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

Breeding
Wintering
Foraging

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)
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

Percent of Sites

Strata

1 2 3 4 5 6 7 10 11 12

Beaver
Depressional
Human
Water
Fish Detection

- Ephemeral
- Permanent w/ Emergent Veg
- Permanent w/o Emergent Veg
- All Sites

Strata

Percent of Sites

Strata

1 2 3 4 5 6 7 10 11 12
Distribution of Chytrid Fungus

★ = Recent Positive  ○ = Recent negative  ● = Historic samples all negative
Northern Leopard Frog \textit{(Rana pipiens)}

- West of Continental Divide – 3 sites
- Southwestern mountain Valleys – 2 new sites
- Eastern Plains
  - 60\% (50-69) of watersheds
  - 14\% (12-16) of sites
### Western Toad (*Bufo boreas*)

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

- No EVeg
  - 0.005 (0.002)
    - 976
  - EVeg
    - 0.02 (0.002)
      - 3357
    - Ephemeral
      - 0.02 (0.003)
        - 1384
      - 0.06 (0.03)
        - 69
    - Permanent
      - 0.03 (0.003)
        - 2381
      - Not Burned
        - 0.04 (0.006)
          - 983
      - Burned
        - 0.29 (0.12)
          - 14
- Not Logged
  - 0.01 (0.003)
    - 1315
- Logged
  - 0.04 (0.006)
    - 997
Long-toed Salamander  
(*Ambystoma macrodactylum*)

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

No Fish | Fish  
---|---
No EVeg | EVeg  
0.38 (0.01) | 0.34 (0.01)  
1767 | 2119  
0.24 (0.02) | 0.15 (0.02)  
372 | 82  
0.42 (0.01) | 0.18 (0.02)  
1395 | 352  
0.04 (0.02) | 0.15 (0.02)  
82 | 352  
0.18 (0.02) | 0.15 (0.02)  
270 | 352
Common Gartersnake
(Thamnophis sirtalis)
Columbia Spotted Frog \((Rana luteiventris)\)

Random Watersheds Surveyed = 256
Random Sites Surveyed = 2,781
Naïve Watershed Occupancy = 65% (59-70)
Naïve Site Occupancy = 29% (27 – 31)

- Stanley Creek
- Sweeney Creek
- Little Rock Creek
Breeding
Foraging
Wintering

Columbia Spotted Frog
Predicted Distribution
Little Rock Creek

<table>
<thead>
<tr>
<th></th>
<th>No EVeg</th>
<th>EVeg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.29</td>
<td>2781</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Ephemeral</th>
<th>Permanent</th>
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</thead>
<tbody>
<tr>
<td>No Fish</td>
<td>0.36</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>1114</td>
<td>1857</td>
</tr>
<tr>
<td>Fish</td>
<td>0.54</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>519</td>
<td>743</td>
</tr>
<tr>
<td></td>
<td>224</td>
<td></td>
</tr>
</tbody>
</table>

Fish: 0.54
No Fish: 0.46

Permanent: 0.52
Ephemeral: 0.43

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

Breeding
Wintering
Foraging
<table>
<thead>
<tr>
<th>Species</th>
<th>Fish</th>
<th>Eveh</th>
<th>Hydroperiod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-toed Salamander</td>
<td>-</td>
<td>+*</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Barred Tiger Salamander</td>
<td>-</td>
<td>+*</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Plains Spadefoot</td>
<td>●</td>
<td>●</td>
<td>Ephemeral</td>
</tr>
<tr>
<td>Western Toad</td>
<td>●</td>
<td>+</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Great Plains Toad</td>
<td>-</td>
<td>+</td>
<td>Ephemeral</td>
</tr>
<tr>
<td>Woodhouse’s Toad</td>
<td>-</td>
<td>+</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Boreal Chorus Frog</td>
<td>-</td>
<td>+</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Pacific Treefrog</td>
<td>-</td>
<td>+</td>
<td>Perm/Ephem</td>
</tr>
<tr>
<td>Northern Leopard Frog</td>
<td>+</td>
<td>+</td>
<td>Permanent</td>
</tr>
<tr>
<td>Columbia Spotted Frog</td>
<td>●</td>
<td>+</td>
<td>Permanent</td>
</tr>
<tr>
<td>Painted Turtle</td>
<td>●</td>
<td>+</td>
<td>Permanent</td>
</tr>
<tr>
<td>Terrestrial Gartersnake</td>
<td>+</td>
<td>+</td>
<td>Perm/Ephem</td>
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<tr>
<td>Plains Gartersnake</td>
<td>+</td>
<td>+</td>
<td>Permanent</td>
</tr>
<tr>
<td>Common Gartersnake</td>
<td>-</td>
<td>+</td>
<td>Perm/Ephem</td>
</tr>
</tbody>
</table>
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

[Diagram showing native breeding, foraging, overwintering]
Structured Surveys and Observations of Western Toads

<table>
<thead>
<tr>
<th>TAXA</th>
<th>ID (click to EDIT)</th>
<th>Common Name (Scientific Name)</th>
<th>OBSERVERS</th>
<th>OBSERVATION DATE</th>
<th>LOCATION</th>
<th>TYPE</th>
<th>PENDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibians</td>
<td>10588219</td>
<td>Western Toad (Bufo boreas)</td>
<td>Bell, Matthew</td>
<td>Jul 13, 2008</td>
<td>Lewis and Clark</td>
<td>7.5 Miles WSW of Hedges Mountain</td>
<td>0</td>
</tr>
</tbody>
</table>

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
Structural Impact to Wetlands

Montana Natural Heritage Program
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