



Inventory and Monitoring Plan Dahomey National Wildlife Refuge



Photo Credit: Larry Pace

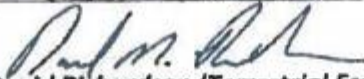
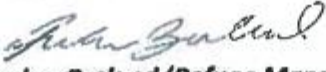
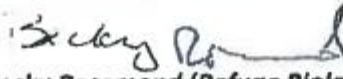
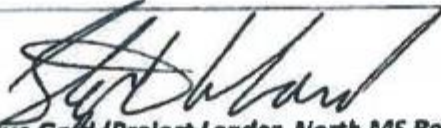
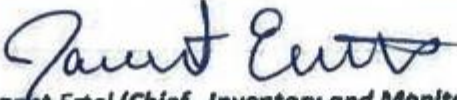



July 2015



Dahomey National Wildlife Refuge

Inventory and Monitoring Plan

Signature Page

Action	Signature /Printed Name	Date
Prepared By:	 David Richardson (Terrestrial Ecologist, I&M Branch)  Amber Breland (Refuge Manager, Dahomey NWR)  Becky Rosamond (Refuge Biologist, N. MS Refuge Complex)	7/8/2015
Submitted By:	 Steve Gatti (Project Leader, North MS Refuges Complex)	7/20/15
Reviewed By:	 Janet Ertel (Chief, Inventory and Monitoring Branch)	8/19/15
Reviewed By:	 Ricky Ingram (Refuge Supervisor)	8/24/15
Reviewed By:	 Chuck Hunter (Chief, Division of Strategic Resource Mgt)	8/25/15
Approved By:	 David Viker (Chief, Division of Refuges, Region 4)	8/27/15

for

Table of Contents

Signature Page	ii
Introduction.....	1
<i>Refuge Purposes</i>	1
<i>Refuge Priorities</i>	1
<i>Vision Statement</i>	1
Methods.....	2
<i>Prioritizing and Selecting Surveys</i>	2
<i>Estimating Capacity</i>	4
Results.....	4
<i>Selected Surveys</i>	4
<i>Non-selected Surveys</i>	5
<i>National Environmental Policy Act (NEPA) Compliance</i>	5
Table 1.	6
Survey Narratives.....	9
1.01. Landbird Point Count; (FF04RMDH00-009)	9
1.02. Migrant and Wintering Waterbird Monitoring; (FF04RMDH00-022).....	11
1.03. Mobile Acoustical Bat Monitoring; (FF04RMDH00-006)	12
1.04. Pondberry Monitoring; (FF04RMDH00-014)	13
1.05. Moist-soil/Grain Production; (FF04RMDH00-020).....	14
1.06. Forest Stand Monitoring; (FF04RMDH00-015).....	15
1.07. Breeding Bird Survey; (FF04RMDH00-004).....	17
1.08. Hardwood Reforestation Evaluation; (FF04RMDH00-013)	18
1.09. North American Amphibian Monitoring; (FF04RMDH00-002).....	20
1.10. Hog Vegetation Damage Assessment; (FF04RMDH00-021)	21
1.11. Hunter Use and Harvest Monitoring; (FF04RMDH00-005)	22
1.12. Groundwater Table Monitoring; (FF04RMDH00-023).....	23
1.13. Stream Temperature Monitoring; (FF04RMDH00-024).....	24
2.1. Bat Basal Cavity; (FF04RMDH00-010).....	25
2.2. Fish Inventory; (FF04RMDH00-025).....	26
2.3. Herpetofaunal Inventory; (FF04RMDH00-026).....	27
2.4. Plant Inventory; (FF04RMDH00-027)	28
2.5. Mussel Inventory; (FF04RMDH00-028).....	30

2.6. Crayfish Inventory; (FF04RMDH00-029).....	31
2.7. Small Mammal Inventory; (FF04RMDH00-030).....	32
References.....	34
Appendix A. Brief Description of “Future- (Tier 3)” Surveys and Non-survey Activities Considered in the Dahomey NWR IMP Process.	38
Table A.1. Nine non-survey activities were identified which were excluded from survey prioritization processes and the reason for not considering them.....	38
Table A.2. Ten surveys were identified for consideration in the future if significant new capacity becomes available “Future (Tier 3)”	39
Appendix B. Survey Prioritization Tool Criteria and Weights Used to Prioritize Surveys.....	40
Table B.1. Criteria and calculated weights used in the Survey Prioritization Tool.....	40
Table B.2. Criteria removed from consideration in the Survey Prioritization Tool and justification.	41
Appendix C. Prioritization Scores and Status of All Ranked Surveys	42
Table C.1. Scores from the Survey Prioritization Tool and an Independent Opinion-based Prioritization Process for 30 surveys	42
Appendix D. Environmental Action Statement for Dahomey National Wildlife Refuge Inventory and Monitoring Plan	44
Appendix E. Initial Survey Instruction Forms for 20 Current and Expected Surveys to be conducted on Dahomey National Wildlife Refuge from 2015-2030.....	45
1.01 Landbird Point Count.....	45
1.02 Migrant and Wintering Waterbird Monitoring	58
1.03 Mobile Acoustical Bat Monitoring	65
1.04 Pondberry Monitoring.....	75
1.06 Forest Stand Monitoring	84
1.07 Breeding Bird Survey	90
1.08 Hardwood Reforestation Evaluation.....	109
1.09 North American Amphibian Survey	111
1.10 Hog Vegetation Damage Assessment.....	122
1.11 Hunter Use and Harvest Monitoring.....	129
1.12 Groundwater Table Monitoring	135
1.13 Stream Temperature Monitoring.....	141
2.1 Bat Basal Cavity	151
2.2 Fish Inventory	158
2.3 Herpetofaunal Inventory	164
2.4 Plant Inventory.....	170

2.5 Mussel Inventory	176
2.6 Crayfish Inventory	183
2.7 Small Mammal Inventory	189
IMP Revision Signature Page	195

Introduction

This Inventory and Monitoring Plan (IMP) documents natural resource surveys that will be conducted at the Dahomey National Wildlife Refuge (NWR) from 2015 through 2030, or until the refuge Comprehensive Conservation Plan (CCP), Habitat Management Plan (HMP) or this IMP are revised. The majority of surveys considered in this plan address resource management objectives identified in the Dahomey NWR HMP (U.S. Fish and Wildlife Service 2013) and the North Mississippi National Wildlife Refuges Complex CCP (U.S. Fish and Wildlife Service 2005). Many surveys are a continuation of past monitoring conducted for tracking long-term trends of specific resources and understanding ecological interactions. Additionally, several surveys feature refuge cooperation in regional (e.g., Landscape Conservation Cooperatives) and national efforts (e.g., Breeding Bird Survey). This plan also includes proposed inventory and monitoring surveys which will rely on future labor and funding. This IMP was developed according to the Inventory and Monitoring (I&M) policy (701 FW 2) for the National Wildlife Refuge System.

Refuge Purposes

Under legislative provisions of the Migratory Bird Conservation Act; Fish and Wildlife Act of 1956; and Emergency Wetlands Resource Act of 1986, Dahomey NWR was established in 1992:

- i. "...for use as inviolate sanctuary, or for any other management purpose, for migratory birds....,"
- ii. "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..." , and
- iii. "...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" (U.S. Fish and Wildlife Service 2005).

Refuge Priorities

Additional refuge priorities include 1) incidental fish and wildlife oriented recreational development, 2) protection of natural resources, 3) conservation of endangered or threatened species (16 USC section 460k-1 Refuge Recreation Act), and 4) biodiversity (National Wildlife Refuge Improvement Act 1997). Dahomey NWR is considered important to meeting migrant and wintering waterfowl habitat needs as identified in the North American Waterfowl Management Plan (USFWS 1986a) and the Dahomey Land Protection Plan (U. S. Fish and Wildlife Service 1991).

Vision Statement

Based on sound science, Dahomey NWR will conserve, protect, enhance, and where possible restore the ecological integrity of bottomland hardwood forests, wetlands, wildlife, fisheries, and other plant communities within upper portions of the Mississippi Alluvial Valley (MAV) for the benefits of present and future generations of Americans (U.S. Fish and Wildlife Service 2005). This IMP will provide a foundation for measuring effectiveness of strategies to achieve HMP goals and objectives and the overarching goals set forth in the North Mississippi Refuges Complex CCP.

Methods

Prioritizing and Selecting Surveys

Background information for historic and current surveys was obtained from data entered in the Planning and Review of Inventory and Monitoring on Refuges (PRIMR) database. In addition, a list of other potential surveys was developed by soliciting input from refuge staff. This list was generated by addressing goals and objectives in the CCP, identifying possible surveys that would evaluate habitat and wildlife response variables associated with objectives in the Dahomey NWR HMP, and considering priorities within other U.S. Fish and Wildlife Service (Service) programs at the local, regional and national levels (i.e., Migratory Birds, Fisheries, and Ecological Services). Also, the list was expanded to include surveys which considered emerging disease, invasives species, and climate/abiotic resource issues relevant to the Southeast or more specific to the Mississippi Delta. An initial list of 39 inventory or monitoring surveys was generated from this exercise to consider for inclusion in the Dahomey NWR IMP. Two surveys were immediately identified as being non-survey activities and dropped from further consideration (Appendix A-Table A.1).

A meeting to establish a procedure for prioritizing and selecting surveys for the Dahomey IMP was held at the North Mississippi NWR Complex office on November 12, 2014. Refuge staff participating in this process included Steve Gard (Project Leader), Travis Carpenter (Deputy Project Leader), Amber Breland (Refuge Manager), and Becky Rosamond (Refuge Wildlife Biologist). Refuge staff was provided general guidance in this process by David Richardson (Terrestrial Ecologist, Region 4 I&M Branch). Based on this meeting, it was decided that two independent processes would be used to evaluate and prioritize the survey list. The two processes served to assist the refuge staff in evaluating surveys based on day-to-day operations perceptions as well as a more regional, objective based approach. The first process involved an opinion-based ranking of each survey by each staff member; no specific criteria were used to rank the surveys. The second evaluation process was developed by the Natural Resource Program Center, National I&M Initiative, along with a Survey Prioritization Tool (U.S. Fish and Wildlife Service 2014a). This tool utilizes a simple, multi-attribute ranking technique based on a linear additive model, whereby an overall prioritization score for each survey is calculated from the product of the total sum of a performance score of each selected criterion and the weight of that criterion (Goodwin and Wright 2014). This process and the Survey Prioritization Tool provided a standard, structured, and transparent approach to prioritizing surveys. Originally, 24 criteria were developed for the Survey Prioritization Tool to evaluate each survey (U.S. Fish and Wildlife Service 2014a). Of these 24 criteria, the Region 4 I&M Branch chose to remove eight after careful consideration because they believed they were either redundant with other criteria, or would not add discrimination among surveys. The final selected criteria are provided in Appendix B-Table B.1.

Opinion-based ranking of 37 surveys was done independently by the Refuge Manager, Wildlife Biologist, and Deputy Project Leader. The Project Leader did not participate in this activity. Each survey was assigned a value from 1-37 (with “1” being the most important). If a staff

member felt multiple surveys were not worth continuing, they were each assigned a value of 37. Finally, the average rank was calculated for each survey to produce a staff consensus opinion-based rank. After review of the 37 rank scores, it was decided that four surveys could be combined into two surveys (pondberry inventory with pondberry monitoring) and (moist-soil vegetation monitoring and cereal grain production). Also six surveys were dropped altogether from further consideration due to their lack of contribution to the refuge (Appendix A-Table A.1). After completing the initial screening of potential surveys using the opinion-based prioritization process, two additional surveys were reviewed (bat basal cavity inventory and abnormal frog monitoring). The bat basal cavity inventory was suggested to be included in the Survey Prioritization Tool process and the abnormal frog monitoring was considered a non-selected survey.

The remaining 30 surveys were subsequently evaluated using the Survey Prioritization 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 criteria independently from each of the four refuge staff members. A fifth rating value from the Region 4 I&M Branch was also incorporated into the tool. These five ratings (four refuge staff + one I&M Branch) were then combined in the Survey Prioritization Tool to create a consensus weighting value to be used to score the surveys by the final 16 criteria (Appendix B-Table B.1). Actual scores for each survey were assigned through a collaborative effort between the Refuge Biologist and I&M Terrestrial Ecologist. To insure consistency, all surveys were scored against a single criterion before moving on to score with the next criterion. Once all surveys were scored by each criterion, final values were generated in the Survey Prioritization Tool.

Both the staff opinion-based assessment and Survey Prioritization Tool process yielded relatively similar priorities for the majority of the highest ranking 15 surveys between the processes. (Appendix C). The final prioritized list of surveys was then divided into the following status and tier groupings:

1) Selected

a. Current (Tier 1): *surveys are ranked as high priority and could be completed based on present station capacity, within the lifespan of the IMP.*

b. Expected (Tier 2): *surveys are ranked as moderate to high station priority and could be completed over the timespan of the IMP with additional capacity obtained through non-station funding sources (e.g., regional biological funds, partners, grants, etc.).*

2) Non-selected

a. Future (Tier 3): *surveys that were proposed were ranked low priority, and/or the chance of obtaining required capacity to conduct them is very low.*

Final assignment of surveys to tiers was evaluated based on prioritization scores, refuge capacity (e.g., staff, dollars, etc.), competing time constraints with anticipated surveys to be conducted on other refuges within the refuge complex (i.e., Coldwater River and Tallahatchie NWRs), and

Regional Office direction with regards to priorities under the work force planning guidance for each refuge. Increased value of a survey was considered if it addressed waterfowl monitoring, public use activity, or there was an existing obligation to conduct the survey.

Estimating Capacity

The ability to conduct surveys on the refuge is a function of available staffing and anticipated annual base funding. Dahomey NWR has very limited staffing resources with only a refuge manager assigned to the station. The wildlife biologist serves three refuges within the North Mississippi Wildlife Refuges Complex and must balance survey efforts and priorities across those stations. No other staff from the refuge complex is available to support monitoring activities at Dahomey NWR. During the summer, the refuge expects to annually hire an intern for three months to assist with natural resource activities. This IMP attempts to recognize the limitations of staffing and funding while conducting the essential monitoring activities needed to fulfill the purposes of the refuge. Capacity, or the staff time and/or dollars to complete a survey, was roughly estimated by the Refuge Biologist (Table 1). These estimates should be considered baseline for 2015, as capacity changes from year to year as it is influenced by staffing and budgets. Estimates of capacity were obtained from the PRIMR database for those surveys selected as either Tier 1 or 2.

Results

Selected Surveys

The processes described above identified 20 surveys to be conducted over the time span of this IMP (Table 1, Appendix C-Table C.1). Of these, 13 were considered “Current (Tier 1)” surveys which the refuge anticipates being able to conduct based on anticipated funding and staffing for the duration of this IMP (2015-2030). Seven additional surveys were deemed “Expected (Tier 2)” and are dependent upon increases in overall or targeted annual funding to support staff in conducting the inventories over the time-frame of the IMP. Expected surveys will probably be conducted over the time span of the IMP because they are of moderate to high station priority and there is a reasonable chance that additional capacity will be made available to have them conducted. The remaining 10 surveys would require significant increases in funding to conduct over the duration of the plan or were deemed of lower priority because they did not address specific needs of the refuge and were more regional in scale.

Assignment of survey to specific tiers (1-3; Current, Expected, Future) largely followed the prioritization scores from the Survey Prioritization Tool. However, after consideration of capacity, protocol logistics, current survey obligations, and considerations for evaluation of environmental effects from climate change, several surveys were re-prioritized. For example, three surveys assigned to Current (Tier 1) status scored relatively low (< 0.260) with the Survey Prioritization Tool. These included hunter use and harvest monitoring (0.255), groundwater table monitoring (0.184), and stream temperature monitoring (0.021). Hunter use and harvest monitoring harvest was assigned a Current (Tier 1) status because it is a critical monitoring tool

to evaluate public hunting as it relates to wildlife populations (e.g., waterfowl, white-tailed deer [*Odocoileus virginianus*]) on the refuge. Stream temperature monitoring was assigned a Current (Tier 1) status because of an existing obligation with Ecological Services to monitor stream temperatures from several sites on the refuge complex. Also, this effort requires minimal annual-time and cost to implement (Table 1). Finally, the reduction of the local groundwater table perceived to be caused by extensive agricultural irrigation surrounding the refuge is an emerging issue that cannot be addressed properly without long-term data. Therefore, groundwater table monitoring was deemed critical to the refuge and assigned a status of Current (Tier 1).

Non-selected Surveys

Ten of the 30 surveys prioritized were not-selected for being conducted during the time span of this IMP (Table 1, Appendix A-Table A.2). The northern long-eared bat inventory, which had a relatively high Survey Prioritization Tool score (0.413), was moved to Future (Tier 3) status due to significant challenges in locating this species using existing sampling techniques. Furthermore, the information needs that this survey would contribute to on Dahomey NWR were considered lower priority than information needs gathered from other surveys. The remaining surveys were generally surveillance for disease or invasive species that would require funding at a regional scale to be most informative. Should special targeted funding become available, these surveys will be reconsidered.

National Environmental Policy Act (NEPA) Compliance

After selection of those surveys that would be conducted during the period of this I & M Plan, the surveys were evaluated to determine the level of NEPA documentation required. An Environmental Action Statement was prepared indicating the surveys to be conducted under this plan are covered by Departmental categorical exclusion because they would not have significant environmental effects (Appendix D).

Table 1. Surveys selected to conduct at Dahomey National Wildlife Refuge (FF04RMDH00) from 2015- 2030.

<i>Survey Priority¹</i>	<i>Survey ID No.²</i>	<i>Survey Name</i>	<i>Survey Type³</i>	<i>Survey Status⁴</i>	<i>Mgmt. Objective⁵</i>	<i>Survey Area⁶</i>	<i>Staff Time⁷</i>	<i>Ann. Cost⁸</i>	<i>Survey Timing⁹</i>	<i>Survey Length¹⁰</i>	<i>Survey Coord.¹¹</i>	<i>Protocol</i>	
												<i>Citation¹²</i>	<i>Status¹³</i>
1.01	FF04RMDH00-009	Landbird Point Count	M	Current	HMP/4.1.4, 4.1.5 CCP/1-7, 1-8	Multiple Management Units	FWS: 0.02	450	Annually May - June	2009-Indefinite	Becky Rosamond Wildlife Biologist	Knutson et al. 2008	National Framework Initial Survey Instructions
1.02	FF04RMDH00-022	Migrant and Wintering Waterbird Monitoring	CM	Current	HMP/4.1.1, 4.1.2	Multiple Management Units	FWS:0.02	300	Annually Biweekly October - March	2014-Indefinite	Becky Rosamond Wildlife Biologist	IWWM Loges et al. 2014	National Framework Initial Survey Instructions
1.03	FF04RMDH00-006	Mobile Acoustical Bat Monitoring	CM	Current	HMP/4.1.4	Multiple Management Units and Off Refuge Lands	FWS: 0.02	388	Annually 2-3 times June-July	2012-Indefinite	Amber Breland Refuge Manager	Richardson 2012a	Regional Framework, Initial Survey Instructions
1.04	FF04RMDH00-014	Pondberry Monitoring	M	Current	HMP/4.1.6 CCP/3-1	Multiple Management Units	FWS:0.03	800	Annually February-March	1990-Indefinite	Amber Breland Refuge Manager	None	Site-specific Initial Survey Instructions
1.05	FF04RMDH00-020	Moist-soil/Grain Production	M	Current	HMP/4.1.1	Multiple Management Units	FWS:0.01	100	Annually August-September	2015-Indefinite	Becky Rosamond Wildlife Biologist	None	Initial Survey Instructions
1.06	FF04RMDH00-015	Forest Stand Monitoring	M	Current	HMP/4.1.4, 4.1.5	Multiple Management Units	FWS:0.21	5750	Every 5-10 years	1995-Indefinite	TBD	None	Regional Framework Initial Survey Instructions
1.07	FF04RMDH00-004	Breeding Bird Survey	CM	Current	CCP/1-7, 1-8, 1-9	Multiple Management Units and Off Refuge Lands	FWS:0.05	100	Annually - June	2010-Indefinite	Becky Rosamond Refuge Biologist	USGS-BBS	National Framework Initial Survey Instructions
1.08	FF04RMDH00-013	Hardwood Reforestation Evaluation	M	Current	HMP/4.1.4, 4.1.5	Multiple Management Units	FWS:0.03	1240	Five year interval Fall/Spring	1998-Indefinite	TBD	None	Regional Framework Initial Survey Instructions
1.09	FF04RMDH00-002	North American Amphibian Monitoring	CM	Current	CCP/2-2	Multiple Management Units and Off refuge lands	FWS:0.01	330	Annually 3 times February-June	2001-Indefinite	Becky Rosamond Refuge Biologist	USGS-NAAMP	National Framework Initial Survey Instructions

1.10	FF04RMDH00-021	Hog Vegetation Damage Assessment	M	Current	CCP/4-3	Multiple Management Units	FWS: 0.03	200	Annually – September	2013-Indefinite	Becky Rosamond Refuge Biologist	None	Site-specific Initial Survey Instructions
1.11	FF04RMDH00-005	Hunter Use and Harvest Monitoring	M	Current	CCP/2-1, 4-3	Entire Station	FWS:0.1	3080	Annually September - May	2000-Indefinite	Becky Rosamond Refuge Biologist	None	Site-specific Initial Survey Instructions
1.12	FF04RMDH00-023	Groundwater Table Monitoring	BM	Current	HMP/4.1.6	Multiple Management Units	FWS: 0.01	600	Annually – 4 times	2015-Indefinite	Amber Breland Refuge Manager	None	Site-specific Initial Survey Instructions
1.13	FF04RMDH00-024	Stream Temperature Monitoring	CM	Current	HMP/4.1.6	Multiple Management Units	FWS: 0.01	150	Annually – 2 times	2014-Indefinite	Amber Breland Refuge Manager	None	Regional Framework Initial Survey Instructions
2.1	FF04RMDH00-010	Bat Basal Cavity	M	Expected	HMP/4.1.4 CCP/3-1	Multiple Management Units	FWS:0.02	685	Five year interval June- October	2015-Indefinite	Amber Breland Refuge Manager	Richardson 2012b	Site-specific Initial Survey Instructions
2.2	FF04RMDH00-025	Fish Inventory	I	Expected	CCP/2-3	Entire Station	FWS:0.04	600	Winter – Spring Occurs one time only	2015-2030	Becky Rosamond Wildlife Biologist	None	Site-specific Initial Survey Instructions
2.3	FF04RMDH00-026	Herpetofaunal Inventory	I	Expected	CCP/2-2, 3-1	Entire Station	FWS:0.08	1000	Throughout the year Occurs one time only	2015-2030	Becky Rosamond Wildlife Biologist	None	Site-specific Initial Survey Instructions
2.4	FF04RMDH00-027	Plant Inventory	I	Expected	CCP/3-1, 4-1, 4-2, 4-3	Entire Station	FWS:0.08	1000	May – November Occurs one time only	2015-2030	Amber Breland Refuge Manager	None	Site-specific Initial Survey Instructions
2.5	FF04RMDH00-028	Mussel Inventory	I	Expected	CCP/2.2, 3-1, 4-3	Entire Station	FWS:0.04	200	Summer and Fall Occurs one time only	2015-2030	Becky Rosamond Wildlife Biologist	None	Site-specific Initial Survey Instructions
2.6	FF04RMDH00-029	Crayfish Inventory	I	Expected	CCP/2-2, 3-1	Entire Station	FWS:0.08	1000	February- November Occurs on one time	2015-2030	Becky Rosamond Wildlife Biologist	None	Site-specific Initial Survey Instructions
2.7	FF04RMDH00-030	Small Mammal Inventory	I	Expected	CCP/2-2, 3-1	Entire Station	FWS:0.10	2000	Fall and Winter Summer for Bats Occurs on one time	2015-2030	Becky Rosamond Wildlife Biologist	None	Site-specific 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 code FF04RMDH00

³ Type of survey: I = Inventory; BM = Baseline Monitoring; M = Monitoring; CM = Cooperative Monitoring.

⁴ Selected surveys planned for the lifespan of this IMP (i.e., Current, Expected)

⁵ The management plan and objectives that justify the described survey.

⁶ Station management unit names, entire station, 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 Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time, TBD = to be determined.

⁹ Timing and frequency of survey field activities.

¹⁰ The years during which the survey has been or will be conducted.

¹¹ Name and position of the survey coordinator for each survey.

¹² Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

¹³ Scale of intended use (National Framework, Regional Framework, Site-specific) and stage of approval of the survey protocol (Initial Survey Instructions, Complete Draft, In Review, or Approved).

Survey Narratives

This section of the IMP provides a brief description of the selected surveys, both Current (Tier 1) and Expected (Tier 2) to be conducted during 2015-2030. The survey narrative provides a justification for the survey; metrics of interest; relationship of the survey to goals and objectives from the North Mississippi National Wildlife Refuges Complex CCP, the Dahomey NWR HMP and other regional or national plans; partners involved in data collection and analysis; and the protocol to be used to conduct the survey. Initial survey instructions for each survey are provided in Appendix E as well as linked to the Region 4, Fishnet Site.

1.01. Landbird Point Count; (FF04RMDH00-009)

Overview

This survey entails annual monitoring of focal bird species (percent occupancy and relative abundance) during the breeding period within mature bottomland hardwood stands. The suite of species detected in these bird surveys addresses the contribution the refuge has to meeting population objectives for high priority, forest interior neotropical migrant birds associated with the MAV (Hamel et al., 1996, Twedt et al. 1998). Species occurrence is directly influenced by forest stand composition and structure of within each management unit. This survey provides a measure for the North Mississippi National Wildlife Refuges Complex CCP goal to promote the conservation and management of migratory birds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005). Moreover, the survey is a foundation of biological information for use in monitoring ecosystem changes and informing local forest management decisions to address HMP goals and objectives. The survey was selected over others because of its high-priority score and opinion rank value, and the refuge assumes to have the capacity to conduct the survey for the duration of the IMP. In addition, data from this survey can be used at the refuge and landscape level to evaluate avian conservation within the lower MAV (Twedt et.al. 1998) and contribute to similar survey efforts within this geography. Interior forest neotropical migrant birds have been identified as a resource of concern for the refuge.

Objectives

This survey will be used to address avian response to two specific habitat objectives from the Dahomey NWR HMP and three CCP Objectives. Presently, there are no defined triggers for forest management decisions based on avian response; however, occupancy by high priority, forest interior neotropical migrant birds will be used to evaluate future forest management strategies.

HMP Objective 4.1.4

During the next 15 years at least 35% of Management Units (1, 4, 13, 23, 24, 27, 37, 38, 44, and 45) should be managed to contain a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by averages of 60 – 70% overstory

*canopy cover, 25 – 40% midstory cover, and 60 – 70 ft²/acre basal area (with over 25 % in older age classes as defined as those stems approaching biological senescence using species-site-size relationships as a surrogate for judging tree age), along with retention of most snags and potential denning trees (for Rafinesque’s big-eared bat, black bear, etc.) to meet the desired forest conditions as developed by the Lower Mississippi Valley Joint Venture (LMVJV) Forest Resource Conservation Working Group (2007). Establish appropriate buffer zones around sloughs and otherwise where potential Rafinesque big-eared bat (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*) roost trees are now found.*

HMP Objective 4.1.5

In Management Units (3, 7, 8, 15, 17, 19, 20, 21, 22, 25, 26, 28, 33, 34, and 36) evaluate the success of reforestation over the next 10 years and implement the LMVJV Forest Resource Conservation Working Group’s desired forest conditions on at least 35% of the reforested acreage. Desired conditions are to include a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by 60-70% overstory canopy cover, 25-40% midstory cover, and 60-70 ft²/acre basal area (with over 25% in older age classes).

CCP Objective 1-7: Forest Birds

Within two years of the plan’s approval, survey forest breeding birds with point counts tied to spatially discrete, georeferenced, habitat-specific locations to assess the preferred habitat, presence/absence, and relative abundance of all forest breeding species.

CCP Objective 1-8: Scrub/Shrub Birds

Maintain existing early successional habitats along buffer strips and within two years after the plan’s approval convert up to 10 percent of acquired agricultural lands throughout the refuge complex to scrub/shrub, supporting priority scrub/shrub breeding species.

Partner Roles

This survey is being done by the refuge primarily to inform local decisions regarding forest habitat management. The LMVJV, United States Geological Service (USGS), and the Migratory Bird Office (Jackson, MS) have previously collaborated on regional landbird point counts. However, no capacity is provided by either program to complete this survey. The refuge will continue to work with these programs and contribute data through the Avian Knowledge Network. In addition, the refuge will seek assistance as needed to summarize data.

Protocol Needs

Landbird point count survey protocol follows that described in the LMVJV Forest Resource Conservation Working Group (2007). It is anticipated that future surveys will follow the national

framework developed by Knutson et al. (2008). Initial survey instructions (<http://tinyurl.com/LndBird>) are linked to this survey record in PRIMR.

1.02. Migrant and Wintering Waterbird Monitoring; (FF04RMDH00-022)

Overview

This survey involves the biweekly monitoring of waterbird use of managed wetlands on the refuge to determine relative abundance and seasonal occurrence throughout the migrant and wintering period. Many refuges rely on traditional mid-winter waterfowl surveys and other periodic sampling to evaluate waterbird (e.g., ducks, geese, coots, and waders) use areas during migration and winter. These data provide information about the local scale utilization of wetlands by waterfowl and other waterbirds on a recurring biweekly basis. The migrant and wintering waterbird monitoring survey provides a measure for the North Mississippi National Wildlife Refuges Complex CCP goal to promote the conservation and management of waterbirds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005). Moreover, the survey is a foundation of biological information for informing local wetland management decisions to address HMP goals and objectives. In addition, data from this survey can be used at the refuge and landscape level to evaluate waterfowl conservation based on goals set by the LMVJV. This survey is coupled with the moist-soil/grain production survey to provide an overall assessment of the refuge contribution toward migrating and wintering waterbird conservation. Waterfowl have been identified as a resource of concern for the refuge.

Objective

This survey will be used to assess the wildlife responses to the wetland habitat objective from the Dahomey NWR HMP. The survey will track actual use of management units by waterbirds during fall and winter. Presently, there are no defined triggers for management decisions based on waterbird use. However, a lack of utilization primarily by waterfowl (duck-use-days) concurrent with food resource availability (duck-energy-days) will be used to evaluate future wetland management strategies.

HMP Objective 4.1.1

Manage Units 9, 10, 11, 12, 30, and 40 (373 acres) in agricultural/moist-soil plants to provide a minimum of 3.3 million duck-energy-days (minimum of 165 acres at 20,000 DED/acre) available beginning November 15 through March 15 in support of wintering waterfowl goals developed by the LMVJV.

Partner Roles

The refuge has the ability to conduct this survey on an annual basis. The survey can merge data with the Integrated Waterbird Management and Monitoring Initiative and contribute support to the LMVJV. Partnership with these two programs will be explored to determine the level of participation.

Protocol Needs

A national framework developed by Loges et al. (2014) will be used as the basis for this survey. A site-specific protocol is needed. Initial survey instructions (<http://tinyurl.com/WinterWaterfowlDHM>) are linked to this survey record in PRIMR.

1.03. Mobile Acoustical Bat Monitoring; (FF04RMDH00-006)

Overview

This survey will measure the relative abundance of bats by using acoustical sampling techniques 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. Mobile acoustical bat monitoring (MABM) is designed to evaluate long-term population trends of bats at a regional scale and provide a baseline inventory of species on the refuge. Multiple stressors including habitat fragmentation and degradation, white-nose-syndrome (WNS), and energy development (i.e., wind farms) are primary causes contributing to declines in bat species especially across the eastern United States. For many species, the decline is anticipated to accelerate as WNS expands west and south. Two species, Rafinesque's big-eared bat and the southeastern myotis, are identified as resources of concern on the refuge and highly reliant on bottomland hardwood ecosystems for roosting and foraging. Understanding population trends and habitat utilization at multiple scales supports efforts to conserve bats and inform the refuge about forest management. These data combined with other NWRs cooperating in this effort represent the only data available to evaluate population changes in foliage roosting bats.

Objectives

Baseline occurrence information will be used to evaluate response by bats within refuge forested management units and address two habitat management objectives from the HMP.

HMP Objective 4.1.4

*During the next 15 years at least 35% of Management Units (1, 4, 13, 23, 24, 27, 37, 38, 44, and 45) should be managed to contain a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by averages of 60 – 70% overstory canopy cover, 25 – 40% midstory cover, and 60 – 70 ft²/acre basal area (with over 25 % in older age classes as defined as those stems approaching biological senescence using species-site-size relationships as a surrogate for judging tree age), along with retention of most snags and potential denning trees (for Rafinesque's big-eared bat, black bear [*Ursus americanus*], etc.) to meet the desired forest conditions as developed by the LMVJV Forest Resource Conservation Working Group (2007). Establish appropriate buffer zones around sloughs and otherwise where potential Rafinesque's big-eared bat and southeastern myotis roost trees are now found.*

HMP Objective 4.1.5

In Management Units (3, 7, 8, 15, 17, 19, 20, 21, 22, 25, 26, 28, 33, 34, and 36) evaluate the success of reforestation over the next 10 years and implement the LMVJV Forest Resource Conservation Working Group's desired forest conditions on at least 35% of the reforested acreage. Desired conditions are to include a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by 60-70% overstory canopy cover, 25-40% midstory cover, and 60-70 ft²/acre basal area (with over 25% in older age classes).

Partner Roles

The refuge has the ability to conduct this survey annually. The data analysis and summary will be done by the Region 4, Inventory and Monitoring Network. The data will be combined for regional and landscape level analysis in cooperation with other partners including USGS and U.S. Forest Service (USFS).

Protocol Needs

A national framework protocol needs to be developed in concert with other state and federal partners. The refuge is currently conducting the MABM survey using the draft mobile acoustical survey protocol (Richardson 2012b). Initial survey instructions (<http://tinyurl.com/MABM-DHM>) are linked to this survey record in PRIMR.

1.04. Pondberry Monitoring; (FF04RMDH00-014)

Overview

This survey will determine the distribution and monitor the population of pondberry (*Lindera melissifolia*) on Dahomey NWR. Pondberry is a deciduous, aromatic shrub associated with wetland habitats of bottomland hardwoods (U.S. Fish and Wildlife Service 1993). The plant was federally listed as an endangered species in 1986 (U.S. Fish and Wildlife Service 1986b). This rare plant has extant populations from North Carolina, South Carolina, Alabama, Arkansas, Missouri, and Mississippi. Sixteen populations of pondberry have been located within the Delta Region of Mississippi (U.S. Fish and Wildlife Service 2014b). Survey efforts for this species on Dahomey NWR occurred in 1990 (Stewart 1990), 2008 (Unpublished data) and in 2014 (Richardson et al. 2014). In 2014, a small colony of 220 stems was located based on an inventory of approximately 2000 acres. However, large expanses of the refuge have yet to be evaluated for the presence of pondberry. This plant has been identified as a resource of concern on the refuge. Continued surveys for this plant address the CCP goal to protect and restore habitat for federal and state threatened and endangered species found in the Lower Mississippi River Ecosystem.

Objective

The first stage is to complete a refuge-wide inventory in order to locate any remaining pondberry colonies; and the second stage will include annual monitoring of the number of stems and

relative area occupied by colonies and evaluation of hydrological or vegetative parameters which might influence the long-term survivorship of the colonies. Declines in stem density or area of occupancy may trigger management actions. Information gathered from this survey will be important to recovery activities for this endangered species across its range. This survey will address issues relating to the following CCP and HMP objectives to manage habitat conditions for pondberry conservation.

HMP Objective 4.1.6

In all forested, reforested, or permanent wetland management units maintain or restore the natural hydrology to the unit through the elimination of artificial drainages and other alterations to the hydrology and the prevention of water retention of >5 acres during the growing season within hardwood areas.

CCP Objective 3-1: Inventory

By 2009, inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

Partner Roles

To date, inventory and monitoring for pondberry has been done exclusively by the refuge. The refuge has worked with the recovery lead for this species in the Mississippi Ecological Services Office (Jackson, MS) to develop inventory and monitoring approaches and describe management considerations. In addition, the Center for Bottomland Hardwood Research, USFS is interested in conducting a complete refuge inventory and monitoring this population of pondberry, in collaboration with the refuge.

Protocol Needs

No formal protocols exist for conducting inventories for pondberry. Surveys on the refuge have been based on intensive survey efforts on the periphery of permanent and semi-permanent forested wetlands systems during the flowering period of pondberry in late winter and early spring to maximize detection. Long-term monitoring for pondberry has been hampered across its range due to non-standardized sampling methods using differing metrics of abundance. Standardized monitoring metrics needs to be established for this clonal species. A site-specific protocol needs to be established. Initial survey instructions (<http://tinyurl.com/Pondberry-DHM>) are linked to this survey record in PRIMR and follow previous survey methods (Richardson et al. 2014).

1.05. Moist-soil/Grain Production; (FF04RMDH00-020)

Overview

This survey monitors the annual floristic composition within individual wetland management units on the refuge and provides a qualitative and/or quantitative estimate of the duck carrying capacity (i.e., duck-energy days/acre). Moist-soil plants and supplemental plantings of cereal

grains provide important energy for migrant and wintering waterfowl which have been identified as resources of concern on the refuge. Dahomey NWR manages wetland units to support the goals of the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1986a) and contribute to foraging habitat objectives as outlined by the LMVJV. This survey is coupled with the migrant and wintering waterbird survey to provide an overall assessment of the refuge contribution toward migrant and wintering waterbird conservation. Waterfowl have been identified as a resource of concern for the refuge. Survey data will inform management about the need to conduct treatments to influence desirable annual plant composition and considerations for cereal grain production to meet local and regional conservation initiatives.

Objective

This survey will estimate the duck-energy-day carrying capacity and percent plant composition on an annual basis. Increases in perennial or undesirable annual plants may trigger a need for a management action within identified wetland units. This survey directly assesses target metrics in the following HMP objective.

HMP Objective 4.1.1

Manage Units 9, 10, 11, 12, 30, and 40 (373 acres) in agricultural/moist-soil plants to provide a minimum of 3.3 million duck-energy-days (minimum of 165 acres at 20,000 DED/acre) available beginning November 15 through March 15 in support of wintering waterfowl goals developed by the LMVJV.

Partner Roles

The refuge has the capacity to conduct this survey on an annual basis. The LMVJV is an important partner in this survey to examine the cumulative contributions of moist-soil/grain production to meeting goals of the North American Waterfowl Plan within this region. The refuge will provide data from this survey to the USGS- LMVJV Impounded Wetlands Managements & Monitoring Application (http://lmvjv.cr.usgs.gov/moist_soils/default.aspx).

Protocol Needs

Multiple methods are available to estimate the qualitative and quantitative values for moist-soil and cereal grain production and composition but no standardized approach has been developed. A regional framework protocol needs to be developed with input from the LMVJV. Initial survey instructions (<http://tinyurl.com/MSoilGrain-DHM>) are linked to this survey record in PRIMR.

1.06. Forest Stand Monitoring; (FF04RMDH00-015)

Overview

Bottomland hardwood forests are an ecologically important component of the MAV and historically dominated this region. However, only 24% of the MAV flood plain remains (Twedt and Loesch 1999). The diversity within this system in terms of forest area and distribution, stand

structure and age, and plant species composition has enormous implications to avian conservation for breeding neotropical migrants (Hunter et al. 1993, Twedt and Loesch 1999), wintering waterfowl (Reinecke et al. 1989), bats (Fokidis et al. 2005) and other resident wildlife (LMVJV Forest Resource Conservation Working Group 2007). Forest stand monitoring provides a foundation for determining existing stand conditions and subsequent strategies to achieve population and habitat management objectives identified in the CCP and HMP. This survey evaluates existing forest stand conditions based on periodic monitoring (10-15 year cycle) using a variable plot measurement technique. A baseline inventory of the existing forested conditions was done by Smith and Sansing (2008). The survey was selected because the information is critical to evaluating avian and other wildlife responses to existing and desired habitat management conditions.

Objectives

The information from this survey will be used to evaluate the overall structure of forest stands and the composition of the trees, shrubs, and vine strata. Mature forest stands that have metrics that differ significant from the desired forestry conditions and limited occupancy by high priority neotropical migrants may be a trigger for forest management activities. The survey directly assesses target metrics in the following HMP objectives.

HMP Objective 4.1.4

During the next 15 years at least 35% of Management Units (1, 4, 13, 23, 24, 27, 37, 38, 44, and 45) should be managed to contain a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by averages of 60 – 70% overstory canopy cover, 25 – 40% midstory cover, and 60 – 70 ft²/acre basal area (with over 25 % in older age classes as defined as those stems approaching biological senescence using species-site-size relationships as a surrogate for judging tree age), along with retention of most snags and potential denning trees (for Rafinesque's big-eared bat, black bear, etc.) to meet the desired forest conditions as developed by the LMVJV Forest Resource Conservation Working Group (2007). Establish appropriate buffer zones around sloughs and otherwise where potential Rafinesque's big-eared bat and southeastern myotis roost trees are now found.

HMP Objective 4.1.5

In Management Units (3, 7, 8, 15, 17, 19, 20, 21, 22, 25, 26, 28, 33, 34, and 36) evaluate the success of reforestation over the next 10 years and implement the LMVJV Forest Resource Conservation Working Group's desired forest conditions on at least 35% of the reforested acreage. Desired conditions are to include a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by 60-70% overstory canopy cover, 25-40% midstory cover, and 60-70 ft²/acre basal area (with over 25% in older age classes).

Partner Roles

The refuge does not have sufficient staffing or expertise to conduct this survey independently. However, previous forest stand inventory of the refuge (Smith and Sansing 2008) utilized a team of foresters, technicians and biologists from other refuges to conduct a refuge-wide forest inventory in a week. It is anticipated that this survey be done using a similar cooperative approach to facilitate data collection, analysis, and reporting.

Protocol Needs

Standard forest stand inventory techniques are widely used by biologists and foresters but field equipment, analysis software, and reporting schedule varies. However, it is anticipated that a regional protocol framework will be drafted by a multi-disciplinary refuge team in concert with the LMVJV Forest Resource Conservation Working Group. A site-specific protocol will be developed from that framework. Initial survey instructions (<http://tinyurl.com/ForestMont-DHM>) are linked to this survey record in PRIMR and follow the methods described by Smith and Sansing (2008).

1.07. Breeding Bird Survey; (FF04RMDH00-004)

Overview

This survey assesses distribution and relative abundance of breeding birds for regional and national assessments with the refuge serving as a sampling location. Birds are a national trust resource for the U. S. Fish and Wildlife Service and represent the foundation for establishing most National Wildlife Refuges. The North American breeding bird survey monitors bird populations across North America and informs researchers and wildlife managers of significant changes in bird population levels so that if declining species are identified, causes can be examined and corrective actions taken to reverse the trend (Sauer et al. 2013). Though the survey examines trends at regional scales, the data can also be used to establish local breeding bird baseline inventories based on roadside vegetative communities. Forest interior birds are considered a resource of concern for the refuge and this survey provides information about their distribution and relative abundance.

Objectives

The information from this survey will be used to evaluate regional scale changes in the relative abundance of breeding birds along roadways. Based on changes in priority bird species associated with the bird conservation area for the MAV, the refuge may adaptively manage to improve habitat conditions for these species. The trend analysis of this survey in conjunction with data captured from the landbird point count survey and forest stand monitoring will be used to evaluate the refuge's contribution to meeting the following three bird objectives from the North Mississippi Wildlife Refuges Complex CCP.

CCP Objective 1-7: Forest Birds

Within two years of the plan's approval, survey forest breeding birds with point counts tied to spatially discrete, georeferenced, habitat-specific locations to assess the preferred habitat, presence/absence, and relative abundance of all forest breeding species.

CCP Objective 1-8: Scrub/Shrub Birds

Maintain existing early successional habitats along buffer strips and within two years after the plan's approval convert up to 10 percent of acquired agricultural lands throughout the refuge complex to scrub/shrub, supporting priority scrub/shrub breeding species.

CCP Objective 1-9: Grassland Birds

Maintain existing acres of grasslands and within five years of the plan's approval convert up to 10 percent of acquired agricultural lands throughout the refuge complex to grasslands to support priority grassland bird species. Conduct baseline information surveys and continue to monitor bird responses to management and habitat alterations.

Partner Roles

The North American breeding bird survey is a coordinated effort between USGS, Patuxent Wildlife Research Center; and the Canadian Wildlife Service, National Wildlife Research Center which manages the data and provides long-term trend analysis of the data at geographic, regional, and national scales. The refuge will collect data for the associated Dahomey NWR Breeding Bird Route.

Protocol Needs

Standard monitoring methodology and a data management processes will follow those outlined by the USGS, Patuxent Wildlife Research Center (<https://www.pwrc.usgs.gov/bbs/index.cfm>). A national protocol framework needs to be developed from which a site-specific protocol will need to be drafted. Initial survey instructions (<http://tinyurl.com/BreedingBrd-DHM>) are linked to this survey record in PRIMR.

1.08. Hardwood Reforestation Evaluation; (FF04RMDH00-013)

Overview

This survey is designed to examine hardwood regeneration, reforestation survivorship and species composition within former agricultural fields on the refuge. In general these sites will be examined 2-3 years after initial planting and 10-20 years later. Many of the refuges acquired in the past 20 years have included large tracts previously used for agricultural production which were historically bottomland hardwood. Most of the hardwood reforestation was done using hardwood seedlings though some fields may have been direct seeded with acorns. This survey was selected because evaluation of acorn germination and seedling survivorship is critical to

addressing the long-term species composition towards final serial stage stand development and evaluating future forest management strategies. The reforestation tracts represent important future areas to support many high priority species of neotropical migrant birds which have been identified as resources of concern for the refuge.

Objectives

This survey is designed to examine hardwood reforestation and develop management decisions to achieve habitat conditions as outlined in the Dahomey NWR HMP. This survey addresses the following two objectives from the HMP.

HMP Objective 4.1.4

During the next 15 years at least 35% of Management Units (1, 4, 13, 23, 24, 27, 37, 38, 44, and 45) should be managed to contain a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by averages of 60 – 70% overstory canopy cover, 25 – 40% midstory cover, and 60 – 70 ft²/acre basal area (with over 25 % in older age classes as defined as those stems approaching biological senescence using species-site-size relationships as a surrogate for judging tree age), along with retention of most snags and potential denning trees (for Rafinesque's big-eared bat, black bear, etc.) to meet the desired forest conditions as developed by the LMVJV Forest Resource Conservation Working Group (2007). Establish appropriate buffer zones around sloughs and otherwise where potential Rafinesque's big-eared bat and southeastern myotis roost trees are now found.

HMP Objective 4.1.5

In Management Units (3, 7, 8, 15, 17, 19, 20, 21, 22, 25, 26, 28, 33, 34, and 36) evaluate the success of reforestation over the next 10 years and implement the LMVJV Forest Resource Conservation Working Group's desired forest conditions on at least 35% of the reforested acreage. Desired conditions are to include a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by 60-70% overstory canopy cover, 25-40% midstory cover, and 60-70 ft²/acre basal area (with over 25% in older age classes).

Partner Roles

The refuge does not presently have the capacity to conduct an evaluation of reforested agricultural fields. However, the refuge will work to conduct a refuge-wide inventory using a team of foresters and technicians from other refuges to assist with data collection, analysis and reporting.

Protocol Needs

Standard forest stand inventory techniques are widely used by Service foresters but field equipment, analysis software, and reporting schedule varies. Sampling methods for hardwood

reforestation evaluation are similar to those associated with the forest stand monitoring, but on a smaller sampling plot. A regional protocol for evaluation of reforested areas needs to be developed by a team composed of foresters and biologists. A site-specific protocol will be developed from that framework. Initial survey instructions (<http://tinyurl.com/HwdRefEval-DHM>) are linked to this survey record in PRIMR.

1.09. North American Amphibian Monitoring; (FF04RMDH00-002)

Overview

This survey will assist in understanding long-term trends of frogs and toads across regional and national scales as well as provide local baseline inventories. Amphibians are important ecological organisms associated with wetland systems. Worldwide declines in this taxon have prompted the need to undertake multiple survey designs to investigate population trends and understand mechanisms that influence them. Throughout the United States there is evidence of species-specific and regional declines of amphibians (Adams et al. 2013a). The MAV has undergone immense anthropogenic changes through hydrologic alterations of the Mississippi River and 80% reduction in the forested wetlands to foster an agricultural landscape. This geographical area continues to undergo significant stressors associated with intense agricultural practices that rely on fertilizers, herbicides, insecticides and irrigation programs to maximize cereal grain production. These stressors, in concert with ongoing climate changes and emerging disease issues are a significant threat for amphibian populations. The North American Amphibian Monitoring Program is a national survey designed to track long-term trends of frogs and toads based on their calling frequency and occupancy at repeated roadside observation sites and has recently been used to document changes in anuran occupancy in the northeastern United States (Weir et al. 2014). This survey was selected because it contributes to efforts to monitor this taxon at regional and national scales and provides a better understanding of the biodiversity for the refuge.

Objective

This survey will monitor frog and toad occupancy from roadside wetlands to determine changes in long-term populations. This information can be used to evaluate the refuge's contribution to the biodiversity of aquatic organisms and address the following objective from the CCP.

Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

Partner Roles

The refuge will annually collect survey data along the Dahomey NWR anuran call route and upload the data to the USGS, North American Amphibian Monitoring Program database. USGS will archive data and conduct periodic analysis of the data at regional and national scales.

Protocol Needs

A national framework and subsequent site-specific protocol needs to be developed. In the interim, procedures for conducting this survey will follow those outlined by the USGS, North American Amphibian Monitoring Program, (<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>). Initial survey instructions (<http://tinyurl.com/NAAmphb-DHM>) are linked to this survey record in PRIMR.

1.10. Hog Vegetation Damage Assessment; (FF04RMDH00-021)

Overview

This survey will provide an evaluation of the long-term effects of wild hogs on vegetation within bottomland hardwoods on the refuge. Wild hogs (*Sus scrofa*) are an invasive species that have become a serious threat to the forest communities in the Southeast. Hogs compete for food with native wildlife species and in particular seek out hard mast in fall and winter. They are also known to be predators on bird eggs, small mammals and herpetofauna. In addition, wild hogs can cause significant damage to levees, roadsides, forest communities and agricultural fields through their rooting, wallowing and trampling activities. Since the establishment of the refuge, the population of hogs has appeared to increase and is consistent with the expansion of the species throughout the MAV. Understanding the effects of wild hogs on refuge vegetation is important to guide refuge management actions. Sampling within both hog-exclusions and hog accessible areas will provide a baseline foundation for changes in the herbaceous and woody plants.

Objective

Information from this survey will be used to understand management efforts to control this invasive species and assess negative effects the species has on native flora. This survey addresses the following objective from the CCP.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

The refuge has the ability to conduct this survey on an annual basis. The refuge may work with the Mississippi Wild Hog Task Force to develop additional monitoring strategies.

Protocol Needs

General vegetation sampling techniques will apply for monitoring the understory and overstory plant community. The survey will require a site-specific protocol. Initial survey instructions (<http://tinyurl.com/HogVeg-DHM>) are linked to this survey record in PRIMR.

1.11. Hunter Use and Harvest Monitoring; (FF04RMDH00-005)

Overview

This survey is designed to estimate the annual harvest of all regulated game species on the refuge and the number of individuals hunting on a daily basis. The National Wildlife Refuge Improvement Act of 1997, Public Law 105-57 provides recognition that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System. Hunting is an effective management tool to control local white-tailed deer populations and wild hogs at Dahomey NWR. In addition, a variety of other small game recreational hunting opportunities occur. Monitoring hunter participation and animals harvested allows assessment of compatibility so as not to interfere with the establishing purposes for the refuge. Moreover, this survey will inform the refuge about the health of animals and identify population changes in white-tailed deer and hogs; two species which have the potential to alter the quality of the habitat.

Objectives

The survey will be used to ensure public hunting is compatible with the enabling legislation for the refuge. The survey may also provide information about game species abundance based on changes in harvest success. Data from this survey will be used to address the following CCP objectives.

CCP Objective 2-1: Game Species

For the duration of the plan, manage game populations to maximize quality hunting opportunities while maintaining habitat for federal trust resources.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

The refuge has the ability to conduct this survey on an annual basis. No partners have been identified.

Protocol Needs

Hunter participation and animals harvested is based on compliance of all hunters to fill out a standardized National Wildlife Refuge System/Big Game Harvest Report (FWS Form 3-2359; Office of Management and Budget Control Number 1018-1040). A site-specific protocol is

needed. Initial survey instructions (<http://tinyurl.com/HuntUse-DHM>) are linked to this survey record in PRIMR.

1.12. Groundwater Table Monitoring; (FF04RMDH00-023)

Overview

This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge. The bottomland hardwood ecosystem of the MAV has been irrevocably altered by flood abatement projects along the Mississippi River, the main tributaries, and the subsequent land clearing of the region for forest products and large-scale agricultural production of cotton and cereal grains. The hydrology of the system continues to be modified as agricultural practices remove small wetlands, improve ditches to facilitate dewatering of fields, and level the landscape for irrigation efficiency. Over the past 20 years, the reliance on groundwater irrigation for corn, milo, rice, and soybeans production has grown to immense proportion compared to non-irrigated agriculture. Dahomey NWR is a habitat fragment of bottomland hardwood within this agricultural-dominated landscape that extensively uses irrigation. The plant community and associated fauna is a function of this forested wetland system. In addition, the refuge on a limited scale uses several existing wells to irrigate moist-soil and cereal grain units or flood these impoundments in fall for waterfowl. Data from the USGS Groundwater Watch shows significant below average levels for large areas of the MAV. These wetlands provide critical support to herpetofauna and many invertebrate species. Also, soil-moisture gradients provide the basis for the existing and future plant communities. Continued alterations to the groundwater table could have major negative effects. The changes in the groundwater table may be further influenced by climate change. Understanding the current rate of groundwater removal and the potential for recharge around the refuge is needed to evaluate long-term management of the forested community.

Objective

Water levels will be measured from the confined aquifer being drawn upon for irrigation as well as shallow wells that represent the local water table. This information will be used in conjunction with surveys for herpetofauna, mussels, crayfish, other wetland species, and forest stand composition to understand potential changes influenced by surface and subsurface water conditions. The groundwater table survey will be used to assess the following HMP objective.

HMP Objective 4.1.6

In all forested, reforested, or permanent wetland management units maintain or restore the natural hydrology of the unit through the elimination of artificial drainages and other alterations to the hydrology and the prevention of water retention of >5 acres during the growing season within hardwood areas.

Partner Roles

Groundwater table monitoring will be done by the refuge. The refuge will work with the Mississippi Department of Environmental Quality, Yazoo Water Management District and

engage the USGS to contribute survey results to the National Ground-Water Monitoring Network (<http://cida.usgs.gov/ngwmn>).

Protocol Needs

The refuge will evaluate groundwater table survey design and monitoring procedures following Lapham et al. (1995). Regional and site-specific protocols need to be developed. Initial survey instructions (<http://tinyurl.com/GrndWater-DHM>) are linked to this survey record in PRIMR.

1.13. Stream Temperature Monitoring; (FF04RMDH00-024)

Overview

This survey will provide baseline information about seasonal and long-term changes in the water temperature on the refuge and contribute to a broader understanding of stream temperature variation across the region. Building a foundation for a spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States is an initiative to better understand the effects of abiotic factors on the distribution of aquatic organisms and ecosystem health (U.S. Fish and Wildlife Service 2014c). Significant changes in aquatic biodiversity are influenced by water temperature extremes. Across the Southeast, there is a paucity of information about daily and seasonal stream temperature regimes which influence the biodiversity and potentially relate to land-use practices in the drainage and climate change. This survey was selected because it supports a collaborative regional effort to fill existing stream temperature gaps and provides important information to the refuge regarding aquatic systems.

Objective

The site-specific data will be used to examine the influence in hydrological restoration efforts on the refuge and contribute to regional monitoring efforts. This survey will be used to assess the following HMP objective.

HMP Objective 4.1.6

In all forested, reforested, or permanent wetland management units maintain or restore the natural hydrology of the unit through the elimination of artificial drainages and other alterations to the hydrology and the prevention of water retention of >5 acres during the growing season within hardwood areas.

Partner Roles

Stream temperature monitoring and data collection will be done by the refuge. This monitoring is being done as part of a regional cooperative effort to monitor long-term stream temperatures across the Southeast, and includes participation from National Wildlife Refuges, National Fish Hatcheries and Ecological Services. The Drought Assessment and Response Team (DART) and Ecological Services will oversee the project and work with USGS and USFS to build a broader partnership.

Protocol Needs

Basic temperature monitoring techniques using automated recording dataloggers and project design have been developed for this initiative (U.S. Fish and Wildlife Service 2014c). A regional framework protocol will need to be developed by DART from which a site-specific protocol will be generated. Initial survey instructions (<http://tinyurl.com/StreamTmp-DHM>) are linked to this survey record in PRIMR.

2.1. Bat Basal Cavity; (FF04RMDH00-010)

Overview

This survey will evaluate the potential occupancy of basal cavities by Rafinesque's big-eared bat and southeastern myotis during the spring and summer in mature bottomland hardwood stands and provide a relative measure of bat abundance and distribution on the refuge. Rafinesque's big-eared bat and southeastern myotis are considered species of special concern and are listed as threatened or endangered throughout most of their range. In Mississippi, there is limited information about the distribution and abundance of these species. Most is based on anecdotal observations of roosting in anthropogenic structure. (Martin et al. 2011). Nonetheless, natural roosts composed of hardwood basal cavities for these and other bats have been well documented and suggested as a limiting factor to species conservation (see review by Bat Conservation International and Southeastern Bat Diversity Network 2013). Surveys for these species in mature hardwood systems of Mississippi have been variable. In east-central Mississippi, both species were found fairly commonly in large diameter basal cavities (Stevenson 2008). However, surveys at Panther Swamp NWR (H. Fleming, Mississippi State University, College of Forest Resources, unpubl. data) and Dahomey NWR (Richardson 2012b) in the Mississippi Delta were unable to locate a single roosting bat despite numerous suitable basal cavities. Therefore, the species distribution may be more complex, reflecting previous limitations of natural roosts and habitat fragmentation precluding population dispersal. This survey is designed to re-examine the existing sample of suitable basal cavities during multiple seasons to facilitate the understanding of the occurrence of these bats at Dahomey NWR. Also, this survey will broadly assess the habitat contribution that the refuge has towards these two species. These bat species have been identified as resources of concern for the refuge.

Objectives

This survey provides an understanding of the availability and wildlife use of basal cavities. A lack of cavities or use by bats may be a trigger for forest management decisions to assess these HMP and CCP objectives.

HMP Objective 4.1.4

During the next 15 years at least 35% of Management Units (1, 4, 13, 23, 24, 27, 37, 38, 44, and 45) should be managed to contain a diverse assemblage of both hard mast and soft mast producing hardwood species characterized by averages of 60 – 70% overstory canopy cover, 25 – 40% midstory cover, and 60 – 70 ft²/acre basal area (with over 25 % in older age classes as defined as those stems approaching biological senescence using

species-site-size relationships as a surrogate for judging tree age), along with retention of most snags and potential denning trees (for Rafinesque's big-eared bat, black bear, etc.) to meet the desired forest conditions as developed by the LMVJV Forest Resource Conservation Working Group (2007). Establish appropriate buffer zones around sloughs and otherwise where potential Rafinesque big-eared bat and southeastern myotis roost trees are now found.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the Complex and contribute to their recovery.

Partnerships

The refuge has the ability to conduct this survey. No partnerships have been identified.

Protocol

Despite extensive recent work focusing on diurnal roosts within basal cavities for Rafinesque's big-eared bat and southeastern myotis, direct study comparisons have been limited because of differing sampling designs and survey methods. A regional framework protocol is needed. Initial survey instructions (<http://tinyurl.com/BatCavity-DHM>) are linked to this survey record in PRIMR and based on Stevenson (2008) and Richardson (2012b).

2.2. Fish Inventory; (FF04RMDH00-025)

Overview

The survey will provide a baseline inventory of freshwater fish across the entire refuge. The biodiversity and health of aquatic systems is often gauged by the assemblage of fish present. Mississippi is a host to 204 native freshwater species of which 35% are considered imperiled to some degree (Ross 2001). Many species are highly specialized and restricted to small drainages. The Mississippi Delta has been poorly sampled and the refuge has a very limited understanding of the fish present. This survey is designed to provide a baseline inventory of the fish on the refuge. This survey was selected because it provides important baseline information regarding a taxon that is imperiled, reflects on the health of the aquatic system, and furthers the CCP objective to conserve the fish fauna.

Objectives

This survey is important to understand the biodiversity within the wetland system on the refuge and it contributes to the conservation of native fish within the Mississippi Delta. This survey will serve as a basis to understand the restoration of the hydrology on the refuge, diversity of the fishery, and assess the following objectives from the HMP and CCP.

HMP -Objective 4.1.6

In all forested, reforested, or permanent wetland management units maintain or restore the natural hydrology of the unit through the elimination of artificial drainages and other alterations to the hydrology and the prevention of water retention of >5 acres during the growing season within hardwood areas.

CCP - Objective 2-3: Fishes

For the duration of the plan, continue to enhance spawning habitats and improve water quality at Coldwater River, Dahomey and Tallahatchie NWRs to maintain healthy, sustainable fish populations.

Partner Roles

Surveys for fish can be done by the refuge but will require some assistance with specialized sampling equipment (e.g., backpack electrofishing unit). In addition, because identification of species can be difficult, the refuge will partner with the Center for Bottomland Hardwood Research (USFS) and the Mississippi Natural Heritage program to verify specimens. Voucher specimens from the survey will be placed in the Mississippi Museum of Natural Science ichthyology collection.

Protocol Needs

A multitude of sampling techniques is needed to sample for the presence of fish on the refuge. Standard methods for sampling freshwater fish have been identified (Bonar et al. 2009). A site-specific protocol needs to be developed. Initial survey instructions (<http://tinyurl.com/FishInv-DHM>) are linked to this survey record in PRIMR.

2.3. Herpetofaunal Inventory; (FF04RMDH00-026)

Overview

This survey establishes a baseline inventory of herpetofauna (reptiles and amphibians) throughout all habitat types on the refuge to describe species occurrence. Many herpetofauna are considered at-risk though a paucity of rigorous long-term population monitoring or species occurrence information exists at local or regional scales. This taxon is extremely vulnerable to a number of current disease issues including chytrid and ranavirus which have been implicated in local and regional scale species decline and extirpation. In addition, the refuge has a significant wild hog population which has been suggested to have significant negative effects on salamanders due to their rooting behavior and destruction of coarse wood debris. This survey was selected because it provides important baseline information regarding a taxon that is poorly understood and reflects on the health of the aquatic system. Also, the survey furthers the CCP objective to conserve biodiversity associated with non-game and threatened and endangered species.

Objectives

The inventory will provide information regarding herpetofauna and the basis for long-term monitoring effort. This survey addresses biodiversity and examines the following two objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

Partner Roles

The refuge has ability to conduct this survey. No partnerships have been identified.

Protocol Needs

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 (<http://tinyurl.com/HerpInv-DHM>) are linked to this survey record in PRIMR.

2.4. Plant Inventory; (FF04RMDH00-027)

Overview

The plant inventory will develop a georeferenced source of vascular plant species composition within both aquatic and terrestrial systems throughout the refuge. Bottomland hardwood forests are the dominant natural community of the MAV. The plant and faunal assemblages of this ecosystem are predominantly a function of the hydrological regimes, local scale landforms, and soil parameters. Within the system are definable plant assemblages related to micro-site conditions which are driven primarily by moisture gradients and plant physiology. Depending on site-location and successional stages of the tree overstory, these systems have a very diverse and dynamic understory and mid-story plant community. Many understory plants within this system are deemed rare or uncommon and highly restricted in range. This is largely due to levee construction to restrict annual flooding of the Mississippi River and its tributaries, and 80% clearing of the forests to support agricultural production. The remaining forested areas are highly fragmented and support unique plant communities that are isolated and disappearing within these forests patches. Dahomey NWR is a remnant tract of forest in the MAV and has not had a complete botanical survey. Plant surveys on the refuge have focused on tree compositions

(Smith and Sansing 2008) and a few specific herbaceous plants (Stewart 1990, Richardson et al. 2014). The plant inventory survey was selected because it provides an understanding of refuge's biodiversity which effects the distribution and abundance of the faunal community. In addition, many unique plant species of state concern are likely to occur on the refuge.

Objectives

The plant inventory will provide a baseline of species diversity and occurrence which is needed to inform refuge management decisions. The survey will complement data being collected through the forest stand monitoring survey. The plant inventory assesses four objectives from the CCP.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

CCP Objective 4-1: Moist Soil

Manage a minimum of 6,689 acres of shallow impounded wetlands on the 3 traditional refuges for optimum production of moist-soil plants, invertebrates, or hard mast for a variety of wetland-dependent migratory birds while meeting the objectives established for dabbling ducks by the LMRVJV.

CCP Objective 4-2: Forest Management

Manage existing forest areas according to the existing forest management plan for the refuge complex. Reforest additional acquisitions where appropriate.

CCP Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

The refuge does not have the capacity to conduct this survey because of the specialized training needed to identify plant species in the field and the duration it will require to complete a comprehensive plant inventory. The refuge would work to fund this project as a contract survey. The refuge will work with the Mississippi Natural Heritage Program to voucher certain botanical specimens.

Protocol Needs

Because plant distributions are rarely homogeneous, it is difficult to conduct baseline inventories using simplified sampling techniques. Instead, sampling requires multiple plot sizes, sampling

intensity, and stratification to adequately describe the relative abundance and distribution of plants. As such, a national frame-work for plant diversity surveys needs to be developed from which a site-specific protocol can be written. Initial survey instructions (<http://tinyurl.com/PlantInv-DHM>) are based on Barnett and Stohlgren (2003) and Elzinga et al. (1998) and linked to this survey record in PRIMR.

2.5. Mussel Inventory; (FF04RMDH00-028)

Overview

The survey will provide a baseline inventory of freshwater mussels (Family Unionidae and Corbiculidae) across the entire refuge. Freshwater mussels represent extremely diverse taxon. While some species have wide geographic distribution, many are more restricted to specific drainages. Freshwater mussels are important indicators of the health of aquatic systems. Unfortunately, greater than 30% of them are listed or proposed for listing under the Endangered Species Act. In Mississippi, 85 species of freshwater mussels have been identified. Inventories for freshwater mussels have previously occurred on Dahomey NWR but a comprehensive survey has not been completed. This survey is designed to provide a baseline inventory of the freshwater mussels on the refuge. This survey was selected because it provides important baseline information regarding a taxon that is of special concern, includes numerous species in decline and at-risk, and relates to the CCP objective to inventory non-game species.

Objectives

This information is important to understand the biodiversity within the wetland system on the refuge and its contribution to the conservation of this taxon within the Mississippi Delta. This survey will serve as a basis to understand the restoration of the hydrology on the refuge, species diversity and the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

Objective 4-3: Invasive and Pest Management

For the duration of the plan, inventory, monitor, and control, where possible, invasive plant and animal populations to minimize or eliminate negative effects on native flora and fauna.

Partner Roles

Surveys for freshwater mussels can be done by the refuge. However, because identification of species can be difficult, the refuge will partner with the Mississippi Ecological Field Services Office, and the Center for Bottomland Hardwood Research (USFS) to verify specimens. Vouchers from the freshwater mussel survey will be placed in the Mississippi Museum of Natural Science mollusk collection.

Protocol Needs

A site-specific protocol needs to be developed. Initial survey instructions (<http://tinyurl.com/MussInv-DHM>) are linked to this survey record in PRIMR.

2.6. Crayfish Inventory; (FF04RMDH00-029)

Overview

The survey will provide a baseline inventory of crayfish across the entire refuge. North America has over 363 species of crayfish with over 33% listed as threatened or endangered (Taylor et al. 2011). In Mississippi, there are no less than 63 species though the number may be as high as 78 if undescribed species in the state are included (Fitzpatrick 2000). This survey was selected because it provides important baseline information regarding a taxon with numerous species listed as threatened, endangered, vulnerable or at-risk. The refuge has been able to conduct limited surveys for crayfish in the past (Rosamond 2012, Adams et al. 2013b), but has not been able to complete an entire survey across a wide spectrum of habitats. This survey was selected because of the vulnerability of this taxon nationally and the importance of understanding the distribution of many of the crayfish species in the state.

Objectives

This survey provides baseline information to understand the biodiversity on the refuge and contributes to the conservation of this taxon. This survey will serve as a basis to understand the restoration of the hydrology on the refuge, diversity of crayfish, and assess the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the Complex and contribute to their recovery.

Partner Roles

Surveys for crayfish can be done by the refuge. However, because identification of species can be difficult, the refuge will partner with the Mississippi Ecological Field Services Office, and the U.S. Forest Service, Center for Bottomland Hardwood Research to verify specimens. Vouchers from the crayfish inventory will be placed in the Mississippi Museum of Natural Science invertebrate collection and other appropriate research collections.

Protocol Needs

A multitude of sampling techniques can be undertaken to sample for the presence of crayfish depending on the habitat and prevalence to burrow. A regional framework protocol needs to be developed. Initial survey instructions (<http://tinyurl.com/CrayInv-DHM>) are linked to this survey record in PRIMR.

2.7. Small Mammal Inventory; (FF04RMDH00-030)

Overview

The primary purpose of the survey is to provide a baseline inventory of the distribution and relative abundance of small mammals throughout the various habitat types on the refuge. Mississippi is host to 68 extant, free-ranging mammals, including 5 species of marine mammals (Jones and Carter 1989). Nearly half of the mammal species in the state are considered terrestrial small mammals (i.e., mice, voles, shrews, rats, and bats). These species play an important role in the function of the ecosystem by serving as base prey for larger mammals, birds, and snakes; providing a mechanism for plant dispersal; and serving as predators on insects. The diversity of small mammals is a function of present and historic land-use practices which influence the current distribution and relative abundance of certain species. Several species of small mammals are on the state's list of species of concern or are listed as federally endangered. Therefore, understanding the small mammal biodiversity is important to make more informed management decisions.

Objectives

This survey will serve as a basis to understand the diversity of small mammals on the refuge and assess the following objectives from the CCP.

CCP Objective 2-2: Non-Game Species

Within 10 years of the plan's approval, reestablish historical hydrological and habitat regimes to increase refuge biodiversity to the maximum extent feasible. Biennially monitor non-game species response to restoration activities.

CCP Objective 3-1: Inventory

Inventory the distribution and habitat use of all threatened and endangered species on the refuge complex and contribute to their recovery.

Partner Roles

The refuge has the capacity to conduct this survey but would partner with the Mississippi Museum of Natural Science to complete a refuge-wide survey.

Protocol Needs

The variability in habitat use and behavior of small mammals requires a multitude of sampling techniques to determine the presence of species including direct capture of individuals or passive detection using acoustic detectors. A national framework is needed to design appropriate survey methods for the various small mammal species. From this frame-work, a site-specific survey protocol will be developed. Initial survey instructions (<http://tinyurl.com/SmallMam-DHM>) are linked to this survey record in PRIMR.

References

- Adams, M. J., D. A.W. Miller, E. Muths, P. S. Corn, E. H. C. Grant, L. L. Bailey, G. M. Fellers, R. N. Fisher, W. J. Sadinski, H. Waddle, and S.C. Walls. 2013a. Trends in amphibian occupancy in the United States. *PLOS ONE* 8(5): e64347.
- Adams, S. B., M. L. Warren, and B. Rosamond. 2013b. Laboratory identification of crayfishes and fishes from the Tallahatchie and Dahomey National Wildlife Refuge, Mississippi. Unpublished Report. USDA, Southern Research Station, Center for Bottomland Hardwood Research. 13 pp.
- Barnett, D. T. and T. J. Stohlgren. 2003. A nested-intensity design for surveying plant diversity. *Biodiversity and Conservation* 12:255-278.
- Bat Conservation International and Southeastern Bat Diversity Network. 2013. A conservation strategy for Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*). Bat Conservation International, Austin, TX.
- Bonar, S. A., W. A. Hubert, and D. A. Willis, (eds). 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.
- Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and monitoring plant populations. Bureau of Land Management, National Applied Resource Sciences Center, Denver, CO. 496 pp.
- Fitzpatrick, J. F., Jr. 2000. The conservation status of Mississippi crawfishes (Crustacea: Decapoda: Cambaridae). *Proceedings of the Louisiana Academy of Sciences*. 63:25-36.
- Fokidis, H. B., S. C. Brandebura, and T. S. Risch. 2005. Distribution of bats in bottomland hardwood forests of the Arkansas Delta Region. *Journal of the Arkansas Academy of Science*. 59:74-79.
- Goodwin, P., and G. Wright. 2014. Decision analysis for management judgment (5th ed). Wiley.
- Graeter, G. J., K. A. Buhlmann, L. R. Wilkinson, and J. W. Gibbons, (eds). 2013. Inventory and monitoring: recommended techniques for reptiles and amphibians. Partners in Amphibian and Reptile Conservation Technical Publication IM-1, Birmingham, AL.
- Hamel, P. B., W. P. Smith, D. J. Twedt, J. R. Woehr, E. Morris, R. B. Hamilton, and R. J. Cooper. 1996. A land manager's guide to point counts of birds in the Southeast. Gen. Tech. Rep. SO-120. New Orleans, LA: U.S. Dept. of Agriculture, Forest Service, Southern Research Station. 39 pp.
- Hunter, W.C., D. N. Pashley, and R. E. F. Escano. 1993. Neotropical migratory landbird species and their habitats of special concern within the Southeast Region. Pages 159-171 *in*.

- D.M. Finch and P.W. Stangel, eds. Status and management of neotropical migratory birds. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-229.
- Jones, C., and C. H. Carter. 1989. Annotated checklist of the recent mammals of Mississippi. Museum of Texas Tech University, Number 128. 9 pp.
- Knutson, M. G., N. P. Danz, T. W. Sutherland, and B. R. Gray. 2008. Landbird monitoring protocol for the U.S. Fish and Wildlife Service, Midwest and Northeast Regions, Version 1. Biological Monitoring Team Technical Report BMT-2008-01. U.S. Fish and Wildlife Service, LaCrosse, WI. 25 pages + 11 Standard Operating Procedures.
- Lapham, W. W., F. D. Wilde, and M. T. Koterba. 1995. Ground-water data-collection protocols and procedures for the national water-quality assessment program: selection, installation, and documentation of wells, and collection of related data. Open-File Report 95-398. U.S. Geological Survey, Reston, VA. 79 pp.
- Lower Mississippi Valley Joint Venture Forest Resource Conservation Working Group. 2007. R. Wilson, K. Ribbeck, S. King, and D. Twedt, (eds). Restoration, management, and monitoring of forest resources in the Mississippi Alluvial Valley: recommendations for enhancing wildlife habitat. 88 pp.
- Loges, B. W., B. G. Tavernia, A. M. Wilson, J. D. Stanton, J. H. Herner-Thogmartin, J. Casey, J. M. Coluccy, J. L. Coppen, P. J. Hanan, M. Heglund, S. K. Jacobi, T. Jones, M. G. Knutson, K. E. Koch, E. V. Lonsdorf, H. P. Laskowski, S. K. Lor, J. E. Lyons, M. E. Seamans, W. Stanton, B. Winn, and L. C. Ziemba. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring (IWMM) approach. Natural Resources Program Center, Fort Collins, CO. 90 pp.
- Martin, C.O., A. S. McCartney, D. Richardson, A.W. Trousdale, and M. S. Wolters. 2011. Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) in Mississippi: distribution, current status, and conservation needs. Pages 63-74 in Loeb, S.C., M. J. Lacki, and D. A. Miller (eds.), Conservation and management of eastern big-eared bats: a symposium. USDA, Forest Service, Southern Research Station, GTR SRS-145. Asheville, North Carolina.
- Reinecke K. J., R. M. Kaminski, D. J. Moorehead, J. D. Hodges, and J. R. Nassar. 1989. Mississippi Alluvial Valley. Pages 203–247 in L. M. Smith, R. L. Pederson, and R. M. Kaminski, eds. Habitat management for migrating and wintering waterfowl in North America. Lubbock, Texas: Texas Tech University Press.
- Richardson, D. M. 2012a. Mobile bat acoustical survey protocol, U.S. Fish and Wildlife Service, Region 4, Division of Refuges. Atlanta, GA. 8pp.

- Richardson, D. M. 2012b. Rapid assessment for basal cavities on Dahomey National Wildlife Refuge: implications for present and future bat conservation. U.S. Fish and Wildlife Service, Grenada, MS. 17 pp.
- Richardson, D.M., B. Rosamond, and A. Breland. 2014. Survey for pondberry (*Lindera melissifolia*) on portions of Dahomey National Wildlife Refuges. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.
- Rosamond, B. 2012. Inventory of vernal pool fauna on Dahomey National Wildlife Refuge, Bolivar County Mississippi FY '12. Unpublished Report. U.S. Fish and Wildlife Service, Grenada, MS. 15 pp.
- Ross, S. T. 2001. The inland fishes of Mississippi. University Press of Mississippi. 624 pp.
- Sauer, J. R, W. A. Link, J. E. Fallon, K. L. Pardieck, and D. J. Ziolkowsk, Jr. 2013. The North American breeding bird survey 1966-2011: summary analysis and species accounts. North American Fauna. 79:1–32.
- Smith, R., and H. Sansing. 2008. Dahomey National Wildlife Refuge stand conditions and habitat management recommendations. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.
- Stevenson, C. L. 2008. Availability and seasonal use of diurnal roosts by Rafinesque's big-eared bat and southeastern myotis in bottomland hardwoods. M.S. Thesis, Mississippi State University, MS.
- Stewart, R. 1990. A botanical and ecological survey of the Dahomey Woods, Bolivar County, Mississippi. Dept. of Biological Sciences, Delta State University, Cleveland, MS. 37 pp.
- Taylor, C. A., G. A. Schuster, J. E. Cooper, R. J. DiStefano, A. G. Eversole, P. Hamr, H. H. Hobbs III, H. W. Robison, C. E. Skelton, and R. F. Thoma. 2011. A reassessment of the conservation status of crayfishes of the United States and Canada after 10+ years of increased awareness. Fisheries. 32:372-389.
- Twedt, D., and C. R. Loesch. 1999. Forest area and distribution in the Mississippi alluvial valley: implications for breeding bird conservation. J. of Biogeography. 26:1215-1224.
- Twedt, D., D. Pashely, C. Hunter, A. Mueller, C. Brown, and B. Ford. 1998. Mississippi Alluvial Valley Bird Conservation Plan Physiographic Area #5. Partners in Flight Version 1. Bureau of Land Management, Washington D.C.
- U.S. Fish and Wildlife Service. 1986a. North American waterfowl management plan. U.S. Department of Interior. 19 pp.
- U.S. Fish and Wildlife Service. 1986b. Endangered and threatened plants; determination of endangered status for *Lindera melissifolia*. Federal Register. 51:27495-27500.

- U.S. Fish and Wildlife Service. 1991. Final land protection plan: proposed establishment of Dahomey National Wildlife Refuge, Bolivar County, Mississippi. U.S. Department of Interior, Fish and Wildlife Service, Atlanta, GA. 8 pp.
- U.S. Fish and Wildlife Service. 1993. Recovery plan for pondberry (*Lindera melissifolia*). U.S. Fish and Wildlife Service, Atlanta, GA. 56 pp.
- U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp.
- U.S. Fish and Wildlife Service. 2013. Dahomey National Wildlife Refuge habitat management plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 62 pp.
- U.S. Fish and Wildlife Service. 2014a. A user's guide for a SMART survey prioritization tool (Version 2.2). Inventory and Monitoring Initiative, Natural Resources Program Center, Fort Collins, CO. 24 pp.
- U.S. Fish and Wildlife Service. 2014b. Pondberry (*Lindera melissifolia*) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service, Jackson, MS. 42 pp.
- U.S. Fish and Wildlife Service. 2014c. Building a foundation for spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States. Region 4, Atlanta, GA. 2pp.
- U.S. Geological Survey, Instructions for conducting the breeding bird survey (Accessed: January 28, 2015; <https://www.pwrc.usgs.gov/bbs/participate/instructions.html>)
- U.S. Geological Survey, North American Amphibian Monitoring Program – Protocol Description (Accessed: January 28, 2015; <https://www.pwrc.usgs.gov/naamp>)
- Weir, L. A., J. A. Royle, K. D. Gazenski, and O. Villena. 2014. Northeast regional and state trends in anuran occupancy from calling survey data (2001-2011) from the North American Amphibian Monitoring Program. Herpetological Conservation and Biology. 9:223-245.

Appendix A. Brief Description of “Future- (Tier 3)” Surveys and Non-survey Activities Considered in the Dahomey NWR IMP Process.

Table A.1. Nine non-survey activities were identified which were excluded from survey prioritization processes and the reason for not considering them.

Activity Name	Description	Reason for Exclusion
Abnormal Frog Survey	Cooperative inventory of abnormal frog larvae on refuges	This historic survey may be replicated in the future but is not exclusive to the refuge and would require substantial funding given the national scale of the effort.
Audubon Christmas Bird Count	Annual Christmas bird count which has a sampling area encompassing a portion of the refuge	Count conducted by non-Service individuals and is not used by the refuge for any management purpose.
Christmas Lake Branch Water Quality Sampling	Annual sampling of water in Christmas Lake Branch by a class at Delta State University (DSU)	Data are not used by the refuge for any defined purpose and would not continue if DSU quit doing the sampling.
Crayfish Vernal Pool Inventory	Inventory of crayfish within vernal pools on the refuge	Project has been completed by the refuge and is being monitored as a research initiative by the USFS, Center for Bottomland Hardwood Research.
LMVJV Moist-soil Database	Annual production estimate of moist-soil and cereal grain in managed units.	Cooperative monitoring is being done by the LMVJV but the level of data collection is very qualitative and requires no field effort. – data call only.
Midwinter Waterfowl Ground Survey	Annual survey of waterfowl observed on the refuge in the first week of January.	The refuge’s data from this survey are no longer being included in the official Midwinter Waterfowl Survey Summary.
Midwinter Waterfowl Aerial Survey	Midwinter waterfowl aerial survey of the Mississippi Delta Region in Mississippi	Survey done by State, does not consistently sample the refuge and provides no management value to the refuge.
Water quality – drinking	Periodic potable well water sampling at refuge office	Not a survey – measurement for health considerations only.
Wood Duck Nest Box Monitoring	Annual inspection of wood duck nest boxes to determine egg production and estimate duckling contribution to fledgling	Intensive survey of boxes is not needed to support utilization of box program to enhance local wood duck production – boxes will be maintained without monitoring actual nest production.

Table A.2. Ten surveys were identified for consideration in the future if significant new capacity becomes available “Future (Tier 3)”.

Survey Name	Description
Avian Disease Surveillance	Long-term periodic sampling of birds for a host of present and emerging diseases including avian influenza - this would not include targeted sampling during potential avian die-off of waterfowl
Chytrid Surveillance Amphibians	Surveillance monitoring for Chytrid in amphibians on the refuge
Deer Herd Health Check	Health assessment of white-tailed deer via collection and necropsy in cooperation with Southeastern Cooperative Wildlife Disease Study
Emerald Ash Borer Surveillance	Annual monitoring for the detection emerald ash borer (<i>Agrilus planipennis</i>) on the refuge
Invertebrate Inventory (Insects)	Complete inventory of insects on the refuge
Nightjar Survey	Annual monitoring of common poorwill (<i>Phalaenoptilus nuttallii</i>) and chuck-will’s-widow(<i>Antrostomus carolinensis</i>) on the refuge
Northern Long-eared Bat Inventory	Inventory to determine the presence of northern long-eared bats (<i>Myotis septentrionalis</i>) on the refuge.
Ranavirus Herpetofaunal Surveillance	Surveillance monitoring for Ranavirus in herpetofauna on the refuge
Raptor Survey	Periodic monitoring of breeding and migrant raptors on the refuge
Redbay Ambrosia Beetle Surveillance	Annual monitoring for the early detection of redbay ambrosia beetle (<i>Xyleborus glabratus</i>)

Appendix B. Survey Prioritization Tool Criteria and Weights Used to Prioritize Surveys

Table B.1. Criteria and calculated weights used in the Survey Prioritization Tool.

Criteria Category	Criteria	Weight
Refuge Priorities and Management Needs	<i>1B. CCP or Other Management Plan Objectives</i>	0.11916
	<i>1C. NWRs Objectives</i>	0.11057
	<i>1D. Management Utility (Decision Support) for the Refuge</i>	0.12039
Partner Priorities and Management Needs	<i>2A. FWS Program Need</i>	0.06388
	<i>2B. FWS Partner Need</i>	0.03317
Ecological Application	<i>3A. Surrogate Species</i>	0.00000
	<i>3C. Survey Breadth</i>	0.02948
Additional Legal Mandates	<i>4A. Listed Species or Vegetation Communities</i>	0.10074
Immediacy of Need	<i>5A. Controversy</i>	0.03317
	<i>5B. Threat</i>	0.07002
Scope and Scale	<i>6A. Baseline Data</i>	0.08108
	<i>6B. Survey Scope</i>	0.03563
	<i>6C. Spatial Scale</i>	0.03563
Protocol	<i>7A. Sampling Design Stage</i>	0.05651
	<i>7B. Field Methods Stage</i>	0.05405
	<i>7C. Data Management, Analysis, and Reporting</i>	0.05651

Sixteen of 24 criteria and associated scoring values from the survey prioritization tool were considered to prioritize ongoing and proposed surveys in developing the Inventory and Monitoring Plan for Dahomey National Wildlife Refuge (Table B.1). Eight criteria were removed after careful consideration and discussion because Region 4 I&M Branch felt they did not apply because they were either redundant with other criteria, or would not add discrimination among surveys in the Southeast (Table B.2) Weights for the relative importance of each criteria for evaluating refuge surveys were developed by four refuge staff and a value developed by the Region 4 I&M Branch. These five weights were subsequently used to create an assigned average weight for each criterion (weights used in the survey prioritization tool are reported next to the criteria). Higher value weights represent criteria that were considered more important. For a

complete description of all 24 criteria and the scoring values see A User's Guide for a SMART Survey Prioritization Tool (U.S. Fish and Wildlife Service 2014a). **Note:** *The surrogate species criterion (3A) was not evaluated in this IMP due to no designated species for this area at this time.*

Table B.2. Criteria removed from consideration in the Survey Prioritization Tool and justification.

Criteria removed by Region 4 I & M Branch from consideration	Justification
1A. Refuge Purpose	This criterion is covered in 1B. Removed to avoid duplication.
3B. Refuge Processes	Refuge ecological processes can be addressed in 3C.
4B. Other Legal Mandates	Few examples in Region 4 where there are legal mandates other than those covered by ESA, state lists, rankings by Heritage Programs, IUCN global Red List, or NatureServe rankings (these covered in 4A).
6D. Integration with Other Survey	Many surveys are integrated on Region 4 refuges to assess overall management success. However, surveys should not have to be completely dependent on each other to provide useful information.
6E. Attribute Quality and Scope	This criterion is covered in 7A, B, and C.
8A. Monetary	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8B. Personnel	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.
8C. Security/Source of Funding	The purpose of prioritizing surveys in Region 4 is based on biological needs and objectives. All cost considerations are dealt with more explicitly by asking the refuge staff to estimate the labor and funding required to complete each survey after the prioritization process.

Appendix C. Prioritization Scores and Status of All Ranked Surveys

Values used to prioritize and select the surveys likely to be conducted through 2030 at Dahomey National Wildlife Refuge. Prioritization scores were generated for candidate surveys by refuge staff using 16 criteria for each survey (Appendix B) or by assigning an independent opinion-rank the survey. Scores were then used as a starting reference to assign the surveys into 3 tiers (Current, Expected, Future). 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 the 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 securing the needed capacity to do them. Surveys selected for the IMP (status = Current or Expected) are shown in blue. Non-selected surveys (status = Future) are also indicated in Appendix A-Table A.1.

Table C.1. Scores from the Survey Prioritization Tool and an Independent Opinion-based Prioritization Process for 30 surveys.

No.	Survey Name	Survey Tool Score	Opinion ^a Based Rank	Tier ^b	Status	IMP Status	Survey Priority
1	Landbird Point Counts	0.572	1	1	Current	Selected	1.01
2	Migrant and Wintering Waterbird Monitoring	0.523	10	1	Current	Selected	1.02
3	Mobile Acoustical Bat Monitoring	0.471	7	1	Current	Selected	1.03
4	Pondberry Inventory/Monitoring	0.446	4	1	Current	Selected	1.04
5	Moist-soil/Grain Production	0.433	9	1	Current	Selected	1.05
6	Forest Stand Monitoring	0.396	6	1	Current	Selected	1.06
7	Breeding Bird Survey	0.385	5	1	Current	Selected	1.07
8	Hardwood Reforestation Evaluation	0.372	2	1	Current	Selected	1.08
9	North American Amphibian Monitoring	0.303	14	1	Current	Selected	1.09
10	Hog Vegetation Damage Assessment	0.299	3	1	Current	Selected	1.10
11	Hunter Use and Harvest Monitoring	0.255	12	1	Current	Selected	1.11
12	Ground Water Table Monitoring	0.184	21	1	Current	Selected	1.12
13	Stream Temperature Monitoring	0.021	23	1	Current	Selected	1.13
14	Bat Basal Cavity Monitoring	0.350	N/A ^c	2	Expected	Selected	2.1
15	Fish Inventory	0.272	24	2	Expected	Selected	2.2
16	Herpetofaunal Inventory	0.272	26	2	Expected	Selected	2.3
17	Plant Inventory	0.258	20	2	Expected	Selected	2.4
18	Mussel Survey	0.243	15	2	Expected	Selected	2.5
19	Crayfish Inventory	0.231	18	2	Expected	Selected	2.6
20	Small Mammal Inventory	0.224	28	2	Expected	Selected	2.7
21	Northern Long-eared Bat Inventory	0.413	37	3	Future	Non-selected	

22	Redbay Ambrosia Beetle Surveillance	0.244	22	3	Future	Non-selected	
23	Emerald Ash Borer Surveillance	0.244	23	3	Future	Non-selected	
24	Nightjar Survey	0.242	32	3	Future	Non-selected	
25	Invertebrate Inventory (Insects)	0.220	25	3	Future	Non-selected	
26	Deer Herd Health Check	0.188	33	3	Future	Non-selected	
27	Avian Disease Surveillance	0.179	37	3	Future	Non-selected	
28	Chytrid Amphibian Surveillance	0.179	35	3	Future	Non-selected	
29	Ranavirus Herpetofaunal Surveillance	0.157	34	3	Future	Non-selected	
30	Raptor Survey	0.154	31	3	Future	Non-selected	

^a Opinion-based prioritization process originally evaluated 37 surveys. Only the ranks of the 30 surveys included in the Survey Prioritization Tool are presented. Opinion rank is the average value of the ranks assigned by the staff.

^b Tier 1--The highest priority surveys that the Project Leader estimates can be conducted with existing staffing and funding.

Tier 2--Surveys that the Project Leader sees as second priority for the station, or high priority surveys that would require an increase in operational capacity.

Tier 3--Lower priority surveys that are currently being conducted or are anticipated but would require the major reallocation of staff and capacity.

^c Survey was not ranked using the opinion-based process

Appendix D. Environmental Action Statement for Dahomey National Wildlife Refuge Inventory and Monitoring Plan

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 statutes, 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 Dahomey National Wildlife Refuge (NWR). This IMP provides specific guidance for surveys of Dahomey NWR's fish, wildlife, plant, habitat, and abiotic resources to fulfill the Dahomey NWR's purposes and help achieve Dahomey NWR's goals and objectives. There are no considered alternatives to the HMP given administrative requirement to complete this step-down plan.

In accordance with 43 CFR 46.205 and 40 CFR 1508.4, 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).



Steve Gard, Project Leader

7/27/15
Date

Reference: U.S. Fish and Wildlife Service. 2005. North Mississippi National Wildlife Refuges Complex Comprehensive Conservation Plan, U.S. Dept. of Interior, Fish and Wildlife Service, Atlanta, GA. 231 pp.

Appendix E. Initial Survey Instruction Forms for 20 Current and Expected Surveys to be conducted on Dahomey National Wildlife Refuge from 2015-2030.



1.01 Landbird Point Count Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring (PRIMR) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Landbird Point Count

This survey occurs on: ☐ Single refuge only ☒ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey entails annual monitoring of focal bird species (percent occupancy and relative abundance) during the breeding period within mature hardwood stands. The suite of species detected in these bird surveys addresses the contribution the refuge has to meeting population objectives for high priority, forest interior neotropical migrant birds associated with the MAV (Twedt et al. 1998). Species occurrence is directly influenced by forest stand composition and structure within each management unit. This survey provides a measure for the North Mississippi National Wildlife Refuges CCP goal to promote the conservation and management of migratory birds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005). Moreover, the survey is a foundation of biological information for use in monitoring ecosystem changes and informing local forest management decisions to address HMP goals and objectives. The survey was selected over others because of its high-priority score and the refuge assumes it will continue to have the capacity to conduct it for the duration of the IMP. In addition, data from this survey can be used at the refuge and landscape level to evaluate avian conservation within the lower MAV (Twedt et.al. 1998) and contribute to similar survey efforts within this geography.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Resident, temperate migrant and neotropical migrant birds – focus is on species identified as the top priority neotropical migrants associated with the MAV Bird Conservation Plan Physiographic Area 5 (Twedt et al. 1998).

Target habitat(s): *(if applicable)*

Bottomland hardwood forest stands

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?).*

1. Inventory resident, temperate migrant and neotropical migrant birds during the breeding season across the refuge's bottomland hardwood stands.
2. Determine occupancy and/or relative abundance of high priority neotropical migratory birds.
3. Evaluate bird community response to existing and desired forestry conditions.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

USFWS, Migratory Bird Division, Eastern Avian Knowledge Network, Southeastern Partners in Flight, and Lower MS Valley Joint Venture in conjunction with USGS-Patuxent Wildlife Research Center. All organizations are, or have been, involved in landbird point count data collection, analysis and reporting.

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Hamel, P. B., W. P. Smith, D. J. Twedt, J. R. Woehr, E. Morris, R. B. Hamilton, and R. J. Cooper. 1996. A land manager's guide to point counts of birds in the Southeast. Gen. Tech. Rep. SO-120. New Orleans, LA: U.S. Dept. Of Agriculture, Forest Service, Southern Research Station. 39 pp.

Knutson, M. G., N. P. Danz, T. W. Sutherland, and B. R. Gray. 2008. Landbird monitoring protocol for the U.S. Fish and Wildlife Service, Midwest and Northeast Regions, Version 1. Biological Monitoring Team Technical Report BMT-2008-01. U.S. Fish and Wildlife Service, LaCrosse, WI. 25 pages + 11 Standard Operating Procedures.

Lower Mississippi Valley Joint Venture Forest Resource Conservation Working Group. 2007. R. Wilson, K. Ribbeck, S. King, and D. Twedt, (eds). Restoration, management, and monitoring of forest resources in the Mississippi Alluvial Valley: recommendations for enhancing wildlife habitat. 88 pp.

Are there refuge-specific elements of implementation? ☐ Yes ☐ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2013

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☒ Point ☐ Other:

Estimation of the distance to individual bird detections from point center is done to a maximum of 150 meters based on 4 defined distance intervals.

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling is done across older hardwood stands (>30 years) and distributed to cover a portion of the refuge. Approximately 30-40 point counts are sampled annually. Ten points are sampled within a stand and points are spaced approximately 250 meters apart in a grid arrangement. Points are at least 250 meters from stand edges.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Surveys are done from late May through early July. Each point count location is sampled 1 time between sunrise and 10:00 am. Survey day conditions must be no rain, winds below 15 mph.

Section 3. Survey Methods

Primary metrics collected:

Bird species occurrence, number of unique individuals by species, estimation of bird detection distance from point center based on 4 variable sampling radii.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Previously conducted point counts on the refuge have been georeferenced. No permanent or temporary monumentation has been done.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Minimally the ability to detect the top 20 prioritized neotropical migrant birds by voice associated with the MAV. Preferable experience in all possible species occurring in the MAV and ability to accurately estimate the distance to the detected bird. Proficiency with call identification can be done using training tapes.

Describe equipment used during the survey:

- GPS unit with waypoints referencing sample points.
- Survey data sheet and Bullseye Map – see forms below.

Describe detailed methodology (field and lab procedures) - Excerpted From:

Lower Mississippi Valley Joint Venture Forest Resource Conservation Working Group. 2007. R. Wilson, K. Ribbeck, S. King, and D. Twedt, (eds). Restoration, management, and monitoring of forest resources in the Mississippi Alluvial Valley: recommendations for enhancing wildlife habitat. 88 pp.

Sample Allocation: Within each forest stand (i.e., a defined area subjected to similar silvicultural treatment), we will allocate six point count locations. Points may be randomly or systematically located within each stand but should be at a minimum of 250 meters apart. Additionally, plots should be >100 meters from roads or agricultural edges. As a general “rule of thumb”, a single point count with a 150 meter outer band represents approximately 7 hectares (ca. 18 acres). Thus, treated areas \leq 40 hectares (ca. 100 acres) will be not be included in the survey.

Standard Operating Procedure for Counting Birds:

Below are step-by-step instructions for conducting the recommended 10 minute point counts, with birds recorded separately in ten time periods (0-1, 1-2, 2-3,9-10 min) as well as birds recorded in four distance intervals (0-25 m, 25-50 m, 50-100 m, and 100-150 m). Readers are referred to Hamel et al. (1996), “A Land Managers Guide to Point Counts of Birds in the Southeast” for details.

1. Prior to the day of the counts, determine which points will be sampled and the order they are to be counted. Also, determine and upload the x,y coordinates for each point into a GPS.
2. Sampling will occur in the morning, beginning as soon as it is light enough to see a distance of 200 m and ending no later than 10 am. The observer should arrive at the first point while it is still dark so that the count can begin as soon as it is light enough to see. This is important because singing rates for most species are highest near sunrise and then slowly decline over the morning.

3. Do not conduct the count during high winds or heavy rains. Counts should not be conducted if it is raining hard (rain code 4; Table 2) or if wind strength on the Beaufort Scale is a sustained 4 or greater (see Table 3). If these conditions are encountered, either wait until the weather improves or cancel the sampling for the day and reschedule.
4. Approach the location noting any birds within 100 m of the counting station that is flushed, fly away, or retreat. Mark these birds in the appropriate distance band on a bull's-eye data sheet. Concentric circles on the data sheet indicate distances of 0-25 m, 25-50 m, and 50-100 m, record birds detected in the 100-150 m band in the margins outside the 100 m band.
5. Orient the bull's-eye data sheet to a fixed direction, record the wind and sky conditions (Tables 2 and 3), temperature, date, time, and observer.
6. Position a GPS unit and start it recording, if exact location is not already known.
7. As soon as possible, start the count. Use a pocket timer or watch to keep track of time.
8. Record each bird seen or heard with the appropriate species codes (Appendix C in Hamel et al. (1996). Count family groups of juveniles with a single adult as a single bird.
9. Mark birds on the data sheet in the appropriate distance band and approximate spatial location. Use standard coding symbols included on the data sheet to aid in separating individuals (4 letter species alpha codes can be found in Appendix C of Hamel et al. 1996).
10. Record data for different time intervals (0-1, 1-2, 2-3, ... 9-10 min) the count in different ways. Some people like to use different color pens; alternatively, detections can be underlined or double underlined to indicate the different time periods. Be sure to record a legend of the chosen coding scheme on the data sheet for future reference.
11. Holding the sheet in a fixed position, spend part of the time facing in each of the cardinal directions in order to better detect birds.
12. Mark each bird once, using the mapped locations to judge whether subsequent songs are from new or already recorded individuals. All birds greater than 100 m from point center are recorded outside of the 100 m band; likewise, flyovers are recorded at the bottom of the page. The recorded distance should be the horizontal distance between the location a bird was first detected and the plot center. For species that occur in flocks, record the flock (e.g., species) and flock size in the appropriate distance band. There is no need to record each bird in a flock individually.
13. Do not record any birds believed to have been counted at previous stations.
14. At the end of 10 minutes, stop recording bird observations. Do not record any new birds seen or heard after the 10 minutes have passed.
15. Record the latitude and longitude coordinates from the GPS unit and mark the location.

16. Field notations from the bull's-eye data sheet can be transcribed to a point count summary form before they are entered into the Eastern Avian Knowledge Data Center (<http://data.pointblue.org/partners/eadc/>). The transcription process will facilitate data entry.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are stored in an excel file at the refuge. However final disposition is done via data entry to the Eastern Avian Data Center, which is a product of the Eastern Avian Knowledge Network.
(<http://www.avianknowledge.net/index.php?page=nodes>)

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Eastern Avian Data Center (<http://www.avianknowledge.net/index.php?page=nodes>), Data may also be stored as summary information in ServCat.

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified, number of detections, and sample locations

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

Annual summary reports are written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi Wildlife Refuges Complex. Data from the refuge surveys may be utilized for regional scale analysis and reporting.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Forest stand inventory data obtained on a 10-year interval can be linked with site-specific point counts to evaluate bird occurrence against desired forest condition metrics (LMVJV Forest Recourse Conservation. Working Group 2007)

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Lower Mississippi Valley Joint Venture Forest Resource Conservation Working Group. 2007. R. Wilson, K. Ribbeck, S. King, and D. Twedt, (eds). Restoration, management, and monitoring of forest resources in the Mississippi Alluvial Valley: recommendations for enhancing wildlife habitat. 88 pp.

Twedt, D., D. Pashely, C. Hunter, A. Mueller, C. Brown, and B. Ford. 1998. Mississippi Alluvial Valley Bird Conservation Plan Physiographic Area #5. Partners in Flight Version 1. Bureau of Land Management, Washington D.C.

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Variable Circular Plot Point Count Summary Sheet

Temp (F):	Wind:	Sky:	Cover Type:	Treatment:	Year of Treatment:
-----------	-------	------	-------------	------------	--------------------

[illegible]

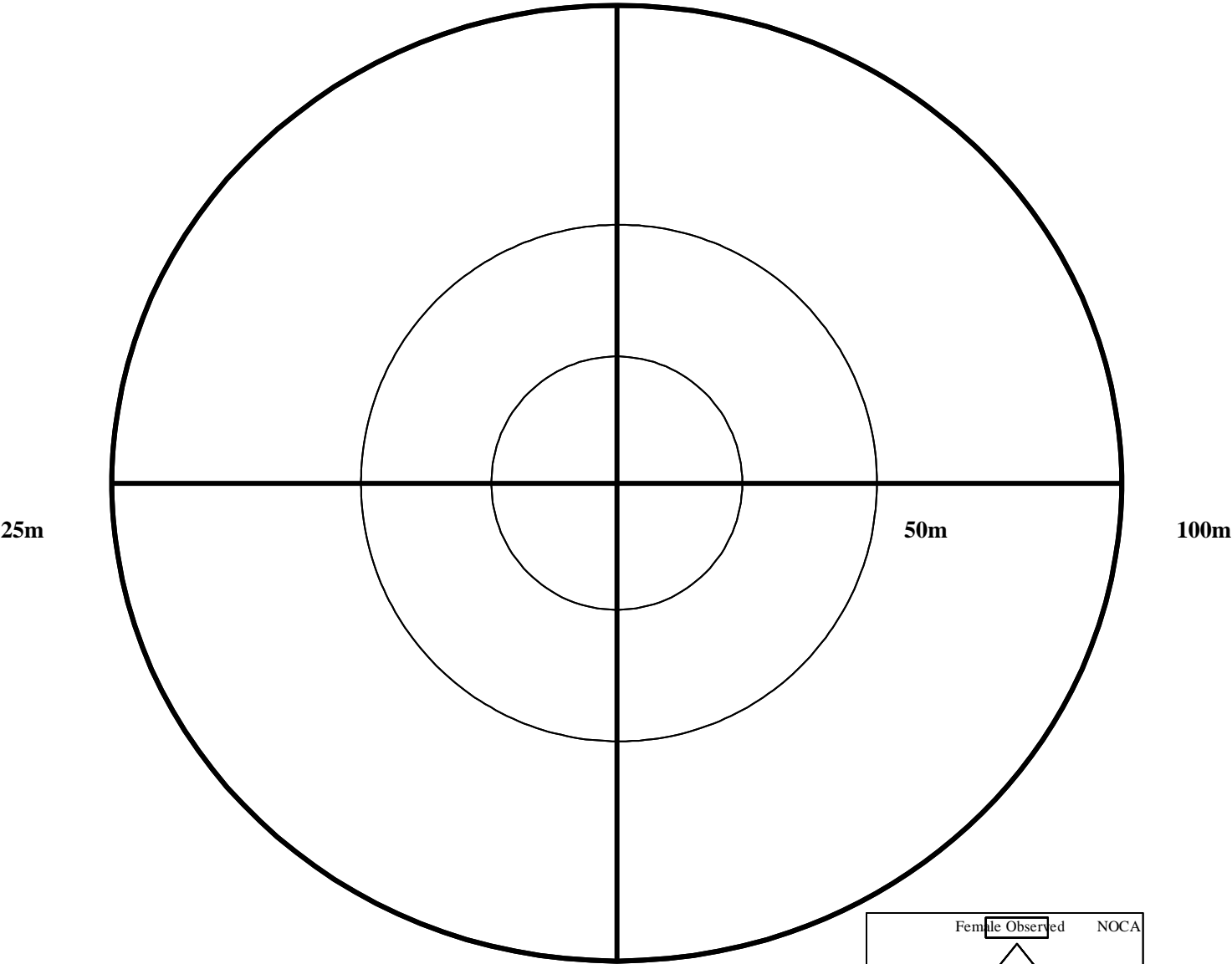
Comments:

Variable Circular Plot Point Count Field Sheet

Date:	Observer:	Start:	End:
-------	-----------	--------	------

State:	Location:	Unit:	Compartment:	Stand:	Point:
--------	-----------	-------	--------------	--------	--------

Temp (F):	Wind:	Sky:	Cover Type:	Treatment:	Year of Treatment:
-----------	-------	------	-------------	------------	--------------------



N-S Coordinate: _____ E-W Coordinate: _____ Zone*: _____
(N-S=Latitude; E-W=Longitude) *Zone = 0 for lat-long (geographic); else enter a UTM Zone.

Flyovers: _____

	Female Observed	NOCA	
	Male Observed	NOCA	
	Pair together, assumed mated	NOCA	
	Observed, sex unknown	NOCA	0-3 minutes
		NOCA	4-5 minutes
		NOCA	6-10 minutes

Habitat Data Associated with Forest Breeding Bird Point Counts

Date:	Observer:			
State:	Location:	Unit:	Compartment:	Stand:
Treatment:		Year Treatment Implemented:		
GPS Coordinates (NAD83-UTM 15):	N-S:	E-W:	UTM Zone:	

Point Count#_____ **Habitat Plot#**_____

Plot-level Data: <i>visible area around plot</i>				
Vines	Cane	Overstory (>30ft)	Mid-Story (10-30ft)	Understory (<10ft)
1 = None 2 = Sparse (<25%) 3 = Moderate (25-50%) 4 = Heavy (>50%)	1 = None 2 = Sparse (<25%) 3 = Moderate (25-50%) 4 = Heavy (>50%)	1 = None 2 = Sparse (<50%) 3 = Moderate (50-80%) 4 = Heavy (>80%)	1 = None 2 = Sparse (<25%) 3 = Moderate (25-60%) 4 = Heavy (>60%)	1 = None 2 = Sparse (<25%) 3 = Moderate (25-60%) 4 = Heavy (>60%)

Tree Data: <i>plotless area using 10-factor prism</i>				
Tree Species	Number Stems (dbh 4 - 9.5")	Number Stems (dbh 10 - 20")	Number Stems (dbh 20 - 30")	Number Stems (dbh > 30")
QUNU = Nuttall Oak QUNI = Water Oak QUPH = Willow Oak QULY = Overcup Oak QUPA = Cherrybark Oak QUSH = Shumard Oak				

Point Count# _____	Habitat Plot# _____			

Plot-level Data: <i>visible area around plot</i>				
Vines	Cane	Overstory (>30ft)	Mid-Story (10-30ft)	Understory (<10ft)
1 = None	1 = None	1 = None	1 = None	1 = None
2 = Sparse (<25%)	2 = Sparse (<25%)	2 = Sparse (<50%)	2 = Sparse (<25%)	2 = Sparse (<25%)
3 = Moderate (25-50%)	3 = Moderate (25-50%)	3 = Moderate (50-80%)	3 = Moderate (25-60%)	3 = Moderate (25-60%)
4 = Heavy (>50%)	4 = Heavy (>50%)	4 = Heavy (>80%)	4 = Heavy (>60%)	4 = Heavy (>60%)

[illegible]

- ### Tree Species Codes

- CAIL = Sweet Pecan
CAAQ = Bitter Pecan

- TADI = Cypress
NYAQ = Tupelo

- ULAM = American Elm
ULCR = Cedar Elm

- DIVI = Persimmon

- PLOC = Sycamore
PODE = Cottonwood
LIST = Sweetgum

- ACNE = Boxelder
ACRU = Red Maple

- CELA = Sugarberry

- FRPE = Green Ash

- GLAQ = Water Locust
GLTR = Honey Locust

- SNAG = Dead Trees

Table 1. Description of variables recorded at point count locations.

Variable	Description
Date	MM/DD/YYYY
Observer	Observer identification (e.g., initials).
Start Time	Time survey started.
End Time	Time survey ended.
State	State
Location	Name of forest, management area, refuge, etc...
Unit	Name of management unit within the location.
Compartment	Name of management compartment within the unit and/or location.
Stand	Name of management stand within the management compartment.
Point #	Number of the point within the compartment, unit, and/or station.
Temp (F)	Temperature in degrees Fahrenheit.
Wind	Wind speed from Beaufort scale (see Table 3).
Sky	Sky condition, combining cloud cover and precipitation (see Table 2).
Cover Type	Forest types follow Table 4 in the DFC Document, LMVJV Forest Resource Conservation Working Group 2007).
	<i>Swamp Forest – baldcypress, baldcypress-water tupelo</i>
	<i>Wet Bottomland Forest – overcup oak-bitter pecan, black willow</i>
	<i>Moist Bottomland Forest – sugarberry-elm-ash, oak-elm-ash</i>
	<i>Dry Bottomland Forest – cherrybark oak-cow oak</i>
	<i>Levee Forest – cottonwood-sycamore, sweet pecan-boxelder</i>
Treatment	Type of treatment (e.g., thinning, group selection, etc..)
Year of Treatment	Year treatment was implemented.
Flyovers	Birds observed flying over the plot.
N - S Coordinate	UTM (Northing - 7 digits) or latitude (DDMMSS) = (30E42'33").
E - W Coordinate	UTM (Easting - 6 digits) or longitude (DDMMSS) = (089E14'59").
Zone	UTM Zone or 0 if latitude / longitude recorded.
Comments	Notes and specific remarks about the count.

Table 2. Codes and descriptions for sky conditions (Weather Bureau Codes)¹.

Sky Conditions:		
Code #		Description
0		Clear or a few clouds
1		Partly cloudy (scattered)
2		Cloudy (broken) or overcast
4		Fog or Smoke
5		Drizzle
7		Snow
8		Showers

¹ These codes are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 0,1, or 2 and wind speeds less than 20 km / h (12 mi/h), preferably less than 13 km / h (8 mi / h).

Table 3. Codes and descriptions for wind speeds (Beaufort Scale)¹.

Wind Speed Codes:				
Code #		km / h	mi / h	Description
0		< 2	< 1	Smoke rises vertically
1		2 to 5	1 to 3	Wind direction shown by smoke drift
2		6 to 11	4 to 7	Wind felt on face; leaves rustle
3		12 to 20	8 to 12	Leaves, small twigs in constant motion; light flag extended
4		21 to 32	13 to 18	Small branches are moved
5		33 to 30	19 to 24	Small trees begin to sway

¹ These codes are the same codes used in the Breeding Bird Survey. Acceptable conditions for counting birds include a sky condition of 0, 1, or 2 and wind speeds less than 20 km / h (12 mi/h), preferably less than 13 km / h (8 mi / h).



1.02 Migrant and Wintering Waterbird Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Migrant and Wintering Waterfowl Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

Many refuges rely on traditional mid-winter waterfowl surveys and other periodic sampling to evaluate waterbird (e.g., ducks, geese, coots, and waders) use areas during migration and winter. These data provide information about the local scale utilization of wetlands by waterfowl and other waterbirds on a recurring biweekly basis. The migrant and wintering waterbird monitoring survey provides a measure for the North Mississippi National Wildlife Refuges CCP goal to promote the conservation and management of waterbirds within northern Mississippi in a manner that supports treaties and national and international plans (U.S. Fish and Wildlife Service 2005). Moreover, the survey is a foundation of biological information for informing local wetland management decisions to address HMP goals and objectives. In addition, data from this survey can be used at the refuge and landscape level to evaluate waterfowl conservation based on goals set by the LMVJV. This survey is coupled with the moist-soil/grain production survey to provide an overall assessment of the refuge contribution toward migrating and wintering waterbird conservation. Waterfowl have been identified as a resource of concern for the refuge.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Waterfowl, herons, grebes, coots, egrets

Target habitat(s): *(if applicable)*

Moist-soil habitat and wetland units planted to cereal grain or other crops for migrating and wintering waterfowl. This could also include more upland fields planted to green crops for grazing by geese.

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*.

1. To estimate the number of waterbirds using each management unit that can be surveyed by a vehicle.
2. Document waterbird use in each unit on a biweekly basis in association with vegetation composition and water conditions throughout the migration and wintering period (i.e., October – March) to inform the refuge if management strategies are supporting actual duck usage

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Nationally the data may eventually be incorporated into the Integrated Waterbird Monitoring and Management Initiative.

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Loges, B. W, B. G. Tavernia, A. M. Wilson, J. D. Stanton, J. H. Herner-Thogmartin, J. Casey, J. M. Coluccy, J. L. Coppen, P. J. Hanan M, Heglund, S. K. Jacobi, T. Jones, M. G. Knutson, K. E. Koch, E. V. Lonsdorf, H. P. Laskowski, S. K. Lor, J. E. Lyons, M. E. Seamans, W. Stanton, B. Winn, and L. C. Ziemba. 2014. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. Natural Resources Program Center, Fort Collins, CO.

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2014

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Sampling will be done along a route at defined locations to estimate waterbird use within individual wetland management units.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

All wetland management units that can be visually inspected from a vehicle along a refuge or public road will be sampled.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Annually, Biweekly, October – March. Begin no sooner than 7:00 am and finish by 12:00 pm. No heavy rain during survey period. No surveys on Wednesday (Public Waterfowl Hunt).

Section 3. Survey Methods

Primary metrics collected:

Number of ducks and other waterbirds by species in each wetland management unit.

How are sites marked? (Examples include GPS waypoints, flagging, etc...)

Not marked – sites for observation points will be identified on survey data sheet maps.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

None – need to be competent in waterfowl identification and other waterbirds

Describe equipment used during the survey:

- Data sheets
- binoculars spotting scope
- 4-wheel drive vehicle
- map of survey route/area

Describe detailed methodology (field and lab procedures) - Excerpted From:

Observer drives along a predefined route during the morning and stops at focal sampling locations to identify waterfowl and other waterbirds roosting and foraging within each unit. The observer, when possible, conducts all counts from within the vehicle to minimize disturbance to the birds and prevent them from leaving the unit. Estimates of birds by species are recorded for each unit. The habitat condition (water level) and type of vegetation will be recorded in the comments section. Counts are not conducted on the day of public waterfowl hunting (Wednesday).

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are stored in an excel file at the refuge. Data in the future will be stored in the Integrated Waterbird and Management (IWMM) – MS Access database application or On-line Database

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data sheets in refuge file, digital on Refuge Server, and possibly hosted on Service Catalog and IWMM national database.

Describe procedure for verifying/checking/securing the data:

None identified.

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified, number of detections, and sample locations. Use of IWMM Access database application will provide predefined summary reports. Regional and national data analysis will be done through the IWWM Initiative.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

No detailed reports from the survey are being written specific to the data collected on the refuge. Summary information is included in the annual narrative for the N. Mississippi Wildlife Refuges Complex. Data from the Refuge surveys may be utilized for regional scale analysis and reporting with the Integrated Waterbird Management and Monitoring Initiative.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original



Maps, Data Sheets and Appendices:

You can insert maps and any appendices of information (e.g., progress tables, timelines, budgets, activity logs, etc...) directly into this document (Insert in Word document version or Attach to Adobe version).



1.03 Mobile Acoustical Bat Monitoring

Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Mobile Acoustical Bat Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will measure the relative abundance of bats by using acoustical sampling techniques 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. Mobile acoustical bat monitoring (MABM) is designed to evaluate long-term population trends of bats at a regional scale and provide a baseline inventory of species on the refuge. Multiple stressors including habitat fragmentation and degradation, white-nose-syndrome (WNS), and energy development (i.e., wind farms) are primary causes contributing to declines in bat species especially across the eastern United States. For many species, the decline is anticipated to accelerate as WNS expands west and south. Two species, Rafinesque's big-eared bat and the southeastern myotis, are identified as resources of concern on the refuge and highly reliant on bottomland hardwood ecosystems for roosting and foraging. Understanding population trends and habitat utilization at multiple scales supports efforts to conserve bats and inform the refuge about forest management. These data combined with other NWRs cooperating in this effort represent the only data available to evaluate population changes in foliage roosting bats.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Bats along road-based transects

Target habitat(s): *(if applicable)*

All habitats encountered along road-based surveys.

Survey objectives: *(Your primary survey objectives, i.e., what questions do you hope to address with this survey?)*.

1. Provide a baseline inventory of bat species occurrence on refuges.
2. Institute long-term monitoring of bat population trends at local and landscape scales using a standardized survey protocol.
3. Develop local and landscape-scale species- habitat associations based on bat occurrence along transects.
4. Integrate indices of species abundance and richness with other agencies and partners to support broad-scale Strategic Habitat Conservation Initiatives for bats.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Regional – coordinated by the Region 4, Branch of Inventory and Monitoring. Data may eventually be integrated in the North American Bat Initiative coordinated by USGS.

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Richardson D and USFWS. 2012. Mobile Bat Acoustical Survey Protocol, U.S. Fish and Wildlife Service, Region 4, Division of Refuges. Protocol-35782 <https://ecos.fws.gov/ServCat/Reference/Profile/35782>

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2012

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☐ Plot ☐ Point ☐ Other:

Sampling will be done along a discrete, fixed route. GPS points will provide spatial references for calls.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

The sampling route is a linear transect that was constructed along improved refuge roads and public roads that were anticipated to be drivable except for short periods of potential flooding. Route was selected to correspond with the Dahomey Breeding Bird Route which overlays with a portion of existing refuge boundary, and extends across portions of the anticipated expanded acquisition boundary. The transect does not attempt to sample across habitat types in proportion to availability. The route is fixed and not subject to modification.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

The survey is done during June 1 – July 15 with a target survey period of June 7 – June 21. Survey is conducted 2 times separated by a minimum of 4 days, but preferably a 7-14 day interval. Sampling begins 30 minutes after sunset and is completed within 2.5 hours.

Section 3. Survey Methods

Primary metrics collected:

The primary metric of interest is bat detections per mile of transect, broke down by individual species if possible. The georeferenced location of the bat detection is also a primary metric of interest.

How are sites marked? (Examples include GPS waypoints, flagging, etc...)

Not marked – sampling is done continuously along the route. A map of the route with turn locations and distances between turns provides driving instructions to conduct the survey.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Familiarity with setting up the acoustical detector and roof-mounted GPS unit. Need to have a map and driving directions for the route (It helps to drive the route in daylight if surveyor has never driven the route). Extra batteries need to be available for the detector. CF Card needs to be ERASED and in detector for data collection. Test the unit to make sure the microphone and power adaptor for the mouse GPS are both functional.

Describe equipment used during the survey:

Data Sheet, Vehicle – 2 wheel drive (4-wheel drive may be needed if recent rain event), Anabat Detector w/ microphone, power cords, and cables, spare batteries, Roof mounted GPS unit, Erased-non-programmed CF Card.

Describe detailed methodology (field and lab procedures) - Excerpted From:

Observer sets up GPS roof mount system with green or silver microphone pointing straight up. GPS is plugged into auxiliary power supply in vehicle via a USB/connector. Attach the serial cable of the GPS into the Anabat Detector.

Anabat detector is powered on at the beginning of the survey, 30 minutes after sunset. Observer drives the route at a speed of approximately 20 mph. At gates or other points along the route that require a stop of more than 30 seconds, the Anabat detector is turned off until the vehicle can begin traveling the route.

At the completion of the route, the data sheet is completely filled out, detector is turned off. The CF Card containing the data is downloaded the following day using the CFREAD application. The survey datasheet and datafiles are uploaded to the mobile acoustical bat monitoring fishnet site (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/bats/default.aspx>). A backup of the data is retained at the field station.

The second survey is conducted preferably 7 -14 days later and no sooner than 4 days.

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

Refuge Biologist, Refuge Manager, interns

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Raw acoustical data are stored in a proprietary file format for the Anabat Detector (SN.....dat). Data sheets are stored as a Microsoft Info Form. Processed datasheets and call data are imported into an MS Access database.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Raw survey data are kept on the refuge server. In addition, an archive copy of all survey data is kept on the I&M Fishnet site.

Describe procedure for verifying/checking/securing the data:

QA/QC is done by the I&M branch during data processing. Refuge staff should examine the Log.txt files after downloading the data from the CF Card to look for any error codes and insure that at least 200 call files were generated.

Describe methods/software used in data analysis:

Data are initially filtered using the CFREAD application. Call analysis and classification is done using BCID version 2.7 or later. Other call software may include EchoClass 2.0.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

Field station summary reports are annually developed by the I & M Branch. The reports are archived on the fishnet site and also uploaded to ServCat (<https://fishnet.fws.doi.net/regions/4/nwrs/IM/bats/default.aspx>).

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Survey Data Sheet, Survey Route

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

U.S. Fish and Wildlife Service. 2005. North Mississippi Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 231 pp

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

**Mobile Acoustical Bat Route – Dahomey NWR
Route Directions**

Mileage	Point	Description of Turn/Road Location
0.0	1	Start at gas ROW and Sawdust Road
1.8	2	At Sawdust and Well Road – Turn Left onto Well Road.
4.3	3	At Well Road and County Road – turn right onto county road
4.7	4	Go over concrete bridge, past grain bins on right – Turn Right on dirt/gravel road
6.8	5	At Highway 446 – Turn Left
8.4	6	At intersection with Highway 446 and Hwy 1 – Turn Right
9.6	7	At St John MB Church - Turn Left onto County Road – Gravel
11.1	8	At Road – turn Right (before bridge)
13.3	9	At paved road – turn right
15.8	10	Intersection with Highway 1 – turn left
16.4	11	At sign for Mt Pleasant MB) turn right onto gravel road
17.8	12	4-way road intersection (Well on SE corner) – turn right
19.2	13	At FWS Kiosk – turn Right
20.4	14	Junction with Christmas Lake Road – turn Left
21.9	15	Junction with Neblitt Road – turn Left
23.7	16	Bear Road – turn Left
26.1	17	Intersection with Headquarters Road – turn Left
27.1	18	End of Headquarters Road – Survey Ends

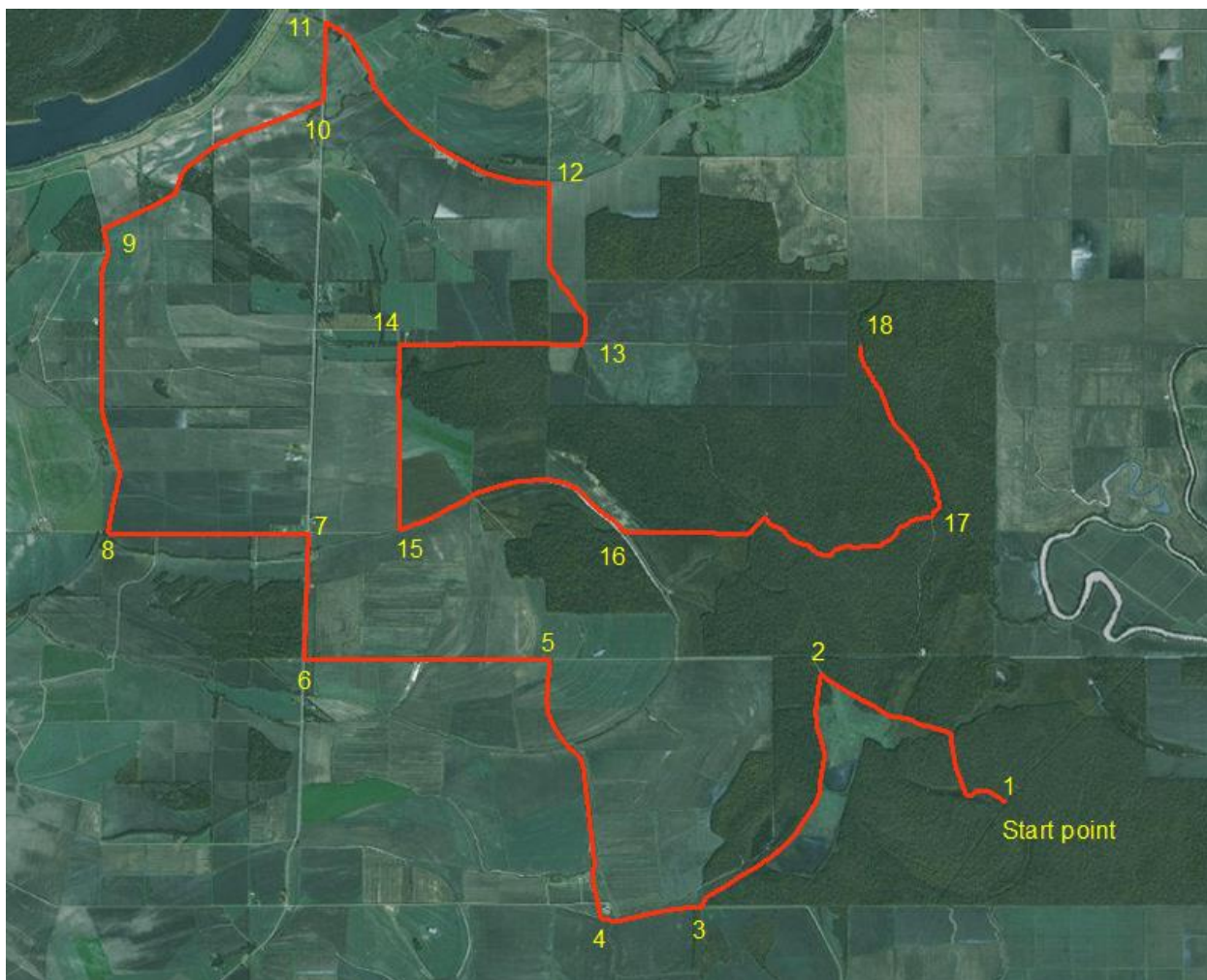


Figure – Map of the mobile acoustical bat monitoring route on Dahomey NWR; numbers refer to point locations along the route from the table above to provide driving directions.

Acoustical Bat Monitoring Survey Data Sheet, Region 4, Refuges

Surveyor Name(s): _____

Contact Number: _____

Survey Route Name (e.g., Carolina Sandhills NWR): _____

State _____ County(s) _____

Date of Survey: _____

Serial Number or ZCAIM# of Anabat Detector: _____

GPS Data Collected: Yes No

Survey Route Completed: Yes No

Weather and Time Data

	Time	Temp (F)	Wind (mph)	Moon Visible?	% Cloud Cover	Moon Phase (New, ¼, ½, ¾, Full)
Start						
End						

Comments: (e.g., High insect noise, traffic, problems with Anabat Detector, GPS Unit, Road hazards, major change in weather pattern – front moved through, recent rains, cold snap, etc.).



1.04 Pondberry Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and *will enhance survey integrity by ensuring that survey procedures are clear and consistent*. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Pondberry Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will determine the distribution and monitor the known population(s) of pondberry (*Lindera melissifolia*) on Dahomey NWR. Pondberry is a deciduous, aromatic shrub associated with wetland habitats of bottomland hardwoods (U.S. Fish and Wildlife Service 1993). The plant was federally listed as an endangered species in 1986 (U.S. Fish and Wildlife Service 1986). This rare plant has extant populations from North Carolina, South Carolina, Alabama, Arkansas, Missouri, and Mississippi. Sixteen populations of pondberry have been located within the Delta Region of Mississippi (U.S. Fish and Wildlife Service 2014). Survey efforts for this species on Dahomey NWR occurred in 1990 (Stewart 1990), 2008 (USFWS, Unpublished data) and in 2014 (Richardson et al. 2014), and 2015 (USFWS, Unpublished data). In 2014, a small colony of 220 stems was located based on an inventory of approximately 2000 acres. However, large expanses of the refuge have yet to be evaluated for the presence of pondberry. This plant has been identified as a resource of concern on the refuge. Continued surveys for this plant address the CCP goal to protect and restore habitat for federal and state threatened and endangered species found in the Lower Mississippi River Ecosystem.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Pondberry

Target habitat(s): (if applicable)

Mature bottomland hardwood stands. This does not include reforestation/afforestation sites on the refuge.

Survey objectives: (Your primary survey objectives , i.e., what questions do you hope to address with this survey?).

The first stage is to complete a refuge-wide inventory in order to locate any remaining pondberry colonies; and the second stage will include annual monitoring of the number of stems and relative area occupied by colonies and evaluation of hydrological or vegetative parameters which might influence the long-term survivorship of the colonies.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Survey is important to address recovery efforts for this endangered species across its range.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2008, repeated annually beginning in 2013

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☒ Point ☐ Other:

Inventory is based on systematically walking along transects to accomplish a 100% coverage of potential habitat for pondberry. Subsequent monitoring of identified pondberry colonies will be for the entire population at each location.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling is based on 100% visual coverage of all mature bottomland hardwood stands on the Refuge to identify pondberry populations. Observations along parallel transects are done at a distance sufficiently close to find pondberry between the transects. This distance varies depending on habitat type, topography and location near permanent and semi-permanent forested wetlands.

There is no identified sampling design for monitoring pondberry populations. Instead the entire population will be evaluated.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Inventory: February – March

Monitoring: after full leaf out (April – May). Seed production can be evaluated in September.

Section 3. Survey Methods

Primary metrics collected:

Location of pondberry, transect delineations of areas searched, pondberry stem density, sex of clones, fruiting, and area occupied by pondberry

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

GPS points mark known location of pondberry. Extent of known colony marked by rebar placed at corners and flagged. GPS tracks have been established delineating actual areas searched to date for the plant.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

Inspection of the existing pondberry population on the refuge in February or March is recommended to validate the species is in flower. No permits are needed to conduct survey.

Describe equipment used during the survey:

GPS unit, compass, aerial photograph or map, data sheet, camera.

Describe detailed methodology (field and lab procedures) - Excerpted From:

Inventory – Observer walks parallel transects in manner to insure 100% visual coverage of the sampling frame. Areas are walked in February and March during the flowering period. More focused observations for the plant should be directed near forested wetlands. Inventory needs only be conducted one time.

Monitoring – Each population is monitored in spring after full leaf-out. Number of stems is counted. The outer edges of the population are defined and the area of occupancy delineated. Number of stems of each sex is counted. Monitoring is done every 2-3 years.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

MS Excel, ArcMap (shapefiles for known populations and survey tracks)

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Files stored on refuge server.

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

No analysis

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report of inventory and monitoring activities will be generated.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Presently there are no standardized methods for monitoring this clonal population.

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Richardson, D.M., B. Rosamond, and A. Breland. 2014. Survey for pondberry (*Lindera melissifolia*) on portions of Dahomey National Wildlife Refuges. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.

Stewart, R. 1990. A botanical and ecological survey of the Dahomey Woods, Bolivar County, Mississippi. Dept. of Biological Sciences, Delta State University, Cleveland, MS. 37 pp.

U.S. Fish and Wildlife Service. 1986b. Endangered and threatened plants; determination of endangered status for *Lindera melissifolia*. Federal Register. 51:27495-27500.

U.S. Fish and Wildlife Service. 1993. Recovery plan for pondberry (*Lindera melissifolia*). U.S. Fish and Wildlife Service, Atlanta, GA. 56 pp.

U.S. Fish and Wildlife Service. 2014b. Pondberry (*Lindera melissifolia*) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service, Jackson, MS. 42 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



1.05 Moist Soil/Grain Production Survey Instructions (FreeForm)

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring (PRIMR) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Free Form

The free form is an alternative to the more structured fillable-Field Form. Similarly, staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where formal protocols are not applicable. The information provided in the ISI form should be as thorough and complete as possible, keeping in mind that it may be the instructions available to another to stand in for current staff and will be the documentation linked to the Inventory & Monitoring Plan. Upload completed ISI to [Fishnet](#) site and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

(Survey Name): Moist-soil/Grain Production

Conducted by (Refuge(s)): Dahomey NWR

Information Current as of (Date): April 2015

Submitted by and contact information: David Richardson, I & M Ecologist

Overview

This survey monitors the annual floristic composition within individual wetland management units on the refuge and provides a qualitative and/or quantitative estimate of the duck carrying capacity (i.e., duck-energy days/acre). Moist-soil plants and supplemental plantings of cereal grains provide important energy for migrant and wintering waterfowl which have been identified as resources of concern on the refuge. Dahomey NWR manages wetland units to support the goals of the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1986a) and contribute to foraging habitat objectives as outlined by the LMVJV. This survey is coupled with the migrant and wintering waterbird survey to provide an overall assessment of the refuge contribution toward migrant and wintering waterbird conservation. Waterfowl have been identified as a resource of concern for the refuge. Survey data will inform management about the need to conduct treatments to influence desirable annual plant composition and considerations for cereal grain production to meet local and regional conservation initiatives.

Design

Sampling will be done in a manner to estimate the pounds/acre of moist-soil or cereal grains produced within each management unit on the refuge on an annual basis. The design will consist of systematically locating sampling points across the entire wetland unit.

Methods

Stand boundaries from shapefiles in the Refuge's GIS system will be used to delineate systematic plot locations. Sampling will be done using 1 meter/squared plots. Metric to collect will include species composition (percent cover) and relative abundance of seeds produced. Survey effort will be approximately 1 plots per acre spaced uniformly across the entire stand. For cereal grain production, seed heads will be counted in each plot and a sample head will be collected from each plot. Average seed weight will be derived and used as a factor to estimate actual seed production. Alternatively, if the unit is being cooperatively farmed, the production yield of the harvested portion based on delivered weight of the grain to the mill can be used to estimate the left portion in the field.

Data Management

Data management will consist of producing summary means and confidence intervals for collected metrics. Data will be stored in excel files in the refuge server. In addition, a more qualitative estimation of production will be assessed and provided to the USGS- LMJVJ Impounded Wetlands Management & Monitoring Application (http://lmvjv.cr.usgs.gov/moist_soils/default.aspx)

Reporting

A summary report of the annual survey findings will be placed in ServCat.

Other Information

None

[Use the following table to track updates to the Survey Instructions.]

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	



1.06 Forest Stand Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Forest Stand Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

Bottomland hardwood forests are an ecologically important component of the MAV and historically dominated this region. However, only 24% of the MAV floodplain remains (Twedt and Loesch 1999). The diversity within this system in terms of forest area and distribution, stand structure and age, and plant species composition has enormous implications to avian conservation for breeding neotropical migrants (Hunter et al. 1993, Twedt and Loesch 1999), wintering waterfowl (Reinecke et al. 1989), bats (Fokidis et al. 2005) and other resident wildlife (LMVJV Forest Resource Conservation Working Group 2007). Forest stand monitoring provides a foundation for determining existing stand conditions and subsequent strategies to achieve population and habitat management objectives identified in the CCP and HMP. This survey evaluates existing forest stand conditions based on periodic monitoring (10-15 year cycle) using a variable plot measurement technique. A baseline inventory of the existing forest conditions was done by Smith and Sansing (2008). The survey was selected because the information is critical to evaluating avian and other wildlife responses to existing and desired habitat management conditions.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Bottomland Hardwoods Trees, cane, and vine composition

Target habitat(s): (if applicable)

Bottomland Hardwoods

Survey objectives: *(Your primary survey objectives, i.e., what questions do you hope to address with this survey?)*.

The information from this survey will be used to evaluate the overall structure of forest stands and the composition of the trees, shrubs, and vine strata. Inventory data will be used to estimate current habitat conditions at the stand level and overall on the refuge and develop appropriate management strategies.

Section 2. Survey Design

For Collaborative Surveys

☐ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

**For Surveys with Refuge-specific Details
(collaborative OR unique refuge surveys)**

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD – each stand to be surveyed a single time before 2030.

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☒ Point ☐ Other:

1/10 acre plot or via 10 factor prism inventory

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: *(e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

A simple cruise grid is generated using SilvAssit (GIS extension), Solo Forester, or GME and cruise points are established at equal distances across all habitats within the sample area at a level to achieve a 1-2% cruise. This equates to 1 plot/5-10 acres. Plots will be systematically located across the stand.

Describe Survey Timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Depends on site conditions – primarily during leaf-on to more readily identify tree species.

Section 3. Survey Methods

Primary metrics collected:

Species, DBH, Canopy closure, % vine, cane quantity, volume coarse woody debris, tree height, age.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Plots are located based on waypoints generated from software.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Generating sampling point locations. Uploading background waypoints and files into data logger. Survey effort may require significant outside assistance.

Describe equipment used during the survey:

GPS unit, 10 factor prisms, densitometers, dataloggers, spare batteries, with either TCruise or Two-dog software

Describe detailed methodology (field and lab procedures)

In conjunction with refuge staff, priority areas are selected across the refuge and identified for inventory. Focus is on areas believed to have reasonable long-term probability of management through silvicultural techniques. This approximate 1-2% inventory will be conducted using point sampling (10 BAF prism).

Two-person teams will conduct the cruise and a hand-held data logger will be used to log data with Solo Forest providing spatial reference to navigate to each point and TCruise or Two-Dog software being used to record forest inventory data at each point.

Both plot level and tree level data will be recorded at each point for each identified forest stand. Plot level variables include canopy cover, midstory abundance, understory cover, cane abundance, abundance of vines in canopy, presence of invasive species and abundance of regeneration (separated into shade tolerant and intolerant). Plot level data are ocular estimates taken from the cruise point and are recorded in ranges relative to DFC guidelines.

- Canopy cover (vertical sunlight blockage) will be estimated as follows: <50% cover, 50-80% cover and >80% cover.
- Midstory abundance are trees typically 10'-30' tall and ocular estimates of midstory (horizontal vision obstruction estimate) will be <25%, 25-40% and >40%.
- Understory woody vegetation (ex. shrubs <10' tall) will be estimated as being <25%, 25-40% or >40% shrub cover in the plot area.
- Cane abundance will be estimated around plot center as being none, sparse (1-25%), moderate (25-50%) or abundant (>50%) cane coverage.
- Abundance of vines in trees will be estimated as being none, sparse (1-25%), moderate (25-50%) or abundant (>50%) of trees in plot having vines.
- Invasives (none, Chinese privet, trifoliolate orange, kudzu, Chinaberry, Japanese climbing fern and "other spp") will be noted at each point (or if observed anywhere in the nearby vicinity).
- Regeneration – both seedlings and advanced regeneration in 1/100 acre (11.8ac) subplot. Quick estimates only
 - Shade Intolerant (I) species
 - Moderate (intermediate) Shade Tolerance Regeneration (M)
 - Tolerant Regeneration (T)
 - None
 - Sparse
 - Moderate
 - Abundant

Tree level information for all trees determined to be "in" using a 10 BAF prism will be recorded at each point and data logged will include species, DBH, merchantable height, note if tree is a super-emergent (dominant as opposed to

codominant) and note presence of cavities by size (none, small = <4", medium = 4-10" and large >10"
Large (minimum 6" x 10') down woody debris will be logged as a tree (species code DD) and DBH/length estimated so that approximate volume of down woody debris can be calculated.

Product categories include Pulpwood, Sawtimber and Cull.

- Pulpwood is 6" dbh to 4" top with height in 5' increments and maximum 26" dbh.
- Sawtimber is 14" dbh to 12" top with height in logs.
- Non-merchantable timber should be recorded as product class culls (CL). Auto assign product for all SNAGS

Note: Products are auto-assigned in TCruise based upon these specifications. Manually downgrade as needed and specify culls.

If a point falls on road/edge atypical of general area, walk 1 chain (66') into woods to collect data.

Who conducts the surveys (***Include staff, interns, contractors, etc... if primary surveyors:***)

Refuge biologist, refuge manager, and assistance from other refuge foresters.

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

TCruise or Two-dog software

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Hardcopy and digital summary report held on the refuge shared drive and compiled inventory uploaded to ServCat.

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

TCruise and Two-Dog software produce predefined summary reports.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

The refuge will archive the report into ServCat. Previous refuge wide forest inventory was completed in 2008 (Smith and Sansing 2008) and is available in ServCat (<https://ecos.fws.gov/ServCat/Reference/Profile/38424>).

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Each inventory is customized to address refuge specific needs, but generally include traditional forest inventory information (tree species, dbh, height, product, etc.) along with numerous habitat variables ranging from groundcover abundance and structure, shrub, midstory and canopy density, invasives, vines, snags, cavities, down woody debris, etc. Most of the plot level variables are simple ocular estimates, as this allows for adequate general analysis of condition relative to DFCs. However, it is likely more variable than using techniques to actually measure these variables, as this would be too time consumptive for our needs

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Smith, R., and H. Sansing. 2008. Dahomey National Wildlife Refuge stand conditions and habitat management recommendations. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



1.07 Breeding Bird Survey Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Breeding Bird Survey

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey assesses distribution and relative abundance of breeding birds for regional and national assessments with the refuge serving as a sampling location. Birds are a national trust resource for the U. S. Fish and Wildlife Service and represent the foundation for establishing most National Wildlife Refuges. The North American breeding bird survey monitors bird populations across North America and informs researchers and wildlife managers of significant changes in bird population levels so that if declining species are identified, causes can be examined and corrective actions taken to reverse the trend (Sauer et al. 2013). Though the survey examines trends at regional scales, the data can also be used to establish local breeding bird baseline inventories based on roadside vegetative communities. Forest interior birds are considered a resource of concern for the refuge and this survey provides information about their distribution and relative abundance.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Resident, temperate migrant and neotropical migrant birds

Target habitat(s): *(if applicable)*

N/A

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*.

1. Determine the status and trends of North American bird populations at various scales.

Section 2. Survey Design

For Collaborative Surveys

☒ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

U.S. Geological Survey

Is there an established protocol for the survey? ☒ Yes ☐ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

<https://www.pwrc.usgs.gov/bbs/participate/instructions.html>

Are there refuge-specific elements of implementation? ☒ Yes ☐ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

2011

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Fixed route is conducted with sampling points located every ½ mile. Birds identified by sight or sound are recorded around the point (1/4 mile out).

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Routes were created based on an initial starting point and subsequent delineation of sampling points every ½ mile. Sampling was emphasized to the refuge property and then moving out to areas identified as part of a proposed expansion to the acquisition boundary.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

May 15 – June 30, 1 time every year, conducted in the morning to end before 12:00 pm

Section 3. Survey Methods

Primary metrics collected:

Number of individual birds by species detected at each sampling point.

How are sites marked? (Examples include GPS waypoints, flagging, etc...)

GPS waypoints, and visual roadside reference points

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

None. However, proficiency with call identification can be done using training tapes prior to conducting local surveys.

Describe equipment used during the survey:

- Data sheet, map
- GPS
- Binoculars
- Stop watch

Describe detailed methodology (field and lab procedures):

Detailed instructions for the methods and survey sheets are attached as an appendix and also available at:

<https://www.pwrc.usgs.gov/bbs/participate/instructions.html>

Survey starts ½ hour before sunrise, every point is sampled for 3 minutes; all birds seen or heard within ¼ mile of sampling point are recorded. Survey route is done the same way each year starting at the same point. See map attached.

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

Refuge Biologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are stored in a web-platform.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data stored on the USGS North American Breeding Bird Survey -
<https://www.pwrc.usgs.gov/bbs/dataentry/>

Describe procedure for verifying/checking/securing the data:

Data are proofed before submitting. BBS office reviews data for reasonableness before accepting.

Describe methods/software used in data analysis:

None identified at this time

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

Not specific to data collected exclusively by the refuge.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Attached is a map and directions for sampling locations for the Dahomey Breeding Bird Survey Route

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Sauer, J. R, W. A. Link, J. E. Fallon, K. L. Pardieck, and D. J. Ziolkowski, Jr. 2013. The North American breeding bird survey 1966-2011: summary analysis and species accounts. North American Fauna. 79:1–32.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/15/2015	Original

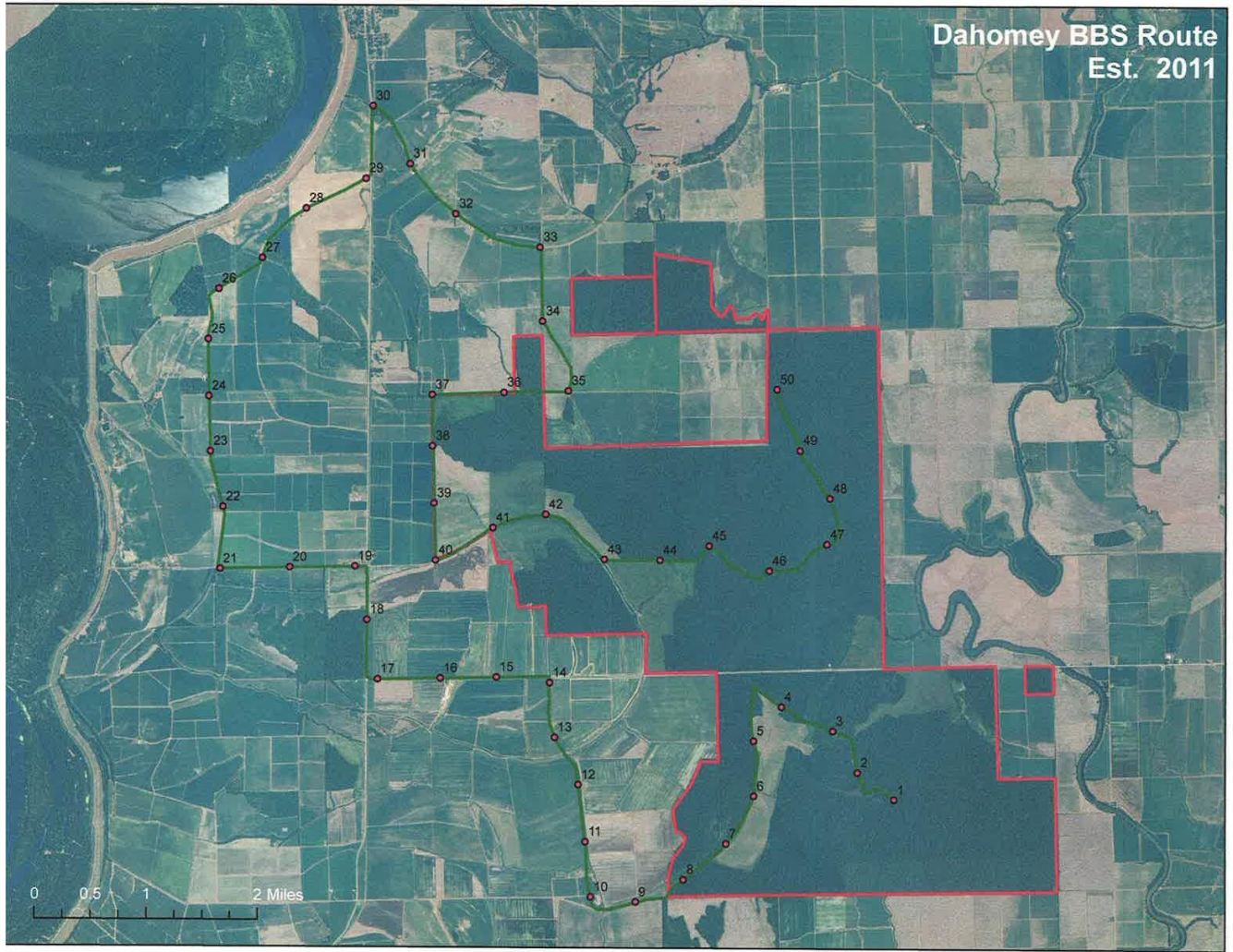
Maps, Data Sheets and Appendices:

Dahomey BBS Route

Stop_No_	LAT	LONG	Mileage Description of Site
1	33.68675888	-90.90118476	0.0 Jct. gas R.O.W. and Sawdust Road
2	33.69034767	-90.90681204	0.5 Stillwater Bayou, between wood duck boxes 289 and 290.
3	33.69576573	-90.91054031	1.0 Trees and cane on right, reforestation area on left
4	33.69900048	-90.91846355	1.5 Jct. field edge and Sawdust Rd, before jct with Well Rd.
			1.8 Jct. Sawdust and Well Rd., left on Well Rd.
5	33.69468212	-90.92288383	2.3 In line with well and edge of trees (looking east)
6	33.68752599	-90.92301258	2.8 Just south of junction with culvert, north end of field 40
7	33.68136764	-90.92745968	3.3 South end unit 40 approx. 0.2 miles before treeline
8	33.67679715	-90.93418130	3.8 Just before small culvert/ditch, reforestation on right
			4.0 Jct. Well Rd. and County road, turn right onto county road
9	33.67400229	-90.94168075	4.3 Just before well on left
			4.7 Turn right just past grain bins
10	33.67473722	-90.94865450	4.8 Before four-way intersection (right road goes to grain bins)
11	33.68193090	-90.94934651	5.3 Between 5th and 6th electric poles after bridge
12	33.68937671	-90.95026919	5.8 Near 11th pole after bridge
13	33.69556725	-90.95379897	6.3 Halfway between the bridge and the well
14	33.70264820	-90.95441588	6.8 Just before junction with Hwy 446
			6.8 Turn left onto 446
15	33.70346904	-90.96269854	7.3 Between well and bridge
16	33.70346904	-90.97143718	7.9 Just past white house on left
17	33.70348513	-90.98123261	8.4 Just before jct. with Hwy 1 at Hwy 1 sign
			8.4 Turn right onto Hwy 1
18	33.71121526	-90.98273464	9.0 Just before culvert
			9.5 Turn left onto county road
19	33.71817291	-90.98442444	9.6 Just before "St. John MB Church", at pole
20	33.71816218	-90.99462220	10.2 Second pole past well on right, turn row to another well on left
21	33.71812999	-91.00543686	10.8 Intersection, just before well. Field access on right.
22	33.72620881	-91.00479850	11.4 Just before junction with ditch
23	33.73341322	-91.00660631	11.9 Between 2 wells on right
24	33.74054790	-91.00664922	12.4 Junction of farm fields and pecan orchard on left
25	33.74794543	-91.00659021	12.9 Between poles
			13.3 Turn right onto paved road
26	33.75443101	-91.00477167	13.4 Across from mainline levee access (to the NW)
27	33.75834167	-90.99792131	13.9 Junction with ditch
28	33.76456976	-90.99100121	14.5 Just before second pole on right after quonset hut
29	33.76830339	-90.98160812	15.1 Just before junction with Hwy 1
			15.8 Turn right onto county road (Sign to "Mt. Pleasant MB
30	33.77762675	-90.98030456	15.8 Immediately after turning and crossing old levee
31	33.77008975	-90.97469338	16.4 Before cell tower on right, ditch on right
32	33.76352370	-90.96769282	17.0 At sign for Mt. Pleasant MB Church on right
33	33.75903904	-90.95464655	17.8 Four-way intersection, well on SE corner
			17.8 Turn right onto gravel road
34	33.74946356	-90.95444807	18.5 Dahomey woods on left and straight ahead
35	33.74037087	-90.95065542	19.2 At kiosk (road turns to right)

Dahomey BBS Route
Established 2011

		19.2 Turn right
36	33.74032259 -90.96068689	19.8 First pole on right
37	33.74021522 -90.97184488	20.4 At junction with Christmas Lake Road
		20.4 Turn left onto Christmas Lake Road
38	33.73358488 -90.97195753	20.9 Field access on left, north boundary of field 5
39	33.72620881 -90.97191461	21.4 Just south of North boundary of field 6
40	33.71876836 -90.97183951	21.9 Junction with Neblett Road at kiosk
		21.9 Turn left onto Neblett Road
41	33.72287205 -90.96279510	22.5 Just past ditch
42	33.72446001 -90.95454999	23.1 Junction west end of rice fields
		23.7 Turn left onto Bear Road
43	33.71846259 -90.94556459	23.7 Junction with Bear Road
44	33.71825337 -90.93688496	24.2 Reforestation on right, forest on left, ditch ahead on right
45	33.71999145 -90.92919775	24.7 Junction with continuation of Bear Rd
		24.7 Turn right to remain on Bear Road
46	33.71658504 -90.91994950	25.4
47	33.71988952 -90.91087827	26.0 At deep culvert
		26.1 Turn left onto Headquarters Road
48	33.72584939 -90.91028818	26.5 Just north of trail crossing
49	33.73210430 -90.91478893	27.0 Just north of pull off area
50	33.74002755 -90.91820070	27.6 Turn around at end of Headquarters Road



Instructions for Conducting the North American Breeding Bird Survey

USGS Patuxent Wildlife
Research Center
12100 Beech Forest Road
Laurel, Maryland, U.S.A. 20708-4038

Canadian Wildlife Service
(CWS)
National Wildlife Research
Centre
100 Gamelin Blvd.
Hull, Quebec, Canada K1A 0H3

STRICT ADHERENCE TO THE RULES IS ESSENTIAL FOR PROPER ANALYSIS OF RESULTS

IF UNABLE TO CONDUCT SURVEY, CONTACT STATE COORDINATOR IMMEDIATELY

PLEASE READ ALL INSTRUCTIONS PRIOR TO CONDUCTING SURVEY

Quick Reference Guide

Topic	Section(s)
Cars and noise	8, 9
Internet data entry	18
Route problems	13
Using scan sheets	14, 15, 16

Topic	Section(s)
Counting birds	6, 7
Manual data entry	14, 15, 16
Reporting weather	10, 11, 12
Using non-scan sheets	14

- | | | |
|---|---|--|
| 1) Requirements | 8) Counting Vehicles | 15) Scannable Field Sheets |
| 2) Scouting | 9) Excessive Noise | 16) Cover Sheet |
| 3) When to Run Routes | 10) Acceptable Weather | 17) Reporting Results |
| 4) Starting | 11) Wind Speed Codes | 18) Electronic Data Submission |
| 5) Stop Locations | 12) Sky condition Codes | 19) All Forms Completed by July 15 |
| 6) Counting | 13) Route Problems | 20) Processing of Results |
| 7) Which Birds to Count | 14) Record Keeping | 21) Income Tax Deduction |

1) REQUIREMENTS: It is very important that the observer know the songs, calls, and visual identification of all species likely to be encountered. It is advisable, even for experienced observers to learn the less common species on the available records and tapes. In Canada, cassettes of bird songs for each region are given to all participants. If you did not receive one please contact the CWS office. Since identification by songs and calls is required, acute hearing is extremely important. An observer with a hearing loss should not be running Breeding Bird Surveys.

2) SCOUTING: Much time can be lost due to closed roads, washed out bridges, and wrong turns. The importance of familiarization with the 50 stops and the proper turns before the day of the run cannot be overstressed. A scouting trip can save time and frustration, especially for first-time observers or on new routes. First-time observers should also conduct a test run to get familiar with the technique and the forms. If the route is far away, try 10 or 20 practice stops somewhere closer to home.

3) WHEN TO RUN ROUTES: In most states, routes should be run in early or mid-June. In Canada and most bordering states, any day throughout June and including the very first few days of July are acceptable. In the desert regions of California, Nevada, Arizona, New Mexico, Texas, Utah, and south Florida, routes may be run as early as May, at the discretion of the State Coordinators. In general, a date as near as possible to last year's is most desirable.

4) STARTING: Start at the marked starting point -- do not reverse the route even if the end is closer to home. The starting point is stop number 1. At the proper starting time, which should be printed on the map as well as the first page of the scannable field sheet, begin counting birds at the marked starting point. The times shown are ½ hour before official sunrise. Beware, local papers and TV stations often give incorrect sunrise data. Be at the starting point early to record weather data and odometer readings.

[Return to the Top](#)

5) STOP LOCATIONS: Stops are supposedly located at ½ mile (0.8 km) intervals; unfortunately, car odometers vary. The most important issue concerning stops is that all 50 stops should be made in exactly the same location from year to year. If your route map has stops marked on it or a list of stop descriptions attached, use those stops regardless of what your odometer says unless the marked stops are entirely unreasonable -- in which case contact this office. Please make a list of stop descriptions and mark the stops on the map if neither are provided -- this can be done while scouting. Update these stop descriptions each year as necessary. If you have a metric odometer and are running a new or unmarked route, the best approach is to go 0.8 km for every stop. Most importantly -- make a list of stop descriptions and mark their locations on the map, so the stops can be duplicated in the future. Stop descriptions should be updated as necessary whenever major landmarks change along the route. If a route problem arises, see the section 13.

6) COUNTING: One and only one observer should count birds. Counting should be done from outside the car but from a stationary point. Every bird seen within 1/4 mile (400 m) and every bird heard by the one observer should be counted during the 3 minutes at each stop. Do not exceed 3 minutes because you are sure a certain "good bird" is there and not calling -- it will probably be recorded some other year, and valid negative data are as important as positive in this survey. Do not stay less or more than 3 min. **ABSOLUTELY NO METHOD OF COAXING BIRDS SHOULD BE USED** under any circumstances during the 3-minute counting periods. This means no "spishing" or tape playbacks or any other method. It is crucial that all surveys be done consistently, because the goal of the survey is to establish a comparison index not an actual count or census. Birds seen between stops or before and after the three minutes or on scouting runs should not be counted, but may be noted in the margin. Such birds are of some interest, but do not spend extra time pursuing them, as it is important to finish within the time limit, which should be 4 to 5 hours; bird activity changes drastically after this time.

[Return to the Top](#)

7) WHICH BIRDS TO COUNT: Count individuals (except dependent young including downy chicks of water and shorebirds) of all species seen or heard during each 3-minute period. Estimates should be used only for flocks too large to count in the brief time they are seen. Do not use check marks (i.e. marking presence of bird rather than actual number of individuals) even for abundant species. No one will detect all birds within hearing or seeing distance. Hundreds of birds present will not be active during each 3-minute count, and you must not try to guess how many you are missing. Report only those birds actually seen or heard during the prescribed 3-minute stops. Be careful not to count any individuals known or strongly suspected to have been counted at a previous stop. Any bird known to be a non-breeder (late migrant, injured bird, or summer vagrant) should be included but marked on the data sheet as such. Easily identifiable subspecies of birds, such as Northern Flicker, Dark-Eyed Junco, and Yellow-rumped Warbler should be identified. Species recorded that are not found on the form should be added at the bottom. Do not fill in AOU numbers; we will do that for you. Any species unusual in the area, whether it appears on the form or not, should be supported by including some details of the observation.

8) COUNTING VEHICLES: At the bottom of the field sheets, record the number of vehicles that pass by during each 3-min stop. Treat all motorized conveyances equally; motorcycles, cars, buses, trucks, semi-tractor trailers, etc., would each count as one vehicle if they were to pass by the point while the count was in progress. Count only those vehicles that are on the road where the count is taking place. Do not count vehicles passing by on nearby thoroughfares even if their noise is interfering with your ability to detect birds. If a stop is located at an intersection, count the vehicles traversing both roads during the count. It is acceptable for assistants to count and record the number of vehicles. We suggest using a mechanical hand-counter or tallying device to count vehicles. If a stop is on a

heavily traveled road, it is acceptable to estimate the number of vehicles that passed by during the 3-min stop since counting birds is the primary objective of the survey. In addition, if you feel counting vehicles distracts too much of your attention from the bird survey, forego this step and indicate on the Cover Sheet that you did not count vehicles.

[Return to the Top](#)

9) **EXCESSIVE NOISE:** At the bottom of each field sheet are five bubbles, one for each stop. Fill in a circle completely if you feel constant excessive noise, other than that produced by counted vehicles, is significantly interfering with your ability to hear birds at that stop. Possible sources of excessive noise include, but are not limited to: lawn mowers, oil well pumps, trains, crop dusters, tractors, vehicles on nearby roads, numerous barking dogs, and rushing river water. Do not fill in the circle if the disturbance is temporary (lasts < 45 sec) or if you temporarily suspend the count until the offending noise has ceased or moved on.

10) **ACCEPTABLE WEATHER:** To be comparable, routes must be run under satisfactory weather conditions: good visibility, little or no precipitation, light winds. Occasional light drizzle or a very brief shower may not affect bird activity but fog, steady drizzle, or prolonged rain should be avoided. Except in those prairie States and Provinces where winds normally exceed Beaufort 3, counts preferably should be made on mornings when the wind is less than 8 m.p.h. (13 kph) and not taken if the wind exceeds 12 mph. (19 kph). If you can walk faster than the wind is blowing, wind conditions are very satisfactory (See sections 11 and 12 for wind and sky codes).

11) **WIND SPEED CODES:** (Enter Beaufort Numbers on Cover Sheet, not m.p.h. or km.p.h.)

Beaufort Number	Wind Speed Indicators	Wind Speed in mph / kmph
0	Smoke rises vertically	< 1 / < 2
1	Wind direction shown by smoke drift	1-3 / 2-5
2	Wind felt on face; leaves rustle	4-7 / 6-12
3	Leaves, small twigs in constant motion; light flag extended	8-12 / 13-19
4	Raises dust and loose paper; small branches are moved	13-18 / 20-29
5	Small trees in leaf sway; crested wave lets on inland waters	19-24 / 30-38

[Return to the Top](#)

12) SKY CONDITION CODES: (Enter these U.S. Weather Bureau code numbers on Cover Sheet.)

0 - Clear or a few clouds 4 - Fog or smoke 7 - Snow
1 - Partly cloudy (scattered) or variable sky 5 - Drizzle 8 - Showers
2 - Cloudy (broken) or overcast

13) ROUTE PROBLEMS: Scouting of routes should eliminate most last-minute adjustments. If any problems arise, notify this office as soon as possible. For maximum consistency, it is best that an alternative be worked out here that pleases both you and us. If it is not possible to scout a route and a problem arises while running it, remember that it is most important to use the same stops in the same order as in previous years. If a detour is necessary, go around and resume on the other side of the obstruction, attempting to preserve as many stops as possible. Do not make new stops along the detour unless necessitated by inaccessible sections of road or if detouring around will take in excess of an hour. There are numerous local traffic regulations dealing with the proper and safe parking of vehicles along roadsides. Please observe these regulations while conducting the Breeding Bird Survey and remember to use caution in selecting an appropriate stopping place and when getting into and out of your vehicle. If a stop is in a dangerous location, it is acceptable to move it as much as 0.1 mile (forward or backward) or put it on a side road. If this does not resolve the safety problem, skip the stop and contact us. Never stop at a location you consider to be dangerous in any way. Counting may be extended by 1 minute at stops with excessive traffic noise. This should be restricted to only a few stops; if many stops have excessive traffic, notify this office. In some cases a replacement route will have to be developed.

[Return to the Top](#)

14) RECORD KEEPING: You can submit your data by Internet (see section 18) or you can mail us the data. Sections 15, 16, and 17 describe procedures for those wishing to send us their data by mail. Two types of data forms are available for collecting BBS data -- Scan forms and Standard forms. The Scan forms are double-sided and have the words "SCAN FORM" printed on them; the Standard forms are single-sided and have a form number printed in the lower right corner. The Standard forms were used regularly before 1997. Unless you indicate otherwise, only the Scan form will be sent to you. Use either set of data sheets to collect the field data. You can also use a field data sheet of your own design. However the type of field sheet chosen will affect the process used to record and report data since all BBS data must now be scanned or electronically entered via the Internet. If you are going to enter your data via the Internet you may use either type of BBS data sheet, or your own data sheets, and record data using any method you desire since the form will not be scanned (see section 18). If you choose to mail your completed data forms to the BBS office for entry, remember that all data must either be transcribed to the Scan form from the original data sheets or recorded directly to the original Scan form in the field. If using hash marks, dots or other methods to count individuals, use the

Standard field sheets, your own field sheets, or make a photocopy of the Scan form for use in the field, then transfer the species data to the original Scan form; if you use Arabic numerals (i.e., 1, 2, 3, . . .) to record the number of individuals per stop directly to the original Scan forms, there is no need to transcribe species data. Do not wait to record birds after the 3 minutes have been completed. This leads to errors of omission and significantly delays the completion of the survey. If you transcribed data, always send both sets of data sheets to our office. Also keep a photocopy of the original data sheets for your records; you will need the photocopy to check against the results we will send you at the end of the year and as insurance against lost mail. A word of caution concerning dictating observations to a tape recorder: it is risky because the data can easily be lost by one manner of malfunction or another. Transferring the taped data is tedious and also subject to error. Another problem is that the tape is technically the original field sheet and it would be unreasonable for people to send us tapes. If you must use a tape recorder, indicate so on the assistant line and please be careful. With practice, an observer can count and record birds alone. Remember to record weather data at start and finish. Record the start and finish time for the route. Use a dark pencil or pen on field sheets, Scan Forms and Cover Sheet. We must photocopy or microfilm these records, which is impossible with light images. Do not use a felt-tip pen; the ink is not waterproof; hence, it smudges, washes out easily and makes corrections difficult.

[Return to the Top](#)

15) SCANNABLE FIELD SHEETS: If using the original scan sheets in the field or when transcribing your data to them, remember: count data must be written in Arabic numbers (1, 2, 3, . . . , 15, 16, etc.) in order to be scanned, print firmly with dark pencil or ink pen, write legibly avoiding contact with edges of entry boxes, do not obscure or mar black cornerstones or identification box at top left corner of pages, do not fill in missing AOU numbers, missing species may be written in lower case letters and abbreviated, and do not staple these data sheets together.

16) COVER SHEET: Always complete and return the Cover Sheet regardless of the method used to record and report survey data. Before submitting the Cover Sheet and data, always verify the address on the Cover Sheet, complete the route summary information, and answer the brief questions listed by filling in the data entry bubble corresponding to the correct response (Y = yes and N = no). When updating the address always use CAPITAL letters and place one character per entry box. If surveying multiple routes, it is only necessary to update the address on one cover sheet.

[Return to the Top](#)

17) REPORTING RESULTS: Upon completion of the route, address data should be verified and date and weather data should be transferred from the Field Sheets to the Cover Sheet; again, use a dark pencil or pen, but not a felt-tip marker. If you did not use the original Scan forms in the field, transfer the data from your own field sheets

to the Scan forms. Please double check the transfer of data; we have found that many observers inadvertently omit information when transferring. For this and other reasons we need your original field sheets. Copied field sheets tend to be less accurate than originals. Be sure to furnish all the summary information requested on the front of the Cover Sheet; please enter only 1 number or letter per block (start the date and starting time entries with a "0"). Please print plainly because all information must be scanned or keypunched. Don't forget to include your middle initial. We need your initials and last name to keep our address and route assignment files accurate. The observer should be the name entered here, not the driver or the recorder. Married women should use their own initials, not those of their husband. Two people should not observe together and take turns putting each others name in the observer block from year to year. The Field Sheets (representing 50 stops), the 5 scannable Data Sheets, 1 Cover Sheet, the route map, and these instructions should be sent in the envelope provided to the USGS Patuxent Wildlife Research Center or, in Canada, these items should be sent to the Canadian Wildlife Service as soon as possible after completion of the count. You will want to keep a copy of your data so that you can check the computer printout that will be sent at a later date.

[Return to the Top](#)

18) INTERNET DATA SUBMISSION: Instructions for Internet data submission are posted on the Internet at: <http://www.pwrc.usgs.gov/bbs/>. Once at the site, select the **BBS Data** link then choose the Data Entry link. Prior to running your route, test the compatibility of your computer with the data entry program. If they are incompatible, you will need to mail your data on the original Scan forms. If you use electronic data submission, please remember that you still need to return the original data sheets (i.e. those used in the field) including the completed Cover Sheet to the BBS office.

19) ALL FORMS MUST BE COMPLETED AND RETURNED BY JULY 15: If you choose to submit your data via the Internet, the data sheets need not be returned until **August 31**. If you cannot run your route, RETURN THE PACKET AS SOON AS POSSIBLE. If for any reason it should be impossible for you to cover your route during the prescribed period, inform the State/Provincial Coordinator or this office immediately. Current contact information for the State and Provincial/Territorial Coordinators is available on the BBS web site: <http://www.pwrc.usgs.gov/bbs/>

[Return to the Top](#)

20) PROCESSING OF RESULTS: Upon receipt of the forms, the Cover and Field Sheets are checked for completion, addresses are checked, and AOU numbers of write-ins are inserted. Data from the Cover and Field Sheets are then scanned into the computer and run through a computer edit program. A machine listing will be mailed, or e-mailed, to each observer and a state/provincial/territorial tabulation will be mailed to each regional Coordinator. Individuals who submitted their data via the Internet will also receive a final machine listing of the data via email once it has

completed the editing process within approximately one week of submission. Data on distribution trends and comparative abundance of individual species are available upon request.

21) INCOME TAX DEDUCTION/RECEIPTS: U.S. citizens who itemize deductions on their Income Tax Returns may make a deduction for mileage necessary for the counting and running of official Breeding Bird Survey routes. Cost of motels, campgrounds, etc. involved with the scouting and running of routes are also deductible. Please check your 1040 instructions each year; it could change. In Canada, it is not possible for the CWS to reimburse expenses or to issue tax receipts for participation in the BBS. However, out-of-pocket expenses incurred while running a BBS route can be treated as a charitable donation through the non-governmental organization Bird Studies Canada (BSC) and participants can thereby receive income tax receipts. Please note: this system provides a tax receipt only and is not a reimbursement of expenses. Participants submit a record of their expenses directly to BSC, along with a check payable to BSC, of an amount equaling the expenses. BSC then treats the check as a donation and issues the participant a tax receipt. Along with the tax receipt, BSC sends the participant a check equaling the amount of the donation. Cost of motels, campgrounds, meals, mileage, etc. involved with scouting and running the official Breeding Bird Survey routes can be included in these costs. For details, see the BSC Tax Relief Form enclosed in your package. The address for BSC is: P.O. Box 160, Port Rowan, Ontario, N0E 1M0.

[Return to the Top](#)

THANK YOU VERY MUCH FOR PARTICIPATING IN THE BREEDING BIRD SURVEY.

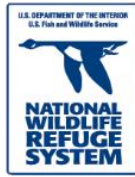
EQUIPMENT CHECKLIST

Clipboard	Binoculars	Watch with second hand (or timer)	Thermometer	Pencils (dark, soft lead) / pen (dark ink)
Gasoline	Flashlight	Route map & stop descriptions	Forms (Field sheets)	Hand counter or Mechanical tally device

Survey Data Sheet

ROUTE: _____ OBSERVER: _____

DATE: <input type="text"/>	Stop	Stop
START TIME: <input type="text"/>		
START TEMP: <input type="text"/>		
(Sky and Wind Code reference scales can be found on last page)		
START SKY: <input type="text"/>		
START WIND: <input type="text"/>		
	Cars _____ Ex Noise? <input type="checkbox"/>	Cars _____ Ex Noise? <input type="checkbox"/>
Stop	Stop	Stop
Cars _____ Ex Noise? <input type="checkbox"/>	Cars _____ Ex Noise? <input type="checkbox"/>	Cars _____ Ex Noise? <input type="checkbox"/>



1.08 Hardwood Reforestation Evaluation Survey Instructions (FreeForm)

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Free Form

The free form is an alternative to the more structured fillable-Field Form. Similarly, staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where formal protocols are not applicable. The information provided in the ISI form should be as thorough and complete as possible, keeping in mind that it may be the instructions available to another to stand in for current staff and will be the documentation linked to the Inventory & Monitoring Plan. Upload completed ISI to [Fishnet](#) site and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey Name: Hardwood Reforestation Evaluation

Conducted by (Refuge(s)): Dahomey NWR

Information Current as of (Date): July 2015

Submitted by and contact information: David Richardson, I & M Ecologist

Overview

This objective of this survey is to examine hardwood reforestation germination, survivorship and species composition within former agricultural fields on the refuge. In general these sites will be examined 2-3 years after initial planting and 10-20 years later. Many of the refuges acquired in the past 20 years have included large tracts previously used for agricultural production which were historically bottomland hardwood. Much of these former agricultural fields have been reforested by direct acorn seeding or presently a more standard practice of planting hardwood seedlings. This survey was selected because evaluation of acorn germination and seedling survivorship is critical to addressing the long-term species composition towards final serial stage stand development and evaluating future forest management strategies. The reforestation tracts represent important future areas to support many high priority species of neotropical migrant birds which have been identified as resources of concern for the refuge.

Design

Presently there is not framework for this survey. However, a regional or national framework is needed to make the data comparable across refuges. All artificial reforestation stands on the refuge will be sampled. These consist of former agricultural fields which were direct seeded with acorns or planted with 1-2 year-old rootstock. Sampling will be based on systematically located plots to insure uniform coverage across each stand. Plots will be sampled 1-3 years post planting and again at 15-25 years of age. Evaluation of stands will be done during leaf-out to facilitate species identification.

Methods

Stand boundaries from shapefiles in the Refuge's GIS system will be used to delineate systematic plot locations.

Sampling will be done using 1/20 acre (26.3 foot radius) circular plots. Metrics to collect will include species composition, stem survivorship, basal area, and qualitative measurement of cane present in the plot. Survey effort will be approximately 1 plot per acre spaced uniformly across the entire stand.

If possible, data will be directly input into either Two-Dog or TCruise software on a hand-held data logger.

Data Management

Data management will consist of producing summary means and confidence intervals for collected metrics. Attribute data will be joined with habitat shapefiles in the refuge's GIS system.

Reporting

A summary report of survey findings will be generated for stands evaluated within a year of completing field work. Report will be placed in ServCat.

Other Information

None

[Use the following table to track updates to the Survey Instructions.]

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	



1.09 North American Amphibian Survey

Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

North American Amphibian Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will assist in understanding long-term trends of frogs and toads across regional and national scales as well as provide local baseline inventories. Amphibians are important ecological organisms associated with wetland systems. Worldwide declines in this taxon have prompted the need to undertake multiple survey designs to investigate population trends and understand mechanisms that influence them. Throughout the United States there is evidence of species-specific and regional declines of amphibians (Adams et al. 2013). The MAV has undergone immense anthropogenic changes through hydrologic alterations of the Mississippi River and 80% reduction in the forested wetlands to foster an agricultural landscape. This geographical area continues to undergo significant stressors associated with intense agricultural practices that rely on fertilizers, herbicides, insecticides and irrigation programs to maximize cereal grain production. These stressors, in concert with ongoing climate changes and emerging disease issues are a significant threat for amphibian populations. The North American Amphibian Monitoring Program is a national survey designed to track long-term trends of frogs and toads based on their calling frequency and occupancy at repeated roadside observation sites and has recently been used to document changes in anuran occupancy in the northeastern United States (Weir et al. 2014). This survey was selected because it contributes to efforts to monitor this taxon at regional and national scales and provides a better understanding of the biodiversity for the refuge.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Frogs and Toads

Target habitat(s): (if applicable)

N/A

Survey objectives: (*Your primary survey objectives , i.e., what questions do you hope to address with this survey?*).

Determine the status and trends in species richness and diversity of frogs and toads of North America

Section 2. Survey Design

For Collaborative Surveys

☒ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

USGS- Patuxent Wildlife Research Center (<https://www.pwrc.usgs.gov/naamp/index.cfm>)

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2011(current route began in 2011; former route surveyed 2001 – 2010. Same protocol)

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☒ Route/linear transect ☐ Plot ☐ Point ☐ Other:

10 sampling locations along a defined road transect are sampled

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Stratified Random Block design at a regional level. Specific sampling locations based on sampling at locations – not equal distance between plots.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Surveys are conducted during 3 sampling periods. February 20-March 31, April 15-May 15, and June 1 – July 1
Each survey period is sampled 1 time.

Section 3. Survey Methods

Primary metrics collected:

Species detected and relative index of calling recorded.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Sites sampled will be identified by GPS waypoints, a map, and mileage distances between points.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Observer should be able to recognize frog calls to species and pass the NAAMP quiz each year to participate:
<https://www.pwrc.usgs.gov/Frogquiz/index.cfm?fuseaction=privateQuiz.StartPARKSQuiz>

Describe equipment used during the survey:

Data sheet, vehicle, flashlight, GPS unit, route map and waypoints of sampling plots. Kestrel or other weather monitoring device if available.

Describe detailed methodology (field and lab procedures) - Excerpted From:

Field methodology follows the Mississippi Amphibian Monitoring Protocol (see below) which is based on the more complete protocol of the North American Amphibian Monitoring Program
(<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>)

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

Refuge Biologist and Refuge Manager

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Paper forms – data uploaded to Web-based portal of USGS-NAAMP

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Paper data forms are kept in the refuge files and submitted to the state MAMP coordinated.

Describe procedure for verifying/checking/securing the data:

State coordinator reviews route data for completeness and errors.

Describe methods/software used in data analysis:

None

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

Data are summarized for inclusion in the refuge Annual Report. Larger data analysis and reporting occurs in multiple peer-reviewed journals.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Field data sheet for recording site observations is attached. Map and directions of route and sampling locations.

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

<https://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol>

Adams, M. J., D. A.W. Miller, E. Muths, P. S. Corn, E. H. C. Grant, L. L. Bailey, G. M. Fellers, R. N. Fisher, W. J. Sadinski, H. Waddle, and S.C. Walls. 2013a. Trends in amphibian occupancy in the United States. PLOS ONE 8(5): e64347.

Weir, L. A., J. A. Royle, K. D. Gazenski, and O. Villena. 2014. Northeast regional and state trends in anuran occupancy from calling survey data (2001-2011) from the North American Amphibian Monitoring Program. Herpetological Conservation and Biology. 9:223-245.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	Original
-----	------------------	----------	----------

Maps, Data Sheets and Appendices:

You can insert maps and any appendices of information (e.g., progress tables, timelines, budgets, activity logs, etc...) directly into this document (Insert in Word document version or Attach to Adobe version).

Mississippi Amphibian Monitoring Program Protocol

Sampling periods

There are three seasonal sampling periods designed to cover the calling periods of all species. These sampling periods vary slightly depending on whether your route is located in the northern or southern part of the state. Each sampling window is 30 - 45 days long with a 2-week interval between sampling periods. Our sampling windows are as follows:

Region	1 st	2 nd	3 rd
Northern MS (north of 33°N):	Feb. 20 – Mar. 31	Apr. 15 – May 15	June 1 – July 1
Southern MS (south of 33°N):	Jan. 23 – Feb. 28	Apr. 1 – May 6	June 1 – July 1

Surveys should be conducted on the first available night when conditions are right (see below for survey conditions).

Nightly sampling conditions

A survey should begin 30 minutes or more after sunset and be completed no later than 1 a.m. Appropriate sampling conditions are based on wind, sky, and air temperature conditions. Wind should be at level 3 or less and surveys should not be conducted during heavy rainfall or during a thunderstorm. (Frogs frequently call less when it's windy and heavy rains/thunderstorms may prevent you from hearing the frogs.)

The air temperature criteria are the minimum allowable temperatures, varying for each sampling period. If you begin a survey and the temperature falls below the minimum required at more than 2 stops, abort the survey and redo it on a different night. (The entire survey must be run in a single night in order to submit data.) Those temperatures are as follows:

	Minimum Temperature
First period	5.6 °C (42 °F)
Second period	10 °C (50 °F)
Third period	12.8 °C (55 °F)

In general, humid nights and nights following a period of rain are the best nights to survey frogs.

Data collection

Stops are conducted in numerical order, in one night by one observer. Because survey ability varies between observers, it is encouraged (though not required) that the same observer conducts all surveys of a route in a given year. If friends accompany you on a survey and would like to collect data also, they should fill out a separate datasheet and should not contribute to your observations. This allows each survey conducted to be of

equal effort. All datasheets should be returned to the state coordinator as soon as possible. Please keep a copy in case it is lost in the mail.

Many of the wetlands we are surveying are located on private property. Please remain at the roadside during the survey and don't venture out to the wetland. If the wetland is located on public land that is accessible, feel free to return once you have completed the survey. However, the surveys themselves should be conducted from the roadside and not from the bank of the wetland.

Below is the basic protocol for conducting a survey.

1. Prior to starting your survey, fill out the front of the datasheet (route information and observer information).
2. When you arrive at your first survey point, record the time and check the appropriate boxes for sky and wind codes.
3. Walk a short distance from your vehicle (along the road) then listen for 5 minutes. After the 5 minute survey period is over, record the species heard and a calling index value for each species. Record the time you started listening, the number of cars that passed during the listening period, the temperature, whether or not moonlight was visible, and the noise index value.
4. Proceed to your next stop and repeat step 3 until you have completed all 10 stops.
5. After you finish your survey at site 10, record the time and check the appropriate boxes for sky and wind codes at the top of the sheet under "Finish". Double-check your datasheet to be certain that all data are in the appropriate row and column.

Amphibian Calling Index

- 1 – Individuals can be counted; there is space between calls
- 2 – Calls of individuals can be distinguished but there is some overlapping of calls
- 3 – Full chorus, calls are constant, continuous and overlapping

Note: Frequently individuals will stop and start calling during the listening period. Record the maximum calling index heard during the listening period. (i.e. if the frogs were chorusing at one point during the listening period, record it as a "3", even if they were silent by the end.)

Beauford Wind Codes

- 0 – Calm (< 1 mph) smoke rises vertically
- 1 – Light Air (1 – 3 mph) smoke drifts, weather vane inactive
- 2 – Light Breeze (4 – 7 mph) leaves rustle, can feel wind on face
- 3 – Gentle Breeze (8 – 12 mph) leaves and twigs move around, small flags extend
- 4* - Moderate Breeze (13 – 18 mph) moves thin branches, raises loose papers

* Do not conduct a survey at level 4 or greater.

Sky Codes

- 0 – Few clouds
- 1 – Partly cloudy (scattered) or variable sky
- 2 – Cloudy or overcast
- 4 – Fog or smoke
- 5 – Drizzle or light rain (not affecting hearing ability)
- 7 – Snow
- 8 – Showers (is affecting hearing ability) – *Do not conduct survey*

Noise Index

- 0 – No appreciable effect (e.g. owl calling)
- 1 – Slightly affecting sampling (e.g. distant traffic, dog barking, one car passing)
- 2 – Moderately affecting sampling (e.g. nearby traffic, 2 – 5 cars passing)
- 3 – Seriously affecting sampling (e.g. continuous traffic nearby, 6 – 10 cars passing)
- 4 – Profoundly affecting sampling (e.g. continuous traffic passing, construction noise)

If there is a major noise disturbance nearby, lasting one minute or longer, you may break the listening period to avoid sampling during the excessive noise. If such a time-out is taken, please note it on the datasheet. After the disturbance ends, resume the listening period and finish up with the remaining time.

Safety First!!

Your safety is important. Please do not put yourself in any dangerous situations. If you feel that one of the stops or routes is unsafe, please contact the State Coordinator immediately.

Data submission

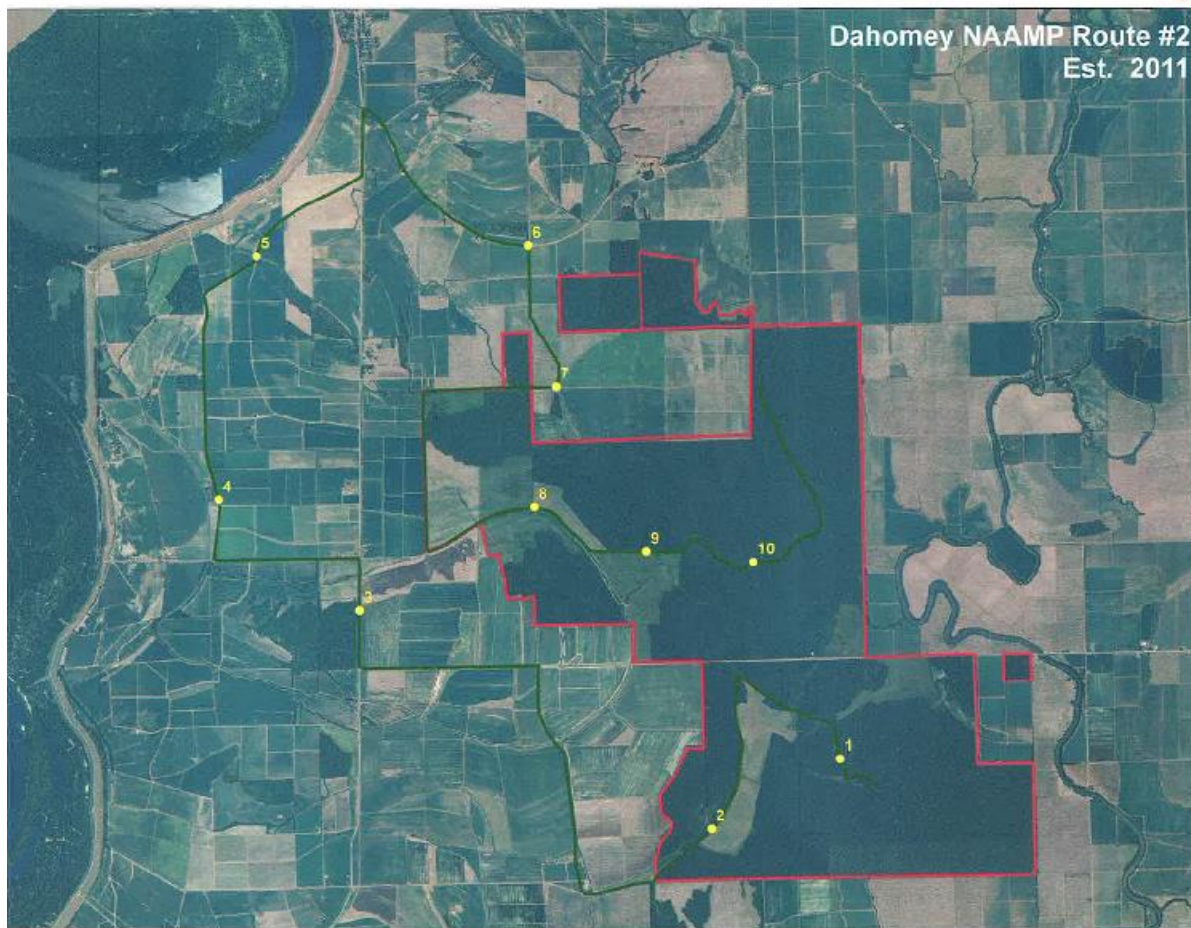
Data should be entered online at the NAAMP volunteer access site (www.pwrc.usgs.gov/NAAMP/Data/index.cfm) Please send the State Coordinator your datasheets as soon as possible after completing a survey. This allows the coordinator to review the datasheet and contact you for clarification (if necessary) while the information is still fresh in your mind. If you hear a frog you are unable to identify or that you think should not be found along your route, please make a recording and submit it to the coordinator as well. All datasheets should be sent to:

Kathy Shelton
MDWFP
211 Critz St N
Wiggins MS 39577

Feel free to email, krshelton64@gmail.com or call 601-528-5705 for information or help.

Dahomey NWR – North American Amphibian Monitoring Program Route

Mileage	Survey Point	Description
0.0		Start at gas ROW and Sawdust Road
0.5	1	Stillwater Bayou between wood duck boxes 289 and 290
1.8		At Sawdust and Well Road – Turn Left onto Well Road.
3.3	2	South end of Unit 40 approximately 0.2 miles before end of tree line
4.3		At Well Road and County Road – turn right onto county road
4.7		Go over concrete bridge, past grain bins on right – Turn Right on dirt/gravel road
6.8		At Highway 446 – Turn Left
8.4		At intersection with Highway 446 and Hwy 1 – Turn Right
9.0	3	Just before culvert
9.6		At St John MB Church - Turn Left onto County Road – Gravel
11.1		At Road – turn Right
11.4	4	Just before junction with ditch
13.3		At paved road – turn right
13.9	5	Junction with ditch
15.8		Intersection with Highway 1 – turn left
16.4		At sign for Mt Pleasant MB) turn right onto gravel road
17.8	6	4-way road intersection (Well on SE corner
17.8		Turn right on Mound City road and Frazier
19.2	7	At FWS Kiosk – turn Right
20.4		Junction with Christmas Lake Road – turn Left
21.9		Junction with Neblitt Road – turn Left
23.1	8	Junction west end of rice fields
23.7		Bear Road – turn Left
24.2	9	Reforestation on right, forest on left, ditch ahead on right
25.4	10	On Bear Road – end of survey points.



Map of Survey Points for the Dahomey NAAMP Route.



1.10 Hog Vegetation Damage Assessment Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and *will **enhance survey integrity by ensuring that survey procedures are clear and consistent.*** It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Hog Vegetation Damage Assessment

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will provide an evaluation of the long-term effects of wild hogs on vegetation within bottomland hardwoods on the refuge. Wild hogs (*Sus scrofa*) are an invasive species that have become a serious threat to forest communities in the Southeast. Hogs compete for food with native wildlife species and in particular seek out hard mast in fall and winter. They are also known to be predators on bird eggs, small mammals and herpetofauna. In addition, wild hogs can cause significant damage to levees, roadsides, forest communities and agricultural fields through their rooting, wallowing and trampling activities. Since the establishment of the refuge, the population of hogs has appeared to increase and is consistent with the expansion of the species throughout the MAV. Understanding the effects of wild hogs on refuge vegetation is important to guide refuge management actions. Sampling within both hog enclosures and hog accessible areas will provide a baseline foundation for changes in the herbaceous and woody plants.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Understory vegetation

Target habitat(s): (if applicable)

Mature and regenerating bottomland hardwood stands

Survey objectives: (Your primary survey objectives , i.e., what questions do you hope to address with this survey?).

This survey will provide an evaluation of the long-term effects of wild hogs on understory vegetation within bottomland hardwoods on the refuge. The information from this survey will be used to understand management efforts to control this invasive species and assess negative effects the species has on native flora.

Section 2. Survey Design

For Collaborative Surveys

☐ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

**For Surveys with Refuge-specific Details
(collaborative OR unique refuge surveys)**

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

2013

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

11 enclosures and 11 control plots are delineated.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

Eleven sampling locations within mature bottomland hardwood stands and reforestation areas were selected. Sites were selected based on access and habitat type.

Describe Survey Timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Survey is conducted in summer. Sampling is done annually.

Section 3. Survey Methods

Primary metrics collected:

Understory species present (herbaceous, woody, and graminoid) and % ground cover of each species (including bare ground); % canopy closure; stem density; DBH for all trees over 2" diameter; hog damage (presence/absence)

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

GPS waypoints; stakes delineating control plot boundaries; exclosures are fenced.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Review of potential plants present in plots to facilitate field identification.

Describe equipment used during the survey:

Data sheet, camera, meter tape, string (for dividing plots into quarters for stem counts), diameter tape, stick (for point intercept), GPS (for marking hog damage?)

Describe detailed methodology (field and lab procedures) - Excerpted From:

Hog Exclosure Vegetation Sampling - Protocol

Percent Canopy Cover

- At plot center, hold camera level with top of panels, facing toward the sky.
- Take 2 pictures.
- Import pictures into Word document, resize to 10" width and overlay 0.5" x 0.5" grid (s:\Invasive's w Volunteer Grant\half-inch grid for photo plots 10in width.doc)
- Count every point that falls on sky and calculate % canopy cover $((1 - (\# \text{ of sky points} / \text{total } \# \text{ of points})) \times 100)$. (Do for each picture and average result.)

Ground Cover Sampling

Point-intercept method (frequency of occurrence)

- 5 transects, 1 m from edge, 2 m apart (8m in length)
- Sample every 40 cm (total 100 pts. per plot)
- Drop pole vertically at point
 - For every point, at least one of the first four categories should be checked.
 - Herbaceous and woody categories can be used on the same point
 - Only use bare ground or leaf litter categories by themselves
 - After assigning the class of vegetation present, identify to species (or the lowest taxonomic classification possible), write in blank, and record presence.
- Only consider plants < 1 m in height
- Can record multiple species or classes of vegetation at each point. However, if no vegetation is present, must record either bare ground OR leaf litter. Do not use these categories if vegetation is present.

Woody Vegetation Stem Counts

Total stem counts

- Divide plot into four quadrants. (Can use string to delineate to avoid double counting.)
- Indicate on the datasheet a direction for each quadrants (NE, SE, NW, SW).
- For each species present, count the number of individual plants < 5 cm dbh in each quadrant.
- Only count ^{Shrub or trees} woody plants < 5 cm dbh. Vines should only be included in this count if they are climbing. + > 1 m

Trees Present

Using the quadrants established for stem counts, identify to species and record the dbh of each tree by quadrant, for the entire plot.

Output

Data collected will be used to calculate the following metrics:

% canopy cover	% occurrence exposed leaf litter
% occurrence herbaceous vegetation	% occurrence by species (ground cover)
% occurrence woody vegetation	Woody plant density
% occurrence bare ground	Species composition/relative abundance

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge biologist, refuge manager, and interns.

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

MS Excel File

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Files stored on refuge server. Annual data summary is also uploaded to ServCat

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

MS Excel – summary query reports are generated.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report is prepared. Summary of survey is also reported in the N. MS Refuges Complex Annual Report.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Data sheet used for vegetation plot monitoring

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



1.11 Hunter Use and Harvest Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and ***will enhance survey integrity by ensuring that survey procedures are clear and consistent.*** It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Hunter Harvest and Use Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey is designed to estimate the annual harvest of all regulated game species on the refuge and the number of individuals hunting on a daily basis. The National Wildlife Refuge Improvement Act of 1997, Public Law 105-57 provides recognition that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System. Hunting is an effective management tool to control local white-tailed deer populations and wild hogs at Dahomey NWR. In addition, a variety of other small game recreational hunting opportunities occur. Monitoring hunter participation and animals harvested allows assessment of compatibility so as not to interfere with the establishing purposes for the refuge. Moreover, this survey will inform the refuge about the health of animals and identify population changes in white-tailed deer and hogs; two species which have the potential to alter the quality of the habitat.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Hunted game species

Target habitat(s): *(if applicable)*

N/A

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*.

This survey is designed to estimate the annual harvest of all regulated game species on the refuge and the number of individuals hunting on a daily basis. Data will be used to evaluate influence of public hunting as a management tool for deer and hog population control and possible negative effects to waterfowl use of the refuge attributed to hunting pressure.

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

**For Surveys with Refuge-specific Details
(collaborative OR unique refuge surveys)**

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

1990

Are specific sampling units identified? ☐ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☐ Point ☒ Other:

All hunters are required to participate in the survey each day of hunting.

Do sampling units remain fixed (i.e., same location from year to year)?
☐ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Entire population of hunters using the refuge is surveyed

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Survey is done throughout all hunting seasons on the refuge. Does not include fishing information.

Section 3. Survey Methods

Primary metrics collected:

Species harvested or pursued and day of hunting. Check station kiosks.

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Survey cards are located at various locations on the refuge for hunters to fill out and deposit.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Need to be certain daily use cards are available on a continuous basis at the check stations.

Describe equipment used during the survey:

Daily use card – See attached below:

Describe detailed methodology (field and lab procedures) - Excerpted From:

Daily use cards are picked up at the check stations weekly. Data are transcribed into a MS Access database.

An annual summary report of species harvested and the overall hunter participation is prepared. No physical metrics from harvested animals are collected.

U.S. Fish & Wildlife Service			
National Wildlife Refuge System / Big Game Harvest Report			
Name of Refuge: _____		Hunt area (unit, zone, description): N/A	
Hunter name: _____		City, State, ZIP: _____	
Date of hunt: _____		Time: N/A Total hours hunted: N/A Number in party: N/A	
Species	Number Harvested	Male/Female	Size*
<small>Note: Not all species are hunted on this refuge. Check refuge regulations for details.</small>			
Deer			
Feral Hog			
Turkey			
Other (specify):			

*points, approximate weight, beard length or other appropriate measure.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist and Refuge Manager

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

MS Access

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Files stored on refuge server. Annual data is also uploaded to ServCat

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

MS Access – summary query reports are generated.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report prepared. Summary of survey is also reported in the N. MS Refuges Complex Annual Report.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



1.12 Groundwater Table Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Groundwater Table Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge. The bottomland hardwood ecosystem of the MAV has been irrevocably altered by flood abatement projects along the Mississippi River, the main tributaries, and the subsequent land clearing of the region for forest products and large-scale agricultural production of cotton and cereal grains. The hydrology of the system continues to be modified as agricultural practices remove small wetlands, improve ditches to facilitate dewatering of fields, and level the landscape for irrigation efficiency. Over the past 20 years, the reliance on groundwater irrigation for corn, milo, rice, and soybeans production has grown to immense proportion compared to non-irrigated agriculture. Dahomey NWR is a habitat fragment of bottomland hardwood within this agricultural-dominated landscape that extensively uses irrigation. The plant community and associated fauna is a function of this forested wetland system. In addition, the refuge on a limited scale uses several existing wells to irrigate moist-soil and cereal grain units or flood these impoundments in fall for waterfowl. Data from the USGS Groundwater Watch shows significant below average levels for large areas of the MAV. These wetlands provide critical support to herpetofauna and many invertebrate species. Also, soil-moisture gradients provide the basis for the existing and future plant communities. Continued alterations to the groundwater table could have major negative effects. The changes in the groundwater table may be further influenced by climate change. Understanding the current rate of groundwater removal and the potential for recharge around the refuge is needed to evaluate long-term management of the forested community.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Groundwater

Target habitat(s): (if applicable)

N/A

Survey objectives: (Your primary survey objectives , i.e., what questions do you hope to address with this survey?).

This survey will provide baseline information about seasonal and long-term changes in the groundwater table on the refuge.

Section 2. Survey Design

For Collaborative Surveys

☒ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

USGS Groundwater Table Network and Yazoo Water Management Board.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☒ Point ☐ Other:

Four wells have been identified for monitoring which encounter the local aquifer. Five to ten additional shallow wells (<50 feet) will be installed for monitoring the water table above the confined aquifer.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling of newly established wells will be based on strategically placing them across the refuge. Shallow wells will be located near existing roads to facilitate installation but a minimum of 100 yards from permanent water.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Wells will be monitored a minimum of 2 times annually, in April and September. This will capture groundwater levels following peak irrigation times for agriculture (September) and the peak water table recharge prior to the irrigation of agricultural fields following the wet season (April). Additional surveys may occur in July and August when extensive irrigation occurs regionally.

Section 3. Survey Methods

Primary metrics collected:

Change in static water level against a bench mark value associated with mean sea level.

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

Well locations will be delineated on a map and GPS waypoints will be recorded. Sites will also be identified with appropriate steel pilings to prevent damage to well sites.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

Permits to drill new well(s) may be required from MS DEQ and the Yazoo Water Management Board along with renewal of existing well permits.

Describe equipment used during the survey:

Water level sounder, solinist or tape device

Describe detailed methodology (field and lab procedures) - Excerpted From:

Detailed methods for conducting manual well monitoring is provided at:
http://www.ecy.wa.gov/PROGRAMS/eap/qa/docs/ECY_EAP_SOP_ManualWellDepth&DepthtoWaterMeasurements_v_1_1EAP052.pdf

Deviation from this procedure will occur if using a water level sounder or similar electronic monitoring device. Use of these devices should be evaluated based on the owner's manuals.

Well measurements will be based on established measuring points for each well. This is critical as all changes in static water level are based against this defined point. Also at each well, this measuring point should be cross referenced to the land surface datum at the well head.

Though the wells to be evaluated are not public drinking water sources, there is the possibility that during measurements of the well contaminants could be introduced into the aquifer. Water level measuring equipment must be cleaned, disinfected or decontaminated prior to and after use in each well.

Well measurements will be recorded to the nearest inch and ambient temperature recorded. Ancillary comments regarding recent irrigation activities near the well head should be recorded.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge biologist and refuge manager.

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

MS Excel

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Files stored on refuge server. Data may also be uploaded to the National Groundwater Table Network - USGS

Describe procedure for verifying/checking/securing the data:

Changes in water level measurements between surveys should be examined. Changes of greater than 10 feet should be suspect of incorrectly read measurements.

Describe methods/software used in data analysis:

Data will be graphically displayed in Excel

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report of groundwater table monitoring will be developed.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

http://www.ecy.wa.gov/PROGRAMS/eap/qa/docs/ECY_EAP_SOP_ManualWellDepth&DepthtoWaterMeasures_v1_1EAP052.pdf

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	Original
-----	------------------	----------	----------

Maps, Data Sheets and Appendices:



1.13 Stream Temperature Monitoring Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and ***will enhance survey integrity by ensuring that survey procedures are clear and consistent.*** It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Stream Temperature Monitoring

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will provide baseline information about seasonal and long-term changes in the water temperature on the refuge and contribute to a broader understanding of stream temperature variation across the region. Building a foundation for a spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States is an initiative to better understand the effects of abiotic factors on the distribution of aquatic organisms and ecosystem health (U.S. Fish and Wildlife Service 2014). Significant changes in aquatic biodiversity are influenced by water temperature extremes. Across the Southeast, there is a paucity of information about daily and seasonal stream temperature regimes which influence the biodiversity and potentially relate to land-use practices in the drainage and climate change. This survey was selected because it supports a collaborative regional effort to fill existing stream temperature gaps and provides important information to the refuge regarding aquatic systems.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Aquatic Community

Target habitat(s): (if applicable)

Primarily moving water systems

Survey objectives: (Your primary survey objectives, i.e., what questions do you hope to address with this survey?).

1. Determine seasonal and annual changes in stream temperatures across the southeast U.S.
2. Correlate stream temperature changes with respect to aquatic organism(s)
3. Evaluate changes in stream temperature with regards to surrounding land-use practices and changes in ambient air temperature

Section 2. Survey Design

For Collaborative Surveys

☒ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

Ecological Services, Drought Assessment and Response Team (DART), Region 4

Is there an established protocol for the survey? ☐ Yes ☒ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

None

Are there refuge-specific elements of implementation? ☐ Yes ☒ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details
(collaborative OR unique refuge surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

2014

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☒ Point ☐ Other:

Belman's Bayou (just east of Headquarters Road) and stream/channel on county road under concrete bridge (<1 mile west of southwest corner of refuge near Wells Road). See attached data sheet/map.

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

None – sites chosen based on available permanent flowing water and surrounding habitat

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Data logger collects temperature readings on an hourly basis. Twice a year the data is downloaded via HOBO Shuttle.

Section 3. Survey Methods

Primary metrics collected:

Water temperature every 30 minutes

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

GPS waypoints

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

None

Describe equipment used during the survey:

Tidbit Temperature data logger and a HOBO Shuttle to download data from the data logger

Describe detailed methodology (field and lab procedures)

Tidbit temperature data logger is cabled to a stake in the streambed. Data logger remains at a constant depth in the stream. Every six months the data is downloaded from the unit using a HOBO shuttle. This information is brought back to the office and transferred to computer via the HOBO PRO software. Processed temperature data and survey metadata sheets are subsequently sent to DART for inclusion in a regional MS Access Database. Data download is done every 6 months. Data will eventually be merged with national data.

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

I&M Ecologist, Refuge Manager, Refuge Biologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are downloaded to the computer via HOBO Pro software. Regional MS Access database stores all data.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

MS Access Database is held by the DART in Cookeville, TN.

Describe procedure for verifying/checking/securing the data:

None identified at this time.

Describe methods/software used in data analysis:

None identified at this time.

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

None to Date

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Original deployment data sheet for each site is attached.

Blank data sheet for periodic data transfer documentation is also attached.

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

U.S. Fish and Wildlife Service. 2014. Building a foundation for spatially continuous map of waterbody temperatures on refuges and neighboring waters in the southeastern United States. Region 4, Atlanta, GA. 2pp

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: 8/28/2014

Station ID: DHM 01 Station Name: Belman Bayou near headquarters Road

Facility Name: Dahomey NWR State: MS County: Bolivar

Site Coordinates (planned) Latitude: 33.716 Longitude: -90.883

Recorder: Will Duncan Add'l Crewmembers: Amber Breland, Jason Phillips

Logger Information (water)

Logger Information (air)

Type (check one): ☒ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Serial No.: 10416346 Samp. Interval (min.): 30

Serial No.: _____ Samp. Interval (min.): _____

Programmed Start Date: 8/28/14 Time: 1100

Programmed Start Date: _____ Time: _____

Deployment Information

Units (m and °C preferred) Distance: _____ m _____ ft Temperature: _____ °C _____ °F

Water Temperature Logger WP 158

Site Sketch

GPS lat.: 33.72088 Datum: NAD 83

GPS long.: -90.90807

Water Depth: 1.5' Logger Depth: 1.5'

Ht above streambed: 1" Time installed: 1055

Air Temperature Logger

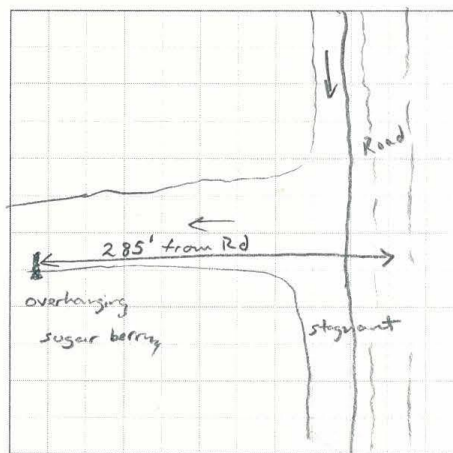
GPS lat.: _____ Time installed: _____

GPS long.: _____

Ht above stream: _____ Ht above ground: _____

Time	Air Temp	Water Temp
<u>1055</u>	<u>31.5</u>	<u>23.5</u>

Weather/Comments



Water Temperature Logger Location:

cabled to the base of sugar berry w/ brick

Air Temperature Logger Location:

Photos

No. or Filename	Description	No. or Filename	Description
<u>0368</u>	<u>Crewmembers</u>		
<u>0370</u>	<u>Sugar berry deployment location</u>		

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: 8/28/2014

Station ID: DHM 02 Station Name: Agricultural Ditch near Dahomey NWR

Facility Name: Dahomey NWR State: MS County: Bolivar

Site Coordinates (planned) Latitude: 33.67292 Longitude: -90.94682

Recorder: Ju Duncan Add'l Crewmembers: Amber Breland, Jason Phillips

Logger Information (water)

Logger Information (air)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2
☒ Pendant ☐ Level Logger (U24)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2
☐ Pendant ☐ Level Logger (U24)

Serial No.: 10409430 Samp. Interval (min.): 30

Serial No.: _____ Samp. Interval (min.): _____

Programmed Start Date: 8/28/2014 Time: 13:30

Programmed Start Date: _____ Time: _____

Deployment Information

Units (m and °C preferred) Distance: _____ m _____ ft Temperature: _____ °C _____ °F

Water Temperature Logger WP 159

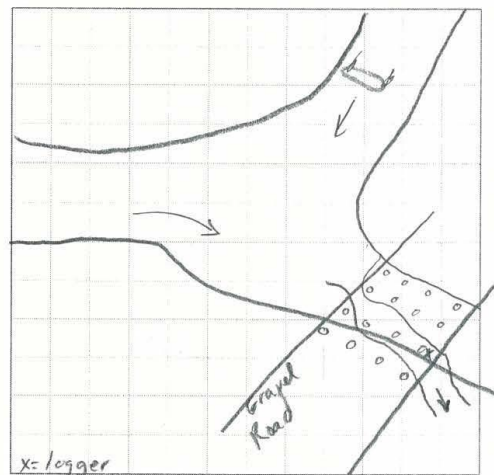
Site Sketch

GPS lat.: 33.67292 Datum: WGS 84

GPS long.: 090.94682

Water Depth: 5" Logger Depth: 4"

Ht above streambed: 1" Time installed: 1320



Air Temperature Logger

GPS lat.: _____ Time installed: _____

GPS long.: _____

Ht above stream: _____ Ht above ground: _____

Time	Air Temp	Water Temp	Weather/Comments
1325	37	30.5	

Water Temperature Logger Location:

Pendant cable tied in PVC Housing. Housing ss. cabled to base of piling

Air Temperature Logger Location:

Photos

No. or Filename	Description	No. or Filename	Description
0371	Deployment method - PVC on piling	0374	Ag ditch v.s.
0372	Amber Breland	0377-0376	Looking down on stream
0373	Jason Phillips	0378	Panorama

USFWS Southeast Region Temperature Monitoring Network – Logger Deployment Datasheet

Header/Station Information

Date: _____

Station ID: _____ Station Name: _____

Facility Name: _____ State: _____ County: _____

Site Coordinates (planned) Latitude: _____ Longitude: _____

Index Gage (station name): _____ Station No.: _____

(Nearby gaging station to monitor when flow conditions are suitable for a site visit)

Visit Information

Visit Type: ☐ Initial deployment ☐ Re-visit (download data) ☐ Re-visit (replace logger)
☐ Decommissioning (remove logger)

Recorder: _____ Add'l Crewmembers: _____

Index Gage Reading (☐ Discharge ☐ Stage)

Value: _____ Units: _____ Date: _____ Time: _____

Logger Information (logger that will be collecting data)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Serial No.: _____ Samp. Interval (min.): _____ Programmed Start Date: _____ Time: _____

Logger Information (logger replaced or removed on this visit, if applicable)

Type (check one): ☐ TidbiT ☐ Water Temp Pro v2 ☐ Pendant ☐ Level Logger (U24)

Serial No.: _____ Samp. Interval (min.): _____ Programmed Start Date: _____ Time: _____

Field Thermometer Information

Type: _____ Serial No.: _____

Deployment Information

Units (m and °C preferred) Distance: _____ m _____ ft Temperature: _____ °C _____ °F

Water Temperature Cross-Section Measurement

(If site conditions allow, measure water temp at approx. midpoint of water column at midpoints of 5 equal width increments—e.g., at 0.1, 0.3, 0.5, 0.7 and 0.9 x the wetted width. Left and right banks are defined facing downstream.)

Wetted width: _____ Increment width: _____

Bank from which distance is measured: ☐ L ☐ R

Dist.	Time	Temp	Comments

Validation Check of Existing Logger Deployment

(If a logger is currently deployed, measure temperature at the logger location at approx. 1-min. intervals starting 2 min. before the scheduled logging time.)

	1	2	3	Avg.
Time				
Temp.				

Time logger removed from water: _____

Logger status when removed: ☐ Active ☐ Inactive

Logger Condition:

Station ID: _____ Date: _____

Time installed: _____ GPS Datum: _____
GPS lat.: _____
GPS long.: _____
Water depth: _____ Wetted width: _____
Logger depth: _____ Ht above streambed: _____

(After logger has been in place at least 5-10 min., measure temperature at the logger location at approx.. 1-min. intervals starting 2 min. before the next scheduled logging time.)

	1	2	3	Avg.
Time				
Temp.				

<p>Logger Location Description:</p>
--

[illegible][illegible]

Additional Comments



2.1 Bat Basal Cavity Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Bat Basal Cavity

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey will evaluate the potential occupancy of basal cavities by Rafinesque's big-eared bat and southeastern myotis during the spring and summer in mature bottomland hardwood stands and provide a relative measure of bat abundance and distribution on the refuge. Rafinesque's big-eared bat and southeastern myotis are considered species of special concern and are listed as threatened or endangered throughout most of their range. In Mississippi, there is limited information about the distribution and abundance of these species. Most is based on anecdotal observations of roosting in anthropogenic structure (Martin et al. 2011). Nonetheless, natural roosts comprised of hardwood basal cavities for these and other bats have been well documented and suggested as a limiting factor to species conservation (see review by Bat Conservation International and Southeastern Bat Diversity Network 2013). Surveys for these species in mature hardwood systems of Mississippi have been variable. In east-central Mississippi, both species were found fairly commonly in large diameter basal cavities (Stevenson 2008). However, surveys at Panther Swamp NWR (H. Fleming, Mississippi State University, College of Forest Resources, unpubl. data) and Dahomey NWR (Richardson 2012b) in the Mississippi Delta were unable to locate a single roosting bat despite numerous suitable basal cavities. Therefore, the species distribution may be more complex, reflecting previous limitations of natural roosts and habitat fragmentation precluding population dispersal. This survey is designed to re-examine the existing sample of suitable basal cavities during multiple seasons to facilitate the understanding of the occurrence of these bats at Dahomey NWR. Also, this survey will broadly assess the habitat contribution that the refuge has towards these two species. These bat species have been identified as resources of concern for the refuge.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Rafinesque's big-eared bat and southeastern myotis

Target habitat(s): (if applicable)

Mature bottomland hardwood forest stands

Survey objectives: (Your primary survey objectives, i.e., what questions do you hope to address with this survey?).

1. Determine the occupancy of basal cavities by Rafinesque's big-eared bat and southeastern myotis during the spring and summer in mature bottomland hardwood stands.
2. Examine long-term use of basal cavities by both species of bats

Section 2. Survey Design

For Collaborative Surveys

This survey is part of a collaborative State, Regional, or National survey:
Coordinating organization(s) and contact information:

Is there an established protocol for the survey? Yes No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

Are there refuge-specific elements of implementation? ☐ Yes ☐ No (☐ Not Sure)

If yes, also specify refuge-specific details in the section below.

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

2011 – one time observation in September/October. Established a baseline for future surveys.

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☒ Point ☐ Other:

Individual Cavity Trees

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Basal cavity trees to be sampled were identified by conducting belt transects across representative stands on the refuge during previous efforts. All basal cavity trees >14 inch DBH were geo-referenced with a Garmin GPS unit.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

The sample of previously identified trees with basal cavities will be inspected during May-August. Ideally, each tree would be inspected 2 times. Survey would be conducted again in 2-5 year intervals to evaluate long-term use of trees.

Section 3. Survey Methods

Primary metrics collected:

Number of bats by species using each tree.

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

Individual trees are geo-referenced (WGS 84 datum). Trees have not been individually marked.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

None – however, individuals with no previous experience looking into cavities should receive training to insure they can identify the presence of bats as well as identify them to species.

Describe equipment used during the survey:

- High intensity rechargeable flashlight – (e.g., Streamlight) with 2 spare batteries.
- 4 inch mirror and one, 2-3 inch mirror
- GPS unit with loaded survey tree locations
- Rag for cleaning mirror
- Data sheet

Describe detailed methodology (field and lab procedures) - Excerpted From:

- Observer walks to each cavity tree using the GPS unit and imported waypoints.
- Tree species is validated against the previous survey effort (Richardson 2012) to insure the correct tree is inspected.
- DBH is taken
- Cavity width and height are measured – nearest inch
- Cavity contents are inspected using the mirror and a flashlight. Observer can point the flashlight directly up into the cavity and look at the mirror to identify any bats or other vertebrates in the cavity. In some cases, the light can be reflected off the mirror to the upper portions of the cavity to see the inside chamber. If the cavity entrance is large enough, the observer should consider lying down on their back and looking directly up into the cavity.
- All vertebrates or other contents of the cavity are recorded on the data sheet. If possible a permanent unique ID metal tag should be placed at the base of the basal cavity to facilitate future identification.
- Data sheets are transcribed to an excel sheet

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist, Refuge Manager

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are recorded to an excel data sheet and also imported into ArcMap as a point shapefile.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data will be stored on the refuge server under the shared drive : Dahomey Bats

Describe procedure for verifying/checking/securing the data:

None identified at this time.

Describe methods/software used in data analysis:

Excel is used to create a data summary of species identified, number of detections, and sample locations

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report of the survey will be developed including a comparison to previous survey efforts.

Richardson, D. M. 2012. Rapid assessment for basal cavities on Dahomey National Wildlife Refuge: implications for present and future bat conservation. U.S. Fish and Wildlife Service, Grenada, MS. 17 pp.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

GPS location and previous data for this project is stored on the refuge server shared drive under Dahomey Bats

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Richardson, D. M. 2012. Rapid assessment for basal cavities on Dahomey National Wildlife Refuge: implications for present and future bat conservation. U.S. Fish and Wildlife Service, Grenada, MS.17 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/15/2015	Original
-----	------------------	-----------	----------

Maps, Data Sheets and Appendices:

You can insert maps and any appendices of information (e.g., progress tables, timelines, budgets, activity logs, etc...) directly into this document (Insert in Word document version or Attach to Adobe version).



2.2 Fish Inventory

Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Fish Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

The survey will provide a baseline inventory of freshwater fish across the entire refuge. The biodiversity and health of aquatic systems is often gauged by the assemblage of fish present. Mississippi is host to 204 native freshwater species of which 35% are considered imperiled to some degree (Ross 2001). Many species are highly specialized and restricted to small drainages. The Mississippi Delta has been poorly sampled and the refuge has a very limited understanding of the fish present. This survey is designed to provide a baseline inventory of the fish on the refuge. This survey was selected because it provides important baseline information regarding a taxon that is imperiled, reflects on the health of the aquatic system, and furthers the CCP objective to conserve the fish fauna.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Fish

Target habitat(s): *(if applicable)*

All aquatic habitat types on the refuge

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?).*

1. Determine the species composition and occurrence of fish on the refuge

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD – survey may take several years to be comprehensive.

Are specific sampling units identified? ☐ Yes ☒ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☐ Point ☒ Other:

Sampling will include a variety of techniques including plots with traps of various types along with electrofishing sections of streams, channels, and lakes.

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Limited permanent water features of sufficient depth and size exist on the refuge to support fish. Sampling units will be based on accessibility to streams, channels and lakes. Efforts will be done to stratify based on type of wetland but because differing sampling gear will be used between wetland types, it will be difficult to standardize sampling effort.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

All year round. However, special efforts will be made to sample channel and intermittent flowing streams on the refuge from March – May, when some fish may swim up them from Bogue Phalia for spawning.

Section 3. Survey Methods

Primary metrics collected:

Species occurrence

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Sampled sites will be GPS referenced.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Observers will need to be able to identify fish in the field. In some cases identification of fish will be done using photo or actual fish vouchers back in the lab.

Describe equipment used during the survey:

GPS, data sheet, dip net, minnow traps, hoop traps, bait, back-pack electrofishing unit, map, five-gallon buckets, ethanol, formalin, quart and pint jars

Describe detailed methodology (field and lab procedures) - Excerpted From:

Fish sampling will be done using various capture gear including, dip-netting, minnow traps, hoop nets, and back-pack electro-shocker. Traps will be set for 3 consecutive days in lakes. In streams and channels, minnow or hoop traps may be set for 3 days and sampled on two different occasions in spring and early summer. Small wetlands will be sampled using dip-nets and a back-pack electro-shocker. When using electro-shocker or only dip nets, time-constrained sampling will be used to index capture abundance.

Fish will be identified in the field and released at the site of capture. Some specimens may be retained for laboratory verification and preserved initially in 5-10 % formalin and then transferred to 70% ethanol.

Standard capture techniques will generally follow the guidance provided by Bonar et al. 2009.

Who conducts the surveys *(Include staff, interns, contractors, etc... if primary surveyors):*

Refuge Biologist, Manager, I & M Aquatic Ecologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are recorded to an excel data sheet and also imported into ArcMap as a point shapefile to show locations of sample plots and where individual fish were identified.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data will be stored on the refuge server.

Describe procedure for verifying/checking/securing the data:

Some voucher specimens will be verified against the collection at the MS Museum of Natural Science and, for uncommon species, placed in the collection with the Natural Heritage Program.

Describe methods/software used in data analysis:

Excel – summary statistics

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

A final report of inventory efforts will be prepared.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Ancillary captures of herpetofauna and crayfish should be recorded to facilitate those inventories.

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Boner, S. A., W. A. Hubert, and D. A. Willis, (eds). 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



2.3 Herpetofaunal Inventory Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Herpetofaunal Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

This survey establishes a baseline inventory of herpetofauna (reptiles and amphibians) throughout all habitat types on the refuge to describe species occurrence. Many herpetofauna are considered at-risk though a paucity of rigorous long-term population monitoring or species occurrence information exists at local or regional scales. This taxon is extremely vulnerable to a number of current disease issues including chytrid and ranavirus which have been implicated in local and regional scale species decline and extirpation. In addition, the refuge has a significant wild hog population which has been suggested to have significant negative effects on salamanders due to their rooting behavior and destruction of coarse woody debris. This survey was selected because it provides important baseline information regarding a taxon that is poorly understood and reflects on the health of the aquatic system. Also, the survey furthers the CCP objective to conserve biodiversity associated with non-game and threatened and endangered species.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Snakes, Lizards, Turtles , Frogs, Toads, Salamanders

Target habitat(s): (if applicable)

All habitat types

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?).*

1. Determine the species composition and occurrence of herpetofauna within each habitat type on the refuge

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD – survey may take several years to be comprehensive.

Are specific sampling units identified? ☐ Yes ☒ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☐ Point ☒ Other:

Sampling will include a variety of techniques including fixed plots, points and transects

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling design and effort will be based on stratifying across habitat types.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

All year round. However, special efforts will be made to sample during spring and summer when herpetofauna are most active.

Section 3. Survey Methods

Primary metrics collected:

Species occurrence

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

Sampled sites will be GPS referenced.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

Observers will need to be able to identify herpetofauna in the field. Ability to determine the species of anuran based on calls should be developed prior to initiation of the survey

Describe equipment used during the survey:

GPS, data sheet, dip net, minnow traps, hoop traps, cover boards, Automated Recording Devices, snake hook, five-gallon buckets, snake box traps and drift fencing, digital camera

Describe detailed methodology (field and lab procedures) - Excerpted From:

Because of the variability of herpetofauna to be encountered and the complexity of their behavior and habitat use, multiple survey methods will be used to inventory for them.

Salamanders will be predominantly sampled with minnow traps in vernal pools and other wetlands. Cover boards may be placed to locate certain salamanders which tend to live near stream edges. Cover boards will also provide opportunities to locate snakes and skinks.

Time- and area-constrained searches of random areas and areas of debris will be done to look for snakes. In addition, drift fences and box traps will be utilized.

Frogs and toads will be inventoried based on conducting fixed call surveys at wetlands near existing roads. Each location will be evaluated 3 times for a period of 5 minutes. Surveys will coincide with precipitation within the past 4 days.

Turtles will be trapped in baited, partially submerged hoop nets.

Survey techniques will generally follow those outlined by Graeter et al. (2013).

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist, Manager, I & M Aquatic Ecologist

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are recorded onto an excel data sheet and also imported into ArcMap as a point shapefile to show locations of sample plots and where individual herpetofauna were identified.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data will be stored on the refuge server.

Describe procedure for verifying/checking/securing the data:

None

Describe methods/software used in data analysis:

Excel – summary statistics

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

A final report of inventory efforts will be prepared. If work is done over multiple years, annual interim reports will be developed.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

For uncommon species, take multiple photographs or consider making a small collection of a few individuals for curation at the MS Museum of Natural Science, Natural Heritage Program

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Graeter, G. J., K. A. Buhlmann, L. R. Wilkinson, and J. W. Gibbons, (eds). 2013. Inventory and monitoring: recommended techniques for reptiles and amphibians. Partners in Amphibian and Reptile Conservation Technical Publication IM-1, Birmingham, AL.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	Original
-----	------------------	----------	----------

Maps, Data Sheets and Appendices:



2.4 Plant Inventory

Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Plant Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

The plant inventory will develop a georeferenced source of vascular plant species composition within both aquatic and terrestrial systems throughout the refuge. Bottomland hardwood forests are the dominant natural community of the MAV. The floral and faunal assemblages of this ecosystem are predominantly a function of the hydrological regimes, local scale landforms, and soil parameters. Within the system are definable plant assemblages related to micro-site conditions which are driven primarily by moisture gradients and plant physiology. Depending on site-location and successional stages of the tree overstory, these systems have a very diverse and dynamic understory and mid-story plant community. Many understory plants within this system are deemed rare or uncommon and highly restricted in range. This is largely due to levee construction to restrict annual flooding of the Mississippi River and its tributaries, and 80% clearing of the forests to support agricultural production. The remaining forested areas are highly fragmented and support unique plant communities that are isolated and disappearing within these forest patches. Dahomey NWR is a remnant tract of forest in the MAV and has not had a complete botanical survey. Plant surveys on the refuge have focused on tree composition (Smith and Sansing 2008) and a few specific herbaceous plants (Stewart 1990, Richardson et al. 2014). The plant inventory survey was selected because it provides an understanding of refuge's biodiversity which effects the distribution and abundance of the faunal community. In addition, many unique plant species of state concern are likely to occur on the refuge.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Plants

Target habitat(s): *(if applicable)*

All major terrestrial and aquatic habitat types on the refuge

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*

3. Determine the species composition and occurrence of vascular flora on the refuge
4. Determine species distribution

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD – survey may take several years to be comprehensive.

Are specific sampling units identified? ☐ Yes ☒ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☒ Other:

Survey for plants will be done using double nested plots of differing scales to facilitate identification of less common species.

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling effort will be stratified based on major habitat types. Plots will be systematically located within habitat units on the refuge. A cumulative species curve will be generated for each season to facilitate determination of sampling effort.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Surveys will be done during two seasons. Spring (May – June) and again in summer (late August-September). With the exception of aquatic habitats, each survey plot will be sampled during both seasons. This will facilitate identification of many herbaceous plants which have differing flowering periods.

Section 3. Survey Methods

Primary metrics collected:

Plant species, % composition, % occupancy

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

Sampled sites will be GPS referenced.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

Observers will need to be able to identify plants in the field. In some cases identification of plants will be done using photo or actual plant vouchers back in the lab.

Describe equipment used during the survey:

GPS, data sheet, 50' tape, field plant ID books, collection press, map, sampling frame(s)

Describe detailed methodology (field and lab procedures) - Excerpted From:

Sampling will be done using a nested plot design of at least two frame sizes. The larger size will be 1/5 acre plots for identification of tree. Within the 1/5 acre plot, four 1-meter plots will be located within 20 feet from plot center in each of the cardinal directions. A percent cover estimate for each plant in the meter plots will be done visually to determine percent composition. An average of the 4 meter plots will be used to determine percent composition. Percent occupancy will be based on a species being present in at least 1 of the meter plots.

Survey of understory plants will be done in spring and a second survey in fall. These survey periods do not have to be done in the same year.

More refined sampling and design methodologies will be developed based on Barnett and Stohlgren (2003) and Elzinga et al. (1988).

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist and Manager in association with a contractor

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are recorded to an excel data sheet and also imported into ArcMap as a point shapefile to show locations of sample plots and where individual plants were identified.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data will be stored on the refuge server.

Describe procedure for verifying/checking/securing the data:

Some voucher specimens will be verified against the collection at the MS Museum of Natural Science and for uncommon species placed in the collection with the Natural Heritage Program as well as the herbarium at the refuge.

Describe methods/software used in data analysis:

Excel – summary statistics

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

A final report of inventory efforts will be prepared. Annual reports will be prepared in the interim.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

None

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Barnett, D. T. and T. J. Stohlgren. 2003. A nested-intensity design for surveying plant diversity. *Biodiversity and Conservation* 12:255-278.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. Measuring and monitoring plant populations. 1998. Bureau of Land Management, National Applied Resource Sciences Center, Denver, CO. 496 pp.

Richardson, D.M., B. Rosamond, and A. Breland. 2014. Survey for pondberry (*Lindera melissifolia*) on portions of Dahomey National Wildlife Refuges. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.

Smith, R., and H. Sansing. 2008. Dahomey National Wildlife Refuge stand conditions and habitat management recommendations. U.S. Fish and Wildlife Service, Grenada, MS. 8 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
1.0	David Richardson	7/8/2015	Original

Maps, Data Sheets and Appendices:



2.5 Mussel Inventory Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including: Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols; Capture information valuable in development of Inventory and Monitoring Plans (IMP); Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Mussel Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

The survey will provide a baseline inventory of freshwater mussels (Family Unionidae and Corbiculidae) across the entire refuge. Freshwater mussels represent extremely diverse taxon. While some species have wide geographic distribution, many are more restricted to specific drainages. Freshwater mussels are important indicators of the health of aquatic systems. Unfortunately, greater than 30% of them are listed or proposed for listing under the Endangered Species Act. In Mississippi, 85 species of freshwater mussels have been identified. Inventories for freshwater mussels have previously occurred on Dahomey NWR but a comprehensive survey has not been completed. This survey is designed to provide a baseline inventory of the freshwater mussels on the refuge. This survey was selected because it provides important baseline information regarding a taxon that is of special concern, includes numerous species in decline and at-risk, and relates to the CCP objective to inventory non-game species.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Freshwater mussels (Family Unionidae and Corbiculidae)

Target habitat(s): *(if applicable)*

Primarily moving water systems, and permanent waterbodies on the refuge

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*

1. Determine the species occurrence and distribution of freshwater mussels on the refuge.

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

Is there an established protocol for the survey? ☐ Yes ☒ No ☐ In Prep (☐ Not Sure)

Protocol Name, citation and/or link to documentation:

None

Are there refugee-specific elements of implementation? ☒ Yes ☒ No (☐ Not Sure)

If yes, also specify refugee-specific details in the section below.

**For Surveys with Refuge-specific Details
(collaborative OR unique refuge surveys)**

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

2013 (incomplete)

Are specific sampling units identified? ☒ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☐ Plot ☐ Point ☒ Other:

Sampling within streams and channels on the refuge and permanent water bodies

Do sampling units remain fixed (i.e., same location from year to year)?

☒ Yes ☐ No (☐ Not Sure)

Describe sampling design: *(e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)*

None – all permanent water bodies will be sampled.

Describe Survey Timing: *(Examples include # repeat visits each year, months, season, time of day, etc...)*

Primary sampling will be done in summer and early fall during low water conditions. Opportunistic sampling

Section 3. Survey Methods

Primary metrics collected:

Species occurrence of mussels by waterbody

How are sites marked? (Examples include GPS waypoints, flagging, etc...)

Stakes and GPS waypoints

Describe preparatory requirements for the survey: (Examples include permits, training, contracts, other logistics, etc...)

None

Describe equipment used during the survey:

GPS, collection pails/bags, data sheet

Describe detailed methodology (field and lab procedures) - Excerpted From:

Identified sampling locations are searched for old shells along the margins of creeks and permanent and semi-permanent waterbodies. In addition, within shallower portions of the waterbodies, observers will look for mussels exposed in the mud. Known shells will be identified in the field. A few shells of speculatively identified mussels will be brought back for positive identification. Representative samples of all species of mussels will be collected and added to the mollusk collection at the MS Museum of Natural Science – Natural Heritage Program. Unless needed for identification, live specimens will be left on site.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

I&M Ecologist, Refuge Manager, Refuge Biologist, interns

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Excel file denoting location, date, lat/long, species ID, and comments.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Excel file at N. MS Refuges Complex Server

Describe procedure for verifying/checking/securing the data:

None identified at this time.

Describe methods/software used in data analysis:

None needed

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

None to date. Anticipate generating a summary report of all sampling efforts and descriptions of locations of identified mussels.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Low water conditions are critical to conducting this inventory. Specimen vouchering can be accomplished working with Dr. Bob Jones, MS Museum of Natural Science; Paul Hartfield, USFWS-Jackson, MS, and Wendall Haag, USFS-Center for Bottomland Hardwoods Research, Stream Ecology Lab, Oxford, MS.

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	Original
-----	------------------	----------	----------

Maps, Data Sheets and Appendices:



2.6 Crayfish Inventory Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions field form was developed to assist refuges in recording important biological survey information and will enhance survey integrity by ensuring that survey procedures are clear and consistent. It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Crayfish Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

The survey will provide a baseline inventory of crayfish across the entire refuge. North America has over 363 species of crayfish with over 33% listed as threatened or endangered (Taylor et al. 2011). In Mississippi, there are no less than 63 species though the number may be as high as 78 if undescribed species in the state are included (Fitzpatrick 2000). This survey was selected because it provides important baseline information regarding a taxon with numerous species listed as threatened, endangered, vulnerable or at-risk. The refuge has been able to conduct limited surveys for crayfish in the past (Rosamond 2012, Adams et al. 2013b), but has not been able to complete an entire survey across a wide spectrum of habitats. This survey was selected because of the vulnerability of this taxon nationally and the importance of understanding the distribution of many of the crayfish species in the state.

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Crayfish

Target habitat(s): (if applicable)

All refuge wetlands and areas of uplands with chimney burrows.

Survey objectives: (Your primary survey objectives , i.e., what questions do you hope to address with this survey?).

1. Determine the species richness and diversity of crayfish communities on the refuge

Section 2. Survey Design

For Collaborative Surveys

☐ This survey is part of a collaborative State, Regional, or National survey:

Coordinating organization(s) and contact information:

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ **This survey has refuge-specific design elements:**

Year of survey origin: (Add year of survey modification after origin if applicable.)

2012 – Survey was focused only on vernal pools; inventory would be refuge-wide. Start date TBD; survey will likely take multiple years of effort to be complete.

Are specific sampling units identified? ☐ Yes ☐ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling design will encompass all types of wetlands on the refuge including vernal pools, more permanent water (sloughs and impounded water), and streams and bayous. Effort will be allocated based on relative amount of each type of wetland.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Depends on wetland type. Vernal pools, sloughs and impounded waters will be sampled predominantly in early spring and summer. Streams and bayous can be sampled throughout the summer and into fall. Sampling will not be done in winter.

Section 3. Survey Methods

Primary metrics collected:

Number of individuals and species by trap night effort.

How are sites marked? (*Examples include GPS waypoints, flagging, etc...*)

Sites sampled will be identified by GPS waypoints.

Describe preparatory requirements for the survey: (*Examples include permits, training, contracts, other logistics, etc...*)

None

Describe equipment used during the survey:

Minnow traps, data sheets, hip boots, burrow traps, collection jars, five-gallon bucket, dip net, dog food (bait), specimen collection labels (write in rain paper), ethanol 70% (preservative), wire-stake survey flags (24-36 inch).

Describe detailed methodology (field and lab procedures) - Excerpted From:

Field: Survey locations will be identified and ground-truthed in advanced to determine water depth is sufficient to partially submerge minnow traps. At each site, a GPS waypoint will be taken. Along streams and bayous, the beginning and end points of the section will be geo-referenced. Minnow traps will be placed at a rate of 5-10 per location. Each trap will be baited with dog food. Traps will be spaced 10-30 feet apart and an attempt will be made to only partially submerge the trap. In streams and bayous, traps will be anchored to the bank with a long cord. All traps will be marked with a wire-stake survey flag to facilitate locating them. A site characteristic data sheet will be prepared for each trapping location.

Traps will be run every day for 3 consecutive days. Number of individuals by species and sex will be recorded. If species identification can be made in the field, the individuals will be released away from the trapping site. All other specimens will be placed in a storage jar with 70% ethanol, a label indicating the site location and sampling date. Ancillary captures of other taxa (fish, snakes, salamanders) will also be recorded. Fish which cannot be readily identified in the field will also be placed in a jar with 5 – 10% formalin for identification back in the lab.

If crayfish burrows are located, PVC burrow traps will be placed to capture the individual.

Lab: All crayfish will be identified minimally to genus. In some cases, species identification can only be made for Form-I males. Appropriate crayfish keys will be used to facilitate species identification. Assistance in identification of individuals will be done through the Center for Bottomland Hardwood Research – USDA, and the MS Museum of Natural Sciences (Natural Heritage Program). Vouchers of collected specimens will be placed in the MS Museum of Natural Sciences.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist and interns

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Microsoft Excel

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Files stored on refuge server. Final report and digital data to be uploaded to ServCat. Voucher specimens from the collection will be given to the MS Museum of Natural Science and other appropriate curated research collections.

Describe procedure for verifying/checking/securing the data:

Species identification will be verified by taxon experts with the FWS, FS, and MS Museum of Natural Science.

Describe methods/software used in data analysis:

MS Excel – data summary only

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

An annual report will be prepared. Summary of survey is also reported in the N. MS Refuges Complex Annual Narrative. After inventory is deemed complete, a comprehensive report of the survey will be developed.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Late summer is a poor period for trapping. Many crayfish in more stagnant waterbodies become fossorial and not readily trapped. Efforts to trap should focus on early spring and summer. Use of a back-pack shocker in shallow stream and bayous should be considered if water clarity is good.

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Adams, S. B., M. L. Warren, and B. Rosamond. 2013b. Laboratory identification of crayfishes and fishes from the Tallahatchie and Dahomey National Wildlife Refuge, Mississippi. Unpublished Report. USDA, Southern Research Station, Center for Bottomland Hardwood Research. 13 pp.

Rosamond, B. 2012. Inventory of vernal pool fauna on Dahomey National Wildlife Refuge, Bolivar County Mississippi FY '12. Unpublished Report. U.S. Fish and Wildlife Service, Grenada, MS. 15 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	
-----	---------------------	----------	--

Maps, Data Sheets and Appendices:

You can insert maps and any appendices of information (e.g., progress tables, timelines, budgets, activity logs, etc...) directly into this document (Insert in Word document version or Attach to Adobe version).



2.7 Small Mammal Inventory Survey Instructions – Field Form

Purpose

Documenting survey design and methods maintains the scientific integrity of refuge biological programs and guards against information loss over time. The Survey Instructions format was developed to assist refuges in recording important biological survey information and ***will enhance survey integrity by ensuring that survey procedures are clear and consistent.*** It will provide additional benefits, including:

- Serve as Initial Survey Instructions (ISI) (701 FW 2), and an initial step in development of formal NWRS survey protocols;
- Capture information valuable in development of Inventory and Monitoring Plans (IMP);
- Augment survey information in the Planning and Review of Inventory and Monitoring ([PRIMR](#)) database; Reveal multi-refuge and landscape-level data inference opportunities.

Using the Initial Survey Instructions Field Form

Staff should use this tool for all on-going surveys, particularly those high priority refuge-based surveys where protocols are not available, and followed by cooperative and/or coordinated surveys with important refuge-specific elements of implementation. The information provided in the ISI form should be as thorough and complete as possible; however it is acceptable to leave fields or sections empty if particular survey information is unknown. Provide completed forms to your I&M ecologist, who will archive it on [Fishnet](#) and link it to the survey record in PRIMR for long-term reference. Regional I&M staff ecologists can assist refuge staff with completing the Survey Instructions. If the Survey Instructions are updated over time, we recommend saving updates as versions (e.g., version 2.0).

Survey name:

Small Mammal Inventory

This survey occurs on: ☒ Single refuge only ☐ Multiple refuges

Refuge name(s):

Dahomey NWR

Background/Survey Justification:

The primary purpose of the survey is to provide a baseline inventory of the distribution and relative abundance of small mammals throughout the various habitat types on the refuge. Mississippi is host to 68 extant, free-ranging mammals, including 5 species of marine mammals (Jones and Carter 1989). Nearly half of the mammal species in the state are considered terrestrial small mammals (i.e., mice, voles, shrews, rats, and bats). These species play an important role in the function of the ecosystem by serving as base prey for larger mammals, birds, and snakes; providing a mechanism for plant dispersal; and serving as predators on insects. The diversity of small mammals is a function of present and historic land-use practices which influence the current distribution and relative abundance of certain species. Several species of small mammals are on the state's list of species of concern or are listed as federally endangered. Therefore, understanding the small mammal biodiversity is important to make more informed management decisions

Section 1. Survey Targets & Objectives

Target species/taxa/community:

Small mammals including, rodents, shrews, bats, mink

Target habitat(s): *(if applicable)*

All major habitat types on the refuge

Survey objectives: *(Your primary survey objectives , i.e., what questions do you hope to address with this survey?)*

5. Determine the occupancy of small mammals within each major habitat type on the refuge.

Section 2. Survey Design

For Collaborative Surveys

☐ **This survey is part of a collaborative State, Regional, or National survey:**

Coordinating organization(s) and contact information:

For Surveys with Refuge-specific Details (collaborative OR unique refuge surveys)

☒ This survey has refuge-specific design elements:

Year of survey origin: (Add year of survey modification after origin if applicable.)

TBD – survey may take several years to be comprehensive.

Are specific sampling units identified? ☐ Yes ☒ No (☐ Not Sure)

Type of sampling unit (sampling geometry):

☐ Route/linear transect ☒ Plot ☐ Point ☐ Other:

Do sampling units remain fixed (i.e., same location from year to year)?

☐ Yes ☒ No (☐ Not Sure)

Describe sampling design: (e.g. study area of interest, how sampling units were selected or modified over time, if stratified sampling area, sample size, etc...)

Sampling effort will be stratified based on major habitat types and unique habitat features (e.g., bottomland hardwood, stream edges, open fields, hardwood regeneration). Most survey work will involve a sampling grid of traps.

Describe Survey Timing: (Examples include # repeat visits each year, months, season, time of day, etc...)

Survey timing will be dictated by specific species or functional group being inventoried.

Bats will be surveyed from April – early November.

Small rodents and shrews will be predominantly sampled from October – April.

Section 3. Survey Methods

Primary metrics collected:

Number of individuals of a species per sampling effort (Trap nights/net nights/detector nights)

How are sites marked? *(Examples include GPS waypoints, flagging, etc...)*

Sampled sites will be GPS-referenced. In the case of bats, sampling may also occur along a continuous survey transect.

Describe preparatory requirements for the survey: *(Examples include permits, training, contracts, other logistics, etc...)*

Observers will need to be able to identify small mammals based on external morphology. In some cases identification of bats will be done using automated call analysis programs.

Describe equipment used during the survey:

GPS, data sheet, cloth holding bags, leather gloves, calipers,
Terrestrial species: snap traps, small live traps, peanut butter and oats for bait, flags, 5 gallon bucket, bulk cotton or other bedding material.

Bats: mist nets, Anabat detector(s), GPS mouse, nitrile gloves, headlamp, weather monitoring device (Kestrel)

Describe detailed methodology (field and lab procedures) - Excerpted From:

Methods for sampling vary greatly depending on species of interest.

Bats: Sampling will be done using acoustical detection. Detectors will be placed in various habitat types for 2-3 days. Detectors should be positioned toward canopy openings. Detectors will be placed no closer than 50 yards from habitat edges. Bat detections will also be done by driving around the refuge roads with a detector mounted to the roof. Some direct captures of bats will also be done using mist-netting at small water pools or in constrained foraging corridors. Acoustical detections will be subsequently classified using commercially available software (e.g., BCID 2.7).

Flying squirrels and White-footed mice. A grid of baited live traps will be placed in mature hardwood systems. Traps will be paired with one at the base of the tree and a second placed on a platform

Other rodents and shrews. Small baited snap traps will be placed on a general grid or transect pattern throughout various habitat types. Traps will be placed at equal distances apart. Some deviations from this pattern may be done near coarse woody debris to increase capture potential of shrews. Larger rat snap traps or live traps may also be placed near basal cavities or debris piles to trap for wood rats.

Trap effort will be approximately 10 traps per transect with a minimum of 3 transects/habitat unit. Traps will be set for 3 consecutive nights and checked daily.

Who conducts the surveys (*Include staff, interns, contractors, etc... if primary surveyors*):

Refuge Biologist, Manager

Section 4. Data Management

Specify data entry file format(s):

Examples include MS Excel, MS Access, GIS, web dbs (e.g., SQL), etc...

Data are recorded to an excel data sheet and also imported into ArcMap as a point shapefile to show locations of traps sites and where individual species were captured.

Specify data storage/archive location (hardcopy and electronic):

Provide file names and locations here if applicable.

Data will be stored on the refuge server.

Describe procedure for verifying/checking/securing the data:

Some voucher specimens from initial snap trapping will be verified against the collection at the MS Museum of Natural Science. Photo documentation of unusual species will be taken.

Describe methods/software used in data analysis:

Excel – summary statistics

Section 5. Reporting

Describe reports developed from this survey:

Include details on reporting schedule/frequency, distribution, archiving, etc... Include links and citations for previous reports if applicable.

A final report of inventory efforts will be prepared. Annual reports will be prepared in the interim.

Section 6. Other Survey Information

Comment on additional survey elements and issues to consider when implementing the survey:

Individuals handling bats must have pre-rabies exposure vaccination.

Description of attachments/supplemental documents/data sets:

Use the space below to describe supplemental documents (e.g., maps, appendices, etc) included with this form.

None

Cite resources:

Cite the source of the information in the form below, including personal communication and citations for published and gray literature.

Jones, C., and C. H. Carter. 1989. Annotated checklist of the recent mammals of Mississippi. Museum of Texas Tech University, Number 128. 9 pp.

Submitted by and contact information:

David Richardson, Terrestrial Ecologist, David_Richardson@fws.gov, 662 226-8286

Version Tracking

You can use the table below to track updates to the Survey Methods Record.

Version	Completed by	Date	Comments/material updated
---------	--------------	------	---------------------------

1.0	David Richardson	7/8/2015	Original
-----	------------------	----------	----------

Maps, Data Sheets and Appendices:

IMP Revision Signature Page

IMP Revisions Dahomey National Wildlife Refuge

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