



An Evaluation of Biological Inventory Data Collected at Hot Springs National Park

Vertebrate and Vascular Plant Inventories

Natural Resource Technical Report NPS/HTLN/NRTR—2009/259



protecting the habitat of our heritage



Heartland
Network

Natural Resource Monitoring

ON THE COVER

Herbert Hoover birthplace cottage at Herbert Hoover NHS, prescribed fire at Tallgrass Prairie NP, aquatic invertebrate monitoring at George Washington Carver NM, the Mississippi River at Effigy Mounds NM.

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Vertebrate and Vascular Plant Inventories

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Abstract

The Inventory and Monitoring program of the NPS provides twelve basic inventories for park managers, including lists of species that occur in NPS units. One thousand one hundred and ninety two species are certified on the list of vascular plants and vertebrates for Hot Springs National Park (HOSP). Based on a review of the evidence, 594 (50 %) species were categorized as Present in Park, and 598 (50 %) as Probably Present. One hundred seventy three species were Unconfirmed, Historic, or Encroaching. In addition to documenting the presence of species, reviewers categorized the general abundance of 545 (92 %) certified species and determined residency for all documented vertebrates with the exception of eight mammals. Species lists for HOSP can be queried from the Natural Resource Information Portal at <http://nrinfo.nps.gov/Home.mvc>.

Sixty four non-native species are documented to occur in the park. Of these are 20 birds, two fish, three mammals, and 39 vascular plants. Non-native vascular plant species were assigned a NatureServe Invasive Species Impact Rank (I-Rank) based on impact to native species and natural biodiversity. Eight of the 39 (21 %) non-native plants found on HOSP received an overall I-Rank score that included the high category (i.e. most threatening).

A total of 83 species are considered to be of conservation status. One federally listed endangered species (harperella) was noted as probably present on HOSP. Four state threatened species (dwarf bristle fern, fen orchid, open ground whitlow grass, waterfall's sedge) are noted as probably present. Future inventory efforts are discussed.

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Introduction

As part of the National Park Service's effort to "improve park management through greater reliance on scientific knowledge," a primary role of the Inventory and Monitoring (I&M) Program is to collect, organize, and make available natural resource data. A list of species known to occur in NPS units is considered a basic inventory need (see: <http://science.nature.nps.gov/im/inventory/index.cfm>). The I&M Program's Heartland Network (HTLN) recently completed inventories of vertebrate species and vascular plants at Hot Springs National Park (HOSP). In doing so, all existing data were cataloged, targeted field investigations were conducted, and species lists were certified by taxonomic experts. The primary goal of these efforts was to document at least 90% of the vertebrate and vascular plant species believed to occur in the park. This report provides a summary of results.

Methods

The HTLN followed a strategic plan of action set forth in an Inventory Study Plan (Boetsch et al. 2000) to complete inventories of vascular plants and vertebrate species. This plan was instigated by the Natural Resource Challenge in response to the National Parks Omnibus Management Act of 1998 and adheres to the requisite approaches delineated in Guidelines for Biological Inventories (NPS 1999) and the recommendations of the Service-wide I&M Program. The Inventory Study Plan identified steps to conduct a natural resource “information assessment” of existing park data. These steps included (1) developing master lists of species known or expected to occur in the park, (2) conducting field inventories, and (3) certifying the resultant species data.

The term species (as opposed to organism) is generically used throughout this report to refer to unique taxa at the species level or below.

Expected Species Lists

In order to determine the completeness of inventory information, the HTLN developed lists of vascular plants and vertebrates expected to occur in the park. The master lists of birds were derived from “A guide to field identification of North American birds” (Robbins et al. 1983) and National Geographic Society’s field guide to the birds of North America (1987). Stan Trauth, Arkansas State University (Jonesboro), compiled expected species lists for amphibians and reptiles. The list of fishes was derived from county records reported in “The Fishes of Arkansas” (Robison and Buchanan 1988). Choate et al. (1994) “Handbook of Mammals of the South-Central States” was used to develop the mammal list. John Logan, former Arkansas Natural Heritage botanist, reviewed the flora for HOSP and standardized nomenclature and infraspecific designations, flagged potentially erroneous records (e.g. species out of range, without sufficient habitat), and derived a list of potentially occurring species from county records (see also Palmer 1926, Scully 1937, Scully 1942, Dale and Watts 1980).

Compiling Existing Inventory Data

Concurrent with development of expected species lists, HTLN staff worked with technical support from the Natural Resource Program Center (NRPC) to consolidate existing inventories. HTLN staff searched for existing inventory data, extracted species lists from the reports, labeled the lists with appropriate reference information, and forwarded the data to NRPC for processing.

HTLN staff mined inventory data from regional inventory databases, and transferred the network’s Flora database. Staff also assembled bibliographic data concerning the primary park inventories. The Procite bibliographic database, NatureBib (aka NRBIB), was queried to produce an initial list of references. The lists were reviewed to ensure that each inventory: 1) included primary, rather than secondary, inventory data; 2) was based on observed, not expected, occurrences; and 3) was the result of professional surveys or research, rather than amateur observations. Park resource managers then reviewed and added to the lists.

HTLN staff searched for references to botanical collections as sources of species occurrence records. The process of searching regional herbaria for pertinent species records then commenced. The primary objectives were: 1) to find previously unknown collections; and 2) to document the current repository for older, known collections. The HTLN initiated a cooperative agreement with the National Wildlife Health Center (Biological Resources Division) to conduct

computerized searches of regional and national museums and herbaria for park records of vertebrate and vascular plant occurrences. Given the limited timeframe, repositories with searchable collections databases were used. Dr. Jim Bennett, author of a summary of Midwestern NPS floras (Bennett 1995), was the principal investigator and was assisted with results of a search of the HOSP ANCS+ database collection provided by the HTLN.

ANCS+ is a database management system developed by NPS to accession and catalog its museum collections.

The NPSpecies Database

NPSpecies is a master database for documenting the occurrence and status of all organisms in NPS units. The database includes standardized information associated with the occurrence of species, including scientific names and their synonyms (i.e. a local list or a standard list of species names), common names, abundance, residency, nativity, T&E status, and notes of particular management interest to a park. NPSpecies supports NPS staff and collaborators at the park, network, regional, and national levels by managing fundamental park-level species information, and making this information available to other applications and databases for more specialized analyses. A primary purpose for NPSpecies is to provide park managers, planners, and scientists with basic information on species occurrences and status for making decisions and working with other agencies, the scientific community, and the public for the long-term protection of park ecosystems (NPSpecies 2009).

Within NPSpecies, each species record is supported by evidence in the form of voucher specimens, references (scientific reports or datasets), and/or observation records that document the occurrence of the species in the park. Historical and currently-accepted scientific names from multiple taxonomic classification systems are cross-referenced using taxonomic standards (e.g., the Integrated Taxonomic Information System and the USDA PLANTS database) to allow for data integration and sharing across parks and with other agencies and organizations. In addition, parks are able to produce species lists based on the taxonomic authorities that are most accepted in their region and by their partner agencies.

Populating NPSpecies focused on three objectives: 1) transferring existing data; 2) including evidence for each record; and 3) verifying the accuracy of lists. As master species lists were compiled and transferred into NPSpecies a conservative approach was taken while assigning park status (e.g. present, probably present, etc.) to ensure that assessments of completeness were based on verifiable records. Many records imported from previous databases were unsubstantiated (i.e. not linked to a verifiable data source) and were classified as unconfirmed. Verification of vertebrate taxa was conducted by comparing digital records to original sources. The process proved valuable for assuring data quality as transcription errors, spelling mistakes, erroneous names, and synonymy problems were identified and corrected. In the process, park status (e.g. present in park, probable, unconfirmed) were also updated. After verifying and updating, any remaining species without evidence were assigned an 'unconfirmed' status. Reliable status information is necessary to generate verifiable species lists for use in assessing inventory completeness. WASO I&M then completed the processing of these data and returned an NPSpecies database.

Inventories

Targeted field inventories were conducted to augment existing inventory data while addressing information gaps and high priority information needs. Two workshops were held during FY 2000 to assist in determining and prioritizing inventory needs (see appendix F in Boetsch et al. 2000). Regional taxa experts participated in these workshops and helped to revise project plans and priorities, and develop a greater awareness of taxa-specific inventory methods.

Subsequent to these initial steps, the HTLN began implementing inventories of amphibians and reptiles, birds, fish, mammals, and vascular plants. When completed, inventory reports were submitted to the HTLN and, once finalized, bibliographic data and the final report were uploaded to NatureBib. Species data (ie. taxonomic name, park status, abundance, etc.) and voucher data were uploaded to NPSpecies. Primary inventory data (ie. locations, events, etc.) and inventory specific data (i.e. bird counts, amphibian observations, etc.) were entered in a Microsoft (MS) Access database standardized to the current natural resource database template (NRDT) and uploaded to the NPS Data Store.

Inventory Certification

To support the objective of documenting 90% of vertebrate and vascular plant species expected to occur, subject matter experts (i.e. those involved with HOSP inventories) participated in the NPSpecies certification of taxonomic and attribute data for each taxa list. The process of certification is a data validation and quality assurance procedure for species checklists performed by subject matter experts most familiar with a particular taxonomic category. Taxon nomenclature are documented as well as park status, abundance, residency, and nativity.

Amphibian, reptile, and fish certifications were compiled with current inventory data (Trauth and McCallum 2003, Petersen and Justus 2005). Bird certifications were conducted by HOSP staff. Mammal certifications were made by HTLN staff. Certification of the vascular plants was completed by Johnnie Gentry, University of Arkansas-Fayetteville. Generally, species lists were distributed as MS Excel worksheets and returned with revisions. Revised expected species lists containing a species park status (present, probably present, etc), abundance (common, uncommon, rare, etc), residency (breeder, resident, etc), and nativity as well as other attribute details were then updated (where necessary) via the desktop NPSpecies to reflect the current species' park status. These lists were then uploaded to the master online version of NPSpecies.

Results

Twenty references (see Appendix 1) and 377 vouchers led to the certification of 1,192 species (NPSpecies 2009). In total, 594 species were categorized as Present in Park and 598 as Probably Present (Table 1). Additionally, 173 species were categorized as Unconfirmed, Encroaching, or Historic. Unconfirmed species were ranked as such due to weak evidence supporting their existence on the park.

Currently 44% of the species on the park's species list are documented (i.e., categorized as Present in Park). If species listed as Present in Park and Probably Present are included in the calculation, the percentage of documented species rises to 87%.

Table 1. Count of species by park status categories at HOSP (NPSpecies 2009).

Park Status ¹	Bird	Fish	Mammal	Amphibian	Reptile	Vascular Plant	Total
Present in Park	106	28	38	13	18	391	594
Probably Present	8	24	11	9	27	519	598
Encroaching	30						30
Unconfirmed	76				2	55	133
Historic	1		2		1	6	10
Total	221	52	51	22	48	971	1,365

¹ Refer to the Appendix for definitions of Park Status categories.

Of the 594 species documented as present, reviewers assigned a general abundance category (e.g., common, rare, etc.) to 545 (92 %) (Table 2). Reviewers believed additional information was needed before an abundance category could be assigned to the remaining 49 (8%) species. Results are available to NPS staff through the Natural Resource Information Portal at <http://nrinfo.nps.gov/Home.mvc>. The portal is the product of the Integration of Resource Management Applications (IRMA) project. To learn more see: http://www1.nrintra.nps.gov/im/datamgmt/docs/IRMA_ProjectBrief_v1.0.pdf.

Residency values (e.g., breeder, migrant, resident, etc.) were assigned for all documented vertebrates with the exception of eight mammals that were categorized as unknown. Unknown residency values were assigned primarily because it was unclear as to whether or not the species bred on the park. Non-natives documented to occur in the park (i.e., Present in Park) total 64. Of these 20 are birds, two fish, three mammals, and 39 vascular plants.

NatureServe, in cooperation with The Nature Conservancy and NPS, developed a protocol to rank the impact of non-native invasive vascular plants (Morse et al. 2004). Through a series of standardized questions, non-native species are evaluated and assigned an Invasive Species Impact Rank (I-Rank) based on impact to native species and natural biodiversity. I-Ranks are categorized as high, medium, low, or insignificant. Eight of the 39 (21%) non-native plants found on HOSP received an overall I-Rank score that included the high category (Table 3.). All are known to occur in the park (i.e., Present in Park).

A total of 83 species (Table 4) are listed by the Arkansas Natural Heritage Commission as a species of conservation status. Additional NatureServe global, national, and subnational ranking

status is provided. The 83 species included four amphibians, four reptiles, 22 birds, one fish, four mammals, and 48 vascular plants. One federally listed endangered species (harperella, *Ptilimnium nodosum*) was noted as probably present on HOSP. Four state threatened species (dwarf bristle fern, *Trichomanes petersii*, fen orchid, *Liparis loeselii*, open ground whitlow grass, *Draba aprica*, waterfall's sedge, *Carex latebracteata*) are noted as probably present.

Table 2. Count of species by abundance categories at HOSP (NPSpecies 2009).

Abundance Category¹	Bird	Fish	Mammal	Amphibian	Reptile	Vascular Plant	Total
Abundant	13	3				20	36
Common	60	11		8	6	110	195
Uncommon	10	11		4	4	185	214
Rare	9	3		1		73	86
Occasional	14						14
Unknown			38		8	3	49
Total	106	28	38	13	18	391	594

¹ Refer to the Appendix for definitions of Park Status categories.

Table 3. Non-native plants, occurring on HOSP, with an Invasive Species Impact Rank (I-Rank) containing high.

Scientific Name	Common Name	Overall I-Rank	Ecological Impact ¹	Management Difficulty ²	I-Rank Reasons Summary ³
<i>Albizia julibrissin</i>	Silk tree	High / Low	High / Low	Medium / Low	Often a plant of human-disturbed areas, but also affects naturally scoured riparian areas and forest edges.
<i>Dioscorea polystachya</i>	Chinese yam	High / Medium	High / Medium	Medium / Low	Alters community structure and composition; initial infestations tend to be associated with disturbances; reproduces vigorously.
<i>Hedera helix</i>	English ivy	High / Medium	Medium	Medium / Low	Negatively effects forest biodiversity; no guaranteed method for either keeping it out of natural areas or removing it once it has established.
<i>Ligustrum sinense</i>	Chinese privet	High / Medium	Medium	Low	Alters community structure and composition; reported as invasive in six southeastern states. Produces large quantities of fruit.
<i>Lonicera japonica</i>	Japanese honeysuckle	High / Medium	Medium	High / Medium	Can have extremely negative consequences for forest communities/forest structure. Few effective control methods known.
<i>Nandina domestica</i>	Heavenly bamboo	High / Low	High / Medium	Unknown	Produces many bright red berries that are attractive to birds; should be watched given that it occurs in both wet and drier habitats, including floodplains and woodlands.
<i>Schedonorus arundinaceus</i>	Kentucky fescue	High / Medium	Medium	High / Medium	Throughout the U.S.; threatens several natural communities, including fens, prairies, woodlands, and other grasslands; aggressive, especially when infected with the fungal endophyte.
<i>Sorghum halepense</i>	Johnsongrass	High / Medium	Medium / Low	High / Medium	Severely inhibits pioneer grass species; massive size creates difficulties for the establishment of other plants; one of the most frequently listed noxious weeds in the U.S.; control is difficult and costly.

¹ Subcategory of Overall I-Rank specifically addressing species negative impacts on native plant/animal populations/communities.

² Subcategory of Overall I-Rank specifically addressing difficulty of control.

³ Summary reasons for NatureServe Overall I-Rank. For more information see the NatureServe Species Explorer at <http://www.natureserve.org>. These summaries reflective of NatureServe data last updated 6 February, 2009.

Table 4. Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Amphibian	Scientific Name	Park Status¹	State Heritage Program Rank/Status²	Federal Status³	Global / National / Subnational Status⁴	Global Short Term Trend⁴
Four-toed salamander	<i>Hemidactylium scutatum</i>	Probably Present	S3 / INV		G5 / N5 / S3	Stable
Mole salamander	<i>Ambystoma talpoideum</i>	Probably Present	S3 / INV		G5 / N5 / S3	Declining to stable
Ringed salamander	<i>Ambystoma annulatum</i>	Probably Present	S3 / INV		G4 / N4 / S3	Declining to stable
Southern redback salamander	<i>Plethodon serratus</i>	Probably Present	S3 / INV		G5 / N5 / S3	Declining to stable
Reptile						
Northern scarlet snake	<i>Cemophora coccinea copei</i>	Probably Present	S3 / INV		T5 / N5 / S3	
Queen snake	<i>Regina septemvittata</i>	Historic	S2 / INV		G5 / N5 / S2	Stable
Western diamondback rattlesnake	<i>Crotalus atrox</i>	Unconfirmed	S2 / INV		G5 / N5 / S2	Stable
Western slender glass lizard	<i>Ophisaurus attenuatus attenuatus</i>	Probably Present	S3 / INV		T5 / N5 / S3	
Bird						
American redstart	<i>Setophaga ruticilla</i>	Present in Park	S3S4B,S5N / WAT		G5 / N5B / S3S4B,S5N	Stable
American kestrel	<i>Falco sparverius</i>	Present in Park	S3S4B,S5N / WAT		G5 / N5B,N5N / S3S4B,S5N	
American woodcock	<i>Scolopax minor</i>	Present in Park	S2B,S4N / WAT		G5 / N5B,N5N / S2B,S4N	Declining
Bald eagle	<i>Haliaeetus leucocephalus</i>	Present in Park	S2B,S4N / INV		G5 / N5B,N5N / S2B,S4N	Stable to increasing
Barn owl	<i>Tyto alba</i>	Encroaching	S2B,S3N / WAT		G5 / N5 / S2B,S3N	
Bank swallow	<i>Riparia riparia</i>	Encroaching	S2B,S3N / INV		G5 / N5B / S2B	

Table 4 (cont.). Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Bird	Scientific Name	Park Status¹	State Heritage Program Rank/Status²	Federal Status³	Global / National / Subnational Status⁴	Global Short Term Trend⁴
Black-throated green Warbler	<i>Dendroica virens</i>	Present in Park	S2B,S5N / INV		G5 / N5B / S2B,S5N	Declining (decline of 10-30%)
Blue-winged warbler	<i>Vermivora pinus</i>	Present in Park	S3B,S5N / WAT		G5 / N5B / S3B,S5N	
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>	Present in Park	S1B,S5N / INV		G5 / N5B / S1B,S5N	Declining (decline of 10-30%)
Cooper's hawk	<i>Accipiter cooperii</i>	Encroaching	S1B,S3N / INV		G5 / N5B,N5N / S1B,S3N	Stable
Great blue heron	<i>Ardea herodias</i>	Present in Park	S3B,S4N / MON		G5 / N5B,N5N / S3B,S4N	Stable
Hairy woodpecker	<i>Picoides villosus</i>	Present in Park	S4S5 / WAT		G5 / N5 / S4S5	Stable
Lark sparrow	<i>Chondestes grammacus</i>	Encroaching	S3S4B / WAT		G5 / N5B / S3S4B	Declining
Little blue heron	<i>Egretta caerulea</i>	Present in Park	S2B / WAT		G5 / N5B,N5N / S2B	
Osprey	<i>Pandion haliaetus</i>	Present in Park	S1B,S4N / INV		G5 / N5B,N4N / S1B,S4N	Increasing
Painted bunting	<i>Passerina ciris</i>	Encroaching	S4B / WAT		G5 / N5B / S4B	Significant declines
Pied-billed grebe	<i>Podilymbus podiceps</i>	Encroaching	S2B,S4N / WAT		G5 / N5B,N5N / S4B,S4N	
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	Present in Park	S4B,S4S5N / WAT		G5 / N5B,N5N / S4B,S4S5N	Local declines reported
Rusty blackbird	<i>Euphagus carolinus</i>	Encroaching	S5N / WAT		G4 / N4B,N4N / S5N	Declining
Sharp-shinned hawk	<i>Accipiter striatus</i>	Present in Park	S1S2B / INV		G5 / N5B,N5N / S1S2B	Stable
Snowy egret	<i>Egretta thula</i>	Encroaching	S2B / WAT		G5 / N5B,N5N / S2B	
Yellow warbler	<i>Dendroica petechia</i>	Present in Park	S3B,S5N / WAT		G5 / N5B,N5N / S3B,S5N	Reportedly declining

Table 4 (cont.). Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Fish	Scientific Name	Park Status¹	State Heritage Program Rank/Status²	Federal Status³	Global / National / Subnational Status⁴	Global Short Term Trend⁴
Ouachita madtom	<i>Noturus lachneri</i>	Present in Park	S2 / INV		G2 / N2 / S2	
Mammal						
Eastern spotted skunk	<i>Spilogale putorius</i>	Historic	S2S3 / INV		G5 / N5 / S2S3	Large decline
Little brown bat	<i>Myotis lucifugus</i>	Present in Park	S3 / MON		G5 / N5 / S3	
Southeastern myotis	<i>Myotis austroriparius</i>	Present in Park	S3 / INV		G3 / N3N4 / S3	Declining to stable
Southeastern shrew	<i>Sorex longirostris</i>	Probably Present	S2 / INV		G5 / N5 / S2	
Vascular Plant						
Arkansas bedstraw	<i>Galium arkansanum</i> var. <i>pubiflorum</i>	Present in Park	S2 / INV		G5 / NNR / S2	
Arkansas twistflower	<i>Streptanthus maculatus</i> ssp. <i>obtusifolius</i>	Historic	S3 / INV		T3 / N3 / S3	Stable
Black huckleberry	<i>Gaylussacia baccata</i>	Probably Present	S3 / INV		G5 / N5 / S3	
Black snakeroot	<i>Sanicula smallii</i>	Probably Present	S3 / INV		G5 / N5 / S3	
Blue cohosh	<i>Caulophyllum thalictroides</i>	Unconfirmed	S2 / INV		G4 / N4N5 / S2	Declining
Browne's waterleag	<i>Hydrophyllum brownei</i>	Probably Present	S2 / INV		G2 / N2 / S2	Stable
Caric sedge	<i>Carex bromoides</i> ssp. <i>bromoides</i>	Probably Present	S2 / INV		T5 / N5? / S2	
Caric sedge	<i>Carex comosa</i>	Unconfirmed	S1S2 / INV		G5 / NNR / S1S2	
Caric sedge	<i>Carex laevivaginata</i>	Probably Present	S2 / INV		G5 / NNR / S2	
Chalk maple	<i>Acer saccharum</i> var. <i>leucoderme</i>	Unconfirmed	S2S3 / INV		G5 / N5 / S2S3	

Table 4 (cont.). Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Vascular Plant	Scientific Name	Park Status ¹	State Heritage Program Rank/Status ²	Federal Status ³	Global / National / Subnational Status ⁴	Global Short Term Trend ⁴
Dwarf bristle fern	<i>Trichomanes petersii</i>	Probably Present	S2 / ST		G4 / N3? / S2	
Dwarf spiderwort	<i>Tradescantia longipes</i>	Unconfirmed	S2 / INV		G4 N4 / S2	
False bugbane	<i>Trautvetteria caroliniensis</i>	Probably Present	S1 / INV		G5 / NNR / S1	
Featherbells	<i>Stenanthium gramineum</i>	Probably Present	S3 / INV		G4 / N4N5 / S3	
Fen orchid	<i>Liparis loeselii</i>	Probably Present	S1 / ST		G5 / NNR / S1	
Georgia holly	<i>Ilex decidua var. longipes</i>	Probably Present	S3 / INV		G5 / N5 / S3	
Giant coneflower	<i>Rudbeckia maxima</i>	Probably Present	S3 / INV		G4 / N4? / S3	
Grave's hybrid spleenwort	<i>Asplenium X gravesii</i>	Present in Park	S1 / INV		GNA / NNA / S1	
Harparella	<i>Ptilimnium nodosum</i>	Probably Present	S2 / INV	Endangered	G2 / N2 / S2	More than half the sites have been destroyed
Kentucky lady's-slipper	<i>Cypripedium kentuckiense</i>	Probably Present	S3 / INV		G3 / N3 / S3	Thriving in Arkansas
Leadplant	<i>Amorpha canescens</i>	Unconfirmed	S1 / INV		G5 / NNR / S1	
Letterman's ironweed	<i>Vernonia lettermannii</i>	Unconfirmed	S3 / INV		G3 / N3 / S3	
Lobed spleenwort	<i>Asplenium pinnatifidum</i>	Present in Park	S3 / INV		G4 / N4 / S3	
Log fern	<i>Dryopteris celsa</i>	Probably Present	S2 / INV		G4 / NNR / S2	
Northern slender ladies'-tresses	<i>Spiranthes lacera var. lacera</i>	Probably Present	S1 / INV		T5 / N5 / S1	
Nuttall's cornsalad	<i>Valerianella nuttallii</i>	Probably Present	S2 / INV		G2 / N2? / S2	

Table 4 (cont.). Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Vascular Plant	Scientific Name	Park Status ¹	State Heritage Program Rank/Status ²	Federal Status ³	Global / National / Subnational Status ⁴	Global Short Term Trend ⁴
Open-ground whitlow-grass	<i>Draba aprica</i>	Probably Present	S2 / ST		G3 / N3 / S2	Declining
Ouachita blazing star	<i>Liatris compacta</i>	Present in Park	S3 / INV		T3 / NNR / S3	
Ouachita bluestar	<i>Amsonia hubrichtii</i>	Probably Present	S3 / INV		G3 / N3 / S3	Arkansas populations are stable
Ouachita bluets	<i>Hedyotis ouachitana</i>	Probably Present	S3 / INV		G3 / N3 / S3	
Ouachita indigo bush	<i>Amorpha ouachitensis</i>	Unconfirmed	S3 / INV		G3 / N3 / S3	
Ozark chinquapin	<i>Castanea pumila</i> var. <i>ozarkensis</i>	Present in Park	S3S4 / INV		T3 / N3? / S3S4	Severely to rapidly declining
Palmer's cornsalad	<i>Valerianella palmeri</i>	Probably Present	S3 / INV		G3 / N3 / S3	
Pennsylvania caric sedge	<i>Carex pensylvanica</i>	Probably Present	S3 / INV		G5 / N5 / S3	
Perfoliate bellwort)	<i>Uvularia perfoliata</i>	Probably Present	S3 / INV		G5 / N5 / S3	
Plantain-leaf sunflower	<i>Helianthus occidentalis</i> ssp. <i>plantagineus</i>	Probably Present	S1 / INV		T2 / N2N3 / S1	
Powdery cloak fern	<i>Argyrochosma dealbata</i>	Unconfirmed	S2 / INV		G4 / NNR / S2	
Robbin's scorpionweed	<i>Phacelia strictiflora</i> var. <i>robbinsii</i>	Probably Present	S1S2 / INV		T4 / NNR / S1S2	
Scott's hybrid spleenwort	<i>Asplenium X ebenoides</i>	Present in Park	S1 / INV		GNA / NNA / S1	
Southern hybrid log fern	<i>Dryopteris X australis</i>	Probably Present	S1 / INV		GNA / NNA / S1	
Sticky hedge-hyssop	<i>Gratiola brevifolia</i>	Probably Present	S3 / INV		G4 / NNR / S3	
Threadstem caric sedge	<i>Carex leptalea</i> var. <i>harperi</i>	Probably Present	S2S3 / INV		T4 / N4N5 / S2S3	

Table 4 (cont.). Species on the park's local list which possess a state heritage program rank and/or other designated conservation status (State Heritage Conservation Rank/Status, Global, National, Subnational, and/or a Federal Status).

Vascular Plant	Scientific Name	Park Status ¹	State Heritage Program Rank/Status ²	Federal Status ³	Global / National / Subnational Status ⁴	Global Short Term Trend ⁴
Tussock sedge	<i>Carex stricta</i>	Probably Present	S3 / INV		G5 / N5? / S3	
Waterfall's sedge	<i>Carex latebracteata</i>	Probably Present	S3 / ST		G3 / N3 / S3	
White prairie rose	<i>Rosa foliolosa</i>	Probably Present	S2 / INV		G5 / NNR / S2	
Willdenow's caric sedge	<i>Carex willdenowii</i>	Probably Present	S1 / INV		G5 / NNR / S1	
Yellow crested-orchid	<i>Platanthera cristata</i>	Probably Present	S1S2 / INV		G5 / NNR / S1S2	
Zigzag spiderwort	<i>Tradescantia subaspera</i>	Probably Present	S1S3 / INV		G5 / N5 / S1S3	

¹ Refer to the Appendix for definitions of Park Status categories.

² The official state rank and status the Arkansas Natural Heritage Commission has assigned to this species. S1 = Extremely rare. Typically 5 or fewer estimated occurrences in the state, or only a few remaining individuals, may be especially vulnerable to extirpation. S2 = Very rare. Typically between 5 and 20 estimated occurrences or with many individuals in fewer occurrences, often susceptible to becoming extirpated. S3 = Rare to uncommon. Typically between 20 and 100 estimated occurrences, may have fewer occurrences but with large number of individuals in some populations, may be susceptible to large-scale disturbances. S4 = Common, apparently secure under present conditions. Typically 100 or more estimated occurrences, but may be fewer with many large populations, may be restricted to only a portion of the state, usually not susceptible to immediate threats. S5 = Demonstrably widespread, common, and secure in the state and essentially ineradicable under present conditions. SA = Accidental. SH = Historically known from the state, but not verified for an extended period, usually 15 years. SU = Possibly in peril in the state, but status uncertain, more information is needed. SX = Apparently extirpated from state. INV = Inventory Element; The Arkansas Natural Heritage Commission is currently conducting active inventory work on these elements. Available data suggests these elements are of conservation concern. These elements may include outstanding examples of Natural Communities, colonial bird nesting sites, outstanding scenic and geologic features as well as plants and animals, which, according to current information, may be rare, peripheral, or of an undetermined status in the state. The ANHC is gathering detailed location information on these elements. WAT = Watch List Species; The Arkansas Natural Heritage Commission is not conducting active inventory work on these species, however, available information suggests they may be of conservation concern. The ANHC is gathering general information on status and trends of these elements. An "*" indicates the status of the species will be changed to "INV" if the species is verified as occurring in the state (this typically means the agency has received a verified breeding record for the species). SE = State Endangered; The Arkansas Natural Heritage Commission applies this term to native plant taxa which are in danger of being extirpated from the state. ST = State Threatened; The Arkansas Natural Heritage Commission applies this term to native plant taxa which are believed likely to become endangered in Arkansas in the foreseeable future, based on current inventory information.

³ U.S. Endangered Species Act: Current status of the taxon as designated or proposed by the U.S. Fish and Wildlife Service (USFWS), and as reported in the U.S. Federal Register in accordance with the U.S. Endangered Species Act of 1973, as amended.

⁴ The NatureServe conservation status, developed by NatureServe and its network of member (state) programs, of a species from a state/province perspective, characterizing the relative imperilment of the species. G = global (rounded), N = national, and S = subnational; 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure; B=Breeding population, NR=Not rated. Refer to <http://www.natureserve.org/explorer/ranking.htm#interpret> for additional information on conservation status ranks.

Discussion

The NPS Inventory Strategic Plan states that “the ultimate goal is to establish an accurate inventory of all life forms within a park...” (NPS 2009, see also NPS 1992). The HTLN supports this goal by documenting over 80% of all vertebrates and vascular plants known to occur at HOSP. One result of these efforts is the compilation of reliable species lists. These lists, however sound, should always be considered incomplete. Inventory lists will change as new information about species distributions becomes available. The overall number of species designated as Present in Park or Probably Present is similar to similarly sized parks in the HTLN (Table 5).

Table 5. Number of species designated as present in park or probably present in HTLN parks (NPSpecies 2009).

Park	Bird	Fish	Mammal	Amphibian	Reptile	Vascular Plants	TOTALS	Park Size (ac.)
HOSP	114	52	49	22	45	910	1,192	5,549
HOME	81	31	41	6	9	304	472	160
HEHO	120	28	45	1	11	230	435	186
LIBO	224	-	38	13	13	332	620	200
GWCA	192	34	44	8	17	662	957	210
HOCU	274	15	40	21	25	457	832	280
PIPE	252	20	31	6	6	557	872	282
ARPO	111	65	33	17	40	332	598	389
EFMO	220	93	43	9	21	426	812	1,481
WICR	134	53	48	11	31	569	846	1,750
PERI	74	41	44	21	36	665	881	4,300
TAPR	136	29	42	8	27	456	698	10,894
CUVA	241	65	37	19	21	1,167	1,550	32,859
OZAR	167	122	55	29	45	880	1,298	82,196
BUFF	211	78	58	22	43	1,353	1,765	95,730

Future Inventory Efforts

While significant strides have been made in documenting the presence of vertebrate species and vascular plants, it is anticipated that additional survey efforts will be required to increase the number of documented species (i.e. Present in Park). For example, roughly half of the birds, fish, amphibians, reptiles, and vascular plants are listed as probably present, unconfirmed, or encroaching and lack adequate documentation. Additionally, one federally listed endangered species (harperella) and four state listed threatened (dwarf bristle fern, fen orchid, open ground whitlow grass, waterfall's sedge) are listed as probably present. If species are thought to be Probably Present or Unconfirmed, follow-up surveys (perhaps targeted inventories?) are warranted or existing monitoring programs broadened to include searches for these species. Additional follow up inventories coupled with habitat studies may document their presence.

Reviewers assigned a general abundance category for all but 49 of the documented species (8 reptiles, 3 vascular plants, and 38 mammals). Reviewers also assigned a residency value for all but eight mammals. Continued monitoring of the species may provide for updated abundance and residency.

Based on the results of the data reported herein, future inventory recommendations include:

- additional resources to survey for species listed in Table 4,
- coupled with the above, focus on species listed as Probably Present, Unconfirmed, and Historic,

Key Findings of Management Interest

- The recent USGS fish inventory (Petersen and Justus 2005) documented two species of special interest, the Ouachita madtom (*Noturus lachneri*) and grass carp (*Ctenopharyngodon idella*). The Ouachita madtom is endemic to the Ouachita Mountains and had previously been collected from only a few locations in the Ouachita River Basin, including one location on a tributary of Gulpha Creek about 2 kilometers south of the southern boundary of HOSP. The grass carp, which is a native of eastern Asia, is present in Ricks Pond. The introduction of grass carp into the United States is a controversial issue because of possible (but undocumented) harmful effects on native species and habitats.
- The recent invasive exotic plant inventory (Becker 2004) noted nandina (*Nandina domestica*) and sericea lespedeza (*Lespedeza cuneata*) as two exotic species of concern. Nandina has successfully invaded glade communities at HOSP and sericea lespedeza, while its current distribution is not great, is a prolific seeder, and can quickly establish previously disturbed ground, forming a monoculture impenetrable to most native species. Infestations of Japanese honeysuckle (*Lonicera japonica*) and common privet (*Ligustrum sinense*) were documented in several areas along trails and roads and in ravines and creeks. Disturbed bottomlands in the park, in general, are characterized by a dense, extensive, diverse assemblage of non-native plants.
- The herpetofauna inventory by Trauth and McCallum (2003) identified three sites of management interest. Stone Bridge Pond (the largest body of standing water on the park) supports a high diversity of herpetofauna at the park. The northern portion of the pond is shallow and forms a marshy wetland with ideal habitat for many amphibians. The Fox Pass Road pond area supported 69% of the documented amphibians at HOSP and was the only location where the western cottonmouth (*Agkistrodon piscivorus leucostoma*) was observed. The landfill within the boundaries of the park, described as a disposal site for toxic chemicals for some time in the past, supported very few amphibians or reptiles in the area. The only species observed was the American toad (*Bufo americanus charlesmithi*) in tadpole and metamorph stages. Many metamorphs demonstrated inflammation of the lymph glands.

- The vascular plant inventory (Witsell 2003) of old growth pine-oak-hickory (*Pinus-Quercus-Carya*) stands identified continued fire suppression and the presence of several non-native invasive species as two main threats to the persistence of these plant communities. The combination of fire and herbicide were identified as two management tools 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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Appendix 1. NPSpecies bibliographic references for HOSP.

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Appendix 2. NPSpecies Data Dictionary

Park Status	The current status of each species in each park.	Applicable only to organisms with the <i>Local List</i> checkbox checked. The possible values reflect a combination of confidence, and availability and currency of verifiable evidence in NPSpecies.
Present in Park	Species' occurrence in park is documented and assumed to be extant.	Extremely high confidence that the species is currently in the park. A current, verifiable reference, voucher, or observation is included in NPSpecies.
Probably Present	Park is within species' range and contains appropriate habitat. Documented occurrences of the species in the adjoining region of the park give reason to suspect that it probably occurs within the park. The degree of probability may vary within this category, including species that range from common to rare.	Very high confidence that the organism is currently in the park. Verifiable evidence may exist in NPSpecies, but is not considered current enough to elevate the status to Present in Park. Efforts should be made to obtain current, verifiable evidence in NPSpecies to elevate the Park Status to "Present in Park". If reasonable efforts to obtain current, verifiable evidence are unsuccessful, then the Park Status should be changed to Unconfirmed, Historic, Encroaching, or False Report as applicable.
Unconfirmed	Included for the park based on weak ("unconfirmed record") or no evidence, giving minimal indication of the species' occurrence in the park.	Any confidence from very low to high that the organism is currently in the park. Verifiable evidence may exist in NPSpecies, but it is not considered sufficient enough to elevate the status to Probably Present, nor current enough to elevate the status to Present. Efforts should be made to obtain current, verifiable evidence in NPSpecies to elevate the Park Status to "Present in Park". If reasonable efforts to obtain current, verifiable evidence are unsuccessful, then the Park Status should be changed to Historic, Encroaching, or False Report as applicable.
Encroaching	The species is not documented in the park, but is documented as being adjacent to the park and has potential to occur in the park.	Extremely low confidence that the organism is currently in the park, but extremely high confidence that the organism is currently adjacent to the park. Verifiable evidence may exist in NPSpecies documenting the occurrence in the park, but it is not current. Potential invasive organisms are good candidates for this Park Status designation, either before they enter a park or after they have been eliminated from a park.
Historic	Species' historical occurrence in the park is documented, but recent investigations indicate that the species is now probably absent.	Extremely low confidence that the organism is currently in the park. Verifiable evidence exists in NPSpecies, but is not current. Extinct, extirpated or eliminated species are candidates for a Historic <i>Park Status</i> designation.
False Report	Species previously reported to occur within the park, but current evidence indicates that the report was based on a misidentification, a taxonomic concept no longer accepted, or some other similar problem of interpretation.	Extremely low confidence that the organism is currently in the park. Evidence exists in NPSpecies, but it cannot be sufficiently verified.

Appendix (cont.). NPSpecies Data Dictionary

Abundance	The current abundance of each organism in each park.	Applicable only to organisms with the <i>Local List</i> checkbox checked and a <i>Park Status</i> of "Present". The values attempt to balance abundance with suitable habitat, and temporal/behavioral considerations. In practice, the entered value should apply (although there are numerous exceptions) to the abundance in the most suitable habitat of the organism, and at the time that the organism is engaged in it's principle behavior in (e.g. breeding, migrating, hibernating, etc.), or most important behavior to, the park. A future generation of NPSpecies will address the coding of <i>Abundance</i> (and associated <i>Residency</i>) to separate out the temporal and behavioral aspects. The Data Source field for Abundance is available to provide a citation that specifically addresses abundance in more detail.
Abundant		Animals: May be seen daily, in suitable habitat and season, and counted in relatively large numbers. Plants: Large number of individuals; wide ecological amplitude or occurring in habitats covering a large portion of the park.
Common		Animals: May be seen daily, in suitable habitat and season, but not in large numbers. Plants: Large numbers of individuals predictably occurring in commonly encountered habitats but not those covering a large portion of the
Uncommon		Animals: Likely to be seen monthly in appropriate season/habitat. May be locally common. Plants: Few to moderate numbers of individuals; occurring either sporadically in commonly encountered habitats or in uncommon habitats.
Rare		Animals: Present, but usually seen only a few times each year. Plants: Few individuals usually restricted to small areas of rare habitat.
Occasional		Animals: Occurs in the park at least once every few years, but not necessarily every year. Plants: Not applicable.
Unknown		Abundance unknown.
Residency	Current residency classification for each ANIMAL species in each park.	Applicable only to ANIMALS with the <i>Local List</i> checkbox checked and a <i>Park Status</i> of "Present". The values attempt to balance temporal and behavioral considerations. In practice, the entered value should apply (although there are numerous exceptions) to the residency of the organism at the time that the organism is engaged in its principle behavior (e.g. breeding, migrating, hibernating, etc.) in, or most important behavior to, the park. A future generation of NPSpecies will address the coding of <i>Residency</i> (and associated <i>Abundance</i>) to separate out the temporal and behavior aspects. The Data Source field for Residency is available to provide a citation that specifically addresses Residency in more detail.
Breeder		Population reproduces in the park.
Resident		A significant population is maintained in the park for more than two months each year, but it is not known to breed there.
Migratory		Migratory species that occurs in park approximately two months or less each year and does not breed there.
Vagrant		Park is outside of the species' usual range.
Unknown		Residency status in park is unknown.

Appendix (cont.). NPSpecies Data Dictionary

Nativity	Nativity classification for each organism for each park	Applicable only to organisms with the <i>Local List</i> checkbox checked. If the park-status of an organism is not “Present in Park”, then nativity represents the nativity if the organism were eventually confirmed in the park.
Native	Native The organism is native, or would be native, to the park (either endemic or indigenous).	
Non-native	The organism is not native, or would not be native, to the park (neither endemic nor indigenous).	
Unknown	Nativity status in the park is unknown.	

The NPS has organized its parks with significant natural resources into 32 networks linked by geography and shared natural resource characteristics. The Heartland Network is composed of 15 National Park Service (NPS) units in eight Midwestern states. These parks contain a wide variety of natural and cultural resources including sites focused on commemorating civil war battlefields, Native American heritage, westward expansion, and our U.S. Presidents. The Network is charged with creating inventories of its species and natural features as well as monitoring trends and issues in order to make sound management decisions. Critical inventories help park managers understand the natural resources in their care while monitoring programs help them understand meaningful change in natural systems and to respond accordingly. The Heartland Network helps to link natural and cultural resources by protecting the habitat of our history.

The I&M program bridges the gap between science and management with a third of its efforts aimed at making information accessible. Each network of parks, such as Heartland, has its own multi-disciplinary team of scientists, support personnel, and seasonal field technicians whose system of online databases and reports make information and research results available to all. Greater efficiency is achieved through shared staff and funding as these core groups of professionals augment work done by individual park staff. Through this type of integration and partnership, network parks are able to accomplish more than a single park could on its own.

The mission of the Heartland Network is to collaboratively develop and conduct scientifically credible inventories and long-term monitoring of park “vital signs” and to distribute this information for use by park staff, partners, and the public, thus enhancing understanding which leads to sound decision making in the preservation of natural resources and cultural history held in trust by the National Park Service.

www.nature.nps.gov/im/units/htln/



The Department of the Interior protects and manages the nation’s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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