

# Status and Management of Montana's Amphibians and Reptiles

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MONTANA  
**Natural Heritage  
Program**  
<http://mtnhp.org>

# Who Are They and How Many?

**Amphibians ~ 6,012 spp. (14)**

- **Caudata (Salamanders) ~ 556 spp. (4)**
- **Gymnophiona (Caecilians) ~ 171 spp. (0)**
- **Anura (Frogs and Toads) ~ 5,285 spp. (10)**

**Reptiles ~ 8,240 spp. (18)**

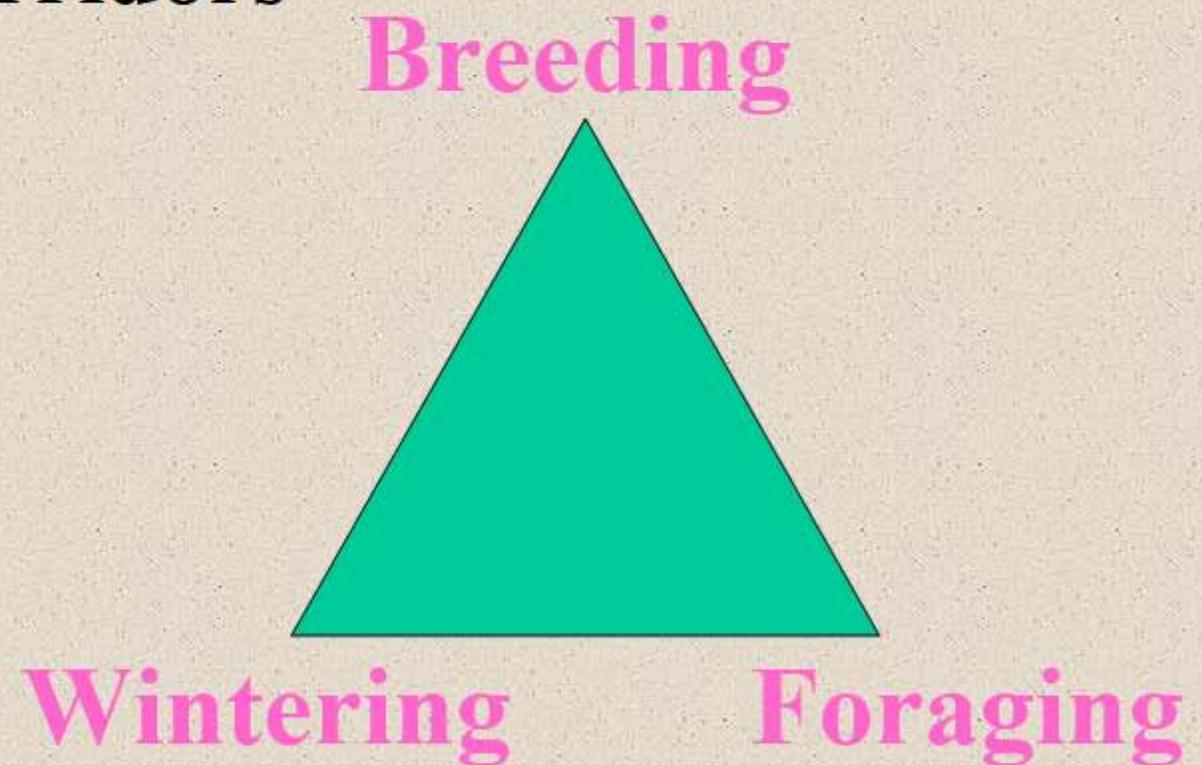
- **Rhyncocephalia (Tuatara) 2 spp. (0)**
- **Crocodylia (Crocodiles) 23 spp. (0)**
- **Testudines (Turtles) ~ 307 spp. (3)**
- **Sauria (Lizards) ~ 4,765 spp. (5)**
- **Serpentes (Snakes) ~ 2,978 spp. (10)**
- **Amphisbaenia (Worm Lizards) ~ 165 (0)**



# Pertinent Background Information

## Complex Life Histories

- **Complex Habitat Use**
- **Managers Need to Consider Full Triangle of Habitats Required and Migration Corridors**



# Ecto

# ance

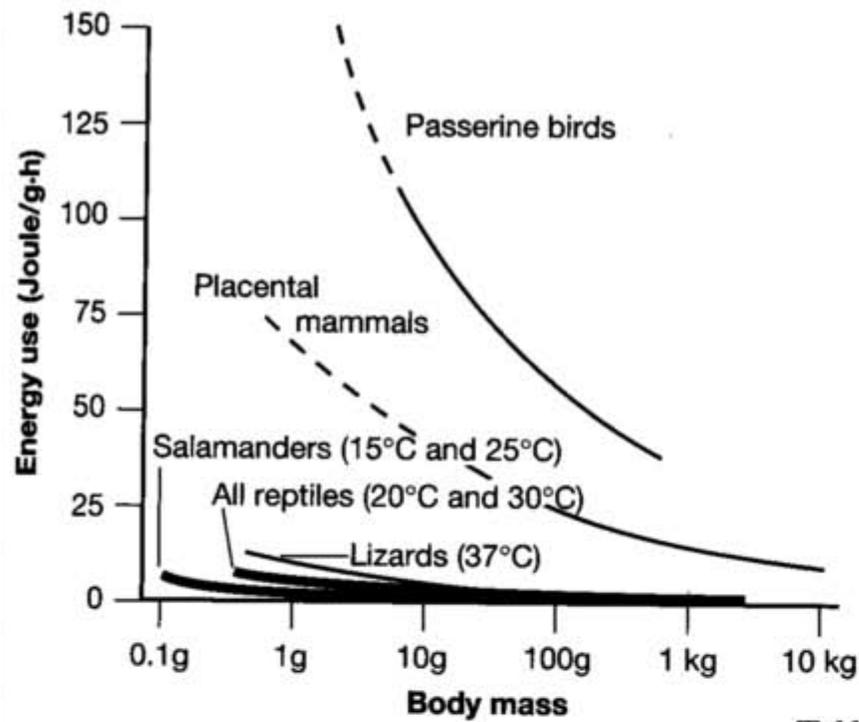


Table 1-1 Efficiency of biomass conversion by ectotherms and endotherms.\*

Ectotherms		Endotherms	
Species	Efficiency	Species	Efficiency
Red-backed salamander <i>Plethodon cinereus</i>	48	Kangaroo rat <i>Dipodomys merriami</i>	0.8
Mountain salamander <i>Desmognathus ochrophaeus</i>	76-98	Field mouse <i>Peromyscus polionotus</i>	1.8
Panamanian anole <i>Anolis limifrons</i>	23-28	Meadow vole <i>Microtus pennsylvanicus</i>	3.0
Side-blotched lizard <i>Uta stansburiana</i>	18-25	Red squirrel <i>Tamiasciurus hudsonicus</i>	1.3
Hognose snake <i>Heterodon contortrix</i>	81	Least weasel <i>Mustela rixosa</i>	2.3
Python <i>Python curtus</i>	6-33	Savanna sparrow <i>Passericulus sandwichensis</i>	1.1
Adder <i>Vipera berus</i>	49	Marsh wren <i>Telmatodytes palustris</i>	0.5
Average of 12 species	50	Average of 19 species	1.4

\*These are net conversion efficiencies calculated as (energy converted/energy assimilated) × 100.  
Source: Pough 1980.



# Montana Salamanders

## Long-toed Salamander



## Tiger Salamander



## Coeur d'Alene Salamander



# Montana Toads



## Plains Spadefoot



## Western Toad



## Great Plains Toad



## Woodhouse's Toad



# Western Toad



**Larval Period**  
**6-10 weeks**  
**= 1 cohort**

**Breeding**



**Wintering**

**Foraging**





# Montana Frogs

## Rocky Mountain Tailed Frog



## Pacific Treefrog



## Boreal Chorus Frog



## American Bullfrog



**Exotic!**

## Columbia Spotted Frog



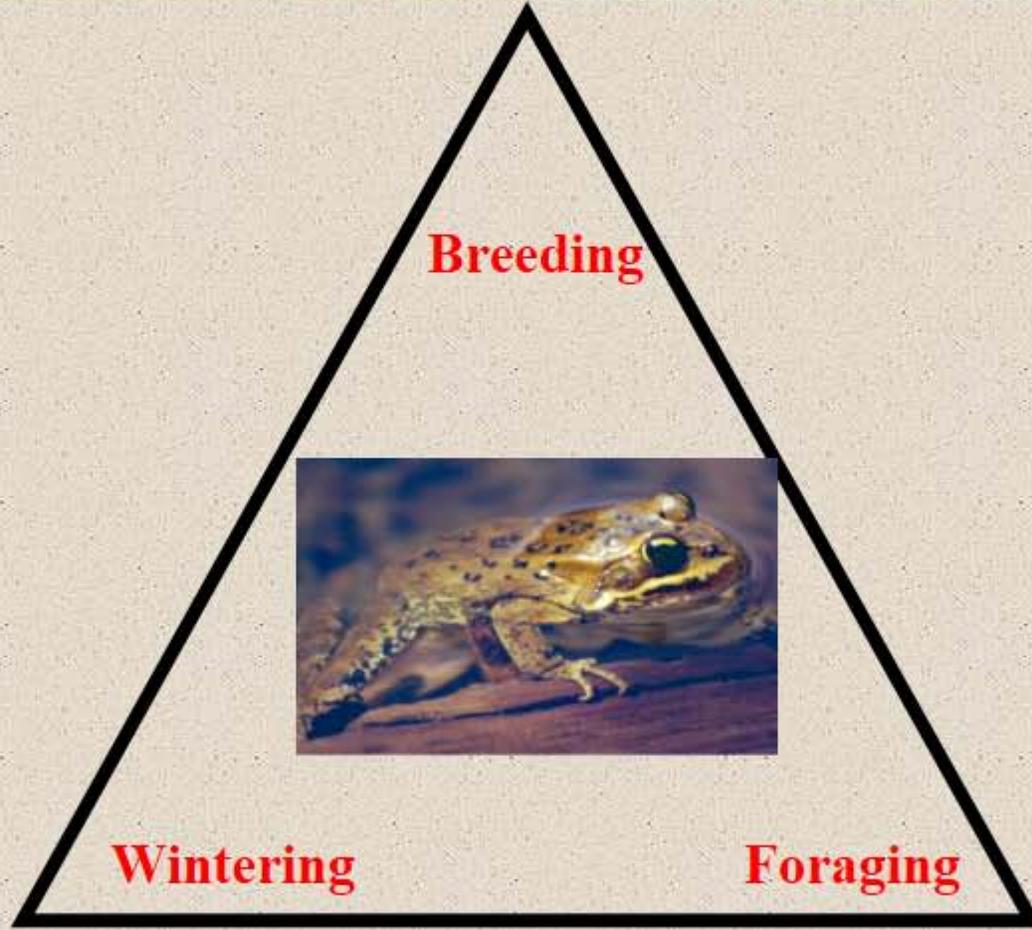
## Northern Leopard Frog



# Columbia Spotted Frog



Larval Period  
2 to 4 months  
= 1 cohort



# Montana Turtles

## Snapping Turtle



## Spiny Softshell



## Painted Turtle



# Western Painted Turtle



**Breeding**



**Wintering**

**Foraging**



# Montana Lizards

**Greater Short-horned Lizard**



**Common Sagebrush Lizard**



**Northern Alligator Lizard**



**Western Skink**



# Northern Alligator Lizard



**Breeding**



**Wintering**

**Foraging**



# Montana Snakes

Rubber Boa



Western Hog-nosed Snake



Eastern Racer



Gophersnake



Milksnake



Smooth Greensnake



Terrestrial Gartersnake



Plains Gartersnake



Common Gartersnake



Western Rattlesnake



# Common Garter Snake



**Breeding**



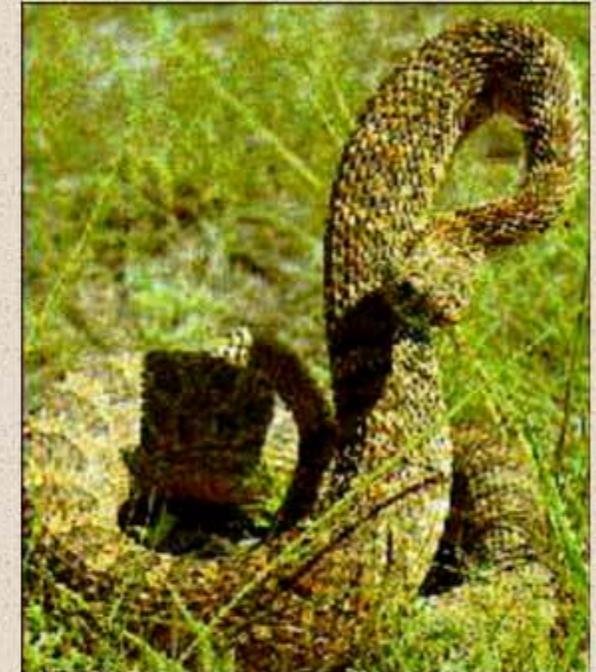
**Wintering**

**Foraging**



# Snake Bite

- **What to do:**
  - Stay calm and keep heart rate low
  - Seek medical attention ASAP
- **What not to do:**
  - Use a tourniquet
  - Pack with ice
  - Make an incision and suck out poison
  - Try to denature proteins with electricity



# Herpetological Declines

- **Loss and Deterioration of Habitat**
  - **Introduction of Exotic Species**
  - **Diseases / Pathogens**
  - **Lack of Knowledge**
  - **Pollutants**
  - **Synergistic Effects**
- 
- **Increased Ambient UV-B Radiation**
  - **Human Harvest**
  - **Climate Change**



# Montana Declines - Northern Leopard Frog (*Rana pipiens*)

From Stebbins (2003) - Field Guide to Western Amphibians and Reptiles



Pre and Post-1990 Distributions

# Undocumented Species Possibly Native to Montana



**Idaho Giant Salamander**  
*Dicamptodon aterrimus*

**Wood Frog**  
*Rana sylvatica*



**Canadian Toad**  
*Bufo hemiophrys*



**Great Basin Spadefoot**  
*Scaphiopus intermontanus*



**Pigmy Short-horned Lizard**  
*Phrynosoma douglasii*

# **Legal/Management Status of Montana's Amphibians and Reptiles**

- All classified as non-game animals**
- Collection for commercial purposes only with a permit (exception is prairie rattlesnake)**
- 7 species are USFS “Sensitive Species”**
- 7 species are BLM “Special Status Species”**
- 14 species (48%) are listed as “Species of Special Concern” by MTNHP and MFWP**
- Poor protection of habitats for many species**

# Loss and Deterioration of Habitat

## Direct Loss

- \*Filling in of wetlands
- \*Destruction of Hibernacula
- \*Flooding habitats

## Functional Loss

- \*Introduced predators
- \*Hydroperiod alteration
- \*Impassible roads/traffic
- \*Altered vegetation
- \*Loss of prey

**Breeding**



**Wintering**

**Foraging**

Forest		Wetlands/Marshes	
Argentina	50%	United States	54%
Guatemala	60%	Cameroon	80%
Mexico	66%	New Zealand	90%
Greece	70%	Italy	94%
India	78%	Australia	95%
Philippines	79%	Thailand	96%
Ethiopia	86%	Vietnam	Almost 100%
Bangladesh	96%		
Savannah/Grassland		Desert/Scrub	
Madagascar	78%	Pakistan	69%
Nigeria	80%	Sri Lanka	75%
New Zealand	90%	India	88%
United States	Almost 100%		

Data from World Resources Institute 1990.

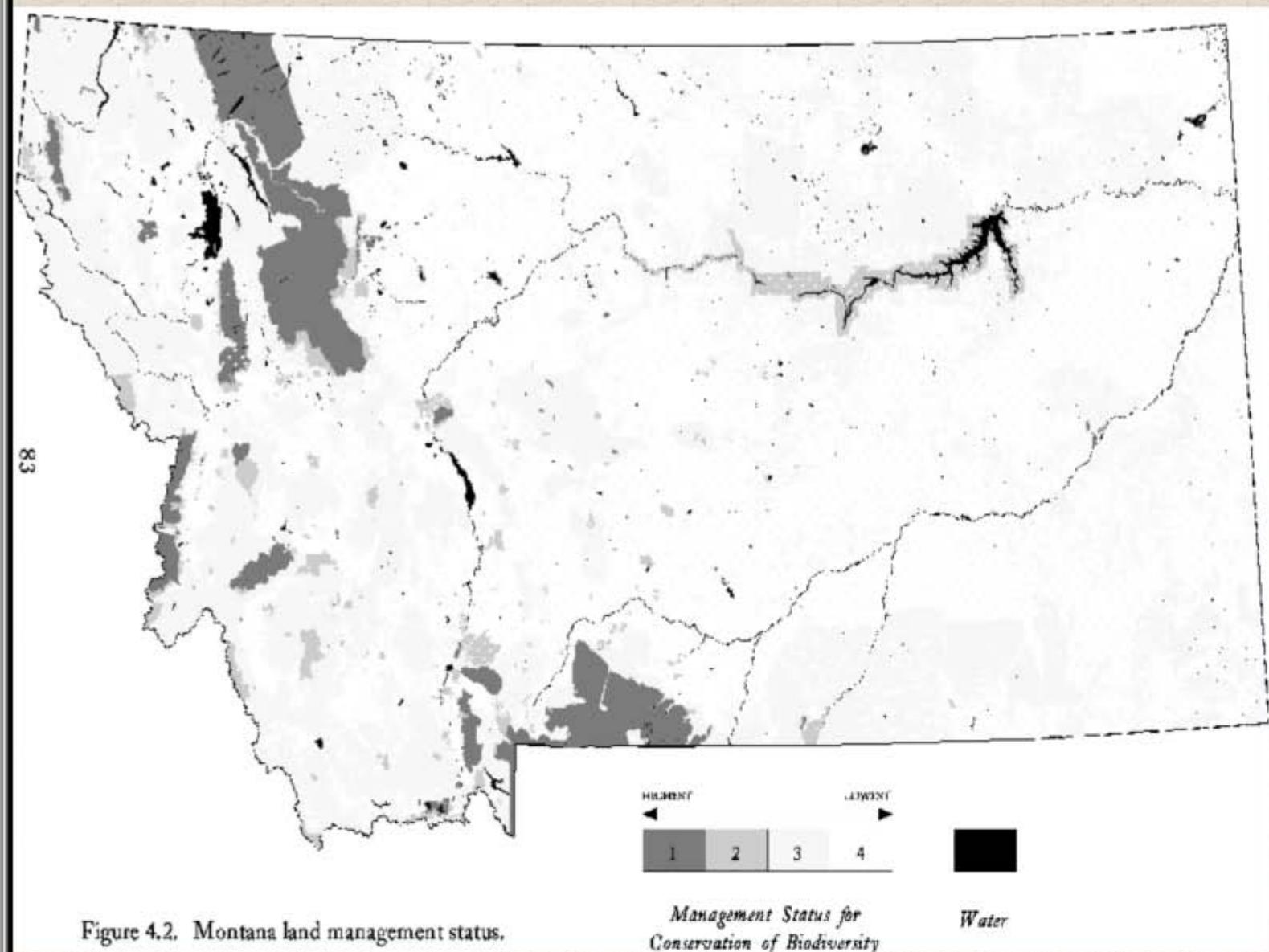
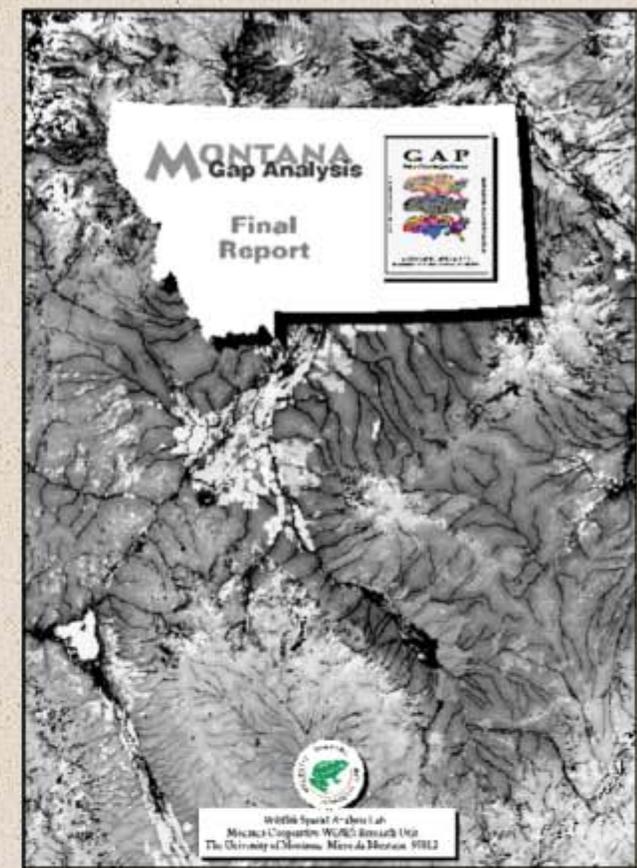
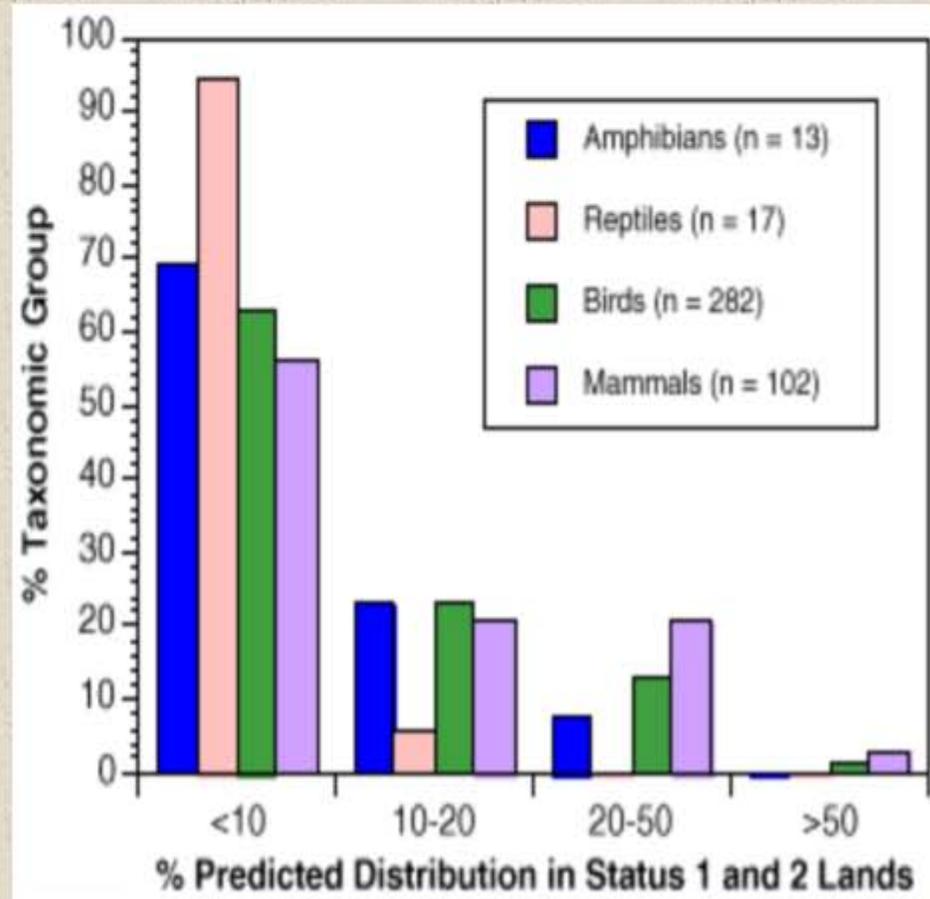


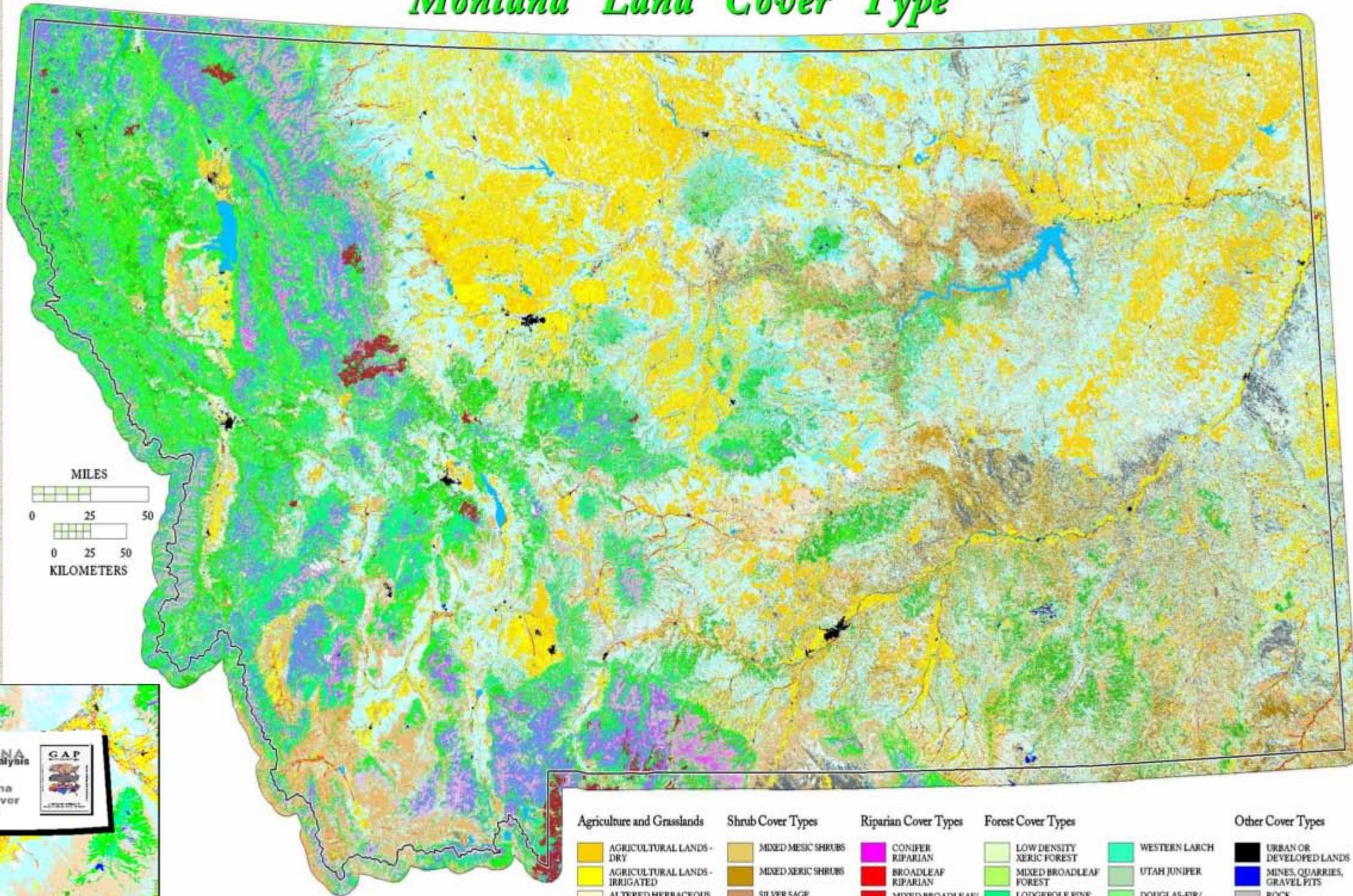
Figure 4.2. Montana land management status.



# Land Management Status for Montana Herpetofauna

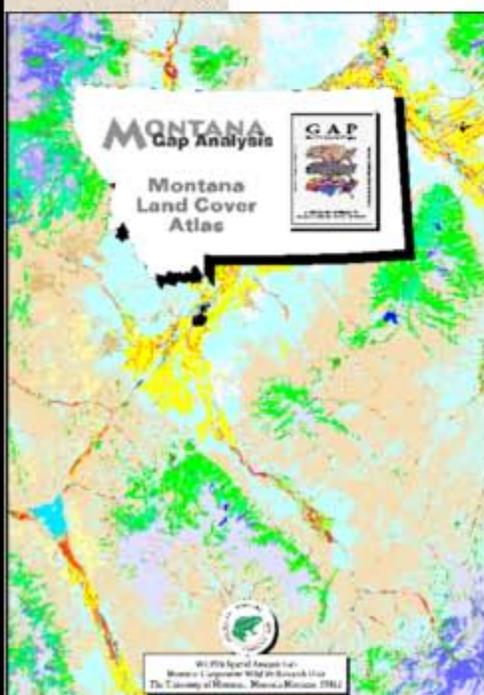


# Montana Land Cover Type



Agriculture and Grasslands	Shrub Cover Types	Riparian Cover Types	Forest Cover Types	Other Cover Types	
AGRICULTURAL LANDS - DRY	MIXED MESIC SHRUBS	CONIFER RIPARIAN	LOW DENSITY XERIC FOREST	WESTERN LARCH	URBAN OR DEVELOPED LANDS
AGRICULTURAL LANDS - IRRIGATED	MIXED XERIC SHRUBS	BROADLEAF RIPARIAN	MIXED BROADLEAF FOREST	UTAH JUNIPER	MINES, QUARRIES, GRAVEL PITS
ALTERED HERBACEOUS	SILVER SAGE	MIXED BROADLEAF/ CONIFER RIPARIAN	LOGEPOLE PINE	DOUGLAS-FIR/ LODGEPOLE PINE	ROCK
VERY LOW COVER GRASSLANDS	SALT-DESERT SHRUB/ DRY SALT FLATS	SHRUB RIPARIAN	LIMBER PINE	MIXED WHITEBARK PINE FOREST	BADLANDS
LOW/MODERATE COVER GRASSLANDS	SAGEBRUSH	MIXED RIPARIAN	PONDEROSA PINE	MIXED SUBALPINE FOREST	MISSOURI BREAKS
MODERATE/HIGH COVER GRASSLANDS	MESIC SHRUB-GRASS ASSOCIATIONS	GRAMINOID & FORB RIPARIAN	GRAND FIR	MIXED MESIC FOREST	MIXED BARREN SITES
	XERIC SHRUB-GRASS ASSOCIATIONS		WESTERN RED CEDAR	MIXED XERIC FOREST	MONTANE PARKLANDS/ SUBALPINE MEADOWS
			WESTERN HEMLOCK	MIXED BROADLEAF/ CONIFER FOREST	ALPINE MEADOWS
			DOUGLAS-FIR	STANDING BURNT FOREST	SNOWFIELDS OR ICE
			ROCKY MTN. JUNIPER	WATER	

May 28, 1998  
 Wildlife Spatial Analysis Lab  
 Montana Cooperative Wildlife Research Unit  
 The University of Montana  
 Missoula, Montana 59812  
 www.wru.umt.edu



# Introduction of Exotic Species

- **Sport Fish**



- **Mosquito Fish**



- **Cane Toads**



- **Bullfrogs**



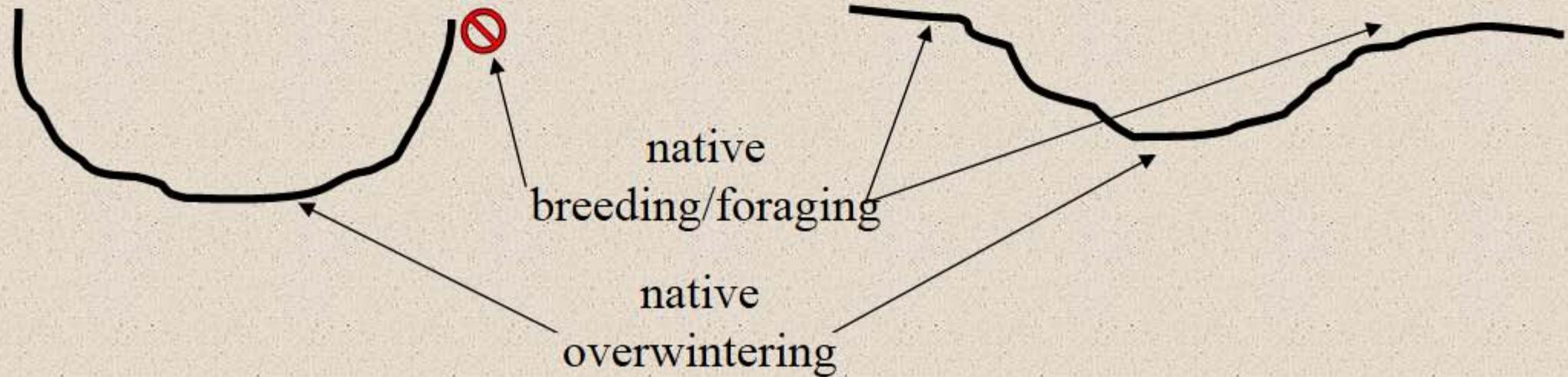
- **Crayfish**

- **Native Mesopredators** (e.g., racoons, crows)

# Concerns Related to Proliferation of Fish Ponds

Pond Created Specifically for Fish

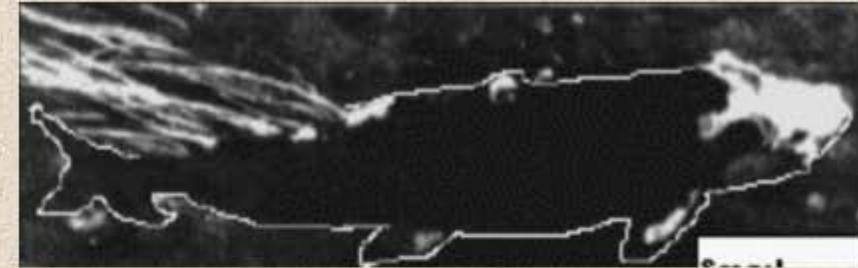
Pond Created Specifically for Amphibians, Insects, and other Natives



# Diseases / Pathogens



1. *Saprolegnia ferax* - a water mold
2. *Ranavirus* – introduced with fish and results in necrosis and hemorrhagic disease
3. *Batrachochytrium dendrobatidis* – a chytrid fungus



# Demasculinization and the Herbicide Atrazine

## Lab Study of *Xenopus laevis*

Hayes et al. (2002) - PNAS 99:5476-5480

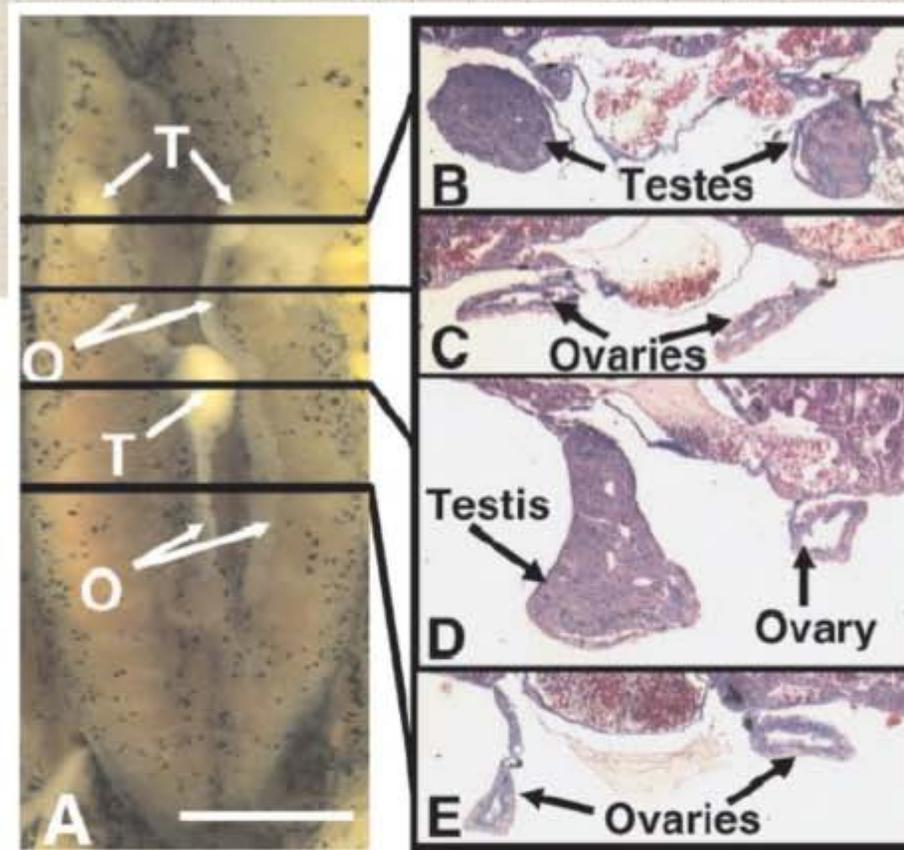
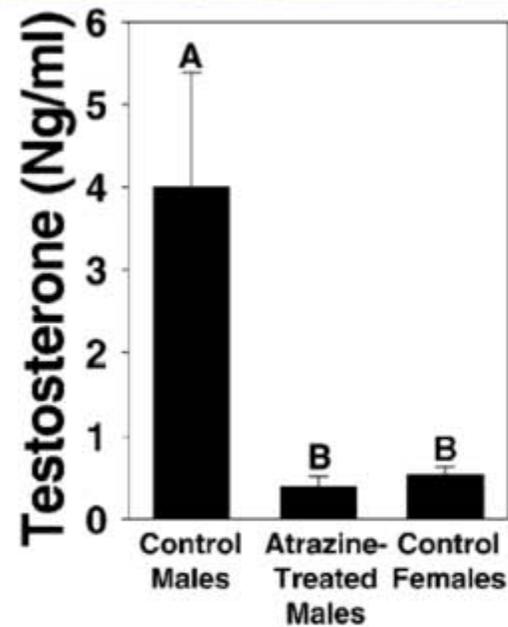
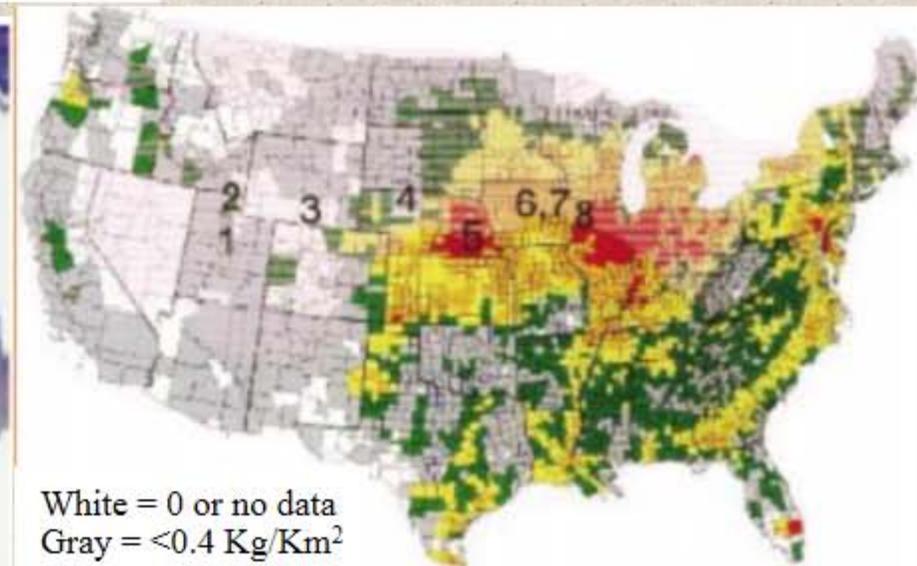
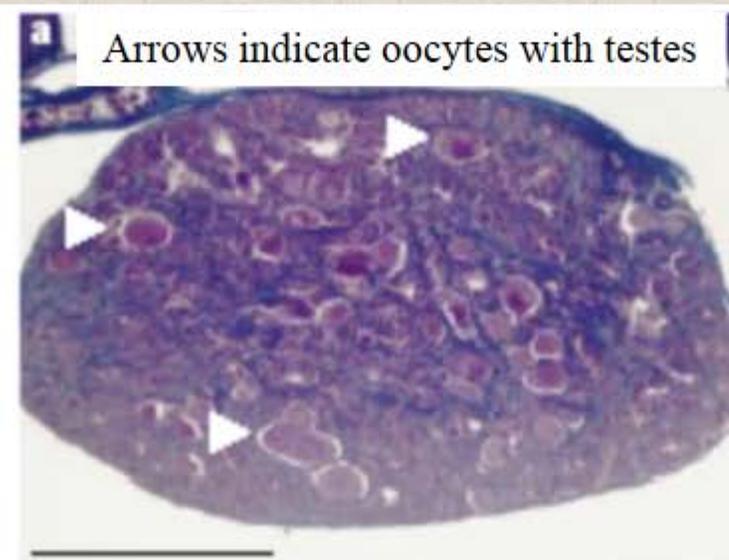


Fig. 2. An atrazine-treated hermaphrodite. The specimen shown was treated with 1 ppb atrazine. A shows the entire dissected kidney-adrenal-gonadal complex. B-E show 8  $\mu\text{m}$  of transverse cross-sections (stained with Mallory's trichrome stain) through the areas indicated by the lines in A. [Bar = 0.1 mm (A) and 25  $\mu\text{m}$  (B-E)]. FB, fatbody; K, kidney; O, ovary(ies); T, testis(es). Note the absence of pigment in the ovaries, which was typical of hermaphrodites.

Fig. 4. Effect of 46-day exposure to atrazine on plasma testosterone levels in sexually mature male *X. laevis*. Sexually mature males were housed individually. Experimental animals were treated every 3 days with 25 ppb atrazine, and controls were treated identically except without atrazine exposure. Control females are shown for comparative purposes. Letters above bars show statistical groupings (ANOVA,  $P < 0.05$ ).

## Field Study of *Rana pipiens*

Hayes et al. (2003) - Nature 419:895-896



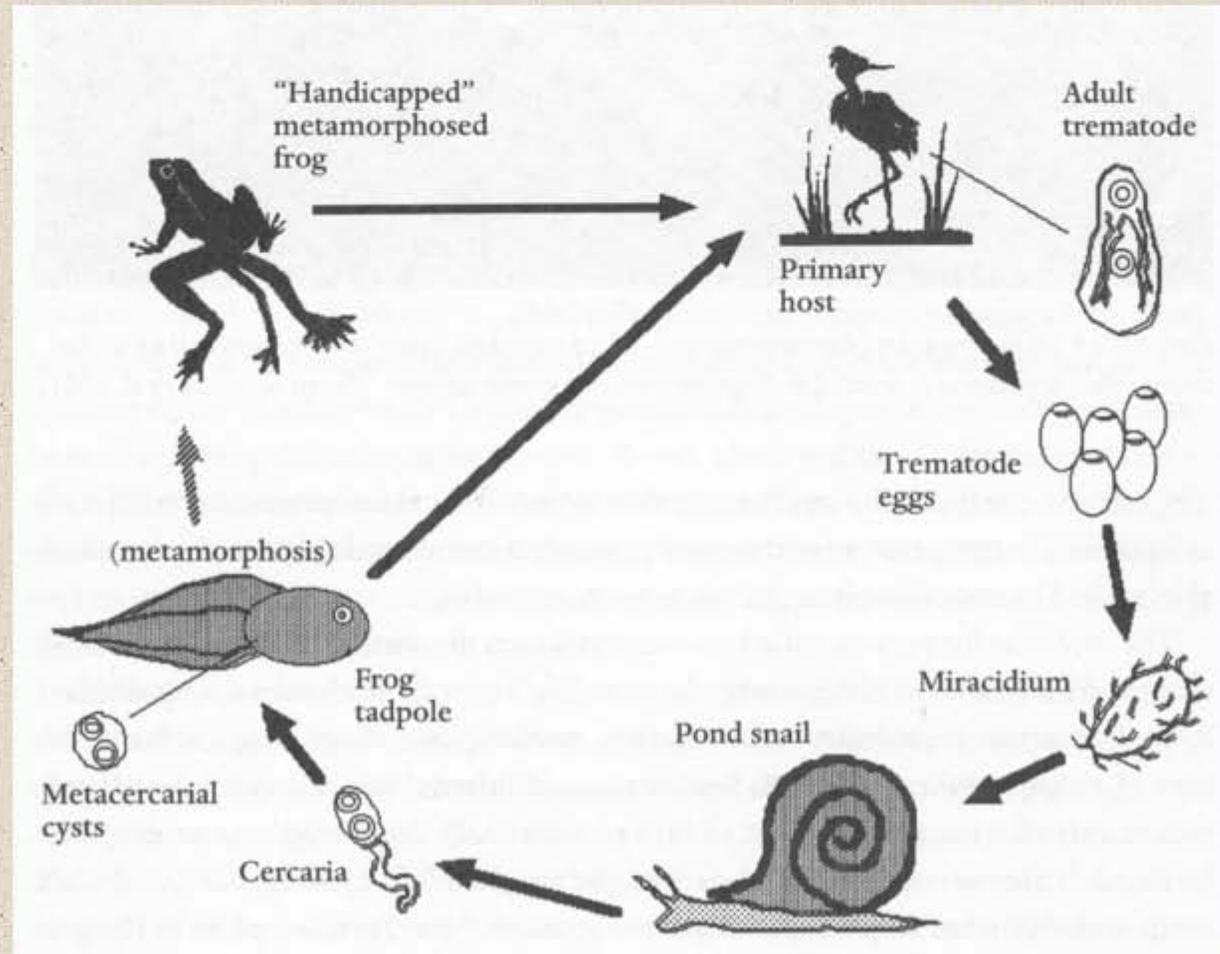
# Deformities

## Missing Limbs

## Multiple Limbs

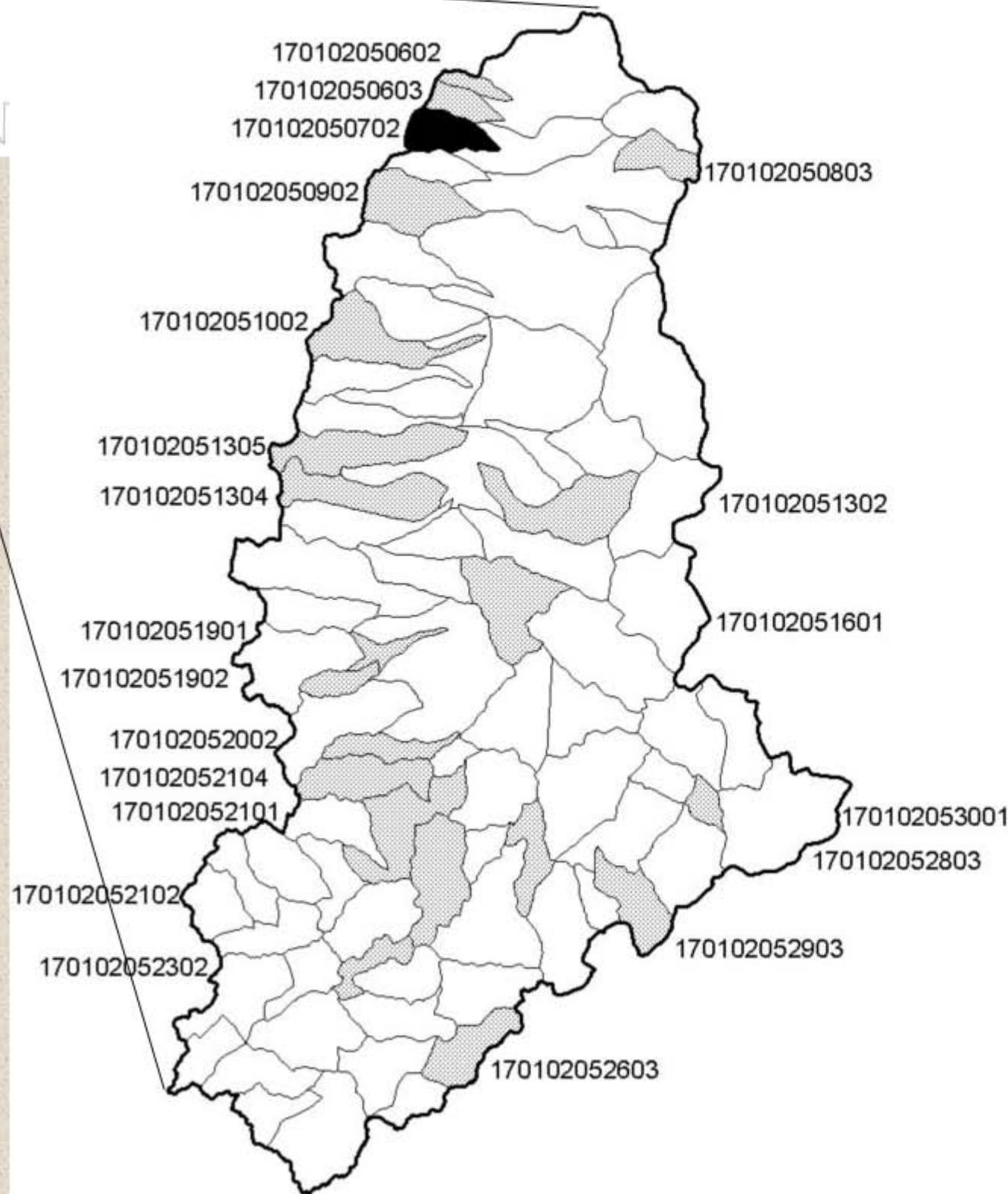


## Pest/Herbicides or Parasites?



# Example

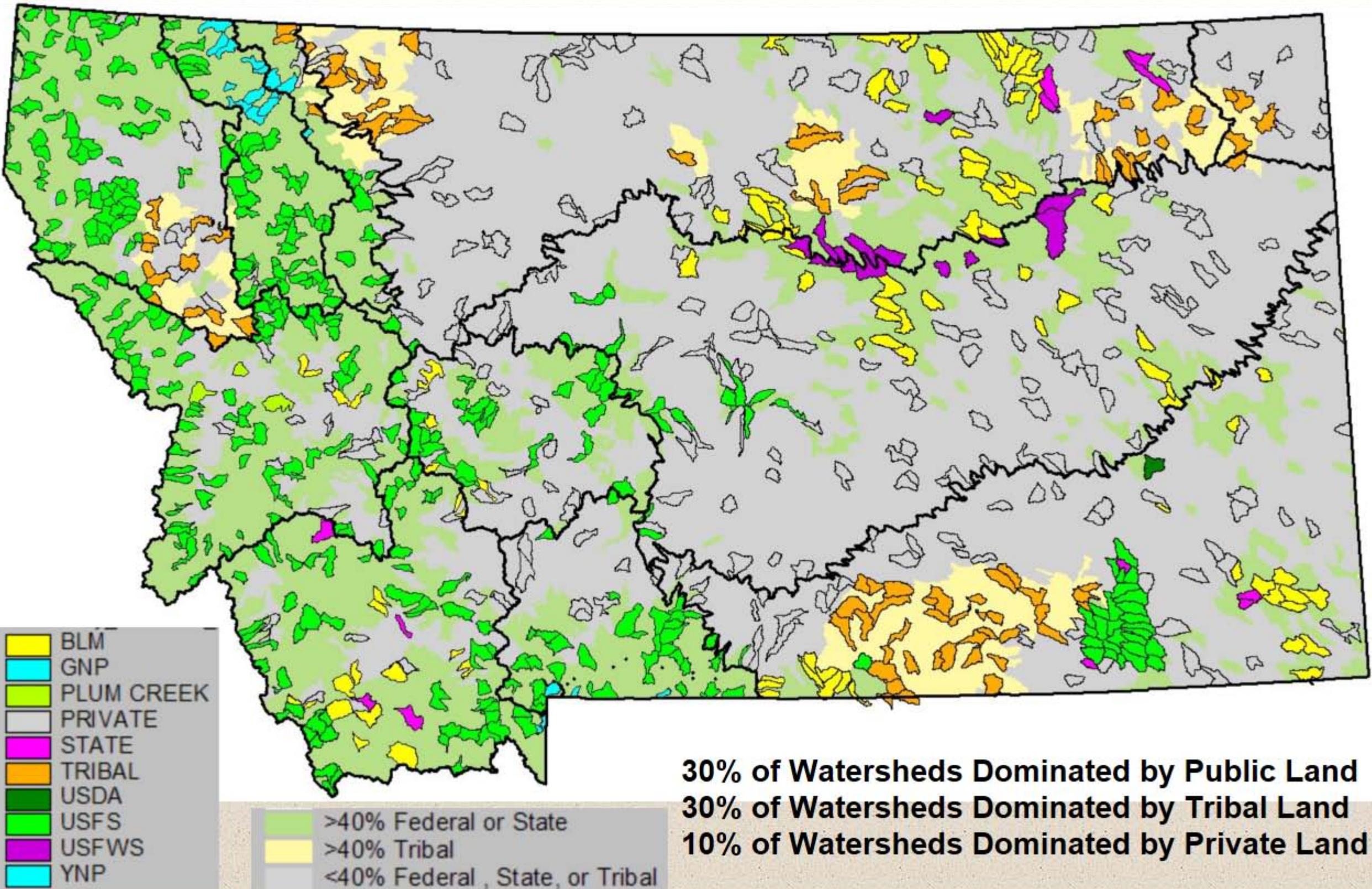
## 6<sup>th</sup>-Digit Hydrologic Unit Code Watersheds Randomly Selected For Survey on and Adjacent to the Bitterroot National Forest



- Identified 298 potential lentic sites in 21 watersheds
- Surveyed 262 sites in randomly selected watersheds (205 of these contained water)
- Conducted 490 site surveys
- Surveyed 9 potential Coeur d'Alene salamander sites
- Monitored 15 sites for western toad breeding

# Montana Amphibian Inventory Sampling Scheme

## Geographic Strata – Ownership Strata – Randomly Selected Watersheds



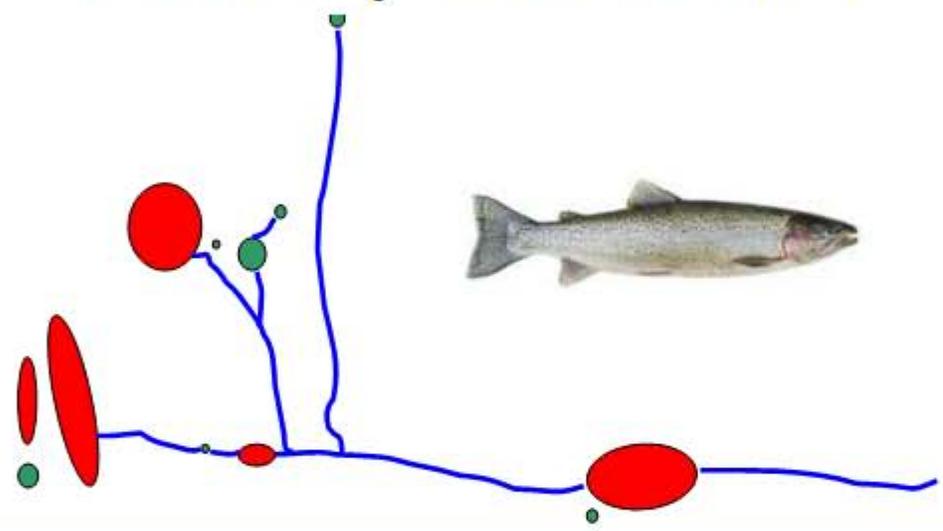
# Stanley Creek Basin



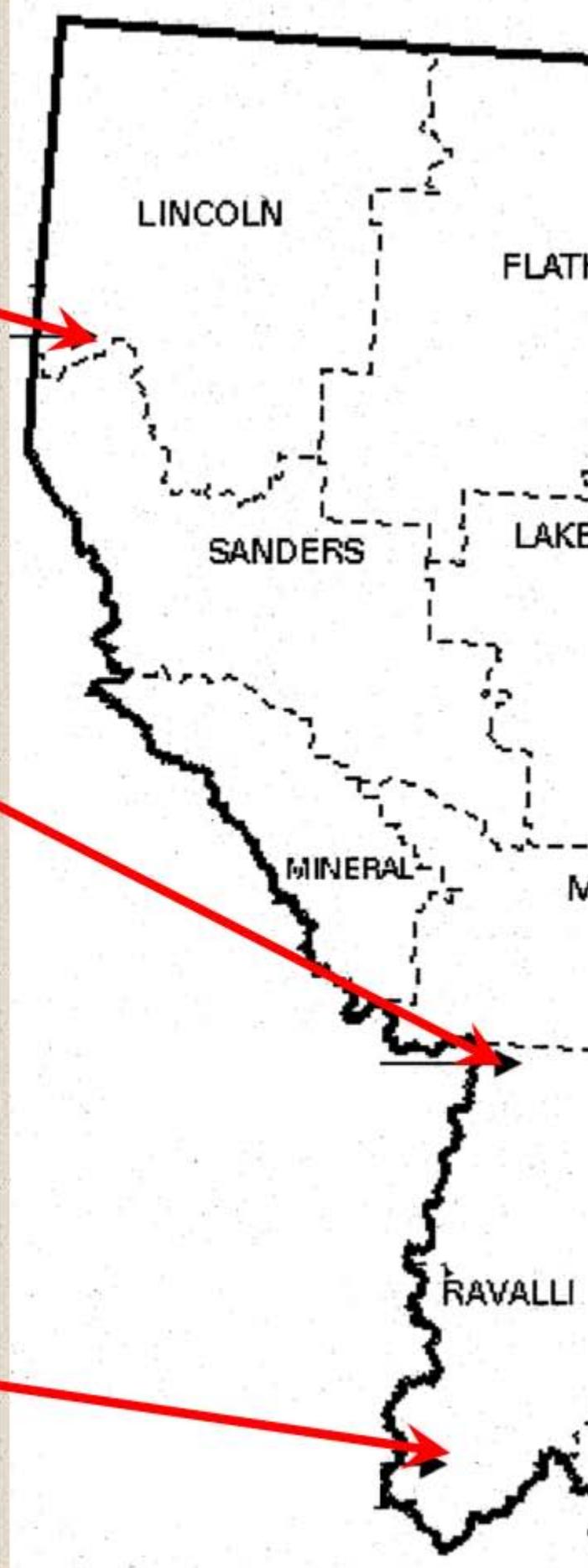
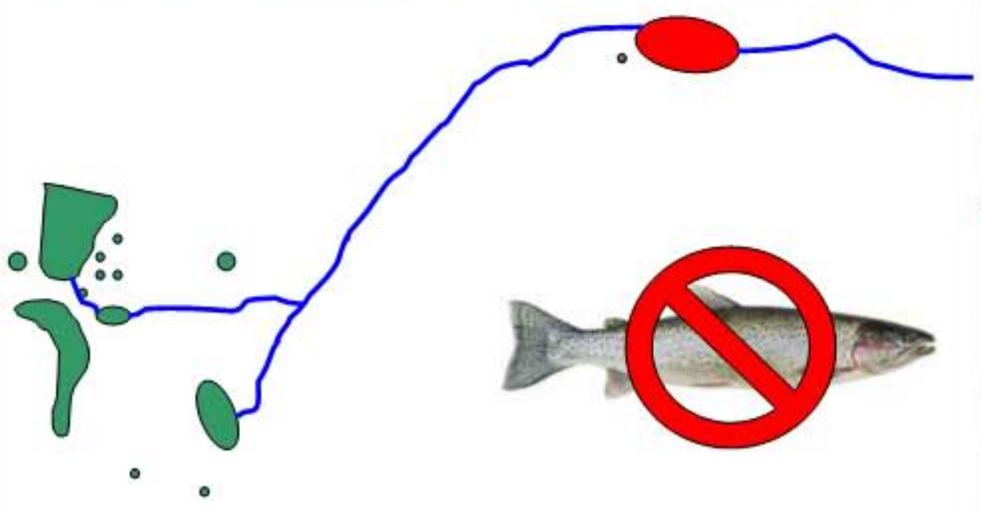
## Population Dynamics

- Fish
- Fishless
- 

# Sweeney Creek Basin



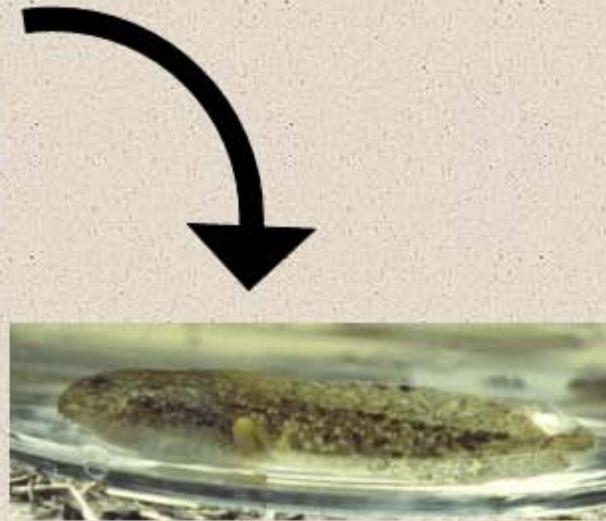
# Little Rock Creek Basin



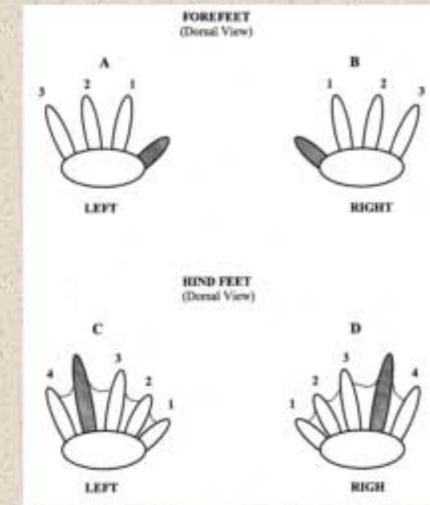
# Estimation of Age and Life History Stage Specific Survival Rates



Egg numbers are estimated and eggs are caged



Mark recapture of frogs is conducted by toe clipping

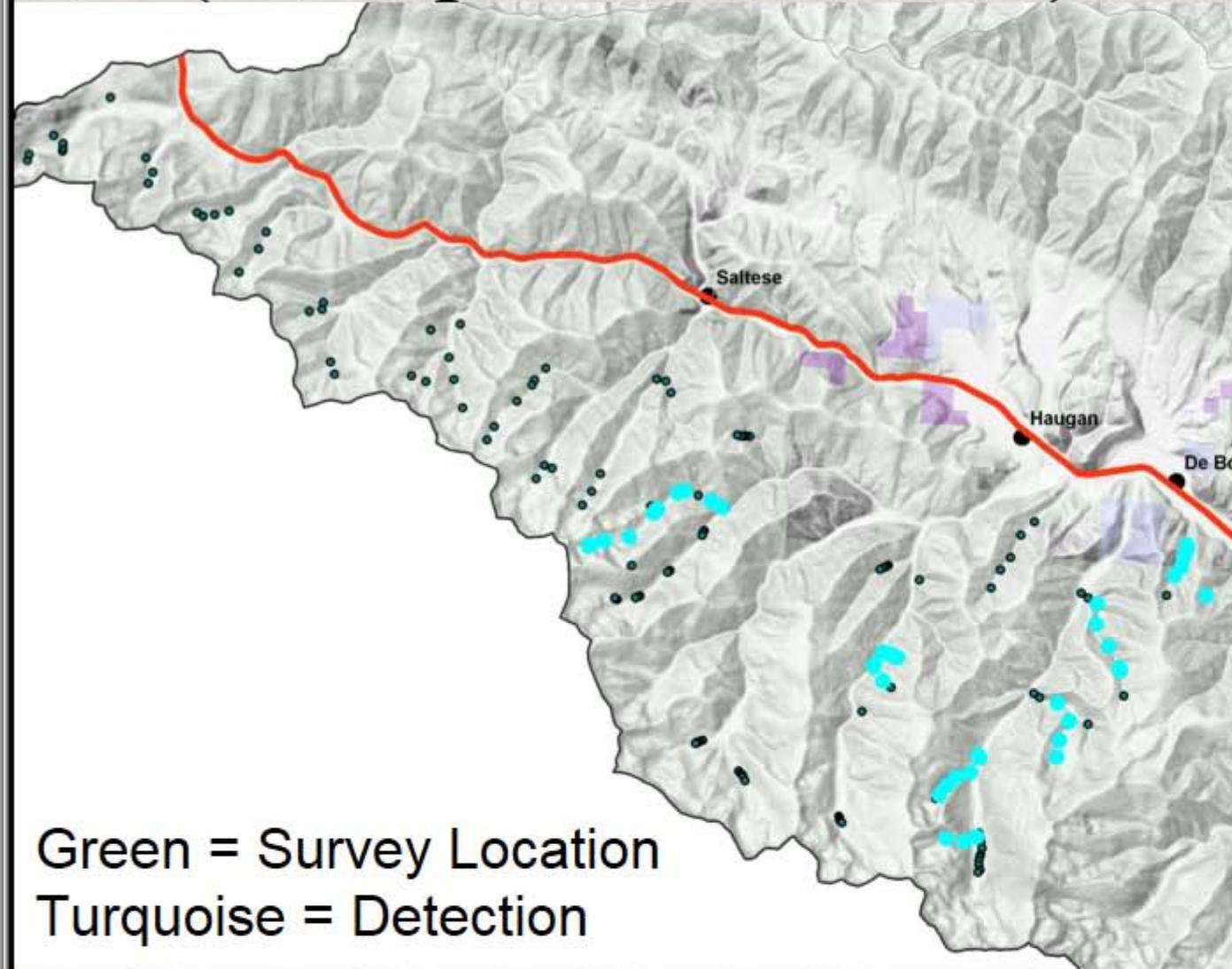


**B**

		FROM STAGE		
		Prejuvenile	Juvenile	Reproductive Adult
TO STAGE	Prejuvenile	0	0	$\left[ \begin{array}{c} \text{F1} \\ \text{Clutch Size} \times \\ \text{Probability of Laying} \times \\ \text{Adult Survival} \end{array} \right]$
	Juvenile	$\left[ \begin{array}{c} \text{G1} \\ \text{Embryo Survival} \times \\ \text{Larval Survival} \times \\ \text{Metamorph Survival} \end{array} \right]$	$\left[ \begin{array}{c} \text{P1} \\ \text{Probability of a Juvenile} \\ \text{Staying a Juvenile} \end{array} \right]$	0
	Reproductive Adult	0	$\left[ \begin{array}{c} \text{G2} \\ \text{Probability of a} \\ \text{Juvenile Becoming} \\ \text{an Adult} \end{array} \right]$	$\left[ \begin{array}{c} \text{P2} \\ \text{Adult Survival} \end{array} \right]$

**Matrix Modeling to Identify Likely Impacts of Fish Introduction**

# Idaho Giant Salamander (*Dicamptodon atterimus*)



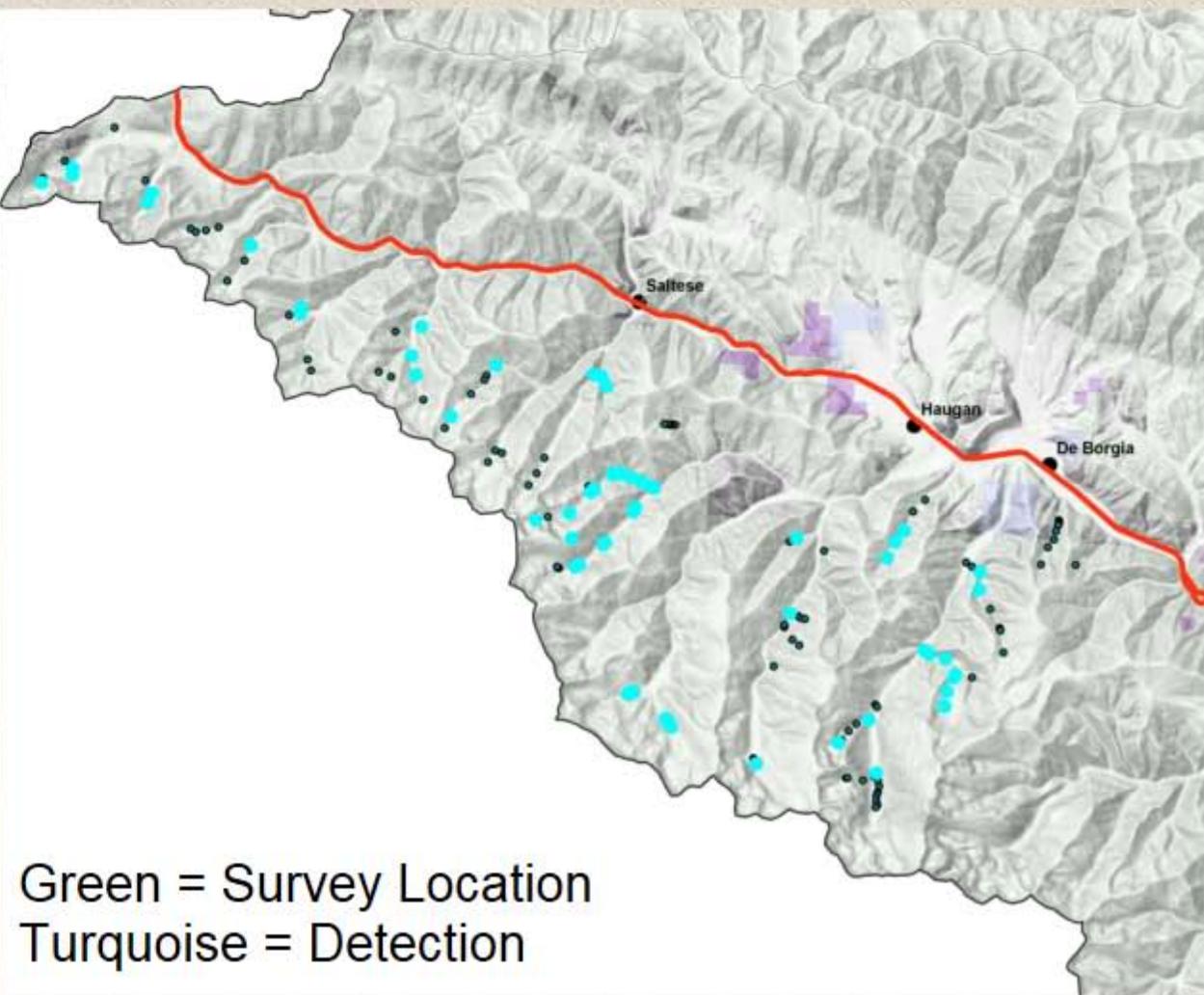
- Only 1 previous detection
- 450 animals detected in 2006
- 15 different tributaries
- 4 different watersheds

# Rocky Mountain Tailed Frog

- Rocky Mountain Tailed Frogs detected at over 95% of sample locations. They easily outnumber and outweigh fish
- Westslope Cutthroat Trout detected in many headwater tributaries which are not usually surveyed by fisheries bios

# Westslope Cutthroat Trout

Green = Survey Location  
Turquoise = Detection

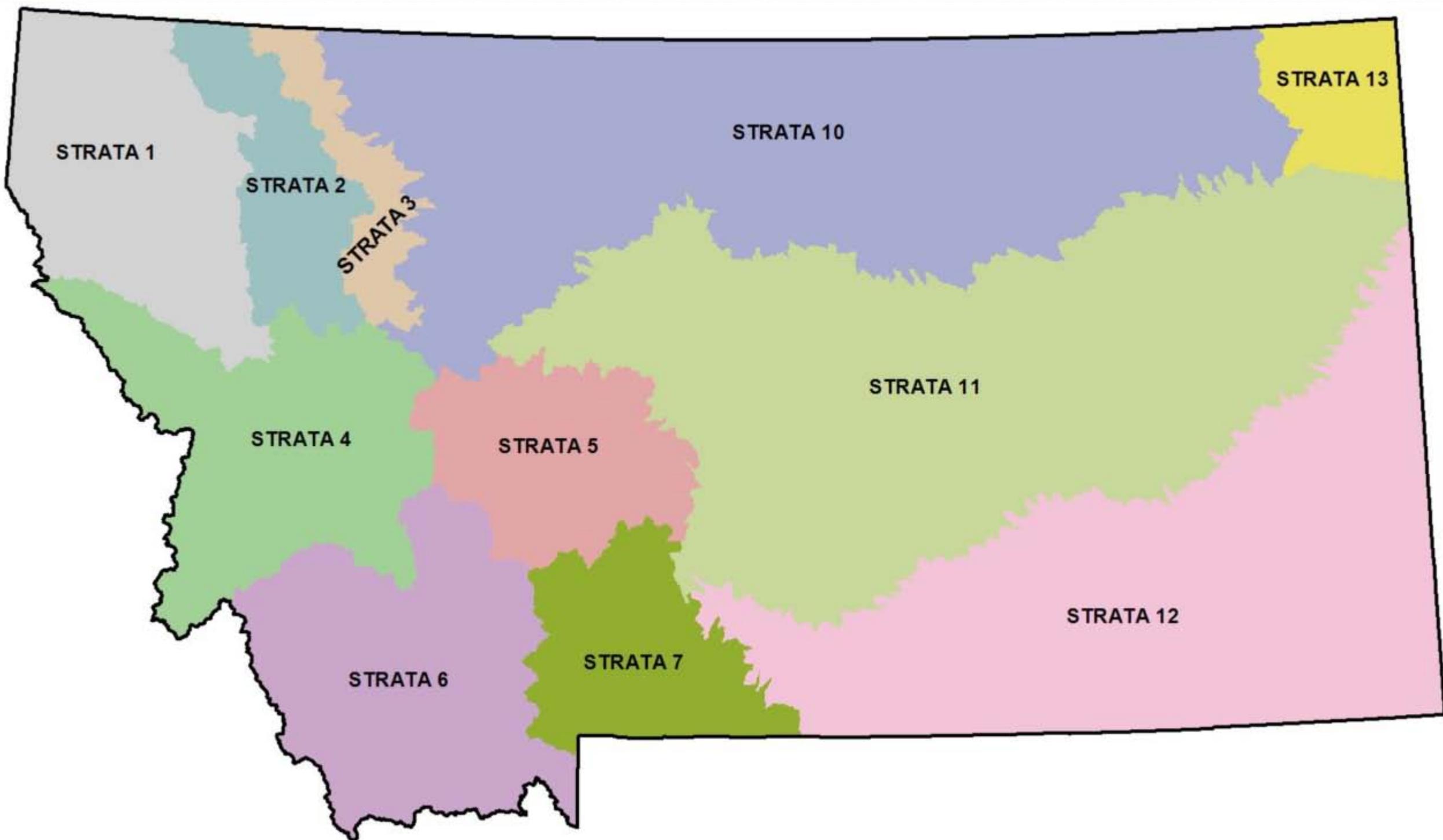


Green = Survey Location  
Turquoise = Detection



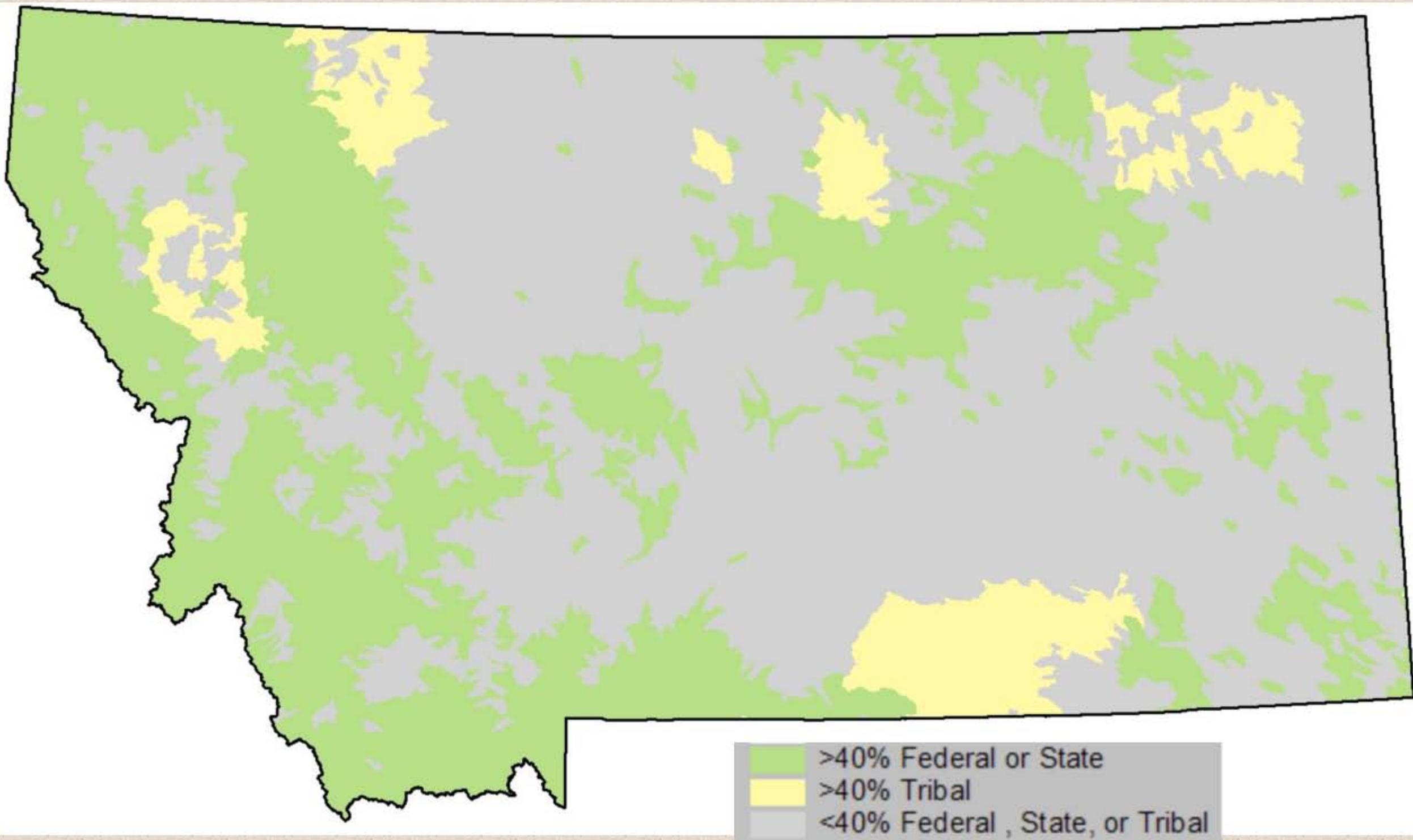
# Montana Amphibian Inventory Sampling Scheme

Geographic Strata – Based on 4<sup>th</sup> Code HUC Watersheds and Level 4 Ecoregions



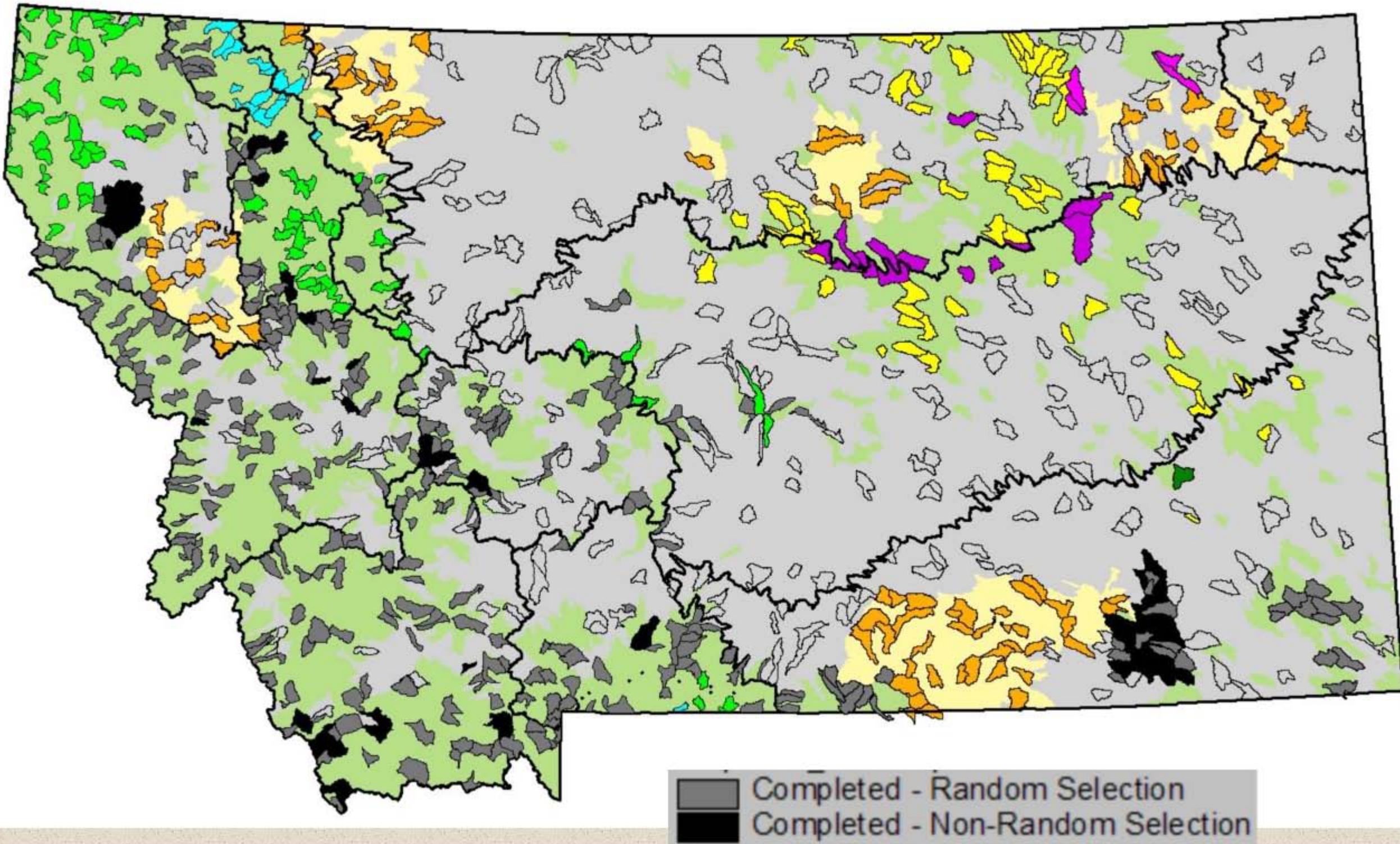
# Montana Amphibian Inventory Sampling Scheme

## Ownership Strata

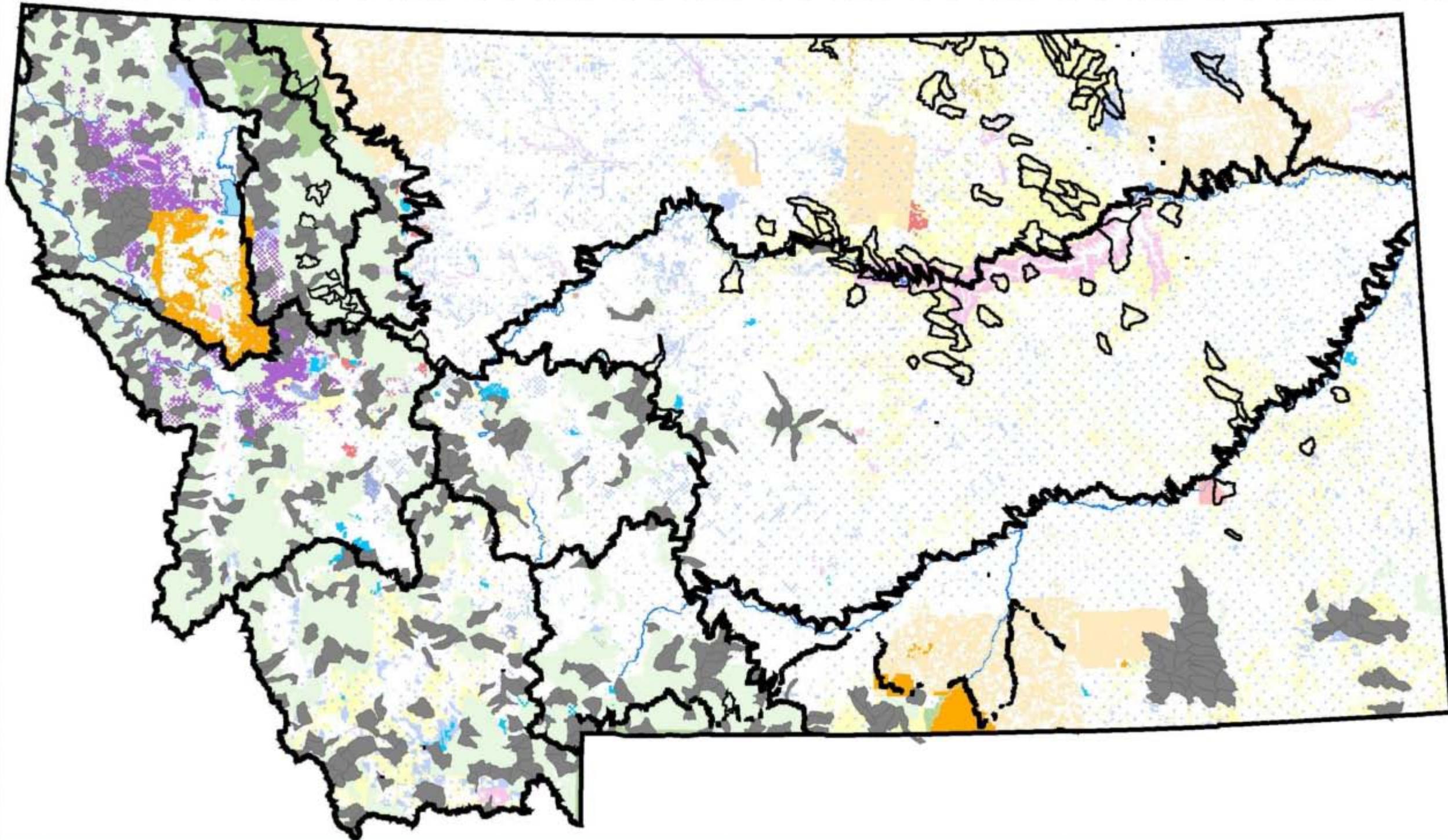


# Montana Amphibian Inventory Sampling Scheme

## Survey Status as of Fall 2005

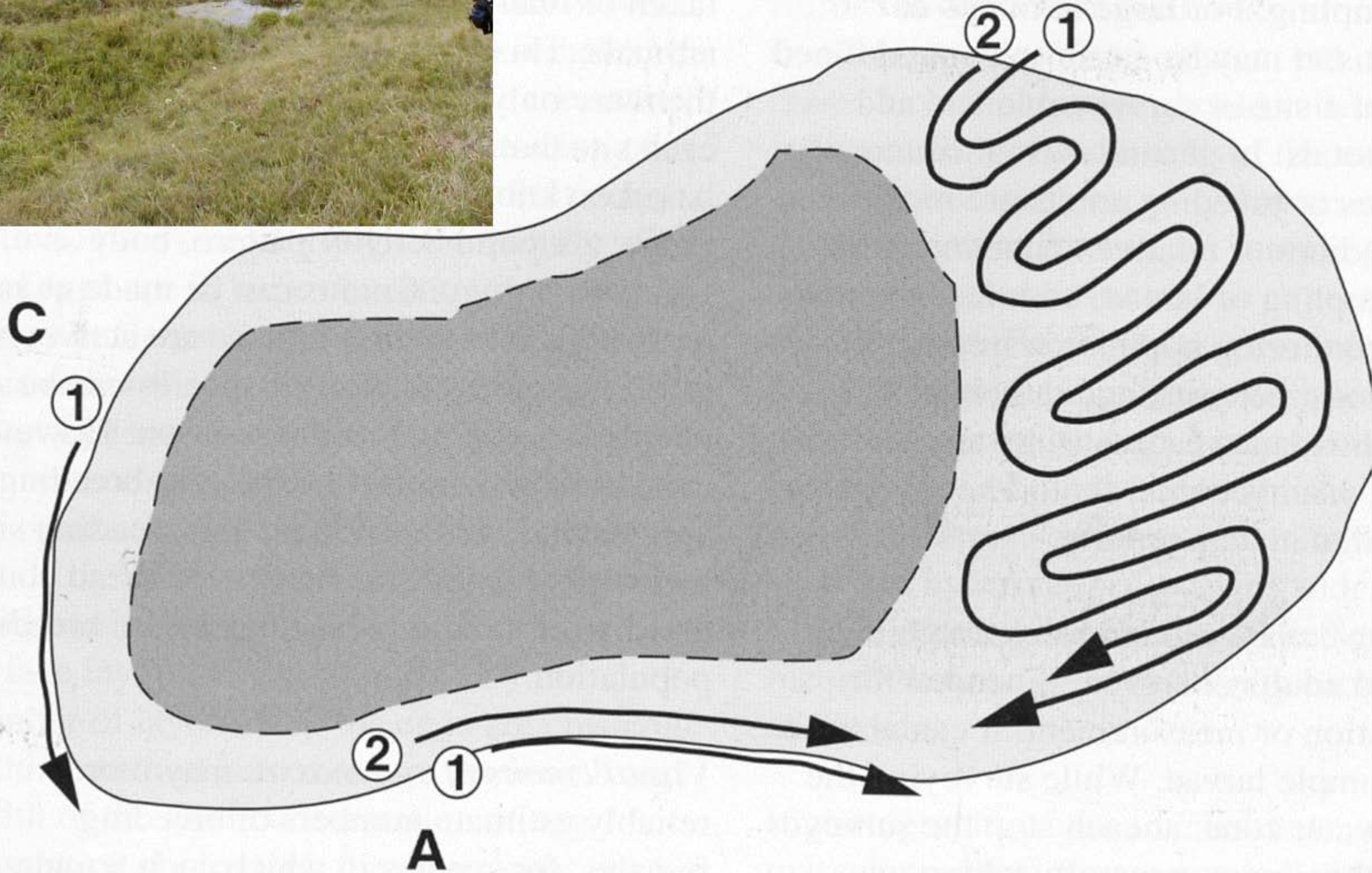


# Montana Amphibian Inventory Status



- 8,000 standing water bodies surveyed
- 7,500 species records
- 2 years of surveys remain in NE Montana
- Rapid wetland assessment
- Wetland photos posted on NHIP
- Non-target observations (pika, h-marmot)

# Timed Visual Encounter (VES) and Dipnet Surveys of Shallow water Habitats



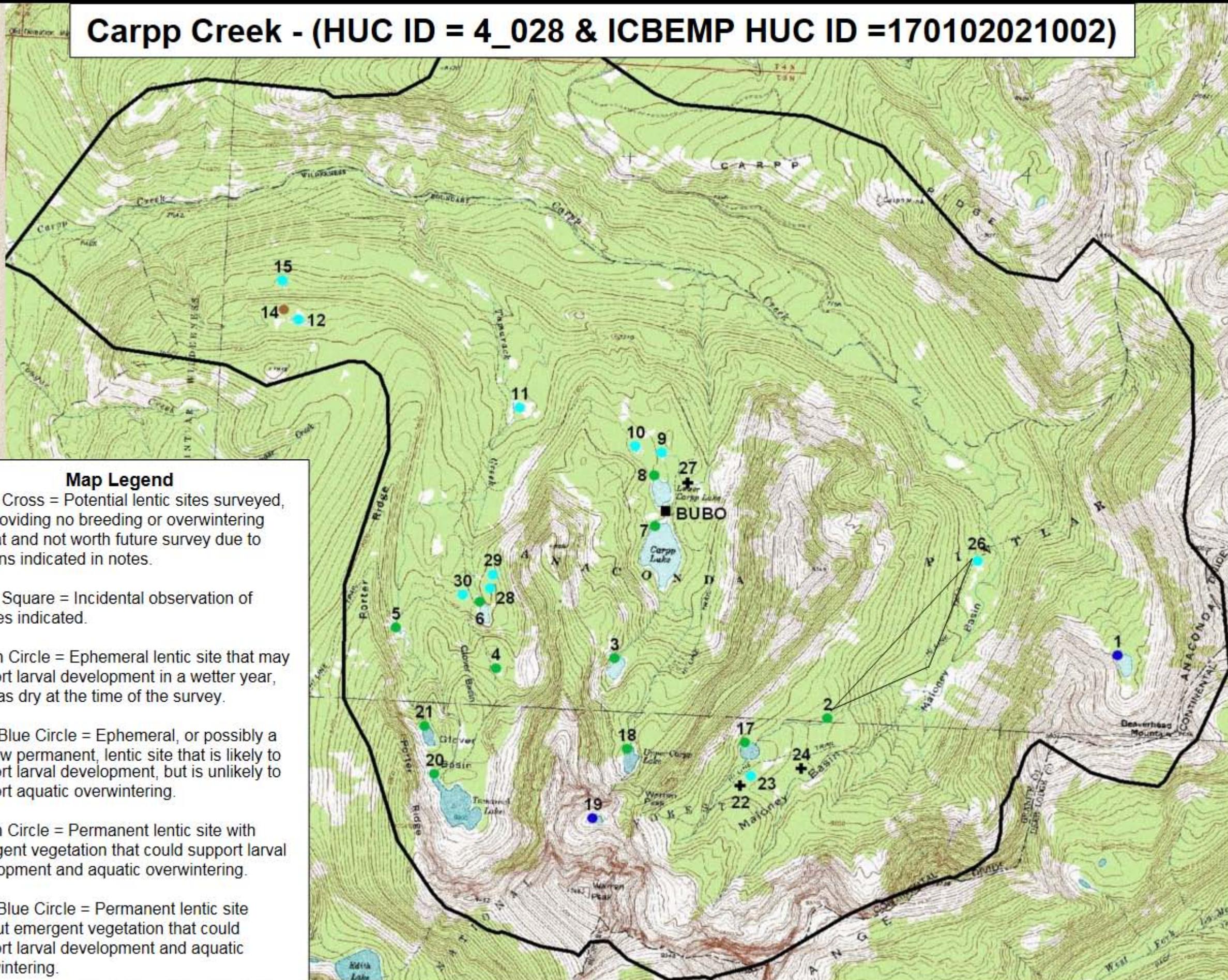
# **Inventory Highlights Through Fall 2005**

- **Surveys of 520 watersheds and >8,200 sites**
- **8,200 new species locality records**
- **Established new state high elevation records for 10 species**
- **Extended known geographic ranges for 10 species**
- **Statistically valid assessment of status for majority of amphibian species**
- **Collaboration on two books and produced 9 reports**
- **Gave 5 workshops and >13 significant presentations**
- **Extensive bibliographic database for access to primary literature**
- **Fencing off rare upland wetlands from cattle trampling on the Custer and Beaverhead-Deerlodge Forests**
- **Beaver reintroduction for lentic breeding site creation on Custer and Beaverhead-Deerlodge Forests**
- **Protection of amphibian populations from fish stocking on Bitterroot and Gallatin Forests**
- **ID of distribution of amphibian diseases and need to decontaminate equipment**
- **Protection of remaining breeding populations of rare species (e.g., Western Toad)**
- **Proactive management of lentic wetlands in Forest Management Plans**
- **Heightened awareness of needs of amphibians and lentic wetlands by USFS and other agency personnel**

# Information on Apparent Occupancy and Breeding Rates for Regional Status

Species	Number and Percent of Watersheds That Were Occupied <sup>3</sup> (N = 21)	Number and Percent of Watersheds Where Breeding Was Detected <sup>3</sup> (N = 19)	Number and Percent of Sites Containing Water That Were Occupied <sup>4</sup> (N = 205)	Number and Percent of Sites Containing Water Where Breeding Was Detected <sup>4</sup> (N = 205)
Long-Toed Salamander ( <i>Ambystoma macrodactylum</i> )	15 71% (95% CI = 55% - 88%)	15 79% (95% CI = 63% - 95%)	59 29% (95% CI = 23% - 35%)	59 29% (95% CI = 23% - 35%)
Rocky Mountain Tailed Frog <sup>5</sup> ( <i>Ascaphus montanus</i> )	5 24% (95% CI = 8% - 40%)	4 21% (95% CI = 5% - 37%)	10 4.9% (95% CI = 1.9% - 7.8%)	6 3% (95% CI = 0.6% - 5.2%)
<b>Western Toad</b> ( <i>Bufo boreas</i> )	8 38% (95% CI = 20% - 56%)	2 10.5% (95% CI = 0% - 23%)	8 3.9% (95% CI = 1.3% - 6.6%)	<u>3</u> 1.5% <u>(95% CI = 0% - 3.1%)</u>
Pacific Treefrog <sup>6</sup> ( <i>Pseudacris regilla</i> )	2 9.5% (95% CI = 0% - 20%)	2 10.5% (95% CI = 0% - 23%)	2 1% (95% CI = 0% - 2.3%)	2 1% (95% CI = 0% - 2.3%)
Columbia Spotted Frog ( <i>Rana luteiventris</i> )	18 86% (95% CI = 73% - 99%)	15 79% (95% CI = 63% - 95%)	96 47% (95% CI = 40% - 54%)	52 25% (95% CI = 19% - 31%)
Terrestrial Gartersnake <sup>7</sup> ( <i>Thamnophis elegans</i> )	11 52% (95% CI = 34% - 71%)	NA	27 13% (95% CI = 9% - 18%)	NA
Common Gartersnake <sup>7</sup> ( <i>Thamnophis sirtalis</i> )	7 33% (95% CI = 16% - 51%)	NA	33 16% (95% CI = 11% - 21%)	NA
Non-indigenous <sup>7</sup> Salmonid Fishes	13 68% (95% CI = 51% - 86%)	NA	39 19% (95% CI = 14% - 24%)	NA

# Carpp Creek - (HUC ID = 4\_028 & ICBEMP HUC ID =170102021002)



## Map Legend

Black Cross = Potential lentic sites surveyed, but providing no breeding or overwintering habitat and not worth future survey due to reasons indicated in notes.

Black Square = Incidental observation of species indicated.

Brown Circle = Ephemeral lentic site that may support larval development in a wetter year, but was dry at the time of the survey.

Light Blue Circle = Ephemeral, or possibly a shallow permanent, lentic site that is likely to support larval development, but is unlikely to support aquatic overwintering.

Green Circle = Permanent lentic site with emergent vegetation that could support larval development and aquatic overwintering.

Dark Blue Circle = Permanent lentic site without emergent vegetation that could support larval development and aquatic overwintering.

# Regional Fish Stocking and Impacts on Fish

**Fish  
Detected**

**Fish Not  
Detected**

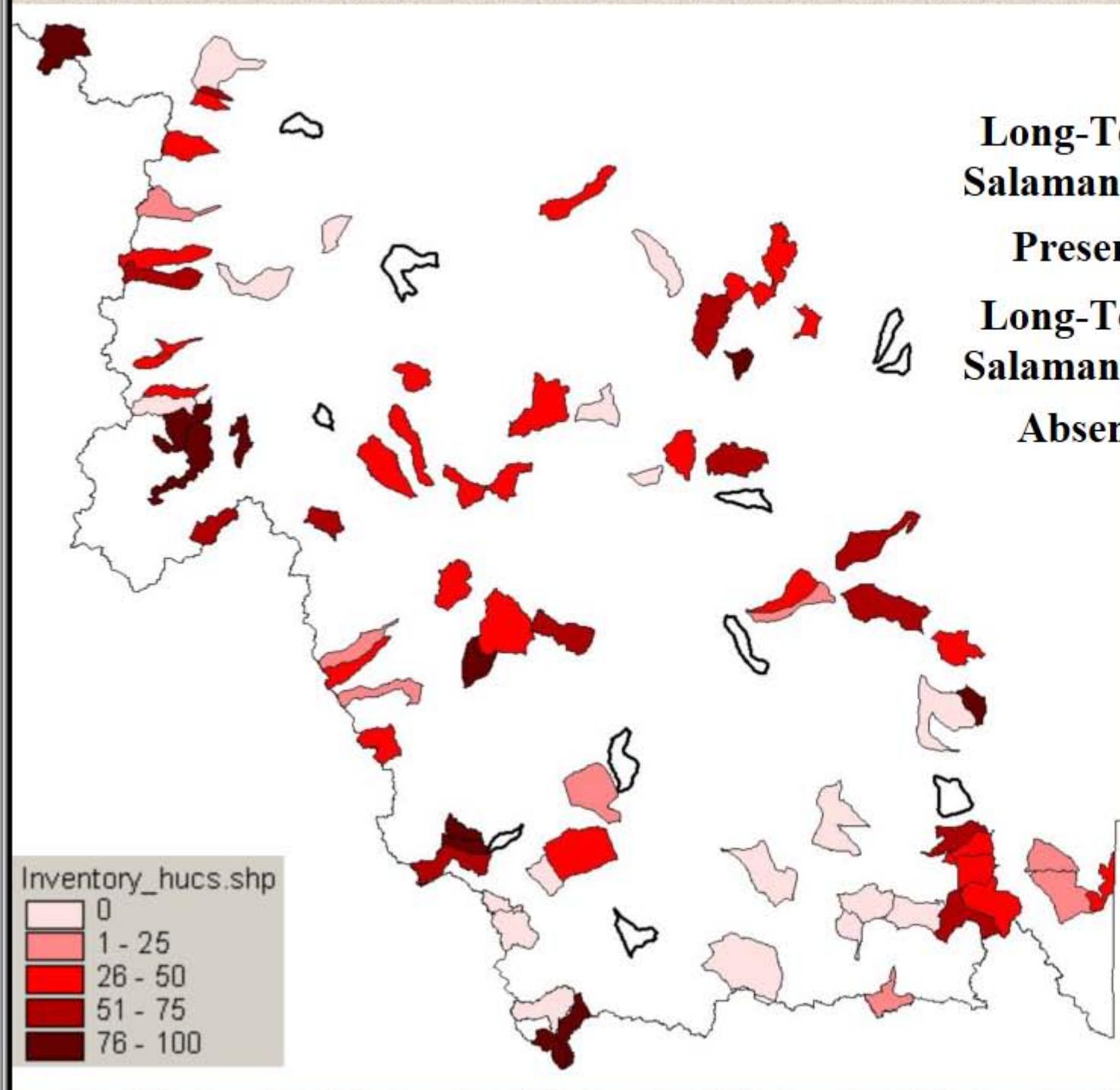
<b>8</b>	<b>92</b>
<b>97</b>	<b>350</b>

**Long-Toed  
Salamanders**

**Present**

**Long-Toed  
Salamanders**

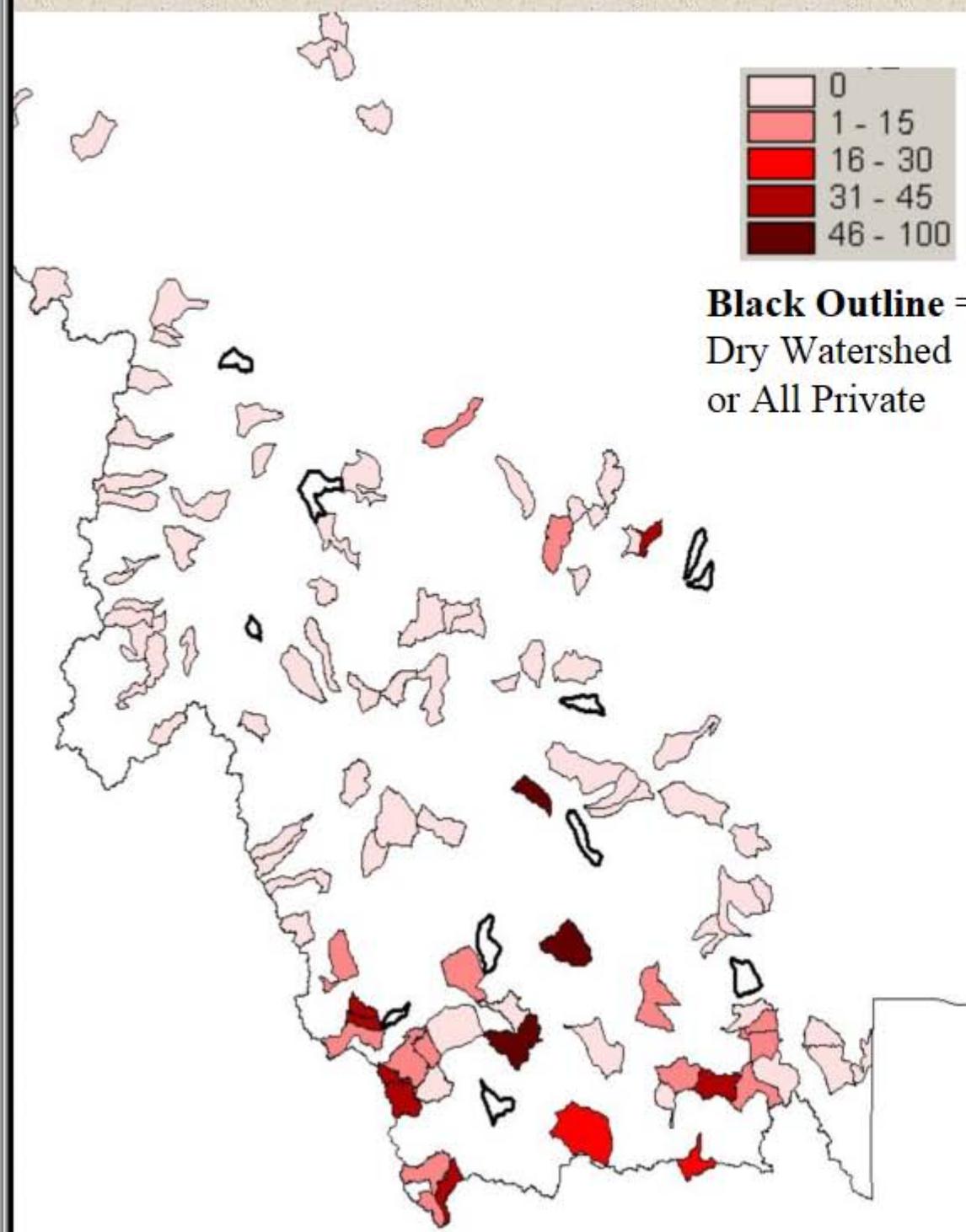
**Absent**



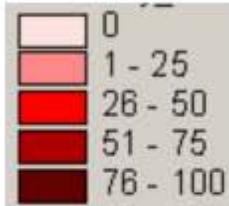
**Black Outline =**  
Dry Watershed  
or All Private



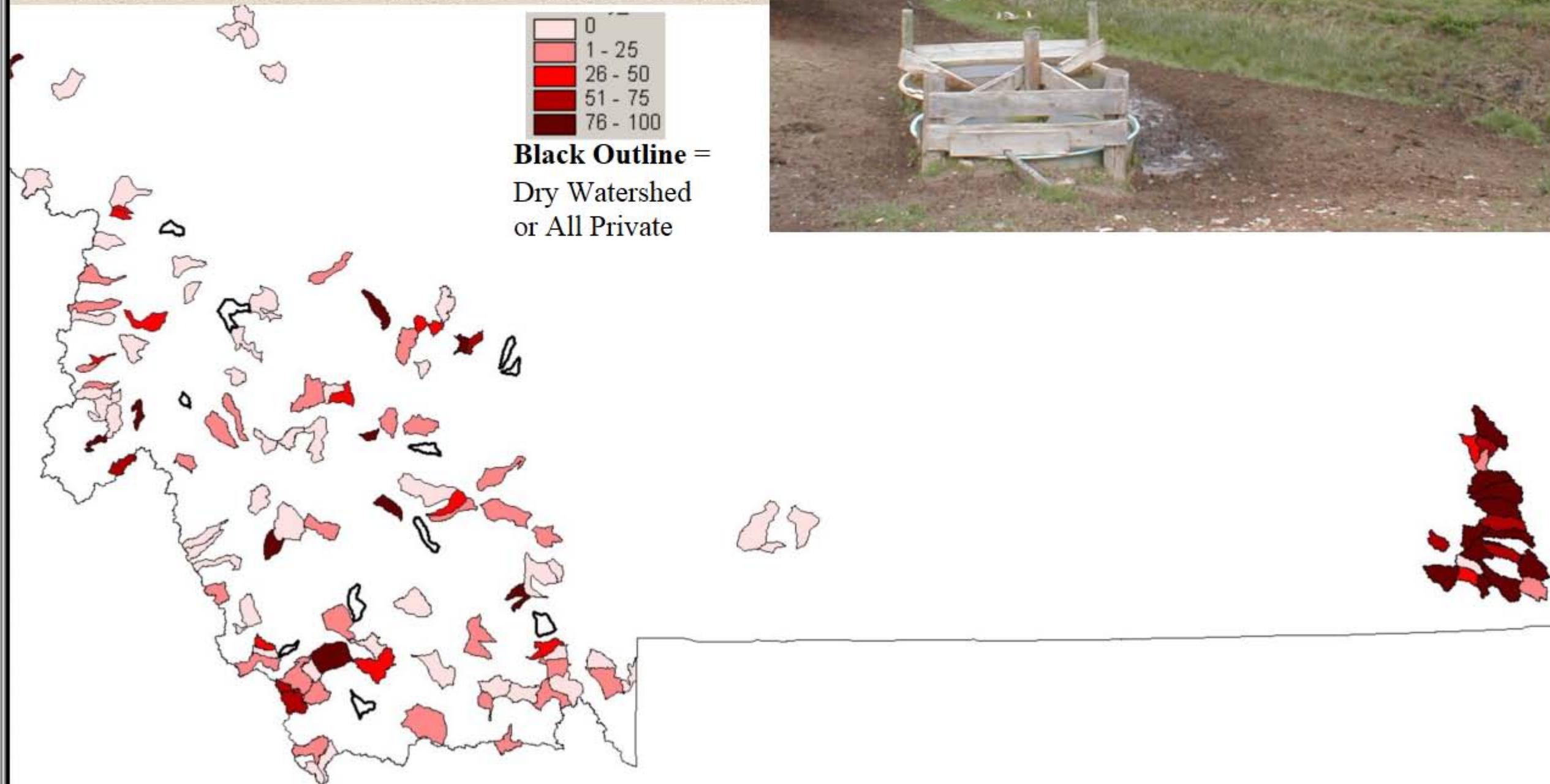
# Percent of Lentic Sites Capable of Supporting Amphibian Reproduction Heavily Impacted by Cattle



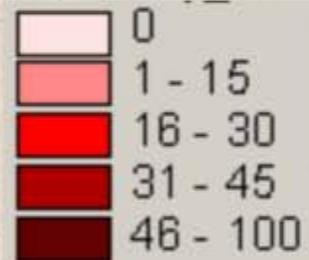
# Percent of Lentic Sites Capable of Supporting Amphibian Reproduction with Water Dammed or Diverted



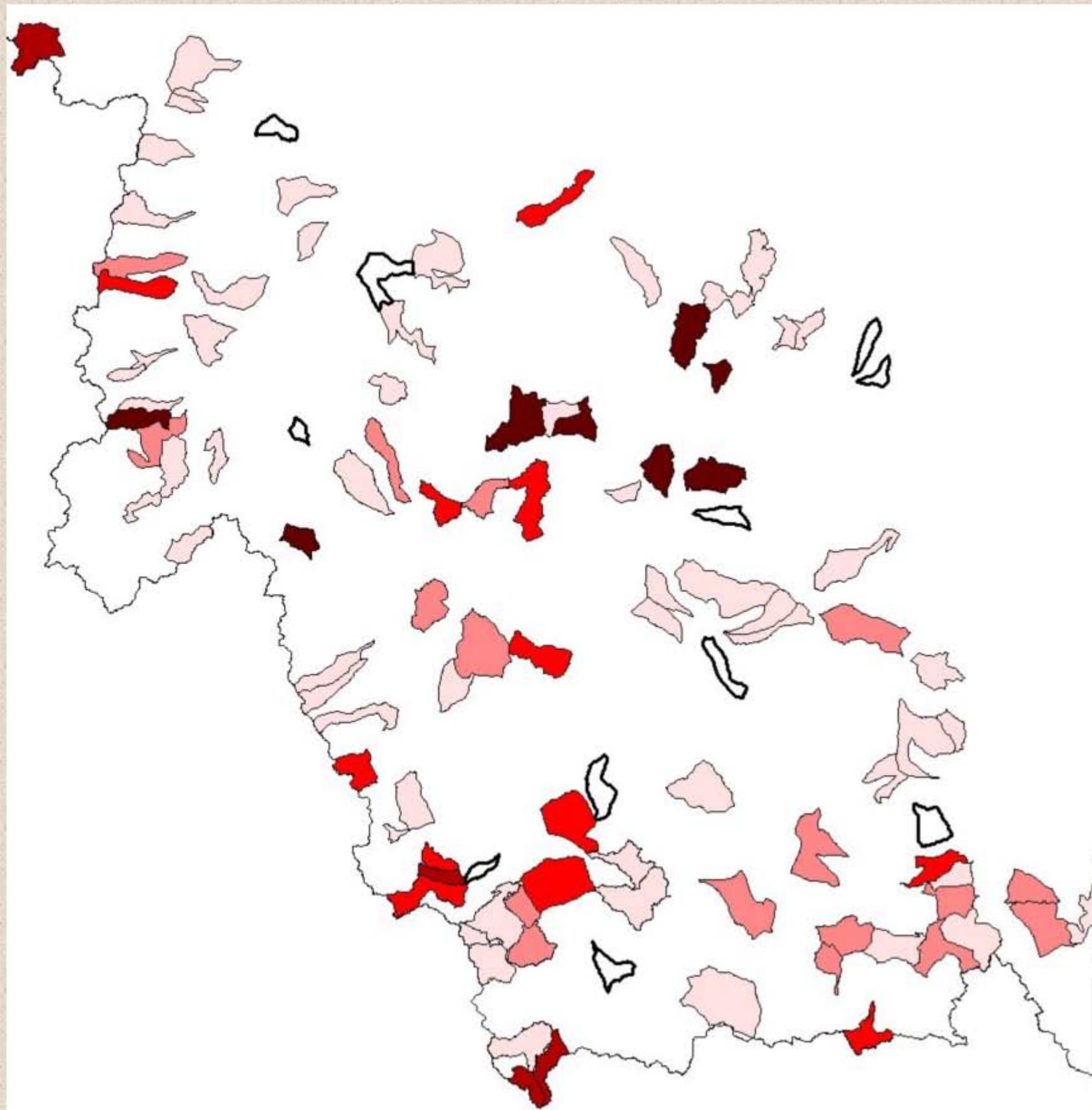
**Black Outline** =  
Dry Watershed  
or All Private



# Percent of Lentic Sites Created By Beaver



**Black Outline** =  
Dry Watershed  
or All Private

















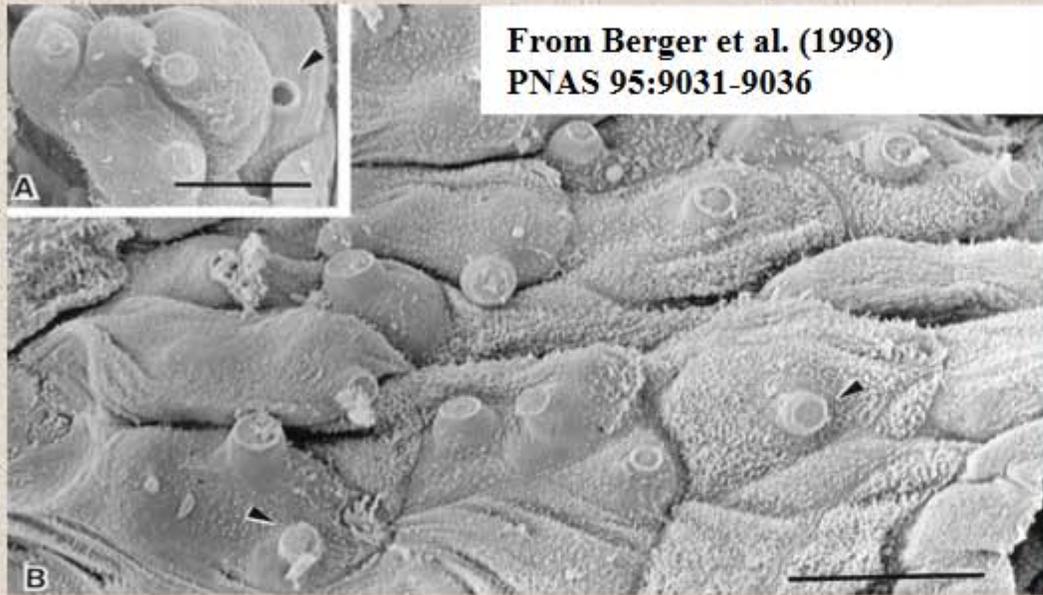




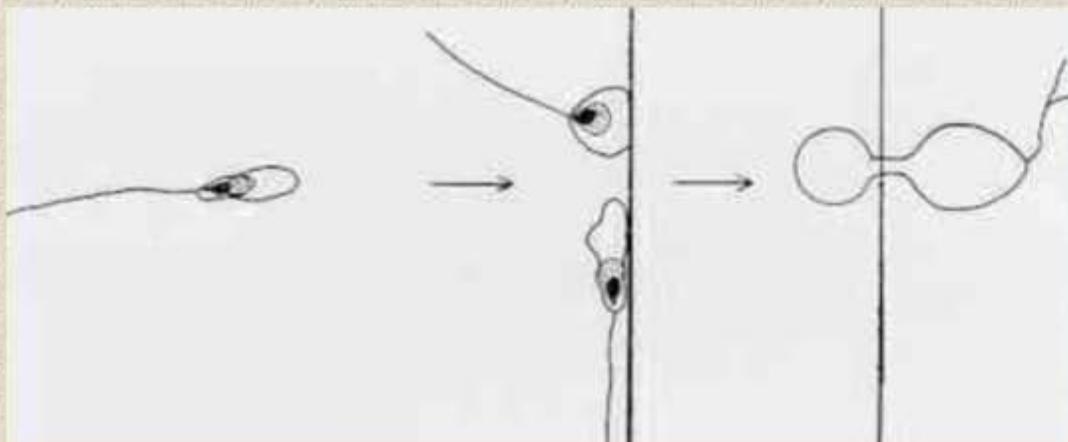


# *Batrachochytrium dendrobatidis*

## Life History



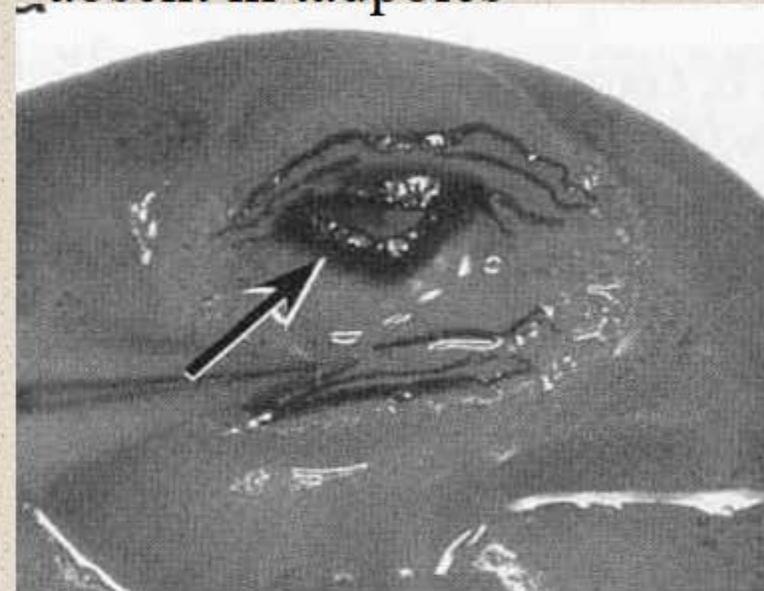
**Chytrid thallus digests keratin in epidermal skin cells  
Sporangia release clonal zoospores via discharge tubes**



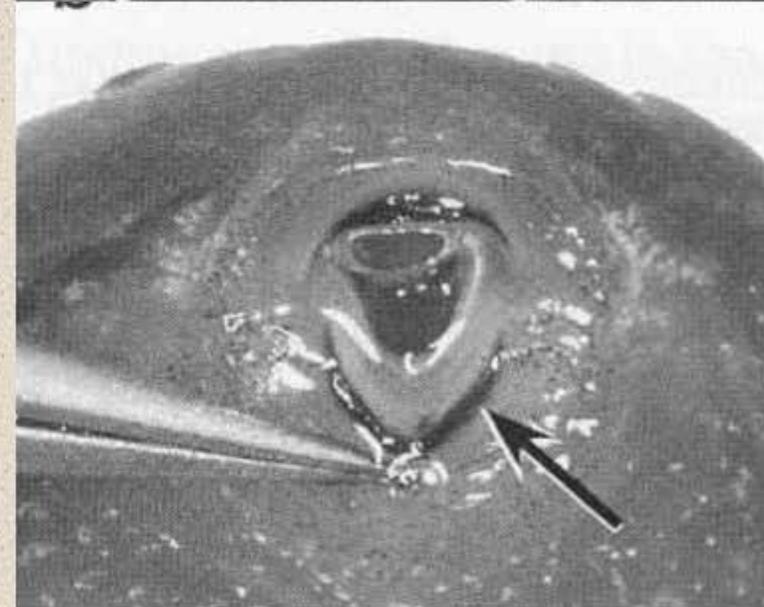
**Free-swimming flagellated zoospores penetrate host cells**

## Field Identification

- Lethargy & skin sloughing in adults
- Keratinized mouthparts reduced or absent in tadpoles



Normal



Infected

**From Vredenburg (2001)  
Herp Review 32(3):151-152**

