

Assessment of Lentic Breeding Amphibians in Montana: management insights from CART analyses

U.S. Fish and Wildlife Service National Conservation Training Center Webinar on High Mountain Lake Management

See other presentations in this webinar at:

http://training.fws.gov/CSP/Resources/native_aquatic_species_restoration/oct_2010.html

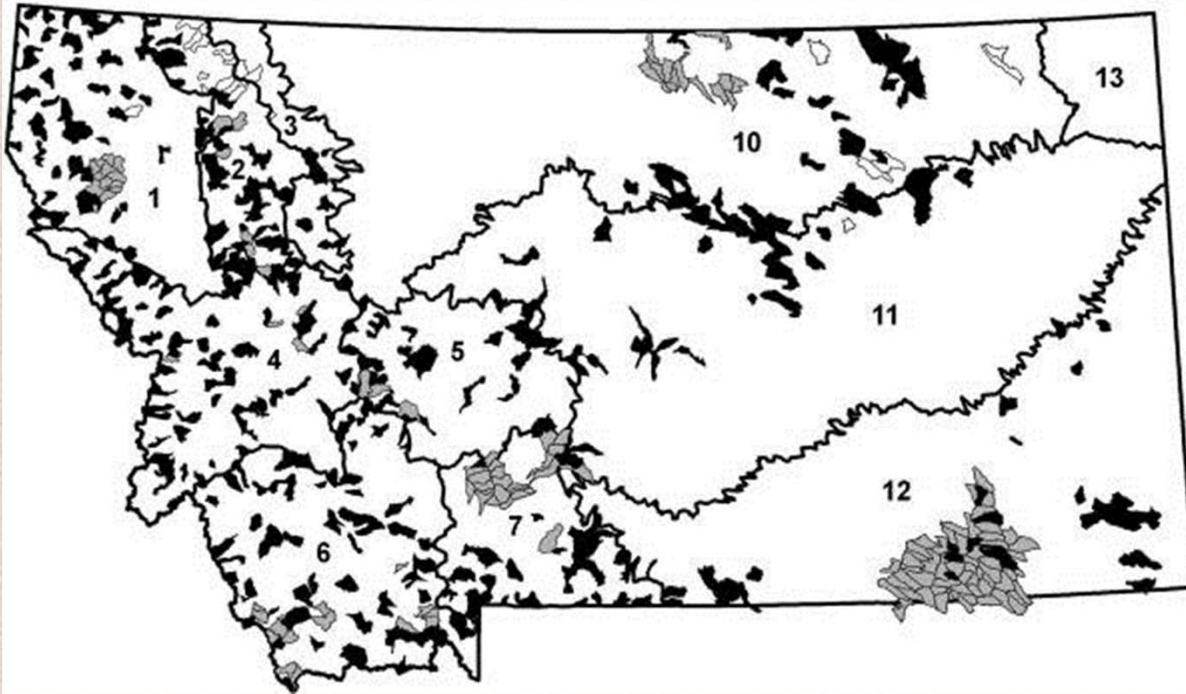
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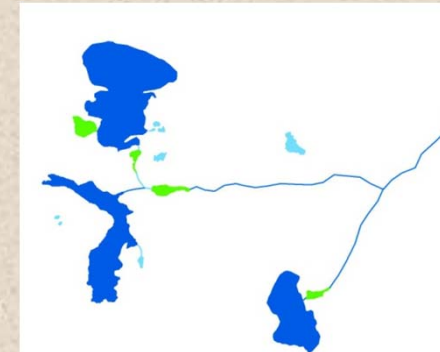
* A powerpoint overview of Montana's amphibian and reptile species, including identification, habitat use, site occupancy rates, and Maxent and CART model outputs is posted at:

http://mtnhp.org/animal/presentations/060709_MT_Herps_ID_Status_files/frame.htm

Statewide Status Assessment



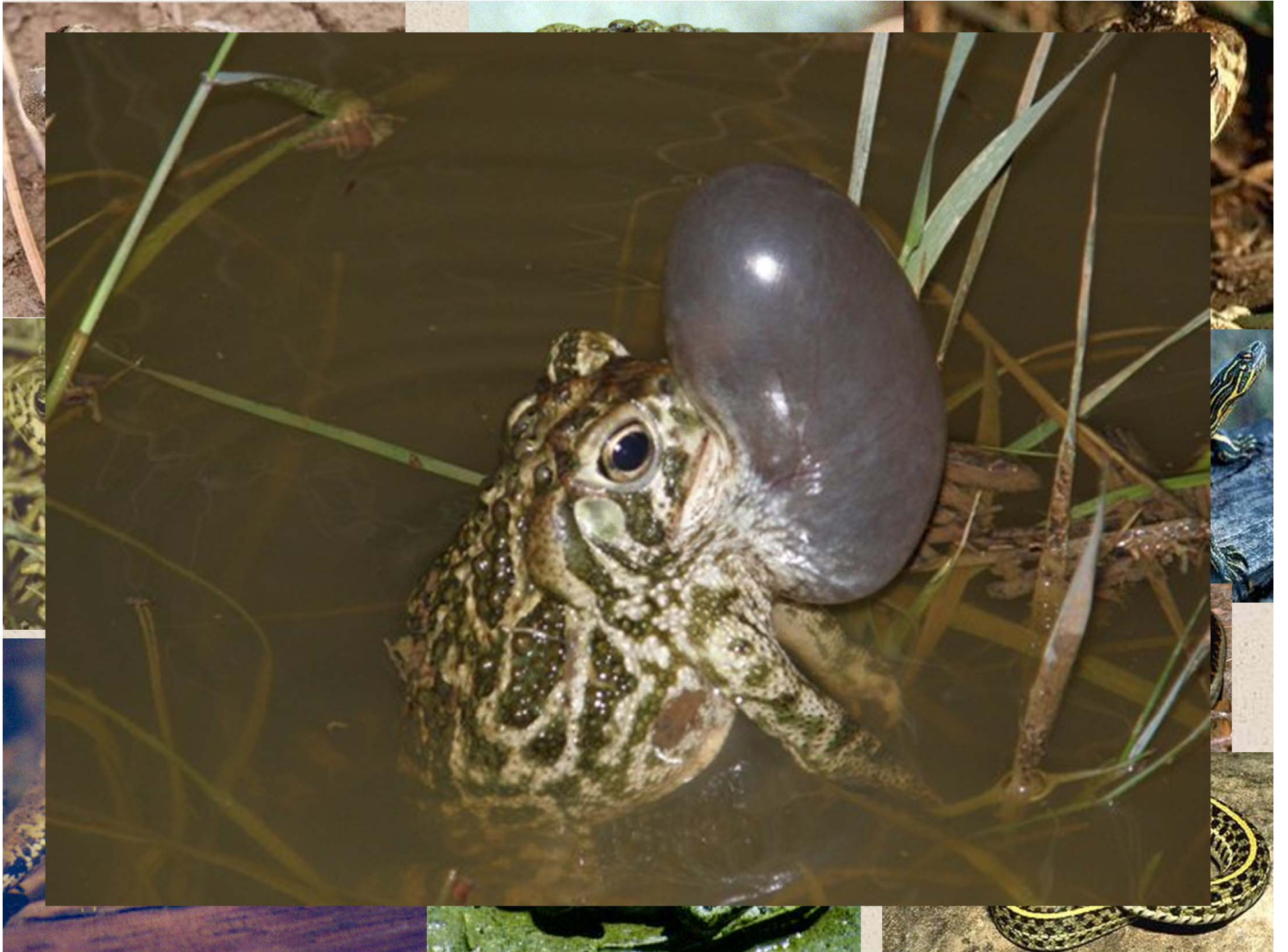
- 11 geographic strata
- 429 random watersheds
- 6,741 lentic sites
- ~129 non-random watersheds
- ~3,000 non-random sites



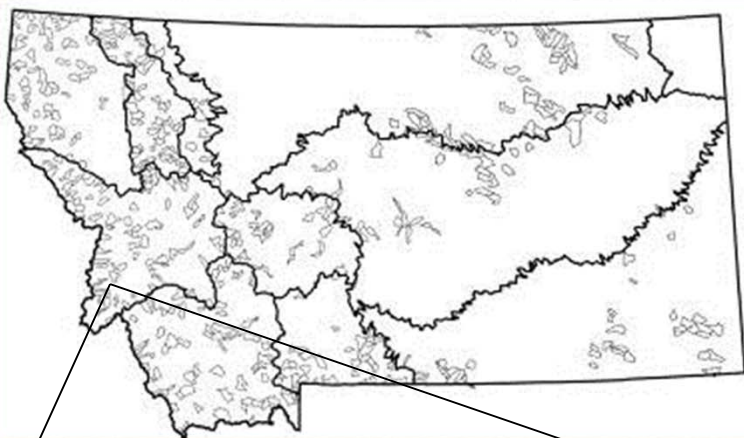
Goals

- Distribution
- Naïve Watershed Occupancy Rates
- Naïve Site Occupancy Rates
- Identify Site Origins
- Assess threats to habitats and species
- Assess distribution of Chytrid Fungus
- Make information easily available to resource managers





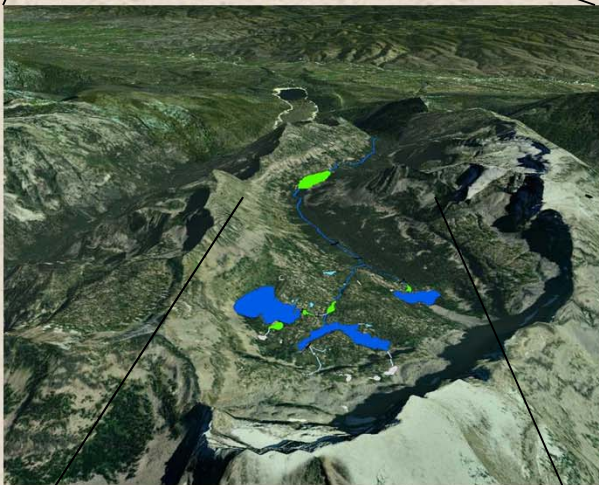
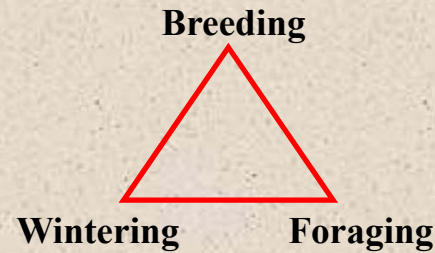
Overview of Research Goals Management Tools



- Distribution
- Watershed Occupancy
- Lentic Site Occupancy

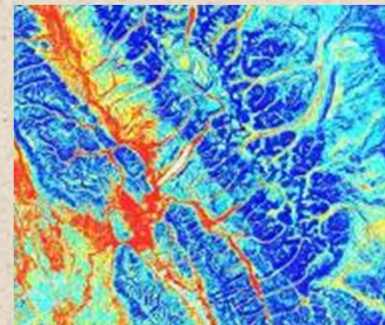
**10 Amphibians
4 Reptiles**

(Maxell 2009)



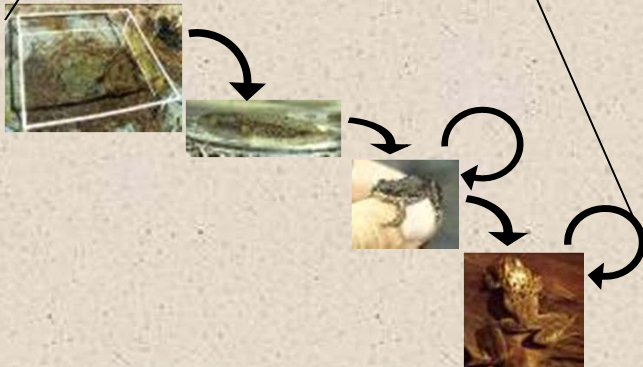
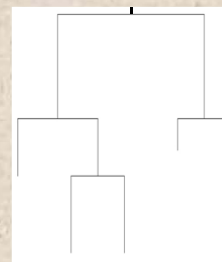
**14 Amphibians
17 Reptiles**

(Maxell 2009)



**10 Amphibians
4 Reptiles**

(Maxell 2009)

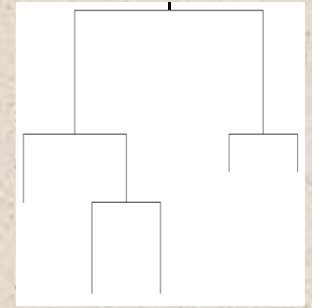


**Columbia
Spotted Frog**

(McAffery & Maxell 2010
PNAS 107(19): 8644-8649)

		FROM STAGE		
		Progeny	Juvenile	Reproductive Adult
TO STAGE	Progeny	0	0	F1 Clutch Size x Probability of Laying x Adult Survival
	Juvenile	G1 (Embryo Survival x Larval Survival x Metamorph Survival)	P1 (Probability of a Juvenile Staying a Juvenile)	0
	Reproductive Adult	0	G2 (Probability of a Juvenile Becoming an Adult)	P2 (Adult Survival)

Classification Trees

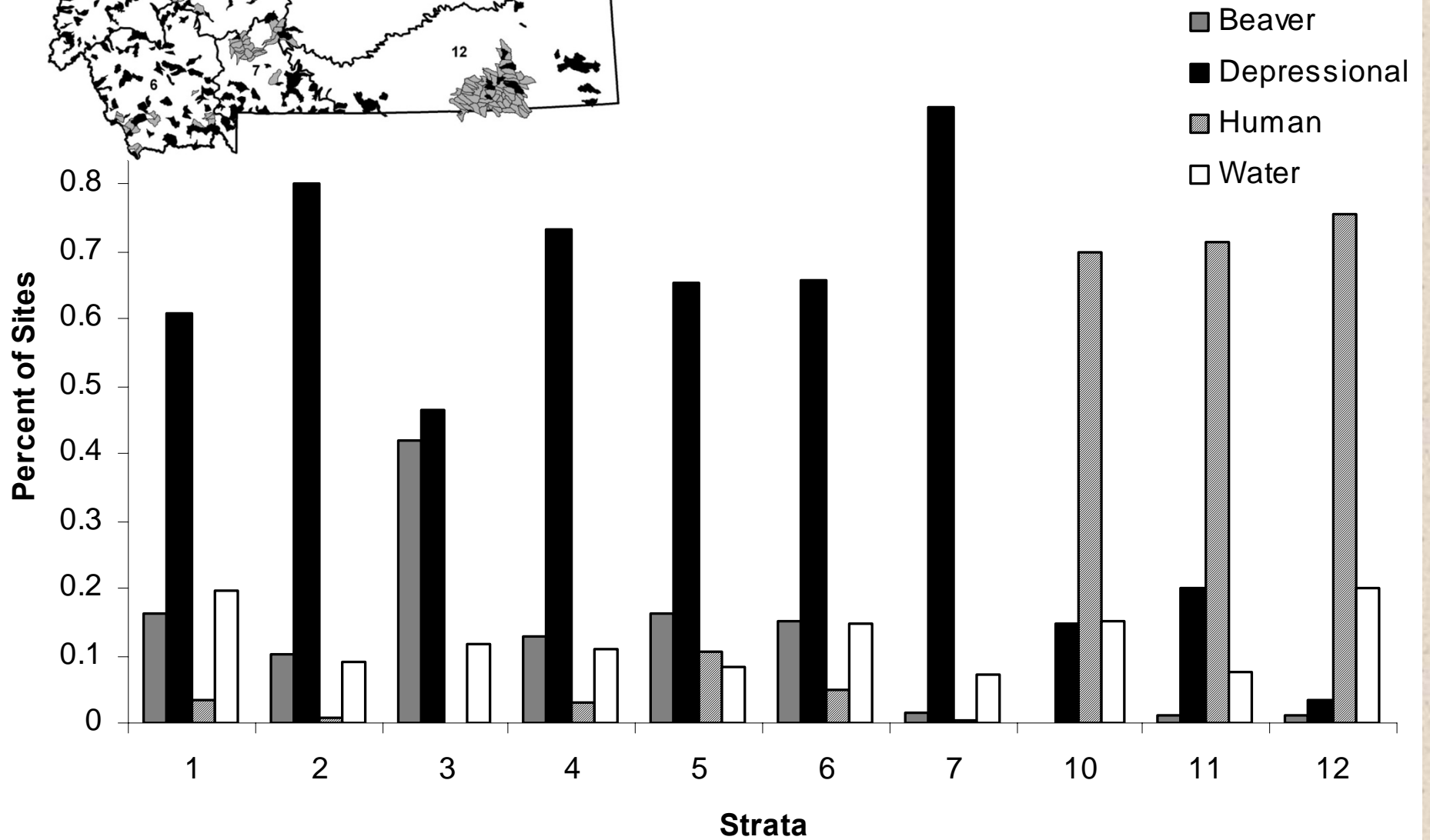
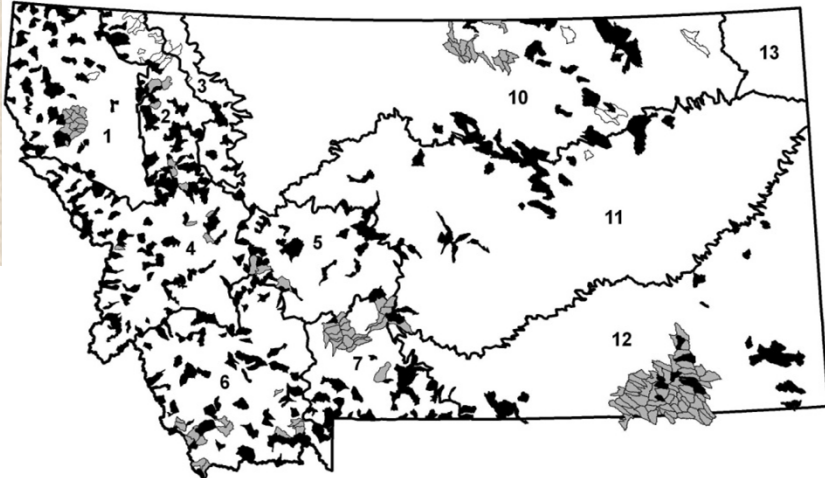


- **Non-parametric**
- **Partitions dataset recursively into increasingly homogeneous binary subsets**
- **Models constructed using the Gini index splitting rule in CART 6.2**
- **Trees were pruned by limiting node size to 10**
- **10-fold cross validation to minimize prediction errors**
- **Variables chosen for interpretability, range-wide representation, and potential to be affected by management actions**

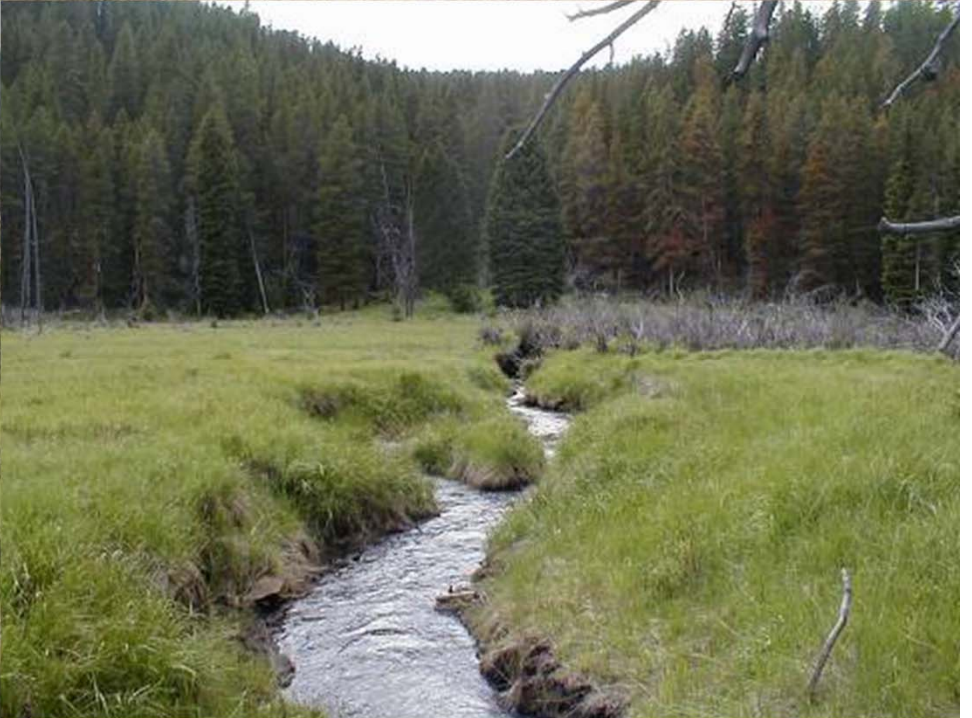
Goals

- **Local site management tool to evaluate:**
 - **overall site suitability**
 - **impacts of fish**
 - **impacts of altering emergent vegetation**
 - **impacts to altered hydrological regime**
 - **disturbances of interest**

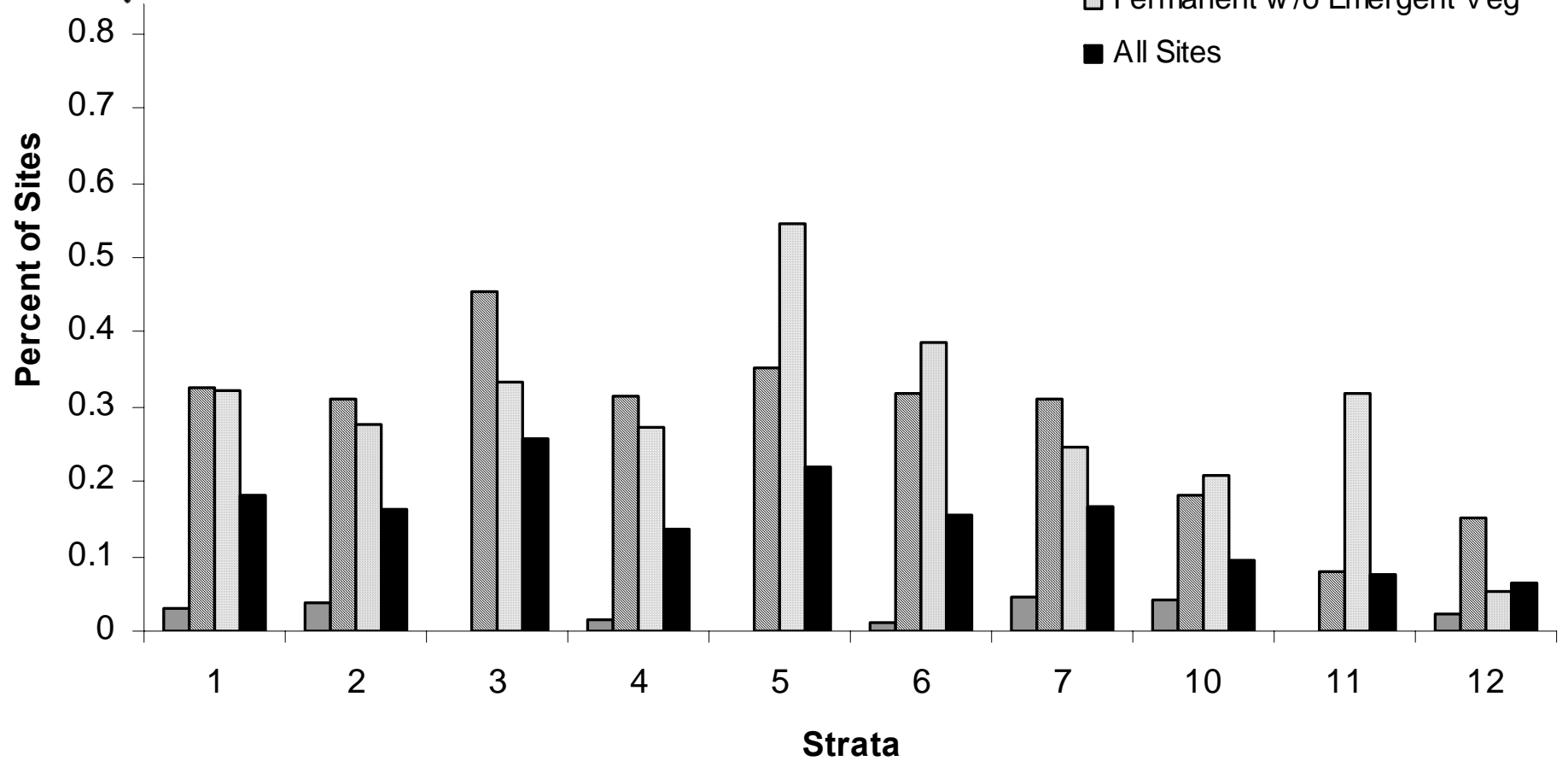
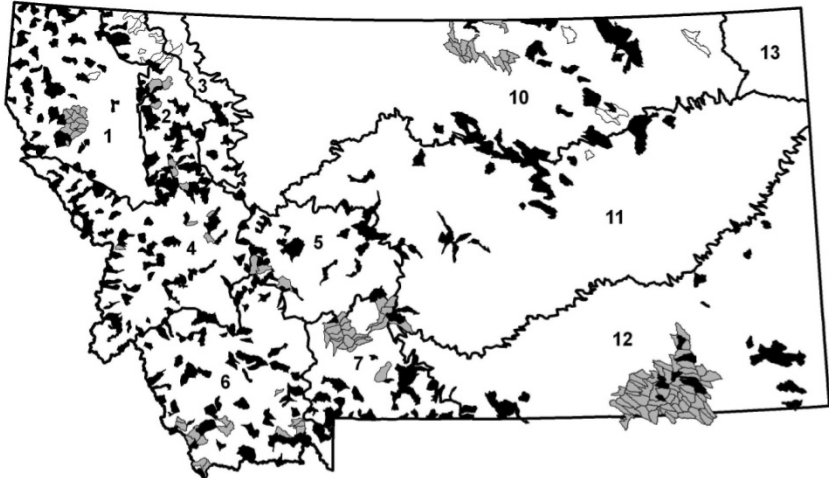
Site Origins



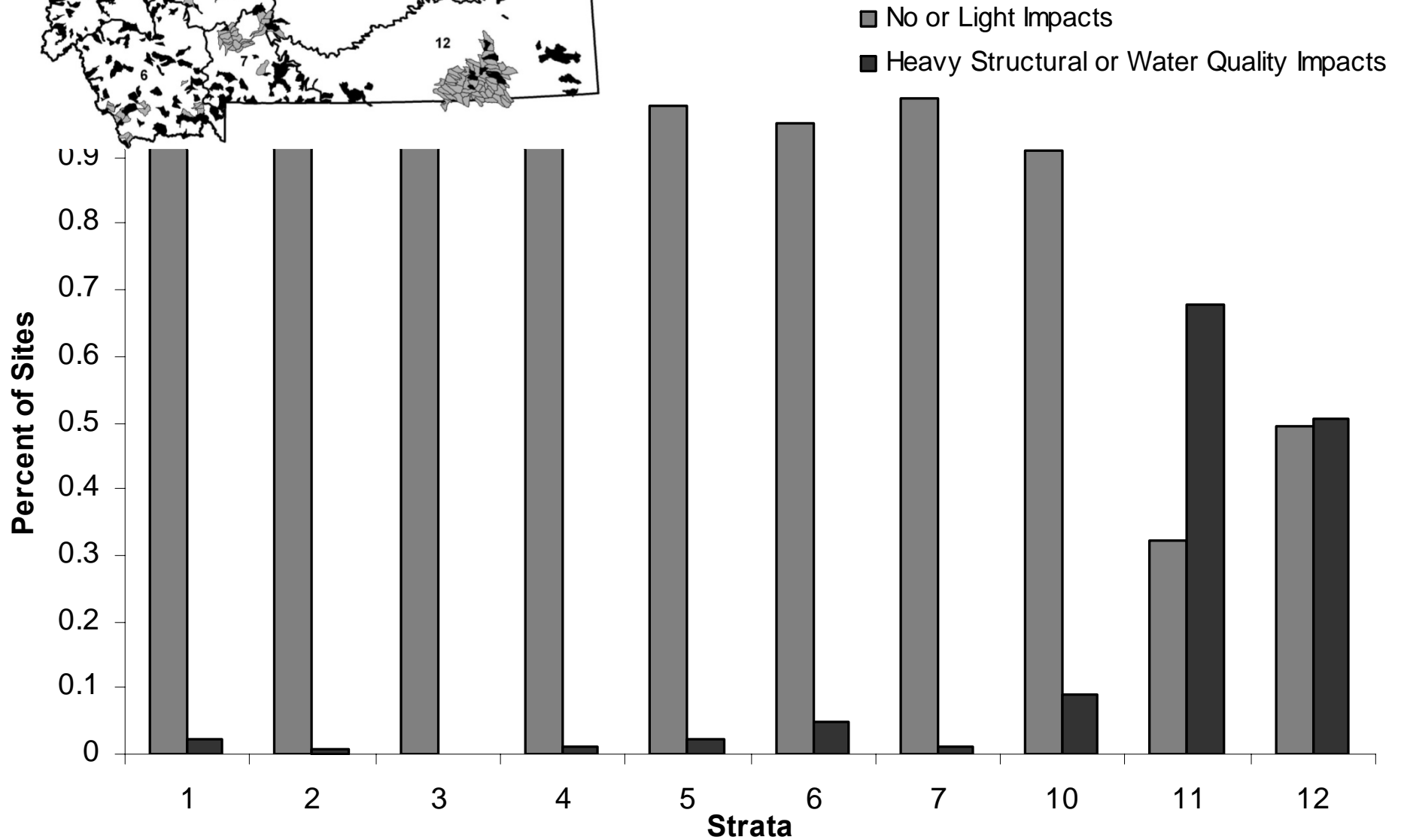
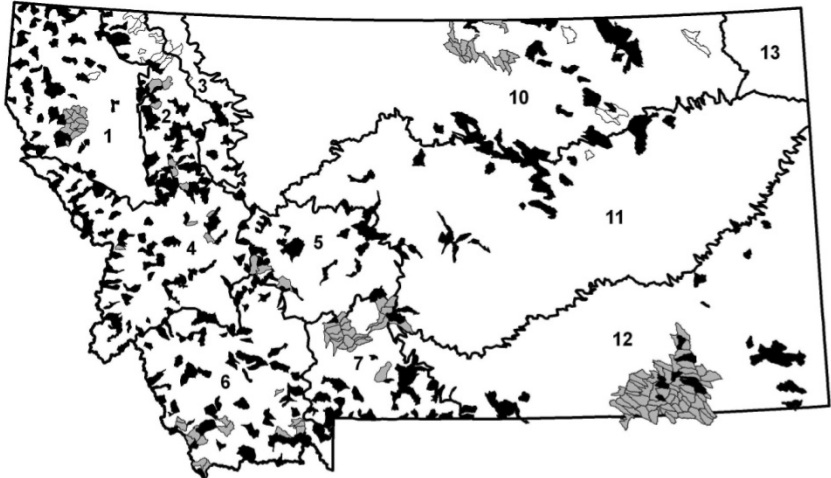


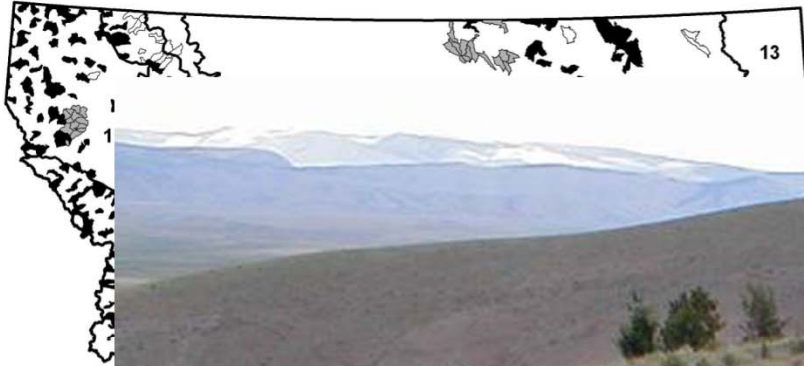


Fish Detection



Grazing Impacts





cts

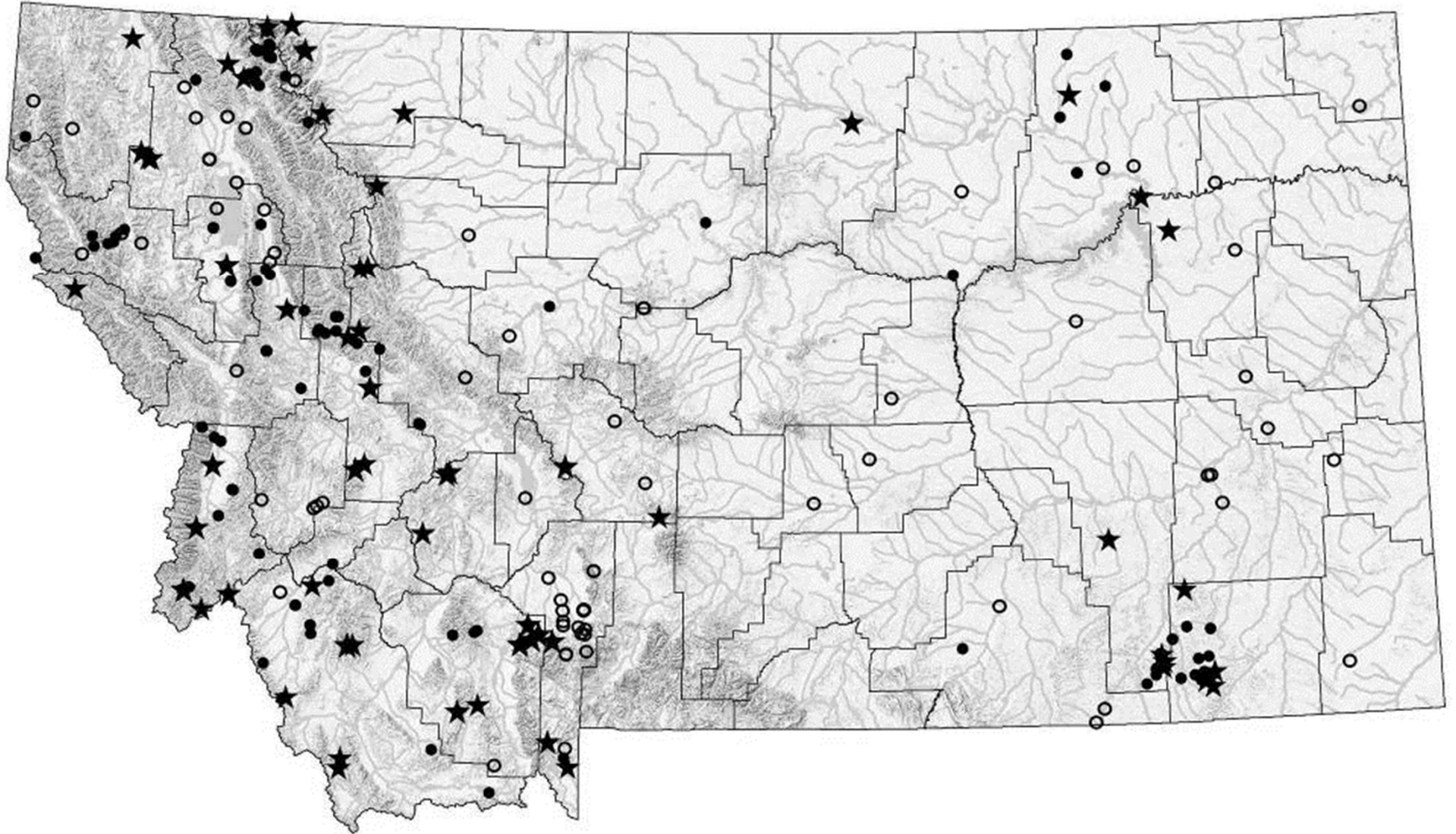
Percent of Sites



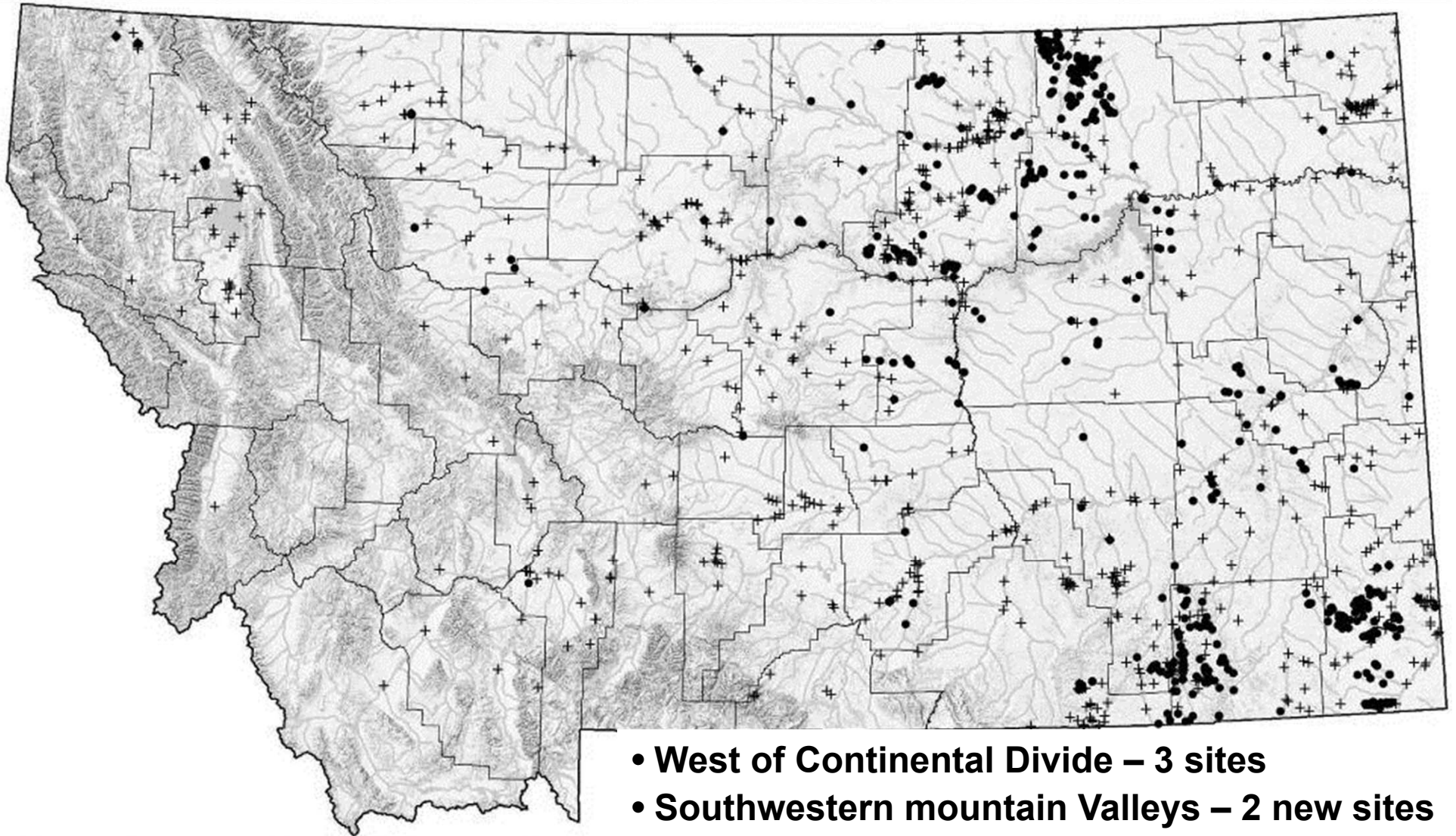
Strata

Distribution of Chytrid Fungus

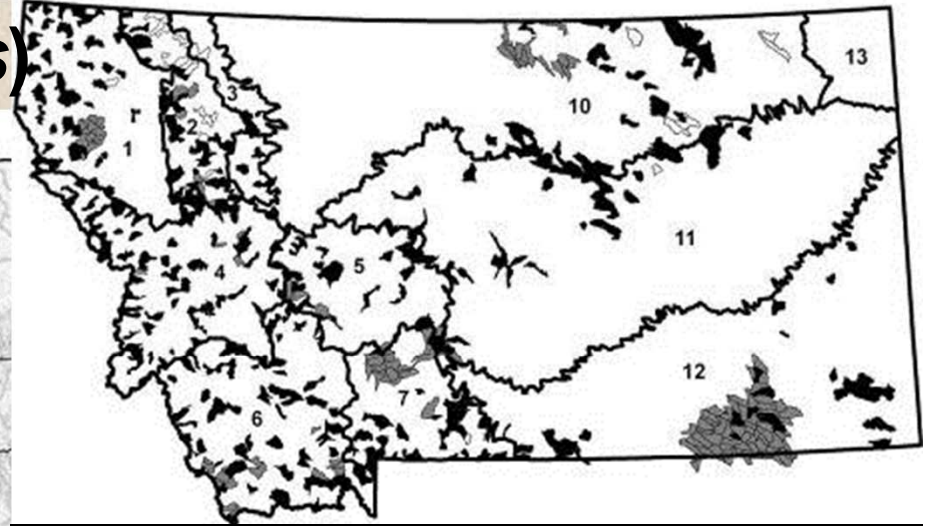
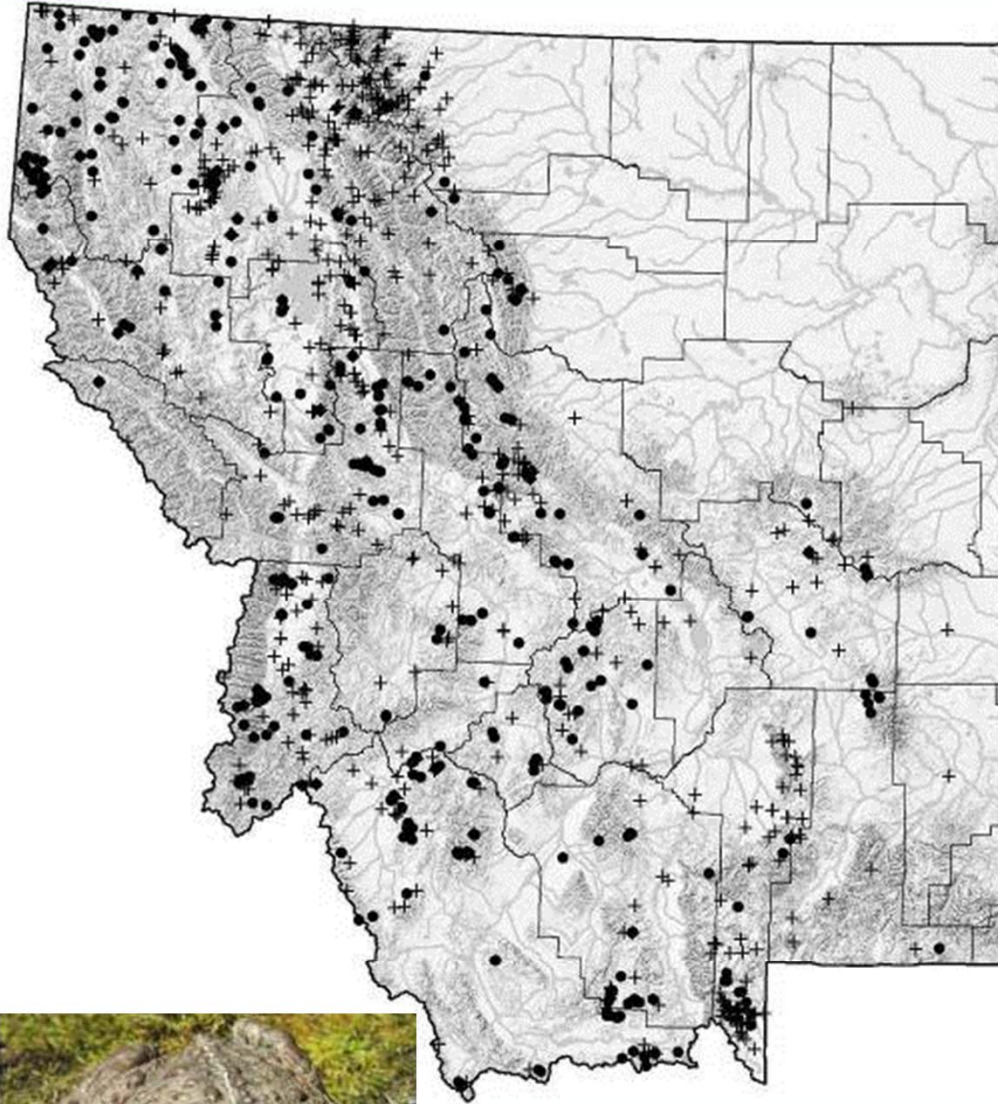
★ = Recent Positive ● = Recent negative ○ = Historic samples all negative



Northern Leopard Frog (*Rana pipiens*)



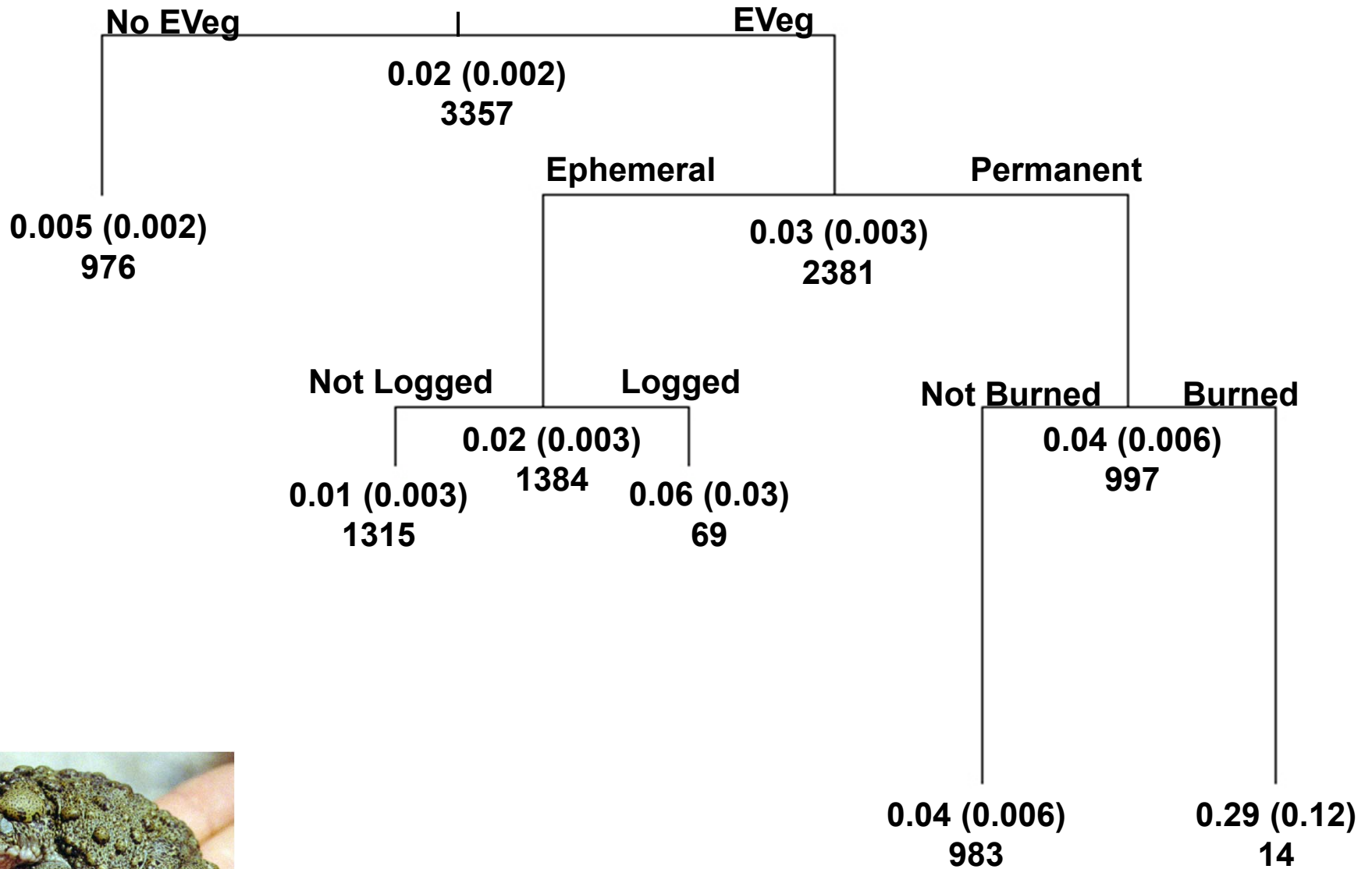
Western Toad (*Bufo boreas*)



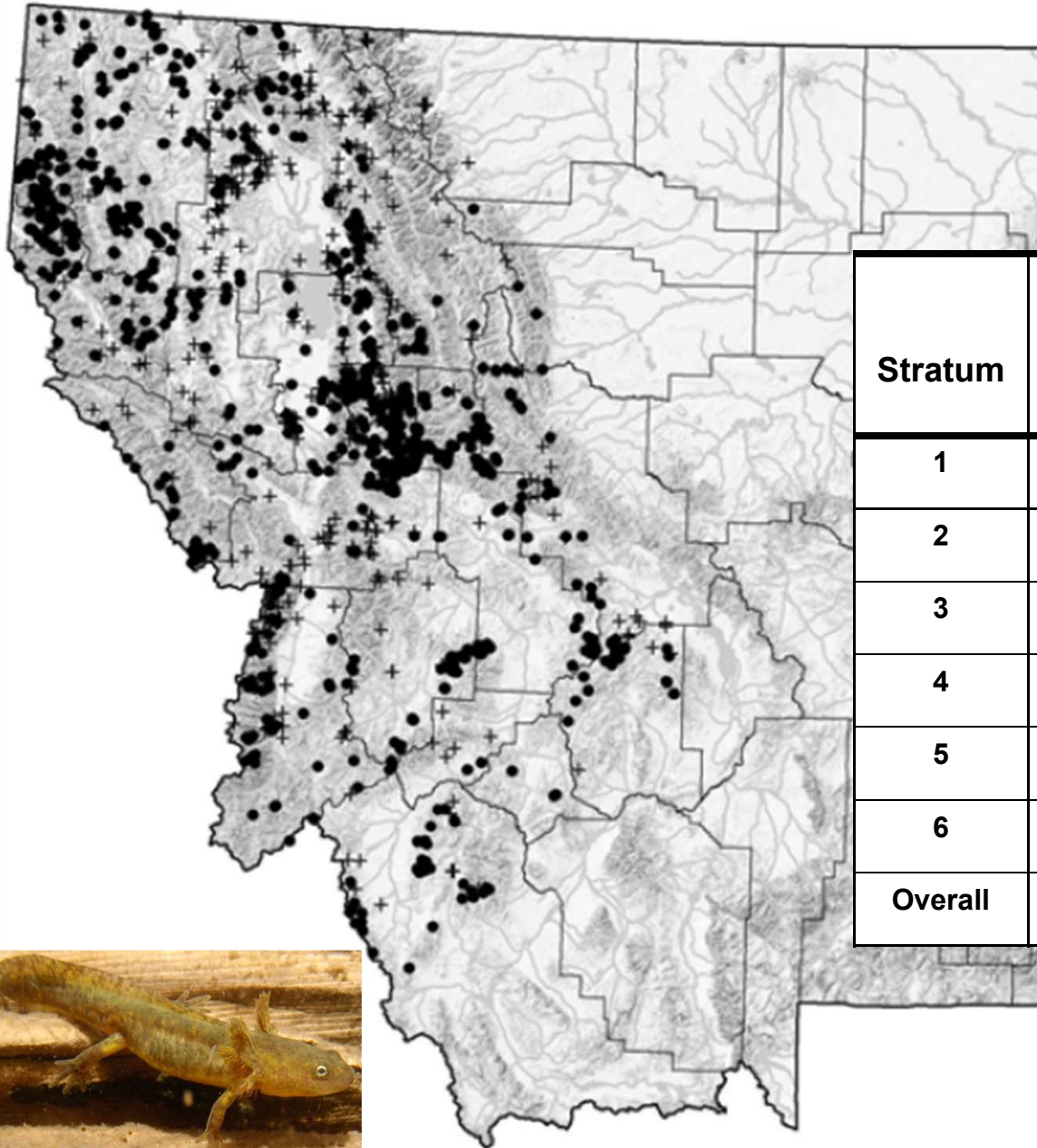
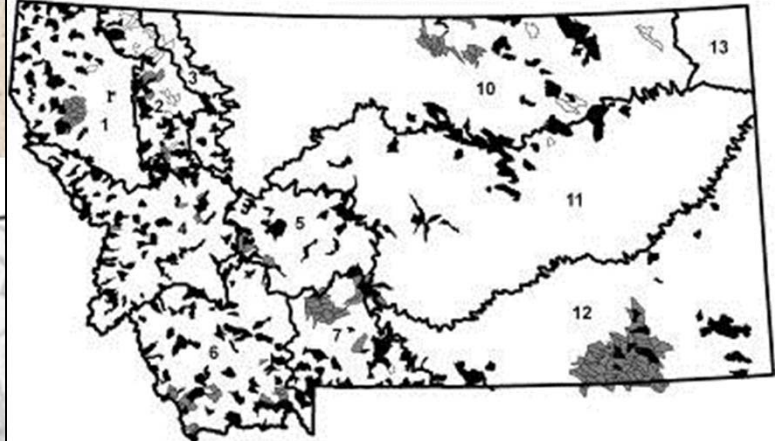
Stratum	N Watershed/ Sites	Naïve Watershed Occupancy Rate	Naïve Site Occupancy Rate
1	52 / 283	17 (8–26)	3 (1–5)
2	36 / 626	17 (6–27)	1 (0–2)
3	4 / 43	50 (2–98)	5 (0–11)
4	64 / 788	23 (14–33)	4 (3–5)
5	19 / 82	11 (0–23)	2 (0–6)
6	53 / 729	23 (12–33)	3 (2–4)
7	29 / 768	0 (-)	0 (-)
10	1 / 1	0 (-)	0 (-)
11	7 / 30	0 (-)	0 (-)
12	1 / 7	0 (-)	0 (-)
Overall	266 / 3357	17 (13–22)	2 (2–3)



Western Toad (*Bufo boreas*)



Long-toed Salamander (*Ambystoma macrodactylum*)



Stratum	N Watersheds / Sites	Naïve Watershed Occupancy Rate (95% CI)	Naïve Site Occupancy Rate (95% CI)
1	53 / 286	66 (55–77)	44 (39 – 50)
2	36 / 638	75 (63–87)	31 (28 – 35)
3	4 / 43	24 (2–98)	12 (2 – 21)
4	65 / 803	77 (68–86)	44 (41 – 48)
5	3 / 11	33 (0–87)	18 (0 – 41)
6	24 / 338	58 (39–78)	10 (7 – 13)
Overall	185 / 2119	70 (64–76)	34 (32 – 36)



Long-toed Salamander (*Ambystoma macrodactylum*)



No J or A Amphibians

J or A Amphibians

0.03 (0.003)
3993

Common Gartersnake (*Thamnophis sirtalis*)



No EVeg

EVeg

0.02 (0.003)
3204

No L Amphibians

L Amphibians

0.06 (0.01)
789

No L Amphibians

L Amphibians

No Fish

Fish

No EVeg

EVeg

0.01 (0.002)
1057

0.03 (0.004)
2147

0.12 (0.03)
110

0.05 (0.01)
679

0.02 (0.004)
1371

Ephemeral

Permanent

0.04 (0.01)
776

0.05 (0.01)
522

0.02 (0.01)
254

No EVeg
0.00 (-)
10

EVeg
0.14 (0.04)
94

0.00 (-)
16

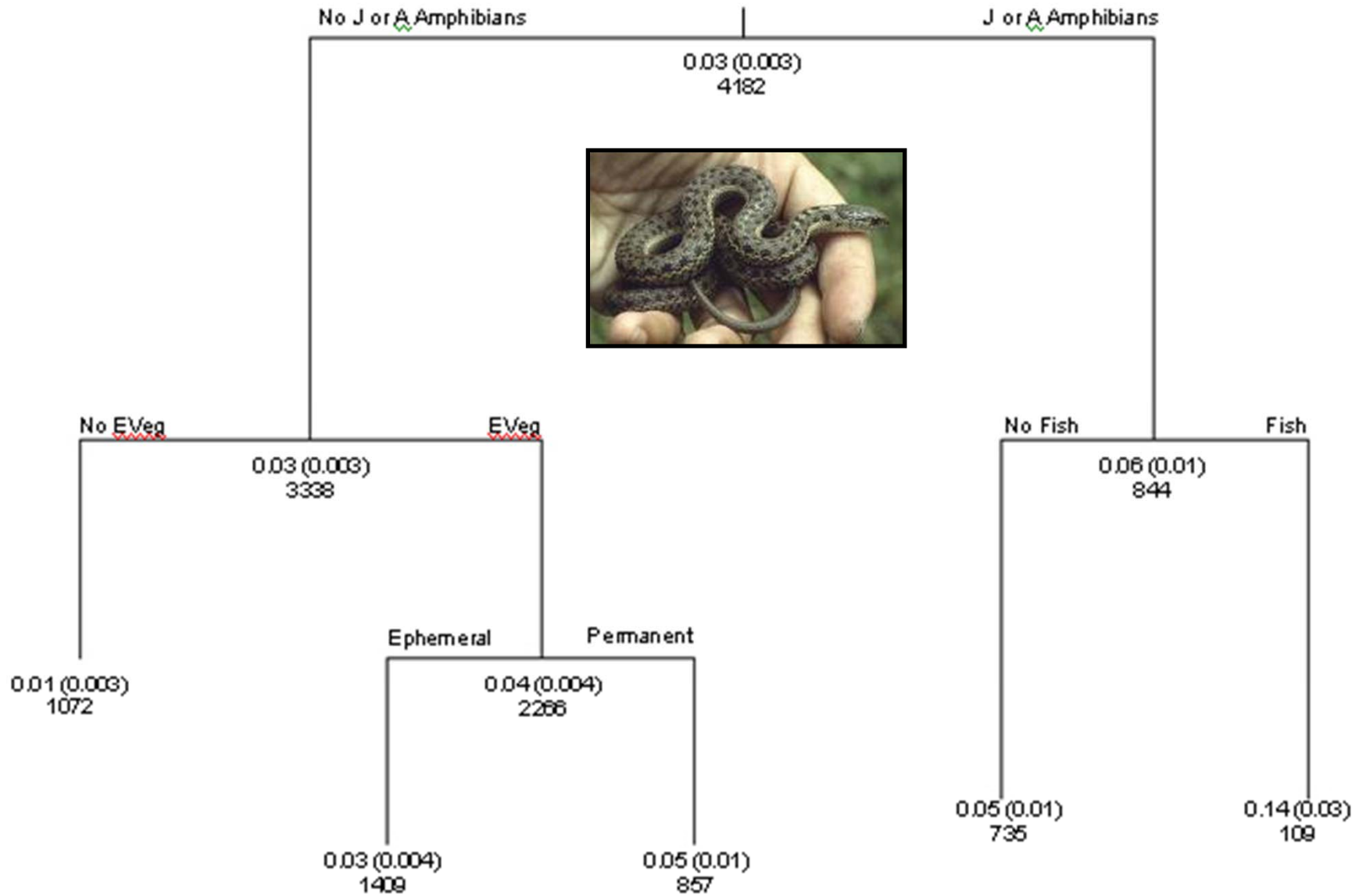
0.00 (-)
10

0.15 (0.04)
84

0.00 (-)
37

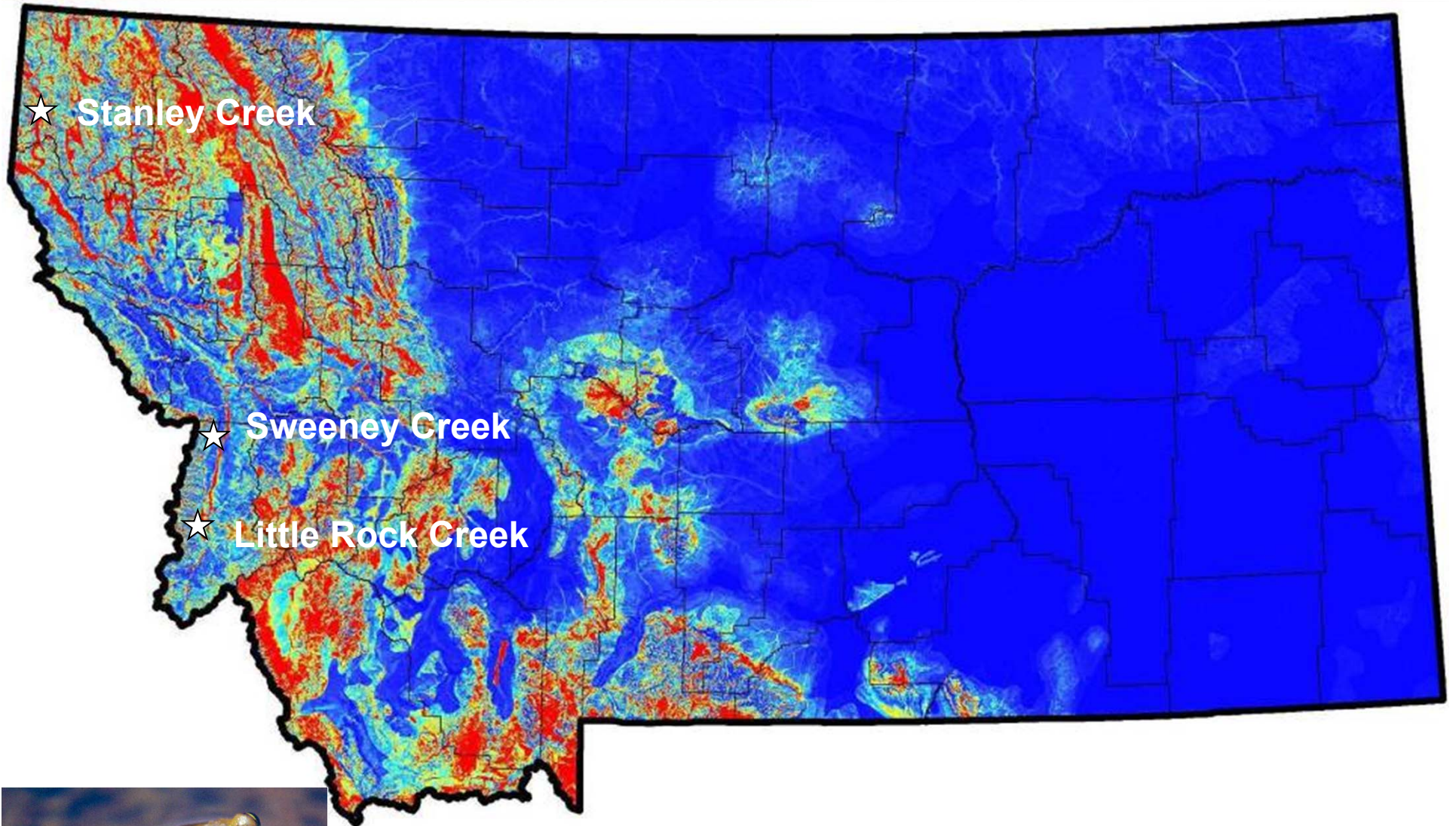
0.05 (0.01)
642

Terrestrial Gartersnake (*Thamnophis elegans*)

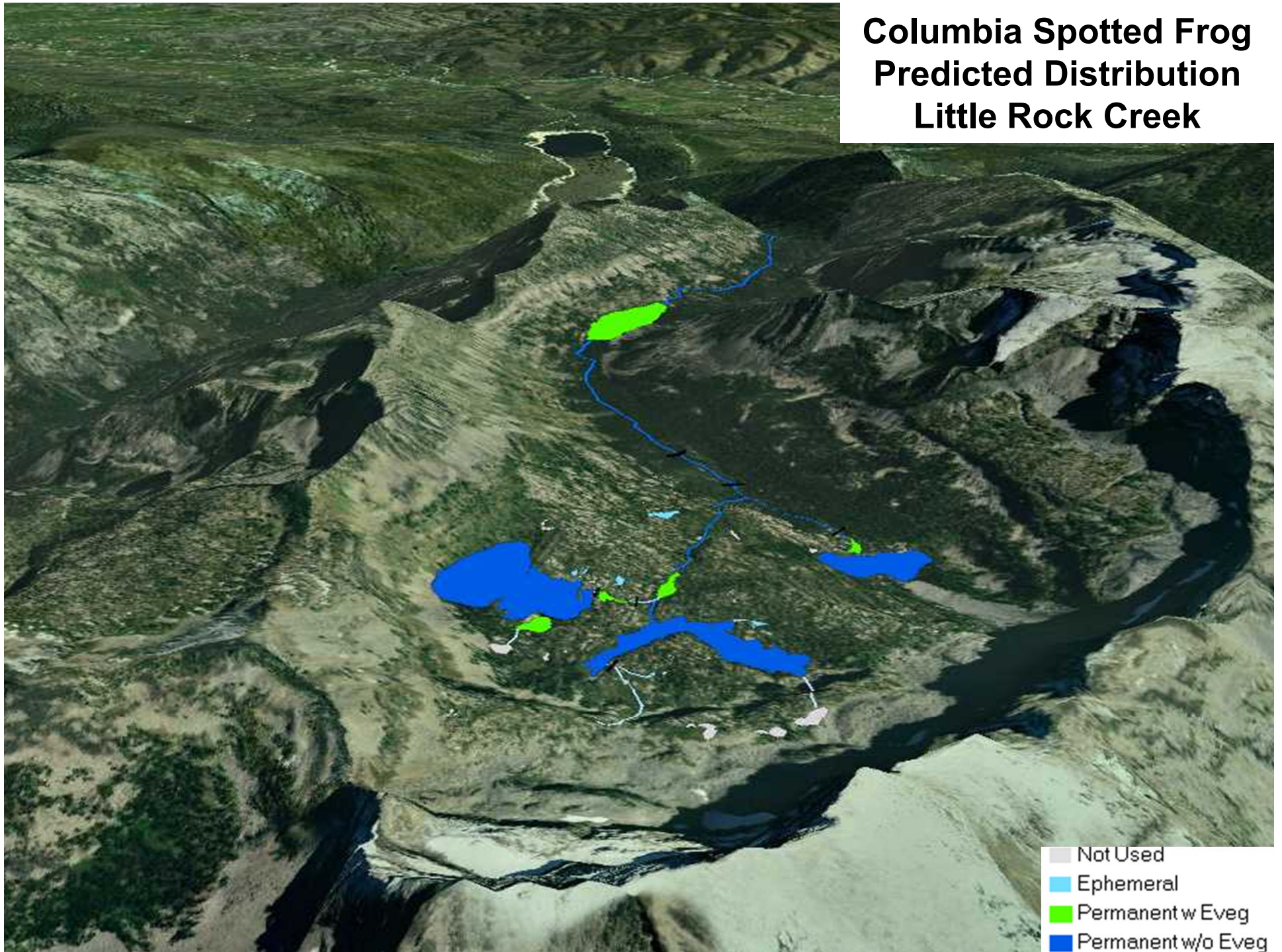


From Maxell (2009)

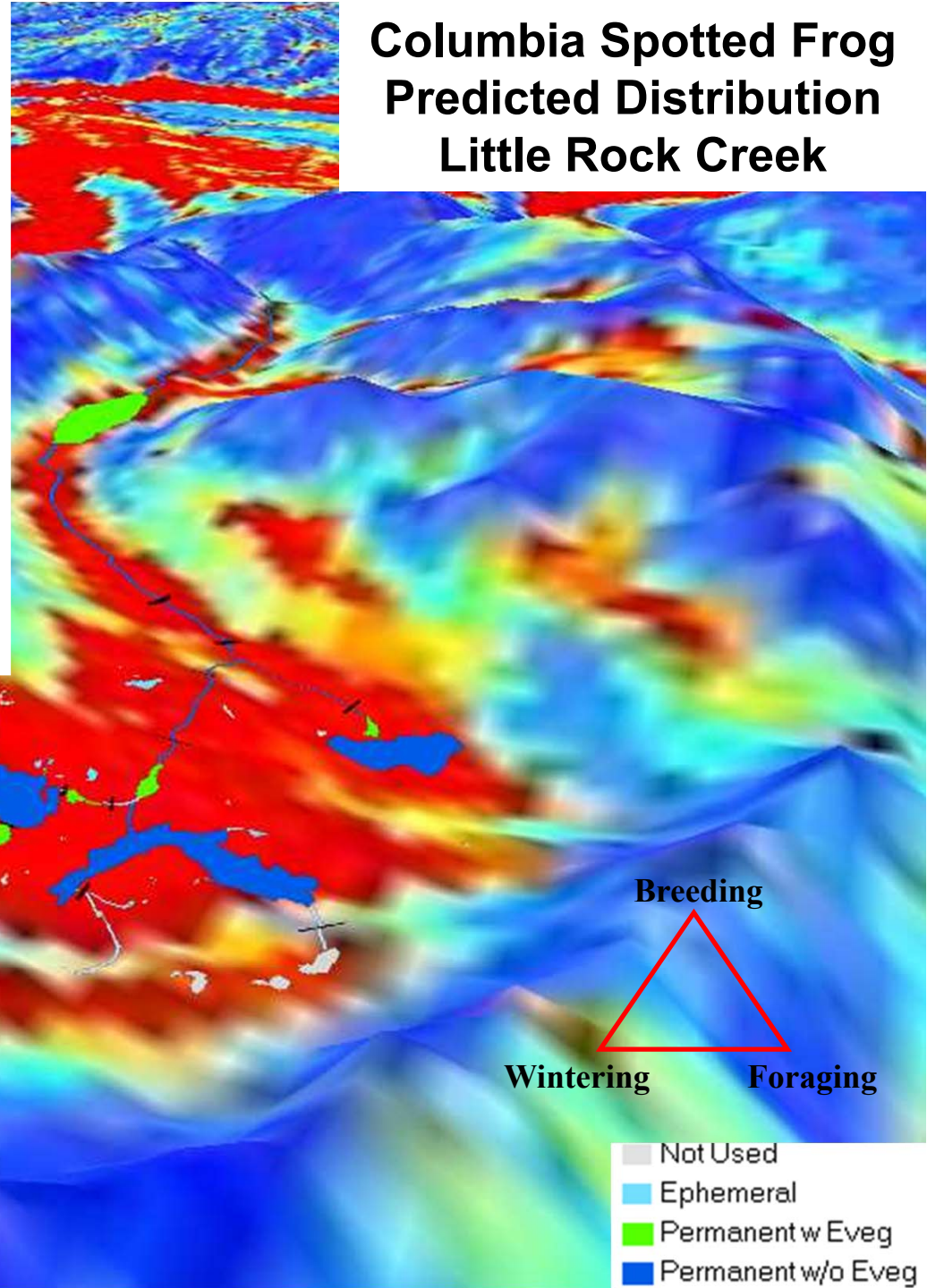
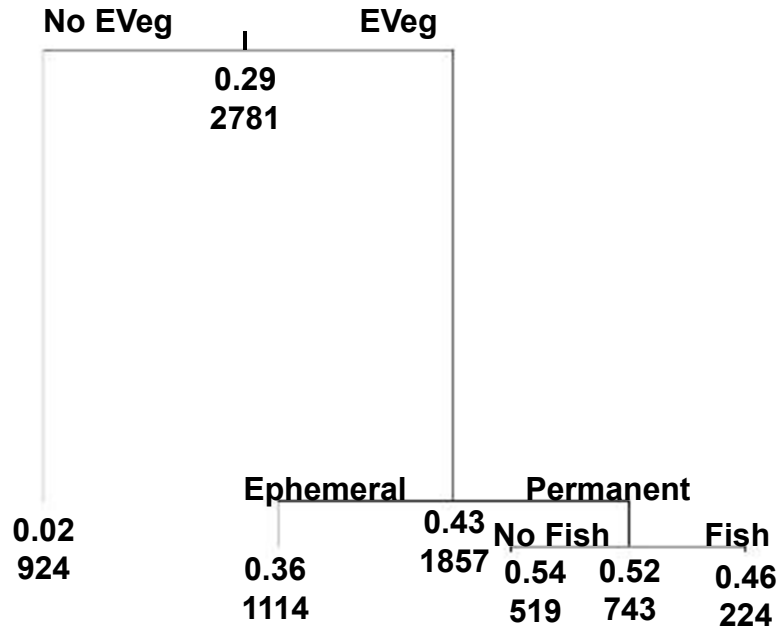
Columbia Spotted Frog (*Rana luteiventris*)



Columbia Spotted Frog Predicted Distribution Little Rock Creek



Columbia Spotted Frog Predicted Distribution Little Rock Creek



Breeding
Wintering **Foraging**

- Not Used
- Ephemeral
- Permanent w/ EVeg
- Permanent w/o EVeg

Response Summary

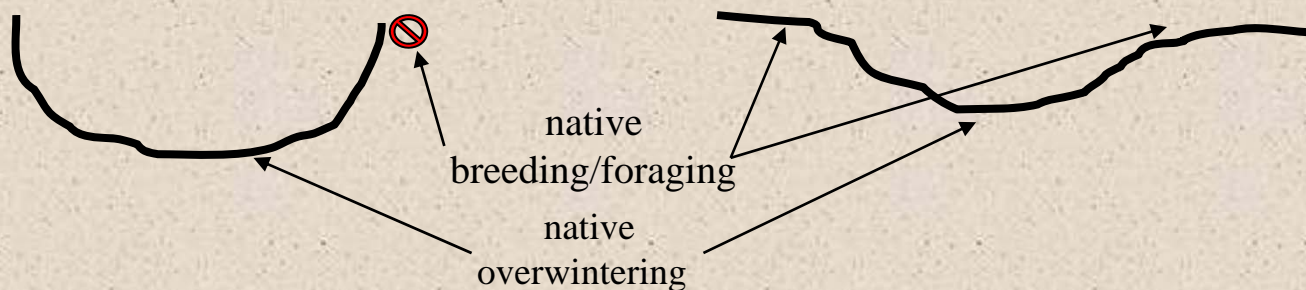
+ = Positive Response

- = Negative Response ● = No clear response

Species	Fish	Eveg	Hydroperiod
Long-toed Salamander	-	+*	Perm/Ephem
Barred Tiger Salamander	-	+*	Perm/Ephem
Plains Spadefoot	●	●	Ephemeral
Western Toad	●	+	Perm/Ephem
Great Plains Toad	-	+	Ephemeral
Woodhouse's Toad	-	+	Perm/Ephem
Boreal Chorus Frog	-	+	Perm/Ephem
Pacific Treefrog	-	+	Perm/Ephem
Northern Leopard Frog	+	+	Permanent
Columbia Spotted Frog	●	+	Permanent
Painted Turtle	●	+	Permanent
Terrestrial Gartersnake	+	+	Perm/Ephem
Plains Gartersnake	+	+	Permanent
Common Gartersnake	-	+	Perm/Ephem

Management Recommendations

- In general don't stock fish in areas they aren't native
- Emergent vegetation is preferred and can be used to mitigate impacts of fish
- Large numbers of natural and artificial lentic sites could be temporarily fenced to allow eveg to thrive
- Consider site characteristics and landscape context to maintain connectivity at local patch and landscape scales.
- When creating lentic sites consider full spectrum of hydroperiods species use

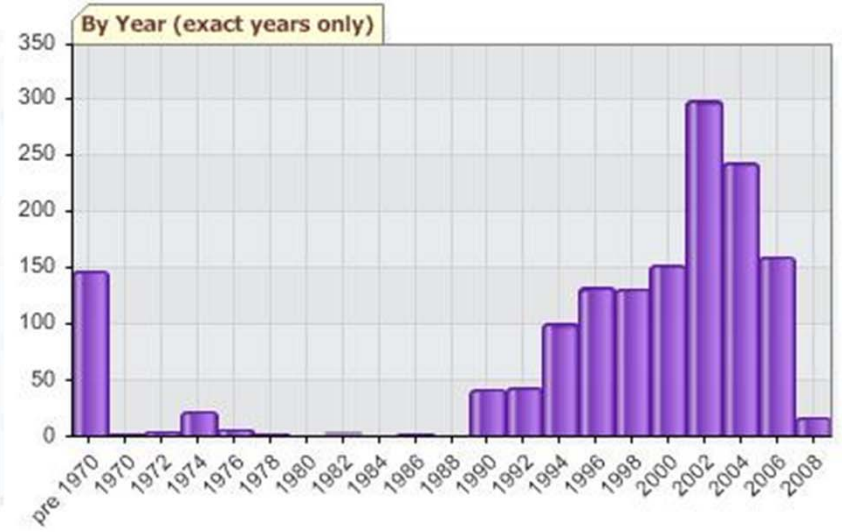


Structured Surveys and Observations of Western Toads



Montana Natural
Heritage Program
TRACKER

TAXA	ID (click to EDIT)	Common Name (Scientific Name)	OBSERVERS	OBSERVATION DATE		LOCATION				TYPE	PENDING	Additional Info		
				MONTH DAY YEAR	Notes	LL QLL QQLL	COUNTY	Comments	Spatial Precision (Meters)					
Amphibians	10588219	Western Toad (Bufo boreas) <i>Species of Concern</i>	Bell, Matthew	Jul 13, 2008		28A3	Lewis and Clark	7.5 Miles WSW of Hedges Mountain	0		Pending	Unknown Sex	Juveniles	
												Males	Immature	
												Females	1	Eggs
												Pairs		Nest
				Species Observation Notes: 65mm SVL, female seen on trail between parking area and rope swing.										
				Habitat Observation Notes: Tall grasses/vegetation downslope toward lake. Dry, rocky, mostly open ponderosa pine forest upslope.										



<http://mtnhp.org/Tracker/NHTMap.aspx>

View Photos of Sites Surveyed



Montana Natural
Heritage Program
TRACKER
MTNHP.ORG/Tracker


The screenshot displays the Montana Natural Heritage Tracker web application interface. On the left is a navigation sidebar with sections for Reports, Add Animal Observations, Photo Viewer, Photosets (with 'Amphibian Inventory Photos' checked), and Map Layers. The Map Layers section includes 'Map Layers' and 'Base Map' options. The 'Map Layers' section has checkboxes for Towns, County, LL / QLL / QOLL, Highway, 24K Quads, Township and Range, Lakes/Streams, Conservation Easements, and Special Designation Lands. The 'Base Map' section includes radio buttons for Air Photos (color 2005), Air Photos (color infrared), Air Photos (color 2005 w/ 2004 hi res cities), Air Photos (b/w), Topographic (hillshade), Topographic, Highway map, Hillshade, and [No Base Map]. A search bar is at the bottom of the sidebar.


The main map area shows a satellite view of a mountainous region with numerous yellow camera icons representing survey sites. A yellow arrow points from a site on the map to the 'Identify' window. The 'Identify' window displays the following information:

Identify


Lat: 46.2731 Long: -110.11073
SPX: 552083 SPY: 113900
Elevation: 2962 meters 9718 feet

Photos


Site = 7038008 - Pond, 1.3 miles S of Lake Mountain
Date = Aug 13, 2005
Name = 7_038_008.jpg


Site = 7043036 - Pond, 5.4 miles SW of Tumble Mountain
Date = Aug 13, 2005
Name = 7_043_036a.jpg

[Click to view larger image](#)


Site = 7043036 - Pond, 5.4 miles SW of Tumble Mountain
Date = Aug 13, 2005
Name = 7_043_036b.jpg

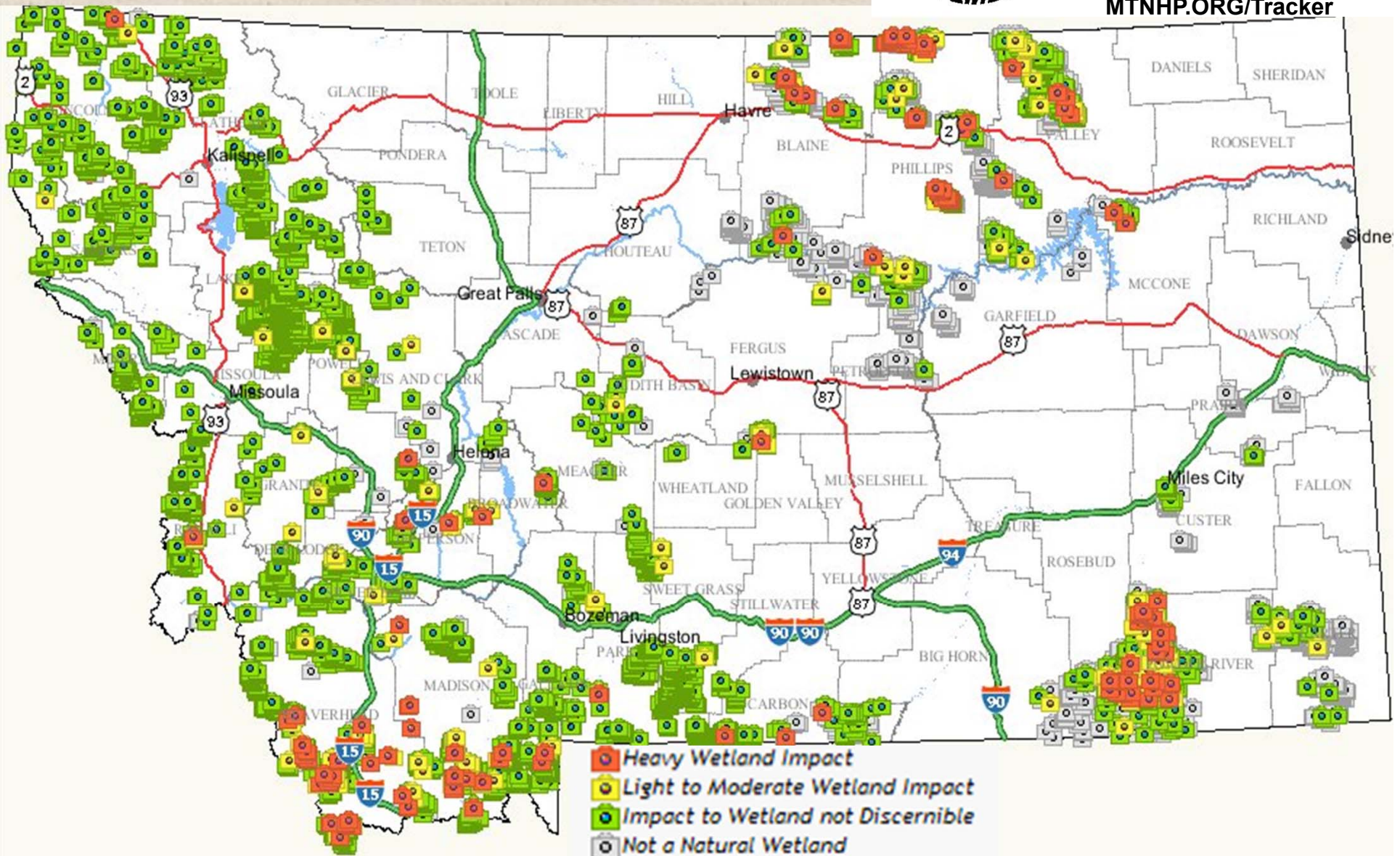
Below the map, a larger photo shows a pond in a rocky, mountainous landscape. A red triangle on the map is labeled 'Breeding', with 'Wintering' and 'Foraging' labels below it.

Structural Impact to Wetlands



Montana Natural Heritage Program
TRACKER

MTNHP.ORG/Tracker



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[http://mtnhp.org/animal/presentations/060709 MT Herps ID Status files/frame.htm](http://mtnhp.org/animal/presentations/060709_MT_Herps_ID_Status_files/frame.htm)



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