TOPIC
Assessing fire management activities on amphibian and reptile survival, movement and habitats.

PURPOSE
To be conducted for the Pennsylvania Fish and Boat Commission (PFBC), in partnership with the Pennsylvania Game Commission (PGC), this project will assess amphibian and reptile habitat use, timing/rate of movement, injury and survival, as well as pre- and post-event habitat conditions in areas of fire management activities. The intent is to develop best practices for minimizing negative impacts to amphibians and reptiles while supporting the many beneficial habitat goals achieved through fire management.

BACKGROUND
Conducting prescribed burning is a common habitat management practice often applied for various uses including to reset natural vegetative succession, control invasive species, or promote plant germination (Bond and Keane 2016, Russell et al. 1999). The Pennsylvania Game Commission (PGC) has used fire as a habitat management practice for many years, for long-term forest health and wildlife habitat benefits including control of invasive species and enhancing structural and species diversity in fire-adapted systems, namely oak forest, barrens and grasslands.

With growing acceptance and use of this forest habitat management practice, there is also increasing interest in understanding impacts on Pennsylvania wildlife, including less-mobile animals such as amphibians and reptiles. It is unclear how local climate factors (e.g., daily/seasonal temperature, relative humidity) used in determining initiation and intensity of a burn event, as well as habitat conditions (e.g., vegetation/ fuel moisture), may influence amphibian and reptile habitat use, movement, and survival. Factors such as time of year, habitat type and spatial location in Pennsylvania, and anticipated fire intensity (e.g., speed and temperature) may also be influential.

OBJECTIVE
This project will qualitatively and quantitatively survey target species, especially Box Turtle (*Terrapene carolina*) and Timber Rattlesnake (*Crotalus horridus*), and as opportunities allow, select vernal pool associated species (e.g., Marbled Salamander *Ambystoma opacum*, Jefferson Salamander *Ambystoma jeffersonianum*), Wood Turtle (*Glyptemys insculpta*), and Spotted Turtle (*Clemmys guttata*) and their habitats; to assess survival and distribution in response to fire management activities. The findings will contribute to recommendations supporting a decision matrix, flow-chart or similar decision-support structure that can help fire managers achieve desired habitat goals while minimizing negative impacts on amphibians and reptiles.
PROJECT OVERVIEW
The successful applicant will:

1. Work with PFBC staff on all aspects of project design, implementation, and reporting.
2. Coordinate with the Pennsylvania Game Commission habitat management crew on fire management activities.
3. Conduct pre-burn assessments on amphibian and reptile Species of Greatest Conservation Need (i.e., species in the 2015-2025 Pennsylvania Wildlife Action Plan), with a focus on Box Turtle (*Terrapene carolina*) and Timber Rattlesnake (*Crotatulas horridus*), and as opportunities allow, vernal pool associated Marbled Salamander (*Ambystoma opacum*), Jefferson Salamander (*Ambystoma jeffersonianum*), Spotted Turtle (*Clemmys guttata*) and Wood Turtle (*Glyptemys insculpta*).
   a. Note: Target species may be adjusted based on regional distribution of sampling sites and associated species.
   b. Conduct pre-burn habitat assessments in the vicinity where target species are found.
4. Use standard methodologies to identify reference sites in dominant habitat types for comparison to fire managed sites.
   a. In reference sites, conduct species distribution surveys, relative abundance, and habitat assessments.
5. Prior to, during, and after burn events, remotely assess (i.e., via radio-tagging) animal movement, when such assessments can be conducted safely and in coordination with the PGC Burn Boss and Division Chief, and PFBC Project Leader.
   a. Be capable of radio-tagging individuals and tracking prior, during and post-burn.
6. Assess injury and mortality of animals immediately following burn events (when safe to do so).
7. Assess target species relative abundance or other life-history factors at selected intervals after burn events to document effects. Frequencies expected to include immediately, one year and two years post activity.
8. Provide an analysis of fire management effects on species behavior, distribution, movement patterns, and relative abundance.
   a. This information will be used to provide management guidance and support development of a decision matrix or flow-chart as a reference for fire managers.

TASKS
For the following major categories, the successful applicant will:

1. **Amphibian and Reptile Assessment**
   a. Describe the qualitative and quantitative methodologies to assess target species distribution, relative abundance, and population demographics (e.g., age), movement and related factors.
   b. Implement the assessment methodologies.
2. **Habitat Assessment**
   a. Coordinate with PFBC and PGC on pre- and post- burn habitat assessments at selected temporal scales (up to 3 assessments per site).
      i. Develop statistical estimates of confidence limits for sample sizes. Currently, estimates are 8-10 new target sites per year for years 2-4. Regional reference sites are to be established in years 1-2.
      ii. Primary habitat sampled will be oak forests, though sampling may occur in barrens and grasslands.
   b. Describe methodologies to assess habitat conditions for pre- and post- fire management events.
   c. Implement the habitat assessment methodologies.

3. **Sampling Site Locations & Descriptions**
   a. Provide a geodatabase that includes locations of animals evaluated and habitats surveyed.
   b. Include narrative description and photo documentation of animals and surveyed areas.

4. **Data Entry and Reporting**
   a. Enter all amphibian and reptile data (e.g., date, location, and habitat) into the Pennsylvania Amphibian and Reptile Survey (PARS) online reporting system.
   b. State how the work, including specific activities support implementation of 2015-2025 Pennsylvania Wildlife Action Plan goals, objectives and strategies identified in the call-for-projects.
   c. Develop recommendations that could contribute to a decision-support tree or flow-chart supporting management decisions.
   d. Provide a comprehensive final report detailing effects of fire management activities on the target species.

5. **Permits**
   The successful applicant must be able to acquire a:
   a. PGC special use permit.
   b. PFBC scientific collectors permit.

6. **Location**
   This work will be conducted statewide.

**DELIVERABLES**

1. A spatially explicit database (i.e., geodatabase) of species and habitat data, including photo documentation.
2. Quarterly and annual performance reports and semi-annual invoices.
3. A final performance report (electronic and hard-copy formats) fully describing the methods, analyses and recommendations, including a decision matrix or flow-chart to guide management activities.
Tasks conducted under this project support implementation of the 2015-2025 Pennsylvania Wildlife Action Plan, including the following goals, objectives and strategies.

### 2015 PENNSYLVANIA WILDLIFE ACTION PLAN RELEVANCE


**Objective 1.1** Protect, restore, maintain or enhance all populations of Species of Greatest Conservation Need.

**Strategy**

1.1.5 Integrate conservation actions for Species of Greatest Conservation Need with resource management activities (e.g., timber harvest, water management).

**Objective 1.2** Maximize the benefit of land protection and habitat management decisions to Species of Greatest Conservation Need.

**Strategy**

1.2.1 Identify where conservation actions should be implemented to maximize the benefit to Species of Greatest Conservation Need and their habitats using best available data and technology.

#### Goal 2. Base wildlife conservation decisions on the best available science, with an emphasis on Species of Greatest Conservation Need and their habitats.

**Objective 2.1** Identify and resolve data deficiencies that limit implementation of conservation actions.

**Strategy**

2.1.3 Develop and implement survey protocols for Species of Greatest conservation Need, data deficient species, and ecological communities.

**Objective 2.2** Assess trends in Species of Greatest Conservation Need and data deficient species.

**Strategy**

2.2.4 Monitor the effectiveness of conservation, restoration and enhancement projects, and modify, as needed, using adaptive management principles.

**Objective 2.3** Evaluate habitat for effective conservation decision-making.

**Strategy**

2.3.3 Survey habitats to characterize current condition and identify conservation actions to support Species of Greatest Conservation Need.

**Objective 2.7** Support research that addresses species and habitat management needs.

**Strategy**

2.7.1 Continually assess limiting factors to populations (e.g., habitat requirements, species population demographics, threats, effectiveness of conservation actions).
2.7.4 Evaluate the effects of conservation practices on target and non-target species, habitats and threats.

**Objective 2.8** Support data compilation and entry into statewide, regional and national data repositories.

**Strategy**
2.8.2. Enter verified sightings of Species of Greatest Conservation Need, data deficient species, or unusual wildlife occurrences into geospatial databases.
2.8.5 Develop and maintain analytical and decision-support tools to guide implementation of conservation actions.

Goal 5. Continue to improve cooperation within and between public agencies and other partners in wildlife conservation planning and implementation.

Objective 5.2 Engage technical experts in planning and implementation to maintain a science-based plan.

Strategy
5.2.3 Seek input from researchers and practitioners on implementation strategies and alternative approaches for more effective conservation actions.

Objective 5.3 Foster coordination and collaboration among partners.

Strategy
5.3.5 Collaborate with public land management agencies to implement Pennsylvania’s Wildlife Action Plan.

REFERENCES


