



# **Inventory and Monitoring Plan**

## **Patoka River National Wildlife Refuge**



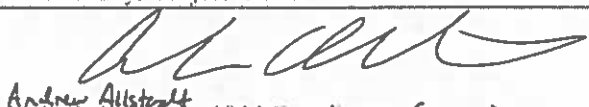
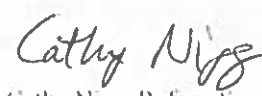

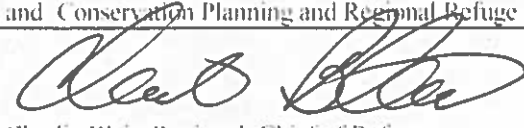
September 2017



## Patoka River National Wildlife Refuge

### Inventory and Monitoring Plan

#### Signature Page<sup>1</sup>

<i>Action</i>	<i>Signature /Printed Name</i>	<i>Date</i>
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<sup>1</sup> Signatures apply to all contents of the IMP.

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## Introduction

The Patoka River National Wildlife Refuge and Management Area (Refuge) is located in Pike and Gibson counties in southwestern Indiana near the town of Oakland City and includes up to 23,743 acres within the current acquisition boundary, which is bisected by the Patoka River. Though this total acreage reflects the entire Refuge, only 8,443 acres have been formally purchased and included as Refuge property to date. The Patoka River and adjacent habitats now included within the Refuge acquisition boundaries were first considered for establishment as a Refuge in the mid-1980's and the Refuge was established in 1994 under the legislative authority of:

- The Emergency Wetlands Resources Act of 1986 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." (16 USC Sec. 3901).
- An Act Authorizing the Transfer of Certain Real Property for Wildlife which shows "...particular value in carrying out the national migratory bird management program." (16 U.S.C. 667b).
- The North American Wetlands Conservation Act "... (1) to protect, enhance, restore, and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife in North America; (2) to maintain current or improved distributions of migratory bird populations; and (3) to sustain an abundance of waterfowl and other migratory birds consistent with the goals of the North American Waterfowl Management Plan and the international obligations contained in the migratory bird treaties and conventions and other agreements with Canada, Mexico, and other countries." (16 U.S.C. 4401-4413).

This Inventory and Monitoring Plan (IMP) documents the inventory and monitoring surveys that will be conducted at Patoka River National Wildlife Refuge (NWR) from 2017 through 2032, or until the refuge's Habitat Management Plan (HMP) is revised. The majority of surveys considered in this plan address resource management objectives identified in the HMP (2017) for this refuge. Other surveys are a continuation of past monitoring conducted for the purpose of understanding long-term trends in specific resources or are part of regional and national survey efforts. This IMP was developed according to the Inventory and Monitoring (I&M) policy (701 FW 2) for the National Wildlife Refuge System.

## Priority Species for the Patoka River NWR, adapted from Table 3.3 in the Habitat Management Plan.

Federally listed threatened and endangered species are indicated by italics.

Focal Species	Habitat Type	Habitat Structure	Life History Requirement
Cerulean Warbler Prothonotary Warbler	Bottomland Forest	Mature canopy forest	Breeding & Migration
Henslow's Sparrow	Grassland	Disturbed prairie – hayed or grazed areas with low vegetation	Breeding
Short-eared Owl			Breeding & Migration
<i>Least Tern</i>	Temporary/Seasonal Wetland	Bare or sparsely vegetated sand or dried mudflats	Breeding
Pectoral Sandpiper		Shallow water wetlands and shallowly flooded agricultural fields	Migration
Mallard			Breeding & Migration
<i>Whooping Crane</i> (Experimental Population)			Wintering
Sora	Emergent Wetlands	Emergent wetlands with tall, dense cover and shorter seed-producing plants	Breeding & Migration
Wood Duck Louisiana Waterthrush	Patoka River, Tributaries, Oxbows, and Scrapes	Wooded streams, rivers, and oxbows	Breeding & Migration
<i>Indiana Bat</i> <i>Northern Long-eared Bat*</i>	Upland Forest	Mature closed-canopy forest	Breeding
Ovenbird			Breeding & Migration
Copperbelly Watersnake Wood Duck	Bottomland Shrubland	Bottomland forests, shrub swamps, and oxbows	Breeding & Migration

\*Northern long-eared bat is not listed in the HMP, but was recently listed as federally Threatened. The species is found in Pike County, according to USFWS website.

## Methods

Station staff generated a list of extant and anticipated surveys from a list of all observational efforts to gather information on refuge resources. Survey lists provided by Region 3 Migratory Birds Division and Ecological Services were also reviewed during the compilation process. This extensive list was later refined to exclude general observations (reconnaissance) of refuge resources that do not require protocols or data management. The remaining surveys were then assigned a priority score using 13 pre-defined criteria (Appendix A). Priority scores were used to assign the survey to one of three groups that ranked the surveys (Appendix B).

## ***Prioritizing and Selecting Surveys***

The priority ranking of surveys was determined during a one-day meeting at Patoka River NWR on May 14<sup>th</sup> 2015. Wildlife Refuge Specialist Heath Hamilton and Refuge Manager Bill McCoy met with Region 3 Zone Biologist Brian Loges and Jennifer Herner-Thogmartin to prioritize and select the surveys. Background information for each survey was summarized in advance by refuge staff and briefly discussed prior to prioritizing the surveys. The 13 criteria, assignment rules, weighting and score calculation process followed the Criteria for Prioritizing Surveys Entered into the PRIMR Database (Appendix A). The Patoka River Refuge staff made all decisions required to produce the survey priority scores (Appendix B).

## ***Estimating Capacity***

To determine a budget threshold, the staff responsible for completing natural resource surveys was asked to estimate the portion of their time in a typical year dedicated to the following: analysis and summary, data management, monitoring, research, and supervision.

Total estimated costs for each survey are presented in Appendix D. The portions of the year dedicated to the activities required for implementing surveys were converted to weeks. The time required to implement an annual iteration of a survey was also estimated using past experiences with established protocols or anticipated commitment for protocols that have yet to be developed. Since the portfolios were developed to document the total benefit of a set of surveys over the life of the IMP, the exercise was useful in identifying low frequency surveys with high cost efficiencies. Balancing the required commitment of the selected surveys with the resources available to the station at the time of the selection will increase the probability of survey implementation.

This IMP presents a ranked list of surveys based on evaluation criteria weighted to reflect the importance of each criterion to refuge staff. However a top-down selection of ranked surveys may not always yield the most efficient or beneficial set of surveys to be implemented for the life of the IMP. A cost-benefit analysis was performed to evaluate the total return of potential sets of selected surveys over the life of the IMP. To explore the cumulative benefit of various IMP sets, we used linear programming to find the optimum sets of ranked surveys using the total of all frequency adjusted scores as an objective function (Appendix C.). Main constraints included costs (weeks) and surveys selected prior to solving the linear function (summation of frequency adjusted scores across all surveys).

Patoka River NWR has a small staff, with only a refuge manager and wildlife refuge specialist available to implement surveys. The estimate of available weeks to implement surveys with current staffing is less than one week. The current workforce plan *Region 3 Refuge Workforce Plan – 2014* (September 26, 2014) assigned a GS9 wildlife biologist position to Patoka River. The capacity for biological surveys with a full time biologist was estimated at 21.2 weeks, based on estimates from other R3 stations with IMP's. The cost benefit analysis was replicated for a staff with either 1 or 0.5 FTE biologist and presented to the refuge staff prior to their final selection. When the biologist vacancy is filled, this IMP and the *Planning and Review of I&M activities on Refuges (PRIMR) Database* should be revised.

## Results: Selected Surveys

The prioritization and cost benefit analysis were used in deliberative selection of surveys to be completed over the life of the IMP. In addition to the priority scores, the level of effort required to complete a survey as well as input from Region 3 Migratory Birds Division and Ecological Services was considered in the selection process. Selected surveys include surveys identified for completion with FY2016 levels of staffing and support (Table 1). The list of surveys selected for implementation with existing resources represents a commitment to implementation by refuge staff. Changes in available capacity, CCP objectives, or other factors that alter the list of selected surveys through addition or removal of selected surveys will trigger a revision of this IMP (701 FW 2).

The process identified 5 surveys (as follows) that can be completed with current staffing levels, (includes assistance from other FWS programs, interns, and volunteers) and current budget for the duration of this Inventory and Monitoring Plan (Table 1). A single survey from the 7 high ranking scores (80th percentile) was selected for implementation. Two of the surveys (Management Actions and Mercury Deposition) were added late in the review process and were not ranked.

An estimated annual work schedule for selected surveys is shown in Appendix E, and non-selected surveys are listed in Appendix F. Survey names were updated after the ranking exercise based on national and regional lists of standardized names, available protocols and companion surveys that must be completed simultaneously to maximize value. A Refuge Condition Summary which can be used as a reporting tool to summarize status, trends, and desired conditions of the selected surveys is provided in Appendix G. Environmental Action Statement requirements are addressed in Appendix H.

### List of Selected Surveys and Rationale for Selection:

<b>Integrated Waterbird Management and Monitoring Initiative</b>	Waterbird use of managed wetlands is tied to the refuge purpose. Multiple metrics are relevant to managing impoundments for nonbreeding waterbirds: waterfowl use, water level monitoring, shorebird use, recording management actions & unit level vegetation response.
<b>Management Actions</b>	This survey documents habitat restoration activities completed by refuge staff by fiscal year.
<b>Mercury Deposition</b>	This survey generates an annual index of mercury deposition for the refuge using data collected by the National Atmospheric Deposition Program's Mercury Deposition Network.
<b>Mobile Acoustical Bat Monitoring</b>	Survey establishes a baseline measure of abundance for certain bat species which occur on or near Patoka River NWR, including the federally listed northern long-eared bat and Indiana bat. This information is the basis for focused questions regarding habitat occupancy of threatened, endangered, or species of concern at the local, refuge level and informs habitat management, especially for listed species.
<b>Water Quality Monitoring</b>	This survey will document sulfate and other parameters as indicators of surface water quality impacts stemming from past and present coal mining activities.

**Table 1. Surveys selected for conduct at Patoka River National Wildlife Refuge 2017— 2031.**

Survey Priority <sup>1</sup>	Survey ID Number <sup>2</sup> FF03RPTK 00-	Survey Name (Type) <sup>3</sup>	Survey Status <sup>4</sup>	Mgmt. Objective Id <sup>5</sup>	Survey Area <sup>6</sup>	Staff Time (FTE) <sup>7</sup>	Avg. Ann Cost (OPR) <sup>8</sup>	Survey Timing <sup>9</sup>	Survey Length <sup>10</sup>	Survey Coord. <sup>11</sup>	Protocol Citation <sup>12</sup>	Protocol Status <sup>13</sup>
1	055	Integrated Waterbird Management and Monitoring Initiative (CB)	Current	HMP / pg 89, 80	Multiple management units	FWS: 0.07	\$0.00	weekly/ Recurring -- every year	2017- Indefinite	Linda Wires, IWMM Coordinator	<a href="#">Loges et. al. 2014</a>	(none)
17	010	Mobile Acoustic Bat Monitoring (CB)	Current	HMP / pg 78, 90	Forested roads	FWS: 0.02	\$0.00	Summer/ Recurring -- every year	2012- Indefinite	Heath Hamilton	Mobile Bat Acoustic Survey Protocol 2012	Initial Survey Instructions
NR	058	Management Actions (M)	Current	HMP / pg 94, 80, 78, 83, 89, 90, 80, 91,& 86	Entire station	FWS: 0.01	\$0.00	December/ Recurring -- every year	2017- 2032	(none)	(none)	Initial Survey Instructions



NR	059	Mercury Deposition	Current	HMP / pg 86,80,89, 94	Regional	FWS: 0.0	\$0.00	December/Recurring -- every year	2017-Indefinite	(none)	(none)	Initial Survey Instructions
NR	018	Water Quality Monitoring	Current	HMP / pg 80	Entire station	FWS: 0.09	\$0.00	December/Recurring -- every year	2017-Indefinite	(none)	(none)	Initial Survey Instructions

<sup>1</sup> The rank for each survey listed in order of priority, <sup>2</sup>A unique identification number. <sup>3</sup>Short titles for the survey name, <sup>4</sup>Current: surveys that are either continued or scheduled to begin in the year of IMP, Expected: previously conducted or new surveys that have a likely chance of being conducted during the span of an IMP, <sup>5</sup>The management plan and objectives that justify the described survey. <sup>6</sup> Station management unit names, entire station, or names of other landscape units included in survey, <sup>7</sup>Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE), <sup>8</sup> Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time. \$ = \$0 to 4,999; \$\$ = \$5,000 to 24,999; TBD = to be determined, <sup>9</sup> Timing and frequency of survey field activities, <sup>10</sup> The years during which the survey has been or will be conducted, <sup>11</sup> Name and position of the Survey Coordinator for each survey, <sup>12</sup> Title, author, and version of the survey protocol (if there is no protocol to cite, enter None), <sup>13</sup> 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). NR = survey was added post-prioritization and not ranked.

## Narratives for Selected Surveys

**Survey:** Integrated Waterbird Management and Monitoring (FF03RPTK00-055)

**Refuge:** Patoka River National Wildlife Refuge

Priority: 1

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP: Emergent Wetlands Objective; Temporary / Seasonal Wetlands Objective 1; Temporary / Seasonal Wetlands Objective 2

Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The data may be used to generate unit specific use-day estimates, document migration chronologies, and explore relationships between count data and habitat condition. Data summaries will guide state dependent decision making at the unit scale, such as choosing a soil disturbance prescription or a seasonal flood regime. Unit level data can be scaled up to refuge or refuge complex as guild specific or species utilities for broad habitat types. Data can be used to assess the efficacy of management actions (accounting for management costs in terms of use-days for targeted populations) and support learning to improve management. Raw count data is also used to answer public inquiries regarding refuge-wide waterfowl populations. Water levels must be monitored to ensure optimum depths are achieved for waterfowl feeding, especially during peak migration.

What is the population or attribute of interest, what will be measured, and when?

This survey involves direct counts or estimates of waterbirds in managed wetland units. Biological Integrity; Other Biota; Aves (Birds); Anseriformes (Waterfowl, Swans, Geese, Screamers, Ducks); Gruiformes (Rails, Cranes); Charadriiformes (Auks, Alcids, Oystercatchers, Plovers, Shore Birds, Gulls); Pelecaniformes (Hérons, Ibises, Pelicans); Recurring -- every year; This will occur during spring and fall migration

Is this a cooperative survey? If so, what partners are involved in the survey?

Coop Baseline Monitoring; U.S. Fish and Wildlife Service, Migratory Birds

**Survey:** *Management Actions (FF03RPTK00-058)*

**Refuge:** *Patoka River National Wildlife Refuge*

**Priority:** *Not Ranked*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP: Bottomland Forest 1; Bottomland Forest 2; Bottomland Forest 3; Bottomland Shrubland Objective; Emergent Wetlands Objective; Grassland Objective 1; Grassland Objective 2; Grassland Objective 3; Grassland Objective 4; Lakes and Ponds Objective; Patoka River, Oxbows, Patoka Tributaries, and Scrapes Objective; Temporary / Seasonal Wetlands Objective 1; Temporary / Seasonal Wetlands Objective 2; Temporary / Seasonal Wetlands Objective 3; Upland Forest Objective

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

This survey documents habitat restoration activities completed by refuge staff for the current fiscal year. The survey is also retroactive capturing available legacy management actions completed by the refuge or by other entities prior to refuge acquisition. Current fiscal year activities will be organized by annual work plans while legacy information existing in multiple forms ranging from mine reclamation plans to logs of tree planting records will be archived as part of an on-going effort by the Division of Natural Resources and Conservation Planning to secure management history of refuge properties in ServCat. Information will be collected at the greatest available detail required to inform future assessments of long term habitat restorations.

**What is the population or attribute of interest, what will be measured, and when?**

Recurring -- every year; December

**Is this a cooperative survey? If so, what partners are involved in the survey?**

No

**Survey:** *Mercury Deposition (FF03RPTK00-059)*

**Refuge:** *Patoka River National Wildlife Refuge*

**Priority:** *Not Ranked*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP: Emergent Wetlands Objective; Lakes and Ponds Objective; Patoka River, Oxbows, Patoka Tributaries, and Scrapes Objective; Temporary / Seasonal Wetlands Objective 1; Temporary / Seasonal Wetlands Objective 2

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

This survey captures and summarizes data collected by the National Atmospheric Deposition Program's Mercury Deposition Network (MDN). Raw data originates from a nearby station in Knox County (Southwest Purdue Agriculture Center site IN-22) MDN that currently samples for total mercury deposition. Annual deposition observed at this station will be downloaded and summarized by refuge staff to produce an annual index of Hg deposition for the refuge and a deposition curve for the year.

**What is the population or attribute of interest, what will be measured, and when?**

Total mercury deposition, ng/m<sup>2</sup>

**Is this a cooperative survey? If so, what partners are involved in the survey?**

Yes, Purdue University & National Atmospheric Deposition Program.

**Survey:** *Mobile Acoustic Bat Monitoring (FF03RPTK00-010)*

**Refuge:** *Patoka River National Wildlife Refuge*

**Priority:** 17

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP Objectives:

Bottomland Forest - Indiana Bat is a focal species for Bottomland Forest Objectives in HMP

Upland Forest - Indiana Bat is a focal species for Upland Forest Objectives in HMP

CCP Objectives:

Endangered Species – CCP states that the Refuge will implement a monitoring program to track abundance, population trends, and habitat associations with listed species (Bat Survey would include FE Indiana Bat and FT Northern Long-eared Bat)

Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The **Indiana bat** (*Myotis sodalis*) is a highly imperiled bat species chosen as a priority species in the Refuge HMP for both the Refuge's upland and bottomland forests. Ten species of bats have been detected using acoustic monitoring from 2012 through 2016 on the Refuge, but the Indiana bat was chosen as a priority species because of its conservation status. It is listed as a species of greatest conservation need in the Indiana Comprehensive Wildlife Strategy, an Ohio River resource of conservation priority, a USFWS Region 3 and Ohio River watershed priority species, and is state and federally listed as endangered.

On the Refuge the Indiana bat will be managed for and monitored in the upland forest. Though they frequent numerous types of habitats, including riparian areas, uplands, ponds, fields, and caves, forested areas are the most important habitat, especially in an agricultural landscape. During the summer the bats can be found in maternity roosts that are often along streams. They prefer mature forests that have dead or dying trees with exfoliating bark and closed canopies where they can hunt for insect prey (NatureServe 2013). By maintaining and protecting habitat for the Indiana bat other species of mature forest dependent species will benefit. Species that require dead or dying trees for nesting or foraging, songbird and raptor species that depend on mature upland forests, and ground birds, mammals, reptiles and amphibians that frequent these forests will all benefit from the preservation and management of upland forests for the Indiana bat.

What is the population or attribute of interest, what will be measured, and when?

Biological Integrity; Other Biota; Mammalia (mammals); Chiroptera (bats); Recurring -- every year; June and July

Is this a cooperative survey? If so, what partners are involved in the survey?

Coop Baseline Monitoring; Region 4 Refuges - Inventory and Monitoring Network; Region 3 - Ecological Services

**Survey:** *Water Quality Monitoring (FF03RPTK00-018)*  
**Refuge:** *Patoka River National Wildlife Refuge*  
**Priority:** *Not Ranked*

**Which station management objective does the survey support? Is the objective derived from the CCP, interim objectives, HMP, or other?**

HMP: Temporary / Seasonal Wetlands Objective, Temporary / Seasonal Wetlands Objective 2, Temporary / Seasonal Wetlands Objective 3(page 80).

**Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.**

An inorganic dissolved solid, Sulfate can be used as parameter for detecting the effects of coal mining on surface water quality and often precedes acidity and pH readings as an indicator of severe pollution.

**What is the population or attribute of interest, what will be measured, and when?**  
Surface water concentration for sulfate in mg/Liter.

**Is this a cooperative survey? If so, what partners are involved in the survey?**  
No.

## **Revising the IMP**

The IMP will be revised according to I&M Policy and as CCP and HMP plans are modified (see Revision Signature Page, Appendix D). Amendments related to the assignment of new or updated protocols without changes to the selected survey list will not require signatures. Revisions requiring survey additions or removals will require signatures from refuge staff, Regional I&M staff, Regional Refuge Biologist/Natural Resources Division Chief (Figure 3), but not the Refuge Supervisor or Regional Chief of Refuges. The PRIMR database was updated along with this IMP; it will be updated as approved protocols are linked to the selected surveys and when revisions are approved.

## **References**

U.S. Fish and Wildlife Service. 2017. Habitat Management Plan for Patoka River National Wildlife Refuge. USFWS Region 3. Bloomington MN.

## Appendix A. Criteria and Weights Used to Prioritize Surveys

Each criterion is grouped under one of eight themes that describe a survey's general contribution to a refuge's or broader needs. Rating values (1—2, 1—3, or 1—4) that are used to score each survey are also given for each criterion. NOTE: The 24 criteria recommended by the NRPC were reduced to the following 13 for use in Region 3. The additional 11 criteria were removed because they would not apply to refuges in the Midwest, were redundant with other criteria, or would not add discrimination among surveys in the Midwest.

### Refuge Priorities and Management Needs

#### 1. CCP or Other Management Plan Objectives

How many refuge CCP or other management plan objectives (e.g., HMP, NRMP, Fire Management Plan, Recovery Plan, Integrated Pest Management Plan) are met by the focus of this survey?

1. Does not address an objective
2. Addresses one objective
3. Addresses two objectives
4. Addresses three or more objectives

#### 2. Management Utility (Decision Support) for the Refuge

Does the survey provide data for recurring management decisions, especially as part of an existing decision framework that is implemented on a regular basis?

1. No set application for the refuge
2. May have management implications, but they are not explicitly defined
3. Has management implications, but no current decision framework
4. Part of an existing adaptive management decision framework

### Partner Priorities and Management Needs

#### 3. FWS Programs

Does the survey provide information that directly contributes to evaluating the status and trends of resources that are a priority for another FWS regional or national program (e.g., Migratory Birds, Fisheries, Water Resources/Hydrology *other than ESA species*)?

1. Does not address a management priority identified by a FWS regional or national program or initiative
2. Addresses a management priority identified by 1 FWS regional or national program or initiative
3. Addresses a management priority identified by 2 FWS regional or national programs or initiatives
4. Addresses a management priority identified by ≥3 FWS regional or national programs or initiatives

#### 4. FWS Partners

Does the survey address an identified priority of a conservation partner, such as a Landscape Conservation Cooperative(s) (LCC), state agencies, or other conservation partner?

1. Does not focus a management priority identified by FWS partners (e.g., LCC, state agency)
2. Focus on a management priority identified by one FWS partner (e.g., LCC, state agency)
3. Focus on a management priority identified by two FWS partners (e.g., LCC, state agency)
4. Focus on a management priority identified by three or more FWS partners (e.g., LCC, state agency)

### Ecological Applications

#### 5. FWS Surrogate Species

Does the survey focus on a surrogate species selected by the FWS?

1. No
2. Yes, one FWS surrogate species



3. Yes, two FWS surrogate species
4. Yes, three or more FWS surrogate species

## 6. Refuge Processes

Does the survey focus on an ecological process (e.g., fire, water temperature, climate) that is changing at a rate that is important to the refuge?

1. No
2. Yes, one significant ecological process
3. Yes, two or more significant ecological processes

## 7. Survey Breadth

The focus of the survey is:

1. A single species or abiotic parameter
2. Multi-species or multi-abiotic parameters
3. A community – multi-trophic level or biota
4. An ecosystem – biotic community and abiotic parameters

## Additional Legal Mandates

## 8. Listed species or vegetation communities

Is the objective of the survey a species or vegetation community federally listed under ESA, state listed (threatened or endangered only), ranked by the state's natural heritage program (S1 or S2 rank only), globally ranked by NatureServe (G1 or G2 rank only), or globally listed on the IUCN Red List of Threatened Species (Critically Endangered, Endangered, or Vulnerable only)?

1. Not state, federally or globally ranked
2. Yes, state listed or ranked by state's natural heritage program
3. Yes, globally listed by NatureServe or IUCN
4. Yes, federally listed under the ESA as threatened or endangered

## Immediacy of Need

## 9. Controversy

Does the survey support decision-making to address an action or management decision related to refuge resources that is controversial to an external party?

1. Not controversial and little to no potential for controversy
2. Not currently controversial, but potentially or suspected of controversy
3. Known controversy, but data or immediate management action is not currently needed but may be in the near future
4. Pressing controversy; data required to support immediate management action

## 10. Threat

Does the survey support decision-making to monitor and mitigate a known or suspected threat to refuge resources?

1. No existing threat or potential for a threat to Refuge resources (the survey does not relate to threat reduction strategies)
2. No known threat, but potential for a threat to Refuge resources (Yes, supports decision making to address a threat reduction strategy with a score of \_\_\_\_ [e.g. 2.5])
3. Known threat to Refuge resources, but immediate management action is not currently needed but may be in the near future (Yes, supports decision making to address a threat reduction strategy with a score of \_\_\_\_ [e.g. 3.0])
4. Urgent threat to Refuge resources; immediate data are needed to support management action (Yes, supports decision making to address a threat reduction strategy with a score of \_\_\_\_ [e.g.

## Scope and Scale

### 11. Baseline data

Does the survey provide high-priority information that contributes to baseline data needs?

1. No
2. Yes

### 12. Spatial Scale

What is the largest scale at which survey results will be applied for resource management?

1. Small scale: Applicable to only a single refuge or sites on a refuge
2. Medium scale: Applicable to a few refuges, a refuge complex, or includes the refuge and a small area beyond the refuge boundary
3. Large scale: Applicable to multiple refuges/complexes across an entire ecoregion, LCC, or region
4. Continental scale: Component of a large landscape level survey (e.g., North American Breeding Bird Survey, North American Amphibian Monitoring Program, and Circumpolar Biodiversity Monitoring Network)

## Protocol

### 13. Protocol development & data management, analysis, and reporting

At what stage of development is the protocol development, data management, analysis, and reporting?

1. Survey has no written protocol, data management, analysis, and/or reporting
2. Written protocol is in development (drafted)
3. Written protocol is in formal review
4. There is a published record or I&M approved protocol

## **Terms Used in the Prioritization Criteria**

For Criterion #1, refuge purpose is defined within the National Wildlife Refuge System Mission and Goals and Refuge Purposes policy (601 FW 1).

The NWRS Improvement Act defines “purposes of the refuge” as the “purposes specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.”

Refuges acquired under the authority of general conservation laws take on the purpose of the law. Examples of such laws include the Endangered Species Act of 1973, as amended; the Migratory Bird Conservation Act; the Fish and Wildlife Act of 1956, as amended; the Fish and Wildlife Coordination Act, as amended; the Emergency Wetlands Resources Act of 1986; and the Alaska National Interest Lands Conservation Act of 1980. Executive orders and proclamations, Secretary’s Orders, public land orders, and refuge-specific legislation generally declare the purpose(s) of the refuge, sometimes broadly (e.g., “as a preserve and breeding ground for native birds”) and sometimes very specifically (e.g., “to protect and preserve in the national interest the Key deer and other wildlife resources in the Florida Keys”).

As written in the Wilderness Act of 1964, the purposes of the Act are to be “within and supplemental” to the purpose(s) of those refuges with designated wilderness. We interpret this to mean the wilderness purposes become additional purposes of the refuge, yet apply only to those areas of the refuge designated as wilderness. Wilderness designations provide additional considerations for determining the administrative and management actions we need to take to achieve a refuge’s purpose(s) on designated wilderness areas within the Refuge System.

Throughout the criteria, the term refuge refers to one or more refuges in the NWRS. Based upon 601 FW 1, a refuge is defined as “...all lands, waters, and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas managed by the Refuge System for the protection and conservation of fish and wildlife, including threatened and endangered species, as determined in writing by the Director of the Service, by Secretary’s Order, or so directed by the President.”

Definitions of refuge management activities and refuge uses derived from the Compatibility policy (603 FW 2.6) that apply to all refuges:

**Table A-1. Weight Applied to Prioritization Criteria.**

The following 13 criteria were weighted by refuge staff at Patoka River NWR (relative values in parentheses with highest values representing criteria that are most important to refuge staff) and used to rank surveys through a Simple Multi-Attribute Ranking Technique (SMART tool).

	<b>Criteria</b>	<b>Station-specific weight</b>	<b>Comparison to even weight</b>
1	CCP or Other Management Plan Objectives	0.15	0.068
2	Management Utility	0.14	0.061
3	FWS Program Need	0.09	0.018
4	FWS Partner Need	0.09	0.018
5	FWS Surrogate Species	0.12	0.039
6	Refuge Processes	0.06	-0.019
7	Survey Breadth	0.03	-0.044
8	Listed Species or Vegetation Communities	0.07	-0.008
9	Controversy	0.02	-0.062
10	Threat	0.08	0.007
11	Baseline Data	0.07	-0.004
12	Spatial Scale	0.06	-0.019
13	Data Management, Analysis, and Reporting	0.02	-0.055

## Appendix B. Prioritization Scores of All Ranked Surveys

Values used to prioritize and select the surveys likely to be conducted through 2031 at Patoka River National Wildlife Refuge. Prioritization scores were generated for candidate surveys by refuge staff using 13 criteria for each survey (Appendix A). Candidate surveys represent specific surveys or general information needs and were not always associated with specific protocols. Groups 1, 2, 3, 4, and 5 represent the >90<sup>th</sup>, >80<sup>th</sup>, >70<sup>th</sup>, >50<sup>th</sup>, and <50<sup>th</sup> percentiles respectively.

**Table B-1** Ranking of priority scores from the SMART tool for all considered surveys.

<i>Survey</i>	<i>Final Rank</i>	<i>Final Score</i>	<i>group</i>	<i>Status</i>
Integrated Waterbird Management and Monitoring	1	<b>0.759</b>	1	Current
Landbird Breeding Bird Survey	2	<b>0.590</b>	1	Historic
Mid-Winter Waterfowl Survey	3	<b>0.557</b>	2	Historic
Mid-Winter Waterfowl Survey (Coordinated Aerial)	4	<b>0.538</b>	2	Historic
International Shorebird Survey	5	<b>0.509</b>	2	Historic
Secretive Marsh Bird Survey	6	<b>0.501</b>	2	Historic
Forest Inventory	7	<b>0.500</b>	2	Historic
Weekly Waterfowl Survey (Coordinated Ground)	8	<b>0.443</b>	3	Historic
Interior Least Tern	9	<b>0.440</b>	3	Historic
Water Quality Monitoring	10	<b>0.426</b>	3	Current
Grassland veg composition	11	<b>0.403</b>	3	Historic
Whooping Crane	12	<b>0.402</b>	3	Historic
Baseline Contaminant Investigation	13	<b>0.375</b>	3	Historic
Breeding Bird Survey	14	<b>0.365</b>	3	Historic
Indiana bat	15	<b>0.329</b>	4	Historic
Rusty Blackbird Blitz	16	<b>0.326</b>	4	Historic
Mobile Acoustical Bat Monitoring	17	<b>0.321</b>	4	Current
North American Amphibian Monitoring Program	18	<b>0.317</b>	4	Historic
Herp Survey	19	<b>0.234</b>	4	Historic
Odonata Survey	20	<b>0.122</b>	4	Historic

## Appendix C. Cost-benefit Analysis

The following table includes results from direct selections and linear programming approaches (all optimized sets). The optimized portfolios used the total of all frequency adjusted scores as an objective function. Main constraints included costs (weeks) and surveys selected prior to solving the linear function (summation of frequency adjusted scores across all surveys). Portfolios represent sets of selected surveys as IMP variants.

Table C-1 Parameters framing IMP portfolios presented in table C-2.

Portfolio	Parameters	staffing level
1	Top-down selection from ranked list	Current
2	Optimized for maximum benefit	Current
3	Optimized constrained to select all group 1	Current
4	Optimized constrained to select all abiotic	Current
5	Optimized constrained to select IWMM	Current
6	Optimized constrained to select Landbird	Current
7	Optimized constrained to select Forest Inventory	Current
8	Optimized constrained to select Water Quality	Current
9	Optimized constrained to select all groups 1&2	Current
10	Top-down selection from ranked list	Full-time biologist
11	Optimized for maximum benefit	Full-time biologist
12	Optimized constrained to select all group 1	Full-time biologist
13	Optimized constrained to select all abiotic	Full-time biologist
14	Optimized constrained to select IWMM	Full-time biologist
15	Optimized constrained to select Landbird	Full-time biologist
16	Optimized constrained to select Forest Inventory	Full-time biologist
17	Optimized constrained to select Water Quality	Full-time biologist
18	Optimized constrained to select all groups 1&2	Full-time biologist
19	Top-down selection from ranked list	Half-time biologist
20	Optimized for maximum benefit	Half-time biologist
21	Optimized constrained to select all group 1	Half-time biologist
22	Optimized constrained to select all abiotic	Half-time biologist
23	Optimized constrained to select IWMM	Half-time biologist
24	Optimized constrained to select Landbird	Half-time biologist
25	Optimized constrained to select Forest Inventory	Half-time biologist
26	Optimized constrained to select Water Quality	Half-time biologist
27	Optimized constrained to select all groups 1&2	Half-time biologist

**Table C-2.** Portfolios (x= selected surveys) were created by direct selections or by solving for optimal sets (maximum benefit within constraints) as described in table C-1. Benefit scores are derived from the ranking results presented in table B-1.

Survey Name	Portfolio																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
IWMM	x		x		x					x		x		x	x	x		x	x		x		x				
Landbird Breeding Bird	x		x			x			x	x	x	x	x	x	x	x	x	x	x	x				x			x
Mid-Winter Waterfowl	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mid-Winter Waterfowl (Aerial)	x				x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
International shorebird	x								x	x	x	x	x	x	x	x	x	x	x	x				x	x		x
Secretive Marsh Bird									x	x	x	x	x	x	x	x	x	x	x								x
Forest Inventory							x			x	x	x		x	x	x		x							x		x
Weekly Waterfowl										x	x	x	x	x	x	x	x	x	x								
Interior Least Tern		x				x	x			x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Water Quality Monitoring				x				x		x			x				x					x					x
Grassland veg composition	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Whooping Crane	x					x				x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Baseline Contaminant	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Breeding Bird	x					x					x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Indiana bat	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Rusty Blackbird Blitz	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Mobile Acoustic Bat											x	x	x	x	x	x	x										
North American Amphibian											x		x				x	x		x	x	x	x	x	x	x	x
Herp		x									x	x	x	x	x	x	x	x		x			x	x			
Odonata	x				x	x					x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x

**Table C-3** Efficiencies in terms of frequency adjusted total benefit for 27 potential IMP portfolios spanning three staffing levels. As of March 2017, it is estimated that the Refuge has less than one week per year to conduct biological surveys due to current staffing levels.

Portfolio	benefit	weeks	# surveys	staffing level
1	0.4	6.70	5	Current
2	1.6	6.10	9	Current
3	1.4	6.70	6	Current
4	1.4	6.60	6	Current
5	1.6	6.60	8	Current
6	1.8	6.40	11	Current
7	1.6	6.70	8	Current
8	1.4	6.60	6	Current
9	0.4	5.30	5	Current
10	1.6	21.20	14	Full-time biologist
11	2.1	18.30	18	Full-time biologist
12	2.1	21.20	18	Full-time biologist
13	2.1	19.10	18	Full-time biologist
14	2.1	21.20	18	Full-time biologist
15	2.1	21.20	18	Full-time biologist
16	2.1	21.20	18	Full-time biologist
17	2.1	19.10	18	Full-time biologist
18	2.1	20.90	18	Full-time biologist
19	0.5	10.50	8	Half-time biologist
20	2.0	9.90	14	Half-time biologist
21	1.9	10.30	13	Half-time biologist
22	1.8	10.00	12	Half-time biologist
23	1.9	10.60	13	Half-time biologist
24	2.0	9.90	14	Half-time biologist
25	1.9	10.20	13	Half-time biologist
26	1.8	10.00	12	Half-time biologist
27	0.4	9.30	6	Half-time biologist



## Appendix D. Estimated Annual Costs for Implementing Surveys

(Surveys with historic status are excluded, NR = survey was added post-prioritization and not ranked).

Survey Name	Survey ID Number (FF03RPTK00-)	Survey Priority	Survey Status	FWS Staff Total	Total Cost
Grassland Vegetation	056	11	Future	\$769	\$769
Integrated Waterbird Management and Monitoring	055	1	Current	\$6,538	\$6,538
Interior Least Tern	001	9	Future	\$962	\$962
Management Actions	058	NR	Current	\$1010	\$1010
Mid-Winter Waterfowl Survey (Ground)	008	8	Future	\$3,037	\$3,037
Mobile Acoustic Bat Survey	010	17	Current	\$1,538	\$1,538
Mercury Deposition	059	NR	Current	\$192	\$192
North American Breeding Bird Survey	015	14	Future	\$962	\$962
Water Quality Monitoring	018	10	Current	\$9,231	\$9,231
Whooping Crane	002	12	Future	\$1,923	\$1,923

## Appendix E. Estimated Annual Work Schedule for Selected Surveys, January – December

(NR = survey was added post-prioritization and not ranked).

Survey Name	Survey ID Number (FF03RCYP00-)	Survey Priority	Jan-March	April-June	July-Sept	Oct-Dec
Mobile Acoustic Bat Monitoring	010	6	P	P, FW, DE	FW, DE, R	A
Integrated Waterbird Management and Monitoring	055	1	FW,DE	A,R	P, FW, DE,	FW,DE
Management Actions	058	NR	FW,DE	FW,DE	FW,DE	FW,DE,A,R
Mercury Deposition	059	NR	~	~	~	DE,A,R
Water Quality Monitoring	018	10	~	FW	FW,A,R	~

P=Planning, T=Training, FW=Field Work, DE=Data Entry, A=Analysis, R=Reporting

\*Denotes Inventory or Monitoring conducted at 2-20 year intervals (not annual work).

## Appendix F. Non-selected Surveys

A status of future denotes surveys that have been prioritized but have low chance of being conducted during the span of the IMP because of low priority or because the capacity to conduct the survey will be difficult to secure. Historic status surveys have been recently completed or discontinued (~ not ranked).

Survey Name	Survey ID Number	Survey Priority	Survey Status
Bald Eagle	FF03RPTK00-003	~	Historic
Baseline Contaminant Investigation of Patoka River Watershed	FF03RPTK00-011	13	Historic
Copperbelly water snake	FF03RPTK00-004	~	Historic
Eastern Box Turtle Translocation Monitoring Survey	FF03RPTK00-019	~	Historic
Grassland Vegetation	FF03RPTK00-056	11	Future
Herp Study	FF03RPTK00-013	19	Historic
Interior Least Tern	FF03RPTK00-001	9	Future
Mid-Winter Waterfowl Survey	FF03RPTK00-004	3	Historic
Mid-Winter Waterfowl Survey (Coordinated Aerial)	FF03RPTK00-007	4	Future
Mid-Winter Waterfowl Survey (Coordinated Ground)	FF03RPTK00-008	8	Future
North American Amphibian Monitoring Program	FF03RPTK00-017	18	Historic
North American Breeding Bird Survey	FF03RPTK00-015	14	Future
Odonata Survey	FF03RPTK00-014	20	Historic
River Float Survey	FF03RPTK00-009	~	Historic
Secretive Marsh Bird Survey	FF03RPTK00-016	6	Historic
Unionid Mussel Survey of the Patoka River	FF03RPTK00-012	~	Historic
Whooping Crane	FF03RPTK00-002	12	Future

## Appendix G. Refuge Condition Summary

This summary can be used as a reporting tool throughout the life of the IMP to track the status, trends, and desired conditions of the selected surveys. Updates to summary can be made during annual reviews and reported in Annual Habitat Work Plans (AHWP).

Updates to this table do not require an IMP revision, but should be uploaded as a digital file associated with the ServCat record that contains the approved IMP.

**Patoka River National Wildlife Refuge- REFUGE SUMMARY TABLE**

**Date of last update: 5/04/2017**

Resource Theme Level 1 <sup>1</sup>	Resource Theme Level 2 <sup>1</sup>	Attribute <sup>2</sup>	Current Condition (values) <sup>3</sup>	Source of Current Condition <sup>4</sup>	Desired Condition (values) <sup>5</sup>	Source of Desired Condition <sup>6</sup>	Within Desired Condition ? <sup>7</sup>	Survey Name and PRIMR ID (FF03RPTK00) <sup>8</sup>
Biological Integrity	At-risk Biota	Bat occupancy	unknown	unknown	TBD	TBD	TBD	Mobile Acoustic Bat Monitoring (010)
Biological Integrity	Other Biota	Waterbird abundance during non-breeding periods	TBD	TBD	TBD	TBD	TBD	Integrated Waterbird Monitoring and Management (055)
Biological Integrity	Other Biota	Restoration activities	TBD	TBD	TBD	TBD	TBD	Management Actions (058)
Air and Climate	Air Quality	mercury deposition, ng/m2	.009 pounds/acre	MDN	TBD	TBD	TBD	Mercury Deposition Monitoring (059)
Air and Climate	Water Quality	sulfate	TBD	TBD	TBD	TBD	TBD	Mercury Deposition Monitoring (059)

<sup>1</sup> Level 1 and 2 refer to the PRIMR Resource Themes 1 and 2 and cannot be altered.

<sup>2</sup> Characteristics of a system that are of interest of survey and can be observed or estimated. Biodiversity, abundance, survival, growth rate, habitat quality, and harvest rate are all system attributes that a monitoring program might seek to quantify.

<sup>3</sup> If known, current conditions of system being measured at the ten Priority 1 Units according to HMP.

<sup>4</sup> Document in which current condition is reported. If not available enter "unknown" or "N/A".

<sup>5</sup> Desired conditions of system being measured.

<sup>6</sup> Document in which desired condition is reported. If not available enter "unknown" or "N/A". <sup>7</sup> Does the current condition and desired condition match? YES/NO/To Be

Determined (TBD) <sup>8</sup> Survey name should match PRIMR record.

## Appendix H. Environmental Action Statement (EAS)

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other 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 Patoka River National Wildlife Refuge. This IMP is a step down plan from the 2008 Comprehensive Conservation Plan and associated Environmental Assessment (EA) for the Refuge. This IMP provides more-specific guidance for surveys of Refuge's fish, wildlife, plant, habitat, and abiotic resources to fulfill the Refuge's purposes and help achieve Refuge's goals and objectives.

The EA for Patoka River NWR CCP included goals and objectives for the refuge and assessed the impacts associated with a range of reasonable alternatives to achieve those goals and objectives. The rationale for selection of one specific alternative for implementation is explained in the Finding of No Significant Impact (FONSI) accompanying the final CCP. The goals, objectives, and survey strategies included in this IMP fall within the bounds of those described and assessed in the CCP and EA or EIS.

Pursuant to 40 CFR 1502.9, no additional NEPA documentation is required to implement this IMP beyond the EA and FONSI prepared concurrently with the CCP. No substantial changes to the proposed action alternative that was identified, analyzed, and selected for implementation within the CCP, EA, and FONSI are proposed through this IMP. Similarly, no significant new information or circumstances exist relevant to environmental concerns and bearing on the proposed action or its impacts.

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

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

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Project Leader/Refuge Manager

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Date

*[Note: this signature and dating is not required if a statement is placed below the IMP signature page indicating that the Project Leaders signing of that page applies to all contents of this IMP].*

Reference: U.S. Fish and Wildlife Service. 2008. *Environmental Assessment of the Comprehensive Conservation Plan For Patoka River National Wildlife Refuge*. USFWS Region 3. Bloomington MN.

## Appendix I. IMP Revision Signature Page

### IMP Revisions Patoka River 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	