
MONITORING AND EVALUATION REPORT

SHAWNEE NATIONAL FOREST
FISCAL YEARS 2016 AND 2017

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Executive Summary

This report includes monitoring results and conclusions associated with the 2006 Shawnee National Forest Land Management Plan for fiscal years 2016 and 2017 (Table 1). In some cases, monitoring data from previous years is included to provide more of a baseline context for trend analysis.

Trend analysis informs leadership if there is a need to amend the Forest Plan. At this time, there is no recommendation to amend the Forest Plan.

Implementation of management actions is critical to moving conditions toward desired conditions in the Forest Plan. It is recognized that in some cases, the Forest is limited by personnel, funding and priorities for projects that could achieve desired conditions. As one example, the Forest experiences a high use of recreational visitors conducting various activities and that use is continuing to grow and evolve. Trail maintenance funding and staffing is limited and therefore cannot always address the full spectrum of needs.

In places where management does implement projects, Plan monitoring will continue to take place, develop conclusions and build trend analysis. For the future, there will always be a continual effort to implement projects and move toward forest plan goals.

Table 1. Monitoring themes and conclusions

Status of Select Watershed Conditions		
Question	Monitoring Theme	Conclusion
1	Public Water Supply Reservoir	Objectives for management actions and projects in water supply watersheds are based on improving water quality and improving watershed health. Best management practices are incorporated into projects to protect water supply watersheds. Partnership efforts at the landscape scale are important to improving water quality in water supply watersheds.
2	Water Quality	Projects that included a stream or wetland were designed to maintain and improve soil and water resources and incorporate best management practices.
3	Water Quantity	Stream channel structure work and stream flow regime work incorporates best management practices and Forest Plan standards/guidelines.
4	Aquatic Biota	Aquatic restoration projects are being planned and implemented to maintain aquatic biota across the Forest.
5	Riparian and Wetland Vegetation	This question was not monitored in 2016 or 2017 due to a shortage of personnel.
6	Travel ways	This question was not monitored in 2016 or 2017 due to a shortage of personnel.

7	Soils	Best management practices are incorporated as design features in projects and activities on the Forest to prevent or abate soil erosion.
Status of Select Ecological Conditions including key characteristics of Terrestrial and Aquatic Ecosystems		
8	Aquatic Habitat Quality	This question was not monitored in 2016 or 2017 due to a shortage of personnel.
9	Mississippi River Hydrologic Regime	Best management practices are incorporated in wetland maintenance, restoration and improvement projects. Annual wetland floodplain projects are implemented and are highly successful in restoring seasonally-flooded wetland habitats in the Mississippi floodplain Management Area of the Shawnee National Forest.
10	Natural Areas Unique Features	This question was not monitored in 2016 or 2017 due to a shortage of personnel.
11	Fire-Adapted Communities	Almost 60,000 acres of projects in fire-adapted communities are approved for implementation across the Forest demonstrating the prioritization to conserve the communities. In 2017, slightly more than 7,000 acres were implemented. Implementation is expected to increase over the years.
12	Species Richness Plants	Vegetation projects are designed to promote biodiversity by facilitating more sunlight and using prescribed fire. This combination has been shown to increase native species richness.
Status of Focal Species to Assess Ecological Conditions		
13	Pileated Woodpecker, Red-headed Woodpecker and Prothonotary Warbler	The trend for both pileated woodpecker and prothonotary warblers had stable or increasing populations in recent and past monitoring summaries. The nomadic red-headed woodpecker was too scarce and variable to draw any conclusions, other than that it persists on the forest.
Status of Select Set of Ecological Conditions to Contribute to Recover of At-Risk Species		
14	Barrens, Glades, and Prairies	Projects designed to maintain and improve at-risk plants at barrens, glades, and prairies are being implemented. Monitoring continues in order to assess the ecological value of these efforts.
15	Upland and Oak-hickory Forest	Projects designed to maintain and improve at-risk plants at barrens, glades, and prairies are being implemented. Monitoring continues in order to assess the ecological value. Barrens, glades and prairies of the Shawnee National Forest would likely benefit from renewed efforts to treat natural area communities with prescribed fire, small tree and brush removal and other treatments, giving preference to sites containing the above listed species.

		Monitoring these areas pre and post-treatment would lend itself to a focused citizen science effort.
16	Dry-mesic and Mesic Hardwood Forests	Dry-mesic and mesic hardwood forests are supporting bats with what appears to be ample habitat. Bat populations appear to be impacted by white-nosed syndrome more than a limitation on habitat.
17	Wetlands, Swamps, Forested Wetlands, Floodplain Forests, Caves	Management projects are implemented to promote sustainability of the bottomland hardwood ecosystem. Based on bat populations it appears that wetlands, swamps, forested wetlands, floodplain forests and caves are being protected and enhanced across the forest.
18	Streams	This question was not answered in 2016 or 2017 due to a shortage of personnel.
19	Openlands	Implementation of restoration and enhancement activities has improved the quality of open grassland habitats. Continuing management activities are needed to maintain the ecological character of openlands.
20	Cliffs	The cliff rare plant populations monitored appear to be stable.
21	Seeps, Springs and Caves	Woody succession, changes in hydrology, and invasive plants have altered the character of the seeps and springs which in turn is changing the plant composition of seep springs. Management projects implement standards and guidelines to protect native plants although management actions have not kept pace with the restoration needs.
Status of Visitor Use, Visitor Satisfaction and Progress Toward Meeting Recreation Objectives		
22	Recreation demand	There are about 450,000 recreational visits to the Shawnee National Forest each year and 78% of visitors rated their experience "Very Satisfied". Recreation interests, activities and partnerships are growing.
23	Recreation Facility Health and Safety	Monitoring showed almost 89% of facilities monitored rated as good.
24	Level of Use of Trail System	Between 2016 and 2017, 372 miles of trail were maintained.
25	Wilderness Management	Published results from the last National Visitor Use Monitoring exit surveys (2013) indicate that in general visitors to designated wilderness in the Shawnee National Forest are satisfied with their experience.
Measurable Changes in the Plan Area Related to Climate Change and Other Stressors		
26	Stream Temperature	Baseline data is being developed for future trend analysis.
27	Invasive Species Control	Management actions are being implemented to limit the spread of invasive plant species in natural areas although eradication has not been achieved.

Progress Toward Meeting Forest Plan Desired Conditions and Objectives, Including Providing Multiple-Use Opportunities

28	Quantitative Performance of the Forest Plan	Based on a review of work accomplished from 2006 through 2017, implementation of the Forest Plan is not meeting the anticipated levels of outputs for various management activities.
29	Species of Recreational Interest	Based on harvest numbers for deer and turkey, these species have adequate habitat to support current populations. Favorable habitat conditions were present for waterfowl although annual harvest data is not tracked.
30	Heritage Resources	<p>Monitoring of heritage resources indicates:</p> <ul style="list-style-type: none"> significant sites and historic properties are being identified prior to project implementation potential effects to heritage resources are being predicted in analysis documents existing conditions of significant sites are being maintained <p>No heritage sites were damaged or otherwise disturbed by project implementation in fiscal years 2016 and 2017. Existing monitoring methods are adequate to meet the identification and protection goals for Heritage Resources prior to project decisions as well as maintaining existing conditions of significant sites identified as Priority Heritage Assets (Heritage Resource Significant Sites Management Prescription).</p>

Effects of (Timber) Management Systems to Determine They Do Not Substantially and Permanently Impair Productivity of the Land

31	Timber Harvest Program	Monitoring of a timber sale shows soil productivity is being protected during project implementation.
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Contents

CIVIL RIGHTS	I
EXECUTIVE SUMMARY	II
1. PUBLIC WATER-SUPPLY RESERVOIR	1
2. WATER QUALITY	4
3. WATER QUANTITY.....	5
4. AQUATIC BIOTA	6
7. SOILS.....	7
9. MISSISSIPPI RIVER BOTTOMLAND HYDROLOGIC REGIME.....	7
11. FIRE ADAPTED COMMUNITIES	9
12. SPECIES RICHNESS - PLANTS.....	11
13. PILEATED WOODPECKER, RED-HEADED WOODPECKER AND PROTHONOTARY WARBLER	12
14. BARRENS, GLADES AND PRAIRIES.....	14
15. UPLAND AND OAK-HICKORY FOREST	19
16. DRY-MESIC AND MESIC HARDWOOD FORESTS	22
17. WETLANDS, SWAMPS, FORESTED WETLANDS, FLOODPLAIN FORESTS AND CAVES.....	24
19. OPENLANDS	28
20. CLIFFS.....	31
21. SEEPS, SPRINGS AND CAVES.....	34

22.	RECREATION DEMAND.....	37
23.	RECREATION FACILITY HEALTH AND SAFETY	38
24.	LEVEL OF USE OF TRAIL SYSTEM.....	38
25.	WILDERNESS MANAGEMENT	39
26.	LONG-TERM STREAM TEMPERATURE MONITORING.....	41
27.	INVASIVE SPECIES CONTROL	42
28.	QUANTITATIVE PERFORMANCE OF THE FOREST PLAN	43
29.	SPECIES OF RECREATIONAL INTEREST	45
30.	HERITAGE RESOURCES	47
31.	TIMBER HARVEST PROGRAM	48

Monitoring Results

1. Public Water-Supply Reservoir

- Is water quality being maintained/improved?
- Is upstream agricultural runoff being mitigated?

Methods

Restoration of Hydrological Conditions: Determine if the subject watersheds are being improved or if impairments have been corrected by projects in the previous year. Review miles of streambank or gully erosion and shoreline stabilization repair for the application of best management practices and the effectiveness of the practices implemented.

Implementation of Water-Supply Watersheds Standards and Guidelines: Management emphasis of Water-Supply watersheds is on the protection of water supplies through implementation of filter-strip guidelines, best-management practices, shoreline-stabilization and the careful consideration of new road construction. Management activities will be reviewed to determine if best management practices and guidelines have been implemented and effective in maintaining or improving water quality.

Mitigation of Agricultural Runoff: The ownership pattern in water supply watersheds is a patchwork of private and public land. Working with partners, such as the Natural Resources Conservation Service and the City of Carbondale, allows us to comprehensively address watershed issues that impact water quality. Only by looking at the erosion and sedimentation sources from all lands in the watershed can we truly reduce the substantial sediment sources. Private land activities that improve water quality will be summarized.

Observations, Results, Trends

Restoration of Hydrological Conditions: Several projects were implemented from 2015-2016 in Kinkaid Lake and Cedar Lake watersheds which are managed under the water supply watershed management prescription in the Forest Plan (Table 2). These projects were designed to improve drainage system stability, reduce erosion and improve water quality and were monitored in 2016 and 2017.

Table 2. Summary of streambank, gully and shoreline stabilization work completed in Water Supply Watersheds in 2015 and 2016.

Water Supply Watershed	Projects	Accomplishments
Kinkaid Lake	Morber Lane	0.8 miles of streambank stabilization
Kinkaid Lake	Johnson Creek	0.4 miles of streambank stabilization
Kinkaid Lake	Taylor Road	0.9 miles of gully stabilization
Kinkaid Lake	Shoreline stabilization	1.0 mile of shoreline stabilization

Kinkaid Lake	NRCS -Private Lands	0.6 miles of streambank stabilization
Cedar Lake	Shoreline stabilization	3.0 miles of shoreline stabilization
Cedar Lake	Landreth Road	2.9 miles of gully stabilization
Cedar Lake	Little Cedar Lake Road	1.7 miles of gully stabilization
Lake of Egypt	No projects implemented	Not applicable

The Shawnee’s partnership with Kinkaid Reeds Creek Conservancy District is working to reduce sedimentation into Kinkaid Lake. Streambank stabilization and gully plugs were installed at Morber Lane, restoring 0.8 miles of stream. At Johnson Creek, streambank stabilization was completed on about 0.4 miles of streambank in 2015. Additionally, about 20 gully plugs were installed in two stream drainages off Taylor road, rehabilitating 0.9 miles of gully erosion. About 1 mile of Kinkaid Lake shoreline was stabilized with rock in 2016.

The Forest is working on a similar project with the City of Carbondale on Cedar Lake, where erosion and sedimentation are also management concerns throughout the watershed. Three large gully plugs were installed at Landreth Road and about 20 smaller gully plugs were installed along stream drainages north of Little Cedar Lake Road.

Through this partnership, Forest Service funds were combined with Environmental Protection Agency funding and City of Carbondale funds to accomplish about 3 miles of shoreline stabilization.

Field monitoring of projects in the Kinkaid and Cedar Lake watersheds (6/12/17 and 5/9/17, respectively) found that most of the structures are improving water quality at the project sites. Shoreline stabilization directly prevents sediment from entering the lake from the shorelines. Gully plugs and streambank stabilization reduce the amount of sediment input from the watershed which clearly improves water quality. Sediment is building up behind structures, as intended, and visual observations confirm that sediment is being trapped. Stream channel erosion is also reduced upstream from the structures.

Implementation of Water-Supply Watersheds Standards and Guidelines: Monitoring also indicated that best management practices and water-supply watersheds standards and guidelines were properly implemented (or applied). These activities were found to be effective at reducing erosion and sedimentation delivered to the lakes.

In early 2017, a tornado toppled about 350 acres of trees in a portion of the Kinkaid watershed. Salvage harvest operations began in 2017 which typically expose soils on skid trails and log landings. Monitoring indicated that best management practices and water-supply watersheds standards and guidelines were properly implemented (or applied). Riparian filter strips were implemented, stream crossings were minimized, and forest slash was placed in temporary operation trails to stabilize soil (photos below). The log landing was rehabilitated by seeding. These practices were effective in minimizing erosion and sedimentation impacts to the streams and the lake.



Photo monitoring the Kinkaid Salvage Project highlighting the use of down woody debris to prevent erosion at a stream crossing and within the salvage area. Pictures display the sites in 2017 and after one year.

Mitigation of Agricultural Runoff: As part of a joint project with the NRCS, about 0.6 miles of streambank were stabilized in Little Kinkaid Creek. NRCS also completed conservation planning efforts with 46 private landowners in the watershed. Additionally, many conservation practices, such as cover cropping, fencing, and nutrient management, were implemented under the Environmental Quality Incentives Program. Similarly, working with the City of Carbondale and addressing impacts from City property and private lands has benefitted water quality. These efforts improve water quality by reducing the impacts of agricultural runoff and impacts from other lands in the watershed. Cooperative cross-boundary watershed efforts are needed to address water quality concerns.

Conclusions:

Objectives for management actions and projects in water supply watersheds are based on improving water quality and improving watershed health. Best management practices are incorporated into

projects to protect water supply watersheds. Partnership efforts at the landscape scale are important to improving water quality in water supply watersheds.

2. Water Quality

- Is water quality being maintained/improved?

Methods

Restoration of Hydrological Conditions: Determine if quality of watersheds across the forest are being maintained or if any impairments have been corrected by projects in the previous year. Review miles and acres of streambank or gully erosion restoration.

Management emphasis of the Forest Plan for soil and water resources states the following:

Soil productivity, water quality and the integrity of riparian ecosystems and water-supply watersheds will be maintained and/or enhanced through non-point water-pollution-control methods found in the best-management practices supported by state and federal agencies and coordinated with the US Environmental Protection Agency. These practices are incorporated into Forest-wide and specific management standards and guidelines or incorporated by reference. Groundwater, lakes, rivers, streams, springs, wetlands and other bodies of water will be protected. Degraded aquatic and riparian ecosystems will be restored, as will the hydrologic condition of watersheds that were degraded by historic land uses.

The bare-soil exposure limit is ten percent of each 150-foot linear segment of filter-strip width. This applies to ground-disturbing activities within 100 to 300 feet of perennial streams, 50 to 150 feet of intermittent streams and 25 feet of ephemeral streams.

Observations, Results, Trends

In 2016, both Harris Branch and Ramsey Branch timber sales were monitored. Filter strips, water bars and placing slash on skid roads were implemented and effective at minimizing impacts to the streams.

Stream habitat improvement and stream bank stabilization at Hutchins Creek restored about 4.5 miles of stream. Similar efforts at Big Creek in Hardin County restored about 3 miles of stream. Monitoring showed that best management practices and standards and guidelines were properly implemented and were effective at minimizing construction impacts from installation of the stream habitat improvement, erosion stabilization and water control structures.

Two wetland sites were improved along the Big Muddy River (82 acres) and several units were improved at Oakwood Bottoms (816 acres). These wetland maintenance and restoration projects are meant to improve water retention during large rain events. Water quality is also improved as water passes through these wetland swamps and sediment settles out.

Conclusion

Projects that included a stream or wetland were designed to maintain and improve soil and water resources.

3. Water Quantity

- How many miles/acres of stream channel or watershed have been improved?
- Is water flow un-impeded?

Methods

Evaluate implementation and effects watershed improvement projects have on watershed conditions.

Observations, Results, Trends

The 2016 Fish and Farmers Habitat Project accomplished streambank stabilization on both private and federal land in the Hutchins Creek watershed. Six sites were identified for installation of large wood and/or rock to reduce streambank erosion while protecting public and private assets, improve instream habitat conditions, improve water quality and to showcase watershed restoration techniques for local landowners. This project restored about 4.5 miles of stream (Table 3).

Erosion was addressed along Big Creek at two Hardin County sites. One site is north of Illinois Iron Furnace, where the stream channel was shifting east, causing the stream bank to erode. Utility poles in an adjacent right-of-way were moved multiple times due to bank erosion. The other site is downstream of the Big Creek Bridge, where a swimming hole is a high-use area for recreation. The eroding bank was stabilized by installing a cross-vane rock structure. In 2017, the structure was re-worked to allow for fish passage. This project stabilized the bank while benefiting recreation and allowing for fish passage. The project restored about 3 miles of stream (Table 3).

Table 3. Summary of stream and wetland work completed in 2016 and 2017.

Watershed	Project	Accomplishments
Hutchins Creek	Fish and Farmers Fish Habitat	4.5 miles of streambank stabilized
Big Creek	Ohio River Basin Fish Habitat	3 miles of stream restored
Edmondson Slough/Sexton Creek	Colyer Levee Repair	75 acres of wetland improved
Edmondson Slough/Sexton Creek	Farmer Home Repair	90 acres of wetland improved
Town Lake/Big Muddy	Turkey and Brushy Bayou Repair	82 acres of wetland improved
Town Lake/Big Muddy	Big Muddy Oxbow Restoration	45 acres of wetland improved
Town Lake/Big Muddy	Cemetery Road Wetland Restoration	65 acres of wetland improved

Three priority watersheds are identified in the Watershed Condition Framework, including Edmondson Slough/Sexton Creek, Town Creek/Big Muddy River, and Harrison Creek/Clear Creek. Work has been accomplished in two of these watersheds during fiscal years 2016 and 2017.

In the Edmondson Slough/Sexton Creek watershed, a project to repair and fortify a levee at the Colyer Tract was accomplished. An undersized water control structure was replaced with a larger structure and spillways were built into the levees to take pressure off most of the levee during high water. These fortified spillways should prevent further levee degradation. This work will help maintain a flooded

wetland of about 75 acres (Table 3). Similar work was accomplished at a 90-acre wetland on the Farmers Home Tract in Alexander County.

In the Town Creek/Big Muddy River watershed, three watershed restoration projects were accomplished. New water control structures were installed at Turkey Bayou and Brushy Bayou enhancing about 82 wetland acres (Table 3). As part of a Duck's Unlimited National Waterfowl Conservation Act project, a head cut at an oxbow along the Big Muddy was also repaired, which floods an additional 45 acres (Table 3). Additionally, water control structures were installed at Cemetery Road in partnership with Ducks Unlimited and a local farmer which floods about 65 wetland acres (Table 3).

Conclusion

Stream channel structure work and stream flow regime work incorporates best management practices and Forest Plan standards/guidelines.

4. Aquatic Biota

- What is the species distribution in sampled streams, ponds and lakes?

Methods

Subjective analysis utilizing various measures, including reports on habitat conditions, species monitoring and annual accomplishment data. Habitat improvement projects will be evaluated for application and effectiveness of best management practices used during construction and the effectiveness of the projects in accomplishing the objectives.

Observations, Results, Trends

Aquatic habitat restoration projects were completed on Hutchins Creek and Big Creek because channel degradation was identified as a resource concern. Best management practices were reviewed in 2017 to assess their effectiveness at the project site.

At Hutchins Creek, the project used an excavator to reshape streambanks and place rock to prevent future erosion of the streambanks. Hutchins Creek is a clear-flowing Ozark-type stream with a healthy aquatic population. Species richness is high, with 33 fish species, 9 mussel species and 5 species of crayfish (Table 4). The fish species such as the darters, sculpins and madtoms are clean water fish, indicating a healthy stream.

At Big Creek, an upstream facing V rock structure was installed and designed to funnel the water down the middle of the channel. The streambanks were rocked and improved the bank stabilization by armoring it to reduce erosion. Additionally, the pool depth was increased by about a foot and additional edge habitat was flooded, which is important for small fish to have refugia from large predators. This project restored about 3 miles of stream. Big Creek is also a clear-flowing stream with a healthy population of aquatic organisms. Species richness is correspondingly high, with about 42 fish species (Table 5) and 14 mussel species found in the watershed recorded prior to 2014. Darters, sculpins and madtoms are also found in Big Creek.

The work was accomplished during a period of dry weather and was successful in reducing impacts to the stream system. The projects effectively accomplished their objectives and moved these areas toward their Forest Plan desired condition.

Conclusion

Aquatic restoration projects are being planned and implemented to maintain aquatic biota across the Forest.

7. Soils

- Is soil protected during management, recreation activities?

Method

Subjective analysis and documented observations of effects of management projects we conduct. Review erosion controls on the projects implemented on the forest.

The Forest Plan provides standards and guidelines for protection of soil resources. The key standards are as follows:

FW25.3 (Standard) Restoration – All disturbed areas that could cause significant impairment of the productivity of Forest land, downstream water resources, or aquatic and/or riparian habitat shall be promptly restored.

FW25.5 (Standard) Equipment Limitations – Soil-type, land-slope and soil-moisture content shall be considered in determining equipment-use restrictions.

FW25.6 (Standard) Disturbance Limitations – Activities shall be designed and located to limit the timing, degree and/or duration of soil disturbance to the inherent capability of the soils involved.

Observations, Results, Trends

The trail system at Lusk Creek allows equestrian use and foot traffic along designated trails. Designated trails at Lusk Creek Wilderness are closed to riding and pack animals for at least 24 hours following 1 inch of rain or more within a 24 hour period, which helps to protect soil.

Trail 405 in the Lusk Creek Wilderness was rerouted to replace a system of braided trails that followed a historic roadbed that was not designed to minimize soil disturbance. Multiple switchbacks were added on areas of steep topography, along with water bars on slopes to divert water from the trail and lessen the erosive force of concentrated water. Monitoring revealed best management practices were properly implemented in the design and construction of the rerouted trail.

Conclusion

Best management practices are incorporated as design features in projects and activities on the Forest to prevent or abate soil erosion.

9. Mississippi River Bottomland Hydrologic Regime

- Is soil protected during management, recreation activities?

Method

Subjective analysis and documented observations of effects of management. Data from various sources: reports regarding quality of habitat, conditions, trends and other elements. Acres of wetlands restored, improved, and maintained are discussed below.

Observations, Results, Trends

In the bottomland hardwood ecosystem management area, 1,400 acres of stand improvement and 400 acres of reforestation were implemented in 2016 and 2017. Species planted include bald cypress, swamp white oak, water hickory, pin oak and cherrybark oak. Reforestation success rates are monitored through stocking surveys. Surveys show success is directly dependent on hydrologic conditions in the floodplain. In years of high-water conditions and flooding, survival of planted trees was low and higher in years where more normal hydrological conditions occurred.

Annually, 125 water-control structures were maintained or managed on wetland restoration sites located within the Mississippi River floodplain. Of these, 98 are located at Oakwood Bottoms Greentree Reservoir, with 27 structures located on four other restored or managed wetland sites.

Wetlands

Restored: Cemetery Road wetland was restored working collaboratively with Ducks Unlimited and Fish and Farmers Fish Habitat Partnership. Ninety acres of wetland restoration occurred at Cemetery Road in 2017. This wetland is an inline working wetland that filters private cropland runoff and uptakes excessive nutrients to prevent it from entering the Big Muddy River. Monitoring showed that best management practices and standards and guidelines were properly implemented. The wetland functions well and the restoration moves the area towards the desired condition.

Improved: Brushy and Turkey Bayous were improved by putting in new concrete culverts with stop log structures. This project, completed in 2016, improved 143 acres of bayou habitat at Turkey Bayou and Brushy Bayou. This work was accomplished in partnership with Ducks Unlimited. Best management practices and standards and guidelines were properly implemented. The structures were put into place to minimize erosion during flooding events and the stop log structures enable water control to provide permanent wetland habitat.

Maintained: Oakwood Bottoms, LaRue, East Cape and Worthen Bayou wetlands were maintained. These wetland areas are either actively or passively managed. Oakwood Bottoms is a 3,700-acre greentree reservoir that is actively managed for wetland habitat. Berms of units 19, 20 and 21 of the units were reshaped and new water structures put in place. This work was completed in partnership with Ducks Unlimited and National Wild Turkey Federation through a North American Wetlands Conservation Act grant. This project was started in 2015 and completed in 2017.

Conclusions

Best management practices are incorporated in wetland maintenance, restoration and improvement projects. Annual wetland floodplain projects are implemented and are highly successful in restoring seasonally-flooded wetland habitats in the Mississippi floodplain Management Area of the Shawnee National Forest.

11. Fire Adapted Communities

- How many acres are under prescriptions?
- Are fire-adapted communities being conserved?

Method

Subjective analysis utilizing various measures, including reports on habitat conditions, fire monitoring and species monitoring.

Observations, Results, Trends

Table 4 shows 59,166 acres were analyzed for prescribed fire, based on decisions made under the National Environmental Policy Act (Table 6). In 2017, about 7,021 acres were implemented including 1,667 acres of openland habitat. Openland burns successfully reduced dense thatch while inhibiting invasive species, especially Japanese honeysuckle and multi-flora rose. However, many woody stems seem to species of brush and small trees persist post prescribed fire, suggesting that dormant season burning may be less effective at controlling woody species.

In response to the concern of woody encroachment in our openlands, we conducted about 50 acres of growing season burns to reduce those species. Growing season burns also favor forbs and appear to be improving the diversity found in these habitats. Similarly, growing season burns delay flowering and can increase fall and winter food sources for wildlife. Observations of these burns in the weeks following burning has been encouraging. Woody growth including sumac and autumn olive was killed at a much higher percentage than we find in our dormant season spring burning.

We burned about 3,660 acres for oak regeneration and invasive species control, mostly in upland hardwoods. Observations indicate that hotter, drier conditions at the time of the burn were better for oak regeneration but even fires at the cooler part of the prescription provided benefits. About 1,575 of the 3,660 acres burned for oak regeneration and invasive species control were in the bottomlands. These bottomland fires were used to eliminate competition and favor oak development in the floodplain hardwood forest. Based on observations, the objectives of oak regeneration and invasive species control were accomplished for the 2017 burns.

About 60 acres were burned on the Johnson County Landfill (56 ac) and Lake Glendale Dam (4 ac). These maintenance burns have proved successful in the objective of keeping woody species off the landfill and dam.

Nearly 600 acres of prescribed fire in the LaRue-Pine Hills Natural Area were burned to preserve the unique pine and oak habitat. The burn was successful in consuming fine fuels and killing some small undesirable woody species such as amur honeysuckle and Japanese honeysuckle. Many small locust, ash and maple trees were killed even though the fire did not burn hot enough to consume the entire leaf litter layer on the forest floor – an important consideration on steep slopes. While conditions varied throughout the unit, overall, the fire accomplished project objectives.

Table 4. Summary of 2017 approved Prescribed Fire sites (bolded acres were implemented in 2017)

<p><u>Openlands Projects</u> Ashby E. Bebout Inagheh McConnel Pennant Bar S Rothamel State of Illinois Tract TPL Tract Turpen Tract Walters Tract W West Tract ac White Tract Wilson Tract</p> <p><u>Oak/Hickory Regeneration & Wildlife</u> Bear Branch Beaver Big Boaz Big Muddy Cedar Grove Cement Hollow Clayton Hollow Condro Delwood Road Dial Eagle Mountain Ederle Gorham Harris Branch Lee Mine Lusk New Hope Oakwood Bottoms One Horse Gap Pyle Qualls Ramsey Teal Pond Trigg Lookout Walnut Grove Waters Whiteside</p>	<p><u>Natural Areas</u> Atwood Ridge Ava Barker Bluff Bell Smith Springs Bulge Hole Cave Hill Copperous Branch Cretaceous Hills/Dean West Dennison Hollow Fink Sandstone Fountain Bluff Gibbons Creek Jackson/Double B Hole Keeling Hill N & S Kickasola/Massac Tower/Poco East/Poco North LaRue-Pine Hills Leisure City Odum Tract Opossum Trot Ozark Hill Prairie Panther Hollow Pleasant Valley/Pope County Landfill/Reddick Hollow Reid’s Chapel Russell Cemetery Simpson Barrens Stoneface Whoopie Cat Wolf Creek</p>	<p><u>Invasive Species – Cultural/Fire</u> Azotus Kudzu site Blowdown Buttermilk Hill Boat Ramp Cedar Lake Kudzu E. Dogwood Flats Kudzu McCormick Kudzu North Lusk Creek Kudzu</p> <p><u>Growing Season Burns – Inagheh</u> Glendale Dam McConnel Tract Pennant Bar</p> <p><u>Maintenance of Dams and Landfills</u> Johnson Creek Johnson Landfill Glendale Dam Pope County Landfill</p>
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Conclusions

Almost 60,000 acres of projects in fire-adapted communities are approved for implementation across the Forest demonstrating the prioritization to conserve the communities. In 2017, slightly more than 7,000 acres were implemented. Implementation is expected to increase over the years.

12. Species Richness - Plants

- Based on monitoring results, is biodiversity being protected by Forest Plan Standards and Guidelines?

Method

Subjective analysis utilizing various measures, including reports on habitat conditions and suitability, species monitoring and annual accomplishment data from FACTS and ArcMap databases. Following project implementations, monitor sites to determine the density of native and invasive species present.

Observations, Results, Trends

Native Plant Species: Vegetation monitoring has been going at the site which was later known as the Harris Branch timber sale site since 2005. Since that time the canopy cover of the project area has been reduced through harvest followed by a prescribed fire.

After the commercial harvest but prior to the prescribed fire, the non-native invasive species Nepalese browntop (stiltgrass) and Japanese honeysuckle increased (see the November 2015 photo below). During FY17, a prescribed fire at the site yielded a dramatic reduction of these two aggressive species and native grasses and forbs were observed along with oak and hickory seedlings (photos below).

In combination, the harvest and burning resulted in more than double the number of native species. The burning promoted the native species. Species richness was improved by project implementation (Figure 1).



November 23, 2015
Non-native invasive

September 15, 2017
Native joe-pye weed, asters, big

Nepalese browntop(stiltgrass)
(Before Prescribed Fire)

bluestem, little bluestem and
goldenrods (after Prescribed Fire)



Native ticktrefoil

Native devil's darning needles

Photos. Botanical conditions at Harris Branch before and after management activities.

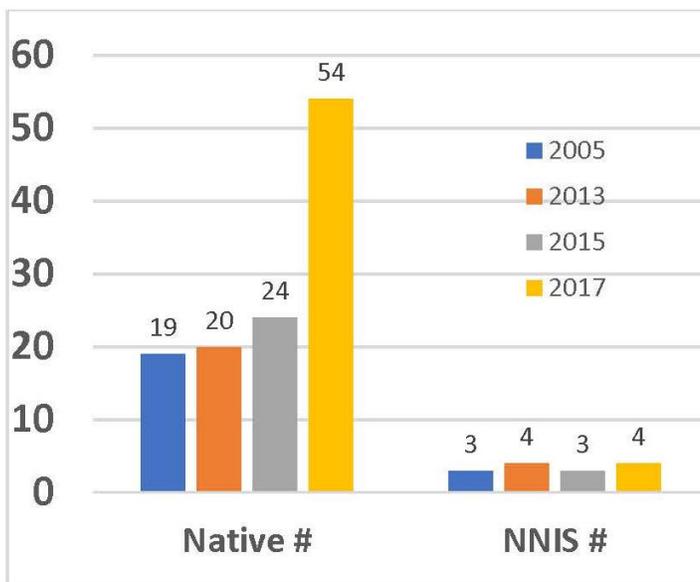


Figure 1. Plot 19 data from Harris Branch site. Post management includes 2015 and 2017.

Conclusions

Vegetation projects are designed to promote biodiversity by facilitating more sunlight and using prescribed fire. This combination has been shown to increase native species richness.

13. Pileated Woodpecker, Red-headed Woodpecker and Prothonotary Warbler

- What are the population trends for these species?

Methods

Forest bird monitoring has been conducted for many years in cooperation with the Cooperative Wildlife Research Laboratory at Southern Illinois University.

Observations, Results, Trends

Monitoring, since 1989, indicated that Pileated woodpecker populations had a stable or increasing trend (Table 5 and Figure 2). Pileated woodpecker has large population sizes across the forest. Dead and deteriorating live trees provide favored sites in which to excavate nest cavities, and hollow trees are typically used to roost in at night. There is an abundance of such habitat across the forest.

Table 5. Breeding bird survey results on the Shawnee National Forest

Species	1989-2003	2005-2009	2009-2013	2014-2017
Pileated woodpecker	Increase	Stable	Increase	Stable
Red-headed woodpecker		Unknown	Unknown	Unknown
Prothonotary warbler		Increase	Stable	Stable

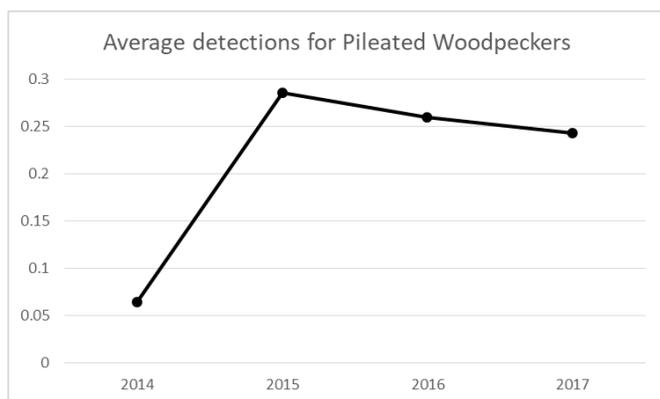


Figure 2. Average detections of Pileated Woodpeckers across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Red-headed woodpecker abundance was too low and too variable to estimate accurate population trends but detections are reported (Figure 3). Red-headed Woodpeckers can be nomadic and difficult to survey because they nest in snags, an ephemeral resource across the landscape.

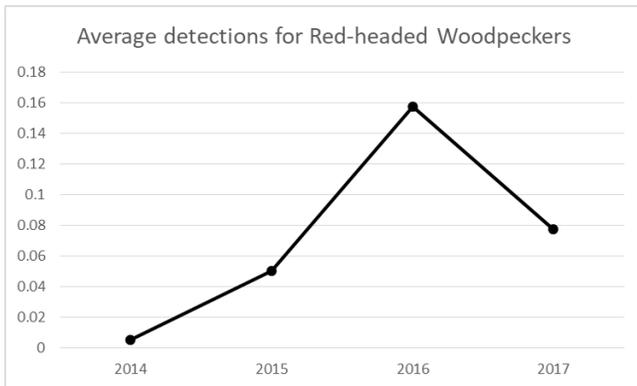


Figure 3. Average detections of Red-headed Woodpeckers across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Prothonotary warbler population appears to be relatively stable, (Figure 4). A significant difference between districts was not found. The prothonotary warbler is a cavity nester that specializes in riparian habitat. Our site selection in the Hidden Springs district may reflect biases against prothonotary warbler populations, simply because our sites may lack this species’ desired habitat.

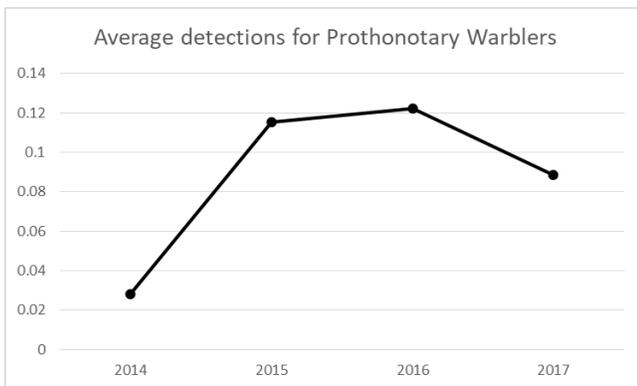


Figure 4. Average detections of Prothonotary Warblers across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Conclusions

Conclusion: The trend for both pileated woodpecker and prothonotary warblers have had stable or increasing populations in recent and past monitoring summaries. The nomadic red-headed woodpecker was too scarce and variable to draw any conclusions, other than that it persists on the forest.

14. Barrens, Glades and Prairies

- Based on at-risk species monitoring are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of barren, glade and prairie habitats being maintained?

Methods

The Forest Plan advocates the protection of sites where Regional Forester’s Sensitive Species are present (FW26.3 (G)). Appendix H, page 293, specifically addresses the habitat management for plain

gentian and procession flower with the periodic use of prescribed fire. Natural Area management in the Forest Plan includes a standard relevant to the maintenance of these habitat types.

NA19.2 (S) Vegetation Management

The objective of vegetation management is to perpetuate natural communities, to maintain or enhance populations of significant wildlife or plants, or to protect other values. Non-native invasive species must be controlled or eradicated. Vegetation practices, such as prescribed burning, cutting of woody growth, application of herbicides or pesticides, or mowing.

The status of barrens, glades, and prairies were assessed by monitoring Shawnee National Forest sensitive plants that grow in those habitats. A list of species monitored in the barrens, glades, and prairies is presented below (Table 6). Botanists field monitored a selection of the sites searching for the presence or absence of the species in Table 6. Plants are counted and population health and vigor observed. Other information was obtained from state records from the Illinois Department of Natural Resources (IDNR) and from the Biotics database, a NatureServe database that maintains IDNR records.

Table 6. Species monitored in the barrens, glades and prairies.

Plant (<i>Scientific name</i>)
American bluehearts (<i>Buchnera americana</i>)
Plain gentian (<i>Gentiana alba</i>)
Crested coralroot (<i>Hexalectris spicata</i>)
Sunbright (<i>Phemeranthus parviflorus</i>)
Hyssopleaf thoroughwort (<i>Eupatorium hyssopifolium</i> var. <i>hyssopifolium</i>)
Procession flower (<i>Polygala incarnata</i>)
Fewflower nutrush (<i>Scleria pauciflora</i>)
Spring lady's tresses (<i>Spiranthes vernalis</i>)
Whorled rosinweed (<i>Silphium trifoliatum</i>)

Observations, Results, Trends

In 2017, 2,500 acres of prescribed burning was accomplished for upland habitat across the forest. These projects maintain the barrens, glades and prairie species present. Since 2003, prescribed fire has been applied to 19,000 natural area acres across the Forest (Table 7). Invasive plant treatments and tree and shrub removal are also important management activities that have been occurring (Table 8).

Table 7. Natural area prescribed fire

Natural Area	Fiscal Year	Natural Area	Fiscal Year
Atwood Ridge RNA	2014, 2016	LaRue Pine Hills RNA	2016, 2017
Barker Bluff RNA	2016	Opossum Trot Trail EA	2010, 2014
Cave Hill RNA	2007, 2011, 2014, 2016	Ozark Hill Prairie RNA	2015, 2017
Dennison Hollow RNA	2007, 2011, 2012, 2015, 2017	Simpson Barrens EA	2007, 2010, 2011, 2014, 2016
Fink Sandstone Barrens EA	2016	Stoneface RNA	2016

Table 8. Natural area invasive plant treatments and tree/shrub removal

Natural Area	Treatment	Fiscal Year	Acres
Barker Bluff RNA	Tree and shrub removal	2017	10.0
Kickasola Cemetery Barrens EA	Herbicide	2016	5.8
Simpson Barrens EA	Herbicide	2016	12.0
LaRue Pine Hills RNA (Government Rock)	Tree and shrub removal	2017	3.0
Ozark Hill Prairie RNA	Tree and shrub removal	2015, 2016	24
Russell Cemetery Barrens EA	Tree and shrub removal	2017	1.0

Several prairies, glades and barrens with sensitive plants were monitored during 2016 and 2017. Observations and trends resulting from those species recently inventoried or monitored are described below (Table 9).

Table 9. Summary of rare plant species status

Common Name	Scientific Name	Description of status of species.
American bluehearts	<i>Buchnera americana</i>	This plant has been observed in 1988 following prescribed burning at one natural area on the Forest (Shimp 2005). Although prescribed fire has been planned at that site for the past three years, it has not been implemented due to weather conditions.
Hyssopleaf thoroughwort	<i>Eupatorium hyssopifolium</i> var. <i>hyssopifolium</i>	The hyssopleaf thoroughwort population has persisted despite lack of management at the single Forest natural area where it has been found. First discovered in 1991, a small population remains there. The numbers of plants increased slightly in 2016 compared to 2011.
Plain gentian	<i>Gentiana alba</i>	This species has been found at two natural areas—at one site 1992 (ILLS, 2014) and at another in 1970 (Anderson and Schwegman 1971). One site was prescribe burned in 2015 and 2017 and the other was partially burned in 2015. In addition, tree and brush

Common Name	Scientific Name	Description of status of species.
		removal took place at the first site in FY 2016. There has been no recent inventory to determine the status of this plant at either site.
Crested coralroot	<i>Hexalectris spicata</i>	Crested coralroot has persisted at two sites in one natural area on the Shawnee National Forest lands, although no management treatment has been implemented there for over 20 years. Its numbers at those sites appear to be somewhat variable, but the orchid remains present. At the first site, 29 plants were reported in 1976, 13 plants in 1989, 3 in 1994, 6 in 2008, and 16 in 2013 and it was observed there in 2017 but no count was reported (Biotics, Shimp 2012). At the other site 5 flowering plants were found in 2015, 25 flowering plants in 2016, and fewer plants in 2017 (Biotics).
Sunbright	<i>Phemeranthus parviflorus</i>	Sunbright appears to have persisted at most sites on the Shawnee National Forest lands where it has been reported, although most sites haven't received recent treatments. This species was recorded at eleven areas across the Shawnee National Forest lands. It was observed at three of those sites from fiscal years 2016-2017. Of those sites, only one had been prescribed burned. Only a few plants were found there in 2016 and 2017 (Biotics). Since the number of plants there prior to prescribed burning is unknown, it is difficult to assess population trends. The population at another natural area was observed in 2016 and 2017 (ArcMap TESP-IS, Biotics) and has persisted and appears healthy, despite visible woody encroachment from eastern redcedar. No management treatments have taken place there recently, but prescribed fire, invasive plant herbicide treatments and tree and shrub removal are authorized. Sunbright was observed at a third natural area in 2016, with the population being described as a few clumps (Biotics). In 2008, 25-50 plants were found at this site (IDNR), so the numbers of plants seem to have remained steady. An infestation of Nepalese browntop was treated near that site in 2015. Prescribed fire and tree and shrub removal are also authorized for this area, although those treatments have not yet taken place.
Procession flower	<i>Polygala incarnata</i>	This species has been found at four Shawnee National Forest natural areas, but has not been observed for over twenty years (ArcMap TESP-IS, IDNR, Shimp 2012). Although three of those natural areas are authorized for prescribed fire treatments, woody encroachment removal, and herbicide treatments of invasive plants, burning is currently planned at only one of those natural areas and has not yet been implemented.
Fewflower nutrush	<i>Scleria pauciflora</i>	This sedge has been observed within or near nine natural areas on the Shawnee National Forest lands. Two of those occurrence records are more than twenty years old. It was observed most recently at in 2008 (IDNR). There have been no recent prescribed burns or removal of encroaching woody vegetation at these sites, although

Common Name	Scientific Name	Description of status of species.
		treatments are authorized for five of them. Nepalese browntop was herbicide treated along the road bordering one of the natural areas in 2017.
Whorled rosinweed	<i>Silphium trifoliatum</i>	This species was collected at one Shawnee National Forest natural area in 1989, and at another in 1992 (the identification at the second site was uncertain, Shimp 2012). One of the natural areas was prescribe burned in 2016, but no subsequent presence search was conducted.
Spring lady's tresses	<i>Spiranthes vernalis</i>	Spring lady's tresses has not persisted at most of the sites where it has been found on the Shawnee National Forest, probably because its habitat of old fields has not been maintained. Of the five sites where it was found, it has only been reported at one during the past decade. It was discovered at Oakwood Bottoms in 2014 in a field that is regularly mowed and had been prescribe burned in 2011. In 2014, 30 flowering plants were counted. In 2016, only 10 flowering plant were counted there. No additional prescribed fire has taken place at the site and annual mowing hasn't been done because of higher than usual rainfall amounts keeping the area to wet for mowing.

Conclusions

Projects designed to maintain and improve at-risk plants at barrens, glades, and prairies are being implemented. Monitoring continues in order to assess the ecological value. Barrens, glades and prairies of the Shawnee National Forest would likely benefit from renewed efforts to treat natural area communities with prescribed fire, small tree and brush removal and other treatments, giving preference to sites containing the above listed species. Monitoring these areas pre and post-treatment would lend itself to a focused citizen science effort.

References:

ArcMap TESP-IS Database. Forest Service Natural Resource Manager Database for Threatened, Endangered, Sensitive, & Proposed Plants and Invasive Species.

Biotics. NatureServe Biotics Database. Biotics/Illinois Department of Natural Resources IDNR. 2014 & 2016. Illinois Department of Natural Resources, State-listed plant records for Southern Illinois counties. Provided upon request by the Illinois Natural Heritage Database Program Manager, Springfield, Illinois.

ILLS. 2014. Illinois Natural History Survey Herbarium. Champaign, Illinois. Provided upon request by R. L. Phillippe, former Director.

Shimp, Elizabeth L. 2005. Shawnee National Forest Biological Evaluation for Regional Forester's Sensitive Species Forest Plan Revision. Harrisburg, Illinois.

Shimp, Elizabeth L. 2012. Biological Evaluation for Regional Forester’s Sensitive Plant Species Invasive Species Management Shawnee National Forest. Vienna, Illinois.

15. Upland and Oak-hickory Forest

- Based on at-risk species monitoring, are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of upland and oak-hickory forest habitats being maintained?

Method

For at-risk species subjective analysis utilizing various measures, including reports from researchers and cooperating agencies on habitat conditions and suitability, species monitoring, and annual accomplishment data from FACTS and WFRP database. A list of species monitored in the upland and oak-hickory forest is presented below (Table 11). To assess the maintenance of forest habitats related to upland oak-hickory sites, accomplishment reporting for 2016 and 2017 was used.

Table 10. A list of species monitored in the upland oak-hickory forest

Species Name	
Scarlet tanager (<i>Piranga olivacea</i>)	Porter’s reedgrass (<i>Calamagrostis porter</i> ssp. <i>insperata</i>)
Wood thrush (<i>Hylocichla mustelina</i>)	Fibrousroot sedge (<i>Carex communis</i>)
Worm-eating warbler (<i>Helmitheros vermivorum</i>)	Ravenel’s rosette grass (<i>Dichanthelium ravenelii</i>)
Timber rattlesnake (<i>Crotalus horridus</i>)	Buffalo clover (<i>Trifolium reflexum</i>)
Eastern woodrat (<i>Neotoma floridana</i>)	Deerberry (<i>Vaccinium stamineum</i>)
American barberry (<i>Berberis canadensis</i>)	

Observations, Results, Trends

The 2009-2013 Avian Monitoring Report for the Shawnee National Forest by the Cooperative Wildlife Research Laboratory, Department of Zoology, and Southern Illinois University (SIU) Carbondale reported a stable or increasing trend for worm-eating warbler and wood thrush (Table 11). The following tables and graphs are from the Southern Illinois University report (Sierzega, K. and M. Eichholz, 2013).

Table 11. Bird monitoring detections from 1989-2013 based on bird monitoring conducted by Southern Illinois University (Sierzega, K. and M. Eichholz, 2013).

Species	1989-2003	2005-2009	2009-2013	2014-2017
Worm-eating warbler	Stable	Stable	Stable	Stable
Scarlet tanager	Stable	Stable	Decline	Decline
Wood thrush	Decline	Stable	Stable	Stable

Population trends for the worm-eating warbler appear to be stable across the Shawnee National Forest. The worm-eating warbler was detected in all forest sites except Oakwood Bottoms and Grand

Pierre (Figure 5). Both sites are characterized by lowland-floodplain habitat, and Oakwood Bottoms is a greentree reservoir subject to intensive management (Robinson and Cottam 2005). Worm-eating warblers are a ground-nesting species found on dry-upland slopes (Robinson and Cottam 2005); a habitat that is non-existent in floodplains.

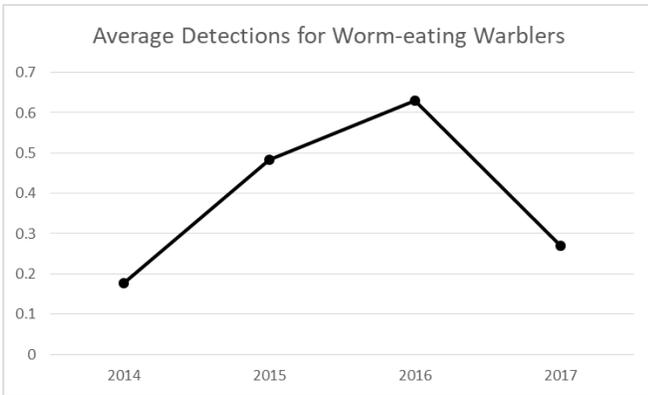


Figure 5. Average detections of Worm-eating Warblers across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Scarlet tanager population trends have declined in the forest since about 2009, (Figure 6).

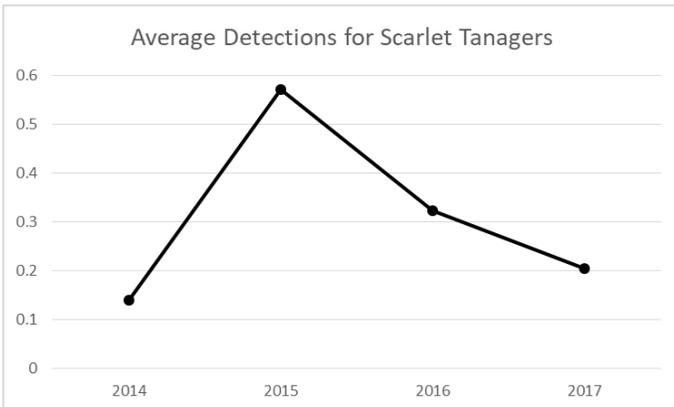


Figure 6. Average detections of Scarlet Tanagers across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Wood thrush population trends appear stable (Figure 7). Individuals were detected at all forest sites from 2009-2013 and detection rates were highest at Caney Creek and South Ripple Hollow. The Pine Hills population, which was once the largest noted by Robinson and Cottam (2005), continued to decline for our period analyzed. Management of the wood thrush is especially pertinent to the forest because global populations of the wood thrush have declined, likely because of habitat degradation on overwintering grounds (Berlanga et al. 2010).

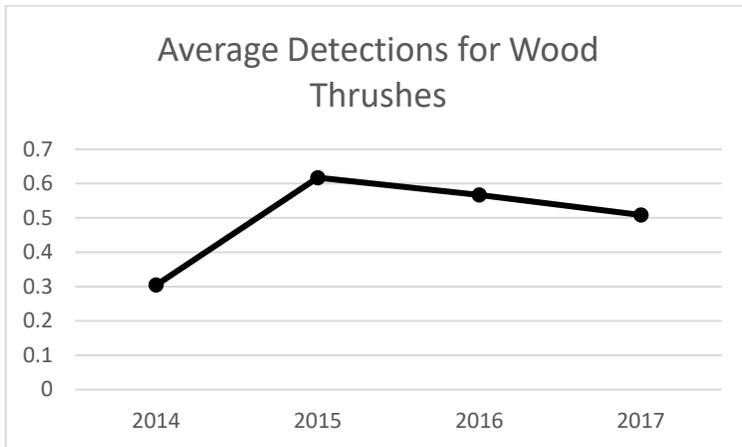


Figure 7. Average detections of Wood Thrushes across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Restoration Projects - A total of 60 acres of short-leaf pine was commercially harvested to restore native hardwood species at the Harris Branch project site in FY16. Also, a total of 9,435 acres of prescribed fire was completed on various portions of the Forest in FY16 with upland forests accounting for about 7,242 acres of that.

Both snag and avian surveys were completed at the Harris Branch project site. Those avian monitoring results suggested an overall increase in forest bird populations, with documented use by at-risk species such as the scarlet tanager and wood thrush. Scarlet tanager detections increased following the harvest at Harris Branch as would be expected with the creation of early successional habitat. Worm eating warblers were not found before or after harvest and wood thrush was found before harvest but not after.

Shawnee National Forest wildlife staff and the Illinois Department of Natural Resources initiated spring emergence monitoring on timber rattlesnakes at two known den sites on the Forest.

Projects are being planned and implemented on the Forest which strive to promote upland oak-hickory forests through various management activities (Table 12). Accomplishments for FOR-VEG-EST reflect acres of vegetation that are established by planting, seeding or site preparation for natural regeneration. Accomplishments for FOR-VEG-IMP reflect acres which receive stand improvement treatments such as release, weeding, thinning or other vegetative enhancement for the purpose of achieving desired ecological conditions such as native plant conversion. Acres treated through commercial timber harvest are those on which silvicultural prescriptions were implemented with the objective to improve upland oak hickory forests.

Table 12. Acres of accomplishment that improve species composition and structure.

Upland Accomplishments	2016	2017
FOR-VEG-EST	0	407
FOR-VEG-IMP	2,147	2,111
Acres treated with timber harvest	113	144

Conclusions

Projects are planned to enhance the upland oak-hickory forest. Dry upland forest habitat is currently supportive of both wood thrush and worm eating warblers, with populations appearing stable from 2009 to 2013 and 2014-2017. Scarlet tanagers were stable from 1989 to 2009 but detections declined between 2009 and 2017.

Projects are planned and implemented to enhance species composition and structure in upland oak forests.

Reference

Sierzega, K. and M. Eichholz, 2013. 2009-2013 Avian Monitoring Report for the Shawnee National Forest. Wildlife Research Laboratory, Department of Zoology, Southern Illinois University Carbondale.

16. Dry-mesic and mesic hardwood forests

- Based on at-risk species monitoring, are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of dry-mesic and mesic hardwood forest habitats being maintained?

Method

Subjective analysis utilizing various measures, including reports on habitat conditions and suitability, species monitoring and annual accomplishment data. A list of species monitored in the dry-mesic and mesic hardwood forests is presented below (Table 13).

Table 13. A list of species in the dry-mesic and mesic hardwood forests.

Species Name	Species Name
Indiana bat (<i>Myotis sodalis</i>)	Turk's-cap lily (<i>Lilium superbum</i>)
Northern long-eared bat (<i>Myotis septentrionalis</i>)	American ginseng (<i>Panax quinquefolia</i>)
Mead's milkweed (<i>Asclepias meadii</i>)	Grove bluegrass (<i>Poa alsodes</i>)
Appalachian bugbane (<i>Actaea rubifolia</i>)	Small's blacksnakeroot (<i>Sanicula smallii</i>)
Black edge sedge (<i>Carex nigromarginata</i>)	Early saxifrage (<i>Saxifraga virginensis</i>)
Sharpshale sedge (<i>Carex oxylepis</i> var. <i>pubescens</i>)	Littlehead nutrush (<i>Scleria oligantha</i>)
Willdenow's sedge (<i>Carex willdenowii</i>)	Blue Ridge catchfly (<i>Silene ovata</i>)
Fairywand (<i>Chamaelirium luteum</i>)	Star chickweed (<i>Stellaria pubera</i>)
Kentucky yellowwood (<i>Cladrastis kentukea</i>)	Bigleaf snowbell (<i>Styrax grandifolius</i>)
Greater yellow lady's slipper (<i>Cypripedium parviflorum</i> var. <i>pubescens</i>)	Guyandotte beauty (<i>Synandra hispidula</i>)
Goldie's woodfern (<i>Dryopteris goldiana</i>)	Threebirds (<i>Triphora trianthophora</i>)
Bursting-heart (<i>Euonymus americanus</i>)	

Observations, Results, Trends

Indiana bat (Myotis sodalis-MYSO): Overall populations of wintering Indiana bats within the Shawnee National Forest boundary have been increasing or at least stable from 2006- 2017 (Table 14). Winter populations have been increasing most notably in Magazine Mine, Ellis Cave and Griffith Cave. Of note was the increase in Magazine Mine which increased by 30,000 bats between 2011 and 2017.

Table 14. Number of Indiana bats (*Myotis sodalis*) reported during winter hibernacula surveys (2006-2017).

Cave/Mine	2006	2007	2009	2010	2012	2013	2014	2015	2016	2017
Ellis Cave		1,856	4,771	4,248	5,678	4,676	2,700	3,654	3,139	
Griffith Cave			787	623	1,372	2,150	2,000	1,834	1,483	
Jason Mine	23	33	9	14		74				
Magazine Mine		43,509	40,705	45,159						69,090
Rich's Cave			19	35		30		19	0	

Indiana bat hibernacula on the Shawnee National Forest continues to be protected from human disturbances with gating, mine entrance stabilization structures and access control policies. Unauthorized access to all the known Indiana bat hibernacula on the Shawnee National Forest is controlled through the presence of either cave gates or fencing. These measures are proving effective in protecting the species from human disturbances and any adverse alterations occurring inside the hibernacula.

Northern long-eared bat (*Myotis septentrionalis*-MYSE): Northern long-eared bats appear to be in steep decline on the forest and range-wide. This species is sensitive to white-nose syndrome (WNS), and based on summer surveys and hibernacula counts detections of this species have declined.

In 2016, mist net surveys were conducted at the Saline River-Gallatin County study area for a total of 23 net nights. A total of 100 individual bats were captured, consisting of 5 species. One northern long-eared bat was captured. This is concerning especially since northern long-eared bats were the most numerous of the bats captured in 2011. This is mostly likely a result of the presence of white-nose syndrome in Southern Illinois since 2013. A total of 5 Indiana bats were captured; 3 males and 2 lactating females. No visible signs of WNS was present on the Indiana bats.

In 2017, mist net surveys were conducted at the Oakwood Bottoms study area for a total of 24 net nights. A total of 103 individual bats were captured, consisting of 5 species. A total of 4 northern long-eared bats and 29 Indiana bats were captured. In comparison to the 2013 survey, Indiana bats appear to be about the same with regards to percent captured, and northern long-eared bats have dropped from 15% in 2013 down to 4%. Although this is a bit concerning, as mentioned earlier, this is most likely a result of the presence of WNS in southern Illinois since 2013. No visible signs of WNS was present on any of the captured bats.

In 2017, mist net surveys were conducted on the Webb property (owned by Heartland Conservancy). A total of 9 individual bats were captured, consisting of 4 species. No federal or state-listed bats were captured during this survey.

Conclusions

Dry-mesic and mesic hardwood forests are supporting bats with what appears to be ample habitat. Bat populations appear to be impacted by white-nosed syndrome more than a limitation on habitat.

17. Wetlands, Swamps, Forested Wetlands, Floodplain Forests and Caves

- Based on at-risk species monitoring, are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of wetland, swamp, forested wetland, floodplain forest and cave habitats being maintained?

Method

Subjective analysis utilizing various measures, including reports from researchers and cooperating agencies on habitat conditions, species monitoring, and annual accomplishment data. A list of species monitored in the wetlands, swamps, forested wetlands, floodplain forests, caves is presented below (Table 15).

Table 15. A list of species monitored in the wetlands, swamps, forested wetlands, floodplain forests, caves.

Species Name	Species Name
Indiana bat (<i>Myotis sodalis</i>)	Cypressknee sedge (<i>Carex decomposita</i>)
Northern long-eared bat (<i>Myotis septentrionalis</i>)	Giant sedge (<i>Carex gigantea</i>)
Southeastern myotis (<i>Myotis austroriparius</i>)	Finger dogshade (<i>Cynosciadium digitatum</i>)
Bird-voiced treefrog (<i>Hyla avivoca</i>)	Variable panicgrass (<i>Dicanthelium commutatum</i>)
Eastern narrow-mouth toad (<i>Gastrophryne carolinensis</i>)	Yadkin panicgrass (<i>Dichanthelium dichotomum</i> subsp. <i>Yadkinense</i>)
Illinois chorus frog (<i>Pseudacris illinoensis</i>)	Wolf's spikerush (<i>Eleocharis wolfii</i>)
Anomalous spring amphipod (<i>Crangonyx anomalus</i>)	Arkansas mannagrass (<i>Glyceria arkansana</i>)
Packard cave amphipod (<i>Crangonyx packardi</i>)	Kidneyleaf mudplantain (<i>Heteranthera reniformis</i>)
Bousfield's amphipod (<i>Gammarus bousfieldi</i>)	American featherfoil (<i>Hotonia inflata</i>)
Cave-obligate planarian (<i>Sphalloplana mohri</i>)	False hop sedge (<i>Carex lupuliformis</i>)
Flat-headed snake (<i>Tantilla gracilis</i>)	Low woodland sedge (<i>Carex socialis</i>)
Bantam sunfish (<i>Lepomis symmetricus</i>)	Red turtlehead (<i>Chelone obliqua</i> var. <i>speciosa</i>)
Redspotted sunfish (<i>Lepomis miniatus</i>)	Oneflower false fiddleleaf (<i>Hydrolea uniflora</i>)
Cerulean warbler (<i>Dendroica cerulea</i>)	Butternut (<i>Juglans cinerea</i>)
Swainson's warbler (<i>Limnothlypis swainsonii</i>)	Palegreen orchid (<i>Platanthera flava</i> var. <i>flava</i>)
Northern copperbelly watersnake (<i>Nerodia erythrogaster neglecta</i>)	Grove bluegrass (<i>Poa alsodes</i>)
Alligator snapping turtle (<i>Macrochelys temminckii</i>)	Clustered beakrush (<i>Rhynchospora glomerata</i>)
Mississippi green watersnake (<i>Nerodia cyclopion</i>)	Leafy bulrush (<i>Scirpus polyphyllus</i>)
Subtle stygobromid (<i>Stygobromus subtilis</i>)	Eastern featherbells (<i>Stenanthium gramineum</i>)
Shining false indigo (<i>Amorpha nitens</i>)	American snowbell (<i>Styrax americanus</i>)
Nottaway Valley brome (<i>Bromus nottowayanus</i>)	Pale false mannagrass (<i>Torreyochloa pallida</i>)
Broadwing sedge (<i>Carex alata</i>)	Heartleaf nettle (<i>Urtica chamaedryoides</i>)

Observations, Results, Trends

Prescribed fire - A total of 9,435 acres of prescribed fire was completed on various portions of the Shawnee National Forest in FY16 with bottomland forests accounting for about 1,051 acres of that. Seven units at Oakwood were burned along with 5 at the Inagheh tract to account for all bottomland forest prescribed fire.

Threatened Endangered and Sensitive Bats – White-nose syndrome (WNS) is still considered the leading cause of most cave-obligate bat population declines. First discovered here on the Shawnee in the winter of 2013, WNS has been observed (but not confirmed) in at least eight (8) different hibernacula. Although WNS appears to be widespread across the Shawnee National Forest, Indiana bat populations in

general seem to have a “normal” fluctuation in numbers in most hibernacula. For instance, in Ellis Cave, where WNS was observed during a 2015 winter survey, there were about 1,856 Indiana bats observed during a 2007 winter survey. That number increased to 3,139 during the 2016 winter survey. The Shawnee National Forest personnel continue to monitor bat populations with hibernacula surveys and monitor maternity colonies at a 2-3-year interval. During a survey on the Gallatin County Indiana bat maternity colony in June 2016, a new maternity colony was located. Upon final exit counts taken from the roost tree, Forest Service personnel counted 113 Indiana bats during the evening departure, verifying the existence of a new primary roost tree on the Shawnee National Forest. This maternity colony will continue to be monitored over the next several years in accordance with strategies and guidelines identified in the Biological Opinion and the Forest Plan.

Oakwood silviculture - Silvicultural practices directly impact bat populations in forest ecosystems by adjusting the number of available roost sites and by altering the density of trees. As desirable hardwood trees become established and make up a larger proportion of the dominant canopy, the resulting mixed stand should become higher-quality summer roosting and foraging habitat, which should persist into the future. Stands are projected to become more productive and better-quality bat habitat as the restored areas become older.

In 2016 and 2017, a total of 1,050 acres of stand improvement was accomplished with the objective to improve species composition, structure and success of trees important to the suite of species that utilize bottomland hardwood forests. The photo below shows oak trees after release and in full sunlight. In 2016, 1,048 acres to establish vegetation was accomplished.



First and third year survival surveys serve as an important monitoring indicator of survival. Surveys in 2016 on sites where stand improvement and planting occurred in previous years found that the planted trees ranged from 5 to 15-foot-tall and some natural regeneration of oak and hickory was present but

also contained mesophytic maple and ash from existing understory seedlings and saplings as well as stump sprouting after stand improvement. Most of the resprouts were over 20-foot tall and were shading out the planted trees.

In July and August of 2017, survival surveys were conducted on sites that were planted in 2014 (3rd year survey) and 2016 (1st year survey) in Oakwood Bottoms (Table 17).

Table 16. Percent survival for 1st and 3rd year survival surveys at Oakwood Bottoms

Unit	3 rd year survival survey (planted 2014)	1 st year survival survey (planted 2016)
Unit 2	0%	
Unit 6	5%	
Unit 7	35%	
Unit 10 NW	20%	
Unit 11	20%	
Unit 2		70%
Unit 3		80%
Unit 4		87%
Unit 10		83%

Planting in 2014 was marginal to poor after the first year and declined over the next two years. Notes suggest that in 2015 it was very wet and flooding occurred into the growing season, which could have contributed to poor survival. All units were flooded in the fall following the planting.

Planting in 2016 show good survival. Units 2 and 3 were left dry the fall of 2016, while units 4 and 10 were flooded (Table 17).

Table 17. 2016 Stocking Surveys from Oakwood Bottoms

Unit Number	Seedlings per acre (TPA)	Remarks
2	2,008	1,546 TPA are oak species
3	2,900	800 TPA are oak species
4	777	100 TPA are oak species
10	817	350 TPA are oak/hickory

Conclusions

Management projects are implemented to promote sustainability of the bottomland hardwood ecosystem. Based on bat populations it appears that wetlands, swamps, forested wetlands, floodplain forests and caves are being protected and enhanced across the forest.

19. Openlands

- Based on at-risk species monitoring are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of openland habitats being maintained?

Method

Subjective analysis utilizing various measures, including reports from researchers and cooperating agencies on habitat conditions, species monitoring and annual accomplishment data. A list of species monitored in openlands is presented below (Table 18).

Table 18. A list of species monitored in the openlands

Species Name	Species Name
Henslow's sparrow (<i>Ammodromus henslowii</i>)	Northern bobwhite (<i>Colinus virginianus</i>)
Migrant loggerhead shrike (<i>Lanius ludovicianus migrans</i>)	Yellow-breasted chat (<i>Icteria virens</i>)

Observations, Results, Trends

Since the summer of 2006, over 1,500 acres have been restored and enhanced in areas designated in the Forest Plan to be managed as "Large Openlands." Habitat restoration has been conducted through disking, mechanical mowing, and mechanical mastication, seeding of native warm season grasses-legumes-forbs, seeding of annual food and cover plantings, and prescribed burning. Restoration of grassland and old-field habitats of the large openlands on the east side of the Shawnee National Forest has nearly been completed, with a few small areas remaining to have grassland restoration completed. Implementation of the Henslow's Sparrow Recovery Act Project has also enabled the Shawnee National Forest to achieve major progress in completing needed habitat restoration activities on large openlands on the west side of the Forest.

A total of 9,435 acres of prescribed fire was completed on various portions of the Shawnee National Forest in FY16 with openlands accounting for about 1,157 acres of that total acreage. Openlands burned included: Bebout, Inagheh 3-4-5N, Pennant Bar, Ashby West, Turpen, West Tract, McConnel and Rothamel Tracts. The burns were relatively successful in reducing some of the woody encroachment and helping maintain the openness of the sites. However, due to the variability and seasonality of prescribed fire, some of the undesirables in these openlands (invasive species and woody vegetation) have been able to flourish and need additional mechanical treatments. The most effective way to continue to manage these will likely be a combination of prescribed fire and mastication or mowing. Due to resource and budget constraints, treatment of woody encroachment in the openlands will continue to be a challenge.

We have not found the migrant loggerhead shrike, likely because monitoring did not occur during migration. Henslow's sparrow was not found in 2016 or 2017. The Henslow's sparrow requires large fields consisting of dense, tall grasses, and responded negatively to the proportion of forested edge and edge to area ratio in openland tracts of the Shawnee National Forest (Hellgren et al. 2010). Variability of

detections in the forest is likely a product of grassland succession and a lack of suitable habitat in openland tracts from year to year.

Northern bobwhite populations are highly variable; they have declined range-wide in the United States during the last 20 years due to habitat loss. Individuals were detected at all sites except Bebout. Detections were highest at Pennant Bar Ranch, which was predictable because the Northern bobwhite responded positively to site area and negatively to edge to area ratio in the forest (Hellgren et al. 2010). West Tract, Pennant Bar Ranch, Turpen Tract, and Ashby Tract are especially important to manage for Northern bobwhite because of their large site area and established populations (Robinson and Cottam 2005). Quail call counts conducted in 2016 resulted in counts only at Ashby and Pennant Bar (Figure 8).

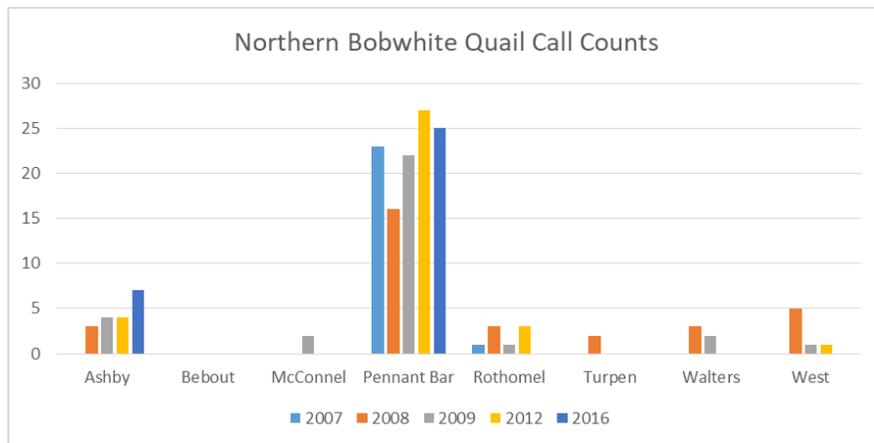


Figure 8. Results from openland quail call counts.

Yellow-breasted chat populations appear stable and did not differ significantly between years. Individuals were detected on all sites during all years surveyed (Figure 9). The yellow-breasted chat requires dense-shrubby habitat, which is abundant in the forest as many past agricultural fields have been taken over by early succession.

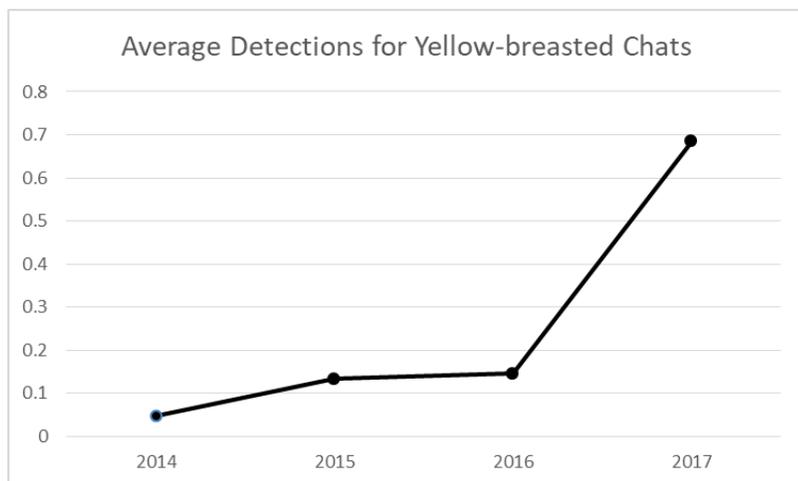


Figure 9. Average detections of Yellow-breasted Chats across the Shawnee National Forest in 2014 (24 sites; N= 358 points), 2015 (19 sites; N=277 points), 2016 (17 sites; N=254 points), and 2017 (13 sites; N=181 points).

Increasingly the Forest Service is working with others to use growing season burns to enhance habitats for openland birds. The partners in this project conducted about 92 acres of prescribed fires during the late growing season within or adjacent to the Shawnee National Forest, broken down as follows: three burns were conducted on the Shawnee for 57 acres. Illinois Department of Natural Resources conducted 5 burns for 24.2 acres, and 10.3 acres of private lands were burned in two units as well. The photos highlight growing season burns. Some ecological benefits of growing season burns are: (1) effective reduction in encroaching woody stems; (2) increased forb and graminoid diversity; and (3) delayed flowering leading to better fall and winter food sources for wildlife.

Monitoring Photos- BEFORE:



McConnel in August



Inagheh in August.

Monitoring Photo- DURING:



Pennant Bar – 9/15/17

Monitoring Photos- AFTER:



Conclusions

Implementation of restoration and enhancement activities has improved the quality of open grassland habitats. Continuing management activities are needed to maintain the ecological character of openlands.

Reference

Sierzega, K. and M. Eichholz, 2013. 2009-2013 Avian Monitoring Report for the Shawnee National Forest. Wildlife Research Laboratory, Department of Zoology, Southern Illinois University Carbondale.

20.Cliffs

- Based on at-risk sensitive species monitoring, are the standards and guidelines adequate to protect these habitat features on the landscape?
- Is the ecological value of cliff habitats being maintained?
- To what extent are recreational or management activities taking place in subject ecosystems or biological communities and what, if any, impacts are occurring?
- To what extent are required mitigation measures being implemented, and are they effective in protecting rare ecosystems and communities?

Method

Subjective analysis utilizing internal and external reports regarding habitat condition. A list of species monitored at cliffs is presented below (Table 19).

Table 19. A list of species monitored at cliffs

Species Names	Species Names
Carinate pillsnail (<i>Euchemotrema hubrichti</i>)	Rock clubmoss (<i>Huperzia porophila</i>)
Bradley's spleenwort (<i>Asplenium bradleyi</i>)	Allegheny stonecrop (<i>Hylotelephium telephioides</i>)
Blackstem spleenwort (<i>Asplenium resiliens</i>)	Limber honeysuckle (<i>Lonicera dioica</i>)
Eastern hay-scented fern (<i>Dennstaedtia punctilobula</i>)	Yellow honeysuckle (<i>Lonicera flava</i>)
French's shooting-star (<i>Dodecatheon frenchii</i>)	Appalachian bristle fern (<i>Trichomanes boschianum</i>)

The Forest Plan protects sites where sensitive (Regional Forester's Sensitive Species) plants are present (FW26.3 (G), and Appendix H), so cliffs where sensitive plants are present have some degree of protection. Further protection of rare habitat sites are covered by the Management Prescriptions for Natural Areas (NA) or for Research Natural Areas (RNA). However, the Shawnee National Forest has numerous cliffs, most of which are not located within natural areas, research natural areas, or do not have records of sensitive plants.

Observations, Results, Trends

Several sensitive plant species found in cliff habitat on the Shawnee National Forest were observed during fiscal years 2016-2017. Those species are: blackstem spleenwort (*Asplenium resiliens*), French's

shooting star (*Dodecatheon frenchii*), Allegheny stonecrop (*Hylotelephium telephioides*), and Appalachian bristle fern (*Trichomanes boschianum*). Observations and trends resulting from those species recently inventoried or monitored and are described below.

Blackstem spleenwort has persisted at a natural area in Jackson County in small numbers. This fern has been observed there since 1940 (Hill 2003). It is not clear from early records exactly where it was found, but later reports indicate it was found at three or four different locations (Biotics, Hill 2003). Two locations are historic—one having been believed extirpated by 1977 (Hill 2003); plants at the other location were first observed in 1969 (Hill 2003) and again in 1987 (IDNR, Biotics), but were not found there during a 2005 search (Biotics). Plants at another location were seen in 2005 (Biotics). Another location was first observed in 1987 (Biotics) and rediscovered in 2005, with only a single plant being found (Biotics). Elizabeth Longo, botanist for the Shawnee National Forest, most recently observed that single individual in 2016 (personal communication).

The two sites of French's shooting star observed from 2016 to 2017 appear to be stable. One location was found during surveys for a trail relocation project in 2016. The population was large and seemed healthy, despite being located close to a user created trail. Six other locations with hundreds of individuals were reported in that area in 2007. This area is located near a private camp and is heavily used for hiking and horseback riding. The second location in Jackson County was discovered in 2004; about 150 individual plants were counted there at that time. In 2017, it was noted that many individuals were observed at that site, although no census was done (Biotics).

Allegheny stonecrop was observed at two sites in 2016 and 2017. A new site was found in Jackson County that had a single plant. The second site is within a natural area. Plants have been collected from this site since 1951 and the population has been observed or inventoried over the past decade: August 2011, several large, non-reproductive clumps were observed; August 2012, many individuals were observed that were about to flower, with smaller plants scattered among them; September 2014, 250 plants in 5 clusters were counted; July 2015, large populations were observed; and September 2016 a large population with many flowering plants was observed (Biotics).

Appalachian bristle fern was inventoried at six sites within one natural area on the Shawnee National Forest during fiscal years 2016 to 2017. This species was mapped at two locations in 1968 and 1969, as well as at another location in 2009 (ArcMap TESP-IS). Plants were observed at several sites in 1993, 1995, and 2002 (IDNR). Plants at one location were described as too numerous to count in 2013 (Biotics). A robust population was observed in 2016. In 2017, this species was observed at one site, while at another location, 2 populations were found that were 6' long and 15' long, respectively (Biotics).

Is the ecological value of cliff habitats being maintained?

The ecological value of cliff habitats appears to be maintained at the sites monitored for sensitive plants in 2016 and 2017. Blackstem spleenwort persists at the LaRue Pine Hills Research Natural Area. French's shooting star maintained good populations at the two sites where it was monitored. Allegheny stonecrop is doing well at Stoneface Research Natural Area and was discovered at a new site in 2017. The Appalachian bristle fern is maintaining robust populations at multiple sites at Bulge Hole Ecological Area.

To what extent are recreational or management activities taking place in subject ecosystems or biological communities and what, if any, impacts are occurring?

Based on the monitoring that took place from 2016 to 2017, recreational activities on the Forest do not appear to have negatively impacted cliff habitats. The cliffs at LaRue Pine Hills are composed of very loose rock that is difficult to climb, so blackstem spleenwort persists. The French's shootingstar population in the Ondessonk vicinity are located near multiple designated and user created trails. There appear to be no impacts from recreation there. The population in Jackson County is located fairly near a designated trail but remains intact. The Bulge Hole Appalachian bristle fern locations appear robust; no designated trails are located near those sites.

Management activities have probably affected one cliff site and may have had slight impacts to others. Stoneface RNA has been prescribed burned five times since 2007, with the latest burn in 2016. This has probably contributed to keeping the canopy from closing in and shading the Allegheny stonecrop population at that site. Impacts appear to be beneficial. A trail reroute in the Ondessonk area brought the designated trail closer to a location of French's shootingstar. However, the trail was user created and was already being heavily used for horseback riding. Impacts from that change appear to be minimal. It should be noted that invasive plant treatments, including herbicide applications, have taken place at LaRue Pine Hills, but were not near the blackstem spleenwort location. An infestation of Nepalese browntop was herbicide treated fairly near a location of Appalachian bristle fern, which may have slowed the Nepalase spread.

Management activity is authorized or has already taken place at several of the sensitive plant locations monitored from 2016 to 2017. Prescribed fire was implemented at LaRue Pine Hills in 2016 and 2017 after blackstem spleenwort was monitored, so effects to this species are not known. Prescribed fires are planned to continue there, as well as invasive infestation treatments and tree and shrub removal at hill prairies. Continued prescribed fire is also planned for Stoneface. Prescribed fire, treatment of invasive plant infestations, and tree and shrub removal are authorized for Bulge Hole, but future treatments there have not been planned.

To what extent are required mitigation measures being implemented and are they effective in protecting rare ecosystems and communities?

Implementation of Shawnee National Forest standards may have preserved blackstem spleenwort at LaRue Pine Hills. This fern has persisted there for decades, albeit in small numbers, despite having been collected numerous times. It was extirpated at one site by 1977 because of over collection, according to Illinois Nature Preserve Commission notes, though the specific location of that site is unclear. It had disappeared from another location by 1987. The current Forest Plan limits collection of any species within research natural areas by requiring a permit from the Forest Service. It is notable that reports of the two extant locations state that the species was observed, rather than collected. Requiring a Forest Service permit may have reduced collection of blackstem spleenwort and prevented it from disappearing from LaRue Pine Hills. Prescribed burning at Stoneface appears to have benefitted the cliff communities at Stoneface RNA. The locations of that species appear to be robust. It has also been observed to be fertile when it was last monitored.

Conclusion

The cliff rare plant populations monitored appear to be stable.

References

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Biotics. NatureServe Biotics Database. Biotics/Illinois Department of Natural Resources Hill, S.R. 2003. Conservation Assessment for the Black-stem Spleenwort (*Asplenium resiliens* Kunze). Prepared for the USDA Forest Service Eastern Region, Shawnee and Hoosier National Forests. INHS Technical 2003 Report (2). January 6, 2003. Illinois Natural History Survey, Center for Biodiversity. Champaign, Illinois. 29 pp.

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Shimp, Elizabeth L. 2005. Shawnee National Forest Biological Evaluation for Regional Forester's Sensitive Species Forest Plan Revision. Harrisburg, Illinois.

Shimp, Elizabeth L. 2012. Biological Evaluation for Regional Forester's Sensitive Plant Species Invasive Species Management Shawnee National Forest. Vienna, Illinois.

21. Seeps, Springs and Caves

- Based on at-risk species monitoring, are the standards and guidelines adequate to protect these habitat features on the landscape?

Method

Subjective analysis using internal and external reports regarding habitat condition. A list of species monitored at seeps, springs and caves is presented below (Table 20). These questions will be answered:

Is the ecological value of seep, spring and cave habitats being maintained?

To what extent are recreational or management activities taking place in subject ecosystems or biological communities and what, if any, impacts are occurring?

To what extent are required mitigation measures being implemented, and are they effective in protecting rare ecosystems and communities?

The Forest Plan provides standards and guidelines that are applicable to protecting and preserving seep springs natural communities. The Forest Plan protects sites where sensitive (Regional Forester's Sensitive Species) plants are present (FW26.3 (G), and Appendix H), so seeps and springs where sensitive plants are present have some degree of protection. Further protection of rare habitat sites is covered by the Management Prescriptions for Natural Areas (NA) or for Research Natural Areas (RNA).

Table 20. A list of species monitored at Seeps, Springs and Caves

Species Names	Species Names
Short-tail bactroid (<i>Bactrurus brachycaudus</i>)	Large whorled pogonia (<i>Isotria verticillata</i>)
Cave-obligate isopods (<i>Caecidotea beattyi</i> , <i>C. bicrenata whitei</i>)	Small green wood orchid (<i>Platanthera clavellata</i>)
Bousfield’s amphipod (<i>Gammarus bousfieldi</i>)	Maryland meadowbeauty (<i>Rhexia mariana</i>)
Twining screwstem (<i>Bartonia paniculata</i>)	Sullivant’s coneflower (<i>Rudbeckia fulgida</i> var. <i>sullivantii</i>)
Prickly bog sedge (<i>Carex atlantica</i>)	Longbeak arrowhead (<i>Sagittaria australis</i>)
Brome-like sedge (<i>Carex bromoides</i>)	Leafy bulrush (<i>Scirpus polyphyllus</i>)
Drooping sedge (<i>Carex prasina</i>)	New York fern (<i>Thelypteris noveboracensis</i>)
Swamp sunflower (<i>Helianthus angustifolius</i>)	

Observations, Results, Trends

State Element Occurrence Records and monitoring of sensitive plants present at the Shawnee National Forest lands’ acid seeps reflect changes to habitat at these sites. Although some populations remain relatively stable, many have declined and a few have vanished. The following list summarizes the status of sensitive plants found in these habitats:

Twining screwstem—known on five natural areas, this species has been found at only two in the last 10 years, one in 2016 and the other in 2017; populations appear to be stable at both sites; since these plants are so tiny and are visible only from late summer through fall, plants may have been missed during searches

Prickly bog sedge—known on five natural areas, this plant has been found at all five in the past 10 years and was most recently observed at two in 2017; although abundant at some sites, it appears to be declining at two of the natural areas

Brome-like sedge—recorded at four seep spring sites on the Shawnee National Forest, this species has been seen at two in the past 10 years, with one site being observed in 2017; census data at one site indicates its numbers are holding steady

Drooping sedge—found at only one natural area and was last observed in 2015; the population may be declining

Swamp sunflower—of the four sites recorded on the Shawnee National Forest, only two have been observed in the last 10 years; one site (observed in FY 2016) has abundant plants, the other just a few (last observed in 2013)

Large whorled pogonia—this species has been found at only one natural area with multiple sites; numbers appear to be declining at most sites and most plants observed were sterile; this orchid was last observed in the Shawnee National Forest in 2016

Small green wood orchid—this species has been found at two Shawnee National Forest natural areas and has been seen at both in the past 10 years; populations are small and may be declining; it was last observed in 2016 at one site and in 2017 at the other

Maryland meadowbeauty—formerly found at ten sites in the Shawnee National Forest; plants have been observed at four within the past 10 years, having last been seen at a natural area in 2016; it was searched for at 3 other natural areas in 2017, but was not found

Sullivant’s coneflower—found at two sites in the Shawnee National Forest, this species was last observed in 1993

Longbeak arrowhead—this species is known from 2 sites at one natural area; its numbers increased from 2005 to 2015, and it was last observed in 2017

Leafy bulrush—recorded at eight natural areas and three other sites, this plant is considered historic at five; populations appear to be stable or increasing at the remaining sites; it was last observed at 3 natural areas in 2017

New York fern—found at a single Shawnee National Forest natural area, this population appeared to be stable when last observed in 2007.

Is the ecological value of seep, spring and cave habitats being maintained?

The ecological value of seep habitat is not being maintained in the Shawnee National Forest. According to Mark Basinger's 2009 study of seep springs in southern Illinois, habitat has declined significantly over 40 years from when John Schwegman (1969) surveyed many of the Shawnee National Forest's seep springs. Habitat at all but one of the sites in the Forest has changed substantially since then. Forest succession has changed several sites from relatively open canopy, sunny wetlands sites to drier forests with closed canopies. Altered hydrology has also caused some to become drier and shadier. Serious erosion issues have created drier conditions at some sites. Invasive plants, especially Nepalese browntop (*Microstegium vimineum*), have reduced native plant diversity and are threatening sensitive plants found in these habitats. Japanese honeysuckle (*Lonicera japonica*) and multiflora rose (*Rosa multiflora*) are also common invaders and are affecting some seep spring habitat.

Forest plan standards and guidelines are adequate to protect sensitive plant species in seeps and springs. However, lack of management implementation has resulted in the degradation of most seep spring sites known on the Forest. According to Mark Basinger's 2009 study (Survey of Some Seep Springs in the Cretaceous Hills of Pope and Massac Counties in Southern Illinois), most sites have declined significantly in quality since the 1960's. Of the 12 springs examined many exhibited degradations from various sources. Woody succession (89%), changes in hydrology (83%), and invasive plants have altered the character of the seeps and springs (100%), changing the plant composition of these sites.

In August 2017, three natural areas with acid-seep springs were treated with herbicide targeting Nepalese browntop.

To what extent are recreational or management activities taking place in subject ecosystems or biological communities and what, if any, impacts are occurring?

There is little evidence of recreational activity at the seeps and springs in the Shawnee National Forest. Impacts are few, if any. The sites where Nepalese browntop infestations were herbicide sprayed were monitored about 6 weeks after treatment. That monitoring showed substantial reductions of this invasive grass at all three springs. Mortality ranged from 60% to 90%.

To what extent are required mitigation measures being implemented, and are they effective in protecting rare ecosystems and communities?

Mitigation measures to protect sensitive plants during herbicide treatment of invasive plant infestations have been implemented. Herbicide spraying of Nepalese browntop did not take place over water (as per label directions), rare plants are flagged to prevent trampling, and rare grasses at these sites were searched for to protect them from the grass specific herbicide used to treat Nepalese browntop. These mitigation measures appear to have protected sensitive plants from damage during treatments.

Conclusions

Woody succession, changes in hydrology, and invasive plants have altered the character of the seeps and springs which in turn is changing the plant composition of seep springs. Management projects implement standards and guidelines to protect native plants although management actions have not kept pace with the restoration needs.

References

ArcMap TESP-IS Database. Forest Service Natural Resource Manager Database for Threatened, Endangered, Sensitive, & Proposed Plants and Invasive Species. Harrisburg, Illinois.

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22.Recreation Demand

- Are recreation users satisfied with their experience?

Method

Numbers of forest-wide visitors and visitor use, and use in recreational activities and some recreational areas, from National Visitor Use Monitoring assessments.

Observations, Results, Trends

The last NVUM survey was conducted in 2013, although the total number of visitors to the Shawnee National Forest annually has probably not changed significantly since that time. In 2013, it was estimated that there were 448,000 visits to the Shawnee National Forest. Ninety-seven percent of the forest visitors in 2013 were white, of which 59 percent were male and somewhat evenly distributed between ages 21-60. Thirty-four percent of the visitors resided within a 25-mile radius from the Shawnee National Forest boundary. Visitors were engaged in a variety of recreational activities, with the top four main activities being hiking, horseback riding, hunting and viewing natural features. According to the 2013 survey, visitors to the Shawnee National Forest were largely (78%) "Very Satisfied" with their visit and the services provided.

The total solar eclipse of 2017 created a short-term spike in the number of visitors in the Shawnee National Forest. The weekend before and the day of the eclipse (August 21) were likely the highest visitor use days ever on the Shawnee National Forest.

The number of Recreation Special Use events increases each year and there appears to be an increasing interest in adventure races (50K or 100K trail running, land/water triathlons, mountain biking, etc.) and dispersed recreation adventure activities (rock climbing, kayaking, mountain biking, seasonal forest-road jeeping). The Shawnee National Forest provides a setting to support these recreation trends and opportunities exist to be responsive to this public interest. In 2017 alone, many partnerships were developed and collaborative projects were completed in support of this public interest.

Partnered with Lusk Creek Conservancy District to construct a kayak/canoe launch on Lusk Creek.

Partnered with a local rock-climbing group to provide medical care stations at Jackson Falls.

Partnered with Shawnee Trails Conservancy and other trail advocates to improve major trailhead/parking areas and maintain several forest trails.

Three Jeep groups have expressed interest in adopting roads and assisting with their maintenance.

The River-to-River Trail Society and Friends of the Shawnee have joined forces to re-invigorate the River to River Trail System and promote its use.

The Friends of the Shawnee created a user-friendly west-side trail map and guide.

Conclusion

There are about 450,000 recreational visits to the Shawnee National Forest each year and 78% of visitors rated their experience "Very Satisfied". Recreation interests, activities and partnerships are growing.

23.Recreation Facility Health and Safety

- Are recreation facilities managed to standard?

Method

To determine the number of recreational facilities meeting standard, about 20% of the recreational facilities are monitored each year. Within a five-year rotation, all facilities are inspected.

Observations, Results, Trends

We inspected 14 facilities in 2016 and 21 in 2017. In 2016, 12 of the 14 rated good and two facilities were suggested for removal/decommissioning. An oil shed and a work shed near Lake Glendale are in poor condition. In 2017, 19 of the 21 buildings rated as fair to good. Two shelters at the Johnson Creek day use area were recommended for demolition.

Conclusion

Monitoring showed almost 89% of facilities monitored rated as good.

24.Level of Use of Trail System

- Is usage consistent with planned usage?

Method

Accomplished miles of trail maintenance which is based on available funding and personnel for a particular year. Assessments from National Visitor Recreation Use Monitoring, can be used and accomplished every five years. The next scheduled assessment is 2018.

Observations, Results, Trends

Observations indicate trail use in the Shawnee National Forest is steady to increasing. In 2016, 127 miles of trail was maintained and 245 miles in 2017. Most of the needed maintenance of the 400+ miles of designated trails in the Shawnee National Forest continues to be deferred as funding levels support only a portion of total trail system that needs to be maintained each year.

Conclusion

Between 2016 and 2017, 372 miles of trail were maintained although this does not capture the entire need of maintenance.

25. Wilderness Management

- Are wilderness users satisfied with their experience?

Method

The Visitor Use Reports for the Shawnee National Forest of National Visitor Use Monitoring Data (SNF NVUM reports) are used to answer the monitoring question 'are wilderness users satisfied with their experience. Use of this data source was specified in the Forest Plan Monitoring Matrix contained in Chapter 6 of the Forest Plan. The National Visitor Use Monitoring (NVUM) program is a recreation sampling system that provides science-based estimates of the volume and characteristics of recreation visitation to the National Forest System. Additionally, it describes the benefits recreation brings to the American public. Once every five years, each National Forest or Grassland has a year of field data collection to accomplish their visitor use monitoring. The Shawnee National Forest completed NVUM data collection in fiscal year (FY) 2008 and 2013. Master Reports are available and accessible on the [National Visitor Use Monitoring Results webpage](https://www.fs.fed.us/recreation/programs/nvum/). We use the 2013 information as the basis because that is the latest current report with relevant results.

The NVUM methodology is explained in detail in: *Forest Service National Visitor Use Monitoring Process: Research Method Documentation; English, Kocis, Zarnoch, and Arnold; Southern Research Station; May 2002* (<https://www.fs.fed.us/recreation/programs/nvum/>). Essentially, visitation is estimated through a combination of traffic counts and surveys of existing visitors. Both are obtained from a random sample of locations and days distributed over an entire forest for a year and stratified by site type and expected use level.

Observations, Results, Trends

The 2013 National Visitor Use Monitoring (2013 NVUM) survey provides user satisfaction results based on 14 satisfaction elements (Table 21). In total there were 219 completed interviews of individuals visiting designated wilderness. Of those 219 individuals, 64 individuals were interviewed for their satisfaction with recreation services and facilities.

Overall, visitors to designated wilderness indicated being satisfied with developed facilities, condition of environment, interpretive displays, parking availability, parking lot condition, recreation information availability, road condition, feeling of safety, scenery, signage adequacy, and trail condition. Visitors to designated wilderness reported being less than satisfied with restroom cleanliness. Restrooms at designated wilderness trailheads or parking lots are not normal designated wilderness amenities in the

Shawnee National Forest. Of the seven wilderness areas in the Shawnee National Forest, only two wilderness trailheads provide primitive restrooms facilities. Finally, results are not reported for employee helpfulness and value for fee paid satisfaction elements therefore no satisfaction ratings are available.

As mentioned previously, a Shawnee NVUM survey was also completed in FY 2008 using the same established methodology as used for the FY 2013 survey. Results of the FY 2008 and FY 2013 satisfaction surveys are provided in Table 20. There were 132 completed interviews of individuals visiting designated wilderness with the 2008 National Visitor Use Monitoring (2008 NVUM) survey. Of those 132 individuals, 42 individuals were interviewed for their satisfaction with recreation services and facilities. However, it seems not all 42 individuals were asked or answered all the 14 satisfaction element questions during the survey. The 2008 NVUM survey number of observations ranged from 0 to 38. The statements made above regarding no satisfaction ratings and differences in the number of observations are applicable to the 2008 results as well.

To illustrate satisfaction for 2008 and 2013, the percent rating of satisfaction for somewhat satisfied and very satisfied were combined and shown for each year in Figure 10. Overall, from 2008 to 2013 visitors to designated wilderness in the Shawnee National Forest remain satisfied. Satisfaction elements with percent rating satisfactions of zero (restroom cleanliness, developed facilities, employee helpfulness and value for fee paid) from Table 21 were not included in Figure 10.

Table 21. 2008 and 2013 Satisfaction for Visits to Designated Wilderness Results

Satisfaction Element	2008 % Somewhat Satisfied	2013 % Somewhat Satisfied	2008 % Very Satisfied	2013 % Very Satisfied	2008 Number of Observations	2013 Number of Observations
Restroom Cleanliness	0	16.7	0	22.6	9	25
Developed Facilities	0	24.7	0	72.9	1	17
Condition of Environment	24	9.7	64.7	90.3	37	64
Employee Helpfulness	0	0	0	0	7	4
Interpretive Displays	36.9	43.4	36.9	26.6	19	41
Parking Availability	7.8	11.6	90.6	78.2	24	53
Parking Lot Condition	16.2	5.6	74.9	88.4	23	53
Rec. Info. Availability	22.2	32.2	35.6	33.5	34	51
Road Condition	28.1	9.7	43.7	71.9	12	41
Feeling of Safety	17.7	9	76.8	84	38	64
Scenery	6.6	4.7	88	95.3	37	64
Signage Adequacy	33	24	27	52.1	35	63
Trail Condition	44.9	42.8	49.3	56.4	37	64
Value for Fee Paid	0	0	0	0	0	1

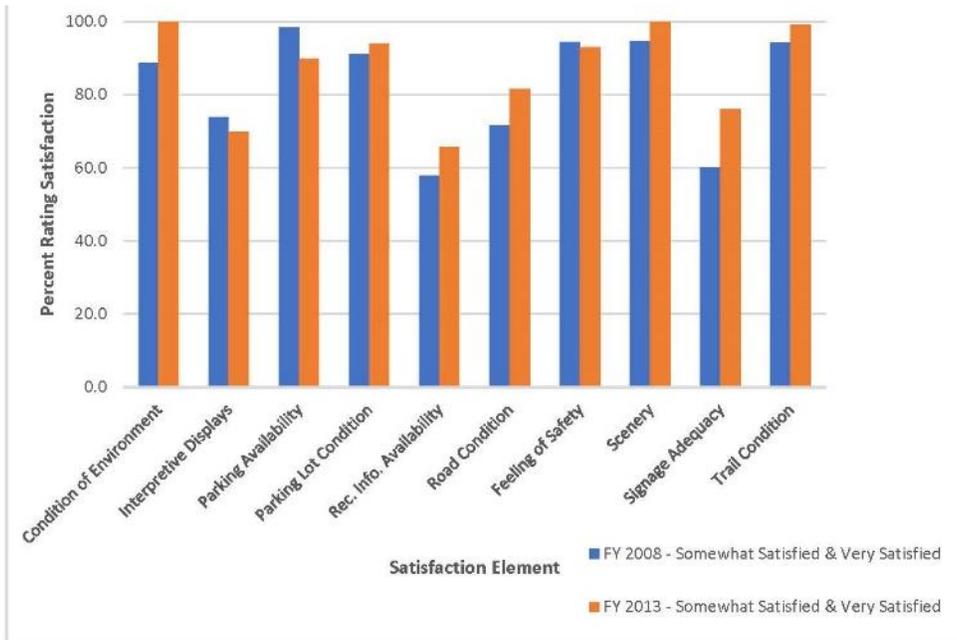


Figure 10. User satisfaction for visits to designated wilderness in 2008 and 2013

Conclusion

Published results from the last National Visitor Use Monitoring exit surveys (2013) indicate that in general visitors to designated wilderness in the Shawnee National Forest are satisfied with their experience.

26. Long-term Stream Temperature Monitoring

- Are stream temperatures changing over time?

Method

In 2014, the Northern Institute of Applied Climate Science and the Forest partnered to deploy eleven long-term temperature monitors in streams on the forest and air temperature monitors (Table 22). Temperatures are recorded hourly and periodically checked.

Observations, Results, Trends

The first 5-10 years of data collection will be used as a baseline to measure long-term change against. Data is presented from a site on Big Creek near Iron Furnace (Figure 11). The graph shows the daily and seasonal fluctuations.

Table 22. The locations of long-term temperature probes

Stream	County
Johnson Creek	Jackson County
Cedar Creek	Jackson County
Hutchins Creek	Union County
Dutch Creek	Union County
Wolf Creek	Alexander County

Bill Hill Hollow	Pope County
Hunting Branch	Pope County
Lusk Creek	Pope County
Big Creek	Hardin County
Big Creek	Hardin County
Big Creek	Hardin County

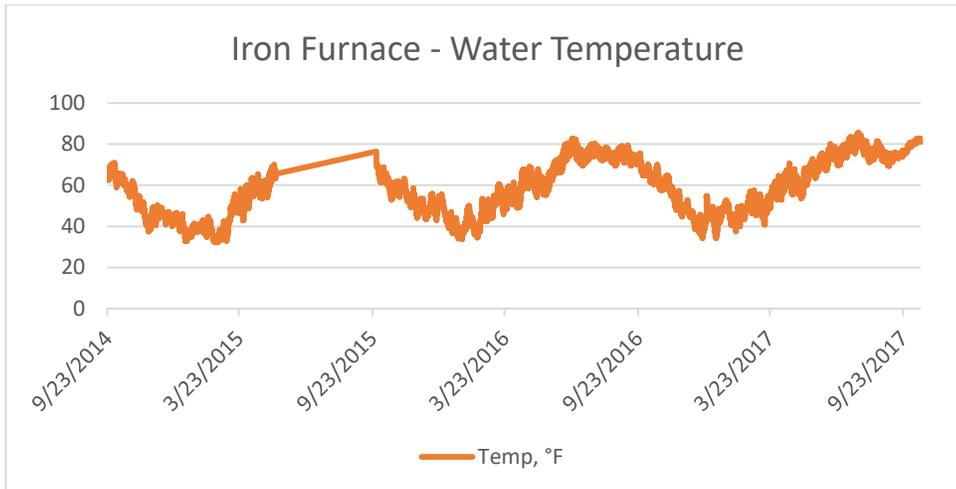


Figure 11. Stream water temperatures on Big Creek near Iron Furnace from 9/23/14 to 9/23/17. No data was collected from 5/13/15 to 9/28/15 because the battery in the probe had failed

Conclusion

Baseline data is being developed for future trend analysis.

27. Invasive Species Control

- Are we losing biodiversity in our natural areas from invasive species?

Method

Natural area surveys, observations and reports regarding habitat condition and acres treated, controlled and monitored.

Observations, Results, Trends

Since the Non-Native Invasive Species Management decision was signed in 2014, invasive plant infestations at twelve natural areas (Table 23) have been treated with herbicide. Additionally, prescribed fire at two natural areas has been conducted primarily to control invasive plants.

Table 23. Non-native Invasive Species Treatments in Natural Areas in 2016 and 2017

Natural Area	Invasive	2016	2017
Ava Cave Zoological Area	Chinese yam	0.5 acre	0.5 acre
Ava Cave Zoological Area	Garlic mustard	3.4 acres	2.8 acres
Bell Smith Springs Ecological Area	Chinese yam	0.5 acre	0.01 acre
Dennison Hollow Research Natural Area	Garlic mustard	0.4 acre	0.4 acre
Double Branch Hole Ecological Area	Garlic mustard	1.6 acres	1.6 acres
Jackson Falls Ecological Area	Chinese yam	0.6 acre	0.0
Kickasola Cemetery Barrens Ecological Area	Nepalese browntop	0.0	5.8 acres
LaRue Pine Hills Research Natural Area	Amur honeysuckle	0.0	12.1 acres
LaRue Pine Hills Research Natural Area	Beefsteak plant	1.1 acres	1.1 acres
LaRue Pine Hills Research Natural Area	Chinese yam	0.2 acre	0.01 acre
LaRue Pine Hills Research Natural Area	Garlic mustard	3.1 acres	3.1 acres
LaRue Pine Hills Research Natural Area	Reed canary grass	0.1 acre	0.08 acres
LaRue Pine Hills Research Natural Area	Sweetclover	1.2 acres	1.1 acre
LaRue Pine Hills Research Natural Area	Bush Honeysuckle	0.0	12.1 acres
Massac Tower Springs Ecological Area	Nepalese browntop	0.0	3.1 acres
Opossum Trot Trail Ecological Area	Garlic mustard	0.6 acre	0.9 acre
Simpson Barrens Ecological Area	Sweetclover	6.0 acres	6.0 acres
Snow Springs Ecological Area	Nepalese browntop	0.0	1.7 acre
Teal Pond Botanical Area	Phragmites	0.1 acre	0.1 acre

Conclusion

Management actions are being implemented to limit the spread of invasive plant species in natural areas although eradication has not been achieved.

28. Quantitative Performance of the Forest Plan

- Quantitative performance, comparing outputs/services with those projected in the Forest Plan
- Is the Plan being implemented?

Method

Accomplishment reporting.

Observations, Results, Trends

Table 24 compares our anticipated output to our actual output for Forest Plan implementation. The proposed level of implementation from the Forest Plan is compared to the actual accomplishments since the beginning of the planning cycle in 2006.

Table 24. Forest plan anticipated outputs and accomplishments

Management Practice/Activity	Unit	Amount Proposed First Decade	Actual First Decade 2006-2015	Amount Probable Second Decade	Actual Second Decade 2016-2017
Timber Harvest					
- Hardwood shelterwood	Acre	3,197	0	6,175	0
- Hardwood shelterwood with reserves	Acre	1,500	0	3,000	0
- Pine shelterwood with reserves	Acre	3,814	204	6,369	53
- Intermediate treatments	Acre	263	0	172	0
- Salvage	Acre	0	0	0	186
Reforestation					
- Site prep for natural regeneration	Acre	7,490	6,281	9,663	407
- Planting	Acre	6,166	4,380	7,186	360
Forest Stand Improvement	Acre	5,362	15,880	12,656	2,300
Roads					
- Reconstruction	Mile	94	1.0	105	0
- Obliteration	Mile	20	7.2	20	0
Equestrian-Hiking Trail Construction	Mile	235	77	0	8
Wildlife Habitat Improvement					
- Wildlife opening maintenance	Acre	700	0	700	0
- Large openland maintenance	Acre	2,700	7,126	2,700	1,977
- Pine-stand restoration to hardwoods	Acre	586	204	1,431	53
- Shelterwood for oak management	Acre	659	0	1,330	0
- Shelterwood with reserves	Acre	400	0	800	0
- Intermediate treatments	Acre	95	0	45	0
Prescribed Burning					
- Site preparation/brush disposal	Acre	17,371	6,457	26,847	407
- Landscape-scale site prep for oak	Acre	66,218	15,880	66,218	2,300
- Ecological for barrens in NAs	Acre	30,000	4,662	30,000	2,665
- Large openland management	Acre	10,800	7,126	10,800	1,977

Conclusion

Based on a review of work accomplished from 2006 through 2017, implementation of the Forest Plan is not meeting the anticipated levels of outputs for various management activities.

29. Species of Recreational Interest

- Based on harvest information from the Illinois Department of Natural Resources is habitat for recreational species in need of management?

Method

Subjective analysis utilizing various measures, including reports on habitat conditions and suitability, species monitoring, and annual accomplishment data. Query databases and websites, along with communications between IDNR and Shawnee National Forest wildlife and recreation staff, when retrieving relevant information pertaining to wildlife species of recreational interest.

Observations, Results, Trends

Eastern wild turkey: Forest Service personnel do not conduct any direct population monitoring of the eastern wild turkey population. Personnel reviewed spring turkey harvest data from IDNR for 2016-2017 for counties that contain portions of the Shawnee National Forest (Table 25). The reported turkey harvest and trends in turkey harvest can serve as two of several indicators of turkey population trends. However, the reported spring turkey harvest can be affected by annual turkey poult production and survival from at least two years prior, spring and early summer weather conditions, and the weather conditions during the spring turkey hunting season. Despite periodic annual increases and decreases, the IDNR spring turkey harvest data suggest a somewhat stable annual reported spring harvest.

Table 26. Eastern Wild Turkey harvest data from the Illinois Department of Natural Resources for counties that contain National Forest lands.

Table 25. Spring turkey harvest data

County	2016	2017
Alexander	110	121
Gallatin	226	187
Hardin	Reporting error	Combined with Gallatin County
Jackson	225	261
Johnson	213	193
Massac	73	75
Pope	322	302
Pulaski	74	85
Saline	79	81
Union	285	268
Williamson	185	239
Total	1792	1812

White-tailed Deer: The reported deer harvest data for Shawnee National Forest counties have trended slightly downward. However, reported harvest numbers were slightly up for the 2015-2016 deer hunting season, and down again for the 2016-2017 deer season (Table 26). Many issues come into play in affecting the fall deer harvest, including the timing of the rut, weather and the availability of fall foods. Over the past years, the IDNR has implemented several harvest regulations aimed at increasing the antlerless deer harvest, including adding additional days to the gun deer-hunting season, and making it easier to purchase antlerless-only harvest tags over-the-counter. Hunters continue to harvest some high-quality antlered bucks in many of the counties. Southern Illinois counties continue to harvest some trophy-class bucks each year.

Table 26. White-tailed deer harvest data from the Illinois Department of Natural Resources

County	2013-2014	2014-2015	2015-2016	2016-2017
Alexander	795	649	801	628
Gallatin	830	838	909	765
Hardin	1442	1352	1497	1349
Jackson	3135	3333	3575	3410
Johnson	2255	2430	2509	2356
Massac	1012	998	1078	960
Pope	2385	2547	2536	2341
Pulaski	867	833	793	670
Saline	1490	1522	1707	1439
Union	2734	2684	2863	2447
Williamson	2632	2826	3127	2773
Total	19577	20012	21395	19139
Percent Change in Reported Harvest from Previous Year		+2.2%	+6.9%	-10.5%

Waterfowl hunting in the Shawnee National Forest is not tracked by IDNR. Therefore, all information is anecdotal, but waterfowl hunting on the forest appears to be increasing for the last 5-10 years. Hunters frequent popular locations such as Oakwood Bottoms, East Cape wetlands and Upper and Lower Bluff Lakes.

The Shawnee National Forest does not collect any population monitoring data or annual harvest rates for waterfowl. However, based entirely on the presence or absence of suitable summer breeding habitat, there were extremely favorable spring and summer water conditions throughout southern Illinois providing excellent habitat conditions. In early September, high numbers of wood ducks could be observed in wetland habitats in the Shawnee National Forest, as well as lands managed by the IDNR. Sub-par water conditions prevailed through late fall and early winter, before precipitation was received to replenish water levels in seasonally-flooded wetlands.

Conclusion

Based on harvest numbers for deer and turkey, these species have adequate habitat to support current populations. Favorable habitat conditions were present for waterfowl although annual harvest data is not tracked.

30. Heritage Resources

- Are significant heritage resources (archaeological and historical properties) being identified through inventories conducted in consultation with the Illinois State Historic Preservation Office (SHPO) according to the National Historic Preservation Act?
- Are potential effects of earth-disturbing activities to heritage resources being accurately predicted in analysis documents?
- Are existing conditions of significant sites included in the Heritage Resource Management Prescription being maintained?

Method

The methods to determine whether potential effects of earth-disturbing activities to heritage resources are being accurately predicted in analysis documents include:

field visits by archaeologists following established Illinois State Historic Preservation Office inventory protocols; field visits are made to record observations both before decisions are made by agency officials and after project implementation

data queries of the NRM Heritage database to determine past field visits and site condition and integrity referencing Illinois State and Tribal Historic Preservation Officer correspondence

In addition, the Forest currently maintains a list of 96 Priority and Multi-Use Heritage Assets. These are sites that have been determined to have distinct public value representing important episodes in our national historical narrative. These sites are included in the Heritage Resource Management Prescription and are managed to preserve their existing condition as determined through condition assessments. Condition assessments occur on a rotating five-year schedule so that each year a minimum of 20 percent of the priority heritage and multi-use assets are visited.

Lastly, archaeological sites and the contents of those sites are protected by state and federal laws. As a result, heritage resource specialists are occasionally called upon to work with law enforcement officers to investigate unauthorized activity at archaeological sites and other historic properties within the Shawnee National Forest boundaries. These investigations also result in existing condition assessments.

Observations, Results, Trends

Monitoring is conducted to observe and record the results of actions and to inform management decisions, whether they are prescribed by the agency, implemented by a user with agency authorization, or unauthorized. In FY16-17, eight heritage surveys were conducted in consultation with the SHPO, resulting in the identification of 34 new heritage sites, and revisits or updates to 18 previously identified sites.

Condition assessments were also carried out on 18 Priority Heritage Assets in 2016 and 2017. All monitored assets/sites were in good condition with no preservation issues or concomitant protection needs. Unrelated to scheduled condition assessments, heritage site stewardship activities were carried out at three priority heritage assets and one multi-use asset in order to: 1) provide learning opportunities for the American public; 2) provide interpretative signage at a site; and 3) to conserve two sites against existing conditions (vandalism). One unauthorized action by a member of the public resulted in a law enforcement investigation that located the offender who was fined and forced to

return the artifacts to the forest. Another vandalized site was restored back to its existing condition with no lasting effect to the heritage resource.

Post-burn monitoring of 33 heritage resources in six burn units identified through a previously agreed upon survey protocol outlined in the Prescribed Fire Programmatic Agreement found no heritage resources were affected during project implementation.

Conclusion

Post-implementation monitoring of heritage resources via 34 field visits determined that:

- significant sites and historic properties are being identified prior to project implementation
- potential effects to heritage resources are being predicted in analysis documents
- existing conditions of significant sites are being maintained

No heritage sites were damaged or otherwise disturbed by project implementation in fiscal years 2016 and 2017. Existing monitoring methods are adequate to meet the identification and protection goals for Heritage Resources prior to project decisions as well as maintaining existing conditions of significant sites identified as Priority Heritage Assets (Heritage Resource Significant Sites Management Prescription).

31. Timber Harvest Program

- Is the productivity of soil being protected during implementation of the timber program?

Method

Subjective analysis and documented observations of effects of management. The Forest Soils Disturbance Monitoring Protocol can be used to observe impacts of skid trails and log landings on soils. The protocol is intended to be used to evaluate physical soil disturbance before and after a ground disturbing management activity. The protocol for the disturbance surveys will be found on-line at: <https://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf>. Penetrometer readings are also taken and designed as if the probe imitates a plant root pushing through the soil to measure penetration resistance. Roots experiencing 80% penetration begin to decrease at about 70 PSI dropping to 0% root penetration at 300 PSI (Duiker, 2002).

Observations, Results, Trends

Forest Soils Disturbance Monitoring Protocol data was collected for 17 points at Harris Branch North (Table 27). The average penetrometer reading of the unit was 56 PSI, and some readings were as low as 44 PSI. One penetrometer reading in a main skid trail was >87 PSI. Though we do not know how high the value of the sample from the skid trail was over 87, we can expect it to slowly revegetate over time from natural processes such as freeze and thaw cycles and biological activity in the soils.

Conclusion

Conclusion: Monitoring of a timber sale shows soil productivity is being protected during project implementation.

Table 27. Soil disturbance monitoring at the Harris Branch North Timber sale

Disturbance Factor	% presence in plots (unless otherwise noted)	Data Interpretation
Fine wood (< 7 cm)	88	Cover on the forest-floor tells about erosion potential and nutrient cycling.
Coarse wood (>7cm)	50	Cover on the forest-floor tells about erosion potential and nutrient cycling.
Live plant	76	Cover on the forest-floor tells about erosion potential and nutrient cycling.
Forest floor impacted	06	These ratings describe the surfaces in the stand.
Bare soil	18	These ratings describe the surfaces in the stand.
Rock	0	These ratings describe the surfaces in the stand.
Topsoil displacement	24	Topsoil tends to have higher infiltration rates, be more fertile, and erode less than subsoil.
Erosion	18	Topsoil tends to have higher infiltration rates, be more fertile, and erode less than subsoil.
Rutting (< 5 cm,)	12	Compacted ruts can channel water downslope and slow regeneration.
Rutting (5 -10 cm)	06	Compacted ruts can channel water downslope and slow regeneration.
Rutting (>10 cm)	0	Compacted ruts can channel water downslope and slow regeneration.
Burning light	88	Helps determine if increased erosion or amount of remaining forest-floor nutrients are a concern.
Burning moderate	06	Helps determine if increased erosion or amount of remaining forest-floor nutrients are a concern.
Burning severe	0	Helps determine if increased erosion or amount of remaining forest-floor nutrients are a concern.
Compaction (0 - 10 cm)	24	Compaction reduces pore space in soils and therefore infiltration, biologic activity, and plant root growth.
Compaction (10 - 30 cm)	29	Compaction reduces pore space in soils and therefore infiltration, biologic activity, and plant root growth.

Disturbance Factor	% presence in plots (unless otherwise noted)	Data Interpretation
Compaction (> 30 cm)	N/A	Compaction reduces pore space in soils and therefore infiltration, biologic activity, and plant root growth.
Platy/Massive /Puddled (0 – 10 cm)	29	Shows if soil structure is changed and tells if porosity is decreased.
Platy/Massive /Puddled (10 – 30 cm)	20	Shows if soil structure is changed and tells if porosity is decreased.
Platy/Massive /Puddled (>30 cm)	N/A	Shows if soil structure is changed and tells if porosity is decreased.
Forest Floor depth	1.9 cm	The forest floor protects the topsoil and provides organic matter and leaf litter.
Estimated Disturbance	Proportion 1: 71% Proportion 2: 29% Proportion 3: 0%	0 = Undisturbed 1 = Light disturbance 2 = Medium disturbance 3 = Heavy disturbance
Detrimental disturbance	0	Long-term reduction in soil productivity and soil-hydraulic conditions.

References

Page-Dumroese, D. S., Abbott, A. M., & Rice, T. M. (2009). *Forest soil disturbance monitoring protocol*. United States Department of Agriculture, Forest Service.