APPENDIX 14

ENDANGERED AND THREATENED SPECIES BIOLOGICAL ASSESSMENT

PREFACE

This Biological Assessment (BA), including the original eight attachments, was transmitted to the U.S. Fish and Wildlife Service (FWS) on 5 December 2005. This BA concluded that the project is not likely to affect the endangered plant pondberry or the threatened Louisiana black bear. The recommended plan was modified after transmittal of the BA which reduced the acreage of reforestation under the nonstructural feature from 62,500 to 55,600. The FWS Louisiana black bear and pondberry analyses were conducted using the revised acreage of 55,600.

The FWS indicated they wanted additional informal consultation on the Louisiana black bear prior to determining whether the project was likely to adversely affect the Louisiana black bear. After additional informal consultation on the Louisiana black bear, FWS, by letter dated 10 August 2006, concurred with the Vicksburg District's determination that the project was not likely to adversely affect the Louisiana black bear. The FWS analysis and concurrence are contained in Attachment 9 to this BA. The FWS also provided in their 23 October 2006 Fish and Wildlife Coordination Act Report recommendations designed to maximize benefit to the Louisiana black bear. These recommendations will be given full consideration and applied, where practicable, during implementation of the nonstructural feature (i.e., reforestation).

The FWS did not concur with the determination that the project was not likely to adversely affect pondberry. Although the BA concluded that the project was not likely to adversely affect pondberry, the Vicksburg District did request initiation of Section 7 formal consultation under the Endangered Species Act. Formal consultation on pondberry began on 18 January 2006.

During formal consultation on the potential effects to pondberry, additional data and analyses were developed and provided to FWS. At the request of FWS, the Vicksburg District conducted a historical 5 percent backwater flood duration analysis (1901 to 1997), which resulted in a spatially explicit wetland extent through time. This analysis is contained in the "PAST PROJECTS" section on the Wetlands Appendix (Appendix 10) and in the FWS Biological Opinion (BO). In addition to the historical wetland flood duration analysis, the Vicksburg District also analyzed National Weather Service rainfall data for stations in or near the study area (Attachment 10). In November 2006, the Vicksburg District, Regulatory Branch, completed wetland delineations on the pondberry sites/colonies that were used during the 2000 and 2005 Vicksburg District pondberry studies (Enclosure 3, Attachment 12).

During January and February 2007, FWS and the Vicksburg District developed a Memorandum of Agreement (MOA) to establish two new pondberry populations in the study area and conduct additional field experiments evaluating the effects on flooding, stand thinning, competition, and pathogens on pondberry (Attachment 11). The purpose of the MOA is to establish a framework for and to implement a conservation and recovery program for pondberry in association with the Yazoo Backwater Area Reformulation Project.

The Vicksburg District received the draft BO on 14 March 2007 and responded with comments to FWS by letter on 30 April 2007 (Attachment 12). In addition to our formal comments on the draft BO, the 30 April 2007 letter included our comments on the preliminary draft BO (provided informally on 18 December 2006), the pondberry colonies/sites wetland delineation analysis, and a pondberry statistical analysis by A. Dale Magoun, Ph.D.

The FWS provided the final BO on 2 July 2007 (Attachment 13). The FWS concluded that the project was likely to adversely affect pondberry. However, they also determined that the project would not jeopardize the continued existence of the endangered plant pondberry.

YAZOO BACKWATER AREA REFORMULATION

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INTRODUCTION

1. This Biological Assessment (BA) evaluates the potential effects of the proposed Yazoo Backwater Reformulation Project on the endangered pondberry (Lindera melissifolia) and the threatened Louisiana black bear (Ursus americanus luteolus). Pertinent biological and ecological data for both species are based on published and unpublished literature, communication with experts, and findings of recent U.S. Army Corps of Engineers, Vicksburg District, studies.

2. The proposed project is authorized by the Flood Control Act of 18 August 1941.

3. The Vicksburg District submitted this BA to the U.S. Fish and Wildlife Service (FWS) pursuant to Section 7 of the Endangered Species Act, as amended. The BA evaluates the potential effects of the recommended plan only (Plan 5). If the recommended plan is modified or another alternative plan is selected, reevaluation of the potential impacts would be conducted.

PROJECT DESCRIPTION

4. The Yazoo Backwater Area is located in west-central Mississippi and lies between the left bank Mississippi River levee on the west and the Yazoo Basin escarpment on the east. The area, which is inundated by the 100-year flood event, includes portions of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo Counties, Mississippi, and part of Madison Parish, Louisiana, contains approximately 629,721 acres and is subject to headwater flooding from the Sunflower River and Steele Bayou and backwater flooding from the Mississippi River. A full range of alternative plans was considered in compliance with the National Environmental Policy Act. The alternatives included nonstructural measures, structural measures, and combined nonstructural and structural measures. The recommended plan includes both structural and nonstructural measures. This plan consists of a 14,000 cubic-foot-per-second (cfs) pump with a year-round pump elevation of 87 feet (approximately 1-year frequency), National Geodetic Vertical Datum (NGVD), at Steele Bayou drainage structure. Additionally, the plan includes conservation easements and reestablishment of forest on 62,500 acres of open land within the 1- to 2-year frequency. Pump construction would require the clearing of only 38 acres of bottom-land hardwoods.

ENDANGERED AND THREATENED SPECIES ASSESSMENT

PONDBERRY

Pondberry Description and Species Account

5. This section summarizes the biological and physical life requirements, status, and description of the pondberry. Supporting documentation is provided in Attachments 1-8.

6. Pondberry was listed Federally as an endangered species on 31 July 1986 (Federal Register 51(47):27495-27500). It is a low growing, deciduous shrub ranging in height from 1.5 to 6.5 feet. The plants commonly grow in clumps of numerous scattered stems somewhat resembling a "plum thicket." The older portions of the stems are dark green to almost black with numerous irregularly spaced, but prominent lenticels, which appear very similar to saplings of young stems of sassafras (Sassafras albidum). The leaves are drooping and have a distinct sassafras-like odor when crushed. Leaves are 0.75 to 2.5 inches wide and 2 to 6.5 inches long with a round to cordate base. The leaf veins are prominent and the undersurface of the leaf is hairy. The male and female flowers are found on separate plants; flowers of both sexes are pale yellow and small. The flower stalks and buds are often hairy. The plant flowers in the second to fourth year of growth. The fruit is about 0.5 inch long at maturity, elliptical, and bright scarlet red. The flowers develop in spring before leaves emerge (generally in early March) with mature fruit evident by October. Fruit stalks are often present until next year's flowering (FWS, 1990; Klomps, 1980a; Tucker, 1984).

Taxonomic Status

7. Pondberry is a member of the family Lauracea. It is one of three members of the genus Lindera found in the southeastern United States, which also include Lindera benzoin and Lindera subcoriacea, a new species described by Wafford in 1983.

8. Pondberry was first described as a new species by Tomas Walter in 1788 (Tucker, 1984). The material upon which he based this description was collected from what is present-day Berkeley County, South Carolina (Mercer, 1984).

Range and Population Level

9. Pondberry is presently found in the Mississippi River alluvial plains of Missouri, Arkansas, and Mississippi, and the Coastal Plains region of Alabama, Georgia, South Carolina, and North Carolina. Historically, pondberry locations have also been reported from Louisiana and western Florida. However, populations of these states are considered extirpated (Tucker, 1984; Wofford, 1983; FWS, 1990). Approximately 262 colonies/populations/sites of pondberry are currently known to exist across its 7-state range. Approximately 194 colonies have been reported in Mississippi, primarily in Delta National Forest (DNF) (182 colonies in DNF and 12 colonies on private lands approximately 65 miles north of the Forest); 2 colonies in Alabama; 36 colonies in Arkansas; 8 populations in Georgia (includes new colony found in March 2004); 15 colonies in South Carolina; 2 populations in North Carolina; and 5 colonies composing 1 natural population in Missouri. Discussion of each State's population level and status is provided in Attachment 1.

Life History

10. Pondberry populations are generally associated with the shade of a mature forest and are possibly shade dependent (Klomps, 1980; Tucker, 1984). Colonies in Mississippi occur in small dense clumps usually averaging less than 0.10 acre in size. Field investigations indicate that vigorous healthy colonies were found in homogeneous clumps with shrub associates growing adjacent to, but not within, the clumps. In less vigorous colonies, shrub/vine associates were usually growing within the clumps.

11. Individual stems within each colony are short-lived, generally dying by their seventh or eighth year. Young stems sprout from the rootstock and replace the dying stems. Over time, colonies may expand vegetatively, resulting in many vastly rooted stems. Thus, a typical vigorous colony is composed of numerous relatively tall stems, dead and dying stems, as well as young leaf sprouts. There is little information regarding new seedling establishment and growth; therefore, colony expansion is suspected to be purely vegetative (Tucker, 1984; FWS, 1990).

12. Individual stems of pondberry begin flowering by their second to fourth year of growth (Tucker, 1984). Flowering begins in late February to early March in Mississippi and generally lasts no longer than 2 weeks. Pondberry is dioecious (male and female flowers found on separate plants). A typical colony in Mississippi is composed primarily of male stems with few to several female stems. In some instances, the entire colony is composed of male plants. In general, seed production in relation to the total number of stems is low. Because flowering occurs in late February to early March, frost or near freezing temperatures often damage flowers, thereby reducing fruit production even more. Rayner and Ferral (1988), in a study of 73 colonies

from the Honey Hill region of South Carolina, reported that only 22 percent of all colonies surveyed produced fruit, with fruit production averaging only 22 fruits per colony. They also noted that fruit production did not seem to improve with plant health since sexual reproduction appeared to be poor even in large healthy plants.

13. Few details are known about pondberry's reproduction. Pondberry is suspected to be insect pollinated. Tucker (1984) noted small bees and flies on flowers when observing plants in Arkansas. The fruit contains many oils and similar compounds, which are suspected to make the fruit unpalatable to most wildlife. Therefore, seed dispersal is likely accomplished by seeds merely falling to the ground or by animals (such as birds) picking the fruit and depositing elsewhere (FWS, 1990). Extremely rare occurrences of seedlings have been documented in the wild. J. A. Steyermark reportedly grew pondberry plants from seed in a wildflower garden in Illinois for 10 years before they died out (Klomps, 1980a). The U.S. Forest Service has successfully grown pondberry plants from seed (pers. communication, Margaret Devall, U.S. Forest Service, 2000). Seed germination beneath parent plants was reported as being successful by Wright (1989), if the seeds were depressed beneath the soils surface (FWS, 1993; Wright, 1989). No hybrids are currently known to occur with pondberry.

14. More detailed discussions on life history and field data collected in 1991, 2000, and 2005 are provided in Attachments 2, 3, and 6.

Habitat Requirements

15. Habitat requirements of pondberry appear to be variable across its range. In general, it occupies wetland habitats that are normally flooded or saturated during the dormant season, but infrequently flooded during the growing season for extended periods (Tucker, 1984). The specific habitat types occupied by pondberry have been variously described; e.g., “inhabits mesic to hydric sites (i.e., bottomland hardwoods, depressions, and margins of sandy sinks and ponds)” (Wofford, 1983) and “sandy sinks and pond margins, swamps and pond margins, and swampy depressions” (Porcher, 1980).

16. These habitat types vary from the edges of limestone sinks in South Carolina to depressions within bottom-land hardwoods in Mississippi. Although factors such as associate species and soils are variable across its range, the characteristic of occupying locally depressed or ponded areas is highly consistent throughout its range. This discussion concerning the Mississippi population is based on previously published data, as well as field surveys of the known colonies conducted in 1990, 1994, and 2000 by the Corps.

17. Tucker (1984) reported that pondberry populations in Mississippi are associated with “. . . mature bottomland hardwood forests in low depressions.” Populations are currently known to exist in the Delta Region of west-central Mississippi. The habitat of pondberry here is similar to that in Arkansas and Missouri (FWS, 1990). The Corps (1991) reported that pondberry colonies in Mississippi are typically found on slight ridges in a ridge and swale community which is either frequently or periodically flooded or is in proximity to a permanent water body.

The extant populations in Mississippi are all associated with bottom-land hardwoods at elevations where rainfall/local hydrology dominates the hydrologic conditions at the pondberry colony site.

18. The Mississippi populations were thought to occur on soils characterized by the Sharkey-Alligator-Dowling Association and less frequently on soils characterized as Alligator-Dowling-Forestdale Association as delineated by the Natural Resources Conservation Service (formerly the Soil Conservation Service) soil survey maps of Sharkey County, Mississippi. These soil associations are very similar, with both being found on level, poorly drained soils in slack-water areas and depressions. The Alligator-Dowling-Forestdale Association can also be found on old natural levees (Natural Resources Conservation Service, 1962). The soils within these associations all have poor drainage, high water table, low permeability rates, and gleyed B and C horizons (Tucker, 1984; Banker and Goetz, 1989). The tight clay subsoils of these associations result in slow permeability rates (0.2 to 0.6 inch per hour near surface and 0.06 inch per hour in subsoils). Therefore, overland sheet flow dominates water movement in these soils (Banker and Goetz, 1989).

19. The Corps (1991) reported that of 44 pondberry colonies surveyed, 41 percent were located in surface soils classified as silty clay, 32 percent is silty clay loams, and 21 percent in silt loam soils. In addition, 62 pondberry sites surveyed in 2000 and 2005 (Attachments 3 and 6) contained clay loams or silty clay soils (Corps 2000). This indicates that pondberry colonies will not likely be found on strictly heavy Alligator, Sharkey, or Dowling clay soils. Extant pondberry colonies are found on soils with a mixture of heavy clays and lighter soils.

20. Habitat and soil discussions for pondberry in each state are provided in Attachment 1.

Critical Habitat

21. Critical habitat is defined in Section 3 of the Endangered Species Act as: (1) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the act, on which are found those physical or biological features, (2) that are essential to the conservation of the species and that may require special management considerations or protection, and (3) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. The FWS has not proposed establishing pondberry critical habitat in either Mississippi or in other states in which the species is known to inhabit.

Associate Species

22. Common reports of associate species for Mississippi pondberry populations list only tree species such as Quercus spp., Celtis laevigata, Ulmus Americana, Fraxinus pennsylvania, Carya, etc. (Morgan, 1983; Tucker, 1984). The Corps (Attachments 2, 3, and 6), through collection of field data in Mississippi, was able to more clearly define associate tree and shrub species.

23. The most common overstory tree species in the 1991 and 2000 data were oaks (Quercus phellos, Q. nuttallii, and Q. lyrata), sweetgum (Liquidambar styraciflua), and elms (Ulmus crassifolia, U. americana, and U. alata). In 2005, the most common overstory species were sweetgum, overcup oak, and pecan. Complete listings of understory and shrub (Carya illinoinensis) species for each data set are provided in Attachments 2, 3, and 4. Devall, et al. (2001), recorded the dominant trees inhabiting the 40-acre Red Gum Research Natural Area in Sharkey County. Dominant tree species observed includes sweetgum, box elder (Acer negundo), American elm, and sugarberry (Attachment 1). Nordman (2002) conducted a botanical inventory of a 164- by 65-foot plot containing pondberry in Compartment 7 of Delta National Forest (DNF) on May 17, 2002. Nordman characterized the pondberry colony as an "Old growth sweetgum stand with canopy gaps containing cedar elm (Ulmus crassifolia) trees up to 20-inch-diameter breast height (dbh) in the subcanopy, with a slightly higher topography than most pondberry sites in DNF.

Reasons for Decline

24. While there are no records in the literature of pondberry's status (whether it was abundant or scarce) before modern times, apparent reasons for the species current endangered status are discussed in the following paragraphs.

a. Alteration and loss of habitat.

(1) The most critical threat to pondberry, as with many endangered species, is the alteration and/or loss of habitat. Three factors which constitute this threat are certain timber harvesting practices, certain drainage activities, and land clearing operations for agricultural, commercial, and private development (FWS, 1990). Various problems are associated with timber harvesting activities such as heavy equipment crushing plants, felled trees crushing plants, or uprooting adjacent trees, opening closed or dense forest canopies, and possible changes in local hydrology. Kral (1983) reported that single-tree selection harvesting in hardwoods would likely not affect pondberry, while clear-cut harvesting, which would result in increased surface

water runoff, could potentially increase floodwater levels to a detrimental degree. Within the DNF in Mississippi, the U.S. Forest Service, along with FWS, determined that a 100-foot undisturbed buffer around known pondberry colonies along with a 40-acre size limit on clear-cut openings would prevent any major changes in hydrology and maintain an adequate crown closure around a colony (Banker and Goetz, 1989).

(2) Authors have made general statements about drainage activities and subsequent effects on pondberry such as ditching which, they report, could change the surface and/or ground-water regime in a manner that could reduce the plant's vigor or possibly eliminate it from an existing site (Kral, 1983; Wright, 1989; FWS, 1990). They have reported that altering wetland habitat by changing water levels in an area could be detrimental to the species. The Corps, through extensive field studies of pondberry within Mississippi and consultation with various experts, determined that only drainage activities which significantly alter the local hydrological regime of depressions, ponds, sinks, or other areas governed by localized hydrology would adversely affect pondberry colonies (Attachments 2, 3, and 6).

(3) A third factor associated with the loss of habitat is land clearing due to agricultural interests and other developments. Throughout pondberry's range, bottom-land hardwoods and similar habitat types have been extensively cleared. Within the Mississippi River alluvial valley, bottom-land hardwoods decreased 56 percent, from 11.8 million acres in 1937 to 5.2 million acres in 1978 while agricultural/croplands increased nearly 5 million acres during that same time period (FWS, 1979). However, approximately 270,000 acres have been reforested in the Mississippi Delta since 1985.

b. Disease/predation.

(1) The literature indicates that nearly all colonies of pondberry are affected by stem dieback. Rayner and Ferral (1988) reported that stem dieback and predation were two factors that lead to poor colony health in the Honey Hill region of South Carolina. Stem dieback has been hypothesized to be fungal and/or drought related, but could be characteristic of the species. Predation has been observed by deer and insects, mainly the spicebush swallowtail caterpillar (Rayner and Ferral, 1988; USACE, 1991). Devall, et al. (2000), found six insect species in association with pondberry, but none of them appear to be a limiting factor for the plant.

(2) Through field studies of pondberry colonies in Mississippi, stem dieback and insect damage seem to influence the general health of many colonies (USACE, 1991). A photograph of a Mississippi pondberry stem in DNF, which is undergoing stem dieback, may be viewed in Attachment 6. McDearman (unpublished data, FWS; e.g., USACE, 1996) monitored substantial dieback and plant mortality during 1991-1993 at a study site in DNF. Devall, et al. (2000), reported dieback of 33 percent of the stems during June at a site in Shelby County, Mississippi. The best available information seems to indicate that stem dieback is related to fungal pathogens, drought, and the interactions between pathogens and drought. In addition, Devall, et al. (2000),

noted that in unusual conditions, stem dieback may be caused by winter freezing. Monitoring and studies of plant growth and decline (unpublished, FWS; e.g. FWS, 2000a) at colonies in DNF found that most instances of stem dieback were accompanied by abnormal patterns of sudden leaf wilt and death during the growing season on plants of all size classes. This pattern was not indicative of senescence and dieback of old or large plants.

(3) Dead stems have been reported at various locations in different pondberry locations. Wright (1989) first reported leaf senescence, summer leaf fall (facultatively deciduous), and twig dieback on pondberry plants in response to summer drought conditions in Arkansas. In DNF, the pathological symptoms of active dieback were directly observed and monitored by McDearman at 10 pondberry colonies (FWS, 2000b). The first symptoms were characterized by rapid leaf-wilt and sudden death of leaves and stems during a late summer dry period, without leaf abscission. Stem, branch (more than one stem), or whole plant death followed during the subsequent fall and winter. Since leaves died rapidly in the summer without abscission at DNF sites, additional investigations by Dr. Douglass Boyette (USDA Agricultural Research Service) revealed several potential pathogens, including *Diaporthe* sp., the cause of stem-canker.

(4) Browsing by vertebrates appears to occur only occasionally. Some stems were reported to have been eaten by rabbits during the winter (Wright, 1989). The USACE (1991) reported evidence of herbivory at only one of 44 pondberry colonies in DNF.

c. Lack of reproduction. Most recent accounts and studies of pondberry list poor sexual reproductive success as another important reason in the decline of pondberry colonies. Many of the colonies studied in Mississippi consisted mainly of male plants. Some entire colonies contained only male stems. Consequently, colony expansion is suspected to occur primarily vegetatively. Sexual reproduction can be accomplished in a controlled environment (such as a nursery) as reported by FWS (1990), which indicated successful seed germination when seeds were depressed below the soil surface. During recent field surveys of the Mississippi population on DNF, numerous apparently viable seeds were observed on plants although no germination from the previous year's fruits were observed. With the abundance of suitable habitat within DNF, it is likely that if germination and sexual reproduction can occur in the wild, it could be occurring here. However, reports by Tucker (1984) and Morgan (1983) indicated that germination and new seedling establishment may not occur in the wild.

Pondberry Surveys

25. Yazoo Backwater Reformulation Project.

a. During the period September-October 1994, field surveys for pondberry were conducted for the Yazoo Backwater Reformulation Project. The surveys included the entire direct rights-of-way for the project and a 5 percent survey (2,000 acres) of forested tracts, with a high potential for pondberry occurrence, south and west of the DNF. In addition to pondberry profile report information (Attachment 2), flood frequency data and professional judgment were utilized to select forested tracts to survey. A summary of the transects surveyed for pondberry is presented in Table 14-1. Also, the Mississippi Natural Heritage Program (MNHP) was asked to

TABLE 14-1
SUMMARY
TRANSECTS SURVEYED FOR PONDBERRY
YAZOO BACKWATER STUDY

Transect Description	Quad (1:62,500)
Twin Oaks 01 and 01A	Lorenzen
Twin Oaks 02	Lorenzen
Twin Oaks 03	Lorenzen
Mahannah 01	Vicksburg
Mahannah 02	Onward
Mahannah 03	Onward
Mahannah 04	Onward
Mahannah 05	Onward
Reach 1, Tract 4	Talla Bena
Reach 1, Tract 9	Alsatia
Reach 1, Tract 43	Onward
Reach 1, Tract 16	Onward
Reach 1, Tract 25	Onward
Reach 1, Tract 59	Lake Providence
Reach 2, Tract 6	Onward
Reach 2, Tract 11	Lorenzen
Reach 2, Tract 14	Lorenzen
Reach 2, Tract 4	Onward
Reach 2, Tract 18	Lorenzen
Reach 2, Tract 23	Lorenzen
Reach 2, Tract 25	Onward
Reach 2, Tract 47	Auter
Reach 2, Tract 32	Swan Lake
Reach 4, Tract 28	Auter
Reach 4, Tract 25	Bayland
Reach 4, Tract 78	Auter
Reach 4, Tract 3, Transect A	Bayland
Reach 4, Tract 3, Transect B	Bayland
Reach 4, Tract 1	Bayland

review its records for reported pondberry colonies within the Yazoo Backwater Project Area. In 2005, the Corps also updated its comprehensive Geographic Information System (GIS) database of known pondberry sites on DNF. This database includes 182 sites and was compiled from several sources, including compartment maps provided by DNF.

b. No pondberry colonies or evidence of pondberry presence was noted within either the rights-of-way or the 2,000 acres surveyed in 1994. In a 31 January 2000 letter with an accompanying site map, MNHP noted only 22 sites where pondberry colonies occurred within the proposed project area. None of the MNHP sites were located in areas of direct impact.

Other Corps Projects

26. A portion of the Yazoo Backwater Reformulation Project Area was surveyed as part of the Upper Steele Bayou Project. Approximately 3,600 acres of bottom-land hardwoods were surveyed, and no pondberry was found.

27. Two colonies were discovered during surveys for two previous Yazoo Basin studies--Upper Yazoo Projects and Mississippi Delta. A colony containing six stems was located in Tallahatchie County, Mississippi, during the Upper Yazoo Projects, and a large area containing hundreds of stems was located in Bolivar County, Mississippi, during the Mississippi Delta study. Both sites were at elevations at or greater than the 100-year frequency flood.

Survey Report – Reevaluation of Pondberry in Mississippi

28. In May-June 2000, data were collected from 62 colonies. Fifty colonies were in DNF, and 12 colonies were in Bolivar and Sunflower Counties, Mississippi (Attachment 3). A range of data was collected on pondberry colony characteristics, surrounding stand characteristics, and site characteristics and elevation. Results from this survey are discussed in the Data Analysis Section.

Survey Report – Reevaluation of Pondberry (Lindera melissifolia)
in the Big Sunflower and Yazoo Rivers Backwater Areas

29. In June-July 2005, data were collected from the same 62 colonies sampled in 2000 (Attachment 6). A discussion of colony changes from 2000-2005 is provided in the Data Analysis Section.

Hydrology and Habitat Evaluation of 51 Selected Colonies of Pondberry in DNF, Mississippi

30. In April 2001, FWS contracted Gulf Coast Biological Surveys, Inc., to examine selected sites of pondberry in DNF and to determine if these colonies were located in ponded depressions mostly influenced by rainwater accumulation or on alluvial ridges mostly influenced by overbank flooding. This report documents these findings (Attachment 4).

DATA ANALYSIS

1991 Pondberry Profile

31. The entire document and detailed data analyses are contained in Attachment 2. The purpose of this study was to develop a pondberry profile to enable the Vicksburg District to reduce time and effort in surveying for pondberry in the Yazoo Basin by identifying landscape and ecological characteristics of pondberry colonies and pondberry sites. The analysis was based on field data from 44 colonies in the Delta of Mississippi. It concluded that pondberry within Mississippi should occur on slight ridges, is frequently or periodically flooded or is within 100 feet of a permanent water body, and is typically located on soils with a mixture of heavy clays and lighter soils. The study determined that common associate tree species were oaks, sweetgum, and elms. Common associate shrub species were American snowbell, deciduous holly, and palmetto. The report also indicated that local precipitation and hydrology appeared to influence pondberry more than overbank flooding.

2001 Reevaluation of Pondberry in Mississippi

32. The entire document and detailed data analyses are contained in Attachment 3. The purpose of this study was to update the 1991 pondberry profile and collect data on additional locations discovered since the Vicksburg District conducted pondberry surveys in the early 1990s. The study area for this project included the DNF in Sharkey County, Mississippi; several parcels of private land in Bolivar County; and a 32-acre plot south of the DNF. Data were collected on 62 colonies (50 in DNF and 12 on private land). Data collected included physical characteristics of the colony, colony health, forest stand conditions, soil characteristics, and evidence of localized depressions. Importantly, the elevation of each colony and surrounding area was determined using a professional land survey crew. These elevations were used to establish the flood frequency of the site. The flood frequency of the sites was used to analyze relationships among pondberry colony characteristics and flood frequency.

33. The analysis found that common associate species were similar to previous studies on the Mississippi pondberry populations. Common associate tree species were sweetgum, oaks, and elms, while associate shrub species were sugarberry, swamp dogwood, and deciduous holly. The study concluded there was no correlation between colony health, measured by stem density, stem diameter, stem height, and elevation (used to determine flood frequency of the site). In other words, there appeared to be no relationship between the variation in pondberry characteristics and variation in flood frequency (as determined from surveyed elevations of each pondberry colony). There was also no correlation between stem density and percent canopy cover or diameter at breast height. Therefore, it was difficult to predict where pondberry might be successful by using these quantifiable variables. Instead, evidence from this and the 1991 pondberry profile suggests that, in general, pondberry was successful in areas of high percent canopy cover, in a ridge and swale community, and in areas that are mostly affected by local precipitation and hydrology. The analysis documented that 94 percent of the colonies had evidence of localized depressions (defined as an area greater than 10 square feet that is slightly lower than the surrounding area and contains ponded water or evidence of ponded water (e.g., water-stained leaves) at some time).

2001 U.S. Fish and Wildlife Service Colony Analysis

34. In May 2001, FWS prepared a document, "Hydrology and Habitat of Fifty-one Selected Colonies of Pondberry in Delta National Forest, MS." The entire document and detailed data analyses are contained in Attachment 4. The study objective was to examine selected pondberry sites in DNF (including the sites documented in the Corps 2001 reevaluation) and determine whether these colonies were located in ponded depressions mostly influenced by rainwater accumulation or on alluvial ridges mostly influenced by overbank flooding.

35. The study concluded that, "At a minimum, 70 percent are not depressional wetland colonies. Five colonies (10 percent) are clearly related to ponded depressions. The remaining 20 percent probably have shallow standing water due to rainfall at irregular intervals, but the frequency and duration of surface water are not sufficient to create pond conditions." The 2001 Corps reevaluation concluded that 92 percent of the 50 DNF colonies had evidence of localized depressions.

36. The different conclusions appear to reflect different criteria used to define depressions. The Corps definition was an area greater than 10 square feet that is slightly lower than the surrounding area and contains ponded water or evidence of ponded water (e.g., water-stained leaves) at some time. This definition included areas that range from very small depressional areas in or around the colony to larger areas considered classic depressional wetlands and ponded depressions. The 1991 and 2001 Corps analyses concluded that pondberry is mostly affected by local precipitation (52 to 55 inches annually) and local hydrology. This does not imply that significant rainfall accumulation in a pond or depressional wetland is required.

37. The FWS document uses criteria to define classic depressional wetlands and ponded depressions (e.g., presence of obligate aquatic vegetation when canopy is open and presence of standing water with no defined exit channel). In addition, as discussed below, several criteria relied on as evidence of overbank flooding are ambiguous indicators and likely provide little use in determining overbank flooding .

a. Absence of standing water. Standing water could be present after an overbank flooding event, depending on the local topography.

b. Presence of loose detrital accumulation. Generally, backwater events have relatively slow rises and falls. Therefore, loose detrital most likely would not be present as a result of this type of flood event .

c. Presence of species typical of alluvial, well-drained environments. These environments reflect past processes in the flood plain and may or may not be good indicators of current overbank flooding. Also, most of DNF is of backswamp geology (poorly-drained environments), and these areas receive overbank flooding .

Statistical Analysis of 2001 Data by A. Dale Magoun, Ph.D.

38. In response to concerns from FWS about the statistical validity of the 2001 data collection and analysis, the Corps contracted with Dr. Dale Magoun of Applied Research and Analysis, Inc., to review the 2001 "Reevaluation of Pondberry in Mississippi" report and conduct, if appropriate, any additional analysis. The entire document and detailed data analyses are contained in Attachment 5.

39. Dr. Magoun summarized both the Corps and FWS conclusions as follows:

a. Corps conclusion. "The COE (Corps of Engineers) has concluded that there is no relationship between variation in the density of pondberry, an obligate wetland species, and variation in flood frequency. In other words, the abundance of pondberry within a colony is a random feature in the BLH (bottom-land hardwoods) flood environment, where Pondberry is as abundant at sites that flood once every 2 years as at sites that flood only once every 100 years."

b. FWS conclusion. "Contrary to the COE conclusion and rationale, the Service finds that the analysis of correlations between the densities of pondberry plants in colonies at various sites to the current frequency of flooding at such sites is insufficient to discount any effect of flooding. More specifically, we disagree with the scope of the inferences made by which sites were selected for the study, and the selection and measurement of certain parameters at these sites."

40. Dr. Magoun noted that no randomization appeared to have occurred in the study (the 2001 report clearly documents that known sites were selected) and that designs arising in this manner are called quasi-random. Therefore, the model of interest is a one-way design, which assumed pondberry characteristics were affected only by the frequency of flooding and random errors. Dr. Magoun's analysis used Wilk's lamda (a multivariate F-test) to simultaneously test the seven pondberry characteristics, individual ANOVA to further substantiate the simultaneous finding, and canonical correlation analysis to find linearly combinations of variables that are correlated with each other.

41. Dr. Magoun's conclusions were as follows:

a. Summary of F-tests. Flood frequency does not affect the number of pondberry clumps, stems, dead stems, females, mature fruit, stem height, or average stem diameter. The p-values for all tests were nonsignificant at the 0.05 level, and the power of the tests for detecting the minimum detectable difference was extremely high. As such, flood frequency is not likely to adversely affect the pondberry.

b. Canonical correlation analysis. Changes in elevation and other ground cover species tend to affect different pondberry characteristics, but not the occurrence of pondberry colonies. Furthermore, elevation and overstory characteristics jointly affect pondberry colonies. These effects are not detrimental, but are changes that affect changes in colony characteristics.

c. The in-depth multivariate exploration did not support the FWS claim that the 2001 analysis of correlations between the density of pondberry colonies at various sites to the current frequency of flooding at such sites is insufficient to discount any effect of flooding .

Pondberry Surveys on Delta National Forest

42. As part of ongoing management efforts, DNF conducts pondberry surveys as part of the preaction evaluation of management activities in stands. They compiled a database incorporating surveys from 1988 to 2005 (Attachment 7). These data were used to assess the spatial distribution of known pondberry colonies in relation to surveyed areas and the 1-year flood frequency. (Note: There are no pump operation effects below the 1-year frequency.)

43. Based on a combined database (DNF, Corps, and researchers), most known pondberry colonies occur in the northeast portion and Compartment 39 of DNF (Figure 1). This spatial distribution does not appear to be the result of entering and surveying a disproportionate number of stands in these areas of DNF. Approximately 32 percent of DNF has been surveyed for pondberry (Table 14-2), and the surveyed stands appear to be well-distributed across DNF.

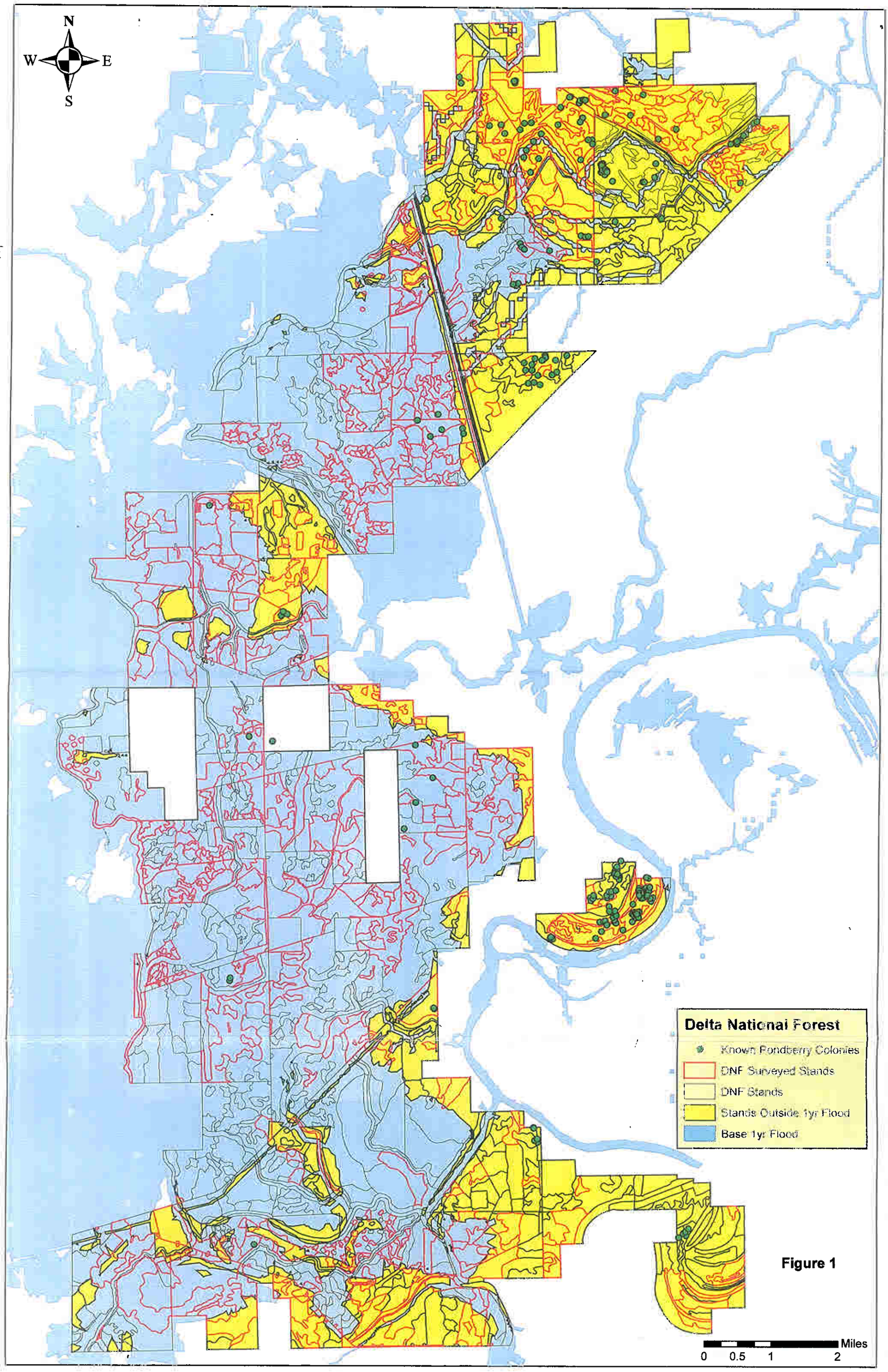

N
W
E
S
Delta National Forest
Known Pondberry Colonies
DNF Surveyed Stands
DNF Stands
Stands Outside 1yr Flood
Base 1yr Flood
Miles
0
0.5
1
2

Figure 1

TABLE 14-2
SUMMARY OF PONDBERRY SURVEYS
IN RELATION TO THE 1 YEAR FLOOD FREQUENCY

Item	Above 1-year Frequency		Below 1-year Frequency		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Delta National Forest	25,061	40.4	36,906	59.6	61,967	100.0
Surveyed Stands [a/]	10,806	43.1	8,977	24.3	19,783	31.9
Known Colonies	159	87.4	23	12.6	182	100.0

a/ Percent reflects relative portion of acres from previous row, not relative portion of stands surveyed.

44. Approximately 60 percent of DNF is below the 1-year frequency, and 40 percent of DNF is above the 1-year frequency. Twenty-four percent of the area below the 1-year frequency has been surveyed, with 23 colonies being located. Forty-three percent of the area above the 1-year frequency has been surveyed, with 159 colonies being located. Based on these data, it appears that there is a low probability of locating pondberry on areas below the 1-year frequency, and the lack of pondberry colonies on the majority of DNF is not the result of limited or disproportionate surveys.

Overbank Flooding (1984-2003)

45. An analysis of potential overbank flooding of pondberry colonies using observed stage-gage data from 1984 to 2003 on DNF was conducted to examine the pattern of overbank flooding. This period of record was selected because it best represented current conditions. The analysis used actual stage-gage data and surveyed colony elevations of 49 sites in DNF included in the 2001 report (one site occurred in a greentree reservoir and was not included). The stage frequency of the colony sites ranged from 0.7 to 17 years. Each colony was associated with the stage reading at either one of three gages or interpolated points between the three gages. It was assumed that if the stage reading was above the colony elevation, the colony was receiving overbank flooding. This is a conservative evaluation because in some cases, although the stage is higher than the colony elevation, the water from the river may not be able to reach the site. The growing season was defined as March to November and the dormant season December to February. Stage, colony/gage association, and overbank frequency data are included in Attachment 7.

46. On average, growing-season overbank flooding did not occur on 91.3 percent of the colonies from 1984 to 2003 (Figure 2). This average included 5 years (20 percent), with no overbank flooding on colonies and only 1 year with greater than 20 percent of the colonies being flooded. On average, dormant-season overbank flooding did not occur on 95.7 percent of the colonies from 1984 to 2003 (Figure 3). This average included 9 years (45 percent), with no overbank flooding on colonies and only 3 years with greater than 10 percent of the colonies being flooded.

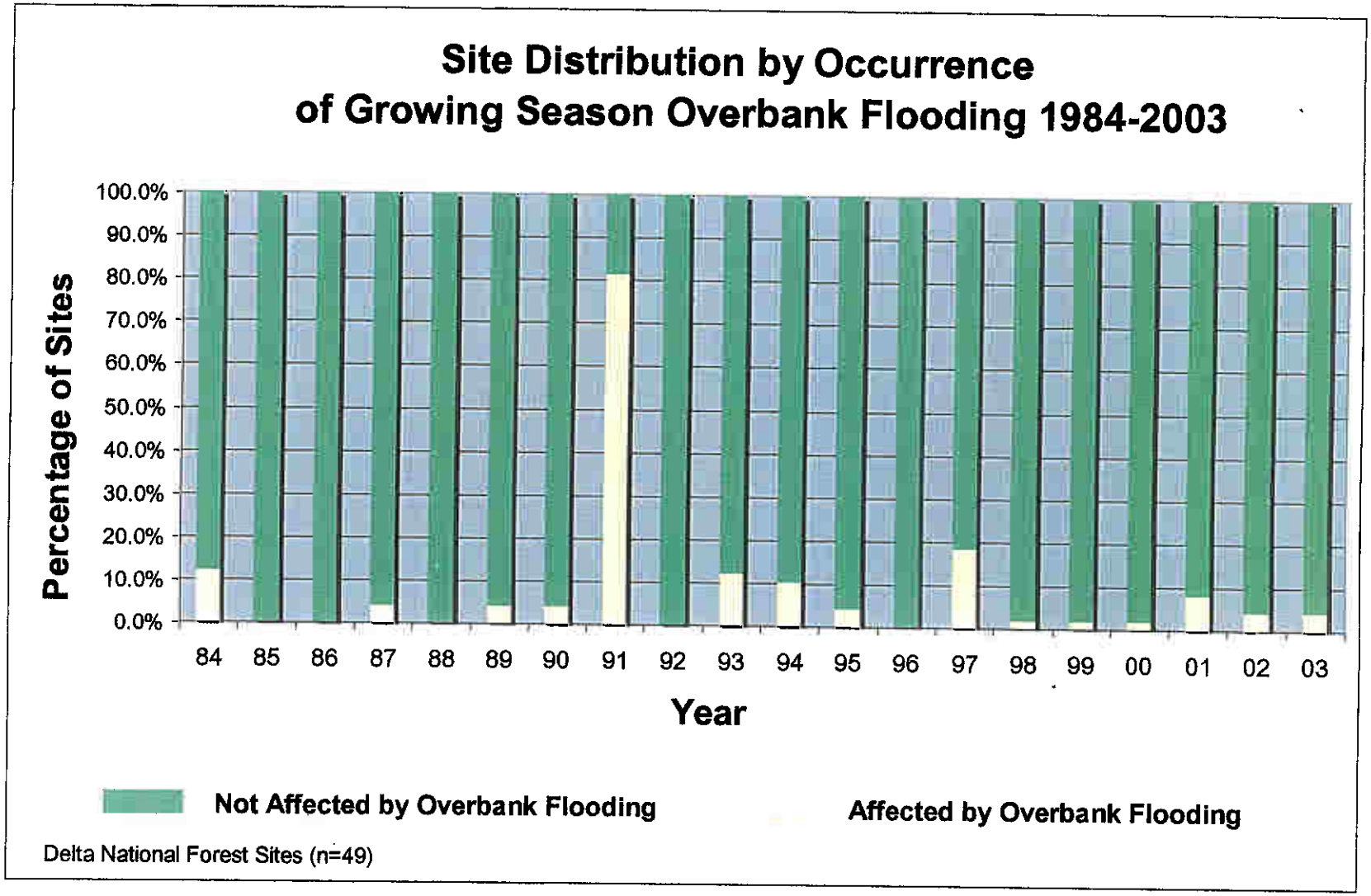

Site Distribution by Occurrence
of Growing Season Overbank Flooding 1984-2003
Percentage of Sites
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
Year
Not Affected by Overbank Flooding
Affected by Overbank Flooding
Delta National Forest Sites (n=49)

Figure 2

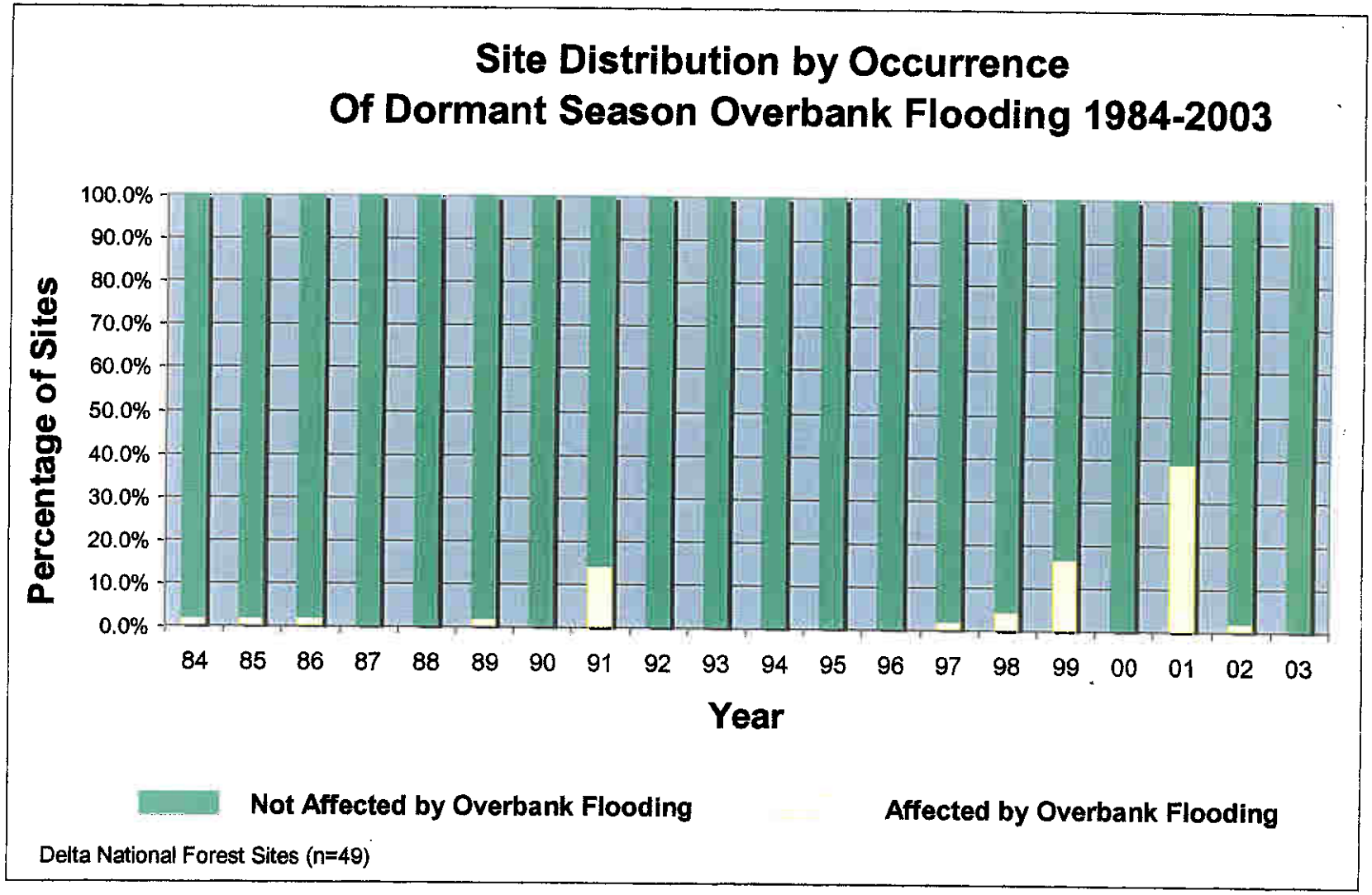

Site Distribution by Occurrence
Of Dormant Season Overbank Flooding 1984-2003
Percentage of Sites
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
00
01
02
03
Year
Not Affected by Overbank Flooding
Affected by Overbank Flooding
Delta National Forest Sites (n=49)

Figure 3

47. With-project conditions, growing-season overbank flooding would not have occurred on 93.5 percent of the colonies from 1984 to 2003 (Figure 4). This was only a 1.8 percent increase in the average over the without-project condition. Colonies would have been affected in only 5 of the 20 years. It is important to note that in the1991 event, 80 percent of the colonies received overbank flooding. Because the 1991 event was a headwater flooding event, and the pumping station would not have been operating, there would have been no change under the with-project condition. The pumping station will only operate under certain backwater conditions. With-project conditions, dormant-season overbank flooding would not have occurred on 98.0 percent of the colonies from 1984 to 2003 (Figure 5). This was a 2.3 percent increase in the average over the without-project condition. This included 17 years where no flooding occurred or occurred only on sites below the 1-year frequency (not affected by the project). Colonies would have been affected in 3 of the 20 years. These data clearly show that the project is not likely to adversely affect the pondberry.

48. Approximately 88 percent of the colonies have been affected by growing-season overbank flooding in 2 years or less in the 20-year period (Figure 6). Thirty-two of the colonies (65 percent) were affected only once (1991 event). Approximately 84 percent of the colonies have been affected by dormant-season overbank flooding in 2 years or less in the 20-year period (Figure 7). Thirty of the colonies (61 percent) were never affected by dormant-season overbank flooding. Again, these data indicate that the project is not likely to adversely affect the pondberry.

49. With-project conditions, approximately 96 percent of the colonies would have been affected by growing-season overbank flooding in 2 years or less in the 20-year period (Figure 8), an 8 percent increase. Approximately 96 percent of the colonies have been affected by dormant-season overbank flooding in 2 years or less in the 20-year period (Figure 9), a 12 percent increase.

50. Twenty-eight of the 49 colonies occurred on sites between the 2- and 5-year frequencies (Figure 10). On average, 2-year frequency sites should flood in 10 out of 20 years, and 5-year frequency sites should flood in 4 out of 20 years. Twenty-three of the 28 colonies flooded only once in the 20-year period, and 3 flooded twice in 20 years. These colonies experienced greatly reduced overbank flooding during the 20-year period. However, the apparent health of these colonies was excellent or good (health of the colony was determined by consensus of the field team based on pondberry colony characteristics--see the 2001 Reevaluation Report for details. In addition, the apparent health of colonies at higher frequencies (>7 years) and lower frequencies (<5 years) also was excellent or good. This suggests that flood frequency of the site is likely not an important factor in determining apparent colony health.

51. Within the 20-year period, 63 percent of the colonies went 12 consecutive years and 18 percent went 20 consecutive years without only growing-season overbank flooding (Figure 11). Twenty-nine of these 31 colonies had excellent or good apparent colony health.

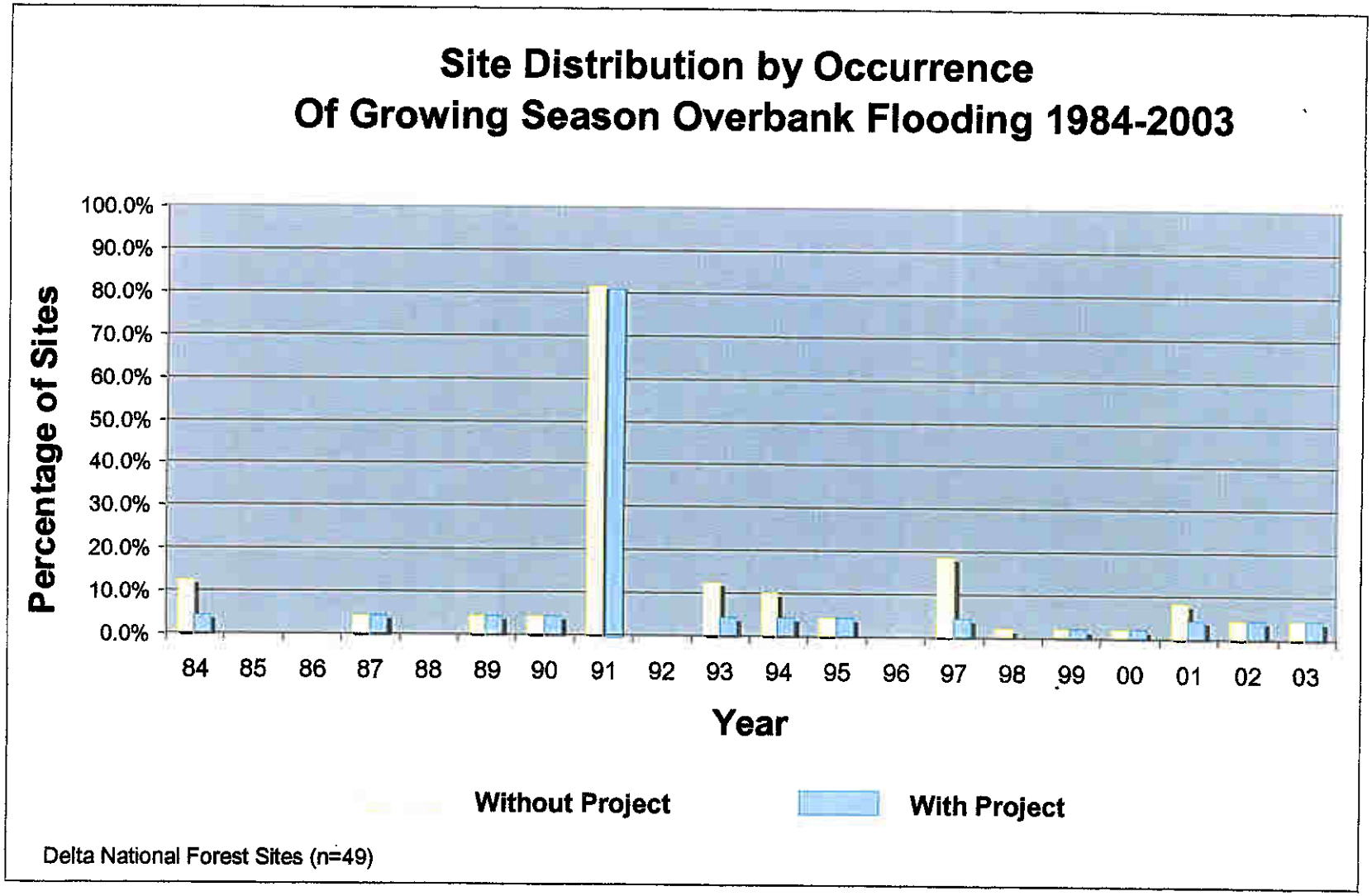

Site Distribution by Occurrence
Of Growing Season Overbank Flooding 1984-2003
Percentage of Sites
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
Year
Without Project
With Project
Delta National Forest Sites (n=49)

Figure 4

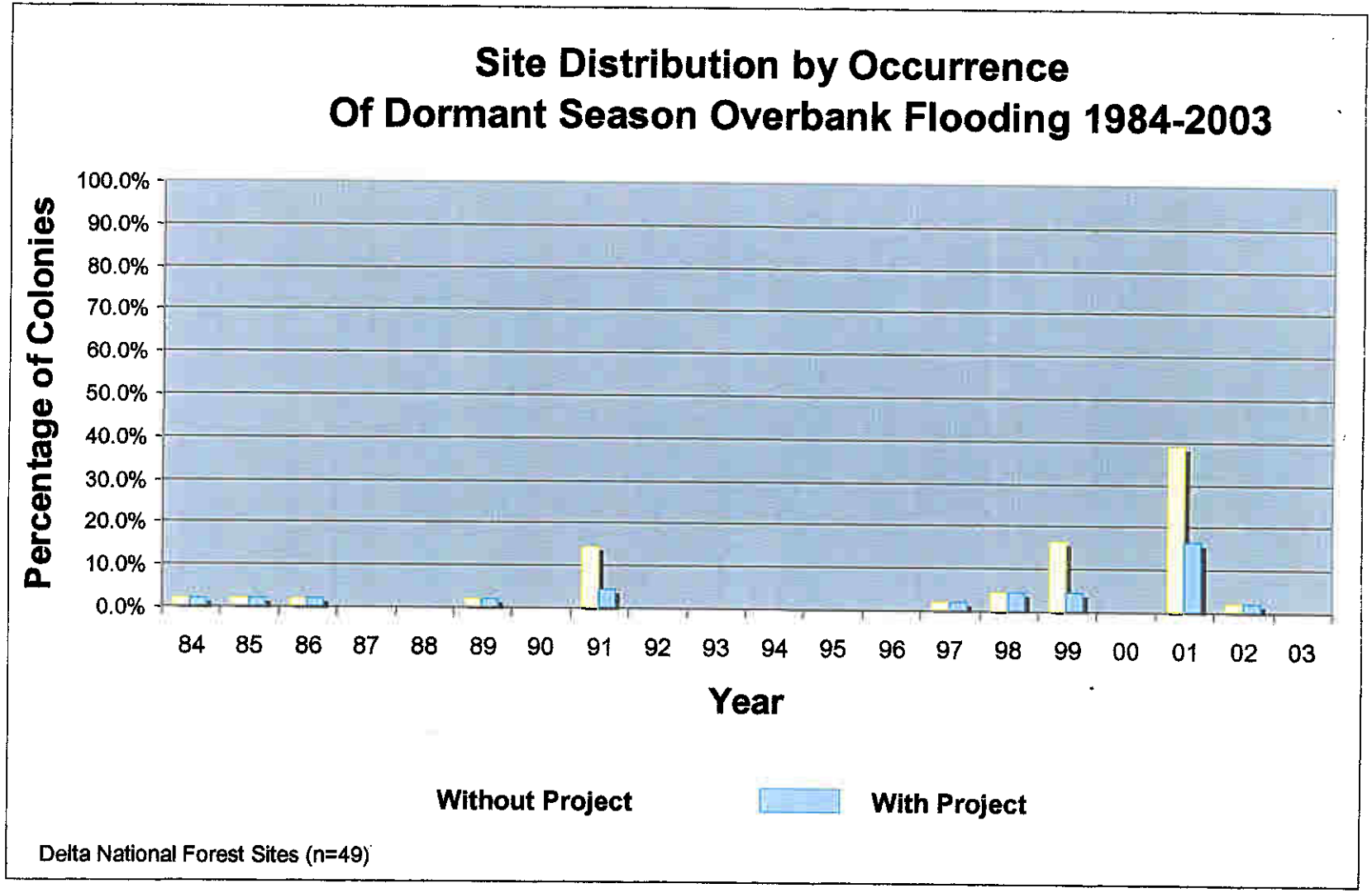

Site Distribution by Occurrence
Of Dormant Season Overbank Flooding 1984-2003
Percentage of Colonies
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
Year
Without Project
With Project
Delta National Forest Sites (n=49)

Figure 5

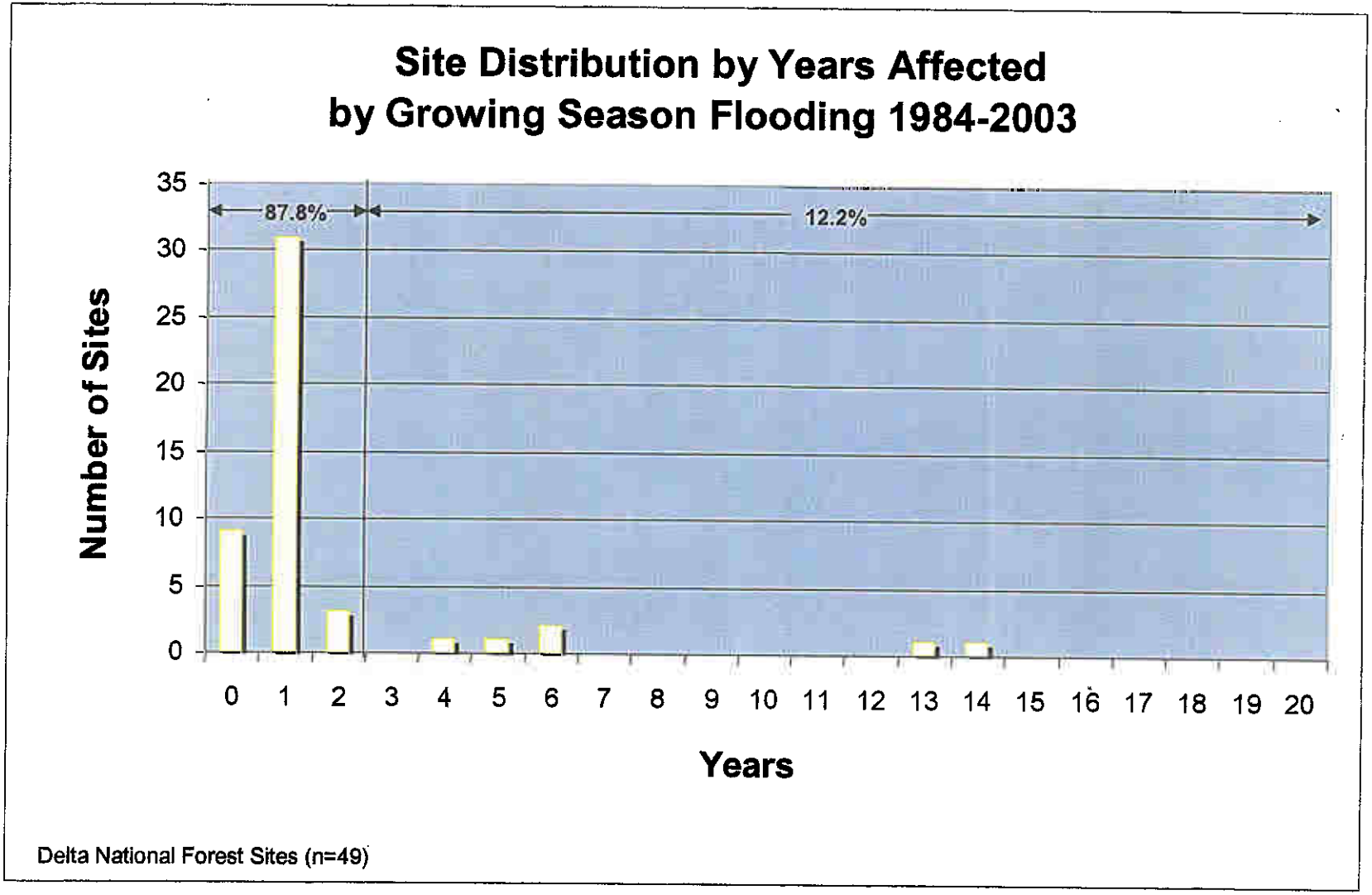

Site Distribution by Years Affected
by Growing Season Flooding 1984-2003
Number of Sites
35
30
25
20
15
10
5
0
87.8%
12.2%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years
Delta National Forest Sites (n=49)

Figure 6

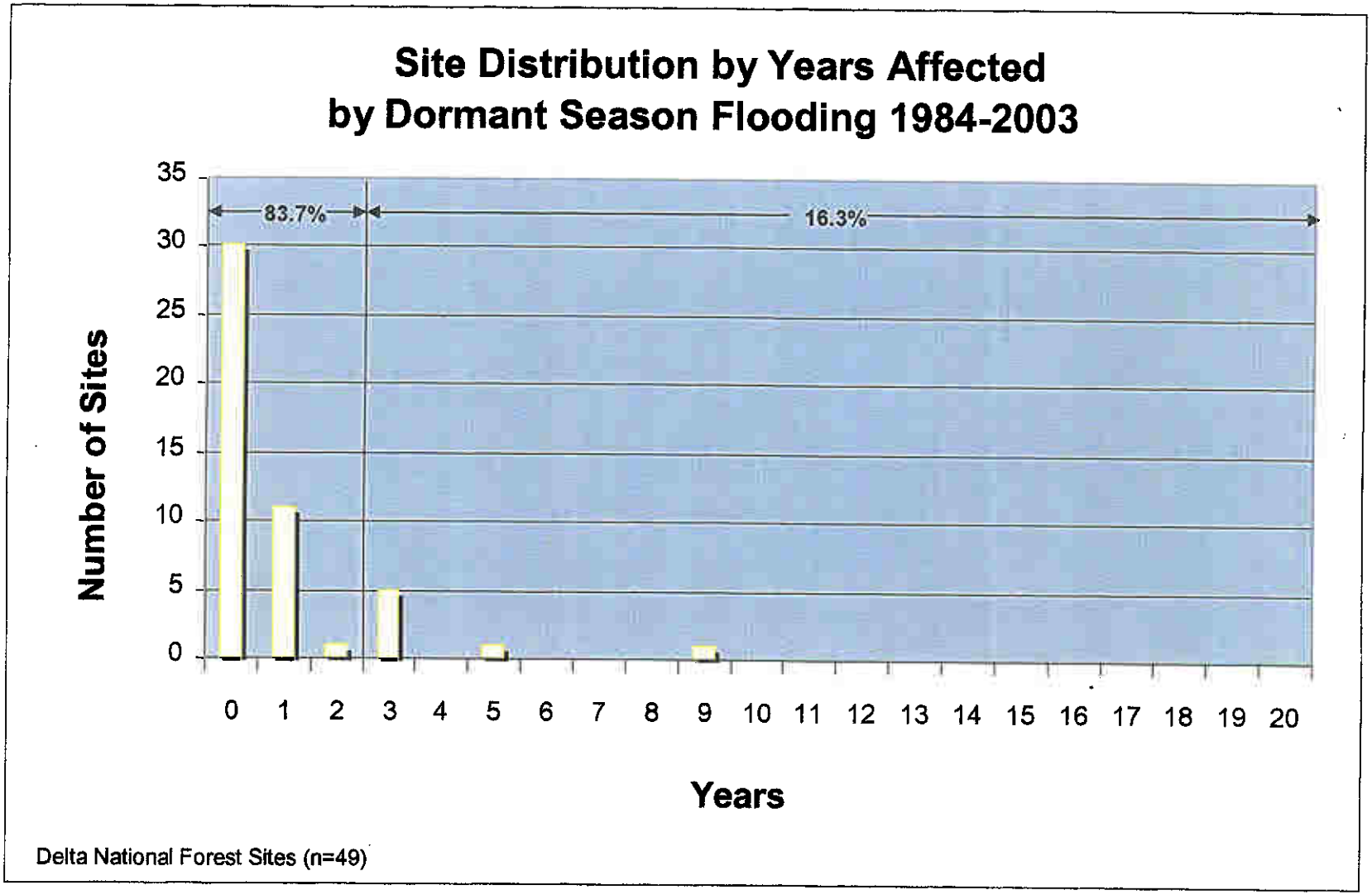

Site Distribution by Years Affected
by Dormant Season Flooding 1984-2003
Number of Sites
35
30
25
20
15
10
5
0
83.7%
16.3%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years
Delta National Forest Sites (n=49)

Figure 7

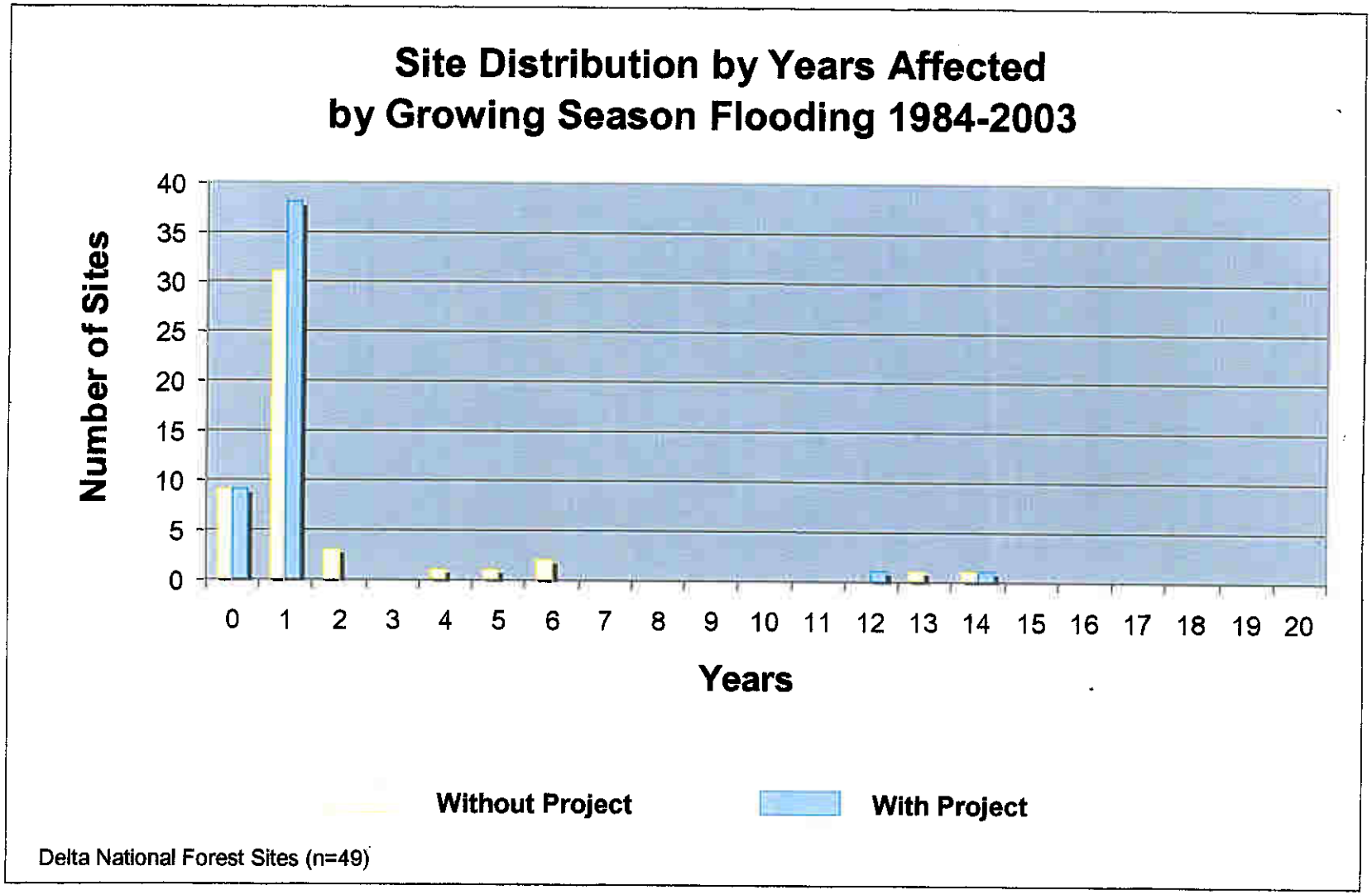

Site Distribution by Years Affected
by Growing Season Flooding 1984-2003
Number of Sites
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years
Without Project
With Project
Delta National Forest Sites (n=49)

Figure 8

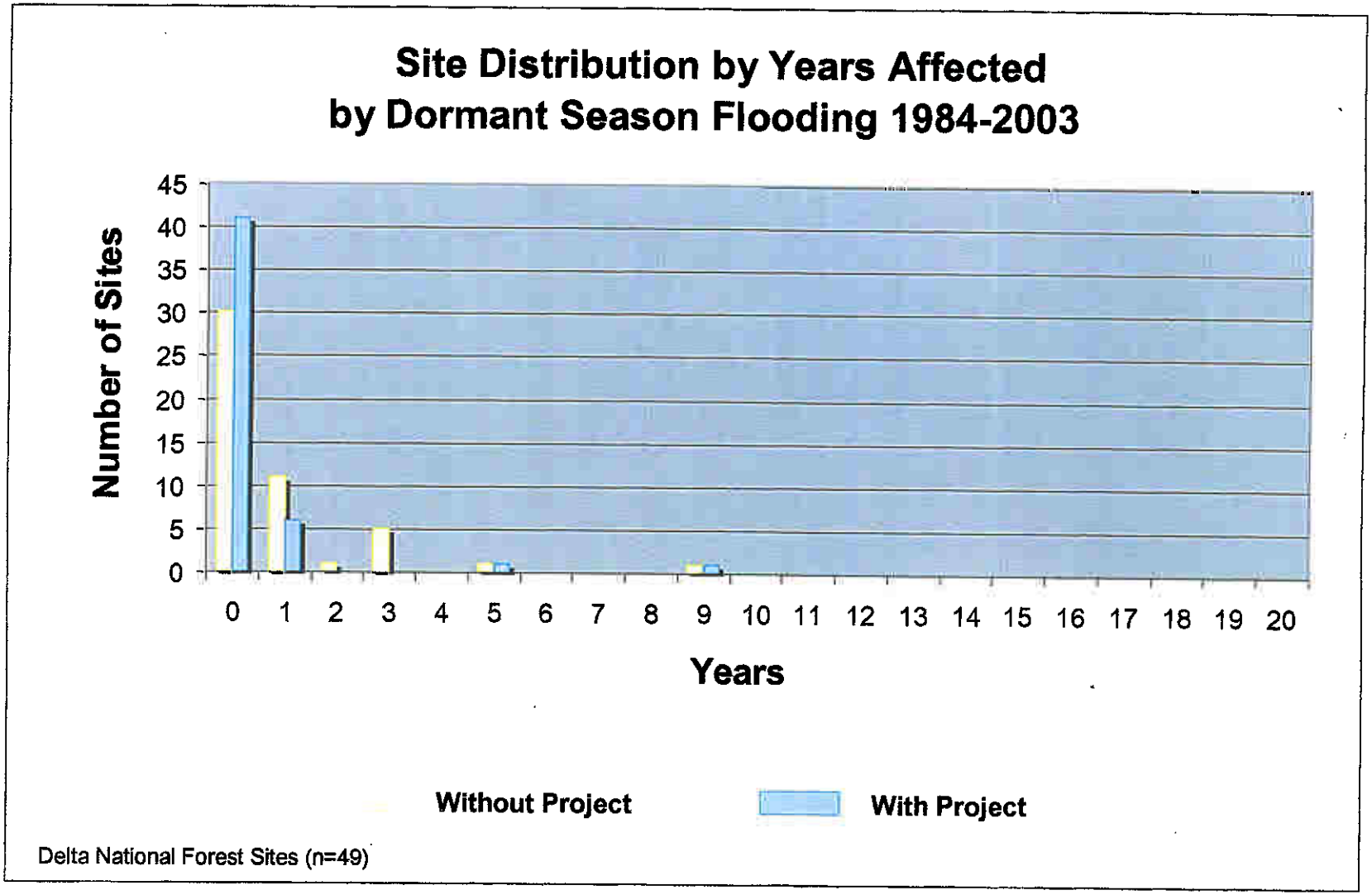
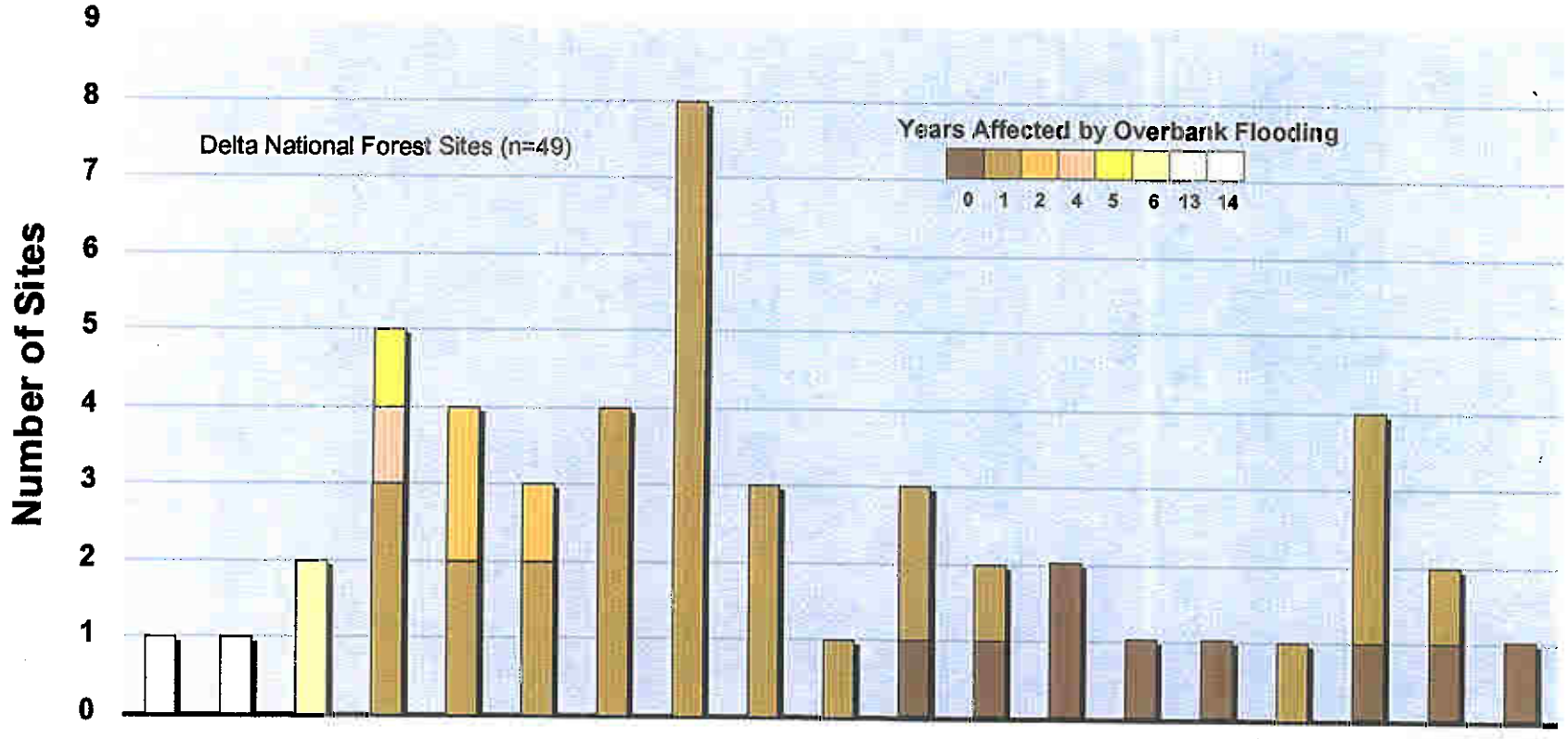

Site Distribution by Years Affected
by Dormant Season Flooding 1984-2003
Number of Sites
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years
Without Project
With Project
Delta National Forest Sites (n=49)

Figure 9

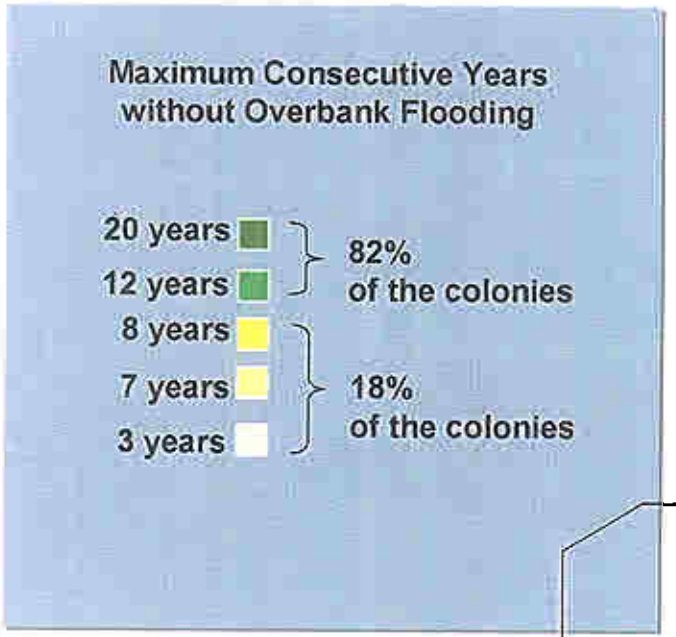
Site Distribution by Flood Frequency and Years Affected by Growing Season Flooding 1984-2003

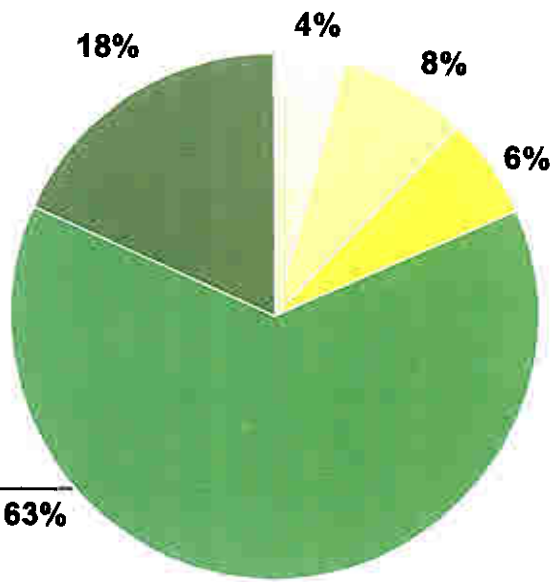


	0.7	0.8	1.5	2	2.5	3	3.5	4	4.5	5	6	7	7.5	9	11	14	15	16	17
Excellent	1	0	1	2	4	1	2	2	3	0	1	0	2	0	1	0	1	1	0
Good	0	1	1	3	0	2	2	5	0	1	2	2	0	1	0	1	2	1	1
Fair	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Poor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 10

Site Distribution by Consecutive Years Without Growing Season Overbank Flooding 1984-2003





Colony Health					
Excellent	5	13	2	1	1
Good	4	16	1	3	1
Fair	0	2	0	0	0
Poor	0	0	0	0	0
Total	9	31	3	4	2

Delta National Forest Sites (n=49)

Figure 11

52. The average annual rainfall over the 20-year period was approximately 56 inches (Figure 12). Although overbank flooding has reached colonies less frequently than predicted by the flood frequency of the site from 1984 to 2003, annual precipitation has been 50 inches or greater in 16 of 19 years during this period (2003 is only a partial data set and not included). During this period, the average monthly precipitation was greater than 5 inches for November through April (Figure 13). This may help explain excellent or good apparent colony health despite less than predicted frequency of overbank flooding. It is not unusual to visit some colony sites during the dormant season and despite the lack of overbank flooding, the site has standing water. For example, the Colby research site on DNF had extensive standing water on the site in winter of 2005 despite no overbank flooding (Figure 14). This general area is in the 1- to 3-year flood frequency, but only experienced overbank flooding in 5 of the 20 years evaluated.

Pondberry Wetland and Geomorphology Assessment

53. Known pondberry colonies on DNF and the 49 colonies from the 2001 reevaluation report were compared to the underlying geomorphology and to the 5 percent duration backwater flooding (Figures 15 and 16). Five percent duration was selected because it meets the hydrology criterion for the jurisdictional definition of wetlands. The definition states that lands flooded for less than 5 percent of the growing season are definitely not wetlands. This analysis assumed that backwater flooding was the only source of saturation.

54. Most of the pondberry colonies occur on point bar and abandoned channel/courses. Eighty-nine percent of known colonies and 96 percent of the 2001 reevaluation report colonies occur on sites above the 5 percent duration backwater event. There is good agreement between geomorphology and the 5 percent backwater flooding duration, with most of the 5 percent duration occurring on backswamp areas.

55. Fifty percent of known pondberry colonies and 59 percent of the 49 sampled colonies are affected by less than 2.5 percent backwater flood duration (Table 14-3). These sites are affected by less than 1 day of flooding every 2 years by a backwater event. Thirty-nine percent of known pondberry colonies and 37 percent of the 49 sampled colonies are affected by backwater flood events of between 1 and 13 days in duration. Therefore, 89 percent of the known pondberry sites and 96 percent of the 49 sampled colonies do not meet the hydrology criterion for jurisdictional wetlands if the sole source of water is backwater flooding. It is important to note that some of these sites may meet the 5 percent duration criterion through precipitation or other local hydrology. It cannot be concluded that the sites are not jurisdictional wetlands (onsite determination would be required), but it appears the needed duration is not being provided by backwater flooding events.

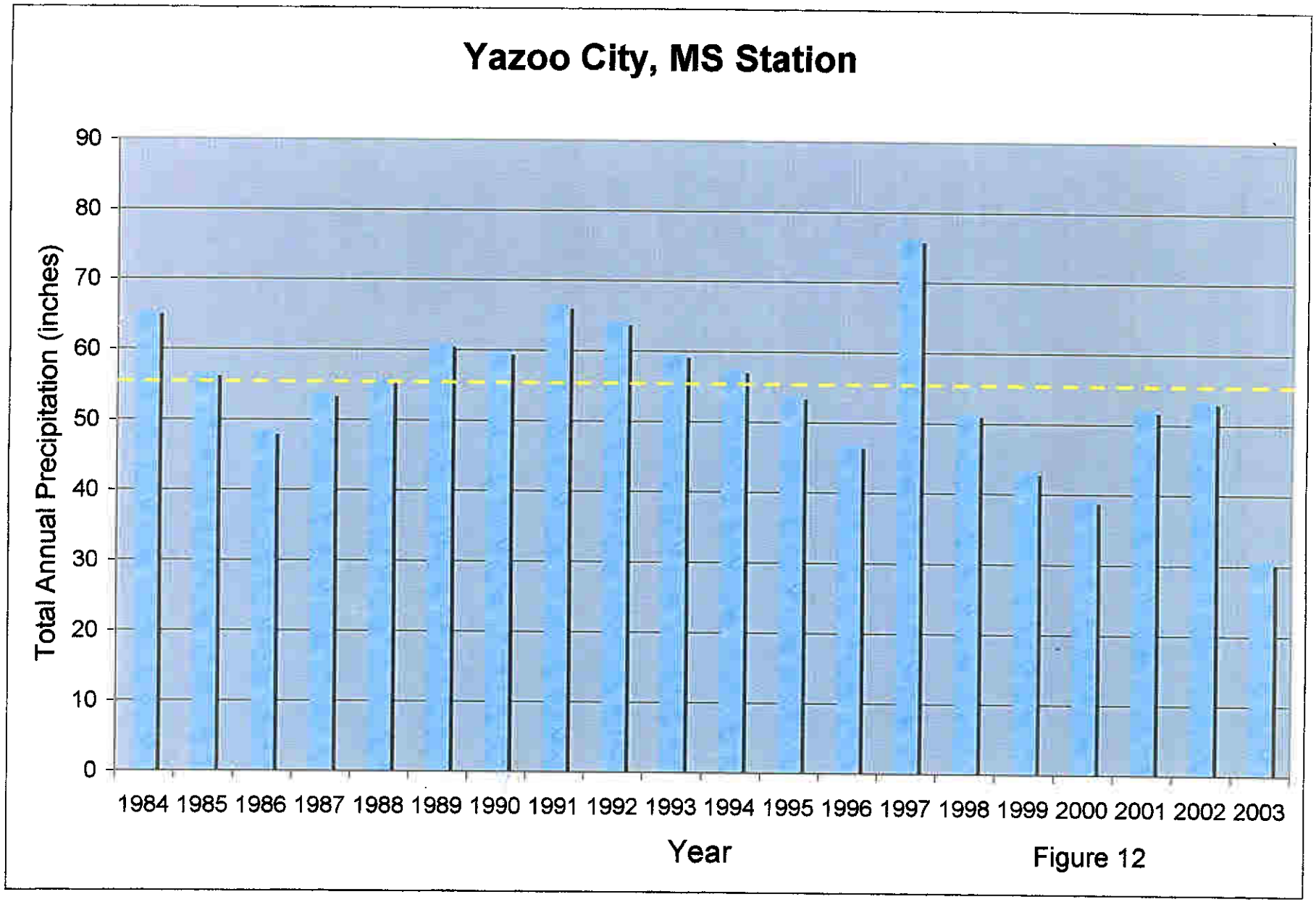
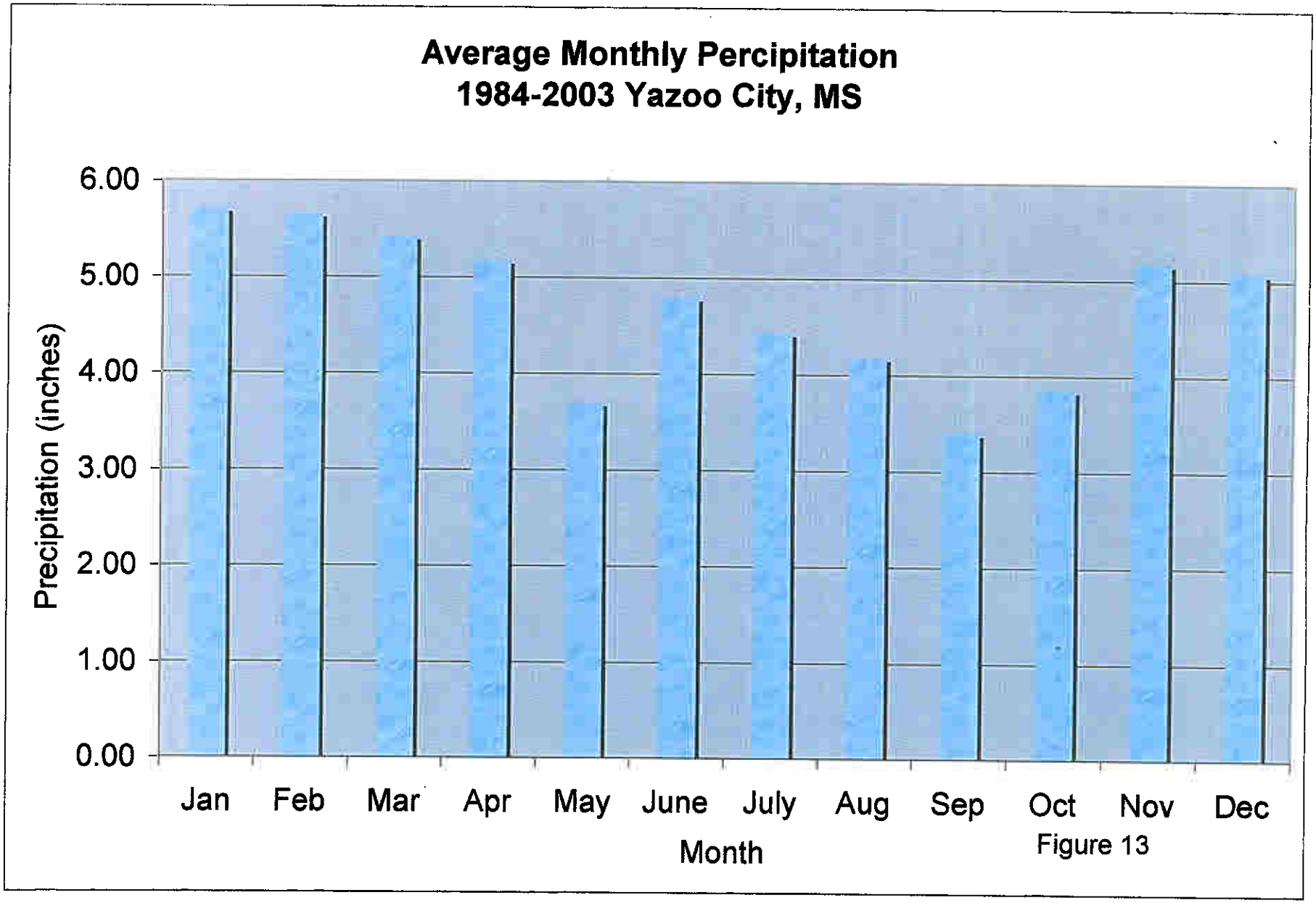

Yazoo City, MS Station
Total Annual Precipitation (inches)
90
80
70
60
50
40
30
20
10
0
1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
Year

Figure 12


Average Monthly Percipitation
1984-2003 Yazoo City, MS
Precipitation (inches)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
Month
Figure 13

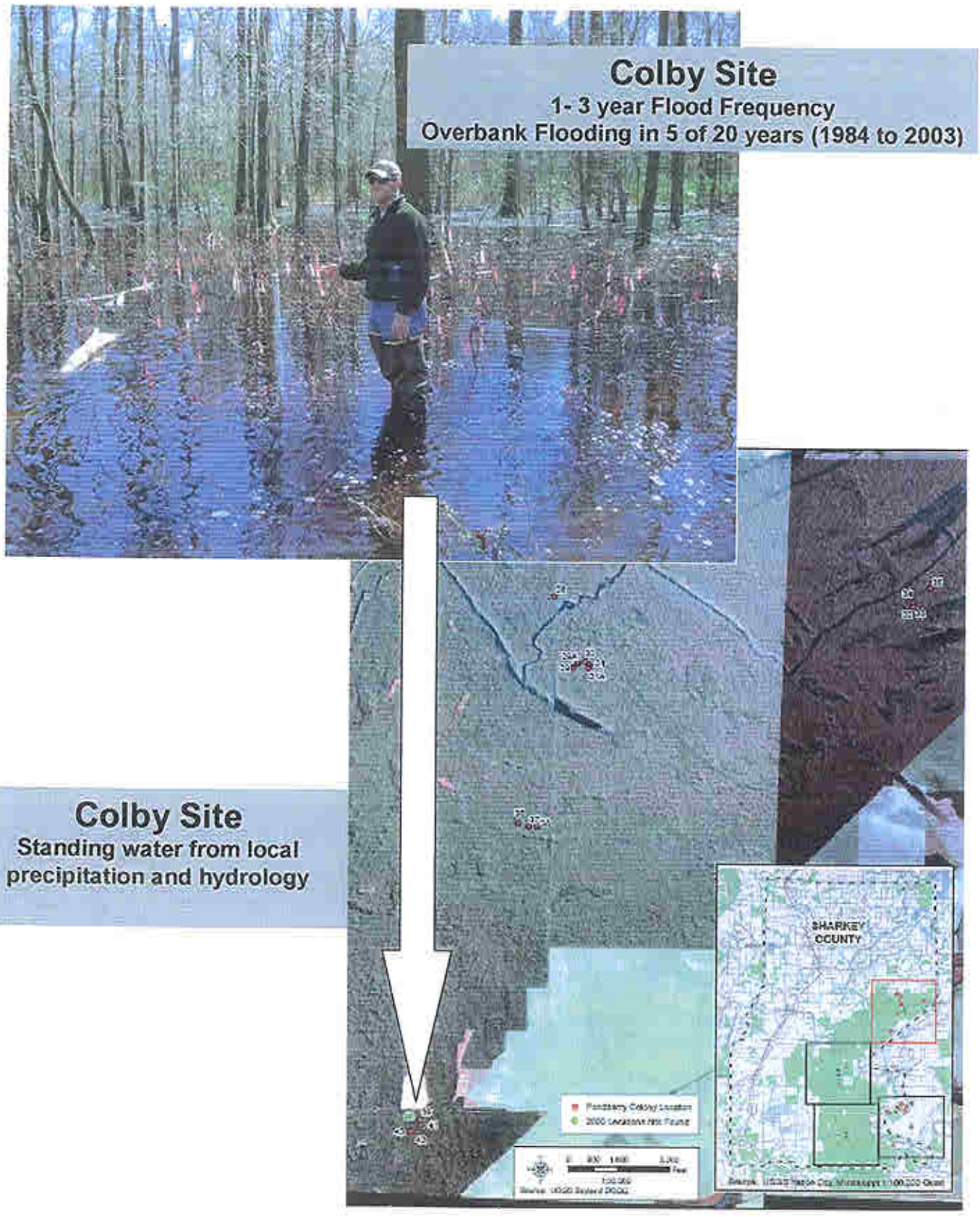

Colby Site
1- 3 year Flood Frequency
Overbank Flooding in 5 of 20 years (1984 to 2003)
Colby Site
Standing water from local precipitation and hydrology
SHARKEY COUNTY

Figure 14

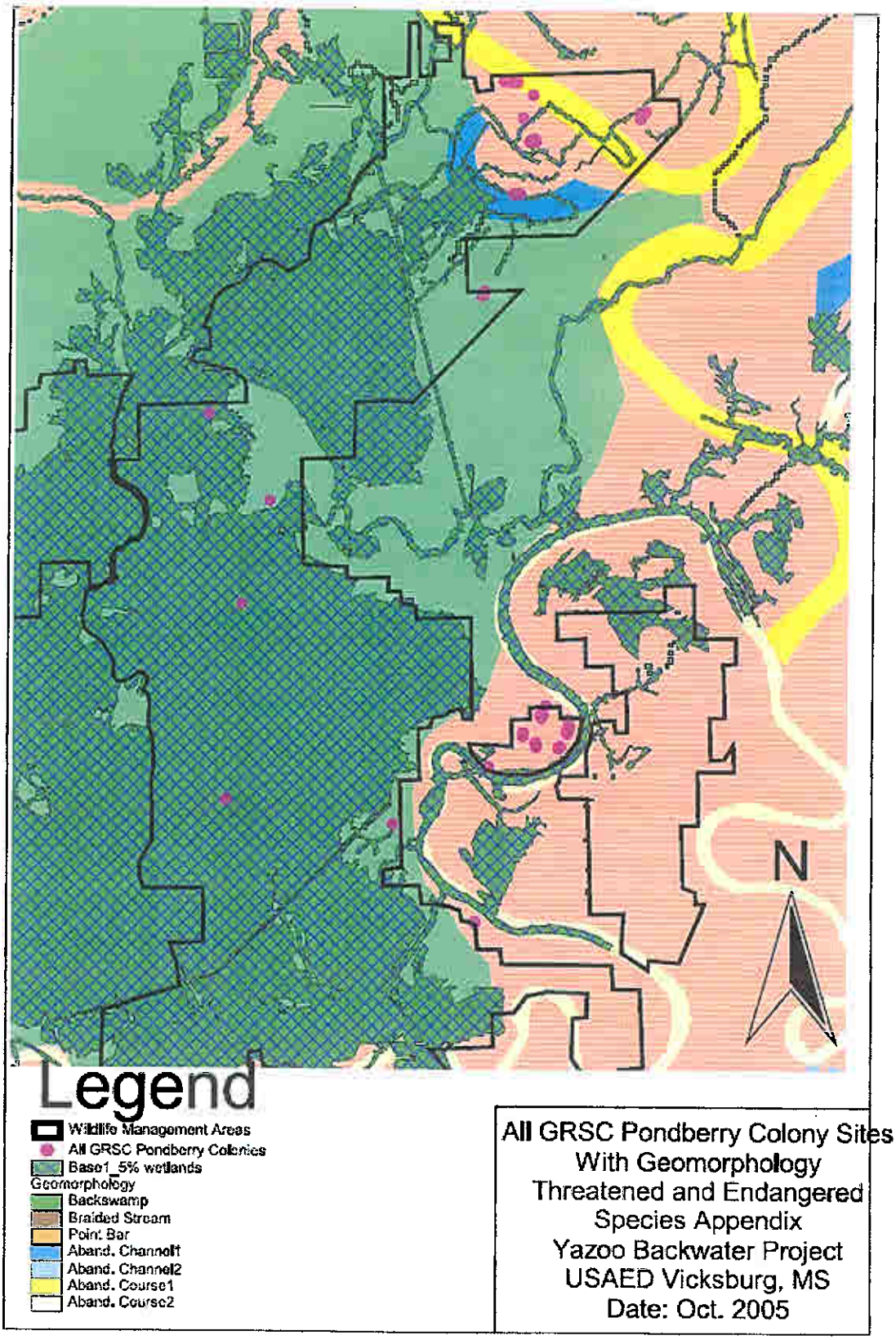
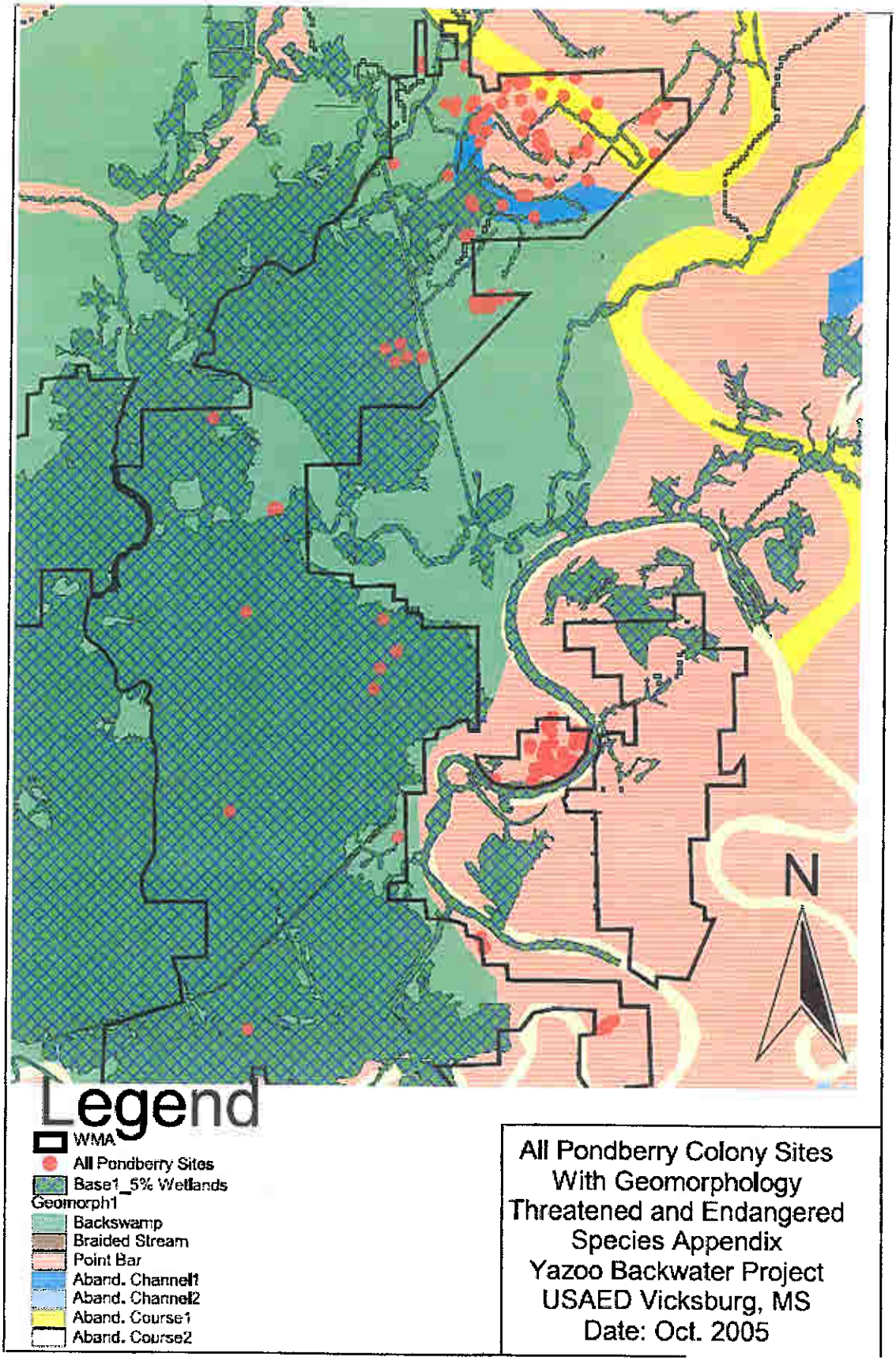

N
Legend
Wildlife Management Areas
All GRSC Pondberry Colonies
Base1_5% wetlands
Geomorphology
Backswamp
Braided Stream
Point Bar
Aband. Channel1
Aband. Channel2
Aband. Course1
Aband. Course2
All GRSC Pondberry Colony Sites
With Geomorphology
Threatened and Endangered
Species Appendix
Yazoo Backwater Project
USAED Vicksburg, MS
Date: Oct. 2005

Figure 15



All Pondberry Colony Sites
With Geomorphology
Threatened and Endangered
Species Appendix
Yazoo Backwater Project
USAED Vicksburg, MS
Date: Oct. 2005

Figure 16

TABLE 14-3
WITHOUT-PROJECT DISTRIBUTION OF PONDBERRY COLONIES
ON DELTA NATIONAL FOREST BY DURATION ZONE

Percent Duration		Days	Pondberry Colonies		GSRC Colonies	
			Number	Percent	Number	Percent
Above 5.0	Outside 2-year frequency	<1	92	50.6	29	59.2
	<2.5	1 to 6	63	34.6	18	36.7
	2.5 to 5.0	7 to 13	8	4.4	0	0.0
Below 5.0	5.0 to 7.5	14 to19	5	2.8	0	0.0
	7.5 to 10.0	20 to 26	13	7.1	2	4.1
	10.0 to 12.5	27 to 33	1	0.5	0	0.0
	>12.5	>34	0	0.0	0	0.0
Total			182	100.0	49	100.0

56. Of the 47 colonies sampled in the 2001 reevaluation report that occurred above the 5 percent backwater duration, 96 percent were in apparent excellent or good health (Table 14-4). This suggests that the 5 percent backwater duration is not critical to the health of pondberry colonies. It does not indicate that 5 percent saturation during the growing season is not critical to pondberry colony health, but the source of the 5 percent saturation is more likely from precipitation or other local hydrology than from overbank flooding.

TABLE 14-4
DISTRIBUTION OF PONDBERRY COLONIES
ON DELTA NATIONAL FOREST BY DURATION ZONE AND COLONY HEALTH

Percent Duration		2001 Colonies	2000 Colony Health			
			Excellent	Good	Fair	Poor
Above 5.0	Outside 2-year frequency	29	17	11	1	0
	<2.5	18	4	13	1	0
	2.5 to 5.0	0	0	0	0	0
Below 5.0	5.0 to 7.5	0	0	0	0	0
	7.5 to 10.0	2	1	1	0	0
	10.0 to 12.5	0	0	0	0	0
	>12.5	0	0	0	0	0
Total		49	22	25	2	0

57. Under with-project conditions, 65 percent of known pondberry colonies and 69 percent of the 49 sampled colonies would be affected by less than 2.5 percent backwater flood duration (Table 14-5). Twenty-six percent of known pondberry colonies and 27 percent of the 49 sampled colonies would be affected by duration events of between 1 and 13 days every 2 years by a backwater event. Therefore, 91 percent of the known pondberry sites and 96 percent of the 49 sampled colonies would not meet the hydrology criterion (as it relates to

backwater flooding events) for jurisdictional wetlands under with-project conditions. Although there would be a shift of colonies from the 2.5 percent to less than 2.5 percent, the percentage of colonies above the 5 percent duration under the with- and without-project conditions would remain approximately 90 percent for known colonies and 96 percent for the 49 sampled colonies. The results from the pondberry wetland and geomorphology assessment clearly indicate that the project is not likely to adversely affect the pondberry.

TABLE 14-5
WITH-PROJECT DISTRIBUTION OF PONDBERRY COLONIES
ON DELTA NATIONAL FOREST BY DURATION ZONE

Percent Duration		Days	Pondberry Colonies		2001 Colonies	
			Number	Percent	Number	Percent
Above 5.0	<2.5	<1	118	64.8	34	69.4
	2.5	1 to 6	46	25.3	13	26.5
	2.5 to 5.0	7 to 13	2	1.1	0	0.0
Below 5.0	5.0 to 7.5	14 to19	3	1.6	0	0.0
	7.5 to 10.0	20 to 26	11	6.0	2	4.1
	10.0 to 12.5	27 to 33	0	0.0	0	0.0
	>12.5	>34	2	1.2	0	0.0
Total			182	100.0	49	100.0

2005 Reevaluation of Pondberry (*Lindera melissifolia*) in the Big Sunflower River and Yazoo Backwater Areas

58. The entire document and detailed data analyses are contained in Attachment 6. The purpose of this study was to resample the 62 colonies documented in the 2001 reevaluation report and update, if appropriate, the existing pondberry profile. The study area for this project was the same as the 2001 study and included the DNF in Sharkey County, Mississippi, and several parcels of private land in Bolivar County. Data were collected on 62 colonies (50 in DNF and 12 on private land). Data collected were similar to those collected in the 2001 study and included physical characteristics of the colony, colony health, forest stand conditions, soil characteristics, and evidence of localized depressions. The elevation and flood frequency of each colony determined from the 2001 reevaluation were used in the 2005 analysis.

59. There were five colonies from the 2001 study where no aboveground evidence was present in the 2005 study. Two of these were in the Bolivar and Sunflower Counties sites (private lands), and three were on DNF. In the 2001 study, these colonies were inundated by water from nearby agricultural fields to the point of wilting. This suggests that colonies might be affected by repeated and prolonged inundation. The three colonies on DNF had low numbers of stems in 2001 and were in fair or good health. These sites should be monitored in any future surveys to evaluate whether the colonies reestablish.

60. The analysis found that common associate species were similar to previous studies on the Mississippi pondberry populations. Sweetgum, overcup oak, and pecan were the most common overstory species, and sugarberry, swamp dogwood, and red maple were the most common associate shrub species.

61. Pondberry colonies in 2005 had on average fewer, smaller, and shorter stems than in 2000, although there was no statistical difference between the numbers of stems observed at each colony in 2000 and in 2005 (this relationship does not include colony 52 at which an estimated 16,000 stems were observed in 2005). Most colonies were of good or excellent health in 2000 and of good health in 2005 (Table 14-6). When compared to 2000, the number of colonies where there was observed fungal damage was 80 percent less in 2005. Conversely, more colonies had insect damage, and nearly equivalent numbers of colonies showed signs of dieback in 2005.

TABLE 14-6
COMPARISON OF COLONY HEALTH,
FUNGAL DAMAGE, INSECT DAMAGE, AND STEM DIEBACK

Year	Health (%)					Number of Colonies		
	NAE[a/]	Excellent	Good	Fair	Poor	Fungal Damage	Insect Damage	Stem Dieback
2000	0	40	45	13	2	27	42	52
2005	8	13	68	8	3	5	52	54

a/ No aboveground evidence of pondberry.

62. The greatest change in colony health (73 percent reduction) on the DNF colonies occurred on those colonies classified as excellent in 2000 (Table 14-7). The majority of the change (59 percent) was to the good health classification in 2005. Fourteen percent of the colonies classified as excellent in 2000 were classified as fair or poor. Colonies classified as in good health in 2000 had a 28 percent reduction in number compared to 2005. Sixteen percent of the colonies classified as excellent in 2000 were classified as fair or poor in 2005, and eight percent had no aboveground evidence in 2005.

TABLE 14-7
COMPARISON OF COLONY HEALTH 2000 TO 2005
DELTA NATIONAL FOREST COLONIES

Year		Colony Health				Total
		Excellent	Good	Fair	Poor	
2000		22	25	2	0	49
2005	Excellent	6	1	0	0	7
	Good	13	18	1	0	32
	Fair	2	3	0	0	5
	Poor	1	1	0	0	2
	NAE[a/]	0	2	1	0	3

a/ No aboveground evidence of pondberry.

63. The greatest change in colony health on the Bolivar and Sunflower Counties colonies (private land) occurred on colonies classified as fair in 2000 (Table 14-8). Six of the 12 colonies were classified as fair in 2000. Five of these colonies were classified as good in 2005, and no aboveground evidence was found on the remaining colony. Overall, 5 of the 12 colonies were classified as good or excellent in 2000, with 10 colonies classified as good or excellent in 2005.

TABLE 14-8
COMPARISON OF COLONY HEALTH 2000 TO 2005
BOLIVAR AND SUNFLOWER COUNTIES COLONIES

2000		Colony Health				Total
		Excellent	Good	Fair	Poor	
		3	2	6	1	12
2005	Excellent	1	0	0	0	1
	Good	2	1	5	1	9
	Fair	0	0	0	0	0
	Poor	0	0	0	0	0
	NAE[a/]	0	1	1	0	2

a/ No aboveground evidence of pondberry.

64. There appears to be some reduction in the apparent health of colonies on the DNF colonies, but an increase in apparent health on the colonies in Bolivar and Sunflower Counties (above 100-year frequency). Although these health assessments are qualitative, they are relative within and between years and represent the best available information on colony health. However, it is difficult to make a strong conclusion about the long-term trend of colony health from these data.

Conclusions

65. The only potential hydrologic effect of the project is associated with a change in the characteristics of the backwater flooding events. It appears that, based on 14 years of data collection and analysis, local hydrology and precipitation have a greater influence on pondberry than backwater flooding events. Notably, the project will not affect local hydrology. These data and analysis do not discount the importance of water in the life cycle requirements and ecology of pondberry, but rather indicate that the frequency of overbank backwater flooding does not appear to play a critical role. If it did play a critical role, given the extensive databases, some quantitative or qualitative indication among colonies to support that conclusion would be evident. Therefore, the project is not likely to adversely affect pondberry. Specific points that support this conclusion are:

a. The 1991, 2000, and 2005 analyses of pondberry sites indicate association with localized depressions .

b. The study area receives an average annual rainfall total of 56 inches.

c. The 2000 and 2005 data indicated no statistical difference among the average values for stem numbers, number of clumps, stems density, stem diameter, stem height, and flood frequency groups on the 50 colonies on DNF. However, in 2005, the average stem height and diameter on the Bolivar and Sunflower Counties colonies (flood frequency > 100 years) was greater on the DNF colonies. There were some weak to moderate correlations among pondberry and site characteristics .

d. The 2001 statistical analysis by Dr. Magoun concluded that changes in elevation and other ground-cover species tend to affect different pondberry characteristics, but not the occurrence of pondberry colonies. He also concluded that flood frequency does not affect the number of pondberry clumps, stems, dead stems, females, mature fruit, stem height, or average stem diameter. Dr. Magoun also concluded that the indepth multivariate exploration did not support the FWS claim that the 2001 analysis of correlations between the densities of pondberry colonies at various sites to the current frequency of flooding at such sites is insufficient to discount any effect of flooding .

e. The 1984 to 2003 analysis showed little overbank flooding of the studied colonies in 20 years, but apparent colony health was good to excellent. The health of colonies was predominantly good to excellent across the entire range of flood frequencies (< 1 to 17 years) in 2000 and 2005.

f. There is a high degree of pondberry site association with areas above the 5 percent duration backwater flood and point bar and abandoned channel/course geomorphology .

66. In addition, implementation of the recommended plan would have no direct impacts on pondberry because no plants were documented within the construction right-of-way. Land clearing and the practice of clearcutting timber pose two of the greatest threats to pondberry. However, the project would not induce land clearing or contribute to promoting timber practices detrimental to pondberry.

Future Monitoring and Research

67. The Vicksburg District, in partnership with the USFS and FWS, has committed to conduct extensive pondberry research. The Vicksburg District has entered into a $5 million, 6-year cooperative agreement with USFS to conduct experiments on pondberry in the following areas--the role of flooding and sunlight; impact of periodic flooding on competition; dynamics of native pondberry colonies; and role of stem dieback, population genetics, and seed ecology. This program involves the propagation of over 80,000 pondberry plants to conduct genetic testing, pathogen and predation analyses, and flood regime requirements. The latter includes both laboratory and field experiments involving 12 1-acre ponds (impoundment cells). More detailed discussions of the experiments to be conducted under this agreement are presented below.

Role of Flooding and Sunlight in the
Ecophysiology and Growth of Pondberry

68. Soil inundation and light availability are prominent environmental variables, which could regulate vigor of native pondberry colonies. The interactions of these two variables on the physiology and growth of pondberry are being examined by varying soil moisture (flooding) and light intensity in the impoundment cells. During this 3-year study, growth and vigor of pondberry as affected by the treatment combinations will be assessed by measuring above and below ground biomass production, photosynthetic light response, and instantaneous nitrogen use efficiency .

Impact of Periodic Flooding on Competition
Between Pondberry and Other Plants

69. A series of competition studies using combinations of different flooding regimes, light availability, ratios of competitor species, and pondberry gender to elucidate the role of periodic inundation on pondberry competitiveness are being conducted. These studies are being conducted in the greenhouse facilities, with some replication at the impoundment facility .

Ecosystem Dynamics and the Sustainability
of Native Pondberry Colonies

70. Measurement of variables such as light intensity, hydroperiod, air and soil temperatures, relative humidity, and precipitation are being conducted to determine the environmental effects on flowering, seed production, seedling recruitment, and other biological variables critical to the sustainability of pondberry colonies. Variables are being measured across the topographical range of pondberry colonies in the DNF, as well as other important sites. This fundamental study will provide baseline information defining the temporal dynamics of pondberry colonies under ambient environmental conditions. In combination with the controlled experiments, this information will allow further assessment of the potential impact of altered hydroperiods on pondberry colonies. An important part of this research will involve marking and mapping (e.g., using a grid system) existing colonies to determine whether they are increasing, decreasing, or staying the same size from year to year.

The Role of Stem Dieback in
Pondberry Health and Survival

71. Whether pondberry dieback and decline can influence survival of this species under different flooding conditions needs additional studies. Preliminary studies investigating the causal agent(s) of pondberry dieback have suggested a biotic cause associated with one or more

fungal pathogens. Evaluations are being conducted to determine whether stem dieback seen in the field can be attributed to pathological causes. To investigate the role of fungal pathogens, the putative causal agent(s) from infected pondberry plants are being isolated. Should a fungus prove to be the causal agent, the range of virulence of different isolates will be measured, and the effects of changes in flooding and light availability on disease development will be determined. In addition, preventive applications of systemic and/or topical fungicides will be used to ensure pathogen-free plant material so that putative environmental and biotic causes of dieback can be explored. A determination of whether dieback affects seed production and thus, long-distance dispersal of this species from clonally propagated, local populations, and whether changes in flooding can influence the effects of the disease(s) on flowering and seed production, will be attempted.

Understanding Pondberry Population Genetics

72. Genetic markers are being used to look at inter- and intrapopulation genetic variation across the range of pondberry. Describing the population genetic structure of wild pondberry will facilitate the development of an efficacious plan for preserving and promoting genetic variation in the species. This research involves collecting leaves from multiple individuals from all populations, generation of identifying markers, and appropriate statistical analyses .

Pondberry Seed Biology and Physiology

73. Several studies are being conducted that will provide a better understanding of normal pondberry seed biology and physiology, including optimum germination temperatures, seed moisture content as related to viability, length of seed viability in soil (seed bank tests), several biochemical measures of seed vigor, and pollen viability. This suite of laboratory and field studies will provide a better understanding of the factors that may limit seed germination in the field and provide important information for sustaining viable pondberry populations .

LOUISIANA BLACK BEAR

Description

74. The Louisiana black bear was listed as a Federally threatened species on 7 January 1992 (57:588-595). The Louisiana black bear is one of 16 recognized subspecies of the American black bear Ursus americanus. Other free-ranging bears of the species Ursus americanus within the same range of the Louisiana black bear have also been designated as threatened due to similarity of appearance. Black bears in the region are normally black with a brown muzzle and an occasional white blaze on the chest (Black Bear Conservation Committee, 1992). The Louisiana black bear is distinguished from other black bears by possessing a skull that is longer,

more narrow, and flat, and possessing proportionately large molar teeth (Nowak, 1986). While size varies depending on the quality and quantity of available food, large males may weigh more than 600 pounds.

Range and Population Level

75. The American black bear was formerly widespread in North America, from northern Alaska and Canada, including Newfoundland, south to central northern Mexico (Lowery, 1974). The Louisiana black bear, subspecies of the American black bear, historically occurred in bottom-land forests from eastern Texas through all of Louisiana to southern Mississippi (Hall, 1981). Today, the black bear population is estimated to be less than 500 individuals (Black Bear Management Handbook, 1996).

Life History

76. Although classified as carnivorous, black bears are opportunistic omnivores since their diet is largely determined by food availability. Black bears spend considerable amounts of time foraging for food. The types of plants eaten vary with the season. Plants that bears may consume during spring and summer months include dewberries, blackberries, wild grapes, soft mast-producing shrubs, persimmons, and pokeweed. In the fall, acorns, pecans, corn, oats, and wheat may be consumed. Animal matter that black bears may consume include invertebrates and carrion.

77. The movement of bears and establishment of their home range are determined by food, water, cover, denning sites, and contact with potential mates. Adult males generally have ranges 3 to 8 times larger than adult females. Home range shape appears to be influenced by available forest cover (Marchinton, 1995). In a movement ecology study completed in fragmented bottom-land hardwood habitat, Marchinton (1995) found mean home ranges of 20.20 square miles and 4.87 square miles for males and females, respectively. Corridors providing cover may facilitate the movement by bears between highly fragmented forest habitats (Pelton, 1982; Norr, 1987).

78. The reproductive biology of the Louisiana black bear is not well-known. Most reproductive characteristics of the bear are assumptions based upon studies of black bears elsewhere. Mating generally occurs in the summer months. After a gestation period of 7 to 8 months, the cubs are born in winter dens in January and February. Litter sizes in the Tensas River Basin range from one to three. Cubs emerge from the den with their mother in the spring and stay with her throughout the year suckling and later, eating solid foods. They den with her the following winter, emerge with her again in the spring, and live with her until the summer when the family unit dissolves.

79. Black bears use hollow trees, brush piles, and ground nests for winter dens. Adult males and subadults use ground dens with greater frequencies than adult females. Weaver and Pelton (1994) found that bears using ground nests and brush pile dens appeared to be more vulnerable to human disturbance than those in tree dens. Tree dens may also be an important component for female reproductive success, especially in areas subject to flooding (Smith, 1985).

80. Black bears may live over 25 years in the wild. The most important natural factor regulating black bear populations appears to be variation in food supply and its effect on physiological status and reproduction (Rogers, 1976).

Reasons for Decline

81. Black bears are primarily animals of heavily wooded areas. Destruction or modification of bottom-land hardwood habitat represents the most significant threat to the Louisiana black bear. In addition, habitat fragmentation has limited the potential for the present population to expand its current range.

Black Bear Surveys

82. The Mississippi Department of Wildlife, Fisheries and Parks Louisiana black bear database dated August 2004 contained 188 sightings statewide and 48 sightings in the project area since 1988 (Table 14-9) (Attachment 7). Also, there are four known den trees in or near DNF. Elevations of the sites were determined using a professional survey crew to determine the flood frequency of the site.

TABLE 14-9
BLACK BEAR SIGHTINGS
IN THE PROJECT AREA, 1988-2004

Year	Number of Sightings
1988	2
1989	0
1990	0
1991	0
1992	0
1993	0
1994	0
1995	1
1996	4
1997	6
1998	1
1999	8
2000	8
2001	0
2002	0
2003	7
2004	11

83. Thirty-eight acres of bottom-land hardwoods at the pumping plant site would likely be cleared for construction. This area was surveyed in February 2000 by Corps biologists. No evidence of bear activity (e.g., scratch marks on trees or suitable denning sites) was observed .

DATA ANALYSIS

84. An analysis of Louisiana black bear sightings in the project area was conducted using a Tobit model to regress the number of bear sightings against time (Attachment 8). The analysis concluded that there has been a significant increase in bear sightings in the project area. However, there was no indication from the data why the increase was occurring. The increase in sightings could come from an increase in human population; an increase in human interaction in bear habitat; an increase in bear population; or variances in annual environmental conditions. Therefore, no valid conclusion concerning changes in bear populations in the project area can be made from the data.

85. The elevation of the four den trees ranged from 86.23 to 92.13 feet, NGVD. Three of the trees occur in the 1-year or less flood frequency and one occurs in the 1- to 2-year flood frequency. Pump operation would have no effect on lands at or below the 1-year frequency.

86. The project would reduce flood duration below the 5 percent duration on 26,300 acres. Approximately 15,900 of these acres are forested. However, 8,400 of these acres are in some form of public protection (Wetland Reserve Program, National Forest, etc.) and would not be cleared. Of the 7,500 acres in private ownership, 2,400 acres are recently reforested for conservation purposes and likely would not be cleared in the future. Approximately 2,600 acres of the remaining 5,400 acres of forested lands are dedicated to conservation purposes (e.g., hunting clubs) and also likely would not be cleared. The probability of the remaining 2,500 acres of private-owned forested land being cleared is low because regulatory provisions of Swampbuster provide disincentives for additional clearing for agricultural purposes. In addition, a GIS analysis of the 1970s, 1980s, 1990s, and 1999 land use indicate that the number of forested acres has remained relatively stable since the early 1980s. Of the 251,780 forested acres in the early 1970s, approximately 200,000 of the same forested acres remained in the early 1980s (199,776 acres), early 1990s (200,505), and 2001 (198,001). Of the 200,000 acres of forest in the project area, approximately 73,000 acres are privately-owned nonwetland forest. These acres were never converted (since the early 1970s), despite lacking jurisdictional protection.

Conclusions

87. Because there were no Louisiana black bear or signs of bear activities in the construction right-of-way, there would be no direct impacts to the Louisiana black bear as a result of construction activities.

88. Although an increase in bear sightings has occurred in the study area since 1988, no valid conclusions about changes in Louisiana black bear populations can be made from these data.

89. Effects to denning trees as a result of changes in backwater flood frequency would likely not occur because known trees occur near or below the 1-year frequency and the operation of the pump would not change the 1-year frequency flood.

90. The probability of project-induced clearing of forested land is extremely low because the majority of lands that potentially would be reduced below the 5 percent duration are in some form of protection, Swampbuster provisions provided disincentives for clearing for agricultural purposes, and GIS analysis *indicates* the amount of forested lands have remained stable in the project area since the early 1980s. Therefore, the project is not likely to adversely affect the Louisiana black bear.

Beneficial Effects

91. The project includes the reforestation of 62,500 acres of cleared lands as a nonstructural flood damage reduction feature. This feature will provide substantial increase in potential habitat for both the pondberry and the Louisiana black bear.

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