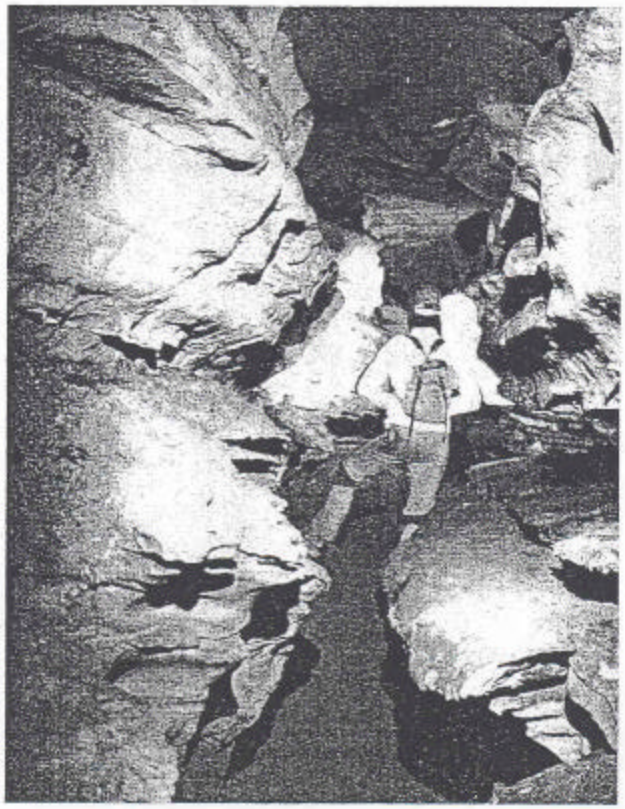
# *Community Conservation Assessment for Non-Riparian Terrestrial Cave Habitat and Associated Rare Animal Species*



(S. Fee in Powell, 1992)

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HOOSIER NATIONAL FOREST

*This Conservation Assessment was prepared to compile the published and unpublished information on non-riparian terrestrial cave habitats and associated rare animals species in the Hoosier National Forest. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.*

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## EXECUTIVE SUMMARY

The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve non-riparian terrestrial cave habitats and communities. Presently listed as Regional Forester Sensitive Species that occur in cave entrance communities on the Hoosier National Forest are the spider Porrhomma cavericolum, milliped Conotyla bollmani, collembolans Sinella alata, Sinella cavernarum, Pseudosinella fonsa and the ground beetle Pseudanophthalmus stricticollis.

Rare cavernicolous species present in non-riparian terrestrial cave communities to be recommended as Regional Forester Sensitive Species are the spider Oreonitides undescribed species, pseudoscorpion Apochtonius indianensis, millipeds Pseudotremia salisae, Pseudotremia undescribed species, collembolan Pseudosinella undescribed species (near fonsa) and Tomocerus undescribed species.

## DESCRIPTION OF HABITAT AND COMMUNITY

Many of the caves of the Hoosier National Forest contain non-riparian terrestrial cave habitats, i.e., cave passages without streams. In some cases the entire cave is streamless, in others sections (typically upper levels) are streamless with riparian habitat present elsewhere. Many non-riparian cave habitats carry water at one time or another. Examples of different kinds of caves with non-riparian habitat:

(1) Pits—These are caves that frequently consist only of a vertical passage allowing rapid travel of water downward toward base-level (and requiring vertical gear for human entry). The horizontal drains at the base of pits are usually small and tortuous, many times too small or choked with breakdown to allow human entry. Examples are Gory Hole (136 feet deep) or Brick Pit (46 feet deep) at Tincher Special Karst Area, Lawrence County.
(2) Talus caves—In these caves the passage consists of spaces between boulders, usually lying against the limestone walls of a sinkhole and probably leading down to conventional solution cave passages if penetration is far enough. Examples are JJ's Cave and JJ's Sister Cave, both on opposite sides of the same sinkhole at the Tincher Special Karst Area, Lawrence County.
(3) Isolated non-riparian caves—This is a catch-all category that is comprised of many sorts of cave situations in which streams are absent in all or part of the cave. In some, the caves are passages formed directly below the sandstone cap like Pavey Cave, Hemlock Cliffs Special Area, Crawford County. Swallowholes such as TRAC Cave or Tincher Hollow Swallowhole, both in the Tincher Karst Special Area are typically streamless, but at times take large quantities of water.

The communities of these caves are comprised only of terrestrial species. Many of these caves, particularly the open air pits that function as leaf traps, are nutrient rich. These leaf litter habitats are usually also species rich with the milliped Conotyla bollmani, collembolans like Pseudosinella fonsa, Sinella alata, Sinella cavernarum, and the spider

predators of the collembolans such as Phanetta subterranea, Porrhomma cavericolum, or Oreonitides undescribed species. In cases where the relative humidity is saturated the beetle Pseudanophthalmus stricticollis may be present.

## ENVIRONMENTAL CONDITIONS

Camacho (1992) listed a number of characteristics of caves terrestrial ecosystems, noting that the environment was heterogeneous and subject to variation in most parameters:

(1) Temperature--Dependent on the latitude, altitude, cave size and ventilation. In southern Indiana the air temperature at a point about 3500 feet into the interior of Binkley Cave monitored monthly for a year varied from 53.7 to 56.3 degrees F. (Lewis and Sollman, 1998).
(2) Light—absent, thus no photosynthetic plants to supply oxygen or nutrients.
(3) Air—The flow of air into and out of a cave is linked to atmospheric factors. Normally cave air composition is the same as the outside atmosphere and is replenished regularly due to flow. In caves lacking multiple connections to the outside that afford air flow and exchange, carbon dioxide can accumulate due to decomposition and other factors.
(4) Humidity—Even caves that appear to be "dry" frequently have high relative humidity and it is not unusual for it to be between 95 to 100%. This is important since many terrestrial troglobites are stenohygrobiont and live only in environments at or near saturation.
(5) Nutrients—All food material for cave communities must be imported. Many of these communities are close to an entrance and trogloxenes may be an important source of nutrients. However, the obvious source of organic material to non-riparian communities is from leaf litter, particularly in open air pits.

## CURRENT COMMUNITY CONDITION, DISTRIBUTION AND ABUNDANCE

Due to the presence of karst topography in large parts of the Hoosier National Forest non-riparian terrestrial cave habitats and their communities are relatively common (examples noted above). Although riparian cave habitat is probably more common if measured by area, on a cave-by-cave basis non-riparian habitat is possibly more abundant since so many Hoosier National Forest caves are small pits or consist of short, streamless passages. In most cases the caves are obscure, little visited by humans and in excellent condition.

## REGIONAL FORESTER SENSITIVE SPECIES

The milliped Conotyla bollmani, spider Porrhomma cavericolum, collembolans Sinella alata, Sinella cavernarum, and ground beetle Pseudanophthalmus stricticollis are presently listed as Regional Forester Sensitive Species that occur in cave non-riparian communities on the Hoosier National Forest.

Rare cavernicolous species present in cave riparian communities to be recommended as Regional Forester Sensitive Species are milliped Pseudotremia salisae, the spider Oreonitides undescribed species, pseudoscorpion Apochthonius indianensis, collembolans Pseudosinella undescribed species near fonsa and Tomocerus undescribed species.

## POTENTIAL THREATS

Non-riparian communities are somewhat less susceptible to disturbance from water-born contaminants, although many of these habitats carry water periodically. Potential contaminants include (1) sewage or fecal contamination, including sewage plant effluent, septic field waste, campground outhouses, feedlots, grazing pastures or any other source of human or animal waste (Harvey and Skeleton, 1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al 1996, 1997, 1998); (2) pesticides or herbicides used for crops, livestock, trails, roads or other applications; fertilizers used for crops or lawns (Keith and Poulson, 1981; Panno, et al. 1998); (3) hazardous material introductions via accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Lewis, 1993, 1996).

Impoundments may detrimentally affect cave species. Conditions in some Tucker Dam Quarry Cave (Springs Valley Recreation Area), a streamless cave with significant amounts of non-riparian habitat was reported to change in response to the height of the adjacent Tucker Lake (Fee, 1992). Another streamless cave in the Deam Wilderness has apparently been covered by the impoundment creating Lake Monroe.

Fire and smoke are potential sources of airborne particulate contamination and hazardous material introduction to the cave environment. Elliott (1998) reviewed the possible insecticide effects of cigarette smoke from cave visitors and the numerous harmful chemicals present in it (Feinstein, 1952; Howarth, 1983). Many caves have active air currents that serve to inhale surface air from one entrance and exhale it from another. Ashes in the entrance of Patton Cave attest to campfires being built there. This activity produces a dead zone due to the heat involved and alters the habitat as well as making smoke.

Cave ecosystems are unfortunately not immune to the introduction of exotic species (Elliott, 1992; 1998). Out-competition of native cavernicoles by exotic facultative cavernicoles is becoming more common, with species such as the exotic milliped Oxidus gracilis (Lewis, et al., 2002 in press) that most heavily affects riparian communities . In some cases this milliped literally over-runs the habitat with its sheer numbers.

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials, e.g., spent carbide, batteries (Peck, 1969; Elliott, 1998).

## SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Numerous caves with excellent non-riparian terrestrial habitats and communities are protected on the Hoosier National Forest. Examples include Gory Hole, Brick Pit, Fuzzy Hole, and Smith's Folly Cave at Tincher Special Karst Area, Lawrence County; Pavey Cave, Treasure Cave, Hemlock Cliffs Special Area, Crawford County. Forest service special areas receive restrictive management for protection of the resources present in these areas (USDA Forest Service, 1991; 2000).

## SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

Cave and karst habitat located on the Hoosier National Forest are subject to standards and guidelines for caves and karst protection and management as outlined in the Hoosier National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1991). These standards and guidelines include the following:

> *Caves are protected and managed in accordance with the Federal Cave and Karst Resources Protection Act of 1988, Forest Service Manual 2353, Memorandums of Understanding between the forest service and the National Speleological Society, the Indiana Karst Conservancy, Inc., the Forest Cave Management Implementation Plan, and individual specific cave management plans.
>
> *Except where modified by an existing cave management prescription, vegetation within a 150-200 foot radius of cave entrances and infeeder drainages with slopes greater than 30 percent will generally not be cut. No surface disturbing activities will be conducted on any slopes steeper than 30 percent adjacent to cave entrances. Similar protection areas will be maintained around direct drainage inputs such as sinkholes and swallow holes known to open into a cave's drainage system of any streams flowing into a known cave.
>
> *Allow no sediment from erosion of access roads and drilling sites to wash into caves or karst features.
>
> *Seismic surveys requiring explosives shall not be conducted directly over known cave passages or conduits.
>
> *All caves will be managed as significant.
> (USDA Forest Service, 1991)

The forest plan includes a cave and karst management implementation plan. This management plan places an emphasis on cave resource protection and mitigation. Understanding of the caves is established through mapping, bioinventory, cataloging of resources (e.g., archaeological, paleontological, speleothems, etc.), and estimating use levels and trends. Protection zones or other mitigation measures recommended by a

management prescription will be established around caves entrances, sinkholes and swallowholes. Specific criteria will include consideration for protection of entrance and cave passage microclimate, animals inhabiting the cave, physical and chemical parameters and aesthetic values associated with the cave.

## RESEARCH AND MONITORING

A bioinventory of subterranean habitats of the Hoosier National Forest is being conducted in which non-riparian terrestrial cave habitats are being intensively sampled (Lewis, et al., 2002; and in progress).

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