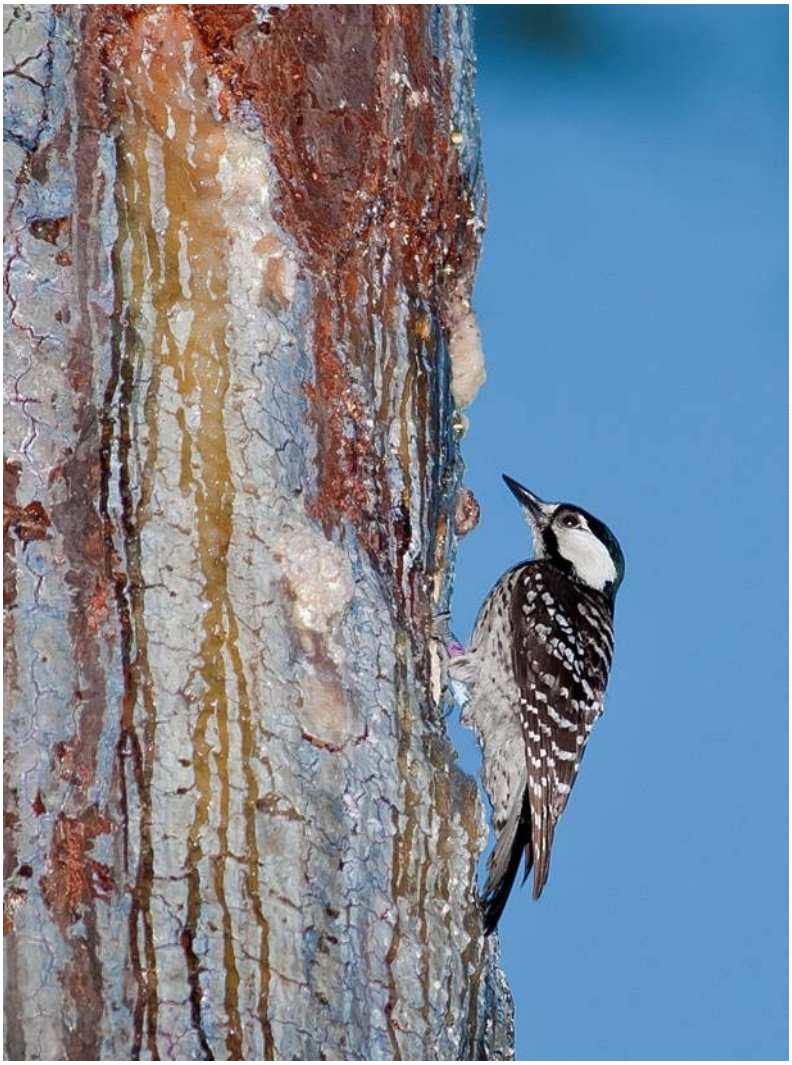
U.S. Fish and Wildlife Service

Inventory and Monitoring Plan
Big Branch Marsh National Wildlife Refuge



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Big Branch Marsh National Wildlife Refuge

Inventory and Monitoring Plan

Signature Page

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Introduction

Big Branch Marsh National Wildlife Refuge (Refuge) is the last undeveloped large natural area on the north shore of Lake Pontchartrain in Louisiana. It is unique because the Refuge is the only area in coastal Louisiana with a combination of sandy beaches, near-shore grass beds, fresh, brackish, intermediate and saltwater marshes, hardwood hammocks, cypress swamps, and pine flatwoods. Within these areas, the fish and wildlife resources are substantial. From pine savannas and flatwoods to brackish marsh, the area hosts habitat for the endangered red-cockaded woodpeckers, wading birds, neo-tropical migratory birds, marsh birds, and shorebirds. The marsh portions of the Refuge provide waterfowl habitat and are located on the edge of the Lower Mississippi Valley Flyway. Small populations of resident wildlife also exist such as deer, squirrel, quail, otter, raccoon, and rabbit. Osprey nest on the Refuge and the marshes are breeding grounds for many estuarine species.

In taking a strategic habitat conservation approach, this Big Branch Marsh NWR Inventory and Monitoring Plan (Refuge IMP) documents the prioritization of natural resource surveys to help make informed management decisions to meet the Refuge's purposes and goals. The majority of surveys considered in this plan address natural resource management objectives identified in the Refuge's Comprehensive Conservation Plan (Refuge CCP) (USFWS 2007a, 2007b), Habitat Management Plan (HMP) (USFWS 2011) or Fire Management Plan (FMP) (USFWS 2007c). The Refuge IMP describes baseline information surveys, monitoring of biotic (plant and animal populations) and abiotic resources (e.g., weather, and fire, water, and air) that will be conducted from 2015 through 2030 or until the Refuge IMP is revised.

The Refuge IMP was developed according to the Inventory and Monitoring (I&M) policy and guidance therein (701 FW 2) for the National Wildlife Refuge System (USFWS 2013a) which requires that refuges develop and follow an I&M Plan that; 1) is an operational plan for one or more refuges that clearly states I&M priorities and clarifies operational commitments, depending on available capacity; 2) relates to and follows from a refuge's CCP; 3) provides the management rationale, timing and costs for conducting refuge surveys; 4) lists the prioritized surveys, identifies the surveys selected for implementation, and documents the protocols that describe the survey objectives and methods.

Refuge Purpose

The Refuge was established on September 29, 1994, under the authority of the Emergency Wetlands Resources Act of 1986, 16 USC § 3901. The purpose of the Act is "to promote the conservation of migratory waterfowl and to offset or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitat, and for other purposes." The Act authorized the purchase of wetlands using money from the Land and Water Conservation Fund.

The purposes of the Refuge are defined by the following authorities:

Emergency Wetlands Resources Act of 1986, 16 USC § 3901 (b) (as stated above):

- For the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions.

North American Wetlands Conservation Act, 16 USC § 4401 2(b):

- To protect, enhance, restore, and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife in North America;
- To maintain current or improved distributions of migratory bird populations;
- To sustain an abundance of waterfowl and other migratory birds consistent with the goals of the North American Waterfowl Management Plan (USFWS 1986) and the international obligations contained in the migratory bird treaties and conventions and other agreements with Canada, Mexico, and other countries.

The Refuge purposes were further refined in the 1994 Final Land Protection Plan (USFWS 1994) and two subsequent Supplemental Environmental Assessments (USFWS 1996, 1998) for expansion of Big Branch Marsh NWR to include the following objectives:

- To provide habitat for natural diversity of wildlife associated with Big Branch Marsh NWR;
- To provide wintering habitat for migratory waterfowl;
- To provide nesting habitat for wood ducks;
- To provide habitat for non-game migratory birds; and
- To provide opportunities for public outdoor recreation, such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation, whenever they are compatible with the purposes of the Refuge.

Additional Refuge priorities considered were determined by the management objectives and resources of concern as described in the CCP (USFWS 2007a), HMP (USFWS 2011), FMP (USFWS 2007c), and other guiding documents (Appendix A) in the development of the Refuge IMP.

This Refuge IMP calls for continuation of current, locally developed surveys to improve management through increased understanding of long-term trends in Refuge biotic and abiotic resources. Additionally, several surveys considered are conducted in cooperation with and supported by state and regional programs that fulfill a vital information need for the Refuge. Proposed inventory and monitoring surveys are also included in this plan for future consideration of information needs but are unable to be addressed at this time with current constraints on personnel and budgets.

Methods

Guidance for developing an I&M Plan includes 1) listing surveys, 2) ranking surveys, 3) selecting surveys and 4) establishing protocols (USFWS 2013a). The method used in the development of this Refuge IMP is provided below.

Prioritizing and Selecting Surveys

A core group of refuge staff and I&M staff were identified as the "Survey Workshop Team" and included the Big Branch Marsh NWR Refuge Manager, Southeast Louisiana National Wildlife Refuges Complex Supervisory Biologist, Refuge Forester, Refuge Assistant Fire Management Officer, Refuge Planner, I&M Deputy Chief Southeast Region and I&M Coastal Ecologist. An initial survey workshop was held on October 29, 2014, at the Southeast Louisiana National Wildlife Refuges (Complex) administrative office. The objective of the workshop was to discuss and produce a list of surveys to be included in the IMP. In preparation of the workshop, each Survey Team member was given a workbook with background information including; 1) Refuge goals and objectives from the CCP, HMP, FMP and other guidance documents and 2) descriptions of on-going surveys currently listed in the Planning and Review of Inventory and Monitoring on Refuges database (PRIMR) (Appendix A).

During the initial survey workshop, the Refuge and I&M staff created a list of 44 potential surveys and survey-related activities that are currently conducted on the Refuge or are potential surveys that support Refuge management objectives or broader landscape, regional or national conservation goals. This list was generated through discussions from all participants to include 1) biological integrity of habitats, or ecological communities, 2) occurrence, abundance, or demographic elements of plant and wildlife populations, 3) elements of the abiotic environment. During the workshop, the Team identified 20 of the 44 surveys listed as "not applicable" to the Refuge resources (Appendix B).The remaining 24 surveys were subject to further priority ranking and were considered for selection in the Refuge IMP (see Selected Surveys Section below).

Also during the survey workshop, a demonstration of the Survey Prioritization Tool (SP Tool, Version 2.2) developed by the National I&M Coordination Team (USFWS 2014b) was presented to the Team. The tool entailed evaluation of the extent to which each survey scored against 24 criteria and pre-defined weighting values for each criterion (Appendix C, USFWS 2014b). Because criteria differed in scope and effect, each was assigned a weight (0-100) using a direct rating process (Goodwin and Wright 2011) that collectively reflected the Refuge's interpretation of priority of importance (Appendix C).

At the end of the survey workshop a group decision was made to weight the criteria and score the surveys individually. Over a two-month period following the workshop, the Team individually assigned weights to the prioritization criteria for the 24 criteria using the SP Tool. Use of the tool began with determining the relative importance weight for each criterion. Importance weights were calculated from rating values (1-100, 100=most important) assigned to each criterion independently from each of the Team members. These

criteria weightings were then combined in the SP Tool to create an average weighting value to be used to score the surveys by the final 24 criteria (Appendix C). Actual scores were submitted individually by each Team member and an average score was produced for each survey. Once all surveys were scored by each criterion, final values were generated in the Survey Prioritization Tool. The SP Tool produced a list of Final assignment of surveys to priority groups was further evaluated based on Refuge capacity (staff and dollars), competing time constraints, and Regional Office direction with regards to priorities under the work force planning guidance for each refuge and other factors.

Estimation of Capacity

The Southeast Region of the USFWS has recently undergone extensive reductions in staffing and budgets. Over 25% of the staffing positions have been abolished at the Complex since the approval of the CCP in 2007 (USFWS 2007a), including a critical position for implementing the Refuge IMP, the wildlife biologist position at the Refuge. To date, there is only one Supervisory Biologist position in place to serve wildlife and resource management concerns across all 8 refuges in the Complex (over 160,000 ac). The consequence of these significant staffing reductions play a major role in the estimation of capacity of the Refuge and other refuges in the Complex to carry out desired inventory and monitoring activities in the near future. This Refuge IMP attempts to recognize the limitations of staffing and budgets while considering monitoring activities needed to fulfill the purposes of the Refuge.

For the purposes of this Refuge IMP, capacity was estimated for each survey based on general information provided by the Refuge staff and information in PRIMR collected from an earlier I&M visit in 2012. Cost estimates for many of the current surveys listed in PRIMR were developed based on 4 general activities:

1. Design and pre-survey logistics (Protocol Development, Training Requirements)
2. Field Work (in and out of the door)
3. Data Management (data entry checking)
4. Data Analysis and Reporting (summaries, adaptive management)

For each category, an index was created based on total hours for the survey activity. These estimates should be considered interim, as capacity changes from year to year as it is influenced by staffing and budget changes. Cost estimates in PRIMR were reviewed and updated by Refuge and I&M staff during this Refuge IMP development process.

Results

Selected Surveys

Of the remaining 24 surveys, the prioritization process identified 14 surveys selected as current or expected surveys to be conducted over the span of this Refuge IMP (2015-2030) and 10 surveys identified as future surveys (Table 1). Assignment of surveys to a specific status (Current, Expected, or Future) largely followed the Final prioritization scores from the SP Tool output (Appendix D). However, after consideration of capacity, protocol

logistics, existing current survey obligations, several surveys were re-prioritized based on current workloads and their status changed (Appendix D).

Six surveys were assigned "Current Surveys" status that the Refuge anticipates being able to conduct based on funding and staffing in 2015. These surveys included; 1) Red-cockaded Woodpecker Nest Monitoring, 2) Hazardous Fuel and Fire Effects Monitoring, 3) Marsh Monitoring via Coast-wide Reference Monitoring System (CRMS), 4) Wood Duck Nest Box Monitoring, 5) Baseline Herpetofaunal Inventory and 6) Weather Monitoring via Remote Access Weather Station. It was decided by the Refuge staff that although resulting in lower priority scores, two surveys (Baseline Herpetofaunal Inventory and Wood Duck Nest Box Monitoring) were assigned "Current Surveys" since they are currently being conducted with Refuge resources in 2015. Considering all of the surveys assigned a "Current" status, Red-cockaded Woodpecker Nest Monitoring was deemed the most important survey to conduct. Conversely, Weather Monitoring was deemed lowest in priority (Appendix D). Also of note, although one survey was ranked high in priority by the SP Tool, (Red-cockaded Woodpecker Habitat Monitoring), the details of protocol selection and survey design have not been established and this survey is not currently being conducted in 2015, and therefore, was moved to the "Expected Surveys" group (Appendix D).

Eight surveys were assigned the status of "Expected". These surveys are expected to be completed within the span of this Refuge IMP (2015-2030). Survey priorities within this group were defined by the final score produced by the SP Tool (Appendix D). The surveys with "Expected" status include; 1) Red-cockaded Woodpecker Habitat Monitoring, 2) Mid-winter Waterfowl Surveys, 3) Aerial Waterfowl Surveys, 4) Invasive Species Monitoring, 5) Savanna Restoration Monitoring, 6) Mid-winter Eagle Surveys, 7) Mobile Acoustical Bat Monitoring, and 8) Seepage Bog Restoration Monitoring (Appendix D).

Non-Selected Surveys

Of the 24 surveys prioritized, 10 surveys would require significant increases in funding as investment over the duration of the plan, or have been deemed of lower priority by the Refuge. These surveys were assigned as "Future Surveys" (Appendices D and E). These surveys included: 1) Fish Inventory, 2) Wood Duck Breeding Bird Surveys, 3) Migratory Shorebird Surveys, 4) Wading Bird Surveys, 5) Pollinator Inventory, 6) Game Species Monitoring, 7) Pest and Predator surveys, 8) Mammal Inventory, 9) Climate Change Phenology Monitoring and 10) Mosquito Control Effects Monitoring.

The Refuge will continue to evaluate survey opportunities that provide baseline inventory data as they arise in the future. If an inventory is needed but is not identified in this Refuge IMP, it will be added through the revision process once it is identified (Appendix F).

Table 1. Surveys selected to conduct at Big Branch Marsh National Wildlife Refuge (FF04RLBM00), 2015-2030.

Survey Priority [1]	Survey ID Number [2] (FF04R LBM00-)	Survey Name/ (Type) [3]	Survey Status [4]	Mgmt. Objective Id [5]	Survey Area [6]	Staff Time (FTE) [7]	Avg. Ann Cost (OPR) [8]	Survey Timing [9]	Survey Length [10]	Survey Coord. [11]	Protocol Citation [12]	Protocol Status [13]
1.01	003	Red-cockaded Woodpecker Nest Monitoring (M)	Current	CCP / 1.1, 1.2	Multiple management units	FWS: 0.31, Other: 0.06	$9,000	year round/ Recurring -- every year	1994-Indefinite	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
1.02	006	Hazardous Fuels Treatment and Fire Effects Monitoring (M)	Current	CCP / 2.3	Multiple management units	FWS: 0.11	$5,000	quarterly/ Recurring -- every year	2004-Indefinite	Chris LeRouge, Prescribed Fire and Fuels Technician	(none)	Initial Survey Instructions
1.03	011	Marsh Monitoring via CRMS (CM)	Current	CCP / 2.1, 2.2	Multiple management units	FWS: 0.0, Other: 0.01	$0	Monthly/ Recurring -- every year	2007-2030	Greg Steyer (USGS), Field Supervisor	(none)	Initial Survey Instructions
1.04	012	Wood Duck Nest Box Monitoring (M)	Current	CCP / 1.2, 1.3	Entire station	FWS: 0.02, Other: 0.0	$500	MAR & APR/ Recurring -- every year	1996-Indefinite	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
1.05	014	Baseline Herpetofaunal Inventory (I)	Current	CCP / 1.2	Multiple stations	FWS: 0.02, Other: 0.01	$60,000	annually/ Occurs one time only	2015-2015	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions

1.06	015	Weather Monitoring via RAWS (CM)	Current	CCP / 2.3	Regional	FWS: 0.02	$1,000	year round/ Recurring -- every year	2004-Indefinite	Chris LeRouge, Prescribed Fire and Fuels Technician	(none)	Initial Survey Instructions
2.01	013	Red-cockaded Woodpecker Habitat Monitoring (M)	Expected	CCP / 1.1, 2.3, 2.4	Multiple management units	FWS: 0.04, Other: 0.02	$20,000	APR -OCT/ Recurring -- every five years	2015-2030	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
2.02	002	Mid-winter Waterfowl Surveys (Coordinated Aerial/Ground) (CM)	Expected	CCP / 1.2, 2.1, 2.2, 2.7	National	FWS: 0.0	$700	mid-WIN/ Recurring – every three years	1994-Indefinite	James Harris, Complex Biologist	Loges et al. 2015	National Approved
2.03	004	Aerial Waterfowl Surveys (M)	Expected	CCP / 1.2, 2.1, 2.2, 2.7	Entire station	FWS: 0.0	$1,400	WIN/ Recurring – every three years	1994-2030	James Harris, Complex Biologist	(none)	Initial Survey Instructions
2.04	007	Invasive Species Monitoring (M)	Expected	CCP / 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.6, 2.7	Multiple management units	FWS: 0.04, Other: 0.02	$19,000	SUM/ Recurring -- every year	1996-Indefinite	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
2.05	009	Savanna Restoration Monitoring (M)	Expected	CCP / 2.3, 2.4	Single management unit	FWS: 0.01	$3,800	SPR & FAL/ Recurring -- every five years	2012-2030	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
2.06	008	Mid-winter Eagle Surveys (CM)	Expected	CCP / 1.1, 1.2	Entire station	FWS: 0.01	$100	WIN/ Recurring -- every year	1996-Indefinite	James Harris, Complex Biologist	(none)	Initial Survey Instructions

2.07	016	Mobile Acoustical Bat Monitoring (CM)	Expected	CCP / 1.2, 1.3	Regional	FWS: 0.01	$150	MAY –JUL/ Recurring – every five years	2014-2030	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions
2.08	017	Seepage Bog Restoration Monitoring (M)	Expected	CCP / 1.2, 1.3, 2.8	Single management unit	FWS: 0.02, Other: 0.01	$25,000	APR -OCT/ Recurring -- every three years	2015-2030	Daniel Breaux, Refuge Manager	(none)	Initial Survey Instructions

1. The rank for each survey listed in order of priority.
2. A unique identification number assigned by the PRIMR database. This number is prefaced by the station cost-center FBMS code FF04RLBM00.
3. Short titles for the survey name, preferably the same name used in Refuge work plans. Also include the PRIMR code for survey type in parentheses. These are: Inventory (I), Cooperative Baseline Monitoring (CB), Monitoring to Inform Management (M), Cooperative Monitoring to Inform Management (CM), Research (R), and Cooperative Research (CR).
4. Surveys selected for the timespan of this Refuge IMP (i.e., Current, Expected).
5. The management plan and objectives that justify the selected survey.
6. Refuge management unit names, entire refuge, or names of other landscape units included in survey.
7. Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).
8. Estimates of average annual operations cost for conducting the survey during the years it is conducted (e.g., equipment, contracts, travel) but not including staff time.
9. Timing and frequency of survey field activities.
10. The years during which the survey is conducted.
11. The name and position of the survey coordinator (the Refuge Biologist or other designated Service employee) for each survey.
12. Title, author, and version of the survey protocol.
13. Scale of intended use (Site-specific, Regional, or National) and stage of approval (Initial Survey Instructions, Complete Draft, In Review, or Approved) of the survey protocol.

Survey Justification Narratives

Selected Surveys Conducted with Current Refuge Capacity

Current Surveys are defined as the highest priority surveys that the Refuge Manager estimates can be conducted with existing staffing and funds. Current surveys are those that have been or will start in this same year of the Refuge IMP (2015) and will continue because of high priority and because capacity from station funds alone (i.e., management capability and funds) have been available in the past and are anticipated to be available for continuing the survey during the life of this plan (USFWS 2014a). A general description of each of the selected surveys in this Inventory and Monitoring Plan follows.

1.01. Red-cockaded Woodpecker Nest Monitoring (FF04RLBM00-003)

Overview

The red-cockaded woodpecker (RCW, *Picoides borealis*) is a federally and state listed endangered species and is identified as a species of conservation concern in the Louisiana Comprehensive Wildlife Conservation Strategy (Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Wildlife Action Plan website: www.wlf.louisiana.gov/wildlife/wildlife-action). A recovery plan has been prepared for the species (USFWS 2003a). Big Branch Marsh NWR is designated as a support population for the RCW with a recovery goal of 20 active clusters; therefore an active population management program is currently underway. The Big Branch Marsh population of RCWs is the only known viable population in Southeast Louisiana (USFWS 2011). Demographic monitoring is critical to assess the overall health of a given population and to assist managers in making informed habitat management decisions (e.g., foraging and nest habitat management, predator control). Individual birds and their habitat (see 2.01 Red-cockaded Woodpecker Habitat Monitoring, FF04RLBM00-013) are monitored closely during the nesting season. This survey was selected because the monitoring and management of RCWs, in accordance with the species recovery plan, is legally mandated (USFWS 2003a). This monitoring effort is currently conducted on the Refuge.

Management Objectives

This monitoring activity is one of highest priority and supports two of the Refuge Objectives as described in the CCP (USFWS 2007a).

> **Objective 1.1.** Manage and protect threatened and endangered species through implementation of recovery plans.
>
> **Objective 1.2.** Monitor species of concern, targeted species, and species of Federal responsibility in order to assess management goals.

Survey Objectives

This survey will monitor the nesting activity and success, cavity usage and condition of individuals in the population at Big Branch Marsh NWR.

Partner Roles
Several federal and state agencies as well as private individuals or companies participate in the recovery plan across the southeast. For Big Branch Marsh NWR, the coordination with the LDWF is essential to completing this survey for the near future as there are no Refuge staff resources to accomplish this currently. The Refuge currently contributes one volunteer towards the survey efforts but the responsibility for monitoring, banding and protocol development is currently provided by the LDWF.

Protocol Needs
The methods for conducting RCW monitoring are well defined as part of the RCW recovery plan (USFWS 2003a). It is anticipated that a regional protocol framework will be drafted and the site-specific protocol will be developed from that framework within the lifecycle of this Refuge IMP. Initial Survey Instructions for this survey can be found **here** and are linked to this survey record in PRIMR.

1.02 Hazardous Fuels Treatment and Fire Effects Monitoring (FM04RLBM00-006)

Overview
Fire is a natural process that plays a critical role in the ecosystem dynamics within Big Branch Marsh NWR. Historically, frequent lightning fires and anthropogenic fires burned the pine forests and marsh that cover the north shore of Lake Pontchartrain promoting fire-maintained systems. Currently, many areas on and off the Refuge have not been burned for over 30 years. Wildfires on or near the Refuge are actively suppressed due to the intense level of urban development surrounding the Refuge. Where fire has not been introduced, accumulations of fuels have occurred and vegetation composition has changed from the historic open pine with herbaceous understory to a more shrub and hardwood dominated understory system. Increased woody growth can lead to increased fireline intensities, flame heights and fire behaviors as grass and herbaceous dominated vegetation is replaced with taller woody growth leading to more challenging fire suppression efforts, especially in the wildland-urban interface, thus making fuels hazardous. Hazardous fuel abundance estimates include measuring the amount of fine and coarse woody debris, live fuel abundance, as well as duff and litter amounts. Fuel loads are estimated using Brown's Fuel Transects, Photopoints, and Cover plots as described in the monitoring protocols in the Southeast Region Monitoring Hazardous Fuel Treatment Field Guide and Regional Plan (USFWS 2013b, 2013c).

The fire management goal of the Refuge is to apply prescribed burns on a two to three year cycle to reduce the threat of accumulating fuels to wildlife and humans on and near the Refuge. This survey was selected because the information from these monitoring activities provides fuel inventory information as well as an assessment of treatment effectiveness following management applications. Monitoring includes impacts from wildfires that occur on the Refuge.

Management Objectives

These monitoring activities fully support the objectives in the Refuge Fire Management Plan (USFWS 2007c) and follow the recommendations for protocols described in the Southeast Region Monitoring Hazardous Fuel Treatment Field Guide and Regional Plan (USFWS 2013b, 2013c). In addition, these activities support the following Refuge Objective as described in the CCP (USFWS 2007a).

> **Objective 2.3.** Manage and maintain pine flatwood, savannah, and hardwood hammock habitats for Refuge resources.

Survey Objectives

The monitoring activities are designed to assess the long term goals of the prescribed fire program as stated in the Big Branch Marsh NWR Fire Management Plan and Fire Effects Monitoring Plan (USFWS 2007c and USFWS 2010 respectively):

- Restoring historical fire dependent plant communities by reducing the height and abundance of midstory species.
- Using prescribed fire to increase the availability and distribution of wildlife food plants such as three-square in the marsh habitats.
- Providing wildland fire protection through hazard fuel reduction on the refuge while protecting the overstory and assist in reducing hazard fuel risks on neighboring lands.
- Reducing the number and abundance of exotic and invasive species through a repeated burning cycle which will encourage native fire dependent plant communities and allow the native plants to better compete and reduce the area where invasive species exist.

Specific monitoring activities include 1) collecting fuel moistures throughout the prescribed fire season to determine prescribed fire treatment parameters are met, 2) collecting on-site weather, fire behavior and smoke observations during prescribed burn treatments to determine fireline intensity, 3) measuring changes in fuel loads pre- and post- prescribed fire treatments to determine treatment effectiveness, 4) estimating live and dead standing vegetation abundance pre- and post- prescribed fire treatment to monitor treatment effectiveness, 5) collecting burn severity measures indicating the severity across a prescribed fire treatment site or in the burned area of a wildfire, 6) collecting vertical fuel structure using photo points to document overall habitat vegetation structure change over time and 7) conducting post burn assessments of prescribed and wildfires on Refuge resources of concern.

Partner Roles

This data is collected using Refuge and regional FWS staff and funding resources. Data are shared with adjacent refuges within Fire District 7, US Forest Service and National Park Service partners for landscape level analyses. At this time, data are not shared through a centralized database and there is no landscape level analysis underway of the locally collected data at each refuge.

Protocol Needs

This monitoring effort follows standard methods and procedures described in the Region 4 Guide to Hazardous Fuel Treatment and Fire Effects Monitoring Guide (USFWS 2013b, 2013c). This guidance is currently treated as Initial Survey Instructions (found **here**) and linked to this survey in PRIMR.

1.03. Marsh Monitoring via Coastwide Reference Monitoring System (CRMS) (FF04RLBM00-011)

Overview

The Refuge consists of approximately 5,000 acres of coastal marsh (fresh, brackish and saltwater marshes) and an additional 3,000 acres of open water. Marshes are tidally influenced and salinities range from saline to brackish to fresh along a landward transect inland from Lake Pontchartrain. Marsh habitats are well defined on the Refuge by a distinct transition to pine forest at the marsh edge along the lake shoreline. Marsh habitats are critically important to the Refuge and provide areas for feeding, roosting, nesting and staging for numerous wildlife species including migratory waterfowl species as stated in the CCP (USFWS 2007a). Coastal ecosystems along the northern Gulf of Mexico are among the first directly impacted by climate change. Changes in coastal ecosystems are monitored to understand the impacts of sea level rise, subsidence rates and changes in marsh vegetation over time. The Refuge participates in the Coastwide Reference Monitoring Systems (CRMS) to monitor marsh health over time. The CRMS design implements a multiple reference approach by using aspects of hydro-geomorphic functional assessments and probabilistic sampling. The Refuge has 5 CRMS reference sites and currently relies on this data as the only mechanism to monitor any changes in marsh habitats on the Refuge.

Management Objectives

The marsh monitoring effort supports the following Refuge objectives as described in the CCP (USFWS 2007a).

> **Objective 2.1.** Manage and maintain fresh, intermediate, and brackish marsh, slough, cypress/tupelo and other aquatic habitats for Refuge resources.
>
> **Objective 2.2.** Improve and restore aquatic habitats, with emphasis on marsh habitat.

Survey Objectives

This survey includes the collection of water quality and pore water, surface elevation, marsh accretion, vegetation, and soils property data on a periodic sampling scheme at each of the designated reference sites on the Refuge. A report is provided by the Louisiana Coastal Protection and Restoration Authority (LACPRA) and produced at the end of each calendar year to show the results of the data collected for that year. It also shows the relative changes observed in relation to the over 300 other reference sites established along the Louisiana coastline as part of a proposed coast-wide reference monitoring system for evaluating wetland restoration trajectories in Louisiana (Steyer et al 2003).

Partner Roles
Although deemed extremely important and ranked as a high priority, significant reductions in Refuge staff and funding have limited the level of Refuge participation in this monitoring activity. The Refuge relies completely on the support of LACPRA for the implementation of this monitoring effort including sampling design, plot establishment, sampling protocols, data collection, data archiving and storage, analysis and reporting.

Protocol Needs
The protocol used in this survey is well established, peer reviewed and published by Steyer et al. 2003 (see CRMS program: http://lacoast.gov/crms2/home.aspx). A Regional protocol framework can be input into ServCat following a quick assessment of these on-line protocol materials. A site-specific survey protocol can then be readily developed by step-down of the framework. Initial Survey Instructions can be found **here** and are linked to this survey in PRIMR.

1.04. Wood Duck Nest Box Monitoring (FF04RLBM00-012)

Overview
Wood ducks (*Aix sponsa*) and mottled ducks (*Anas fulvigula)* are the only year-round resident waterfowl on the Refuge. Managing for wood ducks on Big Branch Marsh NWR fulfills one of the established purposes of the Refuge. Providing habitat for this species, as for other waterfowl, helps reach the goals of the North American Waterfowl Management Plan (NAWMP) (USFWS 1986). Wood ducks naturally inhabit quiet inland waters near woodlands, such as wooded swamps, flooded forests, green tree reservoirs, ponds, marshes and streams. Goals for good natural breeding habitat is approximately one suitable cavity per 2 acres (FWS 2003b) yet the amount of available suitable habitat for wood ducks on Big Branch Marsh NWR has not been quantified to date. Thus the Refuge supports existing wood duck habitat with a system of nest boxes that are monitored for nesting success annually.

Management Objectives
This monitoring effort is implemented on the Refuge to fulfill one of the established purposes of Big Branch Marsh NWR by providing information on artificial nesting habitat for wood ducks as described in the CCP (USFWS 2007a). More specifically this monitoring effort supports a number of Refuge management objectives from the CCP.

> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 1.3.** Manage fish and wildlife populations at Bayou Lacombe Centre, Southeast Louisiana Refuges Complex Headquarters using small demonstration or environmental education projects.

Survey Objectives

The objectives of monitoring wood duck nest boxes are; 1) to provide information to improve wood duck production in artificial cavities, and enhance brood habitat on Service lands; 2) to provide information that demonstrates proper use and placement of predator-proofed wood duck boxes as a supplement to compensate for shortages in natural cavities; 3) to provide information that will contribute to the reduction of excessive predator related mortality via improvement of brood habitats and strategic location of boxes; and 4) to provide information that will help serve in educating the public on wildlife habitat programs.

Partner Roles

This monitoring effort is supported by Refuge resources and private partners. Delta Waterfowl, and other private entities, provides materials for constructing nest boxes. Refuge staff in collaboration with school groups and volunteers, build the boxes. Refuge staff and volunteers establish boxes in select habitats across the Refuge as well as monitor nest box use following the nesting season. Information collected about wood duck nest box use is provided to the Southeast Region FWS Migratory Bird Division.

Protocol Needs

Monitoring of wood duck nest boxes follows standard specifications published for wood ducks (USFWS 2003b). This information is included as Initial Survey Instructions (found **here**) and linked to the PRIMR record for this survey.

1.05. Baseline Herpetofaunal Inventory (FF04RLBM00-014)

Overview

Collectively, Bayou Savage, Big Branch, and Bogue Chitto National Wildlife Refuges represent nearly 100,000 acres of coastal habitat that are considered highly vulnerable to climate change impacts. More than 60 reptile and amphibian species are likely to occur in this area, yet almost no information is available about the herpetofauna on these refuges. Amphibian and reptile inventories were conducted by Refuge interns at Big Branch and Bogue Chitto NWRs in 2001 and at Bayou Savage NWR in 2002. Big Branch NWR was surveyed more recently (2010) by USFWS staff but the survey did not target (or detect) turtles or salamanders. Given the exceptional herpetofaunal diversity of these refuges, their vulnerability to climate change, and the possible occurrence of Threatened and Endangered species, e.g., ringed map turtle (*Graptemys oculifera*) or other at-risk species a comprehensive inventory and a long-term monitoring survey are top priorities.

Management Objective

This survey effort supports the goal of the Refuge to identify native wildlife species representative of the Lake Pontchartrain basin. Specifically this work supports one management objective in the CCP.

> **Objective 1.2.** Monitor species of concern, targeted species and species of federal responsibility in order to assess management plans.

Survey Objectives

Baseline inventories will be conducted to inform the Refuge of amphibian and reptile populations present. Future surveys will extend objectives to include a monitoring effort that will link herpetofauna to habitat use. A total of 15 sites on Big Branch Marsh NWR will be sampled using a combination of visual surveys, trapping, cover boards, and call surveys (frogs only). Sites will be selected semi-randomly across a sampling grid using GIS software. For each habitat type (i.e., flatwoods, grasslands, swamp, marsh, ponds, river, and bayou) the number of sampling sites will be proportional to the total acreage of that habitat on the Refuge.

Partner Roles

This inventory is currently being conducted by the Dr. Kimberly Terrell as a contracting agent for this project (contract underway through 2015, with possible extension through 2016). The Refuge's investment in this survey includes administration of contract and collecting permits, as well as providing guidance on Refuge priorities.

Protocol Needs

Methods for this inventory follow published techniques for inventorying amphibian and reptiles, which include a combination of visual surveys, trapping, cover boards, and anuran call surveys. Reference to the publication will be included in the initial survey instructions and linked to this survey record in PRIMR. A regional or national protocol needs to be developed for the purpose of baseline inventory of herpetofauna. A multitude of sampling techniques will be utilized depending on the species of interest. In general, surveys will be done following procedures outlined by Graeter et al. (2013). Initial survey instructions can be found **here** and are linked to this survey record in PRIMR.

1.06. Weather Monitoring via Remote Access Weather Stations (RAWS) (FF04RLBM00-015)

Overview

Automated weather stations are located on various refuges across the nation to provide real-time on site fire weather conditions and data used to calculate fire danger ratings. This data is shared among many partners at the local, regional and national level to understand current weather conditions for a variety of purposes. The RAWS stations are incorporated into a real-time monitoring and analysis network (MesoNet) across the nation (see http://mesowest.utah.edu/)**.** Fire managers use this data to predict fire behavior and monitor fuels; resource managers use the data to monitor environmental conditions. Locations of RAWS stations can be searched online courtesy of the Western Regional Climate Center (http://www.wrcc.dri.edu/). This survey entails automated recording of weather data by two RAWS stations located on Big Branch Marsh and Bogue Chitto Refuges.

Management Objectives

These monitoring data are vital to the Refuge on a daily and hourly basis and directly support an objective of the CCP (USFWS 2007a) pertaining to the use of prescribed fire and wildfire suppression activities. This monitoring effort also fully supports the objectives in the step down Refuge FMP (USFWS 2007c).

Objective 2.3. Manage and maintain pine flatwood, savannah, and hardwood hammock habitat for Refuge resources.

Survey Objectives
Weather information is collected automatically via a remote weather station and includes: temperature, relative humidity, wind speed, wind direction, max wind speed, precipitation duration, precipitation amounts, 10 hour fuel moisture, and dew point. Some stations have additional sensors to report water level or other variables of interest. Refuge staff are required to initially locate, build, and establish satellite communication as well as maintain all equipment used by the weather station on a regular basis.

Partner Roles
The Refuge relies on partners (RAWS Depot, National Weather Service, Department of Atmospheric Sciences, University of Utah) to produce the data collected on a website medium and maintenance of the remote access weather stations. Data are served on partner sites including MesoNet (University of Utah), and the National Weather Service. Currently all weather stations are serviced via a contract with the National Fish and Wildlife Service office in Boise, ID with some assistance at the Refuge level by staff employees to complete periodic maintenance.

Protocol Needs
A protocol has been developed and published by the National Wildfire Coordinating Group (NWCG 2012). Weather data are collected hourly. Data are transmitted via satellite to a data server and available via internet through WIMS supported by the Fire and Aviation Tools Support System. Data are archived on a United State Forest Service computer server and accessible via KCFAST (Kansas City Fire Access Software). References to these materials are provided as Initial Survey Instructions (found **here**) and are linked to this survey record in PRIMR.

Selected Surveys Conducted with Additional Expected Capacity
Expected Surveys are a second priority for the Refuge or high priority surveys that would require an increase in staffing or costs. Expected surveys will probably be conducted because of moderate to high station priority and there is a reasonably likely chance that additional capacity will be obtained through non-station funding sources (e.g., regional biology funds, partners, grants, etc.) (see Appendix A).

2.01. Red-cockaded Woodpecker Habitat Monitoring (FF04RLBM00-013)

Overview
The Refuge currently provides approximately 4200 acres of suitable foraging habitat (in pine and pine-hardwood forest types), which supports 17 RCW groups. Management is planned to create high quality RCW habitat from pine hardwood forest, as well as currently unsuitable pine habitat that historically supported RCW. This will be done through the application of chemical, mechanical and prescribed fire treatments to provide additional

acres of suitable foraging habitat while improving quality of existing habitat (USFWS 2011).

Quality RCW habitat is defined in the RCW Recovery Plan (USFWS 2003a) as having large older pines, low densities of small to medium pines, no hardwood midstory or hardwoods that are present no greater than 7 feet tall, dominance of native warm-season perennial grass (little bluestem grasses, *Schizacharium* spp.) for Big Branch Marsh NWR and a diversity of native forb groundcover, as well as patches of regenerating pines in the midstory and understory. Habitat response variables have been defined in the recently approved Refuge HMP (USFWS 2011). Foraging habitat variables defined in the plan include; 1) basal area, 2) pine and hardwood stem density, 3) understory and midstory hardwood height, percent cover of grass, and 4) percent cover herbaceous species.

Management Objectives

This monitoring effort will support a number of Refuge management objectives as described in the Refuge CCP (USFWS 2007a).

> **Objective 1.1.** Manage and protect threatened and endangered species through implementation of recovery plans.
> **Objective 2.3.** Manage and maintain pine flatwoods, savanna and hardwood hammock habitats for Refuge resources.
> **Objective 2.4.** Improve and restore pine flatwoods and savanna habitats for Refuge resources.

Survey Objectives

The objectives of the proposed monitoring will establish plots across the Refuge in RCW foraging habitats as part of a modified forest inventory for the Refuge with an emphasis on RCW habitat variables. It is expected that this survey will be conducted 1-2 times across the acres of existing or potential RCW habitat during the life cycle of this Refuge IMP.

Partner Roles

The primary partner in this survey is the LDWF. Interns, Refuge volunteers and other partners may contribute to data collection towards this monitoring effort. Refuge staff and others will be involved with setting up plots and collecting habitat data. Regional I&M staff will be involved in support of data collection and analysis.

Protocol Needs

The Refuge is currently developing a plan for using standard protocols to quantify the foraging habitat according to the RCW Recovery Plan (USFWS 2003a) and the Big Branch Marsh NWR Habitat Management Plan (USFWS 2011). A network of plots have been identified in 2015 as an initial sampling scheme that satisfies the Refuge forest inventory need and also serves as foraging habitat assessment. In addition, the proposed plot design will complement the existing fire effects monitoring sampling scheme used to monitor fire effects (see Hazardous Fuel Treatment and Fire Effects Monitoring-FF04RLBM00-006). It is expected that data will be collected beginning in FY 2016 if staffing and funding allow.

2.02. Mid-winter Waterfowl Survey (FF04RLBM00-002)

Overview
The mid-winter waterfowl survey is coordinated by the Migratory Bird Management Office of the U.S. Fish & Wildlife Service. The U.S. Fish & Wildlife Service is mandated to manage and conserve migratory birds, including waterfowl. Big Branch Marsh NWR participates in this survey to contribute to the step-down plan of the NAWMP (USFWS 1986). Therefore tracking waterfowl numbers on the Refuge and contributing this information to a national database is important to this national plan.

This survey is held the last week of December through the first week of January across the United States. For Big Branch Marsh NWR, this aerial survey has been conducted annually in January. Refuge staff participates in this survey by collecting the data (i.e., counting the numbers of birds by species at various locations) in overflights across the Refuge. The purpose of the survey is to estimate the number of waterfowl using Refuge habitat by each waterfowl species observed. This survey has been conducted on the Refuge from 1994-2013 but due to staff and funding limitations has not continued as a priority survey for the Refuge since 2013. This pause in survey implementation has allowed the Refuge to consider participating in the newly developed (Integrated Waterbird Management Monitoring) (IWMM) protocol, a recently accepted national inventory and monitoring standard for monitoring waterbirds (Loges et al. 2015)(www.iwmmprogram.ning.com). It is expected that the Refuge will participate in this survey during the life cycle of this Refuge IMP.

Management Objectives
Monitoring mid-winter waterfowl supports a number of Refuge objectives as described in the CCP (USFWS 2007a).

> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 2.1.** Manage and maintain fresh, intermediate, and brackish marsh, slough, cypress/tupelo, and other aquatic habitat for Refuge resources.
>
> **Objective 2.2.** Improve and restore aquatic habitats with emphasis on marsh habitat.

Survey Objectives
Monitoring the populations of waterfowl during the mid-winter season can provide Refuge staff with indications of habitat quality in relation to management and restoration activities.

Partner Roles
Once the protocols have been specifically developed for Big Branch Marsh NWR, partners will be identified to support this monitoring activity including the USFWS Migratory Bird Division and the LDWF.

Protocol Needs

When staffing and funding allow for future surveys, Refuge specific protocols will need to be developed to monitor waterfowl during the mid-winter season on Big Branch Marsh NWR. It is recommended that protocol design follow the recently accepted national IWMM protocols (Loges et al. 2015) (www.iwmmprogram.ning.com).

2.03. Aerial Waterfowl Surveys (FF04RLBM00-004)

Overview

This survey is similar to the Mid-winter Waterfowl Survey (FF04RLBM00-002) above but is conducting over a longer period of time to include monthly aerial surveys in November and December in addition to the January survey. Similarly to the mid-winter waterfowl survey, this survey has been conducted historically from 1994 to 2013 and due to limited staff and funding was discontinued after 2013. Unlike the mid-winter waterfowl survey, the data for this survey is used for Refuge purposes. This aerial survey is conducted in a similar fashion to the mid-winter waterfowl survey in that waterfowl counts are made by species along transects flown across the Refuge. The Refuge is currently considering adapting the Integrated Waterbird Management and Monitoring (Loges et al. 2015) (www.iwmmprogram.ning.com) protocols to accomplish this survey in the future if staff and funding allow.

Management Objectives

Monitoring migrant and wintering waterfowl supports a number of Refuge objectives as described in the CCP (USFWS 2007a).

> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 2.1.** Manage and maintain fresh, intermediate, and brackish marsh, slough, cypress/tupelo, and other aquatic habitat for Refuge resources.
>
> **Objective 2.2.** Improve and restore aquatic habitats with emphasis on marsh habitat.

Survey Objectives

Monitoring the populations of use by waterfowl during the late fall and winter can provide Refuge staff with indications of habitat quality in relation to management and marsh restoration activities.

Partner Roles

Once the protocols have been specifically developed for Big Branch Marsh NWR, partners will be identified to support this monitoring activity. Potential partners include LDWF, USFWS Migratory Bird Division, and non-government entities such as Delta Waterfowl, Ducks Unlimited and etc.

Protocol Needs

When staffing and funding allow for future surveys Refuge specific protocols will need to be developed to monitor migrant and wintering waterfowl on Big Branch Marsh NWR.

2.04. Invasive Species Monitoring (FF04RLBM00-007)

Overview

Lake Pontchartrain and the Refuge are at the interface between the temperate and sub-tropical climates of North America. Thus, the region has the potential to foster the introduction and establishment of a wide range of invasive plant and animal species. Control of invasive plants via mechanical and chemical methods as well as prescribed fire treatments are currently being implemented as part of an integrated pest management strategy. Control strategies are subject to change as new invasive species are introduced, current invasive species become a greater problem, or new methods of control become available. The Service promotes an early detection and rapid response strategy to control the spread of invasive species through surveillance (i.e., early detection) and immediate control treatments (i.e., rapid response) whenever possible.

On Big Branch Marsh NWR invasive species monitoring is accomplished by a two-step process. First, surveillance is used to detect early signs of the presence of invasive species throughout the Refuge. Surveillance is on-going and year round and conducted whenever staff, interns or volunteers detect invasive species presence on the Refuge. Once detected, control treatments are applied and treatment effectiveness monitoring is used to determine control success. Success is measured as a percentage of acceptable eradication and is based on monitoring data. This monitoring effort is expected to occur during the life cycle of this Refuge IMP.

Management Objectives

Information obtained from monitoring the status of invasive species populations on the Refuge supports many management objectives of the Refuge as described in the CCP (USFWS 2007a).

> **Objective 1.1.** Manage and protect threatened and endangered species through implementation of recovery plans.
>
> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 2.1.** Manage and maintain fresh, intermediate, and brackish marsh, slough, cypress/tupelo and other aquatic habitats for Refuge resources.
>
> **Objective 2.2.** Improve and restore aquatic habitats with emphasis on marsh habitats.
>
> **Objective 2.3**. Manage and maintain pine flatwoods, savanna, and hardwood hammocks for Refuge resources.

Objective 2.4. Improve and restore pine flatwoods and savanna habitats for Refuge resources.

Survey Objectives
The monitoring data collected informs management of the success of treatment, the need for repeated applications of treatment, or the need for implementing different treatment methods altogether.

Partner Roles
Unfortunately the Refuge is limited in available resources to implement a strategic monitoring program for invasive plant species. While early detection and control treatments are implemented on the Refuge opportunistically and as funding allows, efficacy of treatments using rigorous monitoring protocols are not currently implemented. This is especially true for large established populations of invasive species such as Chinese tallow tree (*Triadica sebifera*), feral hog (*Sus scrofa*), cogon grass (*Imperata cylindrical*) and aquatic invasive species such as *Salvinia molesta.* Extensive partnerships with national, regional, landscape, as well as state and local agencies tackling invasive species issues will need to be pursued to collectively and successfully address invasive species control and monitoring.

Protocol Needs
Surveillance is an observational process that is first used to detect the presence of invasive species on the Refuge. Once invasive species are detected, a rapid response strategy is immediately invoked. An assessment of the population extent, potential threat and impacts is determined and a treatment plan is developed. Treatment is applied and pre and post-treatment effectiveness is monitored over time. Given limited capacity of the Refuge currently due to reduced budget and staffing, future protocols developed should include; 1) continual assessment of threats by invasive species in and around the Refuge regarding impacts to Refuge resources and 2) use of decision making tools to address priority of treatments in a multi-invasive species landscape.

2.05. Savanna Restoration Monitoring (FF04RLBM00-009)

Overview
The Refuge acquired the St. Tammany Holding Tract to restore over 300 acres of longleaf pine savanna to support foraging habitat for the endangered RCW and other associated plants and animal species. Pine savannas exist in pockets throughout the Refuge with occasional longleaf pine trees scattered throughout. Heavy logging in the early 20th century removed longleaf pine and replaced it with slash and loblolly pines. The Refuge has identified the St. Tammany Holding Tract as a site to restore these communities back to longleaf pine savannas. The site was cleared in 2003 and in 2004 was prescribed burned and planted with longleaf pine seedlings.

Management Objectives

This monitoring activity supports the ongoing management objectives to restore the St. Tammany Holding Tract to longleaf pine savanna on the Refuge.

> **Objective 2.3.** Manage and maintain pine flatwoods, savanna and hardwood hammocks for Refuge resources.
>
> **Objective 2.4.** Improve and restore pine flatwoods and savanna habitats for Refuge resources.

Survey Objectives
This monitoring activity provides information on the progress of restoration efforts of the St Tammany Holding Tract longleaf pine restoration site. Monitoring is used to detect the survival of planted longleaf pine seedlings and monitor the response of native ground cover in the restoration efforts. This monitoring effort has occurred since 2012 and will be on-going opportunistically throughout the life span of this Refuge IMP as Refuge resources are available. Monitoring efforts should be conducted at a minimum of every five years.

Partner Roles
The initial savanna restoration monitoring protocols for the St. Tammany Holding Tract longleaf restoration site were established in 2010 by ELOS, an environmental consulting firm. Future monitoring is dependent on increased capacity of Refuge resources (staffing and funding) to continue to collect data from the 7 permanent plots established in 2010.

Protocol Needs
Initial vegetative sampling design and methods were identified in a project monitoring plan by ELOS Environmental in 2010 and will be used as the basis for any future monitoring activities conducted.

2.06. Mid-winter Eagle Surveys (FF04RLBM00-008)

Overview
Bald eagles have long been a trust species of the USFWS and despite delisting in 2007 they continue to be a species of concern. Every January, since 1979, a count of bald eagles has been conducted along various routes across the country. This survey has been on-going since 1996-2014 on Big Branch Marsh NWR. Although this survey does not take significant Refuge staff time or resources to conduct and contributes to a national monitoring effort, it has been deemed a lower priority for the Refuge in the near future. No data was collected in 2015. It is very likely this survey will continue during the life of this Refuge IMP if and when additional Refuge resources are obtained.

Management Objectives

This survey provides information about habitat use by bald eagles on Big Branch Marsh NWR and contributes to the national database on abundance and location of wintering bald eagles. This survey supports Refuge objectives as described in the CCP (USFWS 2007a).

> **Objective 1.1.** Manage and protect threatened and endangered species through implementation of recovery plans.
>
> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.

Survey Objectives
This coordinated survey was created to estimate the wintering population of bald eagles in the lower 48 states and to identify areas of particular importance as wintering habitat. All sighted bald and golden eagles seen within the unit boundaries are sampled. Data recorded includes the total number of eagles seen by estimated age class (adult vs immature) and observed nest locations. Data are collected the first week of January each year.

Partner Roles
The eagle count is conducted annually by Refuge staff. Data are entered in to the database managed by the US Army Corps of Engineers (USACE) and the US Geological Survey (USGS): (http://corpslakes.usace.army.mil/employees/bird/midwinter.cfm). Reports of national population trends and bald eagle status are produced by the USACE every five years (http://corpslakes.usace.army.mil/employees/bird/midwinter.cfm).

Protocol Needs
The USGS has methods for collecting and analyzing data (Steenhof et al. 2002). A National Protocol framework will need to be drafted and the site-specific protocol will be a constituent of that framework.

2.07. Mobile Acoustical Bat Monitoring (FF04RLBM00-016)

Overview
The establishment of mobile bat acoustical surveys on National Wildlife Refuges within the Southeast Region is being undertaken for two central purposes. First, this work will establish a baseline inventory of the bat species which occur on or near national wildlife refuges. This information will then provide opportunities to explore more focused questions regarding habitat occupancy of threatened, endangered, or species of concern at the local refuge level. Second, these efforts will contribute to regional and national efforts to provide population level estimates/ indices of bats. Through a collaborative effort of state, federal, and other conservation organizations, long-term monitoring is being undertaken to address population declines attributed to white-nose syndrome, wind energy development, habitat loss/modification, and urbanization. Acoustical detection equipment and automated software for species identification in conjunction with a mobile sampling methodology provides a robust, relatively unbiased measure of species abundance from which population trend analysis can be evaluated. Fundamental to this abundance measure is that the protocol

used to collect data be standardized among sampling areas and be spatially and temporally repeated across the population of interest. Given the relatively low rates of bat detections per mile separated by species; potentially high variability of detections between sampling periods; and challenges with separating calls by species, it is critical that other factors which might increase variability in the data be minimized. Therefore, the development and adherence to a standardized collection protocol is imperative. Equally important is a process of selecting appropriate survey routes, actual use and selection of the bat echolocation data logger, survey route establishment, data management and storage, analysis of bat calls, and establishment of a project record. The Refuge expects to participate once every five years in this survey within the 15 year life cycle of this Refuge IMP as Refuge staff and funding resources permit. The initial survey on the Refuge was conducted in 2014.

Management Objectives

The survey will measure the relative abundance of bats using acoustical sampling during early summer along predefined roadside routes primarily within the existing acquisition boundary. These data will be geo-referenced to provide information about habitat use for ecological assessments for landscape analysis. Baseline occurrence information supports the following objectives of the Refuge CCP (USFWS 2007a).

> **Objectives 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 1.3.** Manage fish and wildlife populations at Bayou Lacombe Centre, Southeast Louisiana Refuges Complex Headquarters using only small demonstration or environmental education projects. This objective is supported by the establishment of a large bat house and information provided by the survey to educate the public about bats at the Centre.

Survey Objectives

Partner Roles

Currently the Refuge does not have the staff and funding to participate in this survey annually. The data analysis and summary will be done by the Region 4, Inventory and Monitoring Branch. The data will be combined for regional and landscape level analysis in cooperation with other partners including USGS and US Forest Service. Initial routes were established and a baseline survey was completed in 2014 using the draft Southeast Regional mobile acoustical bat survey protocols (Richardson 2012).

Protocol Needs

A national framework protocol needs to be developed in concert with other state and federal partners. The Refuge is conducting the MABM survey presently using the draft mobile acoustical survey protocol (Richardson 2012). Initial Survey Instructions have been developed and are linked in PRIMR.

2.08. Seepage Bog Restoration Monitoring (FF04RLBM00-017)

Overview

A small (less than two acres in size) but significant hillside seepage bog occurs on the Bayou Lacombe Centre, Southeast Louisiana Refuges Complex Headquarters site. In 2009, populations of several state species of concern [white-fringed orchid (*Plantanthera blephariglottis),* pine lily (*Lilium catesbae)* and others] were discovered in the bog following a management action to reduce woody shrub growth in and around the site. The bog is recognized today as a unique habitat type on the Refuge that requires additional long term management treatments as part of restoration efforts to protect the resources at the Bayou Lacombe Centre (USFWS 2007a). Future monitoring efforts should include monitoring survival of selected species of concern and vegetation changes over time in response to restoration treatments. It is expected that this monitoring effort will be conducted once every five years at a minimum within the life cycle of this Refuge IMP.

Management Objectives

The objective of this monitoring effort is to support the U.S. Fish and Wildlife Service seepage bog restoration efforts by providing appropriate on-site rare species monitoring and reintroducing them in sites where they have been deemed extirpated. In addition, as Refuge resources allow, Refuge staff will monitor changes in vegetation structure of the bog over time following applied restoration and management treatments.

> **Objective 1.2.** Monitor species of concern, targeted species, and species of federal responsibility in order to assess management goals.
>
> **Objective 1.3.** Manage fish and wildlife populations at Bayou Lacombe Centre, Southeast Louisiana Refuges Complex Headquarters using small demonstration or environmental education projects.
>
> **Objective 2.8.** Manage habitat of the Bayou Lacombe Centre, Southeast Louisiana Administrative Headquarters.

Survey Objectives

This survey involves the monitoring of selected species of concern and vegetation changes over time in seepage bog habitat to be restored on the Refuge.

Partner Roles

Currently a proposal has been funded to return abundance and composition of southern coastal plain herbaceous seepage bog species to Big Branch Marsh NWR through a coastal program agreement with the Atlanta Botanical Gardens (ABG). The proposed restoration effort will harvest seed from sensitive and rare species, grow species in a greenhouse setting and reintroduce species into sites deemed appropriate for restoration. The long term permanent result is the enhancement of the condition and function of the coastal ecosystem on lands that will remain in public ownership.

Protocol Needs

This monitoring effort was conducted by Refuge staff in conjunction with the Atlanta Botanical Gardens (ABG) in late 2015 and will continue in 2016. The protocol is in a development phase and depends on the successful funding of a project conducted by the Atlanta Botanical Gardens (ABG). A monitoring sampling design should appropriately address the response of native species used and the overall impacts to the vegetation structure as a result of this restoration effort.

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Appendix A. Defining Priorities Workbook- Big Branch Marsh NWR

Big Branch Marsh NWR CCP Goals and Objectives

The Comprehensive Conservation Plan (CCP) for Big Branch was approved in 2007 (USFWS 2007a). A brief description of the CCP goals and objectives as they apply to Refuge habitat management are provided below to describe the overall direction of Refuge management during the life cycle of the current CCP (2007 to 2022).

CCP GOAL 1. Identify, conserve, manage, and restore populations of native fish and wildlife species representative of the Lake Pontchartrain Basin, with emphasis on migratory birds and threatened and endangered species.

> **Objective 1.1:** Manage and protect threatened and endangered species through implementation of recovery plans.
>
> **Objective 1.2:** Monitor species of concern, targeted species, and species of Federal responsibility in order to assess management goals.
>
> **Objective 1.3:** Manage fish and wildlife populations at Bayou Lacombe Centre—Southeast Louisiana Refuges Complex Headquarters using only small demonstration or environmental education projects.

CCP GOAL 2. Restore, improve, and maintain a mosaic of forested and wetland habitats native to the Lake Pontchartrain Basin in order to ensure healthy and viable plant and animal communities, with an emphasis on threatened and endangered species.

> **Objective 2.1**Manage and maintain fresh, intermediate, and brackish marsh, slough, cypress/tupelo, and other aquatic habitats for Refuge resources.
>
> **Objective 2.2**
> Improve and restore aquatic habitats, with emphasis on marsh habitat.
>
> **Objective 2.3**
> Manage and maintain pine flatwoods, savanna, and hardwood hammock habitats for Refuge resources.
>
> **Objective 2.4**
> Improve and restore pine flatwoods and savanna habitats for Refuge resources.
>
> **Objective 2.5**
> Develop a habitat management plan.
>
> **Objective 2.6**
> Support partnerships to protect natural habitats of the Lake Pontchartrain Basin.
>
> **Objective 2.7**
> Review public use programs, such as hunting, fishing, wildlife observation and photography, to determine impacts on Refuge resources.
>
> **Objective 2.8**
> Manage habitat of the Bayou Lacombe Centre—Southeast Louisiana Administrative Headquarters.

HMP Goals and Objectives

The Habitat Management Plan (HMP) was approved in 2011 (USFWS 2011). A brief description of habitat management goals and objectives are provided below to describe the general direction of habitat management during the life cycle of the HMP (2011 to 2026). Details of adaptive monitoring elements for each Habitat Management Goal are presented in the HMP (USFWS 2011).

Habitat Management Goal 1

Provide and restore longleaf and slash pine flatwoods and savanna habitat by implementing an active forest habitat management program to maintain healthy and diverse forest communities and ensure healthy forest ecosystems by providing natural diversity of plant and animal species.

Objective 1.1

By the end of the 15-year planning period covered by this HMP, restore and maintain open stand conditions on up to 5,000 forested acres of the Refuge, keeping stands to an average basal area of 60-90 square feet per acre in pine and pine/hardwood forest types with minimal midstory and less than 20-30 square feet per acre of hardwood overstory. This objective will be met by maintaining the 3500 acres currently in open stand conditions during the entire planning period and by converting an additional 1500 acres by the end of the planning period (Supporting CCP Objectives 2.3 and 2.4).

Objective 1.2

By 2018, provide at least 300 acres of longleaf/slash pine forest-pine savanna in Compartment 9 (Savannah), and by 2026, provide at least 240 acres of savanna in Compartment 6 (Fritchie), maintaining slash and/or longleaf pine basal area approximately 40 square feet per acre and density up to 15 trees per acre, hardwood overstory below 20 square feet per acre, sparse midstory, and a diverse herbaceous understory dominated by native, warm-season perennial grasses. (Supporting CCP Objectives 2.3 and 2.4)

Habitat Management Goal 2

Protect and restore marsh and other aquatic habitat by implementing an active marsh and aquatic habitat management program to maintain healthy and diverse marsh communities and ensure healthy aquatic forest ecosystems by providing natural diversity of plant and animal species.

Objective 2.1

For each year during the 15-year planning period covered by this HMP, maintain approximately 7000 acres of freshwater to brackish marsh found in 9 of the 11compartments on the Refuge. Ratio of open water to emergent marsh vegetation cover should be approximately 1:1, and cover of submerged aquatic vegetation (SAV) in the open water portions should be at least 50% to support wintering waterfowl requirements. Exotic invasive species will be managed so that they do not have deleterious effects on the resources of concern. Trigger points for Chinese tallowtree and cogon grass control were discussed above as they related to Objective 1; however, marsh areas will generally not be targeted for invasive vegetative species control unless it is determined that those or other species are having a solidly negative effect on management for native species. (Supporting CCP objectives 2.1 and 2.2).

Objective 2.2
Over the 15-year planning period covered by this HMP, opportunistically (as dictated by funding availability), restore 4500+ acres of freshwater to brackish marsh (convert from open water). Priority restoration opportunities are in Compartments 3, 5, 6, 8, and 11. Timing of restoration depends on irregular funding episodes (primarily CWPPRA); therefore, a specific timeline for restoration during the planning period cannot be given. (supporting CCP objectives 2.1 and 2.2).

Objective 2.3
Over the 15-year planning period covered by this HMP, restore and maintain approximately 500 acres of forested wetland, including 143 acres of Cypress/Tupelo Swamp and 307 acres of Oak/Gum Hardwood Forests, incorporating a mosaic of suitable wood duck nesting and brood habitat. Specific characteristics of this habitat will include:

- Large pine trees/snags exceeding 12 inches DBH within 100 feet of a riverbank, estuarine margin, or forest/marsh edge will be preserved and favored in silvicultural operations.
- All large super-dominant bottomland hardwood trees, such as baldcypress (*Taxodium distichum*) and water tupelo (*Nyssa* spp.), will be fostered, preserved, and protected as potential wood duck nesting trees.
- Specifically, promote and maintain baldcypress, water tupelo, willow oak, black willow, and hickory trees of at least 16 inch DBH with 10-20 square inch openings to provide suitable wood duck cavities.
- Provide 25 acres of wood duck brood habitat with hardwood/pine, hardwood, or absent overstory; midstory of *Baccharis* spp, willow, dwarf palmetto, and buttonbush; and emergent native herbaceous vegetation in the understory distributed throughout compartments 1, 2, 3NE, 4, 6N, 7, 10, and 11.
- Provide a ratio of 20 acres of natural wood duck nesting habitat as described in section 3.2.2 above, within 1/2 mile of water (including streams) to every 1 acre of brood habitat.
- Allow a minimum of one usable natural wood duck cavity for every 5 acres of wood duck nesting habitat. (Supporting CCP Objective2.1)

Habitat Management Goal 3

Provide high quality foraging habitat in sufficient quantity to support the full red-cockaded woodpecker population goal for Big Branch Marsh NWR listed in the recovery plan (USFWS 2003a) (20 active clusters), including active and recruitment clusters. Achievement of this goal will allow Big Branch Marsh to fulfill its requirements in the RCW recovery plan.

Objective 3.1
By the end of the planning period for this Habitat Management Plan, at least 3500 acres, and up to 5000 acres, of pine or pine/hardwood stands will meet RCW foraging habitat characteristics and support 20 active RCW clusters on current Refuge land. RCW foraging habitat will meet the following conditions:

- At least 200, and ideally 250, acres in association with each cluster site.
- Pine basal area in and around RCW cluster sites on the Refuge should be optimized at 50-80 sq ft/ac.
- Eighteen or more pines trees/ac that are at least 60 years old and average 14 or more inches in DBH.
- Basal area of all pines above 10 inches DBH must be greater than 40 sq ft/ac.
- Basal area of pines smaller than 10 inches DBH must be less than 10 sq ft/ac and made up of less than 20 trees/ac.
- If hardwood midstory is present, it is sparse and is maintained at 7 ft in height or less; naturally occurring xeric hardwood inclusions may be retained but will not be

recognized as foraging habitat Canopy hardwoods are absent or occupy less than 10% of the canopy in longleaf pine forests and less than 30% of the canopy in slash and loblolly forests.

- Native grasses and fire-tolerant herbs cover 40-80% or more of the ground and are dense enough to carry a medium-intensity fire at least every 5 years with an emphasis on growing season burns.
- Non-native trees, grasses and forbs cover no more than 25% of the ground and do not inhibit native vegetation.
- Cluster foraging habitat should not be separated by more than 200 feet of non-forested land, where possible.
- Fifty percent or more of this habitat is within 0.25 miles (1320 ft) of each cluster. (Supports CCP Objectives 1.1, 2.3, 2.4)

Other plans supported by Refuge resource management

North American Bird Conservation Initiative (US NABCI 2000; http://www.nabci-us.org/aboutnabci/NABCIfndtn.pdf)
North American Waterfowl Management Plan 2012 (http://www.fws.gov/birdhabitat/NAWMP/index.shtm)
North American Waterbird Conservation Plan (NAWCP 2002; http://www.waterbirdconservation.org/pdfs/plan_files/introduction.pdf)
Partners in Flight Bird Conservation Plans (PIF http://www.partnersinflight.org/conservation_plans/)
Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) (http://lacoast.gov/new/About/)
Red-cockaded Woodpecker Recovery Plan (USFWS 2003; http://www.fws.gov/rcwrecovery/)

Local plans supported by Refuge resource management

Coast 2050: Towards a Sustainable Coastal Louisiana (http://www.coast2050.gov/)
Louisiana Comprehensive Wildlife Conservation Strategy (Wildlife Action Plan) (http://www.wlf.louisiana.gov/wildlife/wildlife-action-plan-details)
Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin (http://www.saveourlake.org/habitat-management-plan.php)

Refuge Resources of Concern

Wintering Waterfowl (FF04RLBM00-002 and FF04RLBM00-004)
Wood Duck (FF04RLBM00-012)
Red-cockaded Woodpecker (FF04RlBM00-003 and FF04RLBM00-013)

Species of Special Interest

Gulf sturgeon (*Acipenser oxyrinchus desotoi*)-T
American alligator (*Alligator mississippiensis*)-T
Flatwoods digger crawfish (*Fallicambarus oryktes*) -S2
Mole king snake (*Lampropeltis calligaster*)-S1 (FF04RLBM00-014)
Eastern glass lizard (*Ophisaurus ventralis*)-S3 (FF04RLBM00-014)
Brown pelican (*Pelecanus occidentalis*)-D
Ornate chorus frog (*Pseudacris ornata*)-S1 (FF04RLBM00-014)
Pine woods litter snake (*Rhadinaea flavilata*)-S (FF04RLBM00-014)
West Indian manatee (*Trichechus manatus*)-E
Bachman's Sparrow (*Aimophila aestivalis*)
American Swallow-tailed Kite (*Elanoides forficatus*)
Bald Eagle (*Haliaeetus leucocephalus*) (FF04RLBM00-008)
Osprey (*Pandion haliaetus*)
Georgia tickseed (*Coreopsis nudata*)-S2
Louisiana quillwort (*Isoetes louisianensis*)-E

Pine lily (*Lilium catesbaei*)-S1 (FF04RLBM00-017)
Winged primrose-willow (*Ludwigia alata*)-S1
Large white-fringed orchid (*Platanthera blephariglottis* var. *conspicua*) -S1 (FF04RLBM00-017)
Clasping-leaf pondweed (*Potamogeton perfoliatus*)-SH
Bastard oak (*Quercus sinuata* var *sinuata)*-S1
Louisiana spikemoss (*Selaginella ludoviciana*)-S1
Saw palmetto (*Serenoa repens*)-S1
Baldcypress (*Taxodium distichum*)

Refuge Species Groups of Special Interest

Water birds (FF04RLBM00-002 and FF04RLBM00-004)
Game Animals
Reptiles and Amphibians (FF04RLBM00-014)
Fish
Bats (FF04RLBM00-016)

State Rare Natural Communities of Special Interest

Eastern hillside seepage bog (S2) (FF04RLBM00-017)
Eastern longleaf pine savanna (S1) (FF04RLBM00-009)
Eastern upland longleaf pine forest (S1)
Freshwater marsh (S1)
Slash pine-pond cypress bottomland forest (S2)
Estuarine submergent vascular vegetation (S1)

Appendix B. Brief Description of Non-selected Surveys

Table B.1. Description of non-survey activities identified at the scoping meeting which were excluded from survey prioritization and the reason for exclusion (20 activities).

Activity Name	Description	Reason for Exclusion
Alligator Population Surveys	Monitoring of Alligator Populations	Terminated; changed to historic status
Migratory bird diseases studies (e.g., botulism, chlorea, aspergillosis), especially for endangered waterbirds or emerging wildlife disease issues (e.g., white-nose syndrome, chytrid)	Studies are needed to provide information on migratory bird diseases especially for resources of Refuge concern	Independent research question; not considered Refuge survey
Fish Disease Research	Studies are needed to provide information on fish diseases of fish resources of the Refuge	Targeted research needed to address specific fish disease information
Climate change Vulnerability Modeling Studies	Application of current modeling efforts for coastal vulnerability are needed to provide information on climate change responses of the Refuge and future planning	Not a survey; independent research study needed to specifically address modeling efforts of climate change
Submersed Aquatic Vegetation (SAVs) studies related to climate change	Submerged aquatic vegetation information is needed for populations on the Refuge habitats that may be impacted by climate change	Not a survey; specific research study needed to relate SAVs to climate change models
Public Use Impact Study	Information is needed on the impacts of public use, recreation, harvest and other uses on Refuge resources	Not a survey; targeted research study needed to analyze the impacts of public uses on Refuge resources
Climate Change and Shoreline Erosion Study	Studies are needed to provide an overall model of the changes in shoreline along the Refuge in relation to erosion and changes in habitats	Not a survey: specific research studies needed to analyze the impacts of climate change on shoreline erosion
Forest Activity Administrative Monitoring (Timber sales monitoring)	Forestry activities need to be monitored for overall fiscal and budgetary compliance to administrative policy	Not a survey; General Administrative Monitoring of forest timber sales
Marsh Stabilization using Christmas Tree Project Surveillance	Marsh restoration success needs to be monitored to see if the efforts in place are contributing to Refuge marsh creation both long and short term	Not a survey; a research study is needed to evaluate the use of marsh restoration techniques used in land management activities
Marsh Restoration Planting Evaluation	Marsh planting evaluations	Not considered a survey; independent research is needed to evaluate and analyze the overall use of marsh plantings in the restoration of coastal marshes of Louisiana
Ozone Monitoring	Air quality monitoring	The Refuge would need considerable funding to begin data collection for air

		quality monitoring; no significant issues at this time
Mottled duck breeding bird surveys	Mottled Duck breeding bird surveys	No suitable breeding habitat for mottled ducks on the Refuge currently
Lead in Pipeline monitoring	Contaminant information along Refuge gas pipelines	Not applicable; no known Refuge issues to address at this time
Superfund site- Bayou Bonafuca-water quality	Contaminant information associated with superfund site monitoring	Not applicable; no Refuge issues to address at this time
Archaeology of Bonafuca Site	Cultural resource baseline inventory	Bona Fuca site is a superfund site and off-Refuge with no cultural resources on Refuge associated with the site
Diamondback terrapin inventory	Baseline inventory of Diamondback Terrapins on Refuge	Not applicable; no suitable habitat present on Refuge
Forest stand/fuel/vegetation administrative maps	Administrative map products needed for Refuge	Not applicable; This activity is not considered monitoring activity but rather GIS map products needed for the Refuge
Abiotic and Biotic spatial data layers LiDAR, wetland topography, etc.	Baseline map products for Refuge	Not applicable; GIS layer development is needed; information is available to make map
Invasive plant map	Part of baseline information map products needed for the Refuge	Not applicable; GIS map products needed for the Refuge; information available
Water quality monitoring	Water quality, especially where there are known or suspected issues	Considerable funding would be needed to conduct water quality monitoring for the Refuge; no known issues suspected currently

Appendix C. Criteria and Weights Used to Prioritize Surveys

Table C-1. Description of Criteria and Rating score choices used to prioritize selected surveys using the Survey Prioritization Tool (SP Tool) (for details of each Criterion Definition see USFWS 2014b).

Criteria Category	Criteria	Scoring Choices
Refuge Priorities and Management Needs	*1A. Refuge Purpose*	Scale 1-4
	1B. CCP or Other Management Plan Objectives	Scale 1-4
	1C. NWRS Objectives	Scale 1-4
	1D. Management Utility (Decision Support) for the Refuge	Scale 1-4
Partner Priorities and Management Needs	*2A. FWS Program Need*	Scale 1-4
	2B. FWS Partner Need	Scale 1-4
Ecological Application	*3A. FWS Surrogate Species*	Scale 1-4
	3B. Refuge Processes	Scale 1-3
	3C. Survey Breadth	Scale 1-4
Additional Legal Mandates	*4A. Listed Species or Vegetation Communities*	Scale 1-4
	4B. Non-ESA or Refuge Purpose Mandate (s)	Scale 1-3
Immediacy of Need	*5A. Controversy*	Scale 1-4
	5B. Threat	Scale 1-4
Scope and Scale	*6A. Baseline Data*	No/Yes (1-2)
	6B. Survey Scope	Scale 1-3
	6C. Spatial Scale	Scale 1-4
	6D. Integration	Scale 1-4
	6E. Data Quality and Scope	Scale 1-4
Protocol	*7A. Sampling Design Stage*	Scale 1-4
	7B. Field Methods Stage	Scale 1-4
	7C. Data Management, Analysis, and Reporting	Scale 1-4
Cost	*8A. Monetary*	Scale 1-5
	8B. Personnel	Scale 1-4
	8C. Security/Souce of Funding	Scale 1-4

Table C-2. Criteria Weights used to prioritize 24 surveys using the Survey Prioritization Tool (SP Tool) (USFWS 2014b).

Criteria Category	Record	Criteria	Scoring Choices	1 Rank	2 Rating	3 Weights	Comparison to Even Weighting	
							All 24 Criteria	Used Criteria
1. Refuge Priorities and Management Needs	1	*1A. Refuge Purpose*	scale 1-4	7	60	**0.05747**	0.0158	0.0140
	2	*1B. CCP or Other Management Plan Objectives*	scale 1-4	2	87	**0.08333**	0.0417	0.0399
	3	*1C. NWRS Objectives*	scale 1-4	3	77	**0.07375**	0.0321	0.0303
	4	*1D. Management Utility (Decision Support) for the Refuge*	scale 1-4	1	95	**0.09100**	0.0493	0.0475
2. Partner Priorities and Management Needs	5	*2A. FWS Program Need*	scale 1-4	10	47	**0.04502**	0.0034	0.0015
	6	*2B. FWS Partner Need*	scale 1-4	16	17	**0.01628**	-0.0254	-0.0272
3. Ecological Application	7	*3A. FWS Surrogate Species*	scale 1-4	19	10	**0.00958**	-0.0321	-0.0339
	8	*3B. Refuge Processes*	scale 1-3	20	7	**0.00670**	-0.0350	-0.0368
	9	*3C. Survey Breadth*	scale 1-4	16	17	**0.01628**	-0.0254	-0.0272
4. Additional Legal Mandates	10	*4A. Listed Species or Vegetation Communities*	scale 1-4	5	70	**0.06705**	0.0254	0.0236
	11	*4B. Other Legal Mandates*	scale 1-3	10	47	**0.04502**	0.0034	0.0015
5. Immediacy of Need	12	*5A. Controversy*	scale 1-4	15	28	**0.02682**	-0.0148	-0.0167
	13	*5B. Threat*	scale 1-4	8	57	**0.05460**	0.0129	0.0111
6. Scope and Scale	14	*6A. Baseline Data*	No/Yes (1-2)	4	73	**0.06992**	0.0283	0.0264
	15	*6B. Survey Scope*	scale 1-3	14	30	**0.02874**	-0.0129	-0.0147
	16	*6C. Spatial Scale*	scale 1-4	18	13	**0.01245**	-0.0292	-0.0310
	17	*6D. Integration with Other Survey*	scale 1-4	0	0	**0.00000**	-0.0417	-0.0435
	18	*6E. Attribute Quality and Scope*	scale 1-4	17	15	**0.01437**	-0.0273	-0.0291
7. Protocol	19	*7A. Sampling Design Stage*	scale 1-4	9	50	**0.04789**	0.0062	0.0044
	20	*7B. Field Methods Stage*	scale 1-4	11	45	**0.04310**	0.0014	-0.0004
	21	*7C. Data Management, Analysis, and Reporting*	scale 1-4	9	50	**0.04789**	0.0062	0.0044
8. Cost	22	*8A. Monetary*	scale 1-4	13	40	**0.03831**	-0.0034	-0.0052
	23	*8B. Personnel*	scale 1-4	6	67	**0.06418**	0.0225	0.0207
	24	*8C. Security/Source of Funding*	scale 1-4	12	42	**0.04023**	-0.0014	-0.0032
			No. Rated Criteria:		24	0.0417	= even weight for 24 criteria	
			No. non-0 Criteria:		23	0.0435	= even weight non-0 criteria	

Appendix D. Prioritization Scores and Status of All Ranked Surveys

Values used to prioritize 24 surveys likely to be conducted through 2030 at Big Branch Marsh National Wildlife Refuge. Prioritization scores were generated for candidate surveys by Refuge staff using 24 criteria for each survey (Appendix C). Scores were then used as a starting reference to assign the surveys into categories. Finally, survey status was assigned by considering the capacity available for conducting each survey to completion: Current surveys are those that can be done with station funds alone. Expected surveys will possibly be conducted because at present additional capacity is needed from non-station funding sources to do them and staff felt it was more likely than not that capacity would be realized during the span of the IMP. Future surveys are those not very likely to be conducted because of low priority or very limited chance in secure funding with no capacity to do them.

No.	Survey Name (PRIMR ID No. FF04RLBM00-)	Final Score	Tier[a]	Survey Status	IMP Status	Survey Priority
1	RCW Nest Monitoring (003)	0.695	1	Current	Selected	1.01
2	Hazardous Fuel and Fire Effects Monitoring (006)	0.696	1	Current	Selected	1.02
3	Marsh Monitoring via CRMS (011)	0.652	2	Current	Selected	1.03
4	Wood Duck Nest Box Monitoring (012)	0.339	1	Current	Selected	1.04
5	Baseline Herpetofaunal Inventory (014)	0.303	1	Current	Selected	1.05
6	Weather Monitoring via RAWS (015)	0.594	1	Current	Selected	1.06
7	RCW Habitat Monitoring (013)	0.669	2	Expected	Selected	2.01
8	Mid-winter Waterfowl Surveys (002)	0.579	2	Expected	Selected	2.02
9	Aerial Waterfowl Surveys (004)	0.568	2	Expected	Selected	2.03
10	Invasive Plant Species Monitoring (007)	0.468	2	Expected	Selected	2.04
11	Savanna Restoration Monitoring (009)	0.427	2	Expected	Selected	2.05
12	Mid-winter Eagle Surveys (008)	0.402	2	Expected	Selected	2.06
13	Mobile Acoustical Bat Monitoring (016)	0.264	2	Expected	Selected	2.07
14	Seepage Bog Restoration Monitoring (017)	0.262	2	Expected	Selected	2.08
15	Fish Inventory (018)	0.255	3	Future	Not-selected	
16	Wood Duck Breeding Bird Surveys (019)	0.252	3	Future	Not-selected	
17	Migratory Shorebird Surveys (020)	0.250	3	Future	Not-selected	
18	Wading Bird Surveys (021)	0.194	3	Future	Not-selected	
19	Pollinator Inventory (022)	0.151	3	Future	Not-selected	
20	Game Species Monitoring (023)	0.143	3	Future	Not-selected	
21	Pest and Predator Monitoring (024)	0.138	3	Future	Not-selected	
22	Mammal Inventory (025)	0.120	3	Future	Not-selected	
23	Climate Change Phenology Monitoring (026)	0.118	3	Future	Not-selected	
24	Mosquito Control Effects Monitoring (027)	0.037	3	Future	Not-selected	

[a]Tier 1- The highest priority surveys that can be conducted with existing staffing and funding. Tier 2- seen as second priority for the station or high priority that would require increase in operational capacity. Tier 3- Lower priority surveys that are currently being conducted or are anticipated but would require major reallocation of staff and capacity.

Appendix E. Non-Selected Future Surveys

Table E. Surveys conducted in the future if additional capacity becomes available (10 surveys).

Survey Name (PRIMR ID No.)	Description	Survey Status
Fish Inventory (FF04RLBM00-018)	Baseline inventory for fish species on the Refuge	Future
Wood Duck Breeding Bird Surveys (FF04RLBM00-019)	Monitor breeding wood duck populations on the Refuge to determine if the use of artificial wood duck boxes is needed	Future
Migratory Shorebird Surveys (FF04RLBM00-020)	Survey of migratory shorebirds on the Refuge	Future
Wading Bird Surveys (FF04RLBM00-021)	Survey of wading birds on the Refuge	Future
Pollinator Inventory (FF04RLBM00-022)	Baseline inventory of pollinators on the Refuge	Future
Game Species Monitoring (FF04RLBM00-023)	Monitor populations of selected game species on the Refuge	Future
Pests and Predator Monitoring (FF04RLBM00-024)	Monitor populations of pests and their predators	Future
Mammal Inventory (FF04RLBM00-025)	Baseline mammal inventory on the Refuge	Future
Climate Change Phenological Monitoring (FF04RLBM00-026)	Monitor changes in phenology of key indicators (flowering plants, insect abundance, or migratory bird populations) over time for baseline climate change response information	Future
Mosquito Control Treatment Effects Monitoring (FF04RLBM00-027)	Monitor the effects of mosquito control treatments on specific wildlife populations (fish, herps or birds) on the Refuge	Future

Appendix F. IMP Revision Signature Page

IMP Revisions

Big Branch Marsh National Wildlife Refuge

Action	***Signature /Printed Name***	***Date***
Survey list and priority changed:		
Submitted By:	Refuge Manager/Project Leader	
Reviewed By:	Regional I&M Coordinator	
Approved By:	Refuge Supervisor	

Appendix G: Environmental Action Statement (EAS)

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other statues, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action does not require additional NEPA documentation.

Proposed Action, Alternatives and NEPA Documentation

The proposed action is to implement an Inventory and Monitoring Plan (IMP) for the Big Branch Marsh National Wildlife Refuge (Big Branch Marsh NWR). This IMP is a refinement of the 2007 Comprehensive Conservation Plan (CCP) and associated Environment Assessment (EA) for the Refuge. This IMP provides more-specific guidance for surveys of Big Branch Marsh NWR's fish, wildlife, plant, habitat, and abiotic resources to fulfill Big Branch Marsh NWR's purposes and help achieve Big Branch Marsh NWR's goals and objectives.

The EA for Big Branch Marsh NWR's CCP included goals and objectives for Big Branch Marsh NWR and assessed the impacts associated with a range of reasonable alternative to achieve those goals and objectives. The rationale for selection of one specific alternative for implementation is explained in the Finding of No Significant Impact (FONSI, signed August 27, 2007) accompanying the final CCP. The goals, objectives and survey strategies included in this IMP fall within the bounds of those described and assessed in the CCP EA. Pursuant to 40CFR 1502.9, no additional NEPA documentation is required to implement this IMP beyond the EA and FONSI prepared concurrently with the CCP. No substantial changes to the proposed action alternative that was identified, analyzed, and selected for implementation within the CCP, EA and FONSI are proposed through this IMP. Similarly, no significant new information or circumstances exist relevant to environmental concerns and bearing on the proposed action or its impacts.

In accordance with 43 CFR 46.205 and 40 CFR 1508.4, some surveys within this IMP are covered by the following Departmental Categorical Exclusion because they would not have significant environmental effects.

"Research, inventory, and information collection activities directly related to the conservation of fish and wildlife resources which involve negligible animal mortality or habitat destruction, no introduction of contaminants, or no introduction of organisms not indigenous to the affected ecosystem." 516 DM 8.5B(1).

Project Leader or Refuge Manager Date

Big Branch Marsh National Wildlife Refuge

Supporting Documentation

US FWS 2007a. Big Branch Marsh National Wildlife Refuge Comprehensive Conservation Plan. Lacombe, LA

USFWS 2007b. Big Branch Marsh National Wildlife Refuge Environmental Assessment for the Draft Comprehensive Conservation Plan with Finding of No Significant Impact (FONSI). Lacombe, LA

USFWS 2007c. Big Branch Marsh Fire Management Plan. Lacombe, LA

USFWS 2010. Big Branch Marsh Fire Effects Monitoring Plan. April 2010. Lacombe, LA

USFWS 2011. Habitat Management Plan Big Branch Marsh National Wildlife Refuge. Lacombe, LA