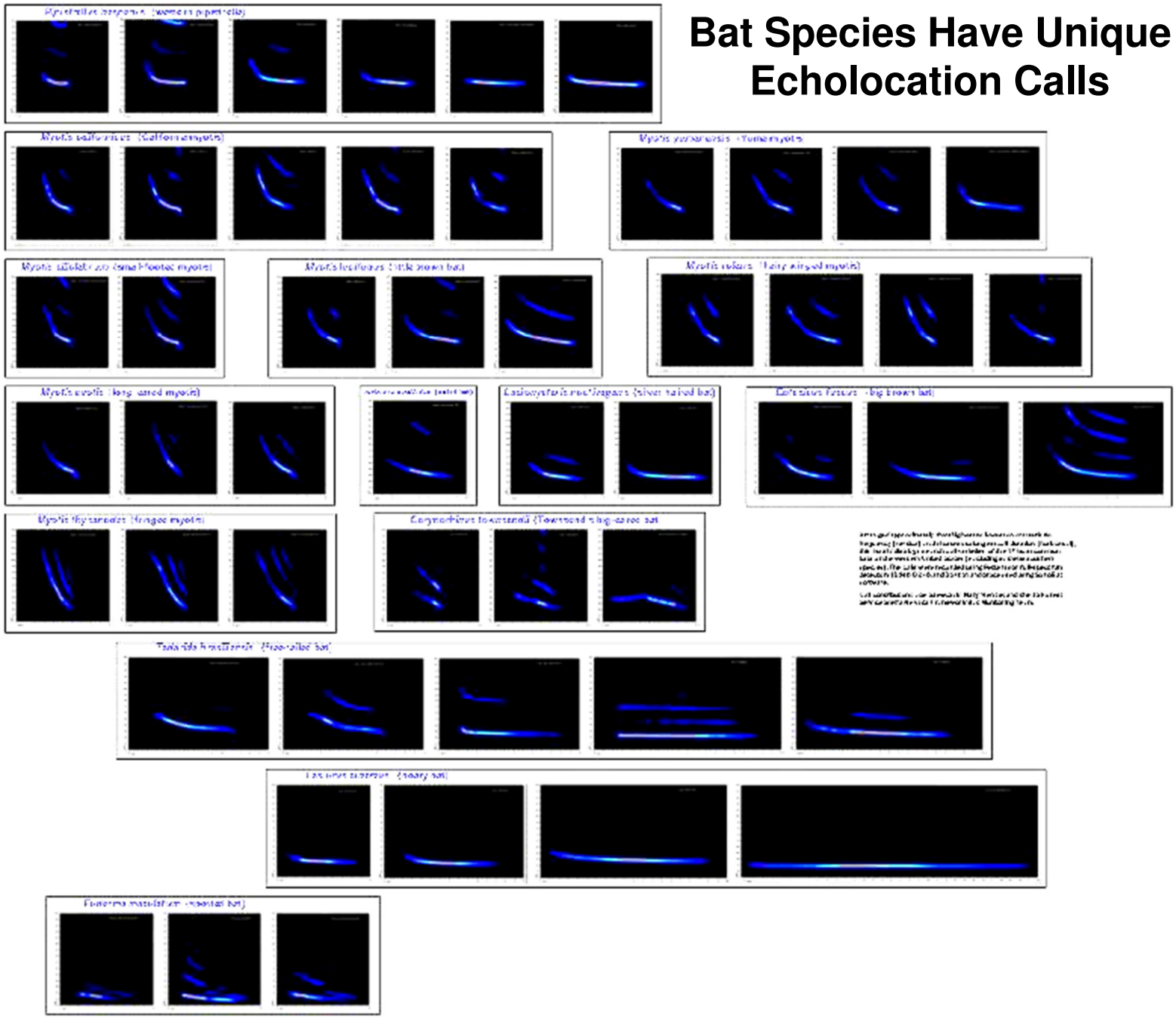
- Assiniboine/Sioux Tribes, Installed
- BLM, Installed
- BLM, Planned
- DEQ, Installed
- DEQ, Planned
- FWP, Installed
- MTNHP, Installed
- NPS, Installed
- Private, Installed
- USFS, Installed

Semi-automated Analyses of Bat Calls using Sonobat 3.0

Images courtesy of Joe Szewczak



Bat Species Have Unique Echolocation Calls



Detection Rates - Mistnetting vs. Acoustic Survey

(Lenard et al. 2007)

Species	Overall Percent Detection Rate	
	Acoustic n=36[a]	Mist-net n=60[b]
Little Brown Myotis (*Myotis lucifugus*)	83.3	15.0
Western Long-eared Myotis (M*yotis evotis*)	63.9	33.3
Fringed Myotis (M*yotis thysanodes*)	**16.7**	**5.0**
Long-legged Myotis (M*yotis volans*)	19.4	33.3
California Myotis (M*yotis californicus*)	8.3*	8.3
Western Small-footed Myotis (M*yotis ciliolabrum*)	36.1	8.3
Silver-haired Bat (*Lasionycteris noctivagans*)	33.3	33.3
Big Brown Bat (*Eptesicus fuscus*)	36.1	21.7
Hoary Bat (*Lasiurus cinereus*)	77.8	21.7
Spotted Bat (*Euderma maculatum*)	**8.3**	**0.0**
	X = 38.2	**X = 18.4**

Landusky Example

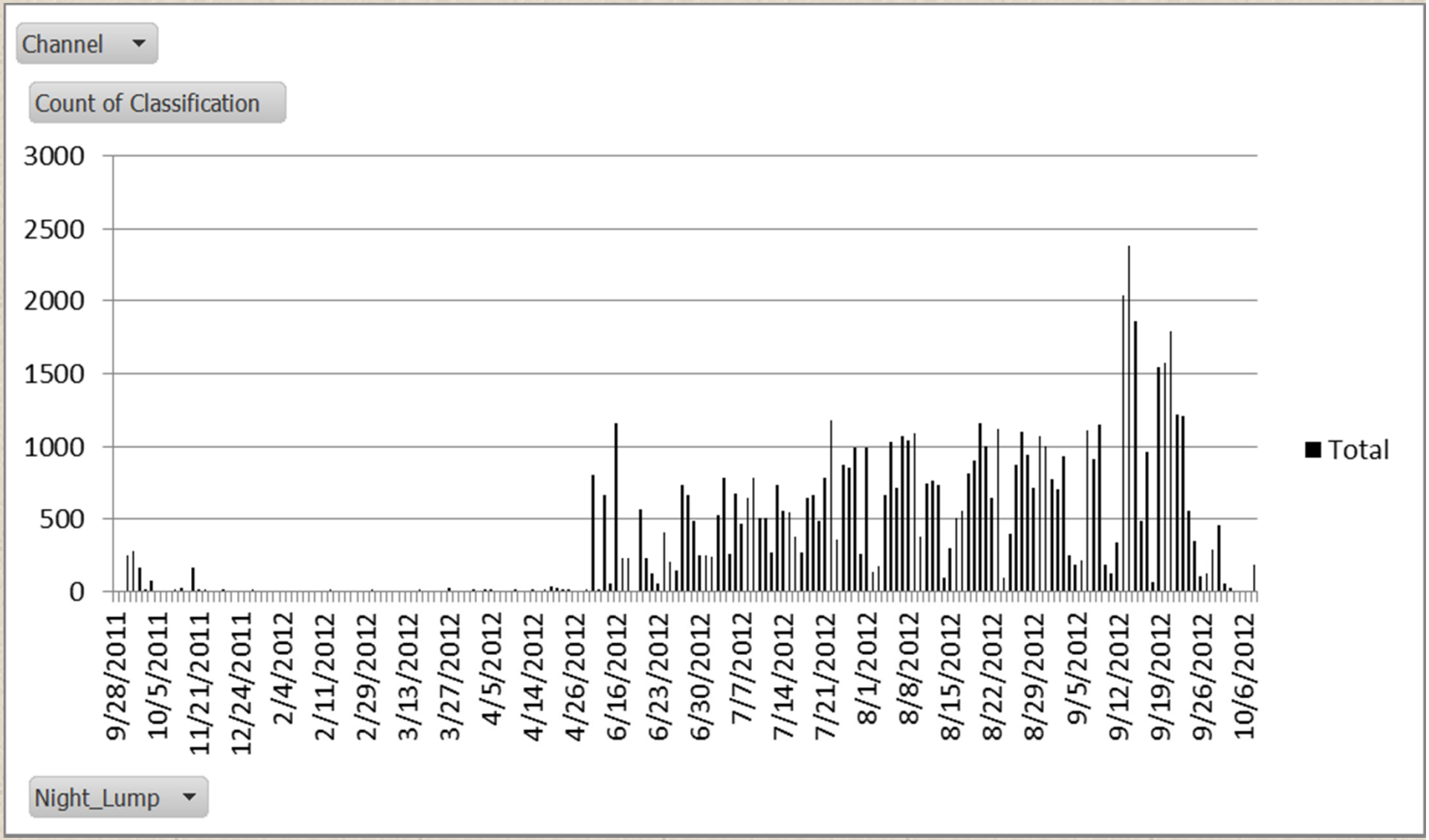

10/29/2012
Left Microphone
Right Microphone

Overview of Data/Analysis

- 71,018 files / call sequences recorded
- 10,064 (14%) calls identified to species by autoanalysis software
- 1,104 (1.5%) hand analyzed

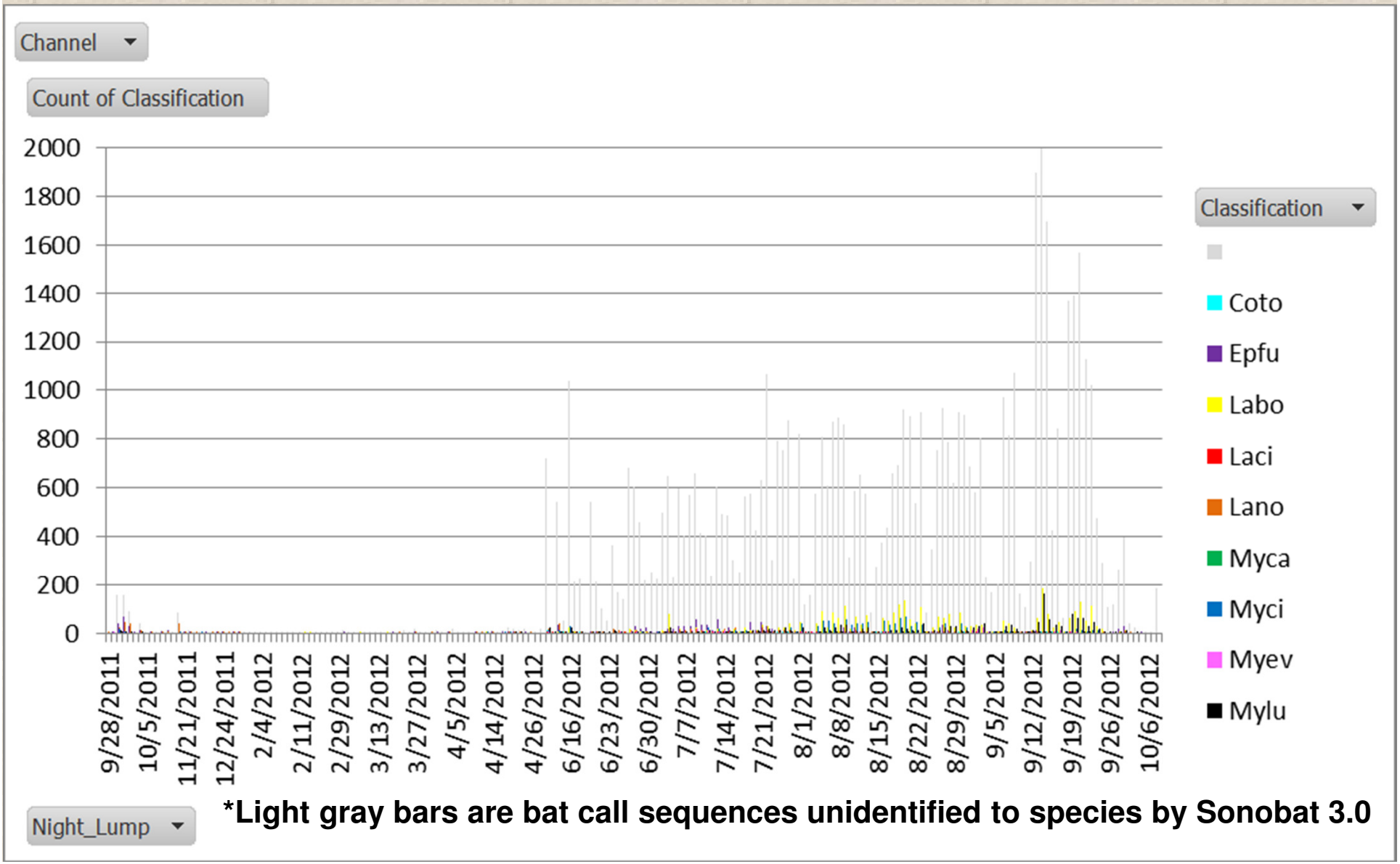
Both Microphones Water Treatment Facility

Total Number of Bat Call Sequences Summarized by Date



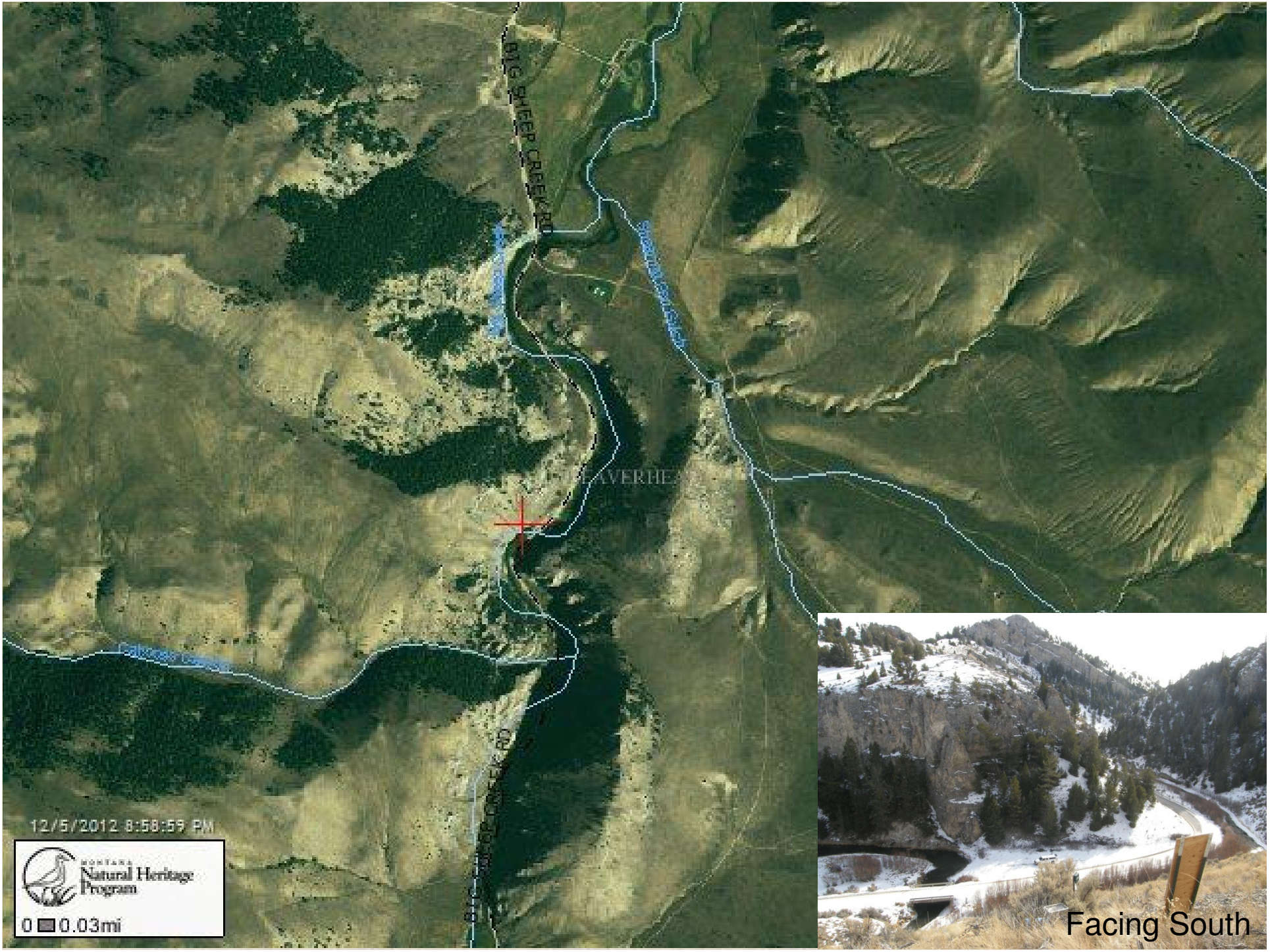
Both Microphones Water Treatment Facility

Total Number of Bat Call Sequences Summarized by Date



***Light gray bars are bat call sequences unidentified to species by Sonobat 3.0**

Big Sheep Creek - Tendoy Mountains Example


BIG SHEEP CREEK RD
12/5/2012 8:58:59 PM
Montana Natural Heritage Program
0 0.03mi
Facing South

Sonobat Species ID Counts with Monthly Presence Confirmed by Hand

Species	Jan 2012	Feb 2012	March 2012	April 2012	May 2012	June 2012	July 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
COTO					1	4	4	2	5			
EPFU		1	1	4	7	41X	57	31X	49	33		
LACI						X	3X	2X				
LANO			12	10	3	13X	18X	28X	23X	5	4	
MYCA						2	1	3X	1	1		
MYCI				17	26	104X	173X	298X	58	55	1	
MYEV						7X	5X	3X	1	1		
MYLU				1	19	49X	108X	81X	13	6	1	
MYTH						X		X				
MYVO						4X	7	10X	3			
MYYU				1	2	4	7	6	8	6		

X = previous documentation of the species in this region during the month indicated.
Red = Erroneous species identification by Sonobat 3.0

Bat Pass Species Temperatures Summarized by Month

Year	Month	Auto Species ID	Avgerage Temp_C	StDev Temp_C	Min Temp_C	Max Temp_C	N
2012	5	Coto	18.3		18.3	18.3	1
2012	6	Coto	20.4	2.1	17.6	22.6	4
2012	7	Coto	18.7	5.0	11.3	22.1	4
2012	8	Coto	14.7	1.2	13.8	15.5	2
2012	9	Coto	18.6	1.7	16.8	20.4	5
2012	2	Epfu	0.6		0.6	0.6	1
2012	3	Epfu	11.7		11.7	11.7	1
2012	4	Epfu	6.3	3.0	3.6	9.5	3
2012	5	Epfu	15.3	3.0	12	20.1	6
2012	6	Epfu	15.3	3.7	8.4	21.7	41
2012	7	Epfu	18.2	2.8	8.7	23.6	57
2012	8	Epfu	17.7	2.5	11.7	21.4	31
2012	9	Epfu	17.3	1.5	15.5	21.9	49
2012	10	Epfu	16.1	1.2	13.3	17.4	33
2012	7	Laci	17.8	0.9	16.8	18.4	3
2012	8	Laci	21.3	5.9	17.1	25.4	2
2012	3	Lano	8.1	1.4	5.7	9.8	12
2012	4	Lano	6.3	2.0	5.5	11.7	9
2012	5	Lano	12.5	3.5	10	15	2
2012	6	Lano	16.0	4.4	8.9	23.4	13
2012	7	Lano	16.8	3.4	8	21.4	18
2012	8	Lano	17.3	4.2	9.8	23.6	28
2012	9	Lano	17.0	2.8	10.3	21.9	23
2012	10	Lano	10.1	3.9	4.4	15.1	5
2012	11	Lano	8.2	2.6	4.7	11	4
2012	6	Myca	18.7	2.7	16.8	20.6	2
2012	7	Myca	21.9		21.9	21.9	1
2012	8	Myca	16.9	2.7	14.6	19.8	3
2012	9	Myca	11.7		11.7	11.7	1
2012	10	Myca	10.2		10.2	10.2	1
2012	6	Myev	14.6	5.4	8.9	22.7	7
2012	7	Myev	16.4	4.8	8	19.8	5
2012	8	Myev	16.0	1.3	15	17.4	3
2012	9	Myev	11.0		11	11	1
2012	10	Myev	10.3		10.3	10.3	1

Year	Month	Auto Species ID	Avgerage Temp_C	StDev Temp_C	Min Temp_C	Max Temp_C	N
2012	4	Myci	7.2	1.1	6.4	8	2
2012	5	Myci	14.7	4.4	6.5	20.1	20
2012	6	Myci	17.1	3.6	6.2	23.2	104
2012	7	Myci	18.4	3.3	7.5	24.4	173
2012	8	Myci	14.2	3.6	7.4	25.9	298
2012	9	Myci	16.6	2.2	12.3	20.4	58
2012	10	Myci	12.1	3.1	4.7	17.4	55
2012	11	Myci	6.4		6.4	6.4	1
2012	4	Mylu					0
2012	5	Mylu	13.4	3.7	3.9	17.6	17
2012	6	Mylu	16.2	4.9	6.7	23.4	49
2012	7	Mylu	17.5	3.4	8	23.9	108
2012	8	Mylu	17.7	3.7	7.7	26	81
2012	9	Mylu	14.1	4.5	4.2	19.8	13
2012	10	Mylu	12.9	2.8	9.7	16.1	6
2012	11	Mylu	9.7		9.7	9.7	1
2012	6	Myvo	17.7	6.0	9.2	22.7	4
2012	7	Myvo	18.5	2.3	14.8	21.9	7
2012	8	Myvo	19.3	3.2	14.3	22.7	10
2012	9	Myvo	14.3	4.1	9.7	17.6	3
2012	4	Myyu					0
2012	5	Myyu	15.9	2.9	13.8	17.9	2
2012	6	Myyu	12.7	3.1	9.4	16.8	4
2012	7	Myyu	18.3	3.4	14.8	24.9	7
2012	8	Myyu	14.6	1.5	12.3	16.8	6
2012	9	Myyu	17.2	1.3	15.1	18.6	8
2012	10	Myyu	14.4	2.2	11	17.4	6
2012	2	Unidentified	5.9		5.9	5.9	1
2012	3	Unidentified	8.2	3.9	0.4	12	21
2012	4	Unidentified	3.7	3.4	-0.1	11	27
2012	5	Unidentified	14.8	4.1	2.4	20.3	423
2012	6	Unidentified	16.5	4.4	2.7	23.7	1143
2012	7	Unidentified	17.7	3.3	3.1	24.7	1365
2012	8	Unidentified	17.7	3.5	6.7	26.5	1572
2012	9	Unidentified	16.5	2.1	7	21.9	1685
2012	10	Unidentified	14.2	3.2	2.6	17.4	738
2012	11	Unidentified	8.2	3.3	0.4	11.3	9

Summary and Future Directions

- Some of our winter roost environments appear capable of supporting WNS – decontamination is essential
- Caves and mines that lack recent surveys should be surveyed as rapidly as possible, especially if there is evidence of bat use
- Cavers and caving groups are critical to baseline assessment and monitoring of our caves and mines!!!
- Need to develop a White-Nose Syndrome risk scoring system
- Year-round acoustic monitoring assessments should continue for a minimum of 2-3 years statewide.
- What wildlife biologists can do:
    1. Bridge surveys and report other bat roosts
    2. Work with local groups to install bat roosts
    3. Introduce kids (and yourself) to our amazing bats!