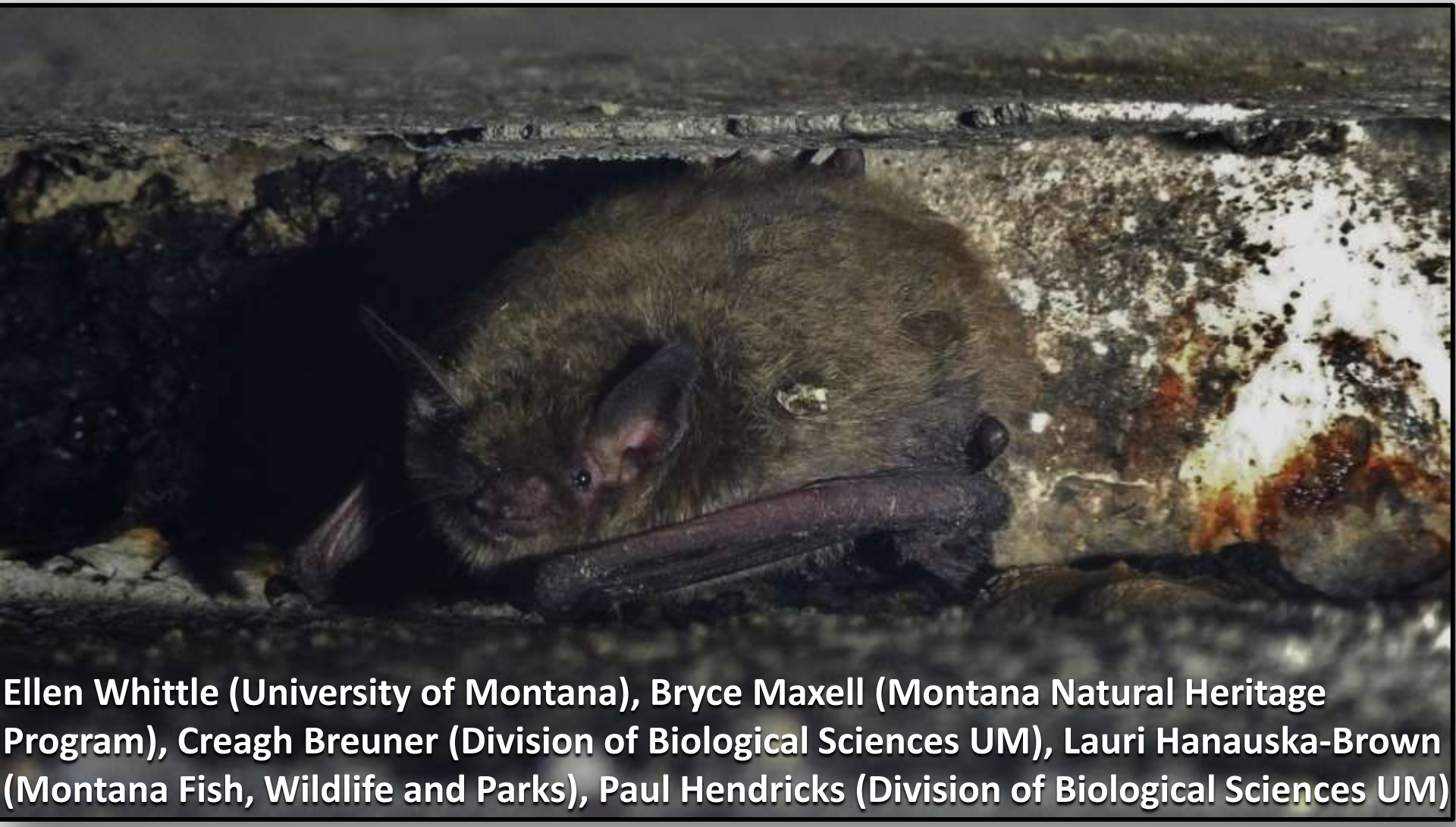
Bat Use of Bridges in Western Montana

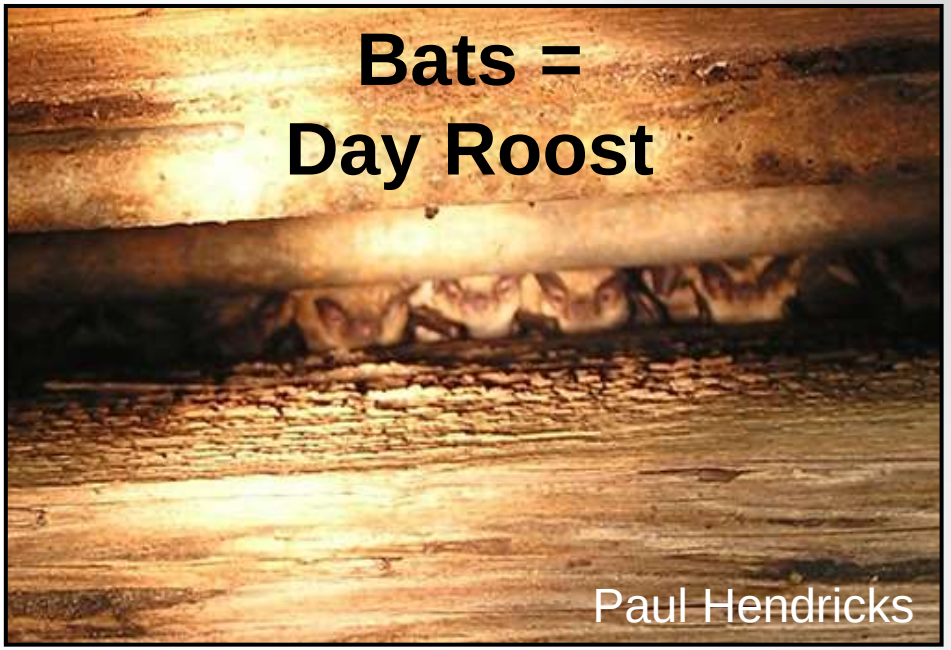


Ellen Whittle (University of Montana), Bryce Maxell (Montana Natural Heritage Program), Creagh Breuner (Division of Biological Sciences UM), Lauri Hanauska-Brown (Montana Fish, Wildlife and Parks), Paul Hendricks (Division of Biological Sciences UM)

Special thanks to the USFS for providing a field vehicle
and to FWP and the USFWS for funding surveys

Definitions

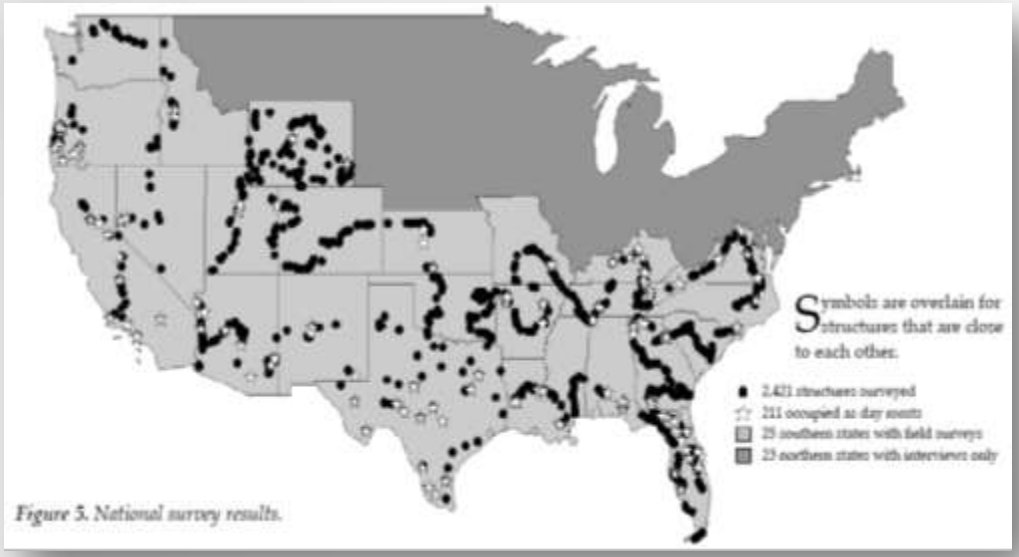
No Bat Sign/Presence= Undetected



Bats in Bridges

Keeley and Tuttle (1999)

BCI surveys across 25 states

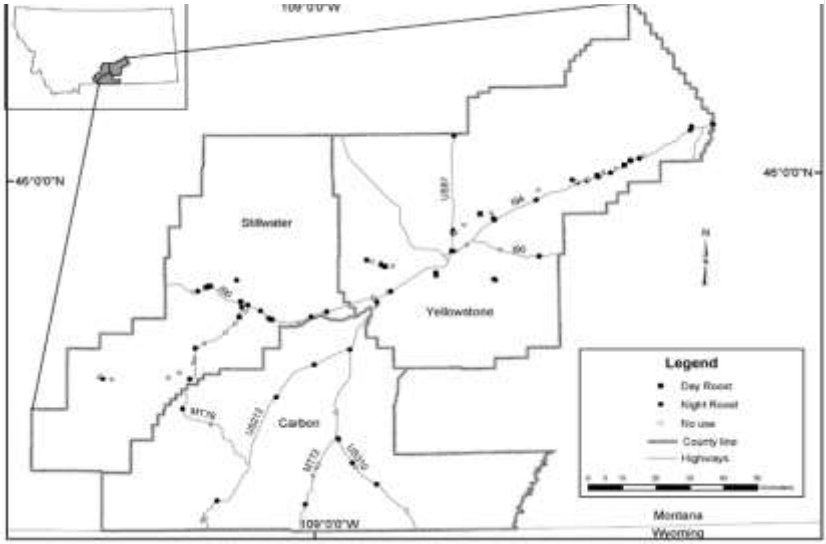


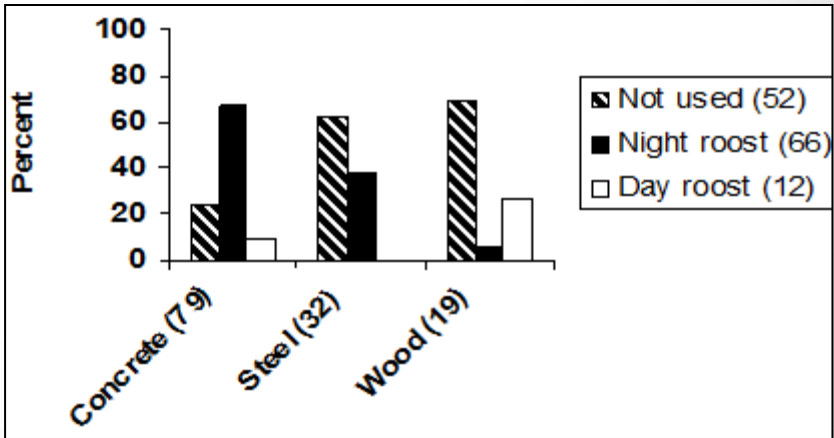
- 211 day roosts found
- 4.25 million bats of 24 species
- Only 1% of bridges had ideal crevice conditions for day roosts

Hendricks et al. (2005)

http://mtnhp.org/Reports.asp?key=7

- 130 bridges surveyed
- 51% night roosts
- 9% day roosts including 4 maternity colonies





Our Overarching Question:

How important are bridges to bats in western Montana during the summer?

Specific Questions:

1. **Does bat use (not detected, night, day, maternity) vary by:**
   - **bridge type**
   - **bridge material**
   - **crevice presence**
   - **landscape features**
2. **What are thermal and humidity characteristics of day roosts?**

Study Area

412 bridges across:

Missoula County (190)

Ravalli County (117)

Mineral County (104)

Ownership:

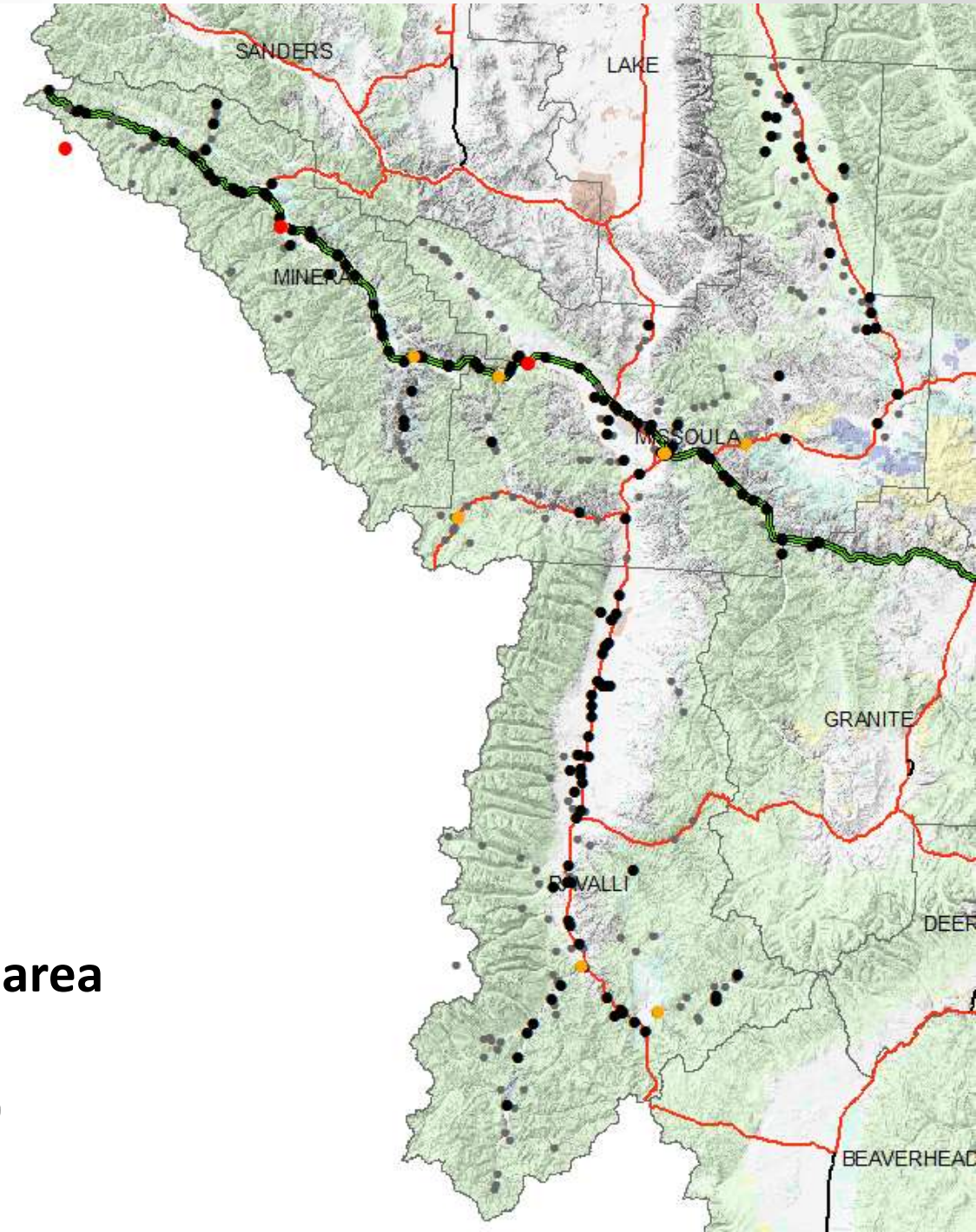
MDT bridges (191)

USFS bridges (162)

Incidental structures (59)

*** 596 total bridges in study area**

*** 184 unsurveyed (culvert, flooded, inaccessible etc.)**



Methods

1) Photograph

2) Look for ideal crevices

3) Look/listen for bat use

4) Classify bat use

5) Record bridge information


Check potential crevices
DeWalt Inspection Camera if needed

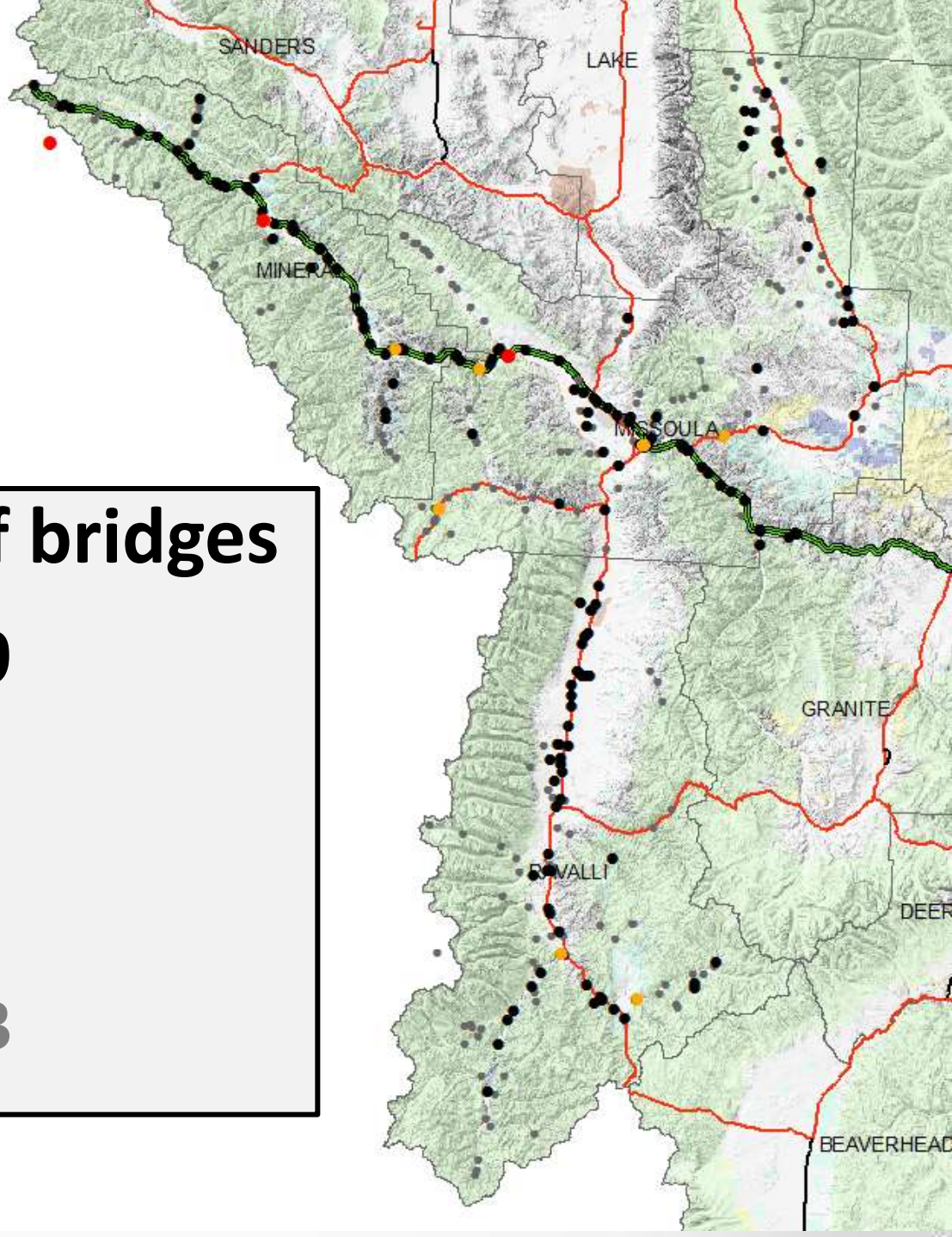
Temperature and Relative Humidity Data Loggers

- Instantaneous roost temperatures with noncontact laser
- iButtons logged temp and RH hourly at 10 sites
- Calculated cumulative growing degree days experienced by bats with a base temperature of 10 C

GDD = ((dailyTmax + dailyTmin) / 2) – Tbase of 10 C

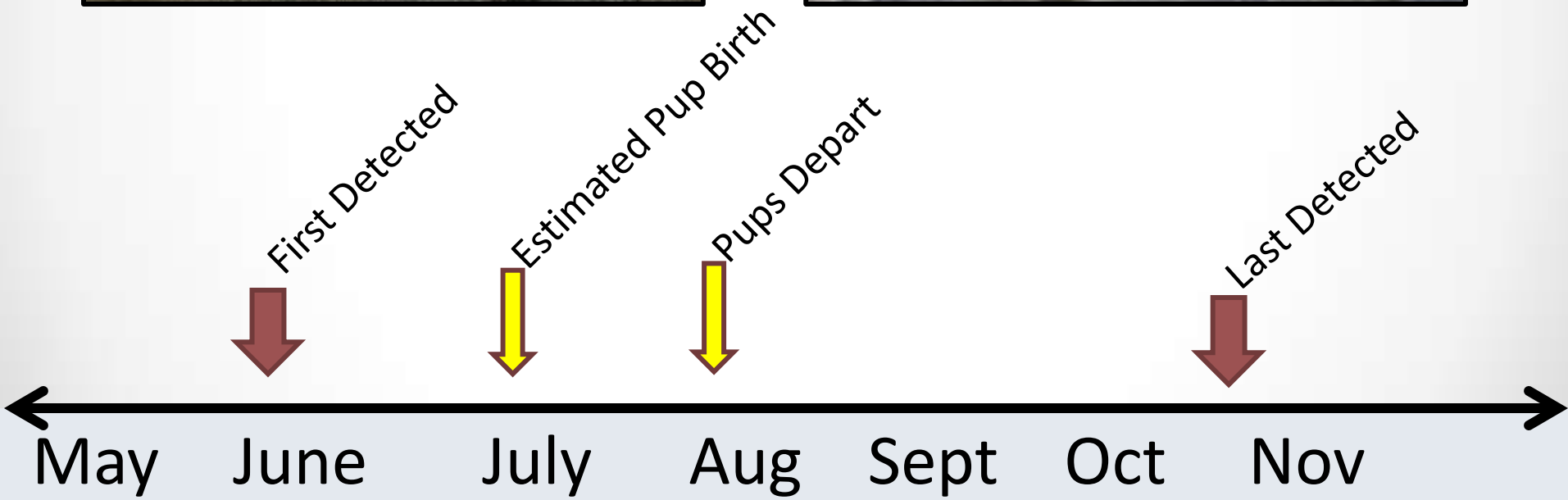
Results:

Bat Use Detected



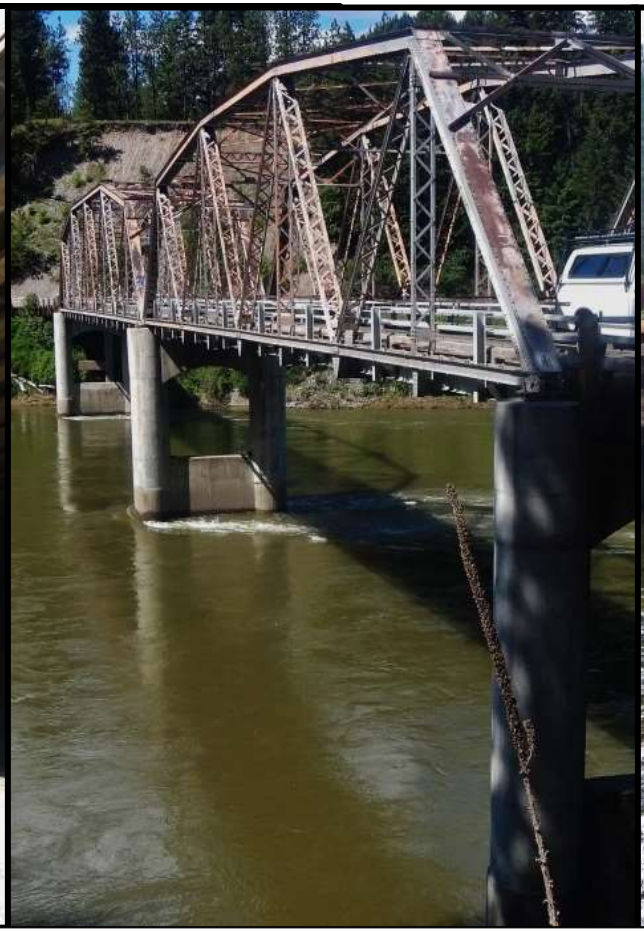
- **Bat sign at 46% of bridges**
  - **Night roost-189**
  - **Day roost-11**
  - **Maternity-3**
  - **Not detected-223**

Phenology of Bridge Occupancy



Maternity Use:
Big Brown Bat Pup

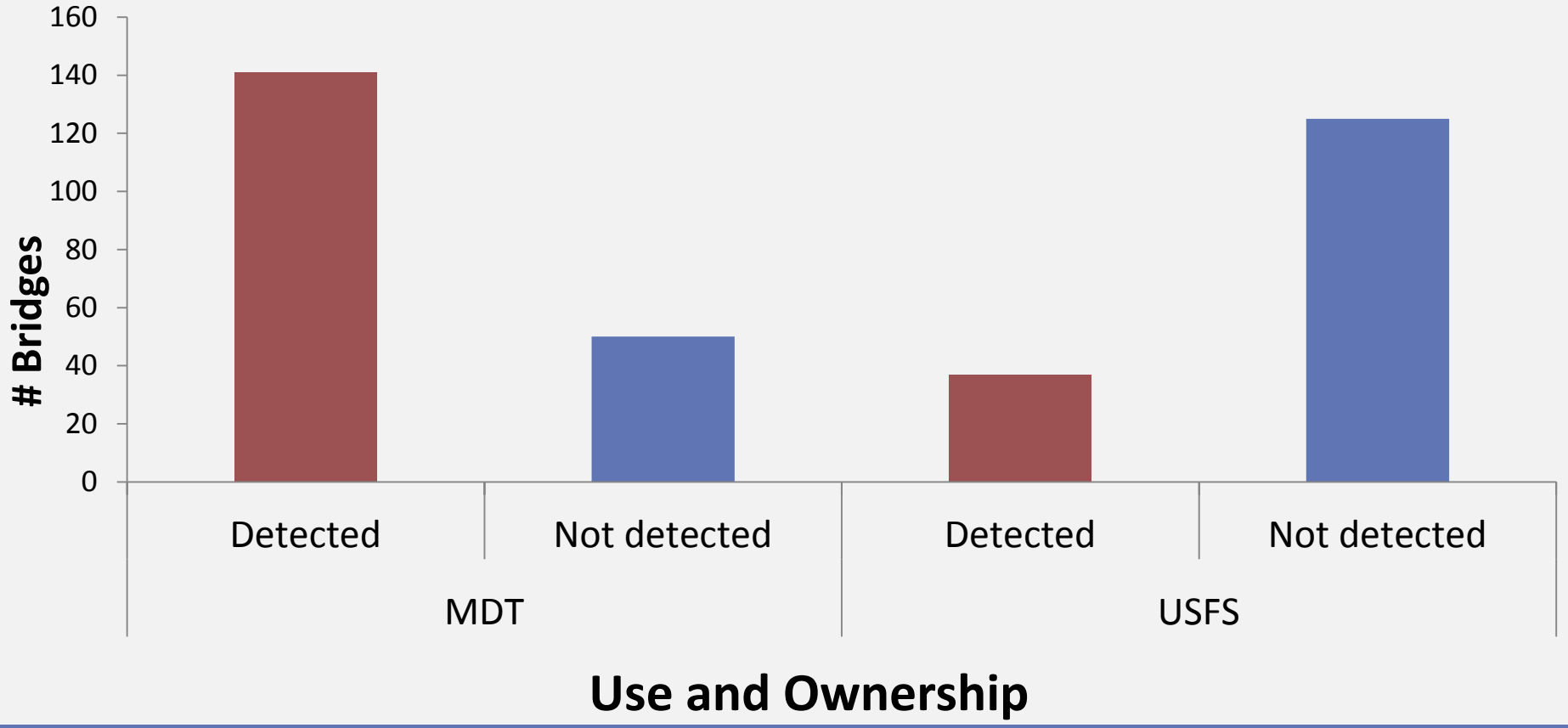
Underdecking Material



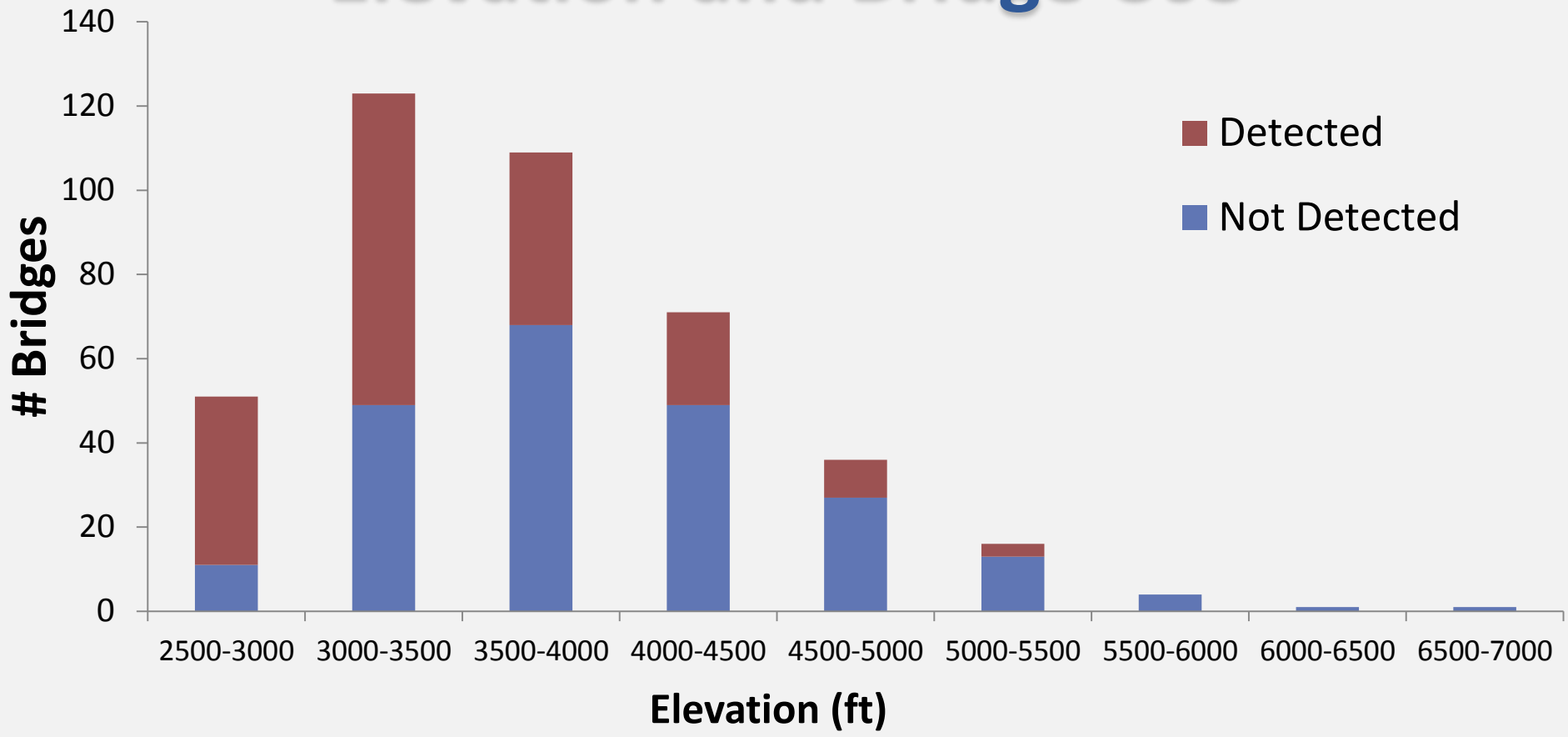
Material	Detected (O/E)	Percent	Undetected (O/E)	Percent	Chi Square	P-Value
Concrete	165 /149.6	**76%**	52 /67.4	24%	-	-
Steel	6 /21.4	**20%**	24 /9.6	80%	**38.1**	**6.71E-10**
Wood	18 /78.8	**11%**	146 /85.2	89%	**155.8**	**2.20E-16**

Bridge Management

Agency	Not Detected	Night	Day	Maternity
MDT	50	131	8	2
USFS	125	36	0	1



Elevation and Bridge Use



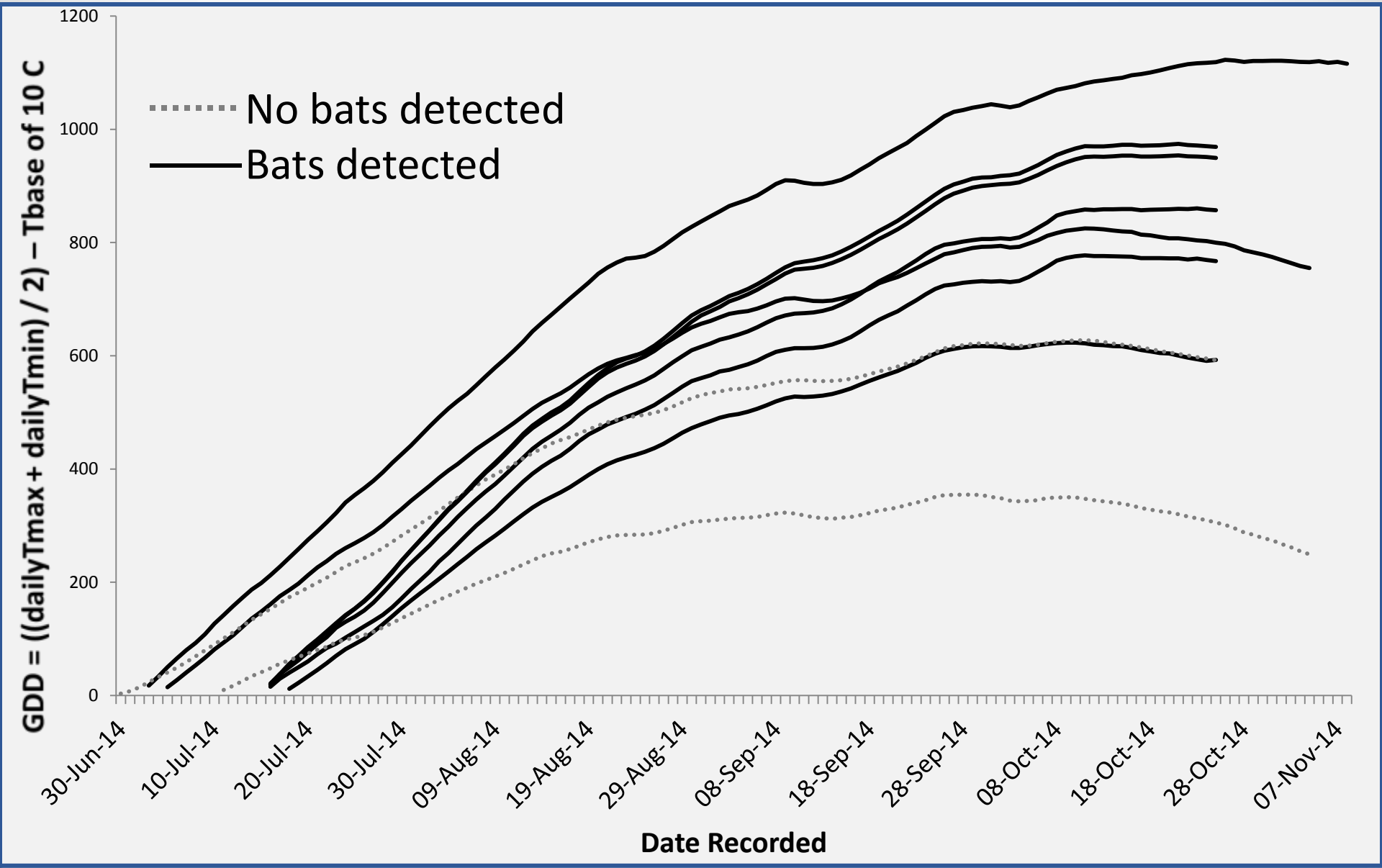
Elevation	Detected (O/E)	Percent	Undetected (O/E)	Percent	Chi Square	P-value
<4500	177 /162.4	**50%**	177 /191.6	50%	16.1	6.07E-05
>4500	12 /26.6	**21%**	46 /31.4	79%		

Ideal Crevices and Bridge Use

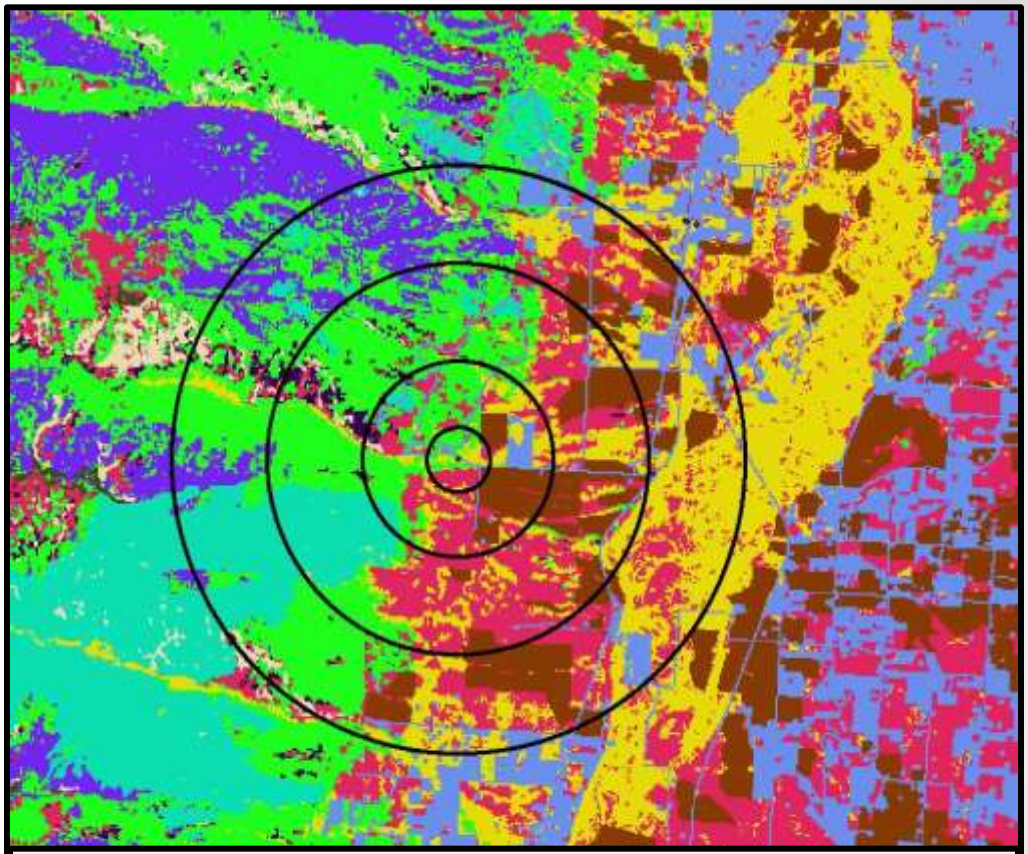
Important for day-roosting bats;
less significant for night roosts.

Crevices	Detected (O/E)	Percent	Not detected (O/E)	Percent	Chi Square	P-Value
Yes	11 /3.1	**9%**	106 /113.9	91%	**25**	**5.76E-07**
No	0 /7.9	**0%**	295 /287.1	100%		

Thermal Characteristics:
Cumulative Growing Degree Days



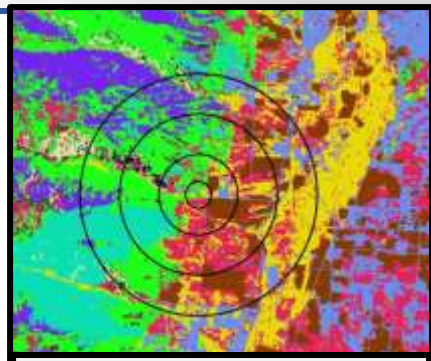
Landscape Ruggedness



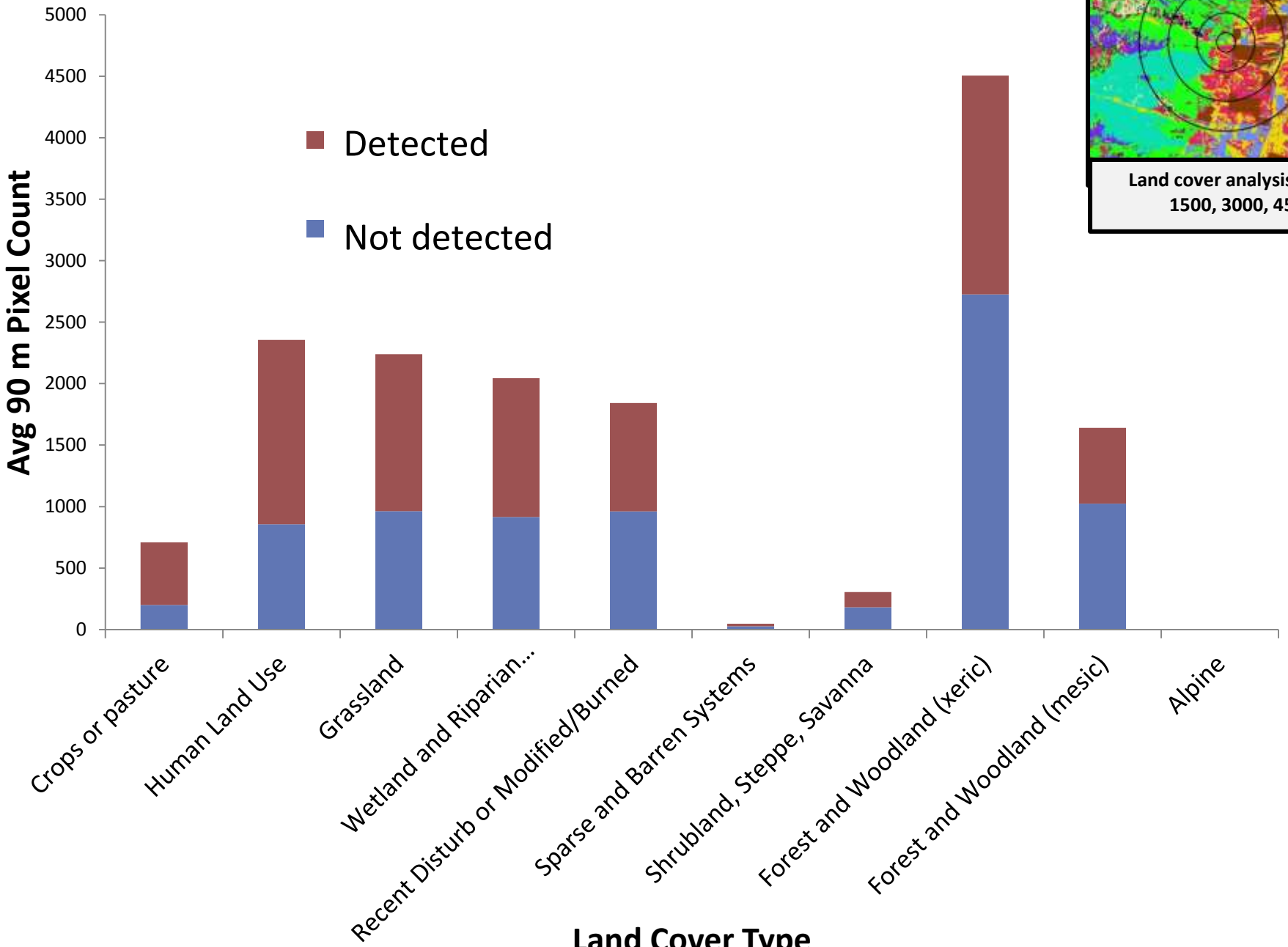
Land cover analysis at 500, 1500, 3000, 4500

Average Landscape Ruggedness within 500 m		
Buffer Distance	**Not detected**	**Detected**
500	14.5	9.8

Land Cover within 1500 m



Land cover analysis at 500, 1500, 3000, 4500



Conclusions

- A high percentage of bridges are being used by bats.
- Bats are using bridges from early June to mid-October; maternity use from circa late June to early August.
- Bridges below 4,500 ft have a much greater rate of use.
- Cement decking material is being used preferentially.
- Some evidence that day roosts accumulate more growing degree days, but this needs further testing.
- Bridges in landscapes with fewer natural roost sites seem to be used to a greater extent.
- Day roost use occurs over a range of bridge types, but require ideal crevices.

Management Recommendations

- **Conduct bat surveys prior to bridge work to reduce disturbance and avoid altering features used by bats**
- **Avoid disturbance of bats at day roosts between late May and mid-October**
- **Provide 3/4 - 1 inch crevices 4+ inches deep when constructing or retrofitting bridges – leave expansion joint crevices open**
- **Add bat boxes with ideal crevice features to bridges**
- **Additional study of bat use of bridges is needed across Montana, including systematic statewide survey**

Photo J. Lindsay

Acknowledgments

Project Coordinators

Bryce Maxell

Senior Zoologist, MTNHP

Jolyn Ortega

Program Specialist, USFS

U. of Montana Faculty Advisors

Creagh Breuner

Lisa Eby

Paul Hendricks

Research Assistants

Carrie Voss (UM)

Macy Dugan (UM)

Field Volunteers:

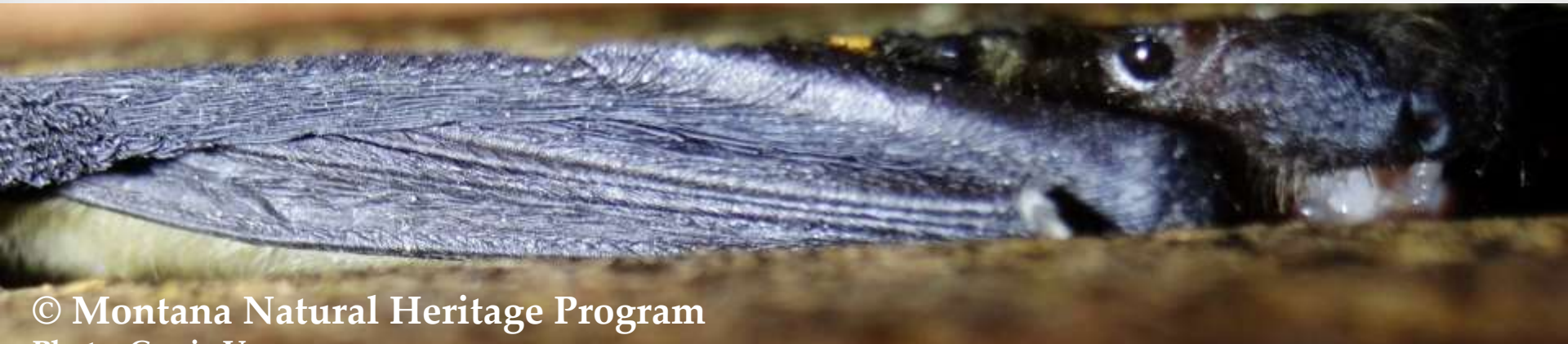
Douglas Tyte (UM)

Sophie Paton (UM)

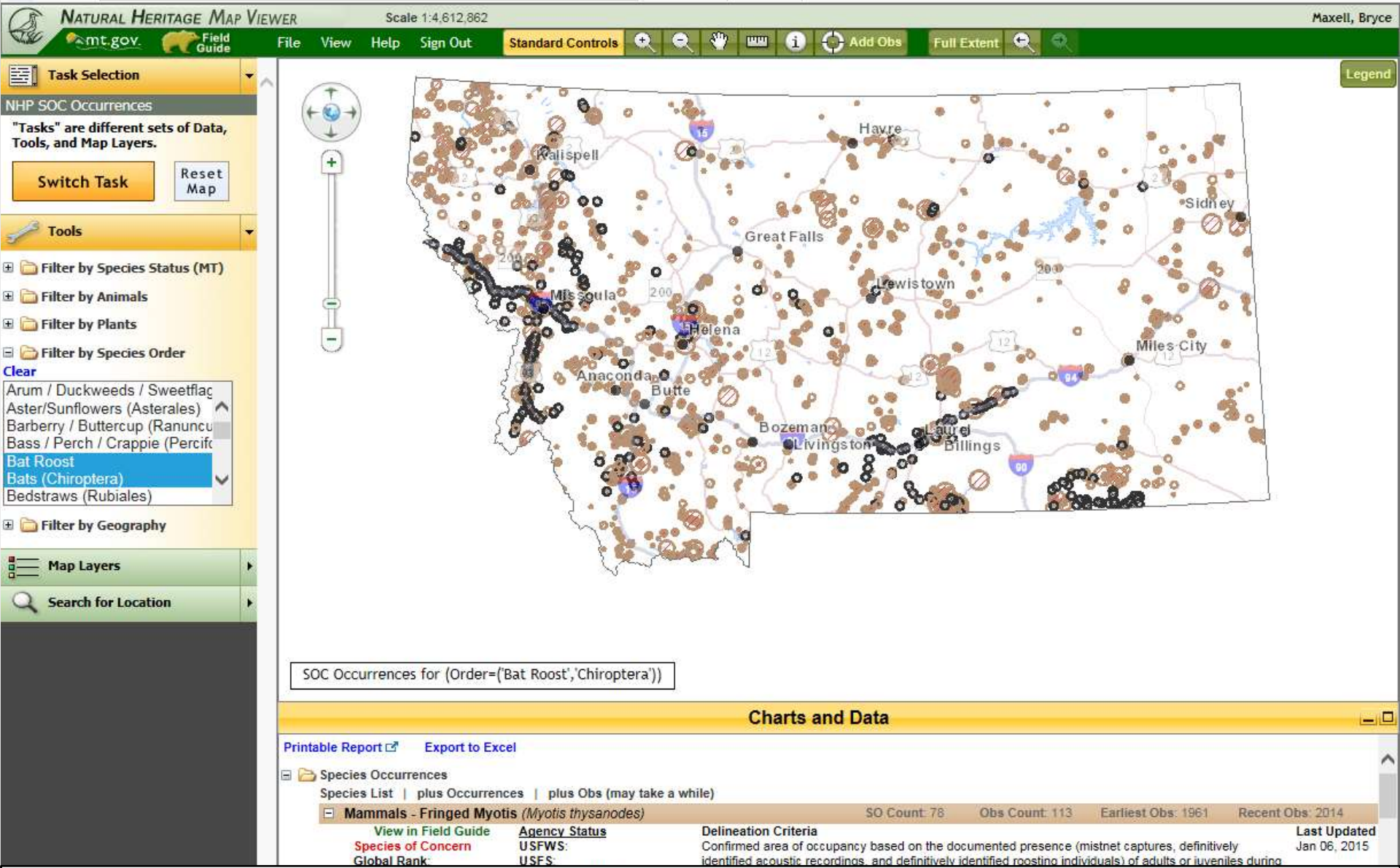
Jessica Lindsay (UM)

Jessie Shapiro (UM)

Elliot Moore (UM)



Data Available on Natural Heritage Map Viewer



http://mtnhp.org/mapviewer/

TxDOT Guidelines

- "During construction planning, **there are no costs for an engineer to specify the appropriate crevice widths** of 3/4 to 1-inches (1.9 to 2.5 cm) for expansion joints or other crevices. Existing structures can be retrofitted with bat-friendly habitats…Signs of bat use in nearby bridges and culverts increase the chances of success for habitat enhancement projects."

- "**No structural damage, aquatic pollution, or disease transmission to humans has been associated** with even the largest bat colonies living in Texas bridges and culverts, but warnings not to handle downed individuals or inhale dust associated with bird or bats droppings are recommended."

(NCHRP 25-25(04) *Final Report Environmental Stewardship Practices, Procedures , and Policies for Highway Construction and Maintenance v1.0* November 2005

Importance of Concrete

Material	Detected (O/E)	Percent	Undetected (O/E)	Percent	Chi Square	P-Value
Concrete	165 /99.6	**76%**	52 /117.5	24%	**165.4**	**2.2E-16**
All Other	24 /89.5	**12%**	171 /105.6	88%		

Classify Night Roosts

1

Small amount of droppings/urine stains in only one location

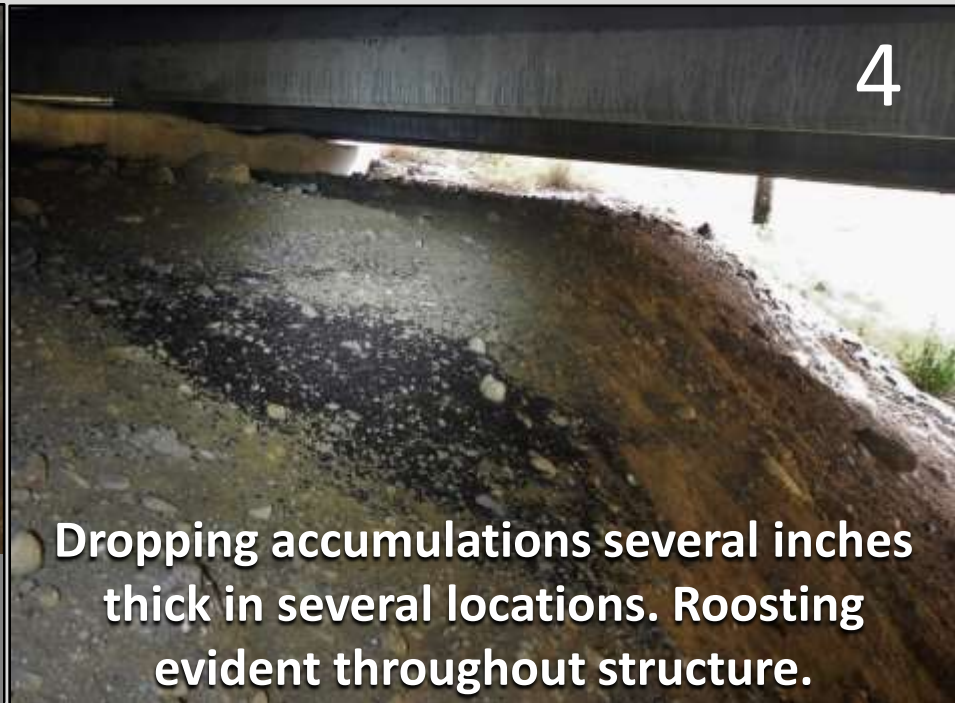
2

Small urine stains and/or scattered droppings in several locations

3

Large dropping accumulations and/or urine stains obvious and widespread

4



Dropping accumulations several inches thick in several locations. Roosting evident throughout structure.