

Survey for Pondberry (*Lindera melissifolia*) on Portions of Dahomey National Wildlife Refuge in Mississippi



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Introduction

Pondberry (*Lindera melissifolia*) is a deciduous, aromatic shrub associated with wetland habitats of bottomland hardwoods in the Southeastern United States (USFWS 1993). The plant was federally listed as an endangered species in 1986 (USFWS 1986). This rare plant has extant populations from North Carolina, South Carolina, Georgia, Alabama, Arkansas, Missouri, and Mississippi. Sixteen populations of pondberry have been located within the Delta Region of Mississippi (USFWS 2014). However, there is limited suitable habitat for this species in the Delta due to the extensive deforestation for agricultural production and altered natural hydrology.

Dahomey National Wildlife Refuge has the potential to support pondberry given the geography and prior land-use practices. Stewart (1990) conducted a botanical survey of the Dahomey Woods from February to June 1990, spending approximately 30 days walking all sections of the woods and paying particular attention to areas that had the greatest potential to support pondberry. He indicated that the Dahomey Woods appeared suitable for the plant but did not locate the species. Nonetheless, he indicated more intensive searches should be undertaken with concentrated efforts associated with areas having extended hydroperiods into the growing season. Specifically, he mentions wetland areas in Sections 1, 10, 11, 12, 19, 30, and 32 (Figure 1). In 2008, a survey of select areas of the refuge was unsuccessful in locating the plant (USFWS, unpubl. data). However, large portions of the refuge were still not surveyed. Therefore, a search of previously unsurveyed areas of the refuge as well as examination of some sites recommended by Stewart (1990, pages 7-8) were undertaken. Figure 1 shows areas surveyed during 2008 and 2014. From his report, it is presumed that Stewart surveyed all forested areas within the Refuge boundary.

Study Area

Dahomey NWR is located in the Mississippi Alluvial Valley in Bolivar County, MS. The refuge is 9,681 acres consisting predominantly of bottomland hardwood forest. Approximately 8,126 acres of the forest is mature hardwoods having been selectively cut on numerous occasions prior the establishment of the refuge in 1992. Another 849 acres of previous agricultural fields have been reforested since 1992 (USFWS 2005). The dominant overstory trees consist of green ash (*Fraxinus pennsylvanica*), overcup oak (*Quercus lyrata*) and sweetgum (*Liquidambar styraciflua*) on moderately drained sites; higher sites contain willow oak (*Q. pagoda*), water oak (*Q. nigra*), Nuttall oak (*Q. texana*), sugarberry (*Celtis laevigata*), cedar elm (*Ulmus crassifolia*), and bitter pecan (*Carya cordiformis*). There are very few permanently flooded wetlands on the refuge, with bald cypress (*Taxodium distichum*) restricted to these areas.

The topography of the refuge is relatively even with a general change of only a few feet. Numerous small bayous and creeks were dredged prior to Service ownership to facilitate draining of agricultural fields. However, small depressions within the mature forest stands retain water into the growing season. The entire refuge's hydrology was historically influenced by winter and spring overbank



flooding of the Mississippi River, but since the completion of the flood abatement levees in the mid-1900s, seasonal flooding is solely a function of precipitation.

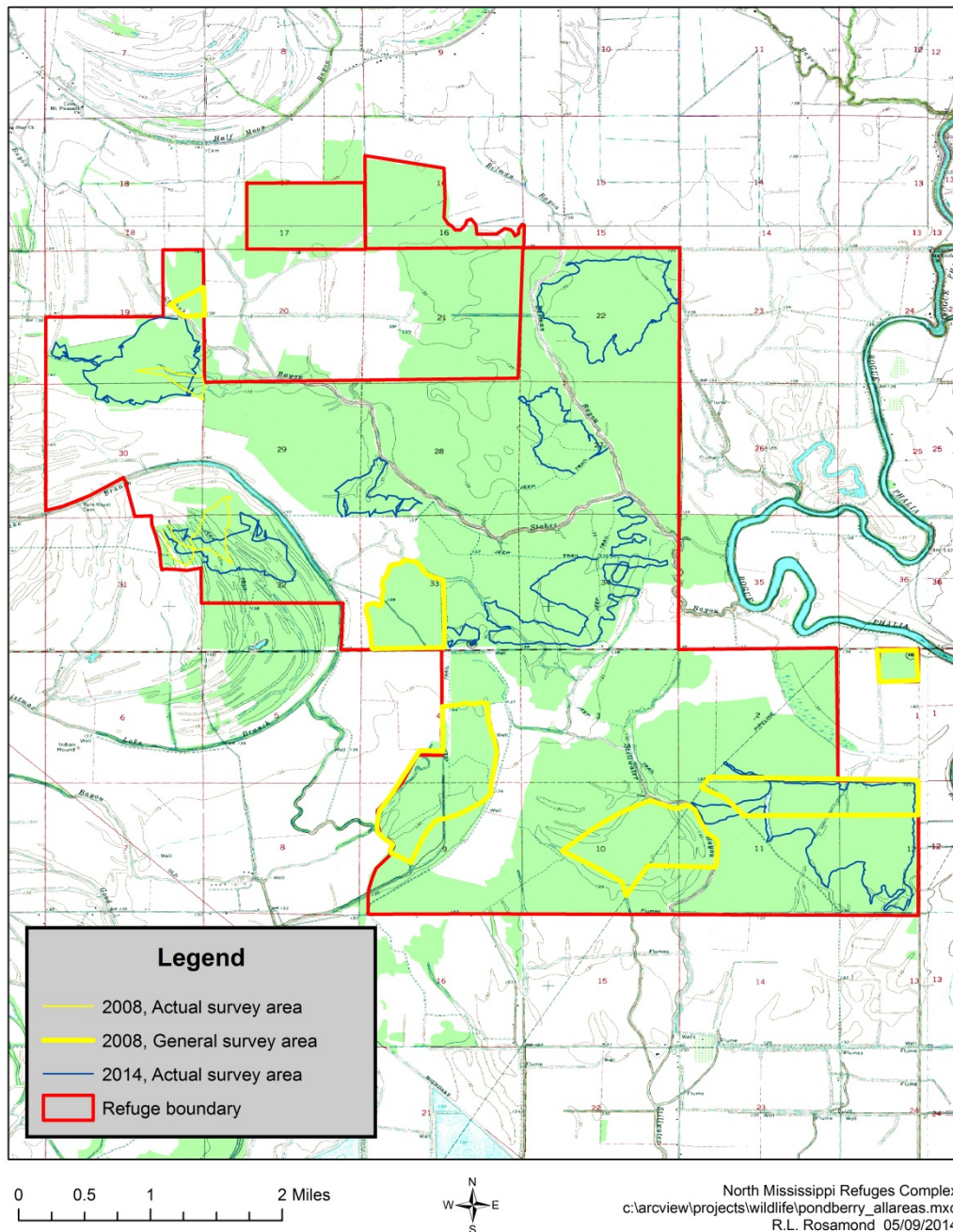


Figure 1. Areas surveyed for pondberry in 2008 and 2014. Stewart (1990) is presumed to have covered all forested areas within the refuge boundary. Lines indicating actual survey areas are the paths walked by surveyors, obtained through the track feature on handheld GPS units. General survey areas indicate the approximate boundaries covered by surveyors, but not the actual paths travelled.

Methods

Survey efforts were restricted to late March and early April 2014 based on known flowering phenology of pondberry to improve detection by observers. The only other yellow-flowering shrubs expected to be encountered during this period were spicebush (*Lindera benzoin*) and swamp privet (*Forestiera acuminata*). Surveying was restricted to mature forest stands. Some of these stands or locations were noted by Stewart (1990) and may not have been completely surveyed previously. Other stands were selected based on review of topographic maps and aerial photographs to locate areas with seasonal wetlands, areas presumed to have the greatest likelihood of encountering the plant. Attempts were not made to conduct 100% visual surveys of each forested area. Instead, observers targeted depressional wetlands within the stands. Attempts were made to conduct 100% visual inspections of these areas by a single observer. Thus, large portions of stands may have only been partially inspected. Each observer used a GPS unit and the track function as a means to identify search areas. The locations of suspected colonies of pondberry were geo-referenced with a hand-held GPS unit. Areas searched and locations of suspected pondberry were mapped using ArcMap 10.0. A follow-up inspection of suspected pondberry colonies was conducted on April 24 and May 6, 2014 to examine diagnostic features of the emerged leaves to confirm species identity as pondberry or spicebush.

Results

Eight locations (~2200 acres) were surveyed on Dahomey NWR for pondberry on March 25, 26 and April 2, 2014 (Figures 2 and 3). All but one of the stands surveyed were located north of State Highway 446. Three observers spent approximately 30 hours over the 3 days searching for pondberry. A single population of pondberry was located just east of the headquarters road and north of the closed area in a depressional wetland of <7 acres (coordinates: N33.712326, W90.909495, WGS 84). This colony consisted of 220 live stems in a 22 x 35 foot area on the western edge of the wetland. Stems were in 6-12 inches of water. No attempt was made to distinguish the sex of the plants based on the flowers. Some stem die-back was noted. The site was dominated by a relatively closed canopy of green ash with little to no understory vegetation. There was no indication of any anthropogenic alterations to the site which would affect the hydroperiod of this depression.



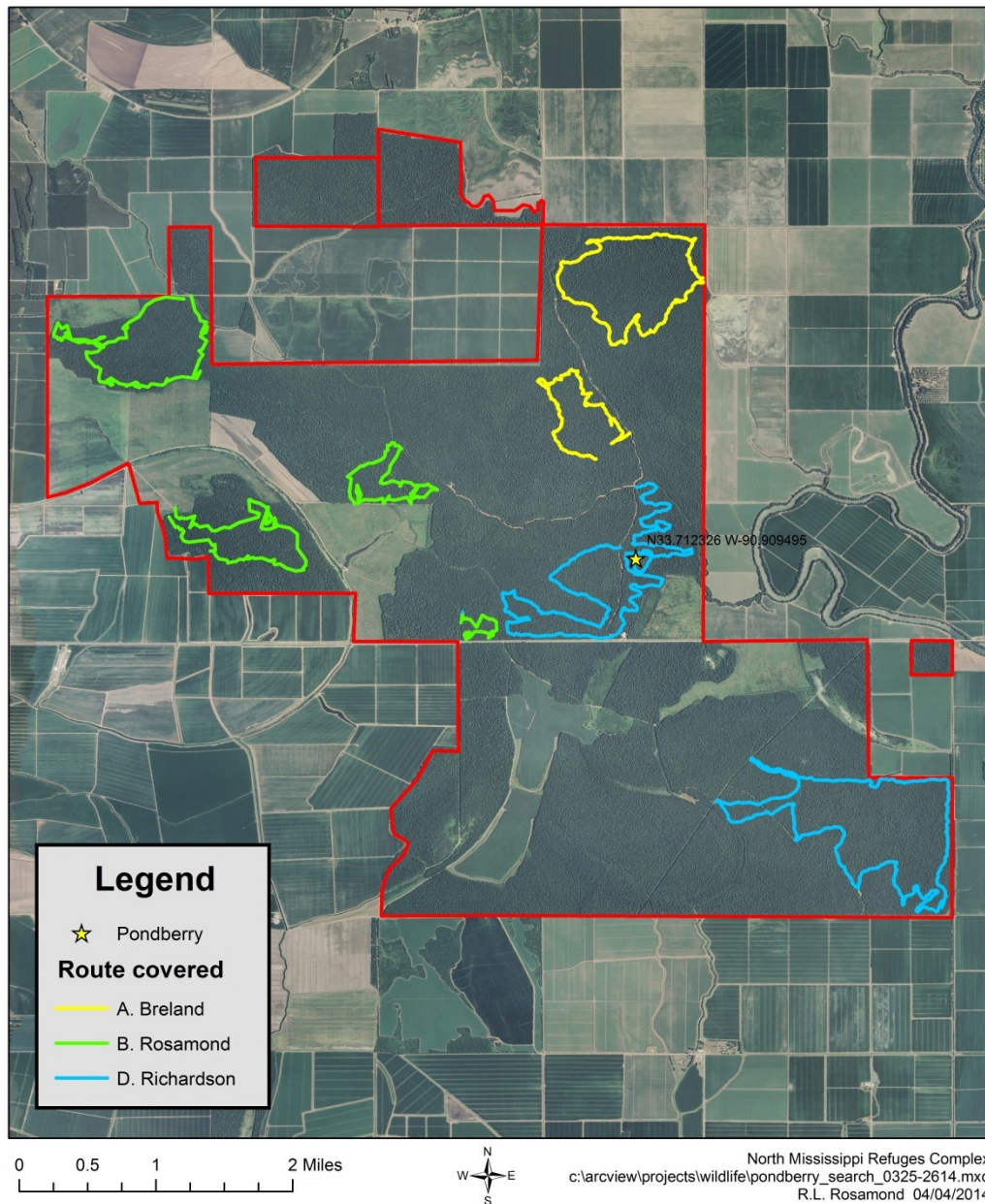


Figure 2. Location of observers' survey tracks and the pondberry (*Lindera melissifolia*) colony at Dahomey National Wildlife Refuge, Bolivar County, Mississippi in March and April, 2014.



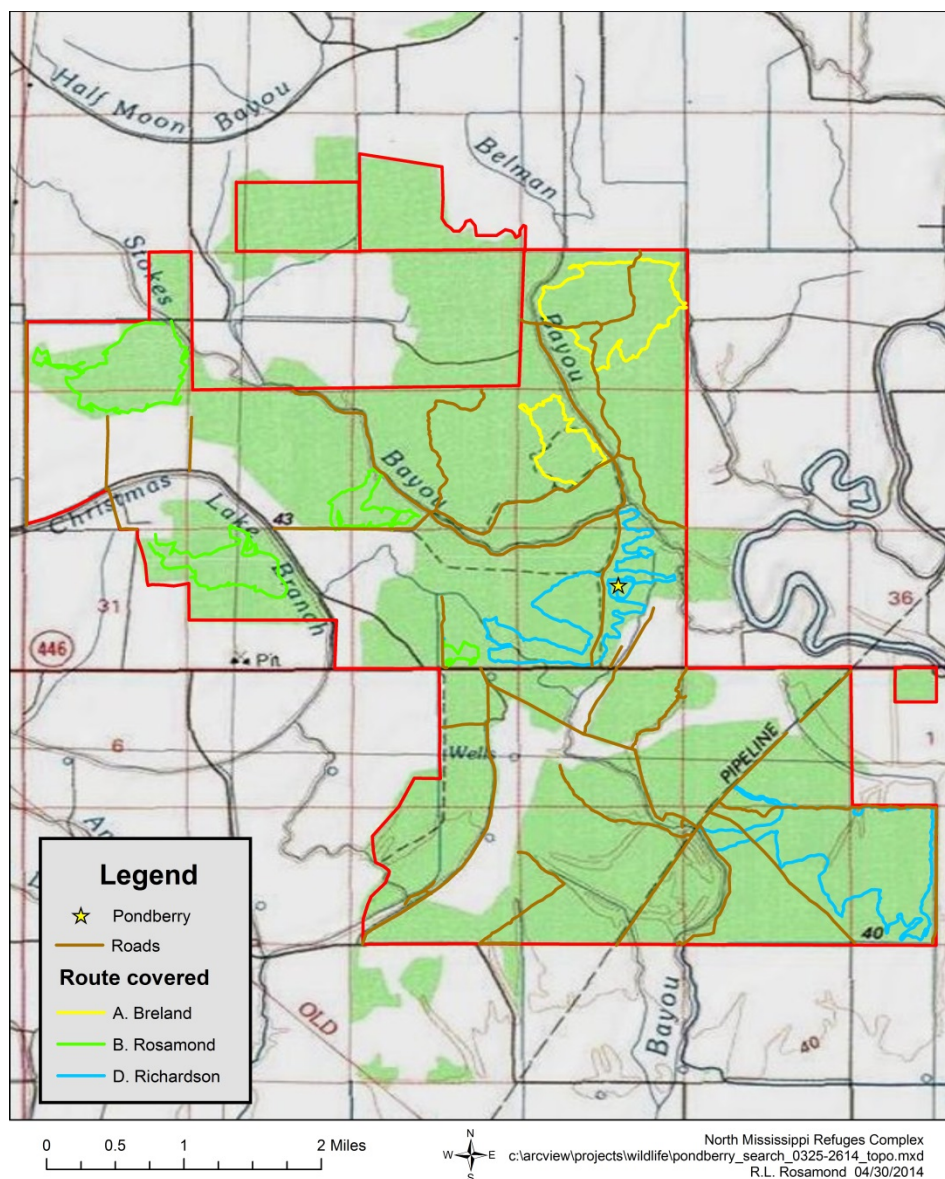


Figure 3. Topographic map delineating the survey tracks of each observer and the pondberry (*Lindera melissifolia*) colony at Dahomey National Wildlife Refuge, Bolivar County, Mississippi in March and April, 2014.

Discussion

Previous surveys for pondberry on Dahomey NWR have been unsuccessful (Stewart 1990, USFWS Unpubl. data 2008). The location of the single pondberry colony during the present survey was in an area partially surveyed by Stewart (1990). Given the relatively small size of the colony and the difficulty of a 100% survey, it is quite understandable the colony was not previously discovered. The present survey likewise did not do a 100% survey within each of the eight sites and the focus was only on high



potential micro-habitat sites (i.e., flooded depressions). Therefore, other colonies could have been missed and this survey effort should not be considered sufficient for Section 7 consultation. Additional surveying of Dahomey NWR is needed to more completely assess the seasonally flooded forested wetlands which could support pondberry. Winter water coverage data for the refuge spanning multiple years is available which may improve future survey efficiency by identifying areas with potential to support pondberry. Several areas south of Hwy 446 have mature forest stands that retain surface water into the early growing season and were identified by Stewart (1990) as possible sites should be investigated in subsequent years during flowering periods.

Presently 61 extant populations of pondberry are found in 6 states (USFWS 2014). In Mississippi, 16 populations have been identified; 13 of those being located on the Delta National Forest, Yazoo County, 2 in Bolivar County on private lands (one of which is partially protected by a wetlands conservation easement held by the USFWS), and 1 population in private ownership in Sunflower County. Those populations on the Delta National Forest appear to be stable or in decline but recurring monitoring of these populations are needed to better determine population trends (USFWS 2014). Moreover, the stability of the larger population in Bolivar County (Hester Property Conservation Easement) may also be in decline from altered hydrology and habitat changes (USFWS 2014). Thus, the importance of a previously unknown pondberry population in Mississippi in federal ownership provides additional support for species recovery. Other surveys for pondberry on national wildlife refuges have occurred in AR, LA, MS, and TN (Felsenthal, Witsell and Baker 2010, Baker and Witsell 2012; White River, Baker and Witsell 2012; Panther Swamp, Leonard 2010; Tensas River, Gulf Coast Biological Surveys, Inc. 2003; Chickasaw, Hatchie, and Lake Isom, Crabtree 2008) without detection. However, in 2012, the Arkansas Natural Heritage Commission located the species on Wapanocca NWR (B. Peterson, Refuge Manager, Pers. Comm.).

Given the relatively small size of the pondberry population at Dahomey NWR, it is more vulnerable to extirpation from overstory habitat modification, disease, or depredation compared to other populations in the Mississippi. Tornadoes and multi-tree wind throw events could easily expose the colony to excessive sunlight that, if coupled with inadequate hydrological regimes, could result in significant stem die-back or decline (Devall 2013; USFWS 2014). Fortunately, the hydrology of the wetland the colony exists within appears to be stable without any indication of ditching or risks from natural scouring which might cause the depression to dry more rapidly. Nonetheless, two other significant threats to the Dahomey pondberry colony exist. The first is a range-wide risk from laurel wilt disease caused by a fungus (*Raffaelea lauricola*) spread from the nonnative redbay ambrosia beetle (*Xyleborus glabratus*) (Fraedrich et al. 2011). This disease has been found in at least one population in GA. The second is destruction caused by the rooting behavior of wild hogs on the refuge. Wild hog rooting for food is rampant on the refuge and tends to be concentrated near wetlands especially during the drier summer months. Rooting within 100 yards of the colony has been observed. The colony could easily be destroyed or significantly reduced in size by a single hog feeding at this location. Therefore, efforts to protect the site from feeding hogs through exclusion fencing with a wide interior buffer could minimize this threat. Opportunities to expand the colony or initiate other recovery activities should be explored in consultation with FWS's Mississippi Ecological Services Office. Monitoring the colony based on stem counts and area of coverage should be repeated every 1-2 years. Determination of the sex of the plants should be done in spring by examination of the flowers and in fall to determine presence of any fruits.



Acknowledgements

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