



# SUBTERRANEAN SYSTEMS

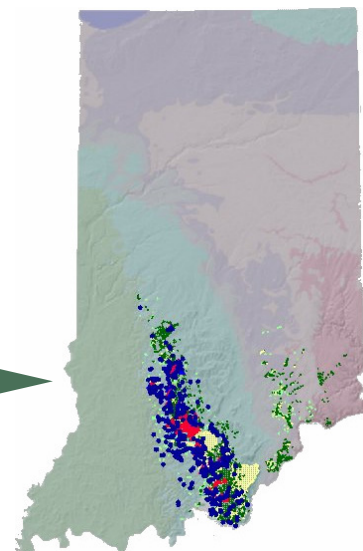
## HABITAT SUMMARY



*Surface openings of subterranean features reaching as far as natural light can penetrate (i.e., twilight zone) and connected underground rooms and passages beyond natural light penetration. This habitat encompasses the following sub-types: caves and cave entrances.*



*Subterranean Systems - the karst region of Indiana is predominantly located in the south-central part of the state.*



# Indiana's State Wildlife Action Plan

## Representative Species of Subterranean Systems

The Subterranean Systems habitat guild is represented by several species. These representative species “paint a reasonable mental picture” of subterranean systems.

Eastern Pipistrelle  
Longtail Salamander

Indiana Myotis  
Four-Toed Salamander

Cave Salamander  
Northern Cavefish



From left to right: *Eastern pipistrelle*,  
*northern cavefish* and  
*cave salamander*

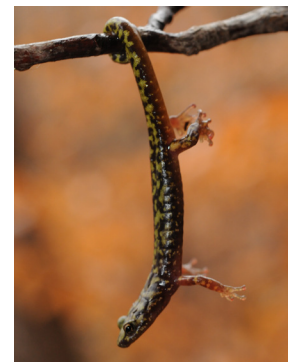
## Species of Greatest Conservation Need (SGCN) in Subterranean Systems

SGCN are animal species whose populations are rare, declining or vulnerable.

Green Salamander  
Gray Myotis  
Eastern Pipistrelle  
Southeastern Myotis

Four-toed Salamander  
Indiana Myotis  
Little Brown Myotis

Northern Cavefish  
Rafinesque's Big-eared Bat  
Northern Myotis



From left to right: *Indiana bats* and *green salamander*

## Threats to Subterranean Systems

- Habitat degradation
- Climate change
- Residual contamination (persistent toxins)
- Habitat fragmentation
- Mining/acidification
- Commercial or residential development (sprawl)
- Agricultural/forestry practices
- Point source pollution (continuing)
- Nonpoint source pollution (sedimentation and nutrients)
- Drainage practices (stormwater runoff)

## High-Priority Conservation Actions for Subterranean Systems

### Technical assistance

- Develop educational materials for landowners in karst topography about relationships between surface activities and subterranean systems.

### Cooperative land management agreements (conservation easements)

- Promote the use of cooperative land agreements to protect sensitive karst features for green salamanders, four-toed salamander and subterranean systems that support northern cavefish and bat species of greatest conservation need.

### Restrict public access and disturbance

- Post signs at important cave sites to reduce/eliminate unauthorized human visitation.
- Erect physical barriers (i.e., fences, gates) where needed to protect important cave sites.

### Land-use planning

- Identify surface recharge areas for cave systems to identify sources of potential threats.

### Habitat protection on public lands

- Develop land management plans protective of subterranean systems and permit recreation use consistent with the conservation of SGCN.

### Habitat protection through regulation

- Support regulations relative to cave closures to protect bat SGCN, especially the Indiana myotis.
- Provide technical assistance to regulatory programs regarding subterranean systems beneficial to SGCN for evaluation of projects conducted under state permit or receiving public funds.

### Habitat restoration on public lands

- Determine and support development of beneficial habitat conditions to be maintained near surface openings (e.g. cave entrances, sinkholes, rises) to subterranean systems.

### Protection of adjacent buffer zone

- Protect woodland buffers surrounding cave entrances to provide habitat for the green salamander.
- Determine effective size of forested buffer around caves used as hibernacula by Indiana bats and other cavernicolous SGCN.
- Provide vegetative buffer strips/zones around sinkholes.

### Pollution reduction

- Identify surface recharge areas.
- Provide adequate filter and buffer strips around input sources to cave systems.

### Corridor development/protection

- Identify all cave-system openings and karst stream (Lost River) tributaries and promote the protection of the entire system.

### Adaptive Management

- Modify survey and monitoring, research and other conservation actions and activities in response to new information to improve habitat conservation efficiency for SGCN.

## Threats to SGCN in Subterranean Systems

- Habitat loss (breeding range)
- Habitat loss (feeding/foraging areas)
- Specialized reproductive behavior or low reproductive rates
- High sensitivity to pollution
- Bioaccumulation of contaminants
- Degradation of movement/migration routes (overwintering habitats, nesting and staging sites)
- Unintentional take/ direct mortality (e.g., vehicle collisions, power line collisions, by catch, harvesting equipment, land preparation machinery)
- Small native range (high endemism)
- Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in availability)
- Predators (native or domesticated)

## High-Priority Conservation Actions for SGCN in Subterranean Systems

### Habitat protection

- Protect wet areas around seeps and springs for the benefit of four-toed salamanders.
- Protect the water quantity and quality in subterranean streams to benefit northern cavefish populations.
- Inventory subterranean systems cave-dependent SGCN such as the Indiana bat and southeastern bat.
- Restrict human access to caves during seasonal use by Indiana bats and other cave-dwelling species. Erect physical barriers (gates, fences) as needed.

### Regulation of collecting

- Provide public notification materials throughout the karst region of Indiana regarding the adverse consequences of collecting or disturbing subterranean system SGCN.

### Threats reduction

- Investigate the threats (e.g. pesticides, water level changes, soil erosion, human disturbance) to subterranean system SGCN.

### Public education to reduce human disturbance

- Erect interpretive warning signs at entrances to important cave sites to discourage human entry.

### Limiting contact with pollutants/contaminants

- Investigate sinkhole buffer systems to minimize the adverse impacts of runoff into subterranean systems from surrounding lands on SGCN.
- Investigate the impact of smoke and other air quality problems on subterranean system SGCN.

### Adaptive Management

- Modify survey and monitoring, research and other conservation actions and activities in response to new information to improve conservation efficiency for SGCN.

