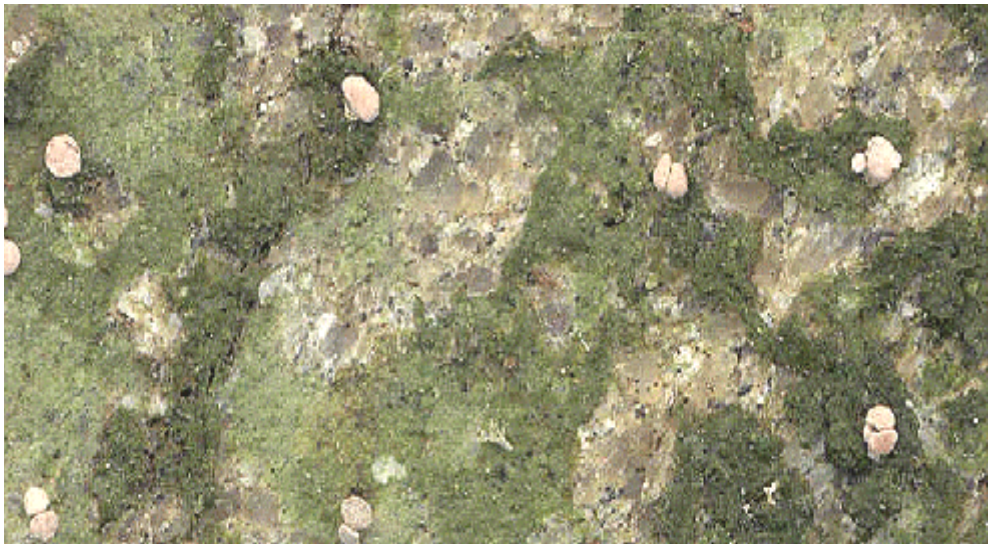
Conservation Assessment for Pink Dot Lichen (Dibaeis absoluta)



Cover photo: by S.R. Hill

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This document is undergoing peer review, comments welcome

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. 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 taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580, Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

This Conservation Assessment is a review of the distribution, habitat, ecology, and population biology of the Pink dot lichen, Dibaeis absoluta (Tuckerman) Kalb & Gierl, throughout its range, and in the USDA Forest Service lands, Eastern Region (Region 9), in particular. This document also serves to update knowledge about the status, potential threats, and conservation efforts regarding the Pink dot lichen to date. Most references have treated this lichen as Baeomyces absolutus Tuckerman, but since 1993, when the new generic placement was made, most treatments have accepted it under its new name. The Pink dot lichen is an inconspicuous perennial lichen that is very widespread in range, and has been found on the continents of Asia, Australia, North America and South America, including the West Indies. Lichens are organisms made up of a fungus and alga that are completely interdependent. This lichen appears as a shiny greenish to brownish gray very thin film-like thallus with scattered pink subglobose stalkless fruiting structures that are 1-1.5 mm in diameter and resemble pink dots. In the United States it is considered rare (though some sources say its status is uncertain nationally), and it is known from ten states, namely, Alabama, Illinois, Indiana, Kentucky, Missouri, North Carolina, Ohio, Tennessee, Virginia, and West Virginia. It grows mainly on moist shaded rocks in mature forests south of the glacial limit. Globally, it has been ranked as G4 (apparently secure world-wide). In Ohio, it is currently listed as Endangered, and it has also been listed as Endangered in Missouri. The Pink dot lichen has been included on the Regional Forester Sensitive Species List (RFSS) for the Hoosier National Forest but not the Shawnee National Forest. While specimens suggest that it is uncommon in Illinois, few botanists have searched for it and there is limited data available. In Illinois, it has been found within the Shawnee National Forest and other sites. Its status is considered secure in Illinois. It faces several risks that could result in its extirpation in portions its range if it is not properly managed.

In additional to species listed as endangered or threatened under the Endangered Species Act (ESA), or species of Concern by U.S. Fish and Wildlife Service, the Forest Service lists species that are Sensitive within each region (RFSS). The National Forest Management Act and U.S. Forest Service policy require that National Forest System land be managed to maintain viable populations of all native plant and animal species. A viable population is one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its range within a given planning area.

The objectives of this document are to:

-Provide an overview of the current scientific knowledge on the species.

-Provide a summary of the distribution and status on the species range-wide and within the Eastern Region of the Forest Service, in particular.

-Provide the available background information needed to prepare a subsequent Conservation Approach.

NOMENCLATURE AND TAXONOMY

Scientific Name: Dibaeis absoluta (Tuckerman) Kalb & Gierl (1993)

Common Names: Pink dot lichen

Synonymy: based on: Baeomyces absolutus Tuckerman (1859). Baeomyces novae-zelandiae Knight

Division and Class: Ascomycota - Ascomycetes (Sac fungi - lichenized)

Family: Baeomycetaceae (the Pink earth lichen family)

Plants Code: DIAB2 (USDA NRCS plant database, W-2)
http://plants.usda.gov/cgi_bin/topics.cgi

There are 2 species of Dibaeis in North America north of Mexico. They are Dibaeis baeomyces (L. f.) Rambold & Hertel, the Pink earth lichen (= Baeomyces roseus Pers.), and Dibaeis absoluta (Tuck.) Kalb & Gierl, the Pink dot lichen (= Baeomyces absolutus Tuck.) (W-3; Esslinger & Egan 1995). These two species have been placed in different subgenera within the genus, the former in Dibaeis subg. Dibaeis, and the latter in Dibaeis subg. Apoda (Gierl & Kalb 1993). There is some disagreement on the family placement of the genus. Currently, the U.S.D.A. Plants website (W-2) and others (W-4, W-5, W-6), place the genus in the family Baeomycetaceae. Other sources refer the genus to the family Icmadophilaceae (W-7, W-8, Brodo et al. 2001), and still other respected sources have included the genus within the family Cladoniaceae (W-9; Skorepa 1973). One of the primary sources on the genus has stated that Dibaeis and Icmadophila should be within the same family but did not specify the family name (Gierl & Kalb 1993), while another has presented a case that the two families are quite distinct (Platt & Spatafora 2000). To add to the difficulty in placing the genus into a family, Stenroos et al. (2002) have recently stated

that the Baeomycetaceae should include Baeomyces and the Icmadophilaceae should include Dibaeis.

The common name Pink dot lichen was found to be in use by the Ohio Department of Natural Resources (W-10) and is particularly descriptive of the organism. No other common name has been found. The epithet 'absoluta' means "perfect, complete' or 'absolute' but its use here is not clear.

DESCRIPTION OF SPECIES

Dibaeis absoluta is a perennial lichenized sac-fungus, a fungus in association with an alga. The organism has two parts, a crustose primary thallus and a fruticose apothecia. The thallus is very thin, brownish, beige, or green, generally smooth or 'polished', sometimes fissured or cracked, and is found as a thin film closely attached to a rock substrate (Gierl & Kalb 1993). Thomson (1967) described the thallus as being consistently emerald-green with a varnish-like crust. The reproductive portion, or apothecium, is pink, bright pink or ivory-white, the podetium is the same color, and the stalk is essentially lacking, while the disc is globose with a diameter of 0.5-2 (-3) mm (adapted from Kalb & Gierl 1993 and Brodo et al. 2001). Typically, the lichens grow as a thin soft membrane or crust that resembles an algal colony on moist soil or rock, until the small pink round apothecia are produced that suggest its common name. The bright pink dots stand out conspicuously against the greenish or brownish thallus. Additional descriptive information can be found in Hale (1979) as follows: Surface of the highly reduced stalks smooth, without phyllocladia and tomentum, ecorticate but not fibrous, usually shiny; stalks (if visible) erect, solid, unbranched, round in cross-section; apothecia small and flattened, flesh-colored to pinkish; encrusting thallus very thin, greenish, to beige, brownish gray (usnic acid lacking), reacting K- or K+ yellow. Hale called this group 'lichens with PODETIA (incl. pseudopodetia)'.

Lichen identifications generally are made based, in part, upon chemical tests, and the chemistry of Dibaeis absoluta has been defined as follows (Brodo et al. 2001): cortex PD- or PD+ yellow, K-, KC-, C-; medulla PD+ bright yellow, K- or K+ pale yellow, KC-, C-; apothecia PD+ bright yellow, K- or K+ pale yellow, KC+ yellow, C- (baeomycesic and squamatic acids). While it has the same chemistry as Dibaeis baeomyces, the Pink dot lichen has a thin continuous thallus without granules or roughenings, and the pink apothecia are virtually stalkless, like those in the genus Icmadophila (Brodo et al. 2001). The habitat and range of the two genera, however, are distinct (Icmadophila is found mostly in the far north).

HABITAT AND ECOLOGY

Concerning the Pink dot lichen, Thomson (1967) stated: "This species grows on sandy soil over boulders and on rock outcrops in very shaded habitats. In Indiana it grew in deep, moist, shaded ravines with rather low light intensities." The Pink dot lichen has been found on several substrate types throughout its wide range, and these include rock, soil, loam, argillaceous rock walls, roadside slopes, soil cracks or drainages, and sandstone (Gierl & Kalb 1993). In the United States, this lichen is normally found in a distinctive and limited habitat, on moist rocks in mature forests (Hale 1979), though Brodo et al. (2001) also mention soil as a substrate. Herbarium records examined recorded its habitat variously as 'soil', 'moist shaded

sandstone','moist north-facing sandstone wall next to waterfall', and 'rock just above lower heath slick', and none have indicated a calcareous substrate. It appears that the species prefers an acidic substrate.

Skorepa (1973) found that in Illinois the Pink dot lichen was restricted to sandstone outcrops within mature forests. It has been found at several sites where French's shootingstar (Dodecatheon frenchii) grows, and so their habitats are somewhat similar, differing in microhabitat factors. Areas of silica rich rock or sandstone ledges along or near streams with a rather dense canopied mature forest surrounding them appear to be the preferred habitat of the Pink dot lichen in the United States. The rock exposure is generally northern to eastern, and the lichens rarely, if ever, are exposed to direct sunlight, at least at mid-day. The air in this habitat is normally still and very humid. These areas are often near rock shelters or rock houses (Francis et al. 1993) because people have used the more protected sites within these areas as protection from the weather since prehistoric times. This species, however, does not grow under ledges but on the exposed, yet shaded, mostly vertical faces of them. The species appears to be very well adapted to this shaded habitat, and there are generally few other organisms that can grow with it other than certain lichens and bryophytes. Therefore, there is little competition from vascular plant species for substrate and the Pink dot lichen often grows alone on bare rock or soil. The species is a delicate one, and it does not appear to be able to compete well with other organisms.

Associates have not generally been recorded with this lichen. In Illinois, Skorepa (1973) compiled a listing of 78 lichens known to grown on sandstone outcrops, 59 of which, including Dibaeis absoluta, were limited to it. Expected associated lichens may include species of Parmelia, Cladonia, Dirinaria frostii (Tuck.) Hale & Culb., Ramalina intermedia (Delise ex Nyl.) Nyl., Lecanora dispersa (Pers.) Sommerf., and Porpidia (Lecidea) albocaerulescens (Wulfen) Hertel & Knoph. The bryophytes Hedwigia ciliata (Hedw.) P. Beauv., Dicranum spp. and Scapania spp. are also expected associates. Surrounding woody vegetation at one site in North Carolina included the acidophiles Kalmia latifolia L. and Pinus spp. The sandstone cliffs where the Pink dot lichen grows are generally surrounded by mature mesic upland forest or floodplain forest elements (White & Madany 1978) dominated by tall mature trees, primarily post oak, white oak, southern red oak, black oak, beech, maples, mockernut hickory, pignut hickory, and hop hornbeam (Mohlenbrock 1978). Skorepa (1973) suggested that while the general aspect of the lichen, moss, and vascular plant vegetation on the sandstone outcrops could lead one to believe that succession is taking place, the lichens and mosses on the exposed rocks actually represent a stable climax. Winterringer and Vestal (1956) likewise saw little evidence of succession on sandstone bluffs in southern Illinois and considered lichens to be of no importance in succession.

DISTRIBUTION AND ABUNDANCE

The Pink dot lichen is very widespread in range (Gierl & Kalb 1993), it is considered to be a pantropical or subtropical lichen, and it has been found on the continents of Asia (Japan, Philippines, Taiwan, New Guinea, Sabah), Australia (New South Wales and Queensland; also New Zealand), South America (Brazil, Colombia, Ecuador, Venezuela, see Vries & Sipman 1984), and North America (Costa Rica, Guatemala, Mexico, the United States), including the West Indies (Cuba, Dominican Republic, Jamaica, Puerto Rico).

In the **United States**, Dibaeis absoluta is considered rare (though some sources say its status is uncertain nationally), and its northern limit is just south of the glacial boundary. This lichen has been found in only a few locations in ten states, namely, Alabama, southern Illinois, southern Indiana, Kentucky, southeastern Missouri, extreme western North Carolina, southern Ohio, Tennessee, extreme western Virginia, and West Virginia (Hale 1979). Globally, it has been ranked as G4 (apparently secure world-wide). In Ohio, it is currently listed as Endangered (W-10), and it has also been listed as Endangered in Missouri (W-11). Within Kentucky, the Pink dot lichen has been found in McCreary County; in Ohio, it has been found in the south in Athens County, Hocking County, and Jackson County (W-10) and historically (pre-1945) in Adams and Fairfield Counties (Taylor 1968); also in Ohio, several populations were discovered in Crane Hollow in 1986, but these could not be relocated in 1993 (W-12); in Missouri it has been found only in the extreme southeastern region in Jefferson and Ste. Genevieve Counties (Ladd 1991, Nigh et al. 1992); in Tennessee it has been found in Cocke County. The location of collection for the North Carolina specimen is unknown, but the Tennessee location suggests that it was in the far western part of the state in the mountains, also suggested by Hale (1979). The Alabama localities include Baldwin County in the far south, but Hale (1979) listed it as in extreme northern Alabama as well, in Lawrence County, which is the type locality for this species. Representative specimens of this lichen have been listed in Appendix 2.

The Pink dot lichen has been included on the Regional Forester Sensitive Species List (RFSS) for the Hoosier National Forest but not the Shawnee National Forest. While the limited number of specimens suggests that it is uncommon in Illinois, one must also consider the fact that it is inconspicuous and few botanists have searched for it, so that there is limited data available. In Illinois, specimens are known from three counties (Clark County, Johnson County, Pope County; see Wiedman & Whiteside 1975). In Indiana, this lichen has been found in Parke County and Putnam County, where it is known from Hoosier Highlands near Greencastle nearly due east of the Clark County, Illinois, site. In Illinois, its known localities are located within the Southern Uplands Section of the Wabash Border Natural Division as well as in the Shawnee Hills Natural Division (Schwegman et al. 1973).

The North American distribution of Dibaeis absoluta resembles closely that of vascular plants considered to have a relict distribution along the southern edge of glaciated portions of the landscape. Other examples include the Appalachian bristle fern (Trichomanes boschianum Sturm), the Appalachian shoestring fern (Vittaria appalachiana Farrar & Mickel), and yellowwood (Cladrastis) among others. These species found refuge among the diversity of protected sites of rocky or mountainous habitats beyond the reach of the glaciers and have not moved north of this line since. Skorepa (1973) interpreted the distribution of the Pink dot lichen and others like it to represent a grouping of 'Southeastern States Elements' because of the similarity of the region's hot summers and mild winters with those in the southeastern states. He also discussed an 'Ozark-Appalachian Element' that appeared to better match the lichen's range in North America (Skorepa 1973). Voigt and Mohlenbrock (1964) also suggested the Ozark-Appalachian affinity of certain species in the flora that have a similar distribution, such as the Appalachian bristle fern, Bradley's spleenwort (Asplenium bradleyi D.C. Eat.), little-flowered alumroot (Heuchera parviflora Bartl.), and cucumber-tree (Magnolia acuminata (L.) L.) but this lichen was not mentioned.

Because of the very limited amount of information concerning this lichen, little can be concluded about its distribution and frequency. It can only be said to be scattered in its distribution over an area from Ohio to Missouri south to southern Alabama and the mountains of North Carolina and Tennessee, and that its frequency at each site is unknown.

PROTECTION STATUS

As stated above, in the United States the Pink dot lichen is considered rare (Hale 1979), and it is known from ten states. Globally, it has been ranked as G4 (apparently secure world-wide). The U.S. Fish and Wildlife Service have not proposed it as a candidate for listing as threatened or endangered. In Ohio, it is currently listed as Endangered (W-10), and it has also been listed as Endangered in Missouri (W-11) and is still being carefully monitored, but current law in that state only allows the listing of federally listed taxa as state endangered (Yatskievych, pers. com.). Therefore, this lichen is protected state-wide only in Ohio. The Pink dot lichen has been included on the Regional Forester Sensitive Species List (RFSS) for the Hoosier National Forest but not the Shawnee National Forest. Its status is considered secure in Illinois, but there have been very few sightings and it is not being actively tracked. Data on its occurrence in Indiana and in the Hoosier National Forest is sparse.

Protection programs for this lichen, and most other lichens, have not been established or else they are in their infancy. Few lichens have been proposed for protection in this country, and this may be due to the lack of data on these organisms as well as a lack of experts on the group. They are difficult to identify by non-experts, and, since they are not considered to be plants, most botanists do not study them. They are normally included in the Kingdom Fungi (Mycota) rather than the Kingdom Plantae, and they are as different from plants as are animals. Protection for this group is currently more dependent on habitat protection and its survival will probably depend more on this then on species protection. Dibaeis absoluta appears to be restricted to a specialized and scarce habitat, moist shaded sandstone cliffs in mature forests, and this habitat (Sandstone overhang, Sandstone cliff) has been given a priority for protection in some states (see W-12). Protection of the habitat and the vascular species protected within them (such as French's shootingstar and others) will help in protecting this lichen as well. Inclusion of this lichen on the Regional Forester Sensitive Species List and other lists of rare or sensitive species has drawn attention to it, and is necessary in highlighting the need for more data collection as well as the sensitivity of its habitat.

Table 1 lists the official state rank assigned by each state's Natural Heritage program according to the U.S.D.A. Natural Resources Conservation Service at their Internet site (W-2). Appendix 1 explains the meanings of the acronyms used (W-13). A summary of the current official protection status for the Pink dot lichen follows:

U.S. Fish and Wildlife Service: Not listed (None)

U.S. Forest Service: Region 9, Sensitive (Hoosier National Forest only)

Global Heritage Status Rank: G4

U.S. National Heritage Status Rank: N?

Table 1: *S-ranks for Dibaeis absolutus [element DIAB2]*

State	Status
Alabama	?
Illinois	?
Indiana	?
Kentucky	?
Missouri	[S1?]
North Carolina	?
Ohio	Endangered [S1?]
Tennessee	?
Virginia	?
West Virginia	?

LIFE HISTORY

Dibaeis absoluta is a perennial lichen (lichenized fungus) but its average life-span is not known. The fungal component (mycobiont) of the organism is an ascomycete (sac-fungus). The alga (photobiont) said to be present within the organism is the green alga Cystococcus sp. (Thomson 1967), which may actually be a Pleurococcus. The green algae Coccomyxa sp. and Elliptochloris sp. have also been reported as associates of Baeomyces and Dibaeis (W-14).

Lichens are named after their fungal partner (mycobiont), usually an ascomycete. Worldwide, about one fifth of all known fungi are lichenized (i.e., lichens). In contrast there are only about 40 genera of photosynthetic partners known. The most common photosynthetic partners (photobionts) are green algae. Although it is often possible to determine the genus of the algal photobiont in lichens, the alga must be isolated and cultured to determine species because life cycle stages and chloroplast morphology must be observed to identify them, but these stages do not occur or are altered in the lichenized state (W-15, McCune & Geiser 1997).

The pink apothecia are sexual structures produced by the fungus and they produce spores. In principle, the fungal partner produces spores that germinate, contact free-living algae, and develop into new individuals (W-15; McCune & Geiser 1997). However, specific data on the reproduction, dispersal, and establishment of Dibaeis absoluta was not found during this assessment.

Fertile specimens of the Pink dot lichen have been collected in the United States in May, August, September, and October. In other countries north of the equator specimens of this lichen have been collected with apothecia in January, February, April, June, August, October, and December. It does not appear that a life history or phenological pattern can be inferred from this limited data. The life history may be dependent upon very local site conditions, or not.

POPULATION BIOLOGY AND VIABILITY

There is very little information available on the population biology or viability for the Pink dot lichen anywhere within its wide range. What little is known has been presented in the previous section concerning life history. Most additional information is really speculation based upon assumptions derived from the habitat and generalized life history of this lichen. Therefore, one can surmise that this lichen has limited opportunity for dispersal because of the nature of its habitat - moist, still air among protecting sandstone outcrops - and that it may not be able to establish well except on bare moist shaded rock where competition from other organisms is not a problem. This may explain the apparent distribution of localized isolated patches of this lichen that are likewise isolated in small areas over a wide area of the southeastern and midwestern United States.

Speculation on the viability of the species would come from the assumption that it follows the same pattern as other very localized species in its habitat, such as French's shootingstar (Hill 2002a). The species may be locally secure in its isolated populations, but changes in the habitat may result in its extirpation even within a state where it occurs. It would appear that it can survive only if its habitat remains stable.

To determine the viability for the Pink dot lichen, more searches should first be conducted for this rather inconspicuous lichen in suitable habitats, starting with areas where small-flowered alum-root (Heuchera parviflora) and French's shootingstar have been found. These, potentially, can be used as indicator species for the lichen. Second, when new populations are found, they should be carefully documented and, wherever possible, the site with its surrounding forest and drainage should be protected from any unnatural disturbance to allow the species to survive.

POTENTIAL THREATS

With a lack of evidence to the contrary, the Pink dot lichen is thought to be relatively secure globally. With its wide distribution, it may persist indefinitely. Upon closer inspection, however, even globally there are actually relatively few precise locations known for the lichen, and almost nothing is known about its frequency within a site. In the United States, its habitat is not common and it appears that the lichen cannot stand some types of disturbance.

The potential threats to the Pink dot lichen include physical damage from humans and animals walking or climbing on its exposed sandstone habitats, competition from other organisms suited to its habitat, erosion (primarily as an influx of smothering deposits), and drying, the latter two as a result of logging or other cutting of the mature trees that shade these unusual habitats. Organisms of this habitat are particularly vulnerable to an influx of nutrients from above. In such conditions, species adapted to a low-nutrient regime can be suddenly overwhelmed by eutrophication or 'biofouling', often seen as thick growths of algae ('slimes') comparable to those algal blooms in lakes, streams, and oceans which eliminate the slower growing organisms. Habitats with an impervious layer, such as the sandstone outcrops, are especially vulnerable. The general principles on the detrimental effects of nutrient-rich runoff can be seen in studies such as that by Bormann et al. (1974) at Hubbard Brook. Therefore, an influx of nutrient rich runoff as a result of logging or agricultural activity, should it occur, may present a serious threat to the species.

Botanists generally believe that most native plants and lichens have reached the limit to which they can travel under present conditions of climate (that is, temperature and rainfall), substrate, dispersal mechanism, and other pertinent factors. In other words, species are in balance with their environment as long as the environment is stable. In many biological simulations, ecological extremes are more important than the means in controlling plant and lichen distribution (Webb et al. 1975). An obvious example is that of frost tolerance (temperature extremes). An organism completely intolerant of freezing can persist in a site indefinitely until the first time extreme temperatures cause it to freeze. One such freeze in a century may be enough to eliminate a species entirely from a wide area of its range, and changes in climate historically have caused the greatest changes in plant and lichen distributions.

In the case of Dibaeis absoluta, current distribution appears to be dependent primarily on historical factors (lack of glaciation within its current range, resulting in a 'relict' distribution), substrate and bedrock type, and age of surrounding forest as well as the degree of canopy closure rather than from temperature extremes. With limited means of spore dispersal, it may also be unable to increase its range very quickly. The climatic factor of moisture (particularly high humidity) appears to be crucial, along with a stability of the rock substrate and lack of competition. Under natural conditions, these habitats are stable, but if trees surrounding the ledges are cut or if human or animal traffic increases, the fragile habitat balance can be destroyed and the populations can be lost. The use of fire as a management tool does not appear to be a beneficial factor for this species; the habitat actually appears to provide some protection from natural fires and a combustible component is not part of its immediate environment. Burning of the surrounding forest shading the habitat may be detrimental by increasing both light and erosion.

Habitat fragmentation can have profound effects on the success and persistence of local populations. Any activities that result in barriers to dispersal, such as developments, clearcuts, road/utility line corridors, and mining limit the possibility of population expansion and genetic exchange in many species. Deleterious effects of fragmentation could possibly go unnoticed for a long period of time, making the short term effects on species' viability less apparent. Over time, as populations become increasingly more isolated, the effects of fragmentation can

potentially be observed at the molecular level by reduced genetic frequencies caused by random drift (Barrett & Kohn 1991). When one is considering populations that are already naturally isolated, as in the case of the Pink dot lichen, random genetic drift may have already occurred.

Restricted access to any known sites, relocation of any trails in the vicinity, and complete elimination of logging, camping, rock climbing, off trail vehicles, and fires in areas where it grows would be indicated as a means to ensure the species' survival and viability (Shawnee National Forest 2001). Most of these activities are currently illegal where this species grows in the National Forest and state parks. In Ohio, the primary threats to this lichen are considered to be clearcutting and destruction of habitat by stripmining (W-10).

Suitable habitat for the species in Illinois and Indiana occurs only along a narrow band in the area of the Shawnee Hills and north in the area of Hoosier Highlands, Indiana, and there appears to be additional habitat for the lichen where it may occur. Its habitat is a very popular one among hikers and botanists, but few searches have been conducted for it, and additional searches are suggested. At the current time, it does not appear that any populations of Dibaeis absoluta in the Hoosier or Shawnee National Forests are immediately threatened with elimination because of habitat loss. However, in the absence of future management of the forest and sandstone outcrops for this species, it could decrease or be eliminated.

RESEARCH AND MONITORING

The Pink dot lichen is not being monitored to any large extent except in Ohio. Certainly, limited monitoring has taken place in Illinois, Indiana, Kentucky, and Missouri. However, a continuing problem is that there is neither sufficient funding nor are there enough botanists or lichenologists available to survey the immense area that needs to be covered in the monitoring of the large numbers of sensitive organisms, including this one (Hill 2002). There is the potential of additional suitable habitat in southern Illinois where Dibaeis absoluta could exist, and continued searches for the species should be conducted.

In addition to the basic effort of locating additional populations of the species, it would be useful to conduct more extensive monitoring of known populations. The techniques for these and other aspects of monitoring and studying rare plant and lichen species are explained well in Collins et al. (2001), Philippi et al. (2001), and Imm et al. (2001). Of particular importance is the monitoring of the same populations over time to determine population dynamics. Also, more research is needed on the longevity of individuals, their phenology and reproductive potential, and the establishment of colonies. Particular attention must be shown to avoid invasive monitoring (climbing on, or trampling) of the sites. In the case of potential disturbance from above, a plan may be needed to construct a sediment or nutrient baffle to protect a colony.

The Hoosier National Forest has instituted an agreement with the Indiana Department of Natural Resources, Division of Nature Preserves, to conduct surveys of rare and exotic organisms in special areas. The populations of rare organisms are to be documented, former sites revisited, and plot information collected, and each exact location is to be noted with Global Positioning System technology (Day 2000). However, this lichen is not included on the listing of state rare, threatened or endangered organisms, and perhaps it should be added. It also needs further

evaluation for listing and protection in the other states where it occurs.

RESTORATION

There are no known restoration efforts being conducted on Dibaeis absoluta anywhere in its range. Most research on the species has been conducted on herbarium material only. Little, if any, attention has been given to the restoration of lichens nationally. More data is needed on these organisms and its listing in the RFSS list should help in this regard. The National Forests of Illinois and Indiana appear to be among the greatest refuges for this narrowly distributed lichen in the United States.

Lichens are normally not available commercially. In the case of native vascular plants, restorations are recommended using only nursery propagated material grown from native, local populations to avoid interbreeding with genotypes not adapted to the local conditions and to avoid compromising the local gene pool. If this rule is not followed, the result is generally the loss of plants because they are not competitive under local conditions or the result could be the success of a plant or plants that can not be considered truly native (considered by some to be a plant community reconstruction rather than a restoration). The introduction of the Pink dot lichen in Illinois or Indiana, if it is even possible, from unknown sources would not be encouraged in a restoration effort. Local individuals should, instead, be propagated for establishment in such an effort. This procedure would, undoubtedly, require considerable expertise.

SUMMARY

Documented as native only in ten midwestern and southeastern states, Dibaeis absoluta, the Pink dot lichen, is found on three other continents as well. It is currently thought to be secure but rare globally, and its very narrow and restricted habitat preferences make it vulnerable for extirpation in several states if the habitat is not managed. The lichen's distribution within its United States range is limited primarily by its preferences for shaded, moist, protected sandstone outcrops south of the glacial boundary. Details are lacking on its reproduction, dispersal, and frequency within populations and on aspects of its ecology. The Pink dot lichen is vulnerable to physical damage by humans and animals, the effects of erosion, from drying due to the loss of surrounding forests, from incidental destruction by campers, and from destruction of the habitat by stripmining. Dibaeis absoluta is currently listed as Endangered in Ohio and it was formerly listed as Endangered in Missouri (and is still being monitored there). It is listed currently as a Regional Forester Sensitive Species in the Hoosier National Forest. Casual access to the vicinity of the populations should be limited, but continued population monitoring is needed and searches should be conducted for additional populations in both Illinois and Indiana within suitable habitat. Management through protection of its habitat may be needed for it to persist at its few currently known locations.

REFERENCES

Barrett, B.C.H. and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: implications for conservation. [pp. 3-30 In Genetics and conservation of rare

plants, D.A. Falk and K.E. Holtzinger, eds. Oxford University Press, New York, NY.

Bormann, F.H., G.E. Likens, T.G. Siccama, R.S. Pierce, and J.S. Eaton. 1974. The export of nutrients and recovery of stable conditions following deforestation at Hubbard Brook. Ecological Monographs 44: 255-277.

Brodo, I.M., S.D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press: New Haven, Connecticut. 795 pp.

Collins, B., P. S. White, and D.W. Imm. 2001. Introduction to Ecology and Management of Rare Plants of the Southeast. Natural Areas Journal 21:4-11.

Day, K.G. 2000. Land and Resource Management Plan: Monitoring and Evaluation Report Fiscal Year 2000 - Hoosier National Forest. 55 pp.

Esslinger, T.L. and R.S. Egan. 1995. A sixth checklist of the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. The Bryologist 98(4): 467-549.

Francis, S.W., J.L. Walck, and J.M. Baskin. 1993. Sandstone rockhouses of the Cumberland plateau of Kentucky and Tennessee. Supplement - American Journal of Botany 80 (6): 50.

Gierl, C. and K. Kalb. 1993. Die Flechtengattung Dibaeis. Eine Übersicht über die rosafrüchtigen Arten von Baeomyces sens. lat. nebst Anmerkungen zu Phyllobaeis gen. nov. Herzogia 9: 593-645.

Hale, M.E. 1979. How to Know the Lichens. Second edition. The Pictured Key Nature Series, Wm. C. Brown Company Publishers: Dubuque, Iowa.

Hill, S.R. 2002. Some recent changes in the Illinois flora. Illinois Natural History Survey Reports. Summer 2002. No. 3722.

Hill, S.R. 2002a. Conservation assessment for French's shootingstar (Dodecatheon frenchii (Vasey) Rydb.). Report prepared for the U.S.D.A. Forest Service, Eastern Region, by the Center for Biodiversity, Illinois Natural History Survey, Champaign. 26 pp.

Imm, D.W., H.E. Shealy, Jr., K.W. McLeod, and B. Collins. 2001. Rare Plants of Southeastern Hardwood Forests and the Role of Predictive Modeling. Natural Areas Journal 21:36-49.

Ladd, D. 1991. Preliminary list of the rare and endangered macrolichens of Missouri. Trans. Missouri Acad. Sci. 25: 5–12.

McCune, B. and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press. 386 pp.

Mohlenbrock. R.H. 1978. Plant communities of Jackson County, Illinois. Bull. Torr. Bot. Club 86(2): 109-119.

Nigh, T. A., W. L. Pflieger, P. L. Redfearn, W. A. Schroeder, A. R. Templeton, and F. R. Thompson. 1992. The Biodiversity of Missouri. Jefferson City, MO: published jointly by Missouri Department of Conservation and USDA Forest Service; 53 pp.

Philippi, T., B. Collins, S. Guisti, and P. M. Dixon. 2001. A multistage approach to population monitoring for rare plant populations. Natural Areas Journal 21:111-116.

Platt, J.L. and J.W. Spatafora. 2000. Evolutionary relationships of nonsexual lichenized fungi: molecular phylogenetic hypotheses for the genera Sipula and Thamnolia from SSU and LSU rDNA. Mycologia 92(3): 475-487.

Schwegman, J.E., G.B. Fell, M.D. Hutchinson, G. Paulson, W.M. Shephard, and J. White. 1973. Comprehensive plan for the Illinois Nature Preserve system. Part 2. The natural divisions of Illinois. Illinois Nature Preserves Commission, Rockford. 32 pp.

Shawnee National Forest. 2001. Natural Area Trails Project: Draft Environmental Impact Statement. Saline, Jackson, Johnson, Pope, and Union Counties. 207 pp. [http//www.fs.fed.us/r9/shawnee/ea/nineday/appendix/Plants.pdf]

Skorepa, A.C. 1973. Taxonomic and ecological studies on the lichens of southern Illinois. Ph.D. dissertation. University of Tennessee, Knoxville. 248 pp.

Stenroos, S., L. Myllys, A. Thell, and J. Hyvönen. 2002. Phylogenetic hypotheses: Cladoniaceae, Stereocaulaceae, Baeomycetaceae, and Icmadophilaceae revisited. Mycological 1(3): 267-282.

Taylor, C.J. 1968. The lichens of Ohio. Part 2. Fruticose and cladoniform Lichens. Ohio Biological Survey Biological Notes No. 4.

Thomson, J.W. 1967. The lichen genus Baeomyces in North America north of Mexico. The Bryologist 70(3): 285-298.

Voigt, J.W. and R.H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press: Carbondale.

Vries, B. G. de & H. J. Sipman. 1984. Studies on Colombian cryptogams XXI. The Lichen genus Baeomyces in Colombia and Venezuela. Proc. Kon. Ned. Akad. Wetensch., Ser. C, 87: 235-246.

Webb, W.L., H.J. Schroeder, and L.A. Norris. 1975. Pesticide residue dynamics in a forest ecosystem: a compartmental model. Simulation 24: 161-169.

White, J. and M.H. Madany. 1978. Classification of natural communities in Illinois. Pages 310-405 (Appendix 30) in: White, J. Illinois Natural Areas Technical Report, Volume 1. Survey Methods and Results. Urbana. Illinois Natural Areas Inventory.

Wiedman, J. E. and W. Whiteside. 1975. The lichen flora of Rocky Branch Nature Preserve, Clark County, Illinois. Trans. Ill. State Acad. Sci. 68: 102–117.

Winterringer, G.S. and A.G. Vestal. 1956. Rock-ledge vegetation in southern Illinois. Ecological Monographs 26 (2): 105-130.

WEBSITES CONSULTED

W-1. Preliminary Conservation Assessments - Hoard & Hill (2002)
http://www.life.uiuc.edu/hughes/undergrad_prog/abstracts/summer02/hoard.html

W-2. USDA, NRCS. 2002. The PLANTS Database, Version 3.5.
National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
http://plants.usda.gov/cgi_bin/topics.cgi

W-3. North American Lichen Checklist.
http://www.ndsu.nodak.edu/instruct/esslinge/chcklst7-1.htm

W-4. NatureServe (The Nature Conservancy)
http://www.natureserve.org/

W-5. Forest Lichens of New Zealand.
http://www.hiddenforest.co.nz/lichens/family/baeomycetaceae/baeomycetaceae.htm

W-6. Natural Heritage Information Centre, Ontario, Canada.
http://www.mnr.gov.on.ca/MNR/nhic/species/listout.cfm?el=n&sort=sci_name

W-7. The New York Botanical Garden, Lichens of Eastern North America.
http://www.nybg.org/bsci/hcol/lena/Icmadophilaceae.html

W-8. Checklist of Australian Lichens.
http://www.anbg.gov.au/abrs/lichenlist/lichens_dtof.html

W-9. Key to Lichens with Podetia, Ecuador. Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin. http://www.bgbm.org/sipman/keys/Ecuclad.htm

W-10. Rare Native Ohio Plants, Ohio Department of Natural Resources.
http://www.dnr.state.oh.us/dnap/heritage/Rare_Species2000_2.htm

W-11. Rare Lichens of Missouri.
http://www.conservation.state.mo.us/nathis/lichens/lichens/d.htm

W-12. List of Rare, threatened and Endangered species by county, Indiana Department of Natural Resources. http://www.in.gov/dnr/naturepr/species/

W-13. California Native Plant Society
http://www.cnpsci.org/html/PlantInfo/Definitions2.htm

W-14. Keys to fruticose macrolichens and microlichens in British Columbia.
http://www.cnpsci.org/html/PlantInfo/Definitions2.htm

W-15. Introduction to Macrolichens of the Pacific Northwest by McCune & Geiser
http://www.orst.edu/dept/press/lichensIntro.html

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APPENDICES

APPENDIX 1

Natural Diversity Database Element Ranking System

Modified from: http://www.cnpsci.org/html/PlantInfo/Definitions2.htm [W-13]

Global Ranking (G)

G1
Critically imperiled world-wide. Less than 6 viable elements occurrences (populations for species) OR less than 1,000 individuals OR less than 809.4 hectares (ha) (2,000 acres [ac]) known on the planet.

G2
Imperiled world-wide. 6 to 20 element occurrences OR 809.4 to 4,047 ha (2,000 to 10,000 ac) known on the planet.

G3
Vulnerable world-wide. 21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac) known on the planet.

G4
Apparently secure world-wide. This rank is clearly more secure than G3 but factors exist to cause some concern (i.e. there is some threat, or somewhat narrow habitat).

G5
Secure globally. Numerous populations exist and there is no danger overall to the security of the element.

GH
All sites are historic. The element has not been seen for at least 20 years, but suitable habitat still exists.

GX
All sites are extirpated. This element is extinct in the wild.

GXC
Extinct in the wild. Exists only in cultivation.

G1Q
Classification uncertain. The element is very rare, but there is a taxonomic question associated with it.

National Heritage Ranking (N)

The rank of an element (species) can be assigned at the national level. The N-rank uses the same suffixes (clarifiers) as the global ranking system above.

Subspecies Level Ranking (T)

Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety.

For example: Chorizanthe robusta var. hartwegii. This plant is ranked G2T1. The G-rank refers to the whole species range (i.e., Chorizanthe robusta, whereas the T-rank refers only to the global condition of var. hartwegii. Otherwise, the variations in the clarifiers that can be used match those of the G-rank.

State Ranking (S)

S1
Critically imperiled. Less than 6 element occurrences OR less than 1,000 individuals OR less than 809.4 ha (2,000 ac). S1.1 = very threatened; S1.2 = threatened; S1.3 = no current threats known.

S2
Imperiled. 6 to 20 element occurrences OR 3,000 individuals OR 809.4 to 4,047 ha (2,000 to 10,000 ac). S2.1 = very threatened; S2.2 = threatened; S2.3 = no current threats known.

S3
Vulnerable. 21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac). S3.1 = very threatened; S3.2 = threatened; S3.3 = no current threats known.

S4
Apparently Secure. This rank is clearly lower than S3 but factors exist to cause some concern (i.e., there is some threat, or somewhat narrow habitat).

S5
Secure. Demonstrably secure to ineradicable in the state.

SH
All state sites are historic; the element has not been seen for at least 20 years, but suitable habitat still exists. Possibly extirpated.

SR
Reported to occur in the state. Otherwise not ranked.

SX
All state sites are extirpated; this element is extinct in the wild.

Notes:

1. Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences.

2. Uncertainty about the rank of an element is expressed in two major ways: by expressing the rank as a range of values (e.g., S2S3 means the rank is somewhere between S2 and S3), and by adding a ? to the rank (e.g. S2?). This represents more certainty than S2S3, but less than S2.

APPENDIX 2

Representative United States specimens of Dibaeis absoluta (either examined or cited in the literature)

Herbaria:

ASU = Arizona State University, Tempe; COLO = University of Colorado, Boulder; FH-Tuck = Farlow Herbarium, Tuckerman collection, Harvard University; ILLS = Illinois Natural History Survey Herbarium, Champaign. MICH = University of Michigan, Ann Arbor; NY = New York Botanical Garden, Bronx; OS = Ohio State University; TENN = University of Tennessee, Knoxville; US = US National Herbarium, Smithsonian Institution; WIS = University of Wisconsin Herbarium, Madison.

ALABAMA: BALDWIN CO., Fish River, Evans 407 (NY); LAWRENCE CO., Moulton, Peters 139 (FH-Tuck) - TYPE COLLECTION.

ILLINOIS: CLARK CO., Rocky Branch Nature Preserve, Casey quadrangle, 22 May 1971, Schoknecht s.n. (ILLS); Rocky Branch, 2 mi northeast of Clarkville, 16 Oct 1983, McKnight 3584 (ILLS); JOHNSON CO., Ferne Clyffe State Park, Skorepa 6082 (TENN); POPE CO., Bell Smith Springs, Skorepa 1422 (TENN); Hayes Creek, 1 mi north of Eddyville, McKnight 3744 (ILLS).

INDIANA: PARKE CO., Fallen Rock, Thomson 5056 (WIS, US); Swordmoss Gorge, Shushan 9076 (COLO); PUTNAM CO.: Hoosier Highlands, Shushan 13980 (COLO); Hoosier Highlands near Greencastle, Aug 1958, Thomson 5117 (UBC, US); Hoosier Highlands, Nash 2574 (ASU)

KENTUCKY: MCCREARY CO., Natural Arch, Allen 62 (NY); Yamacraw Bridge, James 20 (MICH).

NORTH CAROLINA: no locality, Fink 15893 (MICH).

OHIO: ATHENS CO., Wolfe 537 (WIS); JACKSON CO., Rock Run, Wolfe 329 (OS).

TENNESSEE: COCKE CO., trail to Maddron Bald, Indian Camp Creek watershed, Mount Guyot quadrangle, Great Smoky Mountains National Park, Phillippe 32697 (ILLS).