

**A Floristic Inventory of Old Growth Pine-Oak-Hickory Stands in
Hot Springs National Park**

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Summary

Little information on the floristic diversity (particularly herbaceous diversity) of upland old growth forests in Hot Springs National Park existed prior to this inventory. This information is needed for park managers to make appropriate decisions to ensure long-term sustainability of the plant communities in these stands and abide by the NPS mission statement. Two old growth stands (Sugarloaf Mountain and North Mountain) were identified and their boundaries delineated. A comprehensive floristic inventory was conducted within these stands using permanent sampling plots, transects, and general walkthroughs of all habitat types.

A total of 309 vascular plant taxa were found in the two study areas. Species richness was high, which can be attributed to a variety of habitats, especially rock outcrop/glade communities and mesic drainage communities. Species abundance, however, was low for some species, probably due to a history of fire suppression in the study areas. More woody species were found than herbaceous species and may be an artifact of this fire suppression. A number of invasive exotic species were noted that could adversely affect plant diversity in the park. Voucher specimens of all species encountered in reasonable condition for the preparation of a voucher were collected. Management implications and recommendations identify possible steps to ensure the long-term sustainability of the plant communities in these old growth stands.

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Introduction

In 1998 Congress passed the National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the National Parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge Program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I & M) program, has undertaken inventories of vascular plants and vertebrates within 15 parks in 8 midwestern states.

Though there have been botanical inventories of varying intensities in Hot Springs NP, from the Dunbar & Hunter expedition in 1804 to the present, no single study has set out to document all the plant species in the park, or even in a given area of the park. While this study does not focus on the entire park, it does attempt to document all vascular plant species in two upland old growth forest stands within the park boundaries. Examples of past partial inventories include Lesquereaux (1860), Scully (1937), Scully (1942), Dale & Watts (1980), and Taylor (1981).

Old growth forests have become scarce in the Interior Highlands of Arkansas, Missouri, and Oklahoma (Henderson & Hedrick 1991). The few remaining remnants offer clues as to what the presettlement landscape was like. Hot Springs National Park is home to some of the least disturbed forest in the Ouachita Mountains and has provided a refuge from successive widespread timber harvest in the surrounding landscape. Land that is now within the park boundaries was set aside by Congress in 1832 as Hot Springs Reservation, making it the oldest park currently in the National Park System, predating Yellowstone by 40 years (National Park Service 2003). Following the passage of the National Parks Omnibus Act in 1998, two old growth forest stands were identified by the National Park Service as needing a floristic inventory.

As a result of the federal protection given the study areas, no commercial timber cutting has occurred in the older portions of the park aside from some firewood cutting in the 19th century (Devall & Rudis 1991). Since the National Park Service took over management in 1921, hazard trees near trails and roads have been routinely removed, but no other timber management has occurred in the study areas (Devall & Rudis 1991). On the Sugarloaf Mountain tract, trees on both slopes often exceed 140 years old, with some individual trees in excess of 250 years old (Devall & Rudis 1991).

The primary objective of this inventory was to identify the boundaries of two old growth stands and conduct a comprehensive floristic inventory of the two areas. The study had three objectives: 1) document at least 90% of the vascular plant species reasonably expected to occur in upland old growth stands in Hot Springs NP and provide an up-to-date assessment of species richness; 2) estimate the relative abundance and local habitat preferences/restrictions; and 3) collection and deposition of voucher specimens.

Study Area

Hot Springs National Park encompasses nearly 2186 hectares (5400 acres) in and around the town of Hot Springs, Garland County, Arkansas in the west-central part of the state (Figure 1). It lies within the Central Ouachita Mountains subsection of the Ouachita Mountain Natural Division, which is characterized by open high hills and low mountains, often with wide valleys (Foti & Bukenhofer 1998). The park includes portions of Hot Springs, West, Sugarloaf, North, and Music Mountains. Two general areas identified as old growth forest stands with undetermined boundaries (provided by NPS staff) are Sugarloaf Mountain and North Mountain tracts.

The Sugarloaf Mountain tract (figure 2), lies at the northeastern end of Sugarloaf Mountain bounded by the National Park boundary to the east, south, and north, and by an electrical transmission powerline right-of-way to the west. This tract is bisected by the ridgetop of Sugarloaf Mountain and by the Sunset Trail which roughly follows this ridgetop on the north-facing slope of the mountain. An old road trace roughly follows the ridgetop, winding its way between the larger rock outcrops on the ridge. The south-facing slope of this tract is characterized by frequent novaculite outcrops and small glade-like openings with relatively sparse woody vegetation. The boundaries of the old growth forest on this tract are somewhat obvious, and it is typically easily discernible from more recently disturbed forests surrounding it by differences in size class of the trees and general structure of the forest. The total area of this study area was 51.2 ha (127.9 acres).

Soils on the ridgetops are of the Bigfork-Rock outcrop complex (3 to 15% slopes) and soils on the south and southeast slopes are Bigfork-Rock outcrop complex (35 to 60% slopes) (Laurent et al. 1989). Stones, cobbles, gravel, and a few boulders are on the surface. This complex is composed of about 50% Bigfork soil, 20% rock outcrop, and 30% other soils (Laurent et al., 1989). Typically, the Bigfork soil is covered by a thin layer of partly decomposed and decomposed leaves, needles, and twigs. Important properties of this complex include moderate permeability, low available water capacity, medium to strongly acid soil, rapid surface runoff, and no water table within 6 feet of the surface. The north and northwest-facing slopes are Bigfork-Yanush-Carnasaw complex (40 to 60% slopes). This complex consists of soils that are very steep and well drained. Bigfork soil is moderately deep and Yanush and Carnasaw soils are deep. Stones, cobbles, and gravel are commonly on the surface. The complex is made up of about 40% Bigfork soil, 30% Yanush soil, 15% Carnasaw soil, and 15% other soils (are composed of about 50% Bigfork soil, 20% rock outcrop, and 30% other soils. Important properties of this complex include moderate permeability, low available water capacity, medium to strongly acid soil, rapid surface runoff, and no water table within 6 feet of the surface. A small area at the toe of the south-facing slope of the Sugarloaf tract is of the Bismarck-Carnasaw complex (20 to 40 % slopes) and a small area along a drainage on the south-facing slope is of the Yanush-Avant complex (20 to 40% slopes).

Underlying geology consists primarily of Arkansas Novaculite on the ridge, south facing slope, and upper north facing slope. The lower areas of the slopes are underlain by Bigfork Chert, and a portion of the lower north facing slope is underlain by the Chickasaw Creek Chert Member of the Stanley Shale (Haley et al. 1976).

The North Mountain tract (figure 3) lies on the ridgetop and NW-facing slope of North Mountain, bounded by the park boundary to the west and a paved road to the east. The north and south boundaries are not bounded by any permanent feature but are discerned by a change in the composition and structure of the forest. However, the boundaries of the old growth forest of this tract are somewhat difficult to distinguish from adjacent forest and typically grade into younger more recently disturbed stands. Delineation on the North Mountain tract is further complicated by the history of human use and impact. The forest of this tract is fragmented by several roads, both currently-used and decommissioned, and by several recreational trails (Upper Dogwood, Lower Dogwood, etc.). Localized impacts to the landscape and hydrology, such as the cutting and filling activities associated with placing roads and trails on steep terrain, have left permanent, but localized, marks on the landscape. Localized cutting of hazard trees along this network of roads and trails has impacted composition and structure in a corridor of varying widths along each road or trail.

In one area in the northeast part of the tract, there were very few of the large pine trees typical of the rest of the tract. However, there were many scattered, large oaks, hickories, and blackgums, indicating that perhaps the area had been selectively harvested for pine at some time in the past, or had experienced some similar natural disturbance. It is possible that this area is a naturally-occurring hardwood-dominated community, though no differences in soils, geology, or topography were found to support this idea. This area was included in the study unit, but no permanent plots were installed because the history of the area was uncertain. Nonetheless, the total area of probably old growth forest in this study area was 34.87 ha (86.1 acres).

Soils on the ridgetops are of the Bigfork-Rock outcrop complex (3 to 15% slopes), south and southeast slopes are Bigfork-Rock outcrop complex (35 to 60% slopes), and north and northwest-facing slopes are Bigfork-Yanush-Carnasaw complex (40 to 60% slopes). Underlying geology consists of Arkansas Novaculite on the ridgetop and northwest facing slope, with some of the Chickasaw Creek Chert Member of the Stanley Shale along the drainages (Haley et al. 1976).

Materials and Methods

In order to assess the flora of old growth forests, stands first had to be defined and their boundaries delineated. In preparing to do this, the question immediately arose: What is old growth? Martin (1991) makes the point that an “undisturbed virgin forest” does not exist, rather all forests have some type of disturbance regime that affects development, survival and composition. Simply put, even old forests are dynamic.

So what characteristics should we look for to delineate old growth in the Ouachitas? Historical accounts describe old growth pine stands as being open-canopied and “parklike” with relatively few large diameter overstory trees per acre and sparse herbaceous understory vegetation (Fryar 1991). For mixed stands of pine and hardwood, definitions of old growth are more difficult due to a scarcity of historical descriptions, but we know that these would have occurred on more northerly aspects and along stream courses (Martin 1991).

Characteristics of old growth forests in the Interior Highlands of Missouri, Arkansas, and Oklahoma have been summarized in Henderson & Hedrick (1991). In this volume Martin (1991) defines old growth stands as having some combination of the following characteristics: 1) high richness/diversity of species, dominants and communities, 2) uneven-aged structure with tree species in several size classes, 3) several large canopy trees, 4) large, high-quality, commercially important trees, 5) trees greater than or equal to 200 years old, 6) overstory densities ca. 250 trees/ha, 7) overstory basal area greater than or equal to 25 m²/ha, 8) the presence of logs and snags, 9) tree fall gaps formed by windthrow, 10) plants and animals that prefer old growth, 11) undisturbed soils and soil macropores, and 12) little or no human disturbance. Devall & Rudis (1991) add two quantitative measures to these characters, including: 1) net growth of live trees approaches zero, and 2) older, standing dead trees are present and similar to the proportion of live trees.

Of these characteristics, the following were the most frequently used to delineate boundaries of the old growth units in this study: 1) uneven-aged structure, 2) large canopy trees, 3) large & high quality specimens of commercially important tree species (chiefly shortleaf pine, white oak, and northern red oak), 4) the presence of logs and snags, 5) the presence of windthrow gaps, and 6) the absence of signs of human disturbance (e.g. cut stumps). In addition, a few large pines that had fallen across trails had been recently cut, allowing for the counting of annual rings. These trees ranged from 130-200 years old, and were not among the largest trees in the study areas.

Prior to the establishment of plots or transects, general walkthroughs of each study area were conducted and qualitatively compared to stands in other areas of the park. Once search images for old growth characters were developed, tentative boundaries of each old growth area were marked with surveyor’s flagging. These boundaries were adjusted and refined over the course of the study as I became more familiar with the areas and with the characteristics of old growth forest in the park. In addition, two visits were made to the Ouachita National Forest’s Lake Winona Research Natural Area in Saline County, another remnant old growth shortleaf pine-oak-hickory forest in the area, to aid in the development of a search image.

Areas were excluded from the study units on the basis of obvious signs of past human disturbance, including the presence of cut stumps (several apparently from crosscut saws), and by the presence of a wire fence enclosing an area of relatively smaller trees. The latter was assumed to be part of an old pasture and is located near the toe of the slope at the northwest corner of the Sugarloaf tract adjacent to private land and the powerline right-of-way. However, for ease of future management, this particular area should be included in any old growth management unit. The presence of stumps of trees recently cut for safety reasons along trails and roads did not exclude an area from the study unit, but plots were kept out of such areas to avoid sampling in units where trees were recently removed.

A series of 16 permanent 0.1 ha rectangular plots, and 2 smaller (400 m² and 100 m²) “glade” plots were installed in delineated old growth study areas according to the methodology of the North Carolina Vegetation Survey (Peet, Wentworth, & White 1998). Plots were not randomly assigned, but were placed in such a manner as to reduce within-plot heterogeneity and account for the majority of habitat and plant community variations thus maximizing the number of vascular plant species encountered.

The NCVS method is based on a weighted, randomized block design. Within each 0.1 ha plot are ten 100 m² modules. Each module consists of a series of 4 nested plots ranging from 100 cm² to 10 m². Four of these 10 modules in each plot are intensively sampled during the growing season. In accordance with NCVS protocol, a total of 10 module corners in each plot were marked with 30 cm long, 1.2 cm diameter steel nails (see Peet, Wentworth, and White (1998) for detailed information on plot configuration). Surveyor’s flagging was tied to each nail and to the tree or shrub nearest to each nail (at eye level) for ease of relocation. The locations of the two nails at either end of the long axis of the plot were recorded by taking an average of 100 points with a GPS unit. Slope and aspect were calculated for each plot and plots were mapped on a USGS 1:24,000 scale topographic map using ArcView software.

In addition to sampling within plots, transects were walked along ridgelines, trails, and in more or less straight lines between plots. All major drainages in the study areas were also walked. Plant species encountered were recorded and vouchers collected following Wobeser et al. (1980). All specimens were convection dried for at least 48 hours and mounted on archival, acid-free New York Botanical Garden type ragstock mounting paper. These were labeled according to convention and were sorted alphabetically by family, genus, species, and subspecific taxon. Some common species were collected in both flower and fruit, as opportunity presented itself. Plant identification utilized several sources (Bailey 1924; Radford, Ahles, & Bell 1968; Steyermark 1972; Smith 1979, 1980, 1994; and Yatskievych 1999); nomenclature follows USDA Plants Database (2003).

No species were found to be so rare as to warrant photographs rather than voucher specimens as a means of documenting their occurrence. Voucher specimens were deposited with the Heartland Network Inventory and Monitoring Program.

Results

A total of 309 taxa of vascular plants were recorded from the study areas (Table 1). The Asteraceae was the largest plant family represented in the study areas with 42 taxa, followed by the Poaceae (40 taxa), Fabaceae (22 taxa), Rosaceae (15 taxa), Cyperaceae (12 taxa), Lamiaceae (11 taxa), Rubiaceae (10 taxa), Caprifoliaceae (8 taxa), and the Fagaceae (8 taxa). A total of 11 taxa of ferns were found.

Number and type of species varied by habitat within the study areas (Appendices 2-7). Rock drainages had the highest number of taxa (127) followed by south facing slopes (123), ridgetops (117), and north facing slopes (110). Novaculite glades (and outcrops) and roadsides had the fewest number of taxa, 93 and 74 respectively. Regardless of habitat, northern dewberry (*Rubus flagellaris*) and woodland sunflower (*Helianthus divaricatus*) were most common. More than half of the next common species (9 of 17) were woody and included winged elm (*Ulmus alata*), short leaf pine (*Pinus echinata*), bull greenbrier (*Smilax bona-nox*), poison ivy (*Toxicodendron radicans*), highbush blueberry (*Vaccinium arboretum*), Japanese honeysuckle (*Lonicera japonica*), post oak (*Quercus stellata*), muscadine grape (*Vitis rotundifolia*), and black gum (*Nyssa sylvatica*). Common herbs included two asters (*Aster patens*, *A. anomalus*); four grasses (little bluestem (*Schizachyrium scoparium*), poverty oats (*Danthonia spicata*), slimleaf rosette grass (*Dichantheium lineariifolium*), variable rosette grass (*Dichantheium commutatum*); and two ferns: ebony spleenwort (*Asplenium platyneuron*) and bracken fern (*Pteridium aquilinum*).

Fifty of the 309 taxa (16.2%) are considered introduced to Arkansas (Arkansas Vascular Flora Committee 2003) and 21 of these are considered invasive (Witsell & Jardine 2002).

A total of 20 exotic invasive species were found in or immediately adjacent to the study areas that are considered to be of concern to the integrity of the ecological communities in the park (Table 2). Roadsides tended to have more invasive exotics (12) whereas rock drainages, north facing slopes, and ridgetops had fewer (7, 6, 5 respectively). South facing slopes had the fewest (4). Overall, Japanese honeysuckle, Chinese privet (*Ligustrum sinense*), southern magnolia (*Magnolia grandiflora*), and nandina (*Nandina domestica*) were the most common invasive exotic species.

Though no federally listed (threatened or endangered) species were encountered in the study areas, three taxa tracked by the Arkansas Natural Heritage Commission as elements of special concern were found. These include: Ozark chinquapin (*Castanea pumila* var. *ozarkensis*), hairyflower Arkansas bedstraw (*Galium arkansanum* var. *pubiflorum*), and compact blazingstar (*Liatris squarrosa* var. *compacta*).

Within plots 146 taxa were found. The 6 most frequent species were woody and include (in order of most frequent) muscadine grape, cat greenbrier (*Smilax glauca*), black cherry (*Prunus serotina*), lowbush blueberry (*Vaccinium pallidum*), bull greenbrier, and white oak (*Quercus alba*). The five most frequent (>10 occurrences) herbs were (*Helianthus divaricatus*), stalked goldenrod (*Solidago petiolaris*), short leaf pine, flowering spurge (*Euphorbia corollata*), and poverty oats.

As size class increased there were fewer stems of shrub-like species and a tendency towards canopy species (Table 3, Figure 4)(Table 3 was summarized by the ten species with the greatest number of stems per size class). Black cherry and highbush blueberry were most common in the lower size classes but tended to be replaced by a pine-oak-hickory assemblage of canopy species.

Two hundred eighty four vouchers were collected and are stored at the Heartland Network Inventory and Monitoring offices at Wilson's Creek National Battlefield.

Discussion

Old Growth Delineations

As a result of the difficulties encountered in delineating the boundaries of the old growth forests on North Mountain, the delineations should be viewed as the best available but should be considered conservative and subject to change if more data become available. The use of an increment borer would help to firm up these boundaries, but was strictly prohibited in this study by the National Park Service (Phillip Hughes pers. comm. 2001). Similarly, the southeast-facing slope of this mountain, which drains down into Gulpha Creek, may have substantial stands of old growth forest. Inventory of this area was outside the scope and resources of this study.

Expected Species Lists

The primary objective of this inventory was to document the occurrence of at least 90 percent of the vascular plant species estimated to occur in the study areas. Before commencement of the inventory, an “expected species list” was developed by NPS staff. This list was based on historical observations and opinions of subject matter experts.

Several errors were made in the initial list resulting from incorrect, or postulated, species distributions and habitat occupancy. Because the current study was largely restricted to the drier, upland portions of the park, updated information on species that occur outside this habitat type cannot be commented on. However park plant lists were updated for species that were found or expected in the study area.

A Summary of the Floristic Diversity

Total species richness in the study areas can be attributed to the variety of habitats in the areas. Given this habitat diversity, richness and abundance should have been higher but was depressed due to fire suppression in recent years and the lack of any perennial streams or springs in the areas.

The highest species richness was observed on the more open areas on south- and southeast facing slopes and ridge tops, especially in areas of thin soil and abundant rock outcrops (glades). The second highest species richness was in deep wet-weather drainages on north- and northwest-facing slopes.

Considering that the study areas are both rugged upland tracts with no perennial streams or springs, the presence of 309 taxa (259 native) is remarkable. In the following excerpt, Palmer (1926) acknowledged that the thicker soils along Hot Springs Creek, above which both of the study areas are situated, had much higher species richness than the surrounding uplands (which included the study areas):

“The valley of Hot Springs Creek is narrow, in some places the rocky hills extending quite to the margins of the stream, and in its widest parts it seldom exceeds three or four hundred yards across. It has scarcely reached the stage in the cycle of development where real alluvial flood

plains are developed, and the surface is mostly rocky throughout its entire extent. The accumulations of residual soil, however, are sufficiently great to support a rich and varied flora, differing markedly from that of the surrounding hills.”

Despite the relatively high species richness in the study areas, however, many species are locally scarce and occur only in small pockets of suitable habitat, especially the suites of prairie or glade species. Historical evidence indicates that the habitat for these species was much more prevalent in Hot Springs NP and the Ouachita Mountains in general in the past (Foti & Glenn 1991; Jansma & Jansma 1991)

Both of the study areas are rugged upland forests with no perennial streams or springs. Despite their relatively dry character, a total of 309 taxa of vascular plants were found. Areas of significant diversity included glade/outcrop communities, mesic communities along drainages/intermittent springs, and open patches of woodland.

Ozark chinkapin is restricted to the interior highlands of Arkansas, Oklahoma, and Missouri. Like its congener, the American chestnut (*Castanea dentata*), it is susceptible to the chestnut blight, a fungal pathogen introduced to the United States in 1904. Ozark chinkapin was listed for the area that is now Hot Springs NP as early as 1835 by Engelmann (Jansma & Jansma 1991). Chestnut blight is now ubiquitous in Arkansas and it is exceedingly rare to find trees that are not infected with the blight. Blight-stricken trees are easy to recognize, characterized by a shrubby growth form with many small (0-6 cm) diameter stems sprouting from the root collar of the plant. When the stems become large enough that the bark begins to split, the fungus penetrates the bark and the stem dies. One or more dead stems are usually evident within the ring of smaller, live sprouts. More than 100 living Ozark chinkapins were observed in the Sugarloaf Mountain study area. All specimens large enough to have fissured bark were obviously blight-infected. Occasional smaller specimens, which did not exhibit the multi-stemmed growth form characteristic of blight-infected trees, are assumed to be saplings grown from seed. These younger trees are assumed to be blight-susceptible but provide evidence that this population is sexually reproducing despite the blight. Several dead and fallen, but apparently original, trunks were found to have persisted on the north-facing slope of Sugarloaf Mountain. The largest of these were more than 20 cm dbh and these trunks occurred in densities that indicate this species was a major component of the forest, at least locally, prior to the arrival of the blight in the area

Hairyflower Arkansas bedstraw is endemic to the Ouachita Mountains of Arkansas, specifically to Garland and Montgomery Counties. This variety was split from the typical *Galium arkansanum* (Arkansas bedstraw) in 1979 by Dr. Ed Smith, then of the University of Arkansas at Fayetteville Herbarium (Smith 1979). It is distinguished from *Galium arkansanum* var. *arkansanum* by a densely hairy outer corolla surface, largest leaves from 2.5 to 3.5 mm wide, with a single, glabrous midvein. This species was found to be common throughout the study areas, but particularly common in the drier woods along the ridges of both Sugarloaf and North Mountains. Many of these plants encountered in the study area might be better classified as intergradants, or intermediate in character between the two varieties of *G. arkansanum* as mentioned by Smith (1979) who lists intermediate plants from 6 counties in Arkansas and 2 in Oklahoma.

Blazing star is endemic to the Ouachita Mountains and the Arkansas River Valley of Arkansas and Oklahoma. It is most easily distinguished from other varieties of the species by its glabrous (hairless) leaves and stems (Cronquist 1980). These plants were found to be locally common in the most open areas on the south-facing slope of Sugarloaf Mountain. Management activities by the Ouachita National Forest and The Nature Conservancy have shown this to be a fire-dependent species, which will increase with the reintroduction of fire to the ecosystem (Witsell, personal observation).

Other rare species known from the park include the lobed spleenwort (*Asplenium pinnatifidum*) and the very rare Grave's hybrid spleenwort (*Asplenium Xgravesii*). These plants are known from the south-facing slope of North Mountain above Gulpha Creek, growing in cracks on exposed novaculite bluffs. All appropriate habitat in the study areas was surveyed for these species, but no plants were found. The terrain in the study areas is probably not rugged enough for either species. A single plant of the hybrid spleenwort was found in the park by Dr. Charles Werth in 1979 (Werth & Taylor 1980). In order to develop a search image for the plant, the site was revisited with local fern expert Don Crank and the original plant was relocated and photographed. Twenty three years after its initial discovery, the same plant is still alive and well, high on the rocks above Gulpha Creek.

During herbarium work at the University of Arkansas and Fayetteville Herbarium (UARK), I found a specimen of Swan's caric sedge (*Carex swanii*) from "wooded slopes in Hot Springs National Park". Despite extensive searches, no plants were found in the study areas but may be found there in the future. New York fern (*Thelypteris noveboracensis*) is found in a perennial seep just north of Stone Bridge Road in the park but outside the study areas. There was no appropriate habitat in the study areas for this species.

Other tracked species that are known from the area near the park and might be expected to be within the park include Ouachita indigo bush (*Amorpha ouachitensis*), Ouachita bluestar (*Amsonia hubrichtii*), Ouachita bluets (*Houstonia ouachitana*), and perfoliate bellwort (*Uvularia perfoliata*). No suitable habitat was found in either study area for any of the 5 federally listed threatened or endangered plant species known from Arkansas.

Forest Structure and Health

Forest structure in the study areas is consistent with that of other documented old-growth areas in the Ouachita Mountains (Martin 1991). However, the overall structure and understory composition of the study areas today are dramatically different from what they would have been prior to settlement and subsequent fire suppression (Foti & Glenn 1991).

When physician and botanist Dr. George Engelmann visited the hot springs in the fall of 1835, he described the mountains of the region in an article written for the German newspaper *Das Westland* and recently translated into English and published in *Arkansas Historical Quarterly* (Jansma & Jansma 1991). The following excerpt describes the open character and herbaceous understory of the old growth forests of the Ouachitas:

The region in general is a massive high uniform sandstone mountain chain, overgrown with rather small pines, stunted oaks, and a few nut trees. Wild grapes grow among these trees, and the grass and flowers cover the gravelly soil. Such is the virgin forest of these mountains, virgin forest in which the blade of the ax of the bee-hunter has scarcely sounded, where seldom the shy footstep of the native Indian or even the equally light foot of the white hunter of the deer has been heard. Such a primeval forest has something deserted and dispiriting about it, but is nonetheless grand and noble

While Engelmann's attention at Hot Springs is focused on the springs themselves and the rich diversity of plants that occurred around them at the time, he does describe the hills above them (on the upper slopes of Hot Springs and North Mountains). His description in the following excerpt, also from Jansma & Jansma (1991) confirm that even in 1835, shortleaf pine was the tallest species in the canopy, and that the canopy was sufficiently open to allow for a rich herbaceous layer:

“At higher elevations in a mixed woods of oak and citron-yellow nut trees [*hickories*], overtowered by the thin, dark-green pine; and with wine red leaves vines climb up, and fall flowers shine their blue and yellow colors throughout.”

The structure described by Engelmann, and other early explorers to the region (Foti & Glenn 1991), is remarkably different than the structure of the study areas today which can typically be described as having a dense woody understory and thick layers of duff and leaf litter with few herbaceous plants.

Damage sustained by ice and/or wind is evidenced by the large number of downed or broken trees, most noticeably shortleaf pine, in the study areas. These windthrow gaps provide localized areas where sunlight reaches the forest floor, resulting in increased herbaceous and shrub layer growth. Ice damage was particularly evident along the steep slopes of upland drainages where, in some cases, the majority of the canopy trees were downed. While these canopy gaps can provide for a rich understory, they also provide excellent habitat for invasive species to become established. A number of exotic invasives were noted in canopy gaps, including Chinese privet, Japanese honeysuckle, nandina, kudzu (*Pueraria lobata*), Chinese wisteria (*Wisteria sinensis*), and southern magnolia.

Another threat to the existing plant communities in the study areas is disease. In addition to the chestnut blight observed affecting Ozark chinkapin trees, a number of northern red oak trees were found to be dead and dying atop North Mountain. These trees are suffering from what is being generically referred to as “oak decline”, a problem that is widespread in the Ozark and Ouachita mountains. No signs of the red oak borer (*Enaphalodes rufulus*), a major culprit in the Ozarks, were found. The red oaks atop North Mountain appear to be infected with hypoxylon canker, a fungus that attacks stressed trees. Explanations put forth as to the cause of “oak decline” range from sustained drought to a forest that has become too dense. Not all red oaks in the study areas were sick or dying, but the population should be monitored for future problems.

Invasive exotic plants

A byproduct of the long history of human settlement and alteration of the lands in and around the park has been the introduction of a number of exotic invasive plant species to the park.

The majority of the invasive woody plants found in the study area are escaped evergreen ornamental shrubs, presumably spread from surrounding yards and park landscaping by birds or other animals. Some, such as Chinese privet and Japanese honeysuckle, are well-documented in their capacity to disrupt ecosystem processes. Many others are present in numbers large enough to be of concern, especially redbud (*Photinia serratifolia*) and nandina.

Of the naturalized exotic woody plants at this site, the most notable is perhaps southern magnolia. This species, not considered native to Arkansas, has relatively recently naturalized in the state (Marsh, pers. comm. 2001). Nowhere else in the state have I found it in the abundance that it has attained at Hot Springs NP. This species has widely naturalized in the study areas, especially on north-facing slopes and in drainages. Individual trees (in fruit) were found as tall as 8 m and with diameters as large as 12.5 cm dbh. In addition to these good-sized trees, many seedlings, evidently from the study year, were found in both study areas. It is widely planted as an ornamental tree in Arkansas, with large specimens growing along the sidewalk near the display springs in Hot Springs NP.

Japanese honeysuckle is the most widespread of the invasive species encountered and is locally common in both study areas.

Wildlife Value in the Study Areas

Though this study was not concerned with an inventory of animal species, chance encounters with a variety of species give some indication of the animals that use the areas. Martin (1991) defines the presence of logs and snags as an important indicator of old growth forests, second only to the presence of large and old trees. These attributes are extremely important in defining old-growth for wildlife and ecosystem function (Martin 1991). Large numbers of standing dead pine trees provide ecological values in the form of snags, used by a variety of woodpeckers and saproxylic insects. Six species of woodpecker were encountered during the study: red-headed woodpecker (*Melanerpes erythrocephalus*), red-bellied woodpecker (*Melanerpes carolinus*), pileated woodpecker (*Dryocopus pileatus*), hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), and northern flicker (*Colaptes auratus*). Individual snags had many cavities of various ages.

Numerous passerines were seen or heard including white-throated sparrows (*Zonotrichia albicollis*), tufted titmice (*Parus bicolor*), Carolina chickadees (*Parus carolinensis*), and several species of warblers. A barred owl (*Strix varia*) was encountered as was a redbelted hawk (*Buteo jamaicensis*). A wild turkey (*Meleagris gallopavo*) was encountered on North Mountain, within sight of hotels below! Other species of birds, whose identification was beyond this researcher's ornithological ability, were also seen or heard in the study areas. Deer (*Odocoileus virginianus*) and gray squirrels (*Sciurus carolinensis*) were the only mammals encountered. Fence lizards (*Sceloporus undulatus* ssp. *hyacinthinus*), broadhead skinks (*Eumeces laticeps*), ground skinks (*Scincella lateralis*), five-lined skinks (*Eumeces fasciatus*), a rough green snake (*Opheodrys aestivus*), and three-toed box turtles (*Terrapene carolina*) were the only herpetiles encountered,

though it should be noted that these were all chance encounters. No traps or monitoring plots were used and I am not a trained zoologist. I am, however, comfortable with the identifications of all the animal species listed above.

Fire Suppression and Biodiversity

Based on historical accounts of the landscape prior to widespread suppression of fires, and on qualitative comparisons with comparable areas in the Ouachita National Forest where fire has been reintroduced, the forest structure is considerably different today than it was historically (Foti & Glenn 1991). The number of fire-dependent herbaceous species on the ridges and southern exposures of both Sugarloaf and North Mountains are a testament to the past open character of the areas. The local rarity of these species when compared to nearby, similar areas that burn regularly, can be attributed to the increased duff, leaf litter, and woody plant density characteristic of fire suppressed woodlands. Fire scars can still be seen at the bases of the larger pines on the south slope of Sugarloaf Mountain, though the thick layers of duff and leaf litter indicate that it has been some time since the area has burned.

The role of fire in maintaining plant communities of the Interior highlands is now widely accepted and is being considered in the management of lands owned by a variety of agencies and organizations. Widespread natural fires and frequent droughts are regular disturbance events that cause widespread tree mortality in Ouachita forests (Martin 1991). However, the majority of lands in the region continue to be fire-suppressed. A study conducted by Johnson and Schnell in the 1980s found the overall mean fire-return interval in Hot Springs NP to have changed from under 32 years in the period before 1938 to approximately 1,200 years after 1938 (Devall & Rudis 1991).

The ice storms of December 2000 have left large amounts of woody debris on the ground, particularly along the steep drainages, where many trees were uprooted. This debris constitutes a very high fuel load which, if not consumed in prescribed fires, increases the risk of catastrophic wildfire in times of drought.

Ecological Communities

Dale and Ware (1999) analyzed canopy-level species associations on various slopes and aspects in Hot Springs NP and found that shortleaf pine forms a background against which the abundances of hardwood species vary with aspect and topography. Specifically they found blackjack oak, post oak, black hickory and bitternut hickory (*Carya cordiformis*) abundant on southerly and southeasterly exposures, with white oak, black oak, southern red oak, northern red oak, and mockernut hickory on nearly level terrain or less xeric exposures (Dale & Ware 1999). Sweetgum (*Liquidambar styraciflua*) and other mesophytic, non-oak species were found along drainages (Dale & Ware 1999).

Based on the topographic and vegetation patterns they observed, Dale and Ware (1999) found the following four principal forest types in the park:

Pine-Oak-Hickory Forest: This type was found on south-facing slopes near the tops of ridges and was characterized by the overwhelming importance of shortleaf pine (>50%), with post oak, blackjack oak, and sometimes black hickory as important secondary species in the understory.

Oak-Hickory-Pine Forest: This type was found to be the most extensive type in the park. Shortleaf pine was found to be the most important single species in most stands of this type, but pine's importance was less than the aggregate importance value of oaks and hickories. This type was divided into two subtypes: a xeric subtype with post oak and blackjack oak as the dominant hardwoods on south or southeast-facing slopes or steep exposures elsewhere, and a mesic subtype on lower north-facing slopes and flat areas. The mesic subtype is characterized by white oak sharing dominance with shortleaf pine but with black oak, mockernut hickory, southern red oak, occasionally northern red oak, and black gum (*Nyssa sylvatica*) occurring as important secondary species in both high understory and low understory strata.

Upland Hardwood Forest: This type occurs principally on gently sloping or level areas throughout the park, or on ridge tops. In this type, hardwoods greatly exceed pines. Mixed mesic oaks and hickories were found to dominate the canopy in most sites of this type, but more xeric oaks are dominant on the tops of ridges.

Mixed Forest: This type is found in the middle and lower sections of upland ravines or along creeks. High importance of sweetgum and musclewood (*Carpinus caroliniana*) were found to be characteristics of this type and several other species reached their highest importance value or were confined to this type.

While Dale and Ware (1999) examined the canopy and woody understory components of the forest, they did not report on the species or communities of the herbaceous layer. In the current study, variations of all four of their canopy associations were found in each of the study areas, and were considered in the placement of plots so that the herbaceous component of each canopy association could be sampled. While multivariate statistics were not used to analyze the associations of the herbaceous species in the current study, data were gathered so that they could be analyzed this way in the future. Regardless, certain patterns of association are obvious with respect to slope and aspect and certain herbaceous species were confined to certain canopy associations or habitat types. The following shows the five major habitat types found in the old growth study areas and the corresponding forest type as described by Dale and Ware (1999).

Habitat types found in old growth study areas	Corresponding forest types from Dale & Ware (1999)
Novaculite outcrop/glade community	Pine-Oak-Hickory Forest (open, grades into no canopy)
Ridgetop	Upland Hardwood Forest
South facing slope	Pine-Oak-Hickory Forest
North facing slope	Oak-Hickory-Pine Forest
Mesic drainage	Mixed Forest
Roadside	n/a

A sixth habitat type, which was significant because it supported herbaceous species which did not occur in any other habitat type in the study areas, was roadside areas. These roadsides provided an open area and often included seasonally wet ditches. Cuts on the uphill sides of roads provided disturbed soil which provided specialized habitat for a number of species. Below are summaries of the dominant plant communities (canopy, midstory, and herbaceous layer) for each association.

Novaculite Outcrop/Glade Community

Herbaceous layer species richness is high in this community (Appendix 1), which is characterized and dominated by a broad diversity of native warm-season grasses including big bluestem (*Andropogon gerardii*), little bluestem, Indian grass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), arrowfeather threeawn (*Aristida purpurascens*), splitbeard bluestem (*Andropogon ternarius*), narrowleaf rosettegrass, churchmouse threeawn (*Aristida dichotoma* var. *dichotoma*), rough dropseed (*Sporobolus clandestinus*) and hairawn muhly (*Muhlenbergia capillaris*).

A wide diversity of fire-tolerant forbs commonly associated with prairies and glades occur in this community including oldfield goldenrod (*Solidago nemoralis*), western rough goldenrod (*Solidago radula*) pale-purple coneflower (*Echinacea pallida*), butterfly milkweed (*Asclepias tuberosa*), whorled milkweed (*Asclepias verticillata*), compact blazingstar, tall larkspur (*Delphinium carolinianum*), black-eyed Susan (*Rudbeckia hirta*), stalked wild petunia (*Ruellia pedunculata*), large-flowered coreopsis (*Coreopsis grandiflora*), grass-leaved silveraster (*Pityopsis graminifolia*), southern prairie aster (*Aster paludosus* subsp. *hemisphericus*), false garlic (*Nothoscordum bivalve*), wild hyacinth (*Camassia scilloides*), hairystem spiderwort (*Tradescantia hirsuticaulis*), prairie tea (*Croton monanthogynus*), pineweed (*Hypericum gentianoides*), one-seeded copperleaf (*Acalypha monococca*), flowering spurge, sundrops (*Oenothera fruticosa*), Sampson's snakeroot (*Orbexilum pedunculatum*), pencilflower (*Stylosanthes biflora*), and birdsfoot violet (*Viola pedata*). Sedges include slender flatsedge (*Cyperus lupulinus* var. *macilentus*), blackmargin caric sedge (*Carex nigromarginata*), and littleflower nutsedge (*Scleria oligantha*). Ferns include the drought-tolerant woolly lipfern (*Cheilanthes tomentosa*) and blunt-lobed cliff fern (*Woodsia obtusa*).

Shrubs include highbush blueberry (*Vaccinium arboreum*), pasture hawthorn (*Crataegus spathulata*), winged elm, beautyberry (*Callicarpa americana*), blackjack oak (*Quercus marilandica*), post oak, black hickory (*Carya texana*), shortleaf pine, and occasionally sassafras (*Sassafras albidum*). These are typically widely spaced and stunted. Trees, which typically occur around the edges of this community or in pockets of deep soil within it, include shortleaf pine, blackjack oak, post oak, and black hickory.

This community typically occurs on south or southeast-facing slopes and rocky areas along ridgetops. It also occurs along the sides of rocky drainages in areas of thin soil. Much of the steeper slopes on south-facing slopes in the study areas have widely-spaced large trees and have some of the above-mentioned grasses and forbs in the understory.

Ridgetop Hardwood Forest Community

Hardwood trees dominated ridgetops in both areas (especially the Sugarloaf Tract)(Appendix 2). Pines were present, but sites were dominated by post oak, blackjack oak, northern red oak, shumard oak, and black hickory. Shrubs included rusty blackhaw (*Viburnum rufidulum*), blackhaw (*V. prunifolium*), hawthorns (*Crataegus* spp.), shadbush (*Amelanchier arborea*), fragrant sumac (*Rhus aromatica*), and highbush blueberry, black cherry, and winged elm. The forests were more open on the ridgetops than the north- and northwest-facing slopes and had a richer herbaceous layer as a result.

The herbaceous layer was similar to that of the south- and southeast-facing slopes and was dominated by black cherry, woodland sunflower, hairy Arkansas bedstraw, fragrant sumac, Lapham's blue phlox (*Phlox divaricata*), stalked goldenrod, and pussy's toes (*Antennaria fallax*). Other notable species included sedges (*Carex* spp.), grasses (*Dichanthelium* spp.), pale purple coneflower (*Echinacea pallida*), blue sage (*Salvia azurea*), many ray aster (*Aster anomalous*), Appalachian blazing star (*Liatris squarrulosa*), possum grape (*Vitis aestivalis*), four leaved milkweed (*Asclepias quadrifolia*), round leaved skullcap (*Scutellaria ovata*), monarda (*Monarda bradburiana*), yellow passion flower (*Passiflora lutea*), stalked wild petunia (*Ruellia pedunculata*), long bracted false indigo (*Baptisia bracteata*), flowering spurge, and little bluestem.

South Facing Slopes (Xeric Pine-Oak Forest & Woodland)

South facing slopes are typically very rocky and are dominated by shortleaf pine, oaks, and black hickory on upper slopes, with black gum, oaks, and mockernut hickory on lower slopes (Appendix 3). Shrubs include flowering dogwood (*Cornus florida*), hawthorns, black cherry, sassafras, highbush blueberry, deerberry, and lowbush blueberry. The structure ranges from closed canopy forest on the lower slopes, to one of a woodland structure with more widely spaced trees on the more rocky, upper slopes. This community grades into the rock outcrop/glade community described above. The herbaceous layer includes low numbers of many of the fire-tolerant prairie and glade species that are found in the rock outcrop/glade communities.

North Facing Slopes (Mesic Oak-Pine forest)

North slopes are noticeably more mesic than south facing slopes but are also dominated by shortleaf pine (Appendix 4). Hardwood canopy trees include oaks, black gum, hickories, and black cherry. Shrubs include similar canopy species, flowering dogwood, American holly (*Ilex opaca*), and Ozark chinkapin. The understory is dominated by low bush blueberry, with muscadine grape, false Solomon's seal (*Maianthemum racemosum*), crested iris (*Iris cristata*), bluestem goldenrod (*Solidago caesia*), wild yam (*Dioscorea villosa*), round leaved skullcap, and crane fly orchid (*Tipularia discolor*).

Mesic Drainage Community

This community occurs in the deep drainages that carry water from the ridgetops to the base of the slopes. These are typically strewn with novaculite boulders and outcrops and were the only sites in the study areas for species such as bearded shorthuskgrass (*Brachyelytrum erectum*),

purple-stemmed cliff brake (*Pellaea atropurpurea*), spring witchhazel (*Hamamelis vernalis*), large-leaved storax (*Styrax grandifolius*), and strawberry bush (*Euonymus americana*) (Appendix 5). Very small wet-weather seepage areas are occasionally found at the base of rock outcrops in this community and were the only sites in the study area for ferns such as netted chain fern (*Woodwardia areolata*) and southern lady fern (*Athyrium filix-femina*) and the shrub wild hydrangea (*Hydrangea arborescens*).

Canopy is similar to that of the surrounding forest, but includes red maple (*Acer rubrum*) and sweet gum. The shrub layer includes more mesic species such as spring witch hazel (*Hamamelis vernalis*), fall witch hazel (*H. virginiana*), large leaved storax, strawberry bush (*Euonymus americana*), American holly, and occasionally the introduced magnolia (*Magnolia grandiflora*). Other plants typically found in this community include yaupon holly (*Ilex vomitoria*), crane fly orchid, sessile woodoats (*Chasmanthium sessiliflorum*), and wild yam.

Roadside/Disturbed Community

This community occurs along roads in the study areas, both in use (paved) and historic (unpaved and abandoned). A number of species were found in this habitat not found in any other habitat in the study areas (Appendix 6). Several of these species were likely planted to control erosion or were inadvertently introduced on mowing equipment from other areas of the park. This habitat type provided a mix of conditions, particularly wet sunny areas, that do not occur elsewhere in the study areas. Species collected here that did not occur elsewhere included many: Asian dayflower (*Commelina communis* var. *communis*), tall fescue (*Festuca arundinaceum*), sycamore (*Platanus occidentalis*), and horse nettle (*Solanum carolinense*). This does not necessarily include species found along wooded hiking trails (these are narrower and typically lack a ditch on either side). Path rush (*Juncus tenuis*) was found exclusively along hiking trails where it thrives in the compacted soils that are periodically disturbed by foot traffic.

Conclusion

The current expected species list reflects a current understanding of species occurrence in the old growth study areas based on known distributions, availability of habitat, and habitat preferences of vascular plant species. In order to ensure the long-term sustainability of desirable plant species and communities, proper habitat management should be conducted.

Two main threats to the persistence of plant communities in the old growth study areas are the continued fire suppression, and presence of several non-native invasive species. Both have the ability to significantly alter the structure and composition of plant communities, and to alter ecosystem processes over time (if left unchecked).

Reintroduction of fire as an ecological process

Species richness and abundance within the old growth study areas would increase with the reintroduction of fire to these areas. This would also stimulate pine recruitment. At present, there is very little pine recruitment and as the large pine trees in the canopy die from old age, disease, and storm events, they will be replaced by hardwood species, altering the plant community. Without further disturbance, pines will certainly be replaced by hardwoods in the future (Dale & Ware 1999). The plant communities in the old growth study areas evolved in the presence of fire and require low intensity periodic fire for their maintenance. At present a dense woody understory and thick duff layer (>15 cm at some places on the south-facing slope of Sugarloaf Mountain) are suppressing herbaceous species abundance.

Though there are many challenges to the reintroduction of fire in an urban setting such as Hot Springs NP (e.g. smoke management, public misunderstanding of fire as a management tool, etc.), it is a tool that needs to be considered. Not only would the reintroduction of fire have ecological benefits, it would also reduce fuel loads in the park, which are very high in many areas at present due in part to damage sustained in the ice storms of December 2000. Fuel loads are especially high on steep slopes and along drainages where thin, rocky soil results in weak, shallow root systems in pine trees. These high fuel loads increase the risk of catastrophic wildfire, which could destroy property, lives, and the forests of Hot Springs NP.

Recent prescribed fires in older growth pine-hardwood forests in the Ouachitas have provided some insight into details for their conduction. Because larger, older pines often have large mounds of pine needles and sloughed-off bark at their base, these mounds tend to have higher fuel loads than the surrounding landscape. It is advisable to rake this fuel away from the bases of these trees to avoid intense fires at the tree bases girdling these larger trees, especially after lengthy periods of fire suppression (Foti, pers. comm. 2003). Due to the fire-suppressed condition of the study areas, the first step should be a low-intensity “cool” fire with fuel reduction as its primary objective. Subsequent fires should be done under lower fuel moisture conditions with understory removal and duff reduction as goals. One advantage to the situation of the units on slopes and ridgetops is that fire travels uphill. Firelines could be constructed at park boundaries and ignited at the toe of each slope. The two fires would meet at the ridge tops and burn out when the available fuel was consumed.

Control of exotic invasive plant species

A number of exotic invasive plant species are invading the old growth study areas. This is worse on North Mountain than on Sugarloaf Mountain, presumably due to a longer history of human impact immediately adjacent to the study area. The majority of the problem species are ornamental plants, probably spread by birds from nearby yards and other landscaping.

The reintroduction of fire would address many of these invasive species problems, as the majority of these species are fire-intolerant. This approach is also the least labor intensive and most cost-effective. Another approach is a mixture of manual cutting, herbicide treatment, and hand-pulling. Cutting invasive shrubs such as Chinese privet, nandina, and Chinese holly and painting the stumps with a glyphosate herbicide or GarlonTM within 10 minutes of cutting has been an effective treatment on Arkansas Natural Heritage Commission Natural Areas. Japanese honeysuckle can be sprayed with a glyphosate herbicide after native plants have gone dormant for the winter.

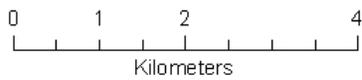
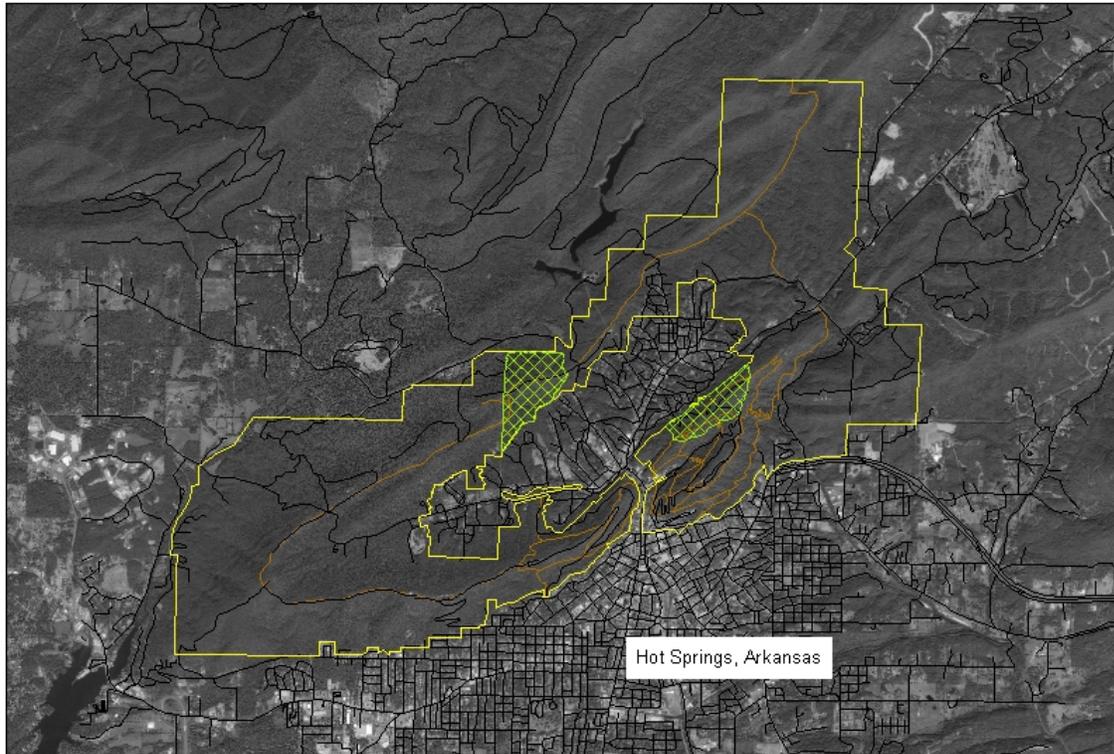
The combination of these two management tools is likely to increase native species richness and abundance in the study areas and allow the dominant plant communities to regenerate and persist on the site in the long term.

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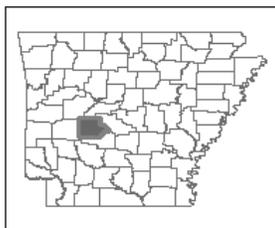
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Hot Springs NP



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Garland County, Arkansas



Legend

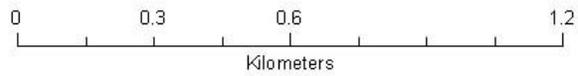
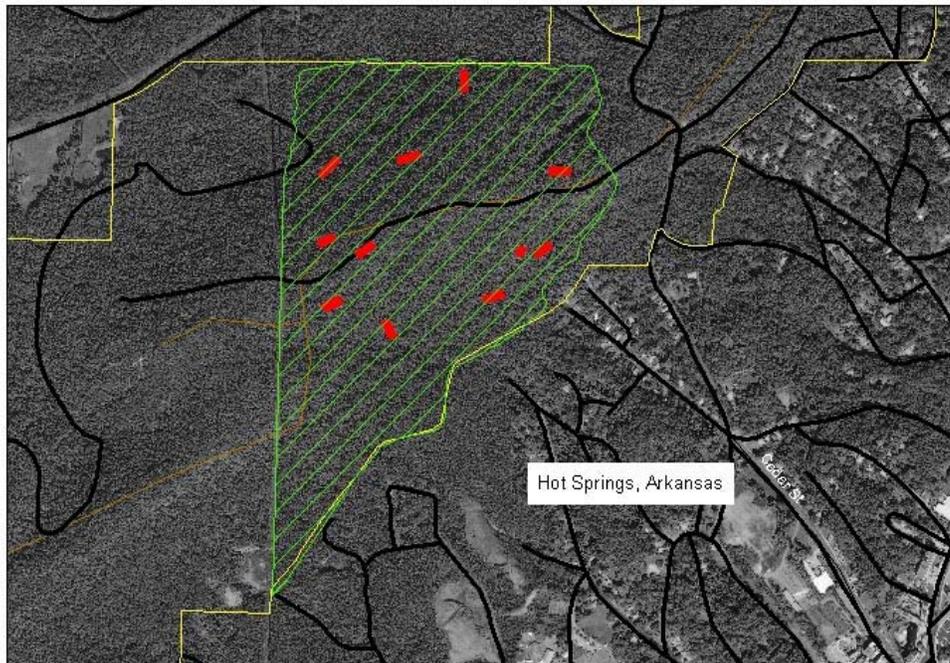
-  Park Boundary
-  Roads
-  Trails
-  Study Tract



Map Produced by: Heartland Network
Inventory and Monitoring Program
Data Source: National Park Service

Figure 1. Location of Hot Springs NP, Garland County, Arkansas.

Sugarloaf Mountain Study Tract



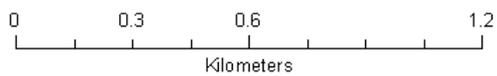
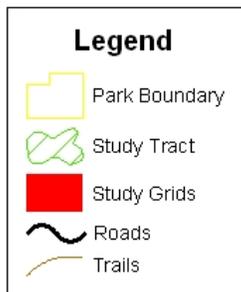
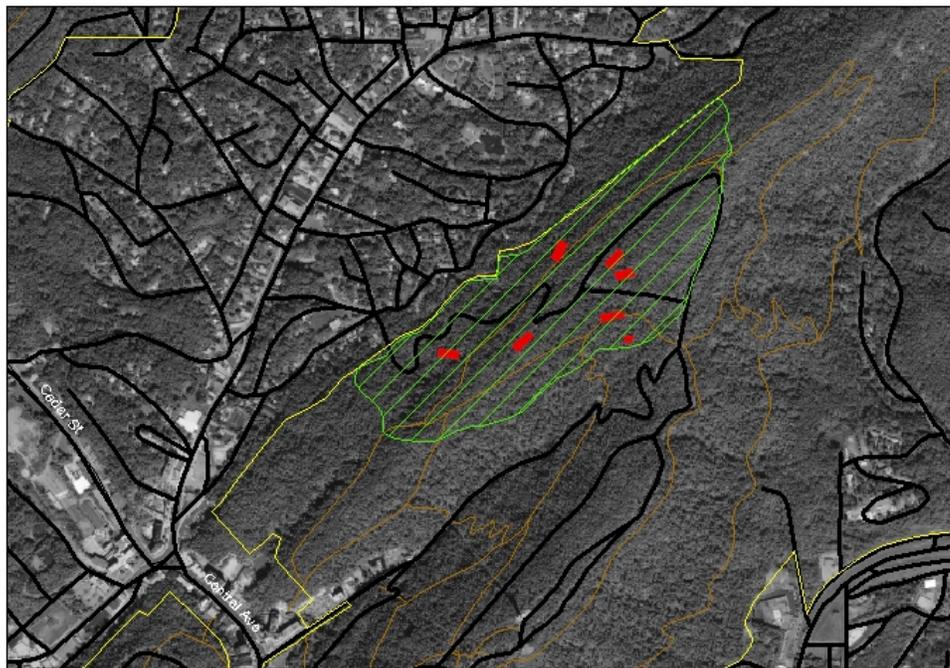
1:11,695



Map Produced by: Heartland Network
Inventory and Monitoring Program
Data Source: National Park Service

Figure 2. Map showing location of Sugarloaf Mountain study tract grids in Hot Springs NP.

North Mountain Study Tract



1:13,660



Map Produced by: Herbaria Network
Inventory and Monitoring Program
Data Source: National Park Service

Figure 3. Map showing location of North Mountain study tract grids in Hot Springs NP.

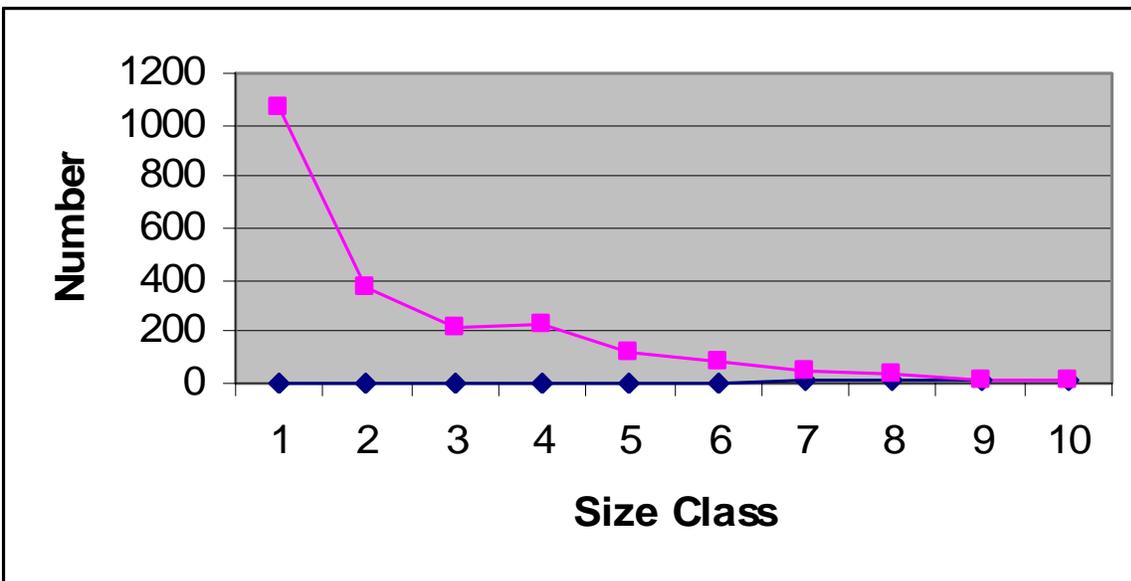


Figure 4. Distribution of woody species according to size class at Hot Springs NP.

Size classes (cm): 1=0-1, 2= 1-2.5, 3=2.5-5, 4=5-10, 5=10-15, 6=15-20, 7=20-25, 8=25-30, 9=30-35, 10=35-40.

Table 1. Vascular plants of old growth project areas in Hot Springs NP and their relative abundance.

Division Polypodiophyta	Scientific Name	Common Name	Abundance
Family			
Aspleniaceae	Asplenium bradleyi D. C. Eat.	Bradley's spleenwort	+
	Asplenium platyneuron (L.) B.S.P.	Ebony spleenwort	++++
Blechnaceae	Woodwardia areolata (L.) Moore	Netted chain fern	+
Dennstaedtiaceae	Pteridium aquilinum (L.) Kuhn	Bracken fern	+++
Dryopteridaceae	Athyrium filix-femina (L.) Roth ex Mert. var. asplenioides (Michx.) Farw.	Southern lady fern	+
	Polystichum acrostichoides (Michx.) Schott	Christmas fern	+++
	Woodsia obtusa (Spreng) Torr.	Blunt-lobed cliff fern	++
Ophioglossaceae	Botrychium dissectum Spreng. f. obliquum (Muhl.) Fern.	Winter grape fern	+
Polypodiaceae	Pleopeltis polypodioides (L.) Andrews & Windham var. michauxiana (Weatherby) Andrews & Windham	Resurrection fern	++++
Pteridaceae	Cheilanthes tomentosa Link	Woolly lip fern	++
	Pellaea atropurpurea (L.) Link	Purple-stemmed cliff brake	+
Division Pinophyta			
Family			
Cupressaceae	Juniperus virginiana L.	Eastern redcedar	+++
Pinaceae	Pinus echinata P.Mill.	Shortleaf pine	+++++
Division Magnoliophyta			
Subdivision Liliatae			
Family			
Agavaceae	Manfreda virginica (L.) Salisb. ex Rose	False aloe	+
	Yucca arkansana Trel.	Yucca	+
Commelinaceae	Commelina communis L. var.	Asian dayflower	+

	communis*		
	<i>Tradescantia hirsuticaulis</i> Small	Hairystem spiderwort	+++
Cyperaceae	<i>Carex albicans</i> Willd. ex Spreng. var. <i>albicans</i>	Whitetinge caric sedge	+++
	<i>Carex blanda</i> Dew.	Eastern woodland caric sedge	+++
	<i>Carex cherokeensis</i> Schwein.	Cherokee caric sedge	+++
	<i>Carex frankii</i> Kunth	Frank's caric sedge	+
	<i>Carex hirsutella</i> Mack.	Fuzzy caric sedge	+++
	<i>Carex muehlenbergii</i> Schkuhr ex Willd. var. <i>enervis</i> Boott	Muehlenberg's caric sedge	++
	<i>Carex nigromarginata</i> Schwein	Blackmargin caric sedge	++
	<i>Carex oxylepis</i> Torr. & Hook.	Sharpscale caric sedge	+
	<i>Cyperus lupulinus</i> (Spreng.) Marcks subsp. <i>macilentus</i> (Fern.) Marcks	Slender flatsedge	+
	<i>Cyperus retrorsus</i> Chapman	Pinebarren flatsedge	++
	<i>Cyperus strigosus</i> L.	Straw-colored flatsedge	++
	<i>Scleria oligantha</i> Michx.	Littleflower nutsedge	+++
Dioscoreaceae	<i>Dioscorea oppositifolia</i> L. *	Air potato	+
	<i>Dioscorea villosa</i> L.	Wild yam	++++
Iridaceae	<i>Iris cristata</i> Solander ex Ait.	Crested iris	++
Juncaceae	<i>Juncus coriaceus</i> Mack.	Leathery rush	+
	<i>Juncus tenuis</i> Willd.	Path rush	++
Liliaceae	<i>Camassia scilloides</i> (Raf.) Cory	Wild hyacinth	+
	<i>Maianthemum racemosum</i> (L.) Link	False Solomon's seal	+++
	<i>Nothoscordum bivalve</i> (L.) Britt.	False garlic	+++
Orchidaceae	<i>Spiranthes tuberosa</i> Raf.	Tuberous ladies' tresses	+
	<i>Tipularia discolor</i> Raf.	Crane-fly orchid	+++
Poaceae	<i>Agrostis perennans</i> (Walt.) Tuckerman	Upland bentgrass	+
	<i>Aira caryophyllea</i> L. *	Silver hairgrass	+
	<i>Andropogon gerardii</i> Vitman	Big bluestem	++
	<i>Andropogon ternarius</i> Michx.	Splitbeard bluestem	++
	<i>Andropogon virginicus</i> L.	Broomsedge bluestem	++
	<i>Aristida dichotoma</i> Michx. var. <i>dichotoma</i>	Churchmouse three-awn	++

	<i>Aristida purpurascens</i> Poir.	Arrowfeather three-awn	+++
	<i>Brachyelytrum erectum</i> (Schreb. ex Spreng.) Beauv.		+
	<i>Chasmanthium latifolium</i> (Michx.) Yates	Riveroats	+
	<i>Chasmanthium laxum</i> (L.) Yates var. <i>sessiliflorum</i> (Poir.) L. Clark	Longleaf woodoats	++
	<i>Cynodon dactylon</i> (L.) Pers. *	Bermuda grass	+++
	<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & J. A. Schultes	Poverty oats	++++
	<i>Dichantherium aciculare</i> (Desv. ex Poir.) Gould & C. A. Clark	Narrowleaf rosettegrass	+
	<i>Dichantherium boscii</i> (Poir) Gould & C. A. Clark	Bosc's rosettegrass	+++++
	<i>Dichantherium commutatum</i> (J. A. Schultes) Gould	Variable rosettegrass	+++
	<i>Dichantherium dichotomum</i> (L.) Gould	Cypress rosettegrass	+++++
	<i>Dichantherium laxiflorum</i> (Lam.) Gould	Openflower rosettegrass	+++
	<i>Dichantherium lineariifolium</i> (Scribn. ex Nash) Gould	Slimleaf rosettegrass	++++
	<i>Dichantherium ravenelii</i> (Scribn. & Merr.) Gould	Ravenel's rosettegrass	++
	<i>Digitaria ishaemum</i> (Schreb. ex Schweigg.) Schreb. ex Muhl. *	Smooth crabgrass	++
	<i>Elymus canadensis</i> L.	Canada wild rye	+++
	<i>Elymus virginicus</i> L.	Virginia wild rye	++
	<i>Erianthus strictus</i> Ell.	Narrow plumegrass	+
	<i>Festuca arundinacea</i> Schreb. *	Tall fescue	+++
	<i>Festuca subverticillata</i> (Pers.) Alexeev	Nodding fescue	+++
	<i>Muhlenbergia sobolifera</i> (Muhl. ex Willd.) Trin.	Rock muhly	+
	<i>Muhlenbergia capillaris</i> (Lam.) Trin.	Hairawn muhly	+
	<i>Muhlenbergia schreberi</i> J. F. Gmel.	Nimblewill muhly	++
	<i>Panicum virgatum</i> L.	Switchgrass	+
	<i>Paspalum notatum</i> Fluegge *	Bahia grass	+++
	<i>Piptochaetium avenaceum</i> (L.) Parodi	Blackseed speargrass	++
	<i>Poa annua</i> L. *	Annual bluegrass	++
	<i>Poa sylvestris</i> Gray	Woodland bluegrass	+++
	<i>Schizachyrium scoparium</i>	Little bluestem	++++

	(Michx.) Nash		
	Setaria parviflora (Poir.) Kerguelen	Marsh bristlegrass	++
	Sorghastrum nutans (L.) Nash	Indiangrass	++
	Sorghum halepense (L.) Pers. *	Johnson grass	+++
	Sphenopholis obtusata (Michx.) Scribn.	Prairie wedgescale	+++
	Sporobolus clandestinus (Biehler) A. S. Hitchc.	Rough dropseed	+
	Tridens flavus (L.) A. S. Hitchc.	Purpletop	+++
Smilacaceae	Smilax bonanox L.	Bull greenbrier	++++
	Smilax glauca Walt.	Cat greenbrier	+++++
Division Magnoliophyta			
Subdivision Magnoliatae			
Family			
Acanthaceae	Ruellia pedunculata Torr. ex Gray subsp. pedunculata	Stalked wild petunia	++
Aceraceae	Acer negundo L. var. negundo	Boxelder	+
	Acer rubrum L. var. rubrum	Red maple	+++
Anacardiaceae	Rhus aromatica Ait. var. aromatica	Fragrant sumac	+++
	Rhus copallinum L.	Winged sumac	++
	Rhus glabra L.	Smooth sumac	++
	Toxicodendron radicans (L.) Kuntze	Poison ivy	+++++
Apiaceae	Chaerophyllum tainturieri Hook. var. tainturieri	Hairyfruit chervil	+++
	Daucus carota L. *	Queen Anne's lace	++
	Sanicula canadensis L.	Sanicle	+++
	Zizia aurea (L.) W. D. J. Koch	Golden Alexanders	+++
Aquifoliaceae	Ilex ambigua (Michx.) Torr.	Carolina holly	+
	Ilex cornuta Lindl. & Paxton *	Chinese holly	++
	Ilex decidua Walt.	Deciduous holly	++
	Ilex opaca Ait.	American holly	++++
	Ilex vomitoria Ait.	Possum haw	+++
Araliaceae	Hedera helix L. *	English ivy	++

Aristolochiaceae	<i>Aristolochia serpentaria</i> L.	Virginia snakeroot	+++
Asclepiadaceae	<i>Asclepias quadrifolia</i> Jacq.	Four-leaved milkweed	+++
	<i>Asclepias tuberosa</i> L.	Butterfly milkweed	++
	<i>Asclepias variegata</i> L.	White-flowered milkweed	+
	<i>Asclepias verticillata</i> L.	Horsetail milkweed	++
Asteraceae	<i>Ambrosia artemisiifolia</i> L.	Common ragweed	++
	<i>Antennaria parlinii</i> Fern. subsp. <i>fallax</i> (Greene) Bayer & Stebbins	Pussy's toes	+++
	<i>Antennaria parlinii</i> Fern. subsp. <i>parlinii</i>	Pussy's toes	++
	<i>Aster anomalus</i> Engelm.	Manyray aster	++++
	<i>Aster paludosus</i> Ait. subsp. <i>hemisphericus</i> (Alex.) Cronq.	Southern prairie aster	+
	<i>Aster patens</i> Ait.	Late purple aster	++++
	<i>Aster pilosus</i> Willd.	Hairy white aster	+
	<i>Baccharis halimifolia</i> L. *	Sea-myrtle	+
	<i>Chrysopsis pilosa</i> Nutt.	Soft goldenaster	+
	<i>Conyza canadensis</i> (L.) Cronq. var. <i>canadensis</i> *	Canada horseweed	+++
	<i>Coreopsis grandiflora</i> Hogg ex Sweet	Largeflower tickseed	+++
	<i>Echinacea pallida</i> (Nutt.) Nutt	Pale purple coneflower	++
	<i>Elephantopus carolinianus</i> Raesch.	Carolina elephant's foot	++
	<i>Erigeron philadelphicus</i> L.	Philadelphia fleabane	++
	<i>Erigeron strigosus</i> Muhl. ex Willd.	Fleabane	+++
	<i>Erigeron tenuis</i> Torr. & Gray	Fleabane	++
	<i>Gamochaeta purpurea</i> (L.) Cabrera	Purple cudweed	++
	<i>Helenium flexuosum</i> Raf.	Sneezeweed	++
	<i>Helianthus divaricatus</i> L.	Woodland sunflower	++++
	<i>Helianthus hirsutus</i> Raf.	Woodland sunflower	++
	<i>Hieracium gronovii</i> L.	Hawkweed	+++
	<i>Krigia biflora</i> (Walt.) Blake	False dandelion	+++
	<i>Krigia dandelion</i> (L.) Nutt.	Potato dandelion	+++
	<i>Lactuca canadensis</i> L.	Wild lettuce	++
	<i>Liatris aspera</i> Michx.	Rough blazing star	+
	Liatris squarrosa (L.) Michx.) var. <i>compacta</i> Torr. & Gray	Blazing star	++
	<i>Liatris squarrosa</i> Michx.	Appalachian blazing star	++
	<i>Pityopsis graminifolia</i> (Michx.) Nutt.	Grass-leaved aster	++

	<i>Polymnia canadensis</i> L.	Canada leafcup	+
	<i>Prenanthes altissima</i> L.	Rattlesnake root	+
	<i>Rudbeckia hirta</i> L.	Black-eyed Susan	+++
	<i>Rudbeckia laciniata</i> L.	Wild goldenglow	+
	<i>Rudbeckia triloba</i> L.	Brown-eyed Susan	+
	<i>Smallanthus uvedalia</i> (L.) Mackenzie & Small	Yellowflower leafcup	+
	<i>Solidago caesia</i> L.	Bluestem goldenrod	++++
	<i>Solidago hispida</i> Muhl. ex Willd.	Hairy goldenrod	+++
	<i>Solidago nemoralis</i> Ait.	Oldfield goldenrod	++++
	<i>Solidago odora</i> Ait.	Fragrant goldenrod	++++
	<i>Solidago petiolaris</i> Ait.	Stalked goldenrod	+++++
	<i>Solidago radula</i> Nutt.	Western rough goldenrod	++
	<i>Solidago ulmifolia</i> Muhl. ex Willd. var. <i>palmeri</i> Cronq.	Palmer's elmleaf goldenrod	++++
	<i>Vernonia baldwinii</i> Torr. subsp. <i>baldwinii</i>	Baldwin's ironweed	++
Berberidaceae	<i>Nandina domestica</i> Thunberg *	Nandina	++++
Betulaceae	<i>Carpinus caroliniana</i> Walt.	Musclewood	+
	<i>Ostrya virginiana</i> (P. Mill) K. Koch	Ironwood	+++
Bignoniaceae	<i>Bignonia capreolata</i> L.	Crossvine	+
	<i>Campsis radicans</i> (L.) Seem. ex Bureau	Trumpet creeper	+
Boraginaceae	<i>Myosotis verna</i> Nutt.	Scorpiongrass	++
Brassicaceae	<i>Arabis canadensis</i> L.	Canada rockcress	+++
	<i>Barbarea verna</i> (P. Mill.) Aschers. *	Yellow rocket	+
	<i>Cardamine hirsuta</i> L. *	Hairy bittercress	++
Caesalpiniaceae	<i>Cercis canadensis</i> L.	Redbud	+
Campanulaceae	<i>Triodanis perfoliata</i> (L.) Nieuwl.	Venus' lookingglass	+
Caprifoliaceae	<i>Abelia X grandiflora</i> Rehd. *	Bigflower abelia	+
	<i>Lonicera fragrantissima</i> Lindl. & Paxton *	Fragrant bush honeysuckle	+
	<i>Lonicera japonica</i> Thunb. *	Japanese honeysuckle	+++++
	<i>Lonicera sempervirens</i> L.	Red honeysuckle	+++
	<i>Sambucus canadensis</i> L.	Elderberry	+

	<i>Symphoricarpos orbiculatus</i> Moench	Coralberry	+
	<i>Viburnum prunifolium</i> L.	Blackhaw	+++
	<i>Viburnum rufidulum</i> L.	Rusty blackhaw	++++
Caryophyllaceae	<i>Cerastium glomeratum</i> Thuill. *	Sticky chickweed	++
	<i>Silene virginica</i> L.	Firepink	+
	<i>Stellaria media</i> (L.) Vill. *	Common chickweed	++
Celastraceae	<i>Euonymus americana</i> L.	Strawberry bush	+
Cistaceae	<i>Lechea tenuifolia</i> Michx.	Narrowleaf pinweed	++
Clusiaceae	<i>Hypericum gentianoides</i> (L.) B. S. P.	Pine-weed	+
	<i>Hypericum hypericoides</i> (L.) Crantz	St. Andrew's cross	++++
	<i>Hypericum mutilum</i> L.	Dwarf St. John's wort	++
	<i>Hypericum pseudomaculatum</i> Bush	Spotted St. John's wort	++
Cornaceae	<i>Cornus florida</i> L.	Flowering dogwood	+++++
Ebenaceae	<i>Diospyros virginiana</i> L.	Persimmon	++
Ericaceae	<i>Vaccinium arboreum</i> Marsh.	Highbush blueberry	+++++
	<i>Vaccinium elliottii</i> Chapman	Elliott's blueberry	+
	<i>Vaccinium pallidum</i> Ait.	Lowbush blueberry	+++++
	<i>Vaccinium stamineum</i> L.	Deerberry	+++
Euphorbiaceae	<i>Acalypha monococca</i> (Engelm. ex Gray) L. Mill. & Gandhi	Slender oneseed mercury	+++
	<i>Croton monanthogynus</i> Michx.	Prairie tea	+++
	<i>Euphorbia corollata</i> L.	Flowering spurge	++++
	<i>Euphorbia dentata</i> Michx.	Summer poinsettia	++
Fabaceae	<i>Amorpha fruticosa</i> L.	False indigo bush	++
	<i>Amphicarpea bracteata</i> (L.) Fern.	American hogpeanut	++
	<i>Baptisia bracteata</i> Muhl. ex Ell. var. <i>leucophaea</i> (Nutt.) Kartesz & Gandhi	Long-bracted false indigo	++++
	<i>Clitoria mariana</i> L.	Butterfly pea	+++
	<i>Desmodium nudiflorum</i> (L.) CD.	Nakedflower tick trefoil	++++
	<i>Desmodium paniculatum</i> (L.)	Panicled tick trefoil	+++

	DC. var. paniculatum		
	<i>Desmodium perplexum</i> Schub.	Paniculate tick trefoil	+++++
	<i>Lathyrus venosus</i> Muhl. ex Willd.	Veiny peavine	++++
	<i>Lespedeza cuneata</i> (Dum.-Cours) G. Don *	Sericea lespedeza	+++
	<i>Lespedeza intermedia</i> (L.) Britt.	Intermediate bushclover	++
	<i>Lespedeza procumbens</i> Michx.	Trailing bushclover	++++
	<i>Lespedeza repens</i> (L.) W. Bart.	Creeping bushclover	++++
	<i>Lespedeza striata</i> (Thunb.) H. & A. *	Knotted bushclover	++
	<i>Lespedeza stuevei</i> Nutt.	Tall bushclover	++++
	<i>Lespedeza virginica</i> (L.) Britt.	Slender bushclover	+++
	<i>Orbexilum pedunculatum</i> (P. Mill.) Rydb.	Sampson's snakeroot	++
	<i>Pueraria lobata</i> (Willd.) Ohwi *	Kudzu	++
	<i>Robinia pseudoacacia</i> L.	Black locust	+
	<i>Stylosanthes biflora</i> (L.) B. S. P.	Pencilflower	+
	<i>Tephrosia virginiana</i> (L.) Pers.	Goat's rue	++
	<i>Vicia caroliniana</i> Walt.	Carolina vetch	+++
	<i>Wisteria sinensis</i> (Sims) DC. *	Japanese wisteria	+
Fagaceae	<i>Castanea pumila</i> (L.) P. Mill. var. <i>ozarkensis</i> (Ashe) Tucker	Ozark chinkapin	+++
	<i>Quercus alba</i> L.	White oak	+++++
	<i>Quercus falcata</i> Michx.	Southern red oak	+++
	<i>Quercus marilandica</i> Muenchh.	Blackjack oak	++++
	<i>Quercus rubra</i> L.	Northern red oak	++++
	<i>Quercus shumardii</i> Buckl.	Shumard's oak	++
	<i>Quercus stellata</i> Wangenh.	Post oak	+++++
	<i>Quercus velutina</i> Lam.	Black oak	+++++
Geraniaceae	<i>Geranium carolinianum</i> L. var. <i>carolinianum</i>	Carolina cranesbill	++
Hamamelidaceae	<i>Hamamelis vernalis</i> Sarg.	Spring witchhazel	++
	<i>Hamamelis virginiana</i> L.	Fall witchhazel	++
	<i>Liquidambar styraciflua</i> L.	Sweetgum	++
Hydrangeaceae	<i>Hydrangea arborescens</i> L.	Wild hydrangea	+
Hydrophyllaceae	<i>Phacelia glabra</i> Nutt.	Smooth scorpionweed	+
Juglandaceae	<i>Carya cordiformis</i> (Wangenh.) K. Koch	Bitternut hickory	+

	<i>Carya texana</i> Buckl.	Black hickory	+++++
	<i>Carya tomentosa</i> (Poir.) Nutt,	Mockernut hickory	++++
Lamiaceae	<i>Cunila origanoides</i> (L.) Britt.	False oregano	++++
	<i>Lamium amplexicaule</i> L. *	Henbit	++
	<i>Lamium purpureum</i> L. *	Deadnettle	++
	<i>Monarda bradburiana</i> Beck.	Horsemint	++++
	<i>Monarda stipatoglandulosa</i> Waterfall	Horsemint	+
	<i>Perilla frutescens</i> (L.) Britt. *	Beefsteak plant	++
	<i>Prunella vulgaris</i> L. *	Heal-all	++
	<i>Pycnanthemum albescens</i> Torr. & Gray	Whiteleaf mountainmint	++
	<i>Salvia azurea</i> Michx. ex Lam.	Blue sage	++
	<i>Salvia lyrata</i> L.	Lyre-leaved sage	++
	<i>Scutellaria ovata</i> Hill	Round-leaved skullcap	++++
Lauraceae	<i>Sassafras albidum</i> (Nutt.) Nees	Sassafras	+++
Loganiaceae	<i>Gelsemium sempervirens</i> (L.) St.-Hil.	Yellow jasmine	+
Magnoliaceae	<i>Magnolia grandiflora</i> L. *	Southern magnolia	+++
Meliaceae	<i>Melia azedarach</i> L. *	Chinaberry	++
Menispermaceae	<i>Cocculus carolinus</i> (L.) DC.	Carolina moonseed	+++
Mimosaceae	<i>Albizzia julibrissin</i> Durz. *	Mimosa	++
Moraceae	<i>Morus rubra</i> L.	Red mulberry	++
Nyssaceae	<i>Nyssa sylvatica</i> Marsh.	Blackgum	+++++
Oleaceae	<i>Fraxinus americana</i> L.	White ash	++
	<i>Fraxinus pennsylvanica</i> Marsh.	Green ash	+
	<i>Ligustrum sinense</i> Lour. *	Chinese privet	+++
Onagraceae	<i>Oenothera biennis</i> L.	Field evening-primrose	+
	<i>Oenothera fruticosa</i> L.	Sundrops evening- primrose	+
Orobanchaceae	<i>Orobanche uniflora</i> L.	Oneflower cancerroot	+
Oxalidaceae	<i>Oxalis corniculata</i> L.	Creeping woodsorrel	+++

	<i>Oxalis dillenii</i> Jacq. *	Yellow woodsorrel	++
	<i>Oxalis violacea</i> L.	Violet woodsorrel	++
Passifloraceae	<i>Passiflora incarnata</i> L.	Showy passionflower	++
	<i>Passiflora lutea</i> L.	Yellow passionflower	+++
Phytolaccaceae	<i>Phytolacca americana</i> L.	Pokeweed	++
Platanaceae	<i>Platanus occidentalis</i> L.	American sycamore	+
Polemoniaceae	<i>Phlox divaricata</i> L. subsp. <i>laphamii</i> (Wood) Wherry	Lapham's blue phlox	+++
Polygalaceae	<i>Polygala verticillata</i> L.	Whorled milkwort	++
Polygonaceae	<i>Polygonum hydropiperoides</i> Michx.	Swamppepper knotweed	+
Portulacaceae	<i>Claytonia virginica</i> L.	Spring beauty	++
Ranunculaceae	<i>Clematis viorna</i> L.	Leather flower	++
	<i>Delphinium carolinianum</i> Walt. subsp. <i>carolinianum</i>	Tall larkspur	++
	<i>Ranunculus abortivus</i> L.	Smallflower crowfoot	++
Rhamnaceae	<i>Berchemia scandens</i> (Hill) K. Koch	Supplejack, Rattan vine	+++
	<i>Ceanothus americanus</i> L.	New Jersey tea	++
	<i>Rhamnus caroliniana</i> Walt.	Carolina buckthorn	+++
Rosaceae	<i>Amelanchier arborea</i> (Michx. f.) Fern.	Serviceberry, Shadbush	+++
	<i>Crataegus crusgalli</i> L.	Cockspur hawthorn	++
	<i>Crataegus marshallii</i> Egglest.	Parsley hawthorn	+++
	<i>Crataegus pruinosa</i> (Wendl. f.) K. Koch	Waxfruit hawthorn	+++
	<i>Crataegus spathulata</i> Michx.	Pasture hawthorn	+++
	<i>Duchesnia indica</i> (Andr.) Focke *	India mockstrawberry	+
	<i>Photinia serratifolia</i> (Desf.) Kalkm. *	Redtip photinia	+++
	<i>Potentilla simplex</i> Michx.	Oldfield cinquefoil	++
	<i>Prunus mexicana</i> S. Wats.	Mexican plum	+++
	<i>Prunus serotina</i> Eeh.	Black cherry	+++++
	<i>Pyrus calleryana</i> Dcne. *	callery pear	+

	<i>Rosa carolina</i> L.	Carolina rose	+++
	<i>Rubus argutus</i> Link	Blackberry	++++
	<i>Rubus flagellaris</i> Willd.	Northern dewberry	+++++
	<i>Rubus trivialis</i> Michx.	Southern dewberry	++
Rubiaceae	<i>Cephalanthus occidentalis</i> L.	Buttonbush	+
	<i>Diodia teres</i> Walt.	Poorjoe	++
	<i>Diodia virginica</i> L.	Virginia buttonweed	++
	<i>Galium aparine</i> L. *	Catchweed bedstraw	++++
	<i>Galium arkansanum</i> Gray var. <i>arkansanum</i>	Arkansas bedstraw	+++++
	<i>Galium arkansanum</i> Gray var. <i>pubiflorum</i> E. B. Smith	Hairyflower arkansas bedstraw	++++
	<i>Galium circaezans</i> Michx.	Licorice bedstraw	++
	<i>Houstonia longifolia</i> Gaertn. var. <i>longifolia</i>	Mountain bluets	+++
	<i>Houstonia pusilla</i> Schoepf.	Bluets	++
	<i>Mitchella repens</i> L.	Partridgeberry	+++
Sapotaceae	<i>Bumelia lanuginosa</i> (Michx.) Pers.	Chittumwood	+++
Saxifragaceae	<i>Heuchera americana</i> L. var. <i>hirsuticaulis</i> (Wheelock) Rosendahl, Butters & Lakela	Hairystem alumroot	+
Scrophulariaceae	<i>Aureolaria flava</i> (L.) Farwell	Smooth false foxglove	++
	<i>Paulownia tomentosa</i> (Thunb.) Sieb. & Zucc. ex Steud. *	Princess tree	++
	<i>Penstemon arkansanus</i> Pennell	Arkansas beard-tongue	+
Solanaceae	<i>Physalis pubescens</i> L.	Downy groundcherry	+
	<i>Solanum carolinense</i> L.	Horsenettle	+
Styracaceae	<i>Styrax grandifolius</i> Ait.	Large-leaved storax	++
Tiliaceae	<i>Tilia americana</i> L.	Basswood	+
Ulmaceae	<i>Celtis laevigata</i> Willd.	Sugarberry	+++
	<i>Celtis tenuifolia</i> Nutt.	Dwarf hackberry	++
	<i>Ulmus alata</i> Michx.	Winged elm	++++
Urticaceae	<i>Boehmeria cylindrica</i> (L.) Sw.	False nettle	+
Verbenaceae	<i>Callicarpa americana</i> L.	Beautyberry	+++

Violaceae	<i>Viola bicolor</i> Pursh *	Johnny-jump-up	++
	<i>Viola palmata</i> L.	Early blue violet	++
	<i>Viola pedata</i> L.	Birdsfoot violet	+++
Vitaceae	<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper	+++
	<i>Vitis aestivalis</i> Michx.	Possum grape	++++
	<i>Vitis rotundifolia</i> Michx.	Muscadine grape	+++++
Nomenclature (with exceptions) according to Kartesz, John. 1994. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland. Timber Press.			

Key: (+++++) = commonly encountered, (+) = rare, * = introduced to Arkansas, boldface = tracked by the Arkansas Natural Heritage Commission as an element of special concern.

Table 2. List of invasive exotic species by habitat in Hot Springs NP study areas.

Scientific Name	Habitat				
	Roadsides	Rocky Drainages	North Facing Slopes	Ridgetops	South Facing Slopes
<i>Albizia julibrissin</i>	X				
<i>Baccharis halimifolia</i>	X				
<i>Cynodon dactylon</i>	X				
<i>Dioscorea oppositifolia</i>	X				
<i>Festuca arundinacea</i>	X				
<i>Hedera helix</i>		X			
<i>Ilex cornuta</i>			X		
<i>Lespedeza cuneata</i>	X				
<i>Ligustrum sinense</i>	X	X	X	X	
<i>Lonicera fragrantissima</i>	X				
<i>Lonicera japonica</i>	X	X	X	X	X
<i>Magnolia grandiflora</i>		X	X	X	X
<i>Melia azedarach</i>	X				
<i>Nandina domestica</i>		X	X	X	X
<i>Paulownia tomentosa</i>					X
<i>Perilla frutescens</i>	X				
<i>Photinia serratifolia</i>			X	X	
<i>Pueraria lobata</i>		X			
<i>Sorghum halepense</i>	X				
<i>Wisteria sinensis</i>		X			

Table 3. List of woody species by size class (top 10 common species) at Hot Spring NP.

	Size Class and Number of Stems										
	0- 1	1- 2.5	2.5- 5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	>40
Scientific Name	1072	370	217	227	124	86	43	31	15	13	
<i>Prunus serotina</i>	176	51	44	14	6	11	2	1	1		
<i>Vitis rotundifolia</i>	119	19	3								
<i>Vaccinium arboreum</i>	103	77	7	1							
<i>Toxicodendron radicans</i>	97	14	1								
<i>Nyssa sylvatica</i>	69	25	34	27	7	5	2	1	1		
<i>Cornus florida</i>	64	39	20	17	7	2					
<i>Acer rubrum</i>	64	13	5	3	2	1					
<i>Smilax glauca</i>	45	1									
<i>Styrax grandifolia</i>	35	28	1								
<i>Quercus alba</i>	35	11	12	40	26	14	8	5	0	1	6
<i>Ilex vomitoria</i>	26	14	9	6							
<i>Amelanchier arborea</i>	14	13	2	0	0	1					
<i>Carya texana</i>	21	11	30	44	25	25	9	3	1		
<i>Sassafras albidum</i>	7	3	11	6							
<i>Quercus velutina</i>	33	8	7	11	4	2	2	2	0	3	1
<i>Pinus echinata</i>	3	2	6	10	14	8	11	16	11	9	30
<i>Quercus marilandica</i>	7	4	6	20	8	5	0	1			
<i>Carya tomentosa</i>	7	10	2	8	7	4	3	1	1		
<i>Quercus rubra</i>	9	6	4	8	13	5	1	1			
<i>Quercus stellata</i>	3	1	2	5	1	2	4	0	0	0	3
<i>Quercus falcata</i>	6	1	0	4	2	1	1	0	0	0	1

Appendix 1. List of plant species observed along novaculite glades and outcrops in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Acalypha monococca</i>	Euphorbiaceae
<i>Andropogon gerardii</i>	Poaceae
<i>Andropogon ternarius</i>	Poaceae
<i>Antennaria fallax</i>	Asteraceae
<i>Arabis canadensis</i>	Brassicaceae
<i>Aristida dichotoma</i> var. <i>dichotoma</i>	Poaceae
<i>Aristida purpurascens</i>	Poaceae
<i>Aristolochia serpentaria</i>	Aristolochiaceae
<i>Asclepias quadrifolia</i>	Asclepiadaceae
<i>Asclepias tuberosa</i>	Asclepiadaceae
<i>Asclepias verticillata</i>	Asclepiadaceae
<i>Asplenium bradleyi</i>	Aspleniaceae
<i>Asplenium platyneuron</i>	Aspleniaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster paludosus</i> subsp. <i>hemisphericus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Callicarpa americana</i>	Verbenaceae
<i>Camassia scilloides</i>	Liliaceae
<i>Carex albicans</i> var. <i>albicans</i>	Cyperaceae
<i>Carex nigromarginata</i>	Cyperaceae
<i>Carex</i> sp.	Cyperaceae
<i>Carya texana</i>	Juglandaceae
<i>Celtis tenuifolia</i>	Ulmaceae
<i>Cheilanthes tomentosa</i>	Pteridaceae
<i>Coreopsis grandiflora</i>	Asteraceae
<i>Crataegus spathulata</i>	Rosaceae
<i>Cyperus lupulinus</i> subsp. <i>macilentus</i>	Cyperaceae
<i>Danthonia spicata</i>	Poaceae
<i>Delphinium carolinianum</i>	Ranunculaceae
<i>Dichanthelium aciculare</i>	Poaceae
<i>Dichanthelium acuminatum</i>	Poaceae
<i>Dichanthelium commutatum</i>	Poaceae
<i>Dichanthelium laxiflorum</i>	Poaceae
<i>Dichanthelium linearifolium</i>	Poaceae
<i>Diospyros virginiana</i>	Ebenaceae
<i>Echinacea pallida</i>	Asteraceae
<i>Euphorbia corollata</i>	Euphorbiaceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Hieracium gronovii</i>	Asteraceae
<i>Hypericum gentianoides</i>	Clusiaceae

<i>Ilex vomitoria</i>	Aquifoliaceae
<i>Krigia dandelion</i>	Asteraceae
<i>Lechea tenuifolia</i>	Cistaceae
<i>Liatris aspera</i>	Asteraceae
<i>Liatris squarrosa</i> var. <i>compacta</i>	Asteraceae
<i>Liatris squarrulosa</i>	Asteraceae
<i>Manfreda virginica</i>	Agavaceae
<i>Muehlenbergia capillaris</i>	Poaceae
<i>Muehlenbergia sobolifera</i>	Poaceae
<i>Nothoscordum bivalve</i>	Liliaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Oenothera fruticosa</i>	Onagraceae
<i>Orbexilum pedunculatum</i>	Fabaceae
<i>Oxalis violacea</i>	Oxalidaceae
<i>Panicum virgatum</i>	Poaceae
<i>Pellaea atropurpurea</i>	Pteridaceae
<i>Phlox divaricata</i>	Polemoniaceae
<i>Pinus echinata</i>	Pinaceae
<i>Piptochaetium avenaceum</i>	Poaceae
<i>Pityopsis graminifolia</i>	Asteraceae
<i>Polygala verticillata</i>	Polygalaceae
<i>Prunus mexicana</i>	Rosaceae
<i>Pteridium aquilinum</i>	Dennstaedtiaceae
<i>Pycnanthemum albescens</i>	Lamiaceae
<i>Quercus marilandica</i>	Fagaceae
<i>Quercus stellata</i>	Fagaceae
<i>Quercus velutina</i>	Fagaceae
<i>Rhus aromatica</i> var. <i>aromatica</i>	Anacardiaceae
<i>Rhus copallinum</i>	Anacardiaceae
<i>Rosa carolina</i>	Rosaceae
<i>Rubus flagellaris</i>	Rosaceae
<i>Rudbeckia hirta</i>	Asteraceae
<i>Ruellia pedunculata</i>	Acanthaceae
<i>Schizachyrium scoparium</i>	Poaceae
<i>Scleria oligantha</i>	Cyperaceae
<i>Silene virginica</i>	Caryophyllaceae
<i>Smilax bonanox</i>	Smilacaceae
<i>Solidago nemoralis</i>	Asteraceae
<i>Solidago radula</i>	Asteraceae
<i>Sorghastrum nutans</i>	Poaceae
<i>Spiranthes tuberosa</i>	Orchidaceae
<i>Sporobolus clandestinus</i>	Poaceae
<i>Stylosanthes biflora</i>	Fabaceae
<i>Tephrosia virginiana</i>	Fabaceae
<i>Toxicodendron radicans</i>	Anacardiaceae

Tradescantia hirsuticaulis	Commelinaceae
Ulmus alata	Ulmaceae
Ulmus alata	Ulmaceae
Vaccinium arboreum	Ericaceae
Viola pedata	Violaceae
Vitis aestivalis	Vitaceae
Vitis rotundifolia	Vitaceae
Woodsia obtusa	Dryopteridaceae

Appendix 2. List of plant species observed ridgetops in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Acalypha monococca</i>	Euphorbiaceae
<i>Acer rubrum</i>	Aceraceae
<i>Amelanchier arborea</i>	Rosaceae
<i>Amorpha fruticosa</i>	Fabaceae
<i>Andropogon gerardii</i>	Poaceae
<i>Antennaria fallax</i>	Asteraceae
<i>Arabis canadensis</i>	Brassicaceae
<i>Aristida purpurascens</i>	Poaceae
<i>Aristolochia serpentaria</i>	Aristolochiaceae
<i>Asclepias quadrifolia</i>	Asclepiadaceae
<i>Asclepias variegata</i>	Asclepiadaceae
<i>Asplenium platyneuron</i>	Aspleniaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Baptisia bracteata</i>	Fabaceae
<i>Berchemia scandens</i>	Rhamnaceae
<i>Bumelia lanuginosa</i>	Sapotaceae
<i>Campsis radicans</i>	Bignoniaceae
<i>Carex albicans</i> var. <i>albicans</i>	Cyperaceae
<i>Carex cherokeensis</i>	Cyperaceae
<i>Carex hirsutella</i>	Cyperaceae
<i>Carya texana</i>	Juglandaceae
<i>Carya tomentosa</i>	Juglandaceae
<i>Celtis laevigata</i>	Ulmaceae
<i>Chaerophyllum tainturieri</i> var. <i>taniturieri</i>	Apiaceae
<i>Clitoria mariana</i>	Fabaceae
<i>Cornus florida</i>	Cornaceae
<i>Crataegus crusgalli</i>	Rosaceae
<i>Crataegus marshallii</i>	Rosaceae
<i>Crataegus pruinosa</i>	Rosaceae
<i>Crataegus spathulata</i>	Rosaceae
<i>Croton monanthogynus</i>	Euphorbiaceae
<i>Cunila organoides</i>	Lamiaceae
<i>Danthonia spicata</i>	Poaceae
<i>Desmodium perplexum</i>	Fabaceae
<i>Dichanthelium angustifolium</i>	Poaceae
<i>Dichanthelium boscii</i>	Poaceae
<i>Dichanthelium commutatum</i>	Poaceae
<i>Dichanthelium dichotomum</i>	Poaceae
<i>Dichanthelium lineariifolium</i>	Poaceae
<i>Dichanthelium ravenelii</i>	Poaceae
<i>Dioscorea villosa</i>	Dioscoreaceae
<i>Echinacea pallida</i>	Asteraceae

<i>Euphorbia corollata</i>	Euphorbiaceae
<i>Euphorbia dentata</i>	Euphorbiaceae
<i>Galium aparine</i>	Rubiaceae
<i>Galium arkansanum</i> var. <i>arkansanum</i>	Rubiaceae
<i>Galium arkansanum</i> var. <i>pubiflorum</i>	Rubiaceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Houstonia pusilla</i>	Rubiaceae
<i>Ilex opaca</i>	Aquifoliaceae
<i>Juniperus virginiana</i>	Cupressaceae
<i>Krigia dandelion</i>	Asteraceae
<i>Lathyrus venosus</i>	Fabaceae
<i>Lespedeza intermedia</i>	Fabaceae
<i>Lespedeza procumbens</i>	Fabaceae
<i>Lespedeza repens</i>	Fabaceae
<i>Lespedeza stuevei</i>	Fabaceae
<i>Lespedeza virginica</i>	Fabaceae
<i>Liatris squarrulosa</i>	Asteraceae
<i>Ligustrum sinense</i>	Oleaceae
<i>Lonicera japonica</i>	Caprifoliaceae
<i>Lonicera sempervirens</i>	Caprifoliaceae
<i>Magnolia grandiflora</i>	Magnoliaceae
<i>Monarda bradburiana</i>	Lamiaceae
<i>Nandina domestica</i>	Berberidaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Ostrya virginiana</i>	Betulaceae
<i>Oxalis corniculata</i>	Oxalidaceae
<i>Passiflora lutea</i>	Passifloraceae
<i>Phlox divaricata</i>	Polemoniaceae
<i>Photinia serrulata</i>	Rosaceae
<i>Pinus echinata</i>	Pinaceae
<i>Pleopeltis polypodioides</i>	Polypodiaceae
<i>Prunus mexicana</i>	Rosaceae
<i>Prunus serotina</i>	Rosaceae
<i>Pycnanthemum albescens</i>	Lamiaceae
<i>Quercus alba</i>	Fagaceae
<i>Quercus falcata</i>	Fagaceae
<i>Quercus rubra</i>	Fagaceae
<i>Quercus shumardii</i>	Fagaceae
<i>Quercus stellata</i>	Fagaceae
<i>Quercus velutina</i>	Fagaceae
<i>Rhamnus caroliniana</i>	Rhamnaceae
<i>Rhus aromatica</i>	Anacardiaceae
<i>Rubus flagellaris</i>	Rosaceae
<i>Rubus trivialis</i>	Rosaceae
<i>Rudbeckia hirta</i>	Asteraceae

Ruellia pedunculata	Acanthaceae
Salvia azurea	Lamiaceae
Sanicula canadensis	Apiaceae
Schizachyrium scoparium	Poaceae
Scleria oligantha	Cyperaceae
Scutellaria ovata	Lamiaceae
Silene virginica	Caryophyllaceae
Smilax bonanox	Smilacaceae
Smilax glauca	Smilacaceae
Solidago hispida	Asteraceae
Solidago odora	Asteraceae
Solidago petiolaris	Asteraceae
Solidago radula	Asteraceae
Solidago ulmifolia var. palmeri	Asteraceae
Tephrosia virginiana	Fabaceae
Tipularia discolor	Orchidaceae
Toxicodendron radicans	Anacardiaceae
Tradescantia hirsuticaulis	Commelinaceae
Triodanis perfoliata	Campanulaceae
Ulmus alata	Ulmaceae
Vaccinium arboreum	Ericaceae
Vaccinium pallidum	Ericaceae
Vernonia baldwinii subsp. baldwinii	Asteraceae
Viburnum prunifolium	Caprifoliaceae
Viburnum rufidulum	Caprifoliaceae
Vicia caroliniana	Fabaceae
Vitis aestivalis	Vitaceae
Vitis rotundifolia	Vitaceae
Yucca arkansana	Agavaceae

Appendix 3. List of plant species observed south-facing slopes in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Acalypha monococca</i>	Euphorbiaceae
<i>Acer rubrum</i>	Aceraceae
<i>Amelanchier arborea</i>	Rosaceae
<i>Andropogon gerardii</i>	Poaceae
<i>Antennaria parlinii</i>	Asteraceae
<i>Arabis canadensis</i>	Brassicaceae
<i>Aristolochia serpentaria</i>	Aristolochiaceae
<i>Asclepias quadrifolia</i>	Asclepiadaceae
<i>Asplenium platyneuron</i>	Aspleniaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster paludosus</i> subsp. <i>hemisphericus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Aster pilosus</i>	Asteraceae
<i>Baptisia bracteata</i>	Fabaceae
<i>Berchemia scandens</i>	Rhamnaceae
<i>Bignonia capreolata</i>	Bignoniaceae
<i>Bumelia lanuginosa</i>	Sapotaceae
<i>Callicarpa americana</i>	Verbenaceae
<i>Carex albicans</i> var. <i>albicans</i>	Cyperaceae
<i>Carex cherokeensis</i>	Cyperaceae
<i>Carex hirsutella</i>	Cyperaceae
<i>Carex muehlenbergii</i> var. <i>enervis</i>	Cyperaceae
<i>Carex nigromarginata</i>	Cyperaceae
<i>Carya texana</i>	Juglandaceae
<i>Carya tomentosa</i>	Juglandaceae
<i>Celtis tenuifolia</i>	Ulmaceae
<i>Cheilanthes tomentosa</i>	Pteridaceae
<i>Chrysopsis pilosa</i>	Asteraceae
<i>Clitoria mariana</i>	Fabaceae
<i>Cornus florida</i>	Cornaceae
<i>Crataegus marshallii</i>	Rosaceae
<i>Crataegus spathulata</i>	Rosaceae
<i>Danthonia spicata</i>	Poaceae
<i>Desmodium perplexum</i>	Fabaceae
<i>Dichanthelium boscii</i>	Poaceae
<i>Dichanthelium commutatum</i>	Poaceae
<i>Dichanthelium dichotomum</i>	Poaceae
<i>Dichanthelium lineariifolium</i>	Poaceae
<i>Dioscorea villosa</i>	Dioscoreaceae
<i>Erianthus strictus</i>	Poaceae
<i>Euphorbia corollata</i>	Euphorbiaceae
<i>Festuca subverticillata</i>	Poaceae

<i>Galium arkansanum</i> var. <i>arkansanum</i>	Rubiaceae
<i>Galium arkansanum</i> var. <i>pubiflorum</i>	Rubiaceae
<i>Galium circaezans</i>	Rubiaceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Hieracium gronovii</i>	Asteraceae
<i>Hypericum hypericoides</i>	Clusiaceae
<i>Hypericum pseudomaculatum</i>	Clusiaceae
<i>Ilex opaca</i>	Aquifoliaceae
<i>Juniperus virginiana</i>	Cupressaceae
<i>Krigia dandelion</i>	Asteraceae
<i>Lactuca canadensis</i>	Asteraceae
<i>Lespedeza intermedia</i>	Fabaceae
<i>Lespedeza procumbens</i>	Fabaceae
<i>Lespedeza repens</i>	Fabaceae
<i>Lespedeza stuevei</i>	Fabaceae
<i>Lespedeza virginica</i>	Fabaceae
<i>Liatris squarrulosa</i>	Asteraceae
<i>Liquidambar styraciflua</i>	Hamamelidaceae
<i>Lonicera japonica</i>	Caprifoliaceae
<i>Lonicera sempervirens</i>	Caprifoliaceae
<i>Magnolia grandiflora</i>	Magnoliaceae
<i>Monarda bradburiana</i>	Lamiaceae
<i>Muehlenbergia schreberi</i>	Poaceae
<i>Nandina domestica</i>	Berberidaceae
<i>Nothoscordum bivalve</i>	Caprifoliaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Oxalis corniculata</i>	Oxalidaceae
<i>Oxalis violacea</i>	Oxalidaceae
<i>Panicum virgatum</i>	Poaceae
<i>Passiflora lutea</i>	Passifloraceae
<i>Paulownia tomentosa</i>	Hamamelidaceae
<i>Phytolacca americana</i>	Phytolacaceae
<i>Pinus echinata</i>	Pinaceae
<i>Piptochaetium avenaceum</i>	Poaceae
<i>Pityopsis graminifolia</i>	Asteraceae
<i>Polygala verticillata</i>	Polygalaceae
<i>Potentilla simplex</i>	Rosaceae
<i>Prenanthes altissima</i>	Asteraceae
<i>Prunus serotina</i>	Rosaceae
<i>Pteridium aquilinum</i>	Dennstaedtiaceae
<i>Pycnanthemum albescens</i>	Lamiaceae
<i>Quercus alba</i>	Fagaceae
<i>Quercus falcata</i>	Fagaceae
<i>Quercus marilandica</i>	Fagaceae
<i>Quercus rubra</i>	Fagaceae

<i>Quercus stellata</i>	Fagaceae
<i>Quercus velutina</i>	Fagaceae
<i>Rhamnus caroliniana</i>	Rhamnaceae
<i>Rhus aromatica</i> var. <i>aromatica</i>	Anacardiaceae
<i>Rhus copallinum</i>	Anacardiaceae
<i>Rosa carolina</i>	Rosaceae
<i>Rubus argutus</i>	Rosaceae
<i>Rubus flagellaris</i>	Rosaceae
<i>Ruellia pedunculata</i> var. <i>pedunculata</i>	Acanthaceae
<i>Sanicula canadensis</i>	Apiaceae
<i>Sassafras albidum</i>	Lauraceae
<i>Schizachyrium scoparium</i>	Poaceae
<i>Scleria oligantha</i>	Cyperaceae
<i>Scutellaria ovata</i>	Lamiaceae
<i>Setaria parviflora</i>	Poaceae
<i>Smilax bonanox</i>	Smilacaceae
<i>Smilax glauca</i>	Smilacaceae
<i>Solidago odora</i>	Asteraceae
<i>Solidago petiolaris</i>	Asteraceae
<i>Solidago ulmifolia</i> var. <i>palmeri</i>	Asteraceae
<i>Sorghastrum nutans</i>	Poaceae
<i>Sphenopholis obtusata</i>	Poaceae
<i>Sporobolus clandestinus</i>	Poaceae
<i>Toxicodendron radicans</i>	Anacardiaceae
<i>Tradescantia hirsuticaulis</i>	Commelinaceae
<i>Tridens flavus</i>	Poaceae
<i>Triodanis perfoliata</i>	Campanulaceae
<i>Ulmus alata</i>	Ulmaceae
<i>Vaccinium arboreum</i>	Ericaceae
<i>Vaccinium pallidum</i>	Ericaceae
<i>Vaccinium stamineum</i>	Ericaceae
<i>Viburnum rufidulum</i>	Caprifoliaceae
<i>Viola palmata</i>	Violaceae
<i>Viola pedata</i>	Violaceae
<i>Vitis rotundifolia</i>	Vitaceae
<i>Woodsia obtusa</i>	Dryopteridaceae

Appendix 4. List of plant species observed on north facing slopes in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Acer rubrum</i>	Aceraceae
<i>Amelanchier arborea</i>	Rosaceae
<i>Amphicarpea bracteata</i>	Fabaceae
<i>Asplenium platyneuron</i>	Aspleniaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Aureolaria flava</i>	Hamamelidaceae
<i>Baptisia bracteata</i>	Fabaceae
<i>Berchemia scandens</i>	Rhamnaceae
<i>Bignonia capreolata</i>	Bignoniaceae
<i>Bumelia lanuginosa</i>	Sapotaceae
<i>Carex blanda</i>	Cyperaceae
<i>Carex cherokeensis</i>	Cyperaceae
<i>Carex hirsutella</i>	Cyperaceae
<i>Carex muehlenbergii</i> var. <i>enervis</i>	Cyperaceae
<i>Carex oxylepis</i>	Cyperaceae
<i>Carya texana</i>	Juglandaceae
<i>Carya tomentosa</i>	Juglandaceae
<i>Castanea pumila</i> var. <i>ozarkensis</i>	Fagaceae
<i>Cercis canadensis</i>	Caesalpiniaceae
<i>Chasmanthium laxum</i> var. <i>sessiliflorum</i>	Poaceae
<i>Clitoria mariana</i>	Fabaceae
<i>Cornus florida</i>	Cornaceae
<i>Cunila origanoides</i>	Lamiaceae
<i>Danthonia spicata</i>	Poaceae
<i>Desmodium nudiflorum</i>	Fabaceae
<i>Desmodium paniculatum</i>	Fabaceae
<i>Desmodium perplexum</i>	Fabaceae
<i>Dichanthelium boscii</i>	Poaceae
<i>Dichanthelium commutatum</i>	Poaceae
<i>Dichanthelium dichotomum</i>	Poaceae
<i>Dichanthelium lineariifolium</i>	Poaceae
<i>Dichanthelium ravenelii</i>	Poaceae
<i>Dioscorea villosa</i>	Dioscoreaceae
<i>Diospyros virginiana</i>	Ebenaceae
<i>Elymus canadensis</i>	Poaceae
<i>Euphorbia corollata</i>	Euphorbiaceae
<i>Festuca subverticillata</i>	Poaceae
<i>Fraxinus americana</i>	Oleaceae
<i>Galium arkansanum</i> var. <i>arkansanum</i>	Rubiaceae

<i>Galium arkansanum</i> var. <i>pubiflorum</i>	Rubiaceae
<i>Gelsemium sempervirens</i>	Loganiaceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Helianthus hirsutus</i>	Asteraceae
<i>Hypericum hypericoides</i>	Clusiaceae
<i>Ilex ambigua</i>	Aquifoliaceae
<i>Ilex cornuta</i>	Aquifoliaceae
<i>Ilex decidua</i>	Aquifoliaceae
<i>Ilex opaca</i>	Aquifoliaceae
<i>Iris cristata</i>	Iridaceae
<i>Juniperus virginiana</i>	Cupressaceae
<i>Krigia biflora</i>	Asteraceae
<i>Lactuca canadensis</i>	Asteraceae
<i>Lathyrus venosus</i>	Fabaceae
<i>Lespedeza intermedia</i>	Fabaceae
<i>Ligustrum sinense</i>	Oleaceae
<i>Liquidambar styraciflua</i>	Hamamelidaceae
<i>Lonicera japonica</i>	Caprifoliaceae
<i>Lonicera sempervirens</i>	Caprifoliaceae
<i>Magnolia grandiflora</i>	Magnoliaceae
<i>Maianthemum racemosum</i>	Liliaceae
<i>Mitchella repens</i>	Rubiaceae
<i>Monarda bradburiana</i>	Lamiaceae
<i>Monarda stipitatoglandulosa</i>	Lamiaceae
<i>Morus rubra</i>	Moraceae
<i>Nandina domestica</i>	Berberidaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Oxalis dillenii</i>	Oxalidaceae
<i>Parthenocissus quinquefolia</i>	Vitaceae
<i>Phlox divaricata</i> subsp. <i>laphamii</i>	Polemoniaceae
<i>Photinia serrulata</i>	Rosaceae
<i>Pinus echinata</i>	Pinaceae
<i>Pleopeltis polypodioides</i>	Polypodiaceae
<i>Poa sylvestris</i>	Poaceae
<i>Polymnia canadensis</i>	Asteraceae
<i>Polystichum acrostichoides</i>	Dryopteridaceae
<i>Potentilla simplex</i>	Rosaceae
<i>Prunus mexicana</i>	Rosaceae
<i>Prunus serotina</i>	Rosaceae
<i>Pteridium aquilinum</i>	Dennstaedtiaceae
<i>Quercus alba</i>	Fagaceae
<i>Quercus falcata</i>	Fagaceae
<i>Quercus rubra</i>	Fagaceae
<i>Quercus stellata</i>	Fagaceae

<i>Quercus velutina</i>	Fagaceae
<i>Rhamnus caroliniana</i>	Rhamnaceae
<i>Robinia pseudoacacia</i>	Fabaceae
<i>Rubus flagellaris</i>	Rosaceae
<i>Sanicula canadensis</i>	Apiaceae
<i>Schizachyrium scoparium</i>	Poaceae
<i>Scutellaria ovata</i>	Lamiaceae
<i>Smilax bonanox</i>	Smilacaceae
<i>Smilax glauca</i>	Smilacaceae
<i>Solidago caesia</i>	Asteraceae
<i>Solidago hispida</i>	Asteraceae
<i>Solidago odora</i>	Asteraceae
<i>Solidago petiolaris</i>	Asteraceae
<i>Solidago ulmifolia</i> var. <i>palmeri</i>	Asteraceae
<i>Sphenopholis obtusata</i>	Poaceae
<i>Tilia americana</i>	Tiliaceae
<i>Tipularia discolor</i>	Orchidaceae
<i>Toxicodendron radicans</i>	Anacardiaceae
<i>Ulmus alata</i>	Ulmaceae
<i>Vaccinium arboreum</i>	Ericaceae
<i>Vaccinium pallidum</i>	Ericaceae
<i>Vaccinium stamineum</i>	Ericaceae
<i>Vicia caroliniana</i>	Fabaceae
<i>Vitis aestivalis</i>	Vitaceae
<i>Vitis rotundifolia</i>	Vitaceae
<i>Zizia aurea</i>	Apiaceae

Appendix 5. List of plant species observed along rocky drainages in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Acer rubrum</i>	Aceraceae
<i>Agrostis perennans</i>	Poaceae
<i>Amelanchier arborea</i>	Rosaceae
<i>Andropogon virginicus</i>	Poaceae
<i>Antennaria fallax</i>	Asteraceae
<i>Aristida purpurascens</i>	Poaceae
<i>Asplenium bradleyi</i>	Aspleniaceae
<i>Asplenium platyneuron</i>	Aspleniaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster paludosus</i> subsp. <i>hemisphericus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Athyrium filix-femina</i>	Dryopteridaceae
<i>Aureolaria flava</i>	Hamamelidaceae
<i>Berchemia scandens</i>	Rhamnaceae
<i>Boehmeria cylindrica</i>	Urticaceae
<i>Brachyelytrum erectum</i>	Poaceae
<i>Bumelia lanuginosa</i>	Sapotaceae
<i>Callicarpa americana</i>	Verbenaceae
<i>Carex albicans</i> var. <i>albicans</i>	Cyperaceae
<i>Carex cherokeensis</i>	Cyperaceae
<i>Carex hirsutella</i>	Cyperaceae
<i>Carex oxylepis</i>	Cyperaceae
<i>Carya cordiformis</i>	Juglandaceae
<i>Carya tomentosa</i>	Juglandaceae
<i>Chasmanthium laxum</i> var. <i>sessiliflorum</i>	Poaceae
<i>Cheilanthes tomentosa</i>	Pteridaceae
<i>Claytonia virginica</i>	Portulacaceae
<i>Clitoria mariana</i>	Fabaceae
<i>Coreopsis grandiflora</i>	Asteraceae
<i>Cornus florida</i>	Cornaceae
<i>Cunila organoides</i>	Lamiaceae
<i>Danthonia spicata</i>	Poaceae
<i>Desmodium nudiflorum</i>	Fabaceae
<i>Dichanthelium aciculare</i>	Poaceae
<i>Dichanthelium acuminatum</i>	Poaceae
<i>Dichanthelium boscii</i>	Poaceae
<i>Dichanthelium commutatum</i>	Poaceae
<i>Dichanthelium dichotomum</i>	Poaceae
<i>Dichanthelium lineariifolium</i>	Poaceae
<i>Dichanthelium ravenelii</i>	Poaceae
<i>Dioscorea villosa</i>	Dioscoreaceae

<i>Elymus virginicus</i>	Poaceae
<i>Erigeron strigosus</i>	Asteraceae
<i>Euonymus americana</i>	Celastraceae
<i>Festuca subverticillata</i>	Poaceae
<i>Fraxinus americana</i>	Oleaceae
<i>Fraxinus pennsylvanica</i>	Oleaceae
<i>Galium aparine</i>	Rubiaceae
<i>Galium arkansanum</i> var. <i>arkansanum</i>	Rubiaceae
<i>Hamamelis vernalis</i>	Hamamelidaceae
<i>Hamamelis virginiana</i>	Hamamelidaceae
<i>Hedera helix</i>	Araliaceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Heuchera americana</i> var. <i>hirsuticaulis</i>	Saxifragaceae
<i>Hieracium gronovii</i>	Asteraceae
<i>Houstonia longifolia</i> var. <i>longifolia</i>	Rubiaceae
<i>Hydrangea arborescens</i>	Hydrangeaceae
<i>Hypericum hypericoides</i>	Clusiaceae
<i>Hypericum mutilum</i>	Clusiaceae
<i>Ilex opaca</i>	Aquifoliaceae
<i>Ilex vomitoria</i>	Aquifoliaceae
<i>Iris cristata</i>	Iridaceae
<i>Juniperus virginiana</i>	Cupressaceae
<i>Krigia biflora</i>	Asteraceae
<i>Krigia dandelion</i>	Asteraceae
<i>Lespedeza virginica</i>	Fabaceae
<i>Liatris squarrulosa</i>	Asteraceae
<i>Ligustrum sinense</i>	Oleaceae
<i>Liquidambar styraciflua</i>	Hamamelidaceae
<i>Lonicera japonica</i>	Caprifoliaceae
<i>Magnolia grandiflora</i>	Magnoliaceae
<i>Maianthemum racemosum</i>	Liliaceae
<i>Mitchella repens</i>	Rubiaceae
<i>Monarda bradburiana</i>	Lamiaceae
<i>Muehlenbergia schreberi</i>	Poaceae
<i>Nandina domestica</i>	Berberidaceae
<i>Nothoscordum bivalve</i>	Liliaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Oxalis corniculata</i>	Oxalidaceae
<i>Parthenocissus quinquefolia</i>	Vitaceae
<i>Pellaea atropurpurea</i>	Pteridaceae
<i>Penstemon arkansanus</i>	Hamamelidaceae
<i>Phlox divaricata</i>	Polemoniaceae
<i>Phytolacca americana</i>	Phytolacaceae
<i>Pinus echinata</i>	Pinaceae
<i>Pleopeltis polypodioides</i>	Polypodiaceae

<i>Poa sylvestris</i>	Poaceae
<i>Polystichum acrostichoides</i>	Dryopteridaceae
<i>Prunus serotina</i>	Rosaceae
<i>Pteridium aquilinum</i>	Dennstaedtiaceae
<i>Pueraria lobata</i>	Fabaceae
<i>Quercus alba</i>	Fagaceae
<i>Quercus falcata</i>	Fagaceae
<i>Quercus marilandica</i>	Fagaceae
<i>Quercus stellata</i>	Fagaceae
<i>Ranunculus abortivus</i>	Ranunculaceae
<i>Rhamnus caroliniana</i>	Rhamnaceae
<i>Rubus flagellaris</i>	Rosaceae
<i>Ruellia pedunculata</i>	Acanthaceae
<i>Sanicula canadensis</i>	Apiaceae
<i>Schizachyrium scoparium</i>	Poaceae
<i>Scleria oligantha</i>	Cyperaceae
<i>Scutellaria ovata</i>	Lamiaceae
<i>Smilax bonanox</i>	Smilacaceae
<i>Smilax glauca</i>	Smilacaceae
<i>Smilax rotundifolia</i>	Smilacaceae
<i>Solidago caesia</i>	Asteraceae
<i>Solidago hispida</i>	Asteraceae
<i>Solidago nemoralis</i>	Asteraceae
<i>Solidago odora</i>	Asteraceae
<i>Solidago petiolaris</i>	Asteraceae
<i>Stellaria media</i>	Caryophyllaceae
<i>Styrax grandifolius</i>	Styracaceae
<i>Symphoricarpos orbiculatus</i>	Caprifoliaceae
<i>Tephrosia virginiana</i>	Fabaceae
<i>Tilia americana</i>	Tiliaceae
<i>Tipularia discolor</i>	Orchidaceae
<i>Toxicodendron radicans</i>	Anacardiaceae
<i>Tradescantia hirsuticaulis</i>	Commelinaceae
<i>Vaccinium arboreum</i>	Ericaceae
<i>Vaccinium elliottii</i>	Ericaceae
<i>Vaccinium pallidum</i>	Ericaceae
<i>Viola pedata</i>	Violaceae
<i>Vitis rotundifolia</i>	Vitaceae
<i>Wisteria sinense</i>	Fabaceae
<i>Woodsia obtusa</i>	Dryopteridaceae
<i>Woodwardia areolata</i>	Blechnaceae

Appendix 6. List of plant species observed along roadsides in old growth study areas, Hot Springs NP.

Scientific Name	Family
<i>Abelia X grandifolia</i>	Caprifoliaceae
<i>Acer negundo</i> var. <i>negundo</i>	Aceraceae
<i>Aira caryophylla</i>	Poaceae
<i>Albizia julibrissin</i>	Mimosaceae
<i>Ambrosia artemisiifolia</i>	Asteraceae
<i>Antennaria parlinii</i>	Asteraceae
<i>Baccharis halimifolia</i>	Asteraceae
<i>Barbarea verna</i>	Brassicaceae
<i>Boehmeria cylindrica</i>	Urticaceae
<i>Cardamine hirsuta</i>	Brassicaceae
<i>Carex frankii</i>	Cyperaceae
<i>Cephalanthus occidentalis</i>	Rubiaceae
<i>Cerastium glomeratum</i>	Caryophyllaceae
<i>Chrysopsis pilosa</i>	Asteraceae
<i>Claytonia virginica</i>	Portulacaceae
<i>Clematis viorna</i>	Ranunculaceae
<i>Cocculus carolinus</i>	Menispermaceae
<i>Commelina communis</i> var. <i>communis</i>	Commelinaceae
<i>Croton monanthogynus</i>	Euphorbiaceae
<i>Cynodon dactylon</i>	Poaceae
<i>Cyperus retrorsus</i>	Cyperaceae
<i>Cyperus strigosus</i>	Cyperaceae
<i>Daucus carota</i>	Apiaceae
<i>Digitaria ishaemum</i>	Poaceae
<i>Diodia teres</i>	Rubiaceae
<i>Diodia virginica</i>	Rubiaceae
<i>Dioscorea oppositifolia</i>	Dioscoreaceae
<i>Duchesnia indica</i>	Rosaceae
<i>Elephantopus carolinianus</i>	Asteraceae
<i>Erigeron philadelphicus</i>	Asteraceae
<i>Erigeron tenuis</i>	Asteraceae
<i>Euphorbia dentata</i>	Euphorbiaceae
<i>Festuca arundinaceum</i>	Poaceae
<i>Gamochaeta purpurea</i>	Asteraceae
<i>Geranium carolinianum</i> var. <i>carolinianum</i>	Geraniaceae
<i>Helenium flexuosum</i>	Asteraceae
<i>Helianthus divaricatus</i>	Asteraceae
<i>Juncus coriaceous</i>	Juncaceae
<i>Lamium amplexicaule</i>	Lamiaceae
<i>Lamium purpureum</i>	Lamiaceae
<i>Lespedeza cuneata</i>	Fabaceae

Ligustrum sinense	Oleaceae
Liquidambar styraciflua	Hamamelidaceae
Lonicera fragrantissima	Caprifoliaceae
Lonicera japonica	Caprifoliaceae
Melia azedarach	Meliaceae
Nothoscordum bivalve	Liliaceae
Oenothera biennis	Onagraceae
Oxalis corniculata	Oxalidaceae
Paspalum notatum	Poaceae
Passiflora incarnata	Passifloraceae
Perilla frutescens	Lamiaceae
Phacelia glabra	Hydrophyllaceae
Physalis pubescens	Solanaceae
Platanus occidentalis	Platanaceae
Polygonum hydropiperoides	Polygonaceae
Prunella vulgaris	Lamiaceae
Pteridium aquilinum	Dennstaedtiaceae
Rhus glabra	Anacardiaceae
Rubus flagellaris	Rosaceae
Rubus trivialis	Rosaceae
Rudbeckia laciniata	Asteraceae
Rudbeckia triloba	Asteraceae
Salvia lyrata	Lamiaceae
Sambucus canadensis	Caprifoliaceae
Setaria parviflora	Poaceae
Smallanthus uvedalia	Asteraceae
Solanum carolinense	Solanaceae
Sorghum halepense	Poaceae
Stellaria media	Caryophyllaceae
Tridens flavus	Poaceae
Triodanis perfoliata	Campanulaceae
Viola bicolor	Violaceae
Viola pedata	Violaceae

Appendix 7. Exotic invasive plant species of concern to the integrity of ecological communities in the park found within the old growth study areas.

Scientific Name	Common Name	Strata	Location
<i>Albizia julibrissin</i>	mimosa, silktree	sapling, tree	North Mountain, along roads
<i>Baccharis halimifolia</i>	sea-myrtle, saltbush	shrub	North Mountain, along roads (in ditches)
<i>Cynodon dactylon</i>	Bermuda grass	herb	North Mountain, along roads
<i>Dioscorea oppositifolia</i>	Asian yam, air potato	herb	North Mountain, along roads
<i>Festuca arundinacea</i>	tall fescue	herb	North Mountain, along roads
<i>Hedera helix</i>	English ivy	woody vine	North Mountain, NW-facing slope, near boundary
<i>Ilex cornuta</i>	Chinese holly	sapling	North Mountain, NW-facing slope
<i>Lespedeza cuneata</i>	sericea lespedeza	herb	North Mountain, along roads
<i>Ligustrum sinense</i>	Chinese privet	shrub	North Mountain & Sugarloaf Mountain
<i>Lonicera fragrantissima</i>	fragrant bush honeysuckle	shrub	Sugarloaf Mountain, along road
<i>Lonicera japonica</i>	Japanese honeysuckle	woody vine	North Mountain & Sugarloaf Mountain
<i>Magnolia grandiflora</i>	southern magnolia	sapling, tree	North Mountain & Sugarloaf Mountain
<i>Magnolia grandiflora</i>	southern magnolia	sapling, tree	North Mountain & Sugarloaf Mountain
<i>Melia azedarach</i>	Chinaberry	sapling, tree	North Mountain, old road, ridgetop
<i>Nandina domestica</i>	heavenly bamboo, nandina	shrub	North Mountain & Sugarloaf Mountain
<i>Paulownia tomentosa</i>	princess tree	sapling	North Mountain, along trail & old road, ridgetop
<i>Perilla frutescens</i>	beefsteak plant	herb	North Mountain, along trail & old road
<i>Peuraria lobata</i>	Kudzu	woody vine	North Mountain, drainage, near park boundaries
<i>Photinia serratifolia</i>	redtip photinia	shrub	North Mountain & Sugarloaf Mountain
<i>Pyrus calleryana</i>	callery pear	shrub, tree	North Mountain, old road, ridgetop
<i>Sorghum halepense</i>	Johnson grass	herb	North Mountain, along roads
<i>Wisteria sinensis</i>	Chinese wisteria	woody vine	North Mountain, drainage, near park boundaries

Appendix 8. List of voucher specimens of plants occurring in Hot Springs NP Old-Growth Project Areas. Nomenclature follows USDA Plants Database (2003).

Scientific Name	Family	Voucher
<i>Abelia X grandiflora</i> *	Caprifoliaceae	02-0365
<i>Acalypha monococca</i>	Euphorbiaceae	02-1018
<i>Acalypha monococca</i>	Euphorbiaceae	01-0724
<i>Acer negundo</i> var. <i>negundo</i>	Aceraceae	02-0444
<i>Acer rubrum</i> var. <i>rubrum</i>	Aceraceae	01-0753
<i>Aira caryophylla</i>	Poaceae	02-0595
<i>Albizia julibrissin</i> *	Mimosaceae	02-0467
<i>Ambrosia artemisiifolia</i>	Asteraceae	02-1433
<i>Amelanchier arborea</i>	Rosaceae	02-0066
<i>Amorpha fruticosa</i>	Fabaceae	02-0600
<i>Amphicarpea bracteata</i>	Fabaceae	01-0751
<i>Andropogon gerardii</i>	Poaceae	01-0754
<i>Andropogon virginicus</i>	Poaceae	02-1498
<i>Antennaria parlinii</i> subsp. <i>fallax</i>	Asteraceae	02-0313
<i>Antennaria parlinii</i> subsp. <i>parlinii</i>	Asteraceae	02-0063
<i>Arabis canadensis</i>	Brassicaceae	02-0316
<i>Arabis canadensis</i>	Brassicaceae	02-0584
<i>Aristida dichotoma</i> var. <i>dichotoma</i>	Poaceae	02-1452
<i>Aristida purpurascens</i>	Poaceae	02-1453
<i>Aristolochia serpentaria</i>	Aristolochiaceae	02-0302
<i>Asclepias quadrifolia</i>	Asclepiadaceae	02-0294
<i>Asclepias quadrifolia</i>	Asclepiadaceae	01-0744
<i>Asclepias tuberosa</i>	Asclepiadaceae	02-1441
<i>Asclepias variegata</i>	Asclepiadaceae	02-0521
<i>Asclepias verticillata</i>	Asclepiadaceae	01-0726
<i>Asplenium bradleyi</i>	Aspleniaceae	01-0818
<i>Asplenium platyneuron</i>	Aspleniaceae	01-0729
<i>Aster anomalus</i>	Asteraceae	02-1435
<i>Aster paludosus</i> subsp. <i>hemisphericus</i>	Asteraceae	02-1451
<i>Aster patens</i>	Asteraceae	01-0750
<i>Aster pilosus</i>	Asteraceae	01-0721
<i>Athyrium filix-femina</i> var. <i>asplenioides</i>	Dryopteridaceae	02-0757
<i>Aureolaria flava</i>	Hamamelidaceae	02-1089
<i>Aureolaria flava</i>	Hamamelidaceae	02-1518
<i>Baccharis halimifolia</i> *	Asteraceae	02-1015
<i>Baptisia bracteata</i> var. <i>leucophaea</i>	Fabaceae	02-0304
<i>Barbarea verna</i> *	Brassicaceae	02-0416
<i>Berchemia scandens</i>	Rhamnaceae	03-0001
<i>Boehmeria cylindrica</i>	Urticaceae	02-0447
<i>Botrychium dissectum</i> f. <i>obliquum</i>	Ophioglossaceae	01-0728
<i>Bumelia lanuginosa</i>	Sapotaceae	02-1470

<i>Callicarpa americana</i>	Verbenaceae	02-0995
<i>Camassia scilloides</i>	Liliaceae	02-0299
<i>Campsis radicans</i>	Bignoniaceae	02-0991
<i>Cardamine hirsuta</i> *	Brassicaceae	02-0064
<i>Carex albicans</i> var. <i>albicans</i>	Cyperaceae	02-0065
<i>Carex blanda</i>	Cyperaceae	02-0371
<i>Carex frankii</i>	Cyperaceae	02-0471
<i>Carex hirsutella</i>	Cyperaceae	02-0378
<i>Carex muehlenbergii</i> var. <i>enervis</i>	Cyperaceae	02-0379
<i>Carex nigromarginata</i> var. <i>nigromarginata</i>	Cyperaceae	02-0377
<i>Carex oxylepis</i>	Cyperaceae	02-0392
<i>Carya texana</i>	Juglandaceae	02-0315
<i>Carya texana</i>	Juglandaceae	02-0470
<i>Castanea pumila</i> var. <i>ozarkensis</i>	Fagaceae	02-0989
<i>Ceanothus americanus</i>	Rhamnaceae	02-1090
<i>Celtis laevigata</i>	Ulmaceae	02-0373
<i>Celtis tenuifolia</i>	Ulmaceae	02-0450
<i>Cephalanthus occidentalis</i>	Rubiaceae	02-1096
<i>Cerastium glomeratum</i> *	Caryophyllaceae	03-0016
<i>Cercis canadensis</i>	Caesalpiniaceae	02-0684
<i>Chaerophyllum tainturieri</i> var. <i>tainturieri</i>	Apiaceae	02-0179
<i>Chaerophyllum tainturieri</i> var. <i>tainturieri</i>	Apiaceae	02-0389
<i>Chasmanthium latifolium</i>	Poaceae	02-1027
<i>Chasmanthium laxum</i> var. <i>sessiliflorum</i>	Poaceae	02-1004
<i>Cheilanthes tomentosa</i>	Pteridaceae	01-0727
<i>Chrysopsis pilosa</i>	Asteraceae	02-1106
<i>Claytonia virginica</i>	Portulacaceae	03-0014
<i>Clematis viorna</i>	Ranunculaceae	02-0676
<i>Clitoria mariana</i>	Fabaceae	02-1101
<i>Cocculus carolinus</i>	Menispermaceae	02-0587
<i>Commelina communis</i> var. <i>communis</i> *	Commelinaceae	02-1000
<i>Conyza canadensis</i> var. <i>canadensis</i>	Asteraceae	02-1100
<i>Coreopsis grandiflora</i>	Asteraceae	02-0687
<i>Cornus florida</i>	Cornaceae	02-0184
<i>Crataegus crusgalli</i>	Rosaceae	02-0354
<i>Crataegus marshallii</i>	Rosaceae	02-0185
<i>Crataegus pruinosa</i>	Rosaceae	02-0605
<i>Crataegus spathulata</i>	Rosaceae	02-0291
<i>Croton monanthogynus</i>	Euphorbiaceae	02-1474
<i>Cunila organoides</i>	Lamiaceae	02-1438
<i>Cynodon dactylon</i> *	Poaceae	02-1028
<i>Cyperus lupulinus</i> subsp. <i>macilentus</i>	Cyperaceae	02-0614
<i>Cyperus retrorsus</i>	Cyperaceae	02-1033
<i>Cyperus strigosus</i>	Cyperaceae	02-1034
<i>Danthonia spicata</i>	Poaceae	02-0381

Daucus carota *	Apiaceae	02-1024
Delphinium carolinianum subsp. carolinianum	Ranunculaceae	02-0578
Desmodium nudiflorum	Fabaceae	02-0997
Desmodium nudiflorum	Fabaceae	02-1016
Desmodium paniculatum var. paniculatum	Fabaceae	01-0735
Desmodium perplexum	Fabaceae	02-1446
Dichanthelium aciculare	Poaceae	02-1105
Dichanthelium boscii	Poaceae	02-0402
Dichanthelium commutatum	Poaceae	02-0362
Dichanthelium commutatum	Poaceae	02-1104
Dichanthelium dichotomum	Poaceae	02-1001
Dichanthelium dichotomum	Poaceae	02-0403
Dichanthelium laxiflorum	Poaceae	02-0374
Dichanthelium lineariifolium	Poaceae	02-0399
Dichanthelium ravenelii	Poaceae	02-0613
Digitaria ishaemum	Poaceae	02-1468
Diodia teres	Rubiaceae	02-1008
Diodia virginica	Rubiaceae	02-1020
Dioscorea oppositifolia *	Dioscoreaceae	02-1029
Dioscorea villosa	Dioscoreaceae	02-0607
Dioscorea villosa	Dioscoreaceae	02-0591
Duchesnia indica *	Rosaceae	02-0398
Echinacea pallida	Asteraceae	02-0463
Elephantopus carolinianus	Asteraceae	02-1098
Elymus canadensis	Poaceae	02-1093
Erigeron philadelphicus	Asteraceae	02-0358
Erigeron strigosus	Asteraceae	02-0586
Erigeron tenuis	Asteraceae	02-0682
Euphorbia corollata	Euphorbiaceae	02-0458
Euphorbia corollata	Euphorbiaceae	01-0748
Euphorbia dentata	Euphorbiaceae	02-1455
Festuca subverticillata	Poaceae	02-0588
Fraxinus americana	Oleaceae	02-0355
Fraxinus pennsylvanica	Oleaceae	02-0356
Galium aparine *	Rubiaceae	02-0178
Galium arkansanum var. arkansanum	Rubiaceae	01-0758
Galium arkansanum var. pubiflorum	Rubiaceae	02-0596
Galium circaezans	Rubiaceae	02-0583
Gamochaeta purpurea	Asteraceae	02-0677
Hamamelis vernalis	Hamamelidaceae	03-0005
Hamamelis virginiana	Hamamelidaceae	02-1519
Hedera helix *	Araliaceae	02-0475
Helenium flexuosum	Asteraceae	02-1022
Helianthus divaricatus	Asteraceae	02-0466

<i>Heuchera americana</i> var. <i>hirsuticaulis</i>	Saxifragaceae	02-0671
<i>Hieracium gronovii</i>	Asteraceae	02-0409
<i>Houstonia longifolia</i> var. <i>longifolia</i>	Rubiaceae	02-0410
<i>Houstonia pusilla</i>	Rubiaceae	02-0179.5
<i>Hypericum gentianoides</i>	Clusiaceae	02-1496
<i>Hypericum hypericoides</i>	Clusiaceae	02-0999
<i>Hypericum hypericoides</i>	Clusiaceae	01-0741
<i>Hypericum mutilum</i>	Clusiaceae	02-0998
<i>Hypericum pseudomaculatum</i>	Clusiaceae	02-0462
<i>Ilex ambigua</i>	Aquifoliaceae	02-0597
<i>Ilex cornuta</i> *	Aquifoliaceae	01-0819
<i>Ilex decidua</i>	Aquifoliaceae	02-1448
<i>Ilex opaca</i>	Aquifoliaceae	02-0369
<i>Ilex vomitoria</i>	Aquifoliaceae	01-0820
<i>Iris cristata</i>	Iridaceae	02-0599
<i>Juncus coriaceus</i>	Juncaceae	02-0469
<i>Juncus tenuis</i>	Juncaceae	02-0582
<i>Juniperus virginiana</i>	Cupressaceae	02-0390
<i>Krigia biflora</i>	Asteraceae	02-0411
<i>Krigia dandelion</i>	Asteraceae	02-0297
<i>Lactuca canadensis</i>	Asteraceae	02-0996
<i>Lamium amplexicaule</i>	Lamiaceae	03-0018
<i>Lamium purpureum</i> var. <i>purpureum</i>	Lamiaceae	03-0019
<i>Lathyrus venosus</i>	Fabaceae	02-0307
<i>Lechea tenuifolia</i>	Cistaceae	02-1464
<i>Lespedeza cuneata</i> *	Fabaceae	02-1026
<i>Lespedeza intermedia</i>	Fabaceae	01-0731
<i>Lespedeza procumbens</i>	Fabaceae	02-1103
<i>Lespedeza repens</i>	Fabaceae	01-0723
<i>Lespedeza striata</i> *	Fabaceae	02-1007
<i>Lespedeza stuevei</i>	Fabaceae	02-1447
<i>Lespedeza virginica</i>	Fabaceae	02-1431
<i>Liatris squarrosa</i> var. <i>compacta</i>	Asteraceae	02-0593
<i>Liatris squarrosa</i>	Asteraceae	02-1439
<i>Ligustrum sinense</i> *	Oleaceae	02-0375
<i>Ligustrum sinense</i> *	Oleaceae	02-1497
<i>Liquidambar styraciflua</i>	Hamamelidaceae	02-0393
<i>Lonicera fragrantissima</i> *	Caprifoliaceae	03-0010
<i>Lonicera japonica</i> *	Caprifoliaceae	02-0400
<i>Lonicera sempervirens</i>	Caprifoliaceae	02-0672
<i>Magnolia grandiflora</i> *	Magnoliaceae	03-0004
<i>Maianthemum racemosum</i>	Liliaceae	02-0308
<i>Manfreda virginica</i>	Agavaceae	02-1009
<i>Melia azedarach</i> *	Meliaceae	02-0388
<i>Mitchella repens</i>	Rubiaceae	02-0401

<i>Monarda bradburiana</i>	Lamiaceae	02-0292
<i>Morus rubra</i>	Moraceae	02-0311
<i>Muehlenbergia capillaris</i>	Poaceae	03-0002
<i>Muehlenbergia schreberi</i>	Poaceae	02-1529
<i>Muehlenbergia sobolifera</i>	Poaceae	02-1530
<i>Myosotis verna</i>	Boraginaceae	02-0404
<i>Nandina domestica</i> *	Berberidaceae	02-0472
<i>Nothoscordum bivalve</i>	Liliaceae	02-0298
<i>Nyssa sylvatica</i>	Nyssaceae	02-0474
<i>Oenothera biennis</i>	Onagraceae	02-1095
<i>Oenothera fruticosa</i>	Onagraceae	02-0414
<i>Orbexilum pedunculatum</i>	Fabaceae	02-0413
<i>Orobanche uniflora</i>	Orobanchaceae	02-0183
<i>Ostrya virginiana</i>	Betulaceae	02-0683
<i>Oxalis corniculata</i>	Oxalidaceae	02-1462
<i>Oxalis dillenii</i>	Oxalidaceae	02-0594
<i>Oxalis violacea</i>	Oxalidaceae	02-0176
<i>Panicum virgatum</i>	Poaceae	01-0719
<i>Parthenocissus quinquefolia</i>	Vitaceae	02-0478
<i>Paspalum notatum</i>	Poaceae	02-1035
<i>Passiflora incarnata</i>	Passifloraceae	02-1025
<i>Passiflora lutea</i>	Passifloraceae	02-0456
<i>Paulownia tomentosa</i> *	Hamamelidaceae	02-0680
<i>Pellaea atropurpurea</i>	Pteridaceae	03-0013
<i>Penstemon arkansanus</i>	Hamamelidaceae	02-0412
<i>Phacelia glabra</i>	Hydrophyllaceae	02-0415
<i>Phlox divaricata</i> var. <i>laphamii</i>	Polemoniaceae	02-0293
<i>Photinia serratifolia</i> *	Rosaceae	03-0003
<i>Physalis pubescens</i>	Solanaceae	02-1030
<i>Phytolacca americana</i>	Phytolacaceae	02-0609
<i>Pinus echinata</i>	Pinaceae	02-0312
<i>Piptochaetium avenaceum</i>	Poaceae	02-0395
<i>Platanus occidentalis</i>	Platanaceae	02-0452
<i>Pleopeltis polypodioides</i> var. <i>michauxiana</i>	Polypodiaceae	02-0301
<i>Poa annua</i> *	Poaceae	03-0015
<i>Poa sylvestris</i>	Poaceae	02-0368
<i>Polygala verticillata</i>	Polygalaceae	02-1440
<i>Polymnia canadensis</i>	Asteraceae	02-0681
<i>Polystichum acrostichoides</i>	Dryopteridaceae	02-0396
<i>Potentilla simplex</i>	Rosaceae	02-0602
<i>Prunella vulgaris</i> *	Lamiaceae	02-0592
<i>Prunus mexicana</i>	Rosaceae	02-0603
<i>Prunus serotina</i>	Rosaceae	02-0306
<i>Pteridium aquilinum</i>	Dennstaedtiaceae	02-1006
<i>Pueraria lobata</i> *	Fabaceae	02-0360

<i>Pycnanthemum albescens</i>	Lamiaceae	01-0822
<i>Pyrus calleryana</i>	Rosaceae	02-0457
<i>Quercus alba</i>	Fagaceae	02-0319
<i>Quercus falcata</i>	Fagaceae	02-0613
<i>Quercus marilandica</i>	Fagaceae	02-0322
<i>Quercus rubra</i>	Fagaceae	02-0608
<i>Quercus shumardii</i>	Fagaceae	02-1466
<i>Quercus stellata</i>	Fagaceae	02-0611
<i>Quercus velutina</i>	Fagaceae	02-0604
<i>Ranunculus abortivus</i>	Ranunculaceae	02-0406
<i>Rhamnus caroliniana</i>	Rhamnaceae	01-0752
<i>Rhus aromatica</i> var. <i>aromatica</i>	Anacardiaceae	02-0068
<i>Rhus copallinum</i>	Anacardiaceae	02-0309
<i>Rhus glabra</i>	Anacardiaceae	02-1037
<i>Robinia pseudo-acacia</i>	Fabaceae	02-1087
<i>Rosa carolina</i>	Rosaceae	02-0673
<i>Rubus argutus</i>	Rosaceae	02-0451
<i>Rubus flagellaris</i>	Rosaceae	02-0674
<i>Rubus trivialis</i>	Rosaceae	02-0445
<i>Rudbeckia hirta</i>	Asteraceae	02-0461
<i>Rudbeckia laciniata</i>	Asteraceae	02-1021
<i>Rudbeckia triloba</i>	Asteraceae	02-1023
<i>Ruellia pedunculata</i> var. <i>pedunculata</i>	Acanthaceae	02-0579
<i>Salvia azurea</i>	Lamiaceae	02-1436
<i>Salvia lyrata</i>	Lamiaceae	02-0408
<i>Sambucus canadensis</i>	Caprifoliaceae	02-0454
<i>Sanicula canadensis</i>	Apiaceae	02-0453
<i>Sassafras albidum</i>	Lauraceae	02-0320
<i>Schizachyrium scoparium</i>	Poaceae	01-0743
<i>Scleria oligantha</i>	Cyperaceae	02-0468
<i>Scutellaria ovata</i>	Lamiaceae	02-0465
<i>Setaria parviflora</i>	Poaceae	02-1449
<i>Silene virginica</i>	Caryophyllaceae	02-0181
<i>Smallanthus uvedalia</i>	Asteraceae	02-1097
<i>Smilax bonanox</i>	Smilacaceae	02-0386
<i>Smilax glauca</i>	Smilacaceae	02-0601
<i>Solanum carolinense</i>	Solanaceae	02-1019
<i>Solidago caesia</i>	Asteraceae	02-1445
<i>Solidago hispida</i>	Asteraceae	01-0739
<i>Solidago nemoralis</i>	Asteraceae	01-0740
<i>Solidago odora</i>	Asteraceae	01-0756
<i>Solidago petiolaris</i>	Asteraceae	02-1456
<i>Solidago petiolaris</i>	Asteraceae	02-1457
<i>Solidago radula</i>	Asteraceae	02-1495
<i>Solidago ulmifolia</i> var. <i>palmeri</i>	Asteraceae	01-0734

<i>Sorghastrum nutans</i>	Poaceae	02-1430
<i>Sorghum halepense</i> *	Poaceae	02-1038
<i>Sphenopholis obtusata</i>	Poaceae	02-0477
<i>Spiranthes tuberosa</i>	Orchidaceae	01-0700
<i>Sporobolus clandestinus</i>	Poaceae	02-1434
<i>Stellaria media</i> subsp. <i>media</i>	Caryophyllaceae	03-0017
<i>Stylosanthes biflora</i>	Fabaceae	02-0460
<i>Styrax grandifolius</i>	Styracaceae	02-0376
<i>Symphoricarpos orbiculatus</i>	Caprifoliaceae	02-0993
<i>Tephrosia virginiana</i>	Fabaceae	02-0580
<i>Tilia americana</i>	Tiliaceae	02-0992
<i>Tipularia discolor</i>	Orchidaceae	02-1521
<i>Tradescantia hirsuticaulis</i>	Commelinaceae	02-0300
<i>Tridens flavus</i>	Poaceae	01-0720
<i>Ulmus alata</i>	Ulmaceae	02-0586
<i>Vaccinium arboreum</i>	Ericaceae	02-0685
<i>Vaccinium elliotii</i>	Ericaceae	02-0187
<i>Vaccinium pallidum</i>	Ericaceae	02-1520
<i>Vaccinium stamineum</i>	Ericaceae	02-0296
<i>Vernonia baldwinii</i> subsp. <i>baldwinii</i>	Asteraceae	02-1092
<i>Viburnum prunifolium</i>	Caprifoliaceae	02-0449
<i>Viburnum rufidulum</i>	Caprifoliaceae	02-0364
<i>Vicia caroliniana</i>	Fabaceae	02-0182
<i>Viola bicolor</i> *	Violaceae	02-0405
<i>Viola palmata</i>	Violaceae	02-0177
<i>Viola pedata</i>	Violaceae	02-0188
<i>Vitis aestivalis</i>	Vitaceae	02-0391
<i>Vitis rotundifolia</i>	Vitaceae	02-0397
<i>Wisteria sinensis</i> *	Fabaceae	02-0372
<i>Woodsia obtusa</i>	Dryopteridaceae	02-0675
<i>Woodwardia areolata</i>	Blechnaceae	02-0473
<i>Yucca arkansana</i>	Agavaceae	02-1036
<i>Zizia aurea</i>	Apiaceae	02-0305