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Biennial Monitoring Evaluation Report for the Shawnee National Forest

Fiscal years 2018-2023

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1.0 Forest Supervisor's Certification

This report documents the results of monitoring activities that occurred from fiscal year 2018 through fiscal year 2023 on the Shawnee National Forest

I have evaluated the monitoring evaluation results presented in this report. After examination, I consider the 2006 Land Management Plan sufficient to continue to guide land and resource management of the Shawnee National Forest and plan a deeper examination of the recommended changes through engagement with resource specialists.

Felipe Cano
Shawnee National Forest Supervisor

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Felipe Cano
Forest Supervisor

2.0 Monitoring & Evaluation Requirements
2.1 Why Monitoring Matters

Each decision maker must weigh the ecological complexity of the ecosystems, the social and economic contributions.

Data from monitoring can therefore be extremely useful. A robust, transparent, and meaningful monitoring program can provide information on specific resources, management impacts, and overall trends in condition.

Every national forest or grassland has a land management plan that balances tradeoffs among recreation, timber, water, wilderness, wildlife habitat, and other uses. The plan describes a set of desired conditions – a science-based vision for the state of the forest or grassland once the goals of the plan are met. The land management plan includes a monitoring plan, organized around a set of monitoring questions and indicators that are designed to track progress toward achieving the desired conditions. Monitoring of certain resources is required by law, regulation, or policy (see box below for required monitoring topics). Other monitoring occurs depending on specific needs of the national forest or grassland. Under the current planning rule, monitoring questions developed for the monitoring plan must be "within the financial and technical capability" of the Forest Service, meaning that we must have the money and ability, including support from partners, to actually carry out the strategic monitoring outlined in the monitoring plan.

Every 2 years, each forest or grassland compiles and evaluates monitoring results and drafts a biennial monitoring evaluation report (BMER) like this one. Monitoring results allow us to learn through management and adjust our strategies based on what we learned. Monitoring also helps us be accountable and transparent to interested and affected parties and colleagues. BMERs are critical to adaptive management because they tell us and the public whether the land management plan is working. Although we don't make any decisions in BMERs, they are a great opportunity to document and share monitoring results.

Our land management plan is available on our website with the monitoring chapter beginning on page 95.

2.2 Partnerships and Data Sources

To accomplish our mission, the Forest Service partners with land management agencies across all levels of government, with nonprofit and for-profit entities, universities, and communities large and small. The diversity of our partners parallels the breadth of Forest Service work that includes: managing the nation's 193 million acres of National Forest System lands to sustain healthy terrestrial and aquatic ecosystems; conducting collaborative research that connects the agency to hundreds of partners around the world; supporting States, Tribes, communities, and nonindustrial private landowners through technical and financial assistance; protecting communities and the global environment from catastrophic wildland fires, climate change and invasive species; and inspiring life-long connections to nature for every American.

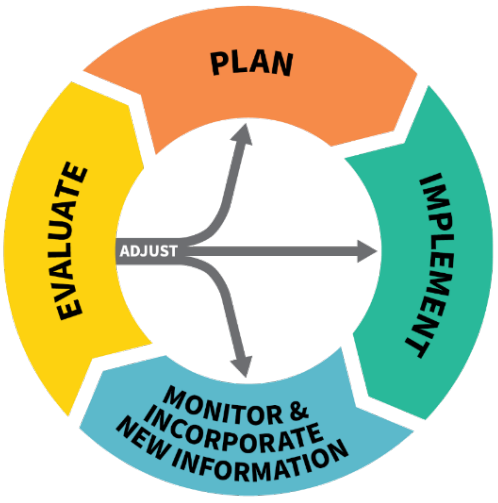
Monitoring can be expensive, time-consuming, and labor-intensive, so we rely on the help of our partners and work collaboratively with them to accomplish monitoring objectives. Some of the entities that we partner with include: Pheasants Forever, Illinois Department of Natural Resources, The Nature Conservancy, Fish and Wildlife Service, Southern Illinois University Carbondale, John A. Logan, Shawnee College, Shawnee Resource Conservation and Development, River to River Cooperative Weed Management Area, Plants of Concern, Chicago Botanic Gardens, National Great Rivers Research and Education Center, Sierra Club, Illinois Native Plant Society Southern Chapter, Friends of the Shawnee, River to River Trail Society, Kinkaid Reeds Creek Conservancy District, Natural Resource Conservation Service, Kinkaid Area Watershed Project, University of Illinois Extension, Soil and Water Conservation District, Southern Illinois University Center For Archaeological Investigations, United Keetoowah Band of Cherokee, Illinois State Historic Preservation Office, National Wild Turkey Federation.

We also rely on existing data sources such as national and regional inventory, monitoring, and research programs; Federal, State, or local government agencies; scientists, partners, and members of the public; and information from Tribal communities and Alaska Native Corporations.

2.3 Monitoring and Evaluation Guide (Monitoring Guide)

Monitoring questions must address the following topics (per 36 CFR sec 219.12 - Monitoring and Forest Service Manual 1909.12 sec. 32.13 - Content of the Plan Monitoring Program):

1. Status of select watershed conditions.
2. Status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
3. Status of focal species to assess the ecological conditions.
4. Status of a select set of the ecological conditions to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species and maintain a viable population of each species of conservation concern.
5. Status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
6. Measurable changes on the plan area related to climate change and other stressors that might be affecting the plan area.
7. Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.
8. Effects of each management system to determine that they do not substantially and permanently impair the productivity of the land.
9. Social, economic, and cultural sustainability must also be addressed in the monitoring plan because sustainability is an inherent part of several of the required monitoring



Adaptive Management Cycle

3.0 Monitoring Activities During Fiscal Years 2018 through 2023

3.1 Report Summary

This 2018-2023 biennial monitoring evaluation report (BMER) for the Shawnee documents monitoring activities that occurred during fiscal years 2018 through 2023. Resource specialists answered 30 of the 31 monitoring questions using preestablished indicators. These responses determine if current activities described in the 2006 Shawnee National Forest Monitoring Plan are moving the forest toward or maintaining the desired conditions or objectives.

The detailed resource data and specialist reports that were used to build this monitoring report are available on request by contacting us at 50 IL-145, Harrisburg, IL 62946 Phone: (618) 253-7114 https://www.fs.usda.gov/detail/shawnee/about-forest/offices. These can be made available by asking for the specialist reports for the data collected. Each new monitoring report builds upon the evaluations and recommendations that precede it. This monitoring evaluation report and previous reports are available at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd789907.pdf where you can review previous recommendations made to move our forest toward the desired conditions and objectives in our land management plan.

Of the 31 monitoring questions examined, we are meeting plan objectives or progressing toward our desired conditions in 30 monitoring questions. To move the Shawnee National Forest closer to the desired condition for vegetation and habitat, we need to increase active management of forests and openlands to reduce fuels and promote regeneration of species like oak and hickory. We also need more active management to increase forest diversity at the landscape scale, expand early seral habitat, and minimize insect and disease outbreaks. Increasing active management will directly and indirectly increase social and economic contributions to the forest's area of influence.

Improved monitoring methods are needed to monitor wildlife species. Several monitoring questions need to be refined to use existing relevant monitoring and data sources, capitalize on existing partnerships, and apply best available science. Additionally, we could develop more meaningful monitoring questions or indicators for assessing recreation demand.

3.2 Recommended Changes

The following table tallies our recommended changes based on evaluation of the monitoring questions addressed in this report. At a glance, it provides the overall totals for how many monitoring questions or indicators are meeting the forest plan direction, or whether changes to the forest plan, management activities, monitoring plan, or new assessment should be considered. See Table 32 at the end of this report for a more detailed summary of the monitoring questions, results, and recommendations.

Recommendations	Yes	No	Uncertain
Land Management plan direction met	30	0	1
Change to land management plan	0	0	0
Change to management activities	1	0	0
Change to monitoring plan	4	0	0
Assessment	7	0	0

Table 1 - Adaptive management recommendations for all monitoring questions addressed in this report

4.0 Monitoring Questions and Key Results
4.1 Status of Select Watershed Conditions

Question 1: Public Water-Supply Reservoir Is upstream agricultural runoff being mitigated? Is water quality being maintained. Improved?

Objective:
The objective of this question is to determine effectiveness of applying best management practices and forest plan standards and guidelines in restoring water-supply watersheds and protecting drinking-water reservoirs.

Methods:
Indicators for this include miles or acres of streambank or gully erosion repaired and supplemented with IEPA water quality reports.

Restoration of Hydrological Conditions: Determine if the subject watersheds (Kinkaid Lake, Cedar Lake, and Lake of Egypt) 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.

Restoration of Hydrological Conditions: Projects have been implemented since 2015 in Kinkaid Lake and Cedar Lake watersheds which are managed under the water supply watershed management prescription in the forest plan, though no work was done in 2021 or 2022. In Table 2, these projects were designed to improve drainage system stability, reduce erosion and improve water quality.

Water Supply Watershed	Projects	Fiscal Years	Accomplishments
Kinkaid Lake	Morber Lane	2016-2018	0.8 miles of streambank stabilization
Kinkaid Lake	Johnson Creek	2016-2018	0.4 miles of gully stabilization
Kinkaid Lake	Taylor Road	2016-2018	0.9 miles of gully stabilization
Kinkaid Lake	Shoreline stabilization	2016-2018	1.0 mile of shoreline stabilization
Kinkaid Lake	NRCS -Private Lands	2016-2018	0.6 miles
Cedar Lake	Shoreline stabilization	2016-2018	3.0 mile of shoreline stabilization
Cedar Lake	Landreth Road	2016-2018	2.9 miles of gully stabilization
Cedar Lake	Little Cedar Lake Road	2016-2018	1.7 miles of gully stabilization
Lake of Egypt	No projects implemented	2016-2018	Not applicable
Kinkaid Lake	Lone Oak	2020-2021	22.9 acres
Kinkaid Lake	Johnson Creek	2020-2021	11.9 acres
Kinkaid Lake	Shoreline stabilization	2020-2021	4.16 acres of shoreline stabilization
Kinkaid Lake	NRCS - Private Lands	2020-2021	Not applicable
Cedar Lake	No projects implemented	2020-2021	None
Lake of Egypt	No projects implemented	2020-2021	None
Kinkaid Lake	Lone Oak Road	2021-2022	0.8 miles of gully stabilization
Kinkaid Lake	Shoreline stabilization	2022-2023	4901 feet of shoreline stabilization

Table 2- Summary of streambank, gully, and shoreline stabilization work completed in Shawnee National Forest Water Supply Watersheds FY16-FY23

Observations/results/trends:
The Shawnee's collaboration with Kinkaid Reeds Creek Conservancy District is working to reduce sedimentation into the lake.

Field monitoring of projects in the Kinkaid Lake Watershed (4/5/18) found that most of the structures are performing well and water quality is being improved at the project sites. 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.

Prescribed burns also occurred in the watersheds. The Cedar Lake Kudzu burn was 245 acres burned on 11/27/18. The Cedar Lake burned 1180.8 acres in FY20-FY21. In the Kinkaid Lake watershed, the sum of 1110.1 acres were burned. In the Kinkaid Lake watershed, the White Tract /White Tract Expansion burned 676 acres on 3/4/18. In these areas, it was estimated the top 1/3 of the litter layer was consumed. Construction for the Johnson Creek Silt Dam was completed September 30, 2020. The purpose is to slow the flow from Johnson Creek and help settle out sediment before reaching the recently dredged, Johnson Creek Boat Ramp. The silt dam is working effectively. A survey conducted on March 16, 2022 showed the silt dam has trapped about 520 cubic yards (~50 dump trucks) of soil thus far. The sediment depth on the downstream side of the structure, at the Johnson Creek Boat ramp, has stayed the same on average over the last year. Thus, the structure is increasing lake water quality below the dam and extend the life of the dredge. The NEPA documents for these fires called for IL Best Management Practices to be implemented and the avoidance of intense burns that remove forest-floor litter and expose excessive bare soil. Best management practices were used during these burns. Only existing roads and trails were used as firelines. Some bare soil exposure occurred from burning the Kudzu, and much of the area was covered in plant material from the burned kudzu that acted like a mulch (Figure 1).

Watershed Name	2018-2019	2020	2021	2022	2023
Cedar Lake-Cedar Creek	245		1180.8		
Kinkaid Lake-Kinkaid Creek	1110.1	937	173.1	2157	3.3
Sum	1355.1	937	1353.9	2157	3.3

Table 3-Total (FS and Non-FS) Acres Burned by Watershed HUC 6 and Year

Figure 1-Old Field on Forest Service Land, Invaded in Kudzu Before and After a Prescribed Burn

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

In 2017, a portion of the Kinkaid watershed was damaged by a tornado that impacted about 350 acres. Salvage harvest operations began in 2017 and monitoring indicated that best management practices and water-supply watersheds standards and guidelines were properly followed. A field visit to monitor the area occurred on 9/19/2018. The log landing was rehabilitated by seeding in 2017 and had thick vegetation a year later (Figure 2). Best management practices were implemented at this project area. Best management practices have been extensively studied, and research shows that when implemented correctly, water quality is protected (Cristan et. al, 2015). In FY20, Purchase Unit 4, 5, and 6 were closed out. Closing out requires equipment trails to be smoothed out and water bars installed on steep slopes, along with other BMPs. Some trails were seeded but trails with slash were not. In Purchase Unit 6, the slope was steep and many water bars (64) were installed in the unit. A site visit on A visit on December 10th, 2021, showed water bars still functioning and revegetation in some areas. Further investigation in the area showed Stream Management Zones (SMZs) were implemented and the contractors did not enter within 25 feet of ephemeral or 50 feet of intermittent streams unless the Forest Service agreed on a crossing to complete operations. Monitoring indicated that best management practices and water-supply watersheds standards and guidelines were properly followed. Some ruts and depressions were noted, especially on the toe slopes, though this damage was sparse and minimal. This likely occurred because the weight of equipment impacts soil more on slopes because the tires make less contact with the ground, so more pressure is in a smaller area, and toe slopes often have more moisture. By slashing the area with nearby slash or waiting for drier soils, the damage is expected to be less. However, BMPs were still followed and overall, the unit looks good.

Figure 2-Vegetated Log Landing on 9/19/2018

Figure 3-The photo shows a skid trail on top of a ridge at Kinkaid Salvage Purchase Unit 6, with evidence of vegetation. The site was visited in winter, so there was likely much more vegetation in the growing season

Figure 4 - Water bar installed at Kinkaid Salvage

Figure 5-Photo of a backpack and soil probe in a rut or wheel depression.

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. They also completed conservation planning efforts with private landowners in the watershed. Additionally, many farm practices, such as cover cropping, fencing, nutrient management and others 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 clearly work to improve water quality by reducing the impacts of agricultural runoff and impacts from other lands in the watershed. These cooperative efforts are needed to comprehensively address water quality concerns.

Illinois EPA Water Quality Reports: The Clean Water Act requires states to develop a list of impaired waters. Total Maximum Daily Loads are developed for water bodies to provide a calculation for a maximum amount of pollutants that can exist and still meet water quality standards. The water-supply watersheds addressed in the forest plan are Cedar Lake, Kinkaid Lake and Lake of Egypt. The IEPA assesses these lakes in relation to their support of beneficial uses, including public and food-processing water supplies. The most recent assessments report that Cedar Lake, Kinkaid Lake, and Lake of Egypt are rated as fully supporting the beneficial uses of public and food-processing water supplies, aquatic life and aesthetic quality. Each of the lakes is rated as not supporting fish consumption due to mercury, with atmospheric deposition as the source. Also see online at: https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/tmdls/2018/303d-list/appendix-a-2.pdf, 303d list - Total Maximum Daily Loads (illinois.gov).

Kinkaid Lake – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0714010611 Kinkaid Lake	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Causes**	**Sources**
2006	3,475	5	Aquatic life and quality – full support Primary and secondary contact not assessed	Fish consumption, food processing, water supply	Manganese, mercury, total phosphorus	Atmospheric deposition, source unknown
2008	3,475	5	Aquatic life and quality – full support Primary and secondary contact not assessed	Fish consumption, food processing, water supply	Manganese, mercury, total phosphorus	Atmospheric deposition, source unknown
2010	3,475	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown

Kinkaid Lake – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0714010611 Kinkaid Lake	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Causes**	**Sources**
			Primary and secondary contact not assessed			
2012	3,475	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting Primary and secondary contact not assessed	Fish consumption	Mercury	Atmospheric deposition, source unknown
2018	3,475	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown
2020	3,475	5	Aquatic life and quality – full support	Fish consumption	Mercury	Atmospheric deposition, source unknown
2021	3,475	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown
2022/2023	3475	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown

Table 4 -Summary from IEPA Water Reports for Kinkaid Lake

Cedar Lake – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0714010602 Cedar Lake	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Cause**	**Source**
2006	1800	5	Aquatic life and quality – full support	Fish consumption, food	Manganese, mercury	Atmospheric deposition,

Cedar Lake – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0714010602 Cedar Lake	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Cause**	**Source**
				processing, water supply		source unknown
2008	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown
2010	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown
2012	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish consumption	Mercury	Atmospheric deposition, source unknown
2018	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting.	Fish consumption	Mercury	Atmospheric deposition, source unknown
2020	1800	5	Aquatic life and quality – full support	Fish consumption	Mercury	Atmospheric deposition, source unknown
2021	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting.	Fish consumption	Mercury	Atmospheric deposition, source unknown
2022/2023	1800	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting.	Fish consumption	Mercury	Atmospheric deposition, source unknown

Table 5-Summary from IEPA Water Reports for Cedar Lake

Lake of Egypt – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0514020401 Lake of Egypt	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Causes**	**Sources**
2006	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support Primary and secondary contact not assessed	Public and food processing water supplies	Manganese	Atmospheric deposition, source unknown
2008	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support Primary and secondary contact not assessed	Public and food processing water supplies	Mercury, manganese, polychlorinated biphenyls	Atmospheric deposition, source unknown
2010	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support Primary and secondary contact not assessed	Public and food processing water supplies	Mercury, manganese, polychlorinated biphenyls	Atmospheric deposition, source unknown
2012	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support	Public and food processing water supplies	Mercury, manganese, polychlorinated biphenyls	Atmospheric deposition, source unknown
2018	2,300	5	Aquatic life, public and food processing water supplies, aesthetic quality – fully supporting	Fish Consumption	Mercury, polychlorinated biphenyls	Atmospheric deposition, source unknown
2020	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support Primary and secondary contact not assessed	Fish consumption	Aldrin, dieldrin, endrin, heptachlor, mirex, polychlorinated biphenyls, toxaphene	Atmospheric deposition, source unknown

Lake of Egypt – Summary from Illinois Environmental Protection Agency - Water Reports						
HUC 0514020401 Lake of Egypt	**Acres**	**Category**	**Designated Uses Attainment? Yes or No**	**Non-attainment**	**Causes**	**Sources**
2021-2023	2,300	5	Aquatic life, aesthetic quality, fish consumption – full support Primary and secondary contact not assessed	Fish consumption	Aldrin, dieldrin, endrin, heptachlor, mirex, polychlorinated biphenyls, toxaphene	Atmospheric deposition, source unknown

Table 6-Summary from IEPA Water Reports for Lake of Egypt

Conclusions:
Monitoring in water-supply watersheds showed that the best management practices and standard/guidelines were followed during erosion project implementation. These practices minimize impacts and improved water quality. Erosion work, including shoreline, gully and stream stabilization improved water quality in project areas. Agricultural runoff and impacts from private land were reduced and water quality was improved by the stabilization projects below agricultural land. IL EPA water quality reports show an overall increase in water quality since 2006, with each lake supporting more beneficial uses. Partnership efforts that address issues at the landscape scale are critical to improving water quality in these watersheds.

Recommendations:
No changes to the forest plan, management activities or monitoring are needed. Continue to work on BMPs in timber sales to identify adaptive practices if needed.

References:
Cristan, R., Aust, W. M., Bolding, M. C., Barrett, S. M., Munsell, J. F., & Schilling, E. (2016). Effectiveness of forestry best management practices in the United States: Literature review. *Forest Ecology and Management*, *360*, 133-151.

United States Department of Agriculture. Forest Service. Eastern Region. 2006. Land and Resource Land and Resources Management Plan – Shawnee National Forest, 2006. Pages 90 – 91. Online: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5151577.pdf.

Question 2: Water Quality – Is water quality being maintained/improved?

Objective:
The objective of this question is to determine effectiveness of applying best management practices and forest plan standards and guidelines in protecting water quality of streams, lakes and ponds.

Methods:
Indicators for this include miles or acres of streambank or gully erosion repaired and supplemented with IEPA water quality reports.

Restoration of Hydrological Conditions: Determine if quality of watersheds across the forest is being maintained or if any impairments have been corrected by projects in the previous year. Review miles and acres of streambank or gully erosion repair. We will review management activity for the application of best management practices and standards/guidelines. We will also evaluate the effectiveness of the practices implemented. The condition of soil and water in each watershed contribute to the water quality across the forest. 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.

One guideline in the forest plan established bare-soil exposure limits. The allowable bare-soil exposure limit is ten percent of each 150-foot linear segment of filter-strip width. These limits apply 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. Filter strips are important for the protection of water quality and will be a focus of monitoring.

The monitoring results listed in question #1 on water quality in water supply watersheds is also relevant to this question but will not be repeated here. Filter strips are considered with forest management activities. The Forest carried out the Copperhead Road, Agropelter, Flume Walker, Iron Duke Pine Reoffer, Dog Hook and Crazy chain sales and filter strips were utilized on the sale. Site evaluation at Copperhead Road Purchase unit 1 verified that BMPs were followed. Filter strips and water bars are found in the units. Below are photos or waterbars from 8/27/18 of the recently closed unit. Waterbars were adequately spaced. The ten percent bare ground is in line with the forest plan. Forest established filter strips, or stream management zones, in each timber sale for FY22. Site evaluation by the FS Timber Sale Administrator at active units verified that BMPs were followed. If timber sales are left because of the season ended, but work is expected to start there again next season, main trails will be temporarily dressed, and temporary erosion control measures are implemented. By installing temporary erosion control measures, erosion and sedimentation are decreased. Best management practices have been extensively studied and research shows that when implemented correctly, water quality is protected (Cristan et. al, 2015).

Guidance from the forest plan allows ten percent bare ground exposure in filter strips, or stream management zones, to allow for stream crossings when they cannot be avoided. We expect to have some short-term sedimentation effects from these bare soil exposure areas, but no long-term

detrimental effects are anticipated. Below is a photo of a log crossing on an ephemeral drainage after being temporarily closed out for the season. The photos (Figure 6, Figure 7) show sediment being deflected by a water bar before entering the crossing. By limiting the crossings and having as few as possible, forest plan guidelines and BMPs are working, however more erosion control practices (e.g. installing silt fences at crossings, slashing the approach for the length of the filter strip, etc.) could help reduce sedimentation even more.

Figure 6-The photo shows a water bar deflecting water and sediment off the skid trail and down the slope to dissipate

Figure 7-The photo shows the pooled up sediment off of the skid trail and spread on the hill, away from the drainage

Figure 8-Photo of a water bar soon after Purchase Unit 1 was closed at Copperhead Road.

Conclusion:
Monitoring showed that best management practices and standards/guidelines were properly implemented and were effective at minimizing construction impacts from installation of the habitat, erosion stabilization and water control structures. These stabilization projects are effective at reducing erosion and improving water quality.

Overall monitoring showed that best management practices and standard and guidelines were followed thus minimizing water quality impacts. Wetland (almost 900 acres) and stream (7.5 miles) restoration are improving water quality. Gully mitigation (0.8 miles) will improve water quality at Kinkaid Lake. Timber sales are inputting small amounts of sediment at stream crossings, as expected, but should not detrimentally impact the ecosystem in the long-term.

Recommendations:
No changes to the forest plan, management activities or monitoring are needed. Installing more erosion control at stream crossings (e.g. silt fences, berms, slashing or hardening at the crossings, etc.) would help reduce sedimentation in the short-term.

References:
Cristan, R., Aust, W. M., Bolding, M. C., Barrett, S. M., Munsell, J. F., & Schilling, E. (2016). Effectiveness of forestry best management practices in the United States: Literature review. *Forest Ecology and Management*, *360*, 133-151.

United States Department of Agriculture. Forest Service. Eastern Region. 2006. Land and Resource Land and Resources Management Plan – Shawnee National Forest, 2006. Pages 90 – 91. Online: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5151577.pdf.

Question 3: Water Quantity – How many miles/acres of stream-channel or watershed have been improved? Water flow un-impeded?

Objective:
The objective of this question is to determine effectiveness of applying best management practices and forest plan standards and guidelines in improving or maintaining stream-channel structure and natural stream-flow regime.

Methods:
Indicators for this include miles, acres treated, including with NRCS partnership
Determine if the quality of watersheds across the forest is being maintained or if any projects implemented had watershed effects. To answer this question, we examine changes in stream channels implemented through watershed improvements.

Observations, Results, Trends:
This question was developed in 2015 and has no previous data reported. Below in Table 7 is previous work since 2015 to improve water quantity. A total about 15 miles of stream-channel that was improved in 2016 & 2017. Water flow was improved and not impeded by stream channel improvements. Additionally, about 357 acres of wetlands were restored. No additional projects were accomplished in fiscal years 2018 to 2023 for water quantity in maintaining stream-channel structure.

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

Table 7-Summary of stream and wetland work completed for water quantity improvements in 2016 and 2017

Conclusion:
Stream channel and watershed work has improved instream conditions and reduce streambank erosion thus improving water flow. Wetland restoration also improved the watersheds and water flow. These projects are moving these areas toward the desired condition.

Recommendations:

No changes to the forest plan or management activity are needed. The monitoring question should be revised or combined with other questions. This question looks at water quantity, which is not a concern in southern Illinois and is not discussed in the forest plan. The answer is repetitive and is very similar to the answer above (Water Quality Item #2).

References:

United States Department of Agriculture. Forest Service. Eastern Region. 2006. Land and Resource Land and Resources Management Plan – Shawnee National Forest, 2006. Pages 90 – 91. Online: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5151577.pdf.

Question 4: Aquatic Biota - What is the species distribution in sampled streams, ponds, lakes?

Objective:

The objective of this question is to determine the effectiveness of applying best management practices in maintaining, restoring, or enhancing aquatic habitat with respect to fragmentation, large woody debris and channel shape and function.

Methods:

Indicators for this are collected through sampling data

Observations, results, trends:

John Crawford and Ethan Kessler have been monitoring bird-voiced treefrogs and other amphibians for four years on the SNF. For example, 170 of 629 (27 percent) ponds sampled in 2020-2022, had spotted salamander present. For wood frogs, 91 of 629 points (14.4 percent) had wood frog egg masses present on the SNF. For marbled salamanders, 41 of 629 (6 percent) of known ponds on the SNF had larvae, eggs or adults present. The prevalence of nature ponds, old cattle ponds, and created vernal ponds on the SNF has helped maintained aquatic biota in forested habitats under different management regimes (silviculture and prescribed fire).

A volunteer citizen-science program at Snake Rd has not indicated any declines in snakes emerging or wintering in the limestone cliffs at LaRue-Pine Hills. A total of 37 people volunteered for the Snake Rd Sentinel program. A total of 63 volunteer datasheets were submitted (N = 52 through the application; N= 11 datasheets). Volunteers logged 183.8 hours and 263.05 miles at Snake Rd starting on 31 August 2023 through 29 October 2023 (N = 46 of 60 days; 76 percent of the closure period). We tested the new application on 31 August 2023 and used those data in our analysis. Volunteers averaged 2.9 hours and 4.2 miles per volunteer day.

A total of 1,199 visitors were counted by volunteers at Snake Rd during the fall closure period of 2023. Peak visitation occurred in October (N= 839 people; $\bar{X}$= 28.9 people per volunteer survey). Volunteers counted 651 vehicles with 446 vehicles at the north entrance and 205 vehicles at the south entrance. The average number of vehicles observed at the north entrance was 7.1 on volunteer days. The highest count of vehicles was on 14 October 2023 (N = 34) at the north parking area.

Volunteers observed a total of 302 snakes with an observation rate of 1.7 snakes per hour. Seventeen of 22 (77 percent) possible species were observed at Snake Rd during the 2023 fall season. Of the 210 northern cottonmouths, 113 were identified as adults and 36 were juveniles. Of the 23 rough green snakes, 11 were identified as adults and four were juveniles. Two juvenile timber rattlesnakes were observed on 26 September 2023. Four species were only detected once by volunteers (Table 8).

The 2023 fall volunteer season observed more snakes, snake species, visitors, and vehicles compared to the previous two seasons (Table 9). The highest daily total for snake observations was on 19 and 23 October 2023 (Figure 9; N= 24 snakes). More surveys occurred during the mid-afternoon time period (N = 40) compared to early (N = 15) and late afternoon surveys (N= 9). Mid-afternoon surveys resulted in the highest snake observation rate but early surveys had a higher snake observation rate compared to late-afternoon surveys (Table 10).

Species	**# Observed**
Northern cottonmouth	210
Plain-bellied watersnake	16
Western ribbon snake	5
Ring-necked snake	7
Rough green snake	23
Gray rat snake	1
DeKay's brownsnake	4
North American racer	7
Mississippi green watersnake	6
Eastern Copperhead	1
Red-bellied snake	1
Timber rattlesnake	4
Smooth earthsnake	3
Common gartersnake	1
Eastern black kingsnake	2
Wormsnake	0

Eastern milksnake	0
Diamond-backed watersnake	1
Northern hognose snake	0
Flat-headed snake	0
Common watersnake	3
Scarlet snake	0
Unidentified snake	7
Total	**302**

Table 8-Total numbers of snakes observed by volunteers during the 2023 fall closure period at Snake Rd, Union County, IL, USA. Seventeen of 22 possible species (77 percent) were observed.

	Fall 2022	**Spring 2023**	**Fall 2023**
Snakes observed	113	128	302
Snake species	14	13	17
Visitors counted	877	575	1,199
Vehicles counted	238	233	651

Table 9-The number of snakes, snake species, visitors counted, and vehicles observed from the fall 2022, spring 2023, and fall 2023 season at Snake Rd, Union County, IL, USA.

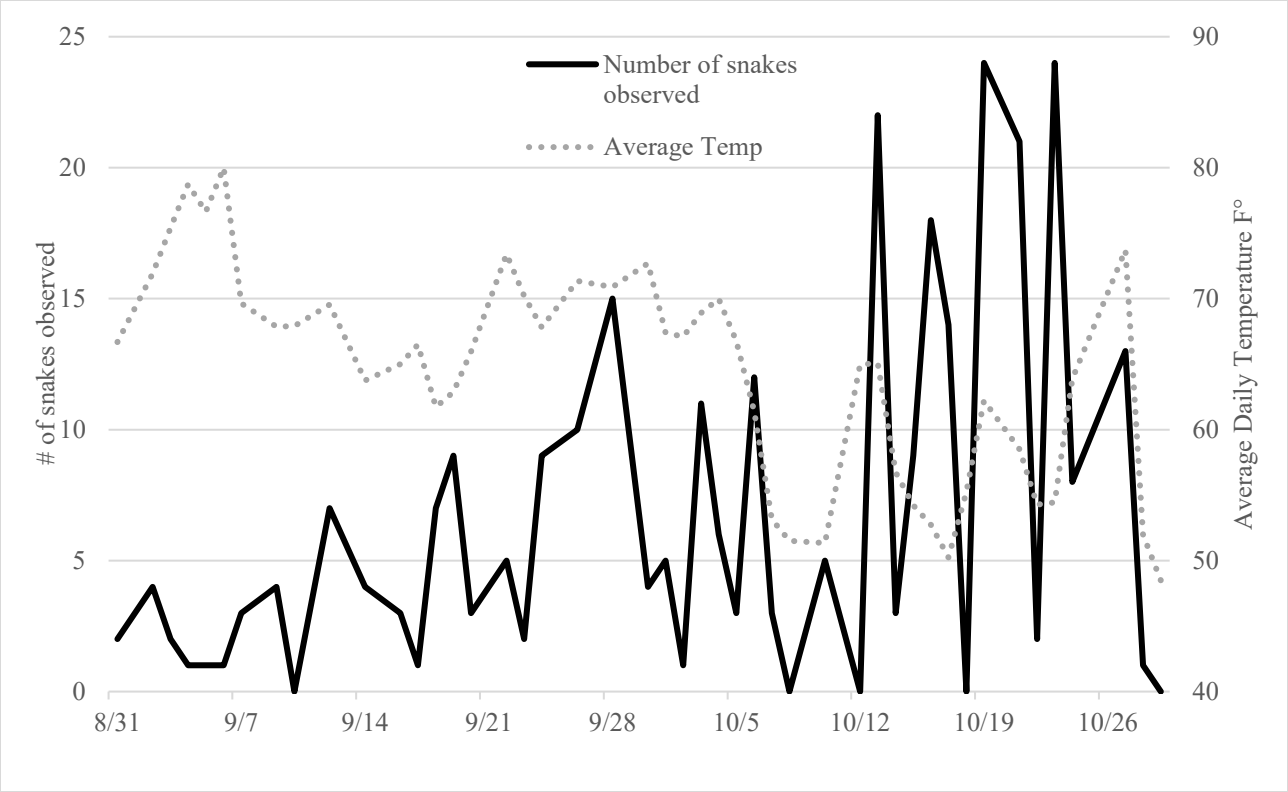


Figure 9-The total number of snakes observed on volunteer dates with average daily temperatures at Snake Rd, Union County, IL, USA in the fall of 2023.

Survey Time Period	# of snakes	# of surveys	Miles surveyed	Snake rate per mile
Early	43	14	45.35	0.95
Mid-afternoon	238	39	182.4	1.30
Late-afternoon	18	9	35.3	0.51

Table 10-The total number of snakes observed by three different survey time periods, Union County, IL during the 2023 fall season.

The fall 2023 volunteer program was the largest citizen-science effort to date at Snake Rd and the new ArcSurvey 123 application played a pivotal role. We obtained a higher effort throughout the 60-day closure period (46 of 60 days; 76 percent) and the highest counts for snakes, public visitation, and vehicles were achieved. Outreach about the Snake Rd Sentinel program through social media accounts likely helped recruit more volunteers this fall season, particularly local students, that resulted in this larger effort. Volunteers are proving to be effective in monitoring the snake population and public visitation rates at Snake Rd. Although Garden of the Gods in Saline County is likely the most important site for public visitation, there are no continuous data that approach the work accomplished by volunteers at Snake Rd. The new mobile application made data collection, submissions, and data analysis more efficient by reducing time spent

organizing and sending data and photographs.

This was the second fall season of the citizen-science program at Snake Rd and data suggest that visitation is higher during the fall. There are typically two federal holidays (Labor Day and Indigenous People's Day) during the fall season compared to one holiday in late May (Memorial Day) during the spring closure season. The spring holiday is later in the spring season when temperatures may be warmer and peak snake movements are typically completed by then. Furthermore, visitors probably prefer weather moving towards cooler temperatures in the fall compared to warmer and more humid conditions.

We observed higher rates of snake observations in the earlier part of the day compared to the late afternoon. This fall we were able to split up observation periods due to the higher volunteer effort to examine potential trends in snake movements and the time of day. Volunteer times still tend to be in the middle of the afternoon which is when public visitation is the highest and temperatures are ideal. Most of the previous work at Snake Rd does not mention temporal or spatial observation trends within seasons (Rossman 1960, Palis 2016 and 2018, Vossler 2021) and so continued citizen-science efforts could likely highlight new observational and spatial trends moving forward.

Volunteers can play a long-term integral role in monitoring the snake populations at Snake Rd temporally and spatially but also protect populations from potential threats. For example, SFD is an ongoing issue and how SFD is affecting local populations at Snake Rd is unclear. Using weather data combined with snake observational data to evaluate numbers and trends over time is important and may help inform management. Other serious factors affecting snake populations may occur, like the illegal pet trade (Stanford et al. 2020, Hierink et al. 2020), and the Snake Rd Sentinel citizen-science program helps keeps eyes on the ground to ensure that illegal collections do not occur. Maintaining a steady stream of volunteers can ensure a good effort in data collection, and thus, evaluating trends, but also watching over the snake population from potential threats. In sum, the Snake Rd Sentinel program is just as much about people than it is about snakes. The Snake Rd Sentinel program gives citizens the opportunity to engage in science, potentially discover and highlight new observational trends, and help inform managers, law enforcement, and scientists in real time.

Question 5: Riparian/wetland vegetation - Is native vegetation maintaining dominance near waterbodies, streams or wetlands?

The objective of this question is to determine the effectiveness of applying best management practices and forest plan standards and guidelines in protecting, maintaining, restoring, or enhancing native riparian vegetation along streams, waterbodies, or wetlands.

Indicators for this are collected through sampling data

Due to lack of staffing this monitoring question was not answered during the 2018-2023 monitoring cycle.

Question 6: Travelways - Are travelways located and maintained to prevent erosion?

Objective:
The objective of this question is to determine the effectiveness of applying best management practices and forest plan standards and guidelines in maintaining, locating, or restoring trails and roadways.

Methods:
Indicators for this are quantified in miles of roads, trails de-commissioned, improved, maintained.

Observations, results, trends:

No roads were decommissioned in 2018-2023.

The majority of road maintenance on the Shawnee NF is conducted through two IDIQ contracts covering the ranger districts and one road maintenance agreement with Johnson County. Maintenance accomplishments through these mechanisms for FY2018-FY2023:

FY	Total* Miles	Location	Miles HC	Miles PC	Blading (mi)	Mowing (mi)	Brushing (mi)	Rock (ton)
18	86.0	Hidden Spgs.	11.6	37.3	71.1	51.3	12.9	1930
		Miss. Bluffs	4.7	32.4	59.4	36.7	9	1300
19	96.9	Hidden Spgs.	13.3	41.0	80.5	77.4	12.3	2720
		Miss. Bluffs	6.7	35.9	58.6	57.6	0	1750
20	86.2	Hidden Spgs.	6.5	41.0	70	61.6	1.9	800
		Miss. Bluffs	5.7	33	48.3	38	11.8	260
21	59.8	Hidden Spgs.	5.7	29.6	49.7	36.3	0	1375
		Miss. Bluffs	2.0	22.5	39.3	3.6	0	430
22	86.7	Hidden Spgs.	12.0	41.0	68.6	42.8	10.1	1325
		Miss. Bluffs	2.2	31.5	45.2	31.9	10.2	410
23	60.8	Hidden Spgs.	5.0	29.6	41.7	35.4	0	700
		Miss. Bluffs	0	26.2	21.7	9.1	0	0

Table 11-Roadways maintained during FY18 – FY23 through contracts

** Total Miles equals the sum of High Clearance (HC) and Passenger Car (PC) mileage on both districts and represents the actual footprint of roadway maintained. The sum of all blading, mowing, and brushing is substantially higher than total miles because the same sections of road generally receive more than one treatment and often repeat blading and/or mowing in one year.*

With approximately 400 miles of road open at least seasonally to motor vehicle travel, our routine road maintenance efforts are addressing 15-24 percent of our active road network annually; however, this does not equate to maintaining close to 100 percent over five years. The core 15 percent is predominantly the US Mail and school bus routes that must be maintained drivable for local resident access, as well as roads accessing key recreation sites. These are maintained at some level every year. When funding allows, additional heavily traveled roads are also maintained, including roads providing access to private property and those accessing smaller recreation sites and popular dispersed recreation areas. A large percentage of our road miles have not received maintenance in at least ten years.

A small number of these untended roads have received some maintenance through timber projects. Timber sale road work has been limited to High Clearance (ML2) roads at the following levels:

FY	Total* Miles	Location	Miles HC	Miles PC	Blading (mi)	Mowing (mi)	Brushing (mi)	Rock (ton)
18	0.4	Hidden Spgs.	0.4	0	0.4	0	0.4	15
		Miss. Bluffs	0	0	0	0	0	0
19	3.05	Hidden Spgs.	0.55	0	1.1	0	0.55	817
		Miss. Bluffs	2.5	0	5	0	2.5	335
20	5.06	Hidden Spgs.	2.56	0	7.68	0	2.56	748
		Miss. Bluffs	2.5	0	7.5	0	0	0
21	2.64	Hidden Spgs.	2.55	0	3.38	0	2.55	1584
		Miss. Bluffs	0.09	0	0.18	0	0.09	0
22	4.79	Hidden Spgs.	1.1	0	2.2	0	0	0
		Miss. Bluffs	3.69	0	4.01	0	3.69	1260
23	3.06	Hidden Spgs.	1.3	0	2.6	0	1.3	762
		Miss. Bluffs	1.76	0	5.28	0	1.76	1024

Table 12-Roadways maintained during FY18-FY23 through timber sales

Lack of maintenance, in particular insufficient quantities of rock applied to the unpaved roads, can affect road surface stability and contribute to erosion/sedimentation concerns. Lack of continuous gravel surface on highly traveled roads leads to exposed soil and increased rutting. Failure to grade often enough results in ruts and potholes remaining in the road surface and retaining water which will cause increasing soil displacement as they are driven through, as well as the potential loss of the crown on the roadbed. Both issues can lead to increased soil erosion from the road surface. Lack of ditch maintenance exacerbates the problem when water leaves the ditches – or fails to reach the ditches due to loss of crown – and flows across the road surface.

Conclusions:

Budget limitations have resulted in decreasing road maintenance mileage to the point that less than one-third of the active Shawnee NF road system is receiving regular road maintenance, and

the trend is toward decreasing funding which will further reduce our ability to maintain the road system. The unmaintained roads are likely contributing to erosion and sedimentation problems on the forest, in addition to causing user dissatisfaction among visitors and local residents who drive on the NFS roads.

Recommendations:

None at this time.

References: N.A.

Question 7: Soils – Is soil protected during management, recreation activities?

Objective: The objective of this question is to determine the effectiveness of applying best management practices and forest plan standards and guidelines in preventing or abating erosion.

Methods:
Indicators for this are quantified by the level of erosion abatement, mitigation and prevention measures that have been taken.

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.

Several projects have required soil protection for erosion control through use of best management practices (BMPs).

Observations, results, trends:
Timber harvests in 2018 and 2019 occurred at Copperhead Road and Agropelter in the Lee Mine Project area. At Copperhead Road Purchase Unit 1, best management practices for erosion control were in place and effective and riparian areas look healthy. Timber harvests in 2020 to 2021 occurred at Copperhead Road, Agropelter, Flume Walker, Iron Duke Pine Reoffer, Dog Hook and Crazy Chain areas.

In 2019 several monitoring trips were made to Agropelter purchase unit 7 where timber harvest operations occurred near an intermittent stream, one after operations and prior to erosion control and one after erosion control. The intermittent stream at Agropelter Purchase Unit 7 measured 1,265ft along the southern edge of the payment unit. In the Lee Mine decision, the following design criteria were identified for intermittent streams:

- 50ft wide beginning from the ordinary high-water mark extending landward
- 0-50ft maintain 50-60 ft^2/ac basal area. No cutting of trees on the streambank
- Allowable bare soils exposure limit is 10 percent of each 150-foot linear segment of the filter strip

In June of 2019 prior to erosion control measures being put in, the forwarder trail near the intermittent stream was measured and totaled 1,182ft. At its closest point was 12ft from the stream and was as far as 65ft. Ten points were taken along the trail. At each point a photo was taken and measurements taken of forest conditions and the trail. All points had a basal area (BA) of 80 ft2/ac or greater. The average width of the trail was approximately 12ft with each track having an average impact of 2ft 8inches wide. Most sections of the trail had an area of 18inches or greater of grass between each tread impact. The trail crossed drainages at several locations. One crossing location had minimal wear suggesting few crossings during operation, and at time of observation no siltation was apparent. A crossing that was used on a regular basis was filled with debris which likely decreased siltation into Big Creek. No areas were noted to be actively contributing sediment into stream.

Water bars were installed at Agropelter purchase unit 7 after harvesting operations were completed. During a field visit in September of 2019 these waterbars were effective at mitigating sedimentation. Sediment did not appear to be moving offsite. Diversion ditches were located along the main skid trail and were effective at diverting overland flow from channeling down the equipment road. Diversion ditches then fan the water over the undisturbed hillside to allow sediment to drop out before reaching a stream.

Conclusions:
Monitoring of the forwarder trail along the intermittent stream in Agropelter purchase unit 7 revealed that best management practices were followed during harvest operations. Only three of the plots would have fallen within the recommended IL SMZ zone. No trees were cut on streambanks. Basal area at all plots was well above the 50-60 ft^2 minimum with an average of 102 ft^2. Bare soil was calculated on average to be 4,356 ft^2 and within the allowable 12,650 ft^2. The trail would need to be 17ft wide and all soil exposed within the trail to exceed the bare soil threshold. The trail never crosses the stream by design and only runs parallel. No sedimentation was noticeable during monitoring and revegetation is starting to occur.

The forest is properly implementing best management practices to mitigate erosion. Monitoring during implementation has led to adaptive management that improved erosion abatement. The system is working as envisioned in the forest plan. Soil productivity is mostly being protected during project implementation and more monitoring will show recovery overtime.

Recommendations:
Other soil properties that influence soil quality and the productivity of the forest should be considered (e.g. compaction). Soil moisture criteria would be beneficial to better guide when soil is too moist that equipment operation can cause unwanted impacts to the soil.

This BMP is open to interpretation as to what constitutes dry, how much rain would push it outside that category, or what sort of drying period is required to obtain dry conditions after rainfall. The type of trail, skid or forwarder should also be considered when determining design criteria associated with harvesting because ground disturbance and compaction will vary between them. Illinois Forestry BMPs area used and generally consider their guidance for skid trails where trees are dragged on the ground to the landing.

References:

Illinois Department of Natural Resources (IDNR) Division of Forestry. 2012. Forestry Best Management Practices. Revised and updated by Eric Holzmueller and Paul Deizman. State of Illinois. Springfield.

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#1 **Public Water-Supply Reservoir** Is upstream agricultural runoff being mitigated? Is water quality being maintained. Improved?	Yes. Monitoring in water-supply watersheds showed that the best management practices and standard/guidelines were followed during erosion project implementation.	No changes to the forest plan, management activities or monitoring are needed. Continue to work on BMPs in timber sales to identify adaptive practices if needed.
MQ#2 **Water Quality** – Is water quality being maintained/improved?	Yes. Monitoring showed that best management practices and standards/guidelines were properly implemented and were effective at minimizing construction impacts from installation of the habitat, erosion stabilization and water control structures.	No changes to the forest plan, management activities or monitoring are needed. Installing more erosion control at stream crossings (e.g. silt fences, berms, slashing or hardening at the crossings, etc.) would help reduce sedimentation in the short-term.
MQ#3 **Water Quantity** – How many miles/acres of stream-channel or watershed have been improved? Water flow un-impeded?	Yes. Stream channel and watershed work has improved instream conditions and reduce streambank erosion thus improving water flow. Wetland restoration also improved the watersheds and water flow. These projects are moving these areas toward the desired condition.	No changes to the forest plan or management activity are needed. The monitoring question should be revised or combined with other questions. This question looks at water quantity, which is not a concern in southern Illinois and is not discussed in the forest plan. The answer is repetitive and is very similar to

		the answer above (Water Quality Item #2).
MQ#4 **Aquatic Biota** - What is the species distribution in sampled streams, ponds, lakes?	Yes. Volunteers can play a long-term integral role in monitoring the snake populations at Snake Rd temporally and spatially but also protect populations from potential threats.	Option 4 use specific locations from IL EPA in certain creeks on federal property every time this question is needed to be answered so that biologists through and across time answer the question in a similar fashion that is comparable to the past.
MQ#5 **Riparian/wetland vegetation** - Is native vegetation maintaining dominance near waterbodies, streams or wetlands?	This question was not answered during FY18-FY23 monitoring cycles	NA
MQ#6 **Travelways** - Are travelways located and maintained to prevent erosion?	Yes, but budget limitations have resulted in decreasing road maintenance mileage to the point that less than one-third of the active Shawnee NF road system is receiving regular road maintenance, and the trend is toward decreasing funding which will further reduce our ability to maintain the road system.	No changes to the forest plan, management activities or monitoring are needed.
MQ#7 **Soils** – Is soil protected during management, recreation activities?	Yes. The forest is properly implementing best management practices to mitigate erosion	Other soil properties that influence soil quality and the productivity of the forest should be considered (e.g. compaction). The forest plan has a standard on equipment limitations, but a clear standard is not defined. Soil moisture criteria should be developed to better guide when soil is too moist that equipment operation can cause detrimental impacts to the soil.

Table 13-Monitoring question recommendations for the status of select watersheds

4.2 Status of Select Ecological Conditions Including Key Characteristics of Terrestrial and Aquatic Ecosystems

Question 8: Aquatic Habitat Quality – What is the species distribution in sampled streams, ponds and lakes?

Objective:
The objective of this question is to determine the effectiveness of applying best management practices in maintaining, restoring, or enhancing aquatic habitat with respect to fragmentation, large woody debris and channel shape and function.

Methods:
Indicators for this are acquired with sampling data.

Observations, results, trends:
There is evidence that some creeks on the Shawnee National Forest may have higher levels of pollutants and pesticides. The impact of pesticides extends beyond agricultural fields through runoff into nearby watersheds with negative effects to aquatic insects and, concomitantly, wildlife dependent on these aquatic resources (Schulz 2004). This may particularly impact Chiropteran communities, as bats rely on riparian habitat for clean drinking water, commuting corridors, and for preying upon emergent aquatic insects (Fukui et al. 2006). Since most North American bat species are insectivores, a decrease in prey availability is predicted to negatively impact local bat populations. Given the catastrophic impact of white-nose syndrome (WNS) on many species of bats during hibernation and compounded by wind turbine-induced mortality during spring and fall migrations, understanding how ancillary factors may influence their survivability in summer may provide critical information to guide conservation.

The nearly ubiquitous detection of neonicotinoid pesticides (most commonly Imidacloprid, Clothianidin, and Thiamethoxam) in the 10 major Great Lakes tributaries (Hladik et al. 2018) is a disturbing finding for regional insect and bat communities. These insecticides are commonly used for pest control both commercially and domestically (http://npic.orst.edu/ingred/imid.html) and are toxic to aquatic insects at concentrations frequently observed in surface waters (Roessink et al. 2013). Contamination of waterways with neonicotinoid pesticides likely contributes to decreases in aquatic insects that spend their larval period in water and emerge as aerial bat prey as adults (Clare et al. 2011). Given Chiropteran foraging ecology, we predict that negative impacts on aquatic insect prey-base would have cascading and negative impacts on bat populations.

Illinois represents a fragmented and habitat mosaic, in which urban, suburban, and exurban complexes (i.e. Chicagoland) transition to extensive agricultural lands, before the Shawnee National Forest and adjacent forested become the predominant habitat type. Knowing that Illinois bat species eat agricultural pests, with substantial economic impacts (Maine and Boyles,

2015; Maslo et al., 2022). The University of Illinois investigated the occurrence of pesticides in creeks and water bodies to determine whether pesticides may be present in water (Figure 10).

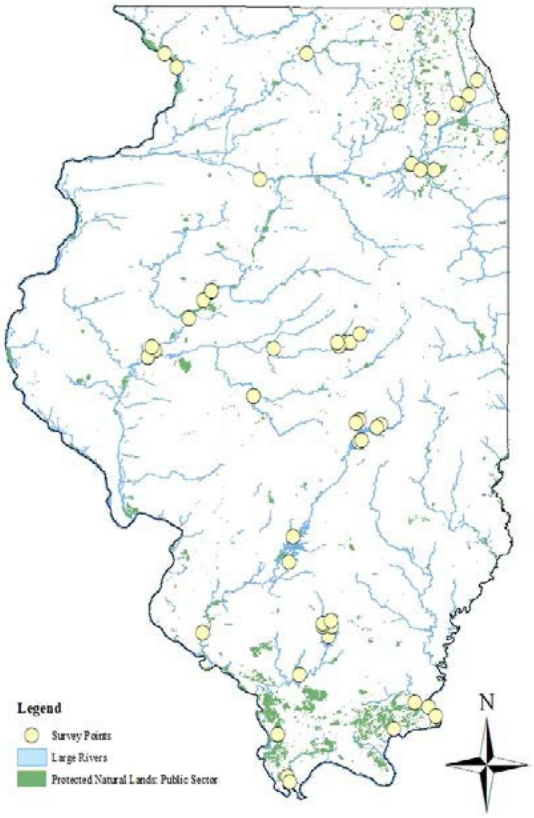


Figure 10-Map of survey locations for 2021 sampling

There were 13 sites with Clothianidin values above Environmental Protection Agency benchmarks and 22 for Imidacloprid (EPA 2021). The sum of insect biomass per site ranged from 0.5 to 295 grams. There seemed to be a decline in insect biomass beyond EPA benchmarks (Figure 11, Figure 12).

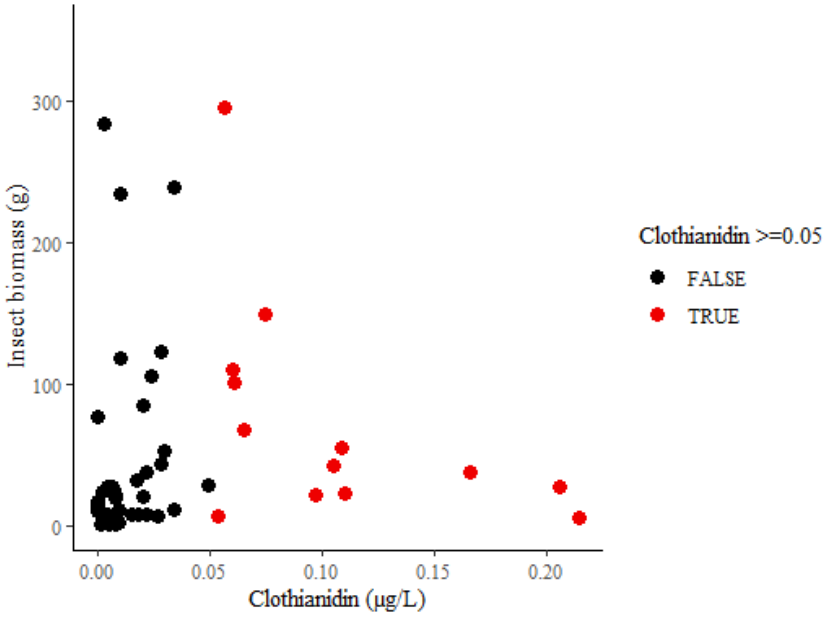


Figure 11-Insect biomass collected using blacklight bucket traps compared to neonicotinoid (Clothianidin) concentrations, with levels above EPA benchmarks highlighted in red.

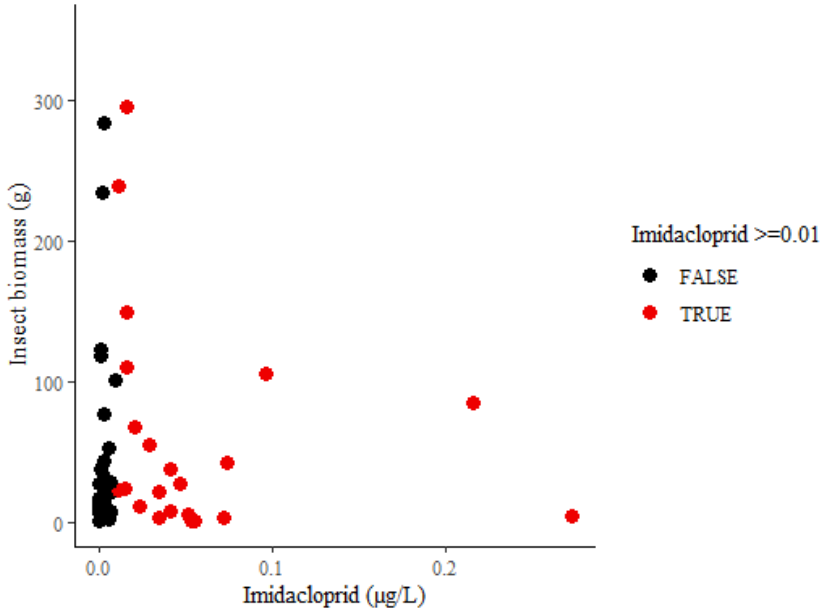


Figure 12-Insect biomass collected using blacklight bucket traps compared to neonicotinoid (Imidacloprid) concentrations, with levels above EPA benchmarks highlighted in red.

Conclusions:

Concentrations of neonicotinoids being higher than EPA benchmarks at 50 percent of sites is concerning for aquatic insects, especially since we only surveyed on protected lands in Illinois. Insects provide ecosystem services in the United States at an estimated $57 billion per year (Losey and Vaughan 2006), making conservation of insect abundance and diversity of critical

importance. University of Illinois observed a negative trend in insect biomass at sites with neonicotinoid concentrations above EPA benchmarks.

The water samples were only collected on one day of the summer providing a snapshot of current conditions, while the impacts of neonicotinoids on insect populations would occur over time. A sample size larger than 50 sites with additional samples may be better able to clarify this relationship. There may also be a benefit to sampling a greater diversity of habitats outside of protected lands which could produce a wider range of concentration values.

Widespread use of neonicotinoids in the Great Lakes region (Hladik et al. 2018) is alarming as we identify precipitous declines in insect populations (Cardoso et al. 2020). The study that University of Illinois conducted provides additional data that even in the protected lands of Illinois, these contaminants are commonly detected.

Furthermore, terrestrial non-native invasive plant species (NNIS) are likely the most important factor for aquatic habitat quality on the SNF. For example, Japanese knotweed is prevalent in Hutchin's Creek which borders Bald Knob and Clear Creek Wilderness areas. Autumn olive, which was once planted, also grows along many creeks and riparian areas and can have negative effects on the water chemistry. However, the now active NNIS eradication program, can improve these conditions in the future. Furthermore and comparatively the SNF actively manages less than 1 percent of the land in federal holding and with less pesticide than agricultural private lands acre for acre.

Recommendations:
More research is needed on water quality of creeks and water features on the Shawnee National Forest. The fragmented and intertwined nature of the forest with private lands, which many parcels are active agricultural businesses, makes pesticide contamination a real concern.

References:
Cardoso, Pedro, Philip S Barton, Klaus Birkhofer, Filipe Chichorro, Charl Deacon, Thomas Fartmann, Caroline S Fukushima, et al. 2020. "Scientists ' Warning to Humanity on Insect Extinctions" 17 (January). https://doi.org/10.1016/j.biocon.2020.108426.

Environmental Protection Agency (EPA). August 31, 2021. Aquatic Life Benchmarks and Ecological Risk Assessments for Registered Pesticides. Accessed https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk

Fukui, Dai, Masashi Murakami, Shigeru Nakano, and Toshiki Aoi. 2006. "Effect of Emergent Aquatic Insects on Bat Foraging in a Riparian Forest." *Journal of Animal Ecology* 75 (6): 1252–58. https://doi.org/10.1111/j.1365-2656.2006.01146.x.

Hladik, Michelle L., Steven R. Corsi, Dana W. Kolpin, Austin K. Baldwin, Brett R. Blackwell, and Jenna E. Cavallin. 2018. "Year-Round Presence of Neonicotinoid Insecticides in Tributaries to the Great Lakes, USA." *Environmental Pollution* 235: 1022–29. https://doi.org/10.1016/j.envpol.2018.01.013.

Losey, J.E. and Vaughan, M., 2006. The economic value of ecological services provided by insects. Bioscience, 56(4): 311-323.

Maine, J.J. and Boyles, J.G., 2015. Bats initiate vital agroecological interactions in corn. Proceedings of the National Academy of sciences, 112(40): 12438-12443.

Schulz, R., 2004. Field studies on exposure, effects, and risk mitigation of aquatic nonpoint-source insecticide pollution: A review. Journal of environmental quality, 33(2): 419-448.

Question 9: Mississippi River Bottomland Hydrologic Regime – How many acres have improved wetland characteristics?

Objective:
The objective of this question is to determine effectiveness of applying best management practices and forest plan standards and guidelines in restoring, protecting wetland habitat, hydrology, and wetland functions in the Mississippi bottomlands.

Methods:
Indicators for this question are measured in acres of wetlands restored, improved and maintained

Observations, results, trends:
Oakwood Bottoms and the surrounding bottomland forest is among the largest contiguous oak-hickory bottomland forest along the Mississippi River from Kaskaskia to Thebes (~40 percent of current existing floodplain forest; Heitmeyer 2008). Oakwood Bottoms was a barley farm before it became a part of the Shawnee National Forest and converted back into an oak/hickory bottomland forest with berms and rudimentary flooding compartments. It was made into a successful greentree reservoir for ducks and, to date, is still an important duck hunting location in southern Illinois. Flooding compartments has continued at Oakwood but has been diminished in the last two years due to oak wilt (*Bretziella fagacearum*). The Shawnee National Forest initiated the Oak Wilt Project in 2020, which involves the improvement of forest health by reducing the spread and risk posed by oak wilt within the Big Muddy River bottomlands. Oak wilt was confirmed in 2018 in management unit 17 of Oakwood Bottoms. The Oak Wilt Project falls within the Shawnee National Forest's (SNF) 2019 Farm Bill Insect and Disease Treatment Area Designation under section 602 of the Healthy Forest Restoration Act (HFRA) of 2003.

Conclusions:
The Oakwood Bottoms Greentree Reservoir Habitat Rehabilitation and Enhancement Project (HREP) seeks to enhance and restore the natural hydrologic conditions for migratory wildlife and increase the regeneration of the bottomland forest at Oakwood Bottoms. HREP involves an extensive reconfiguration of existing berms and the creation of new berms and tree removal will be required. HREP should improve the hydrologic regime at Oakwood Bottoms in the future.

Question 10: Natural Areas' Unique Features - Are natural area characteristics being conserved?

Objective:

The objective of this question is to determine the effectiveness of management activities and forest plan standards and guidelines in protecting and restoring rare ecosystems and communities.

Methods:
Indicators for this are collected through reports from Forest Service, researchers, cooperating agencies and others regarding habitat condition.

Natural Areas were initially searched for in Illinois during the 1970s to identify areas that met criteria in one of, if not multiple categories used to qualify a site. Eighty natural areas fall within the boundaries of the Shawnee National Forest and our forest plan tasks staff and natural resource specialists as their stewards to conserve these features and rare communities. Natural areas are classified according to their dominant or outstanding features and are categorized as: research (RNA), botanical (BA), ecological (EA), geological (GA), and zoological (ZA). There are approximately 16,000 acres of natural areas across the Forest, some exhibit two or more outstanding features. Each area will be managed under the natural area management prescription for the protection and perpetuation of its significant and exceptional features, including areas located within other management areas (forest plan 2006, pages 162-202). Four areas are also designated as national natural landmarks (NNL) and their management ensure conformance with the US Department of the Interior management standards for these areas (forest plan 2006, pages 159-161). Below are data showing the management accomplishments in Natural Areas.

Observations, results, trends:
Data were collected from 2018-2023 using the forest service's "forest activities tracking system" (FACTS) and the "watershed improvement tracking" (WIT) database. These tracked activities include prescribed fire, NNIS treatments, small tree and shrub removal and boundary delineations. These data can be found in the at the end of this report in appendix 2.

Conclusions: With continuous monitoring and careful application of management techniques the designated natural areas on the Shawnee National Forest can be maintained and enhanced. External pressures will continue to alter these sites and prioritizing their management is incredibly important if we are to maintain and enhance their features.

Recommendations: The continued management and monitoring of natural areas is critical to maintaining their integrity and ecological functioning. Employing a continuous rotation of natural area visits is necessary to keep the threats to these communities current and understood. No changes to the monitoring question or indicators are recommended.

Question 11: Fire Adapted communities - How many acres are under burning prescriptions? Are fire-adapted communities being conserved?

Objective:
Most of the Shawnee National Forest evolved with frequent, low-intensity fire. It is a mediating factor in the structure and composition of the Forest's ecosystems, and integral to their functioning. For this reason, prescribed fire was included in the prescriptions for every Management Area (MA) in the forest plan. The objectives of this question are 1) to determine how much fire is being applied across the Forest, 2) what the impacts of those fires were, and 3) to determine the effectiveness of applying best management practices (BMPs) and forest plan standards and guidelines in restoring and maintaining fire-adapted communities.

Methods:
To determine the first objective, we looked at acres burned by prescribed fire. We also looked at our wildfire statistics, but given the relatively small acreage involved, and that many of these were partially on private land, we did not separate these by management area.

For the second objective, we looked at compiled post-burn monitoring reports, including some repeated-measures data regarding fuel loads, seedling counts, and floral diversity. Fuel loads were calculated following protocol listed in Brown 1974. Floristic Quality Index (FQI) was created using the FQA (floristic quality assessment) calculator (Freyman et al. 2016). This uses Coefficient of Conservatism ranks (C-values) to determine the FQI of a specific site or plant community and follows *Floristic Quality Assessment for vegetation in Illinois, a method for assessing vegetation integrity* (Taft et al. 1997).

The third objective, which is directly outlined by the Forest Monitoring Plan, is evaluated in multiple ways. The application of BMPs for soil and watershed resources is monitored annually and reported as part of a national framework. Effects on soil, air and water quality are also covered elsewhere in this document. To monitor compliance with Forest Plan Standards and Guidelines, we compared relevant standards or guidelines against Shawnee National Forest data.

Observations, results, trends:

How much fire is being applied across the landscape? Where did those burns occur?

Most of the Forest fits the definition of fire-regime condition classes 2 or 3, meaning that it shows a moderate to high departure from the historical range of variability in vegetation characteristics, fire frequency and severity.

In FY18-23, the Forest conducted 142 burns for 59,153 acres, or an average of 9,857 acres/year. The trend was a slight increase in burned acres over this period, continuing a longer trend of gradually increasing prescribed fire treatment acreage.

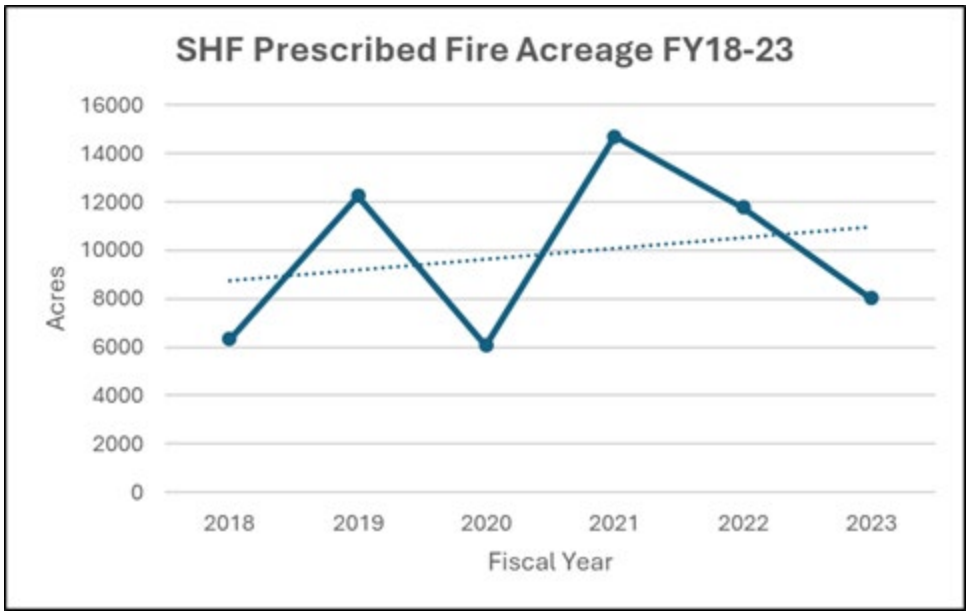


Figure 13-Shawnee NF Prescribed Fire Acreage FY2018-2023 with trendline dashed

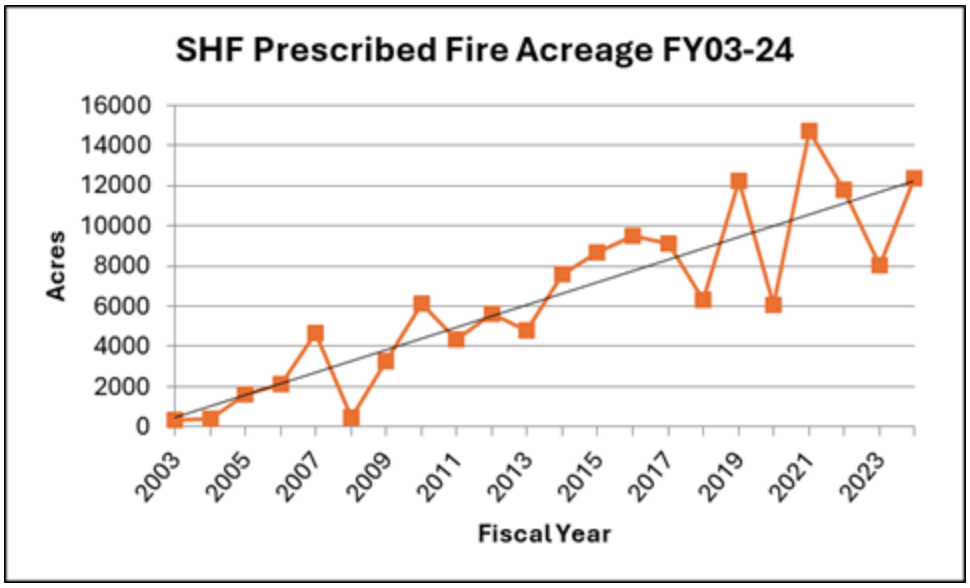


Figure 14-Shawnee NF Prescribed Fire Acreage FY2003-2024 with trendline in gray

In the second decade (FY16-25), the forest plan predicts an average annual output of 13,300 acres of prescribed burning to meet its restoration goals. This suggests a deficit on the order of ~3,400 acres per year in this time. It should be noted that prescribed burning was halted in 2020 in March (the peak of our main burning season) because of the COVID-19 pandemic. However,

some of the prescribed fire occurred on private land by agreement with adjoining landowners. Though it is encouraged, this private land burning was not factored into the forest plan's predicted output. Therefore, the deficit is likely larger than the initial estimate of ~3,400 acres.

The Even-Aged Hardwood (EH) had the most prescribed fire acreage, followed by the Natural Area (NA), Water-Supply Watershed (WW) and Large Openland (LO). This trend is in line with what is indicated in the forest plan's scheduled practices.

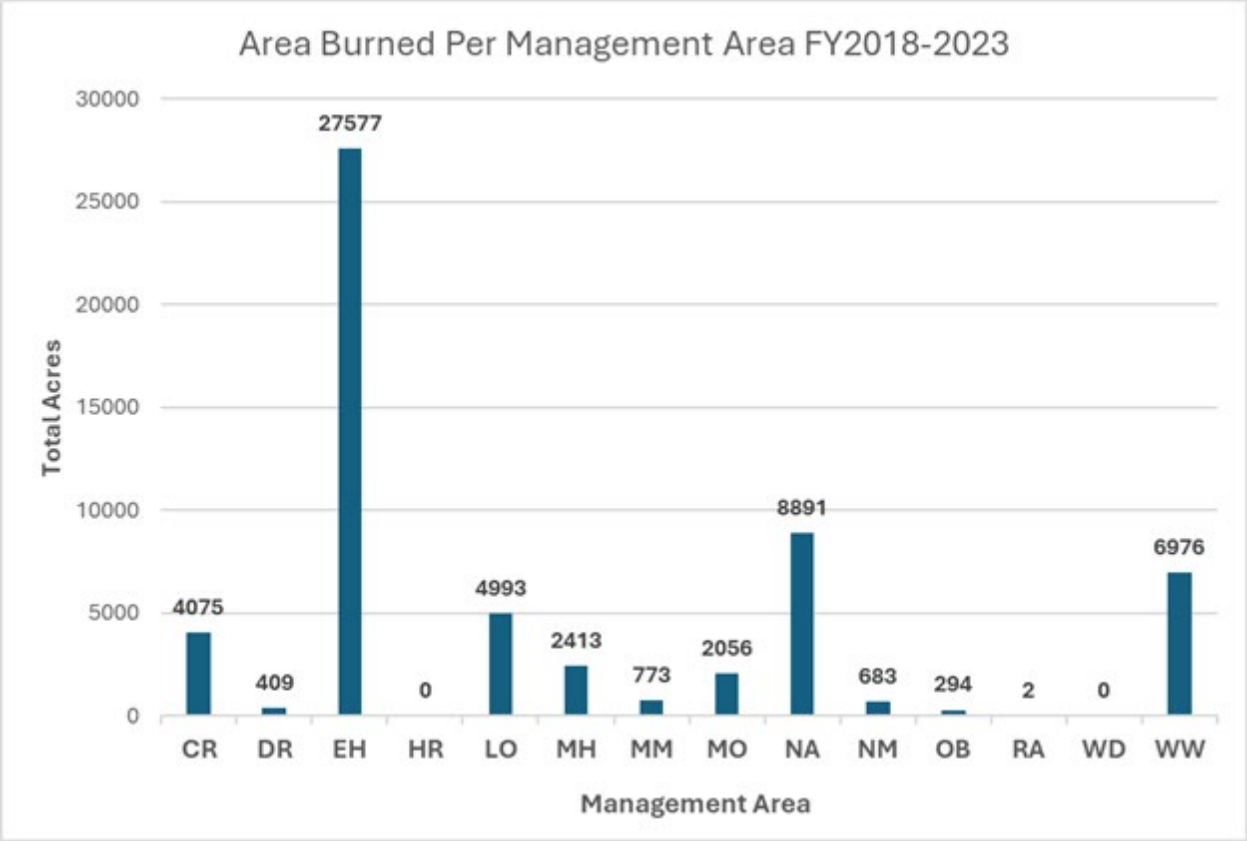


Figure 15-Shawnee Acres Burned Per Management Area FY2018-2023

From FY18-23, the Forest recorded 109 wildfires for 809 acres. While vegetative impacts from wildfires are not routinely monitored, some anecdotal reports were that most of these were similar in intensity or severity as a prescribed fire and may have yielded positive impacts to fire-adapted communities. Some of these, particularly in the very dry fall of 2022 and spring of 2023, may have had higher severity impacts to vegetation than would be desired from a prescribed fire, though no quantitative measures of severity were conducted.

What were the impacts of the prescribed fires to fire-adapted communities?
Prescribed fire is the primary method implemented to restore the Forest and is tasked with reversing the effects of mesophication, promoting oak regeneration and plant diversity, and other objectives. Effective fire use is evident in the mortality of shade-tolerant tree species, re-

sprouting of oak seedlings, reduction in leaf litter depths, and limiting of woody encroachment of undesirable vegetation. Moreover, the application of fire should mimic natural fire regimes.

All prescribed fires receive some level of monitoring. We monitor weather and fire behavior throughout the burn, as well as smoke production and impacts. After the burn we estimate the percent coverage of the burned area, and fire effects such as crown scorch, bark scorch, litter, duff, and downed woody fuel consumption. A subset of our burns received more thorough monitoring and documentation of effects to vegetation or other facets of the natural community.

Some burns were selected for an enhanced level of fire effects monitoring, which consisted of a combination of established plots and walk-through inspections. These burn units represented a range of hardwood timber with occasional pine and openland (grass and grass-shrub) components. This synopsis addresses observations, results and trends consolidated from the monitoring reports of those burns completed between FY18-23. These were split among burns with primary objectives being silvicultural/site preparation for oak regeneration/slash treatment, natural community restoration and maintenance, wildlife habitat improvement, watershed maintenance, and wildfire hazard / risk reduction. All prescribed fires have some impact to vegetation, select for more fire-tolerant plants, and reduce fuel loads and continuity. Accordingly, most burns have both restoration and protection objectives.

In general, burns resulted in a mosaic of both intensity and spatial coverage, which was attributed to variability of fuel type, moisture, microsite variability (e.g. an area that is too wet or too sparse fuels), fire-resistant invasive species, and especially the fire history of the unit. Burn coverage within the units ranged from 45 percent to 95 percent and averaged 79 percent. Most burns were 65-85 percent blackened. This is important, as leaving some unburned areas can be crucial refugia for invertebrates and plants to recolonize an area after a burn.

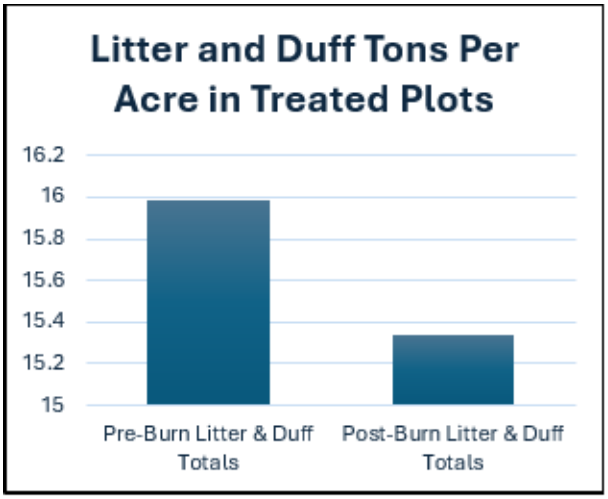
Monitoring reports noted good fire effects, with bark scorch heights varying from 6 inches to 4 feet. Over 25 percent of the stems in the 2” size class and smaller were top killed. Nearly all oak seedlings resprouted. Mesic species also had good sprouting response, but typically not as many sprouted and the sprouts were less robust. It was noted that germination of new oak seedlings was limited in some burns. However, multiple burns are expected to favor oak regeneration through gradual elimination of competition and steady accumulation of oak seedlings. Sprouting alone may be enough to build a sufficient cohort of oak seedlings. At the Makanda – Mill Creek unit, oak seedlings and saplings increased by 27 percent overall, whereas at Ozark Hill Prairie, total oak seedlings decreased by 6 percent overall, but were found in 29 percent more plots.

In sites where botanical surveys occurred, forest diversity and natural quality showed a slight increase, or remained the same. In the Makanda burn project area specifically, vegetation surveys from 2019 and 2021 indicate that forest diversity and natural quality increased slightly. Using data from the plots that were burned and only native species, total FQI increased 3 percent and native mean C increased 12 percent. Including non-native species, adjusted FQI increased 6 percent and total mean C increased 5 percent. When comparing the plots that didn’t burn to the plots that did burn, evidence shows that the treated plots had a slight increase in total FQI, total

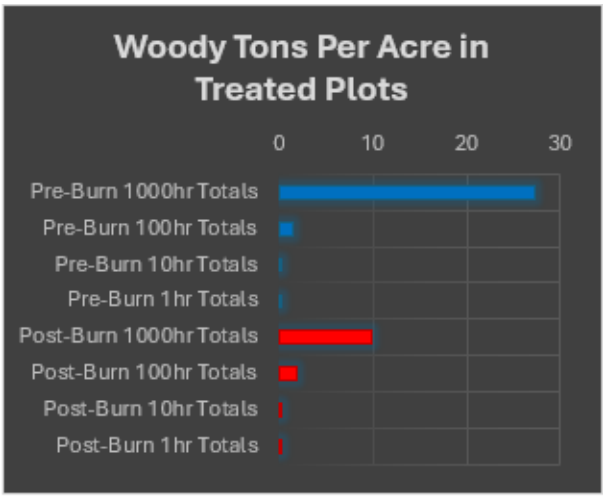
mean C, and native mean C. This increase in floral diversity, along with regeneration of desirable tree species, is expected to increase with a sustained application of frequent fire.

Prescribed fire helps to reduce fuel loading and continuity which reduces risk from wildfires. Most of the leaf litter and 1-hour fuels were consumed. Duff and 1000-hour fuels (heavy logs) were minimally consumed in these burns. The consumption of 10- and 100-hour fuels varied widely, as can be expected with the variability of topography, fire behavior and fuel moisture throughout the burn season.

The Makanda – Mill Creek project is the site of the first Community Wildfire Protection Plan in the vicinity of the Shawnee National Forest and was targeted for landscape scale burns to reduce wildfire risk. Even as a first entry treatment, it is evident that the litter and woody fuels both experienced significant decreases. Further development of CWPPs in additional counties will provide the opportunity to plan, prioritize, and implement similar treatments across the region.



Litter and duff fuel load pre and post burn, Makanda – Mill Creek Prescribed Fire.



Woody fuel load pre and post burn, Makanda – Mill Creek Prescribed Fire.

Figure 16-Litter and Duff Tons Per Acre in Treated Plots and Woody Tons Per Acre in Treated Plots respectively.

Invasive species were seen (re)invading burn units within the first year. Species common to the burn units include Japanese honeysuckle (Lonicera japonica/LOJA) and Japanese stiltgrass (Microstegium vimineum/MIVI) Japanese chaff flower (Achyranthes japonica/ACJA), autumn olive (Elaeagnus umbellate/ELUM), and multiflora rose (Rose multiflora/ROMU). In most cases, Japanese stiltgrass was seen establishing especially well in firelines and trails, though it was typically already on site prior to the burn.

In 2017 the Forest began doing some burns in late summer (after August 15) in openland areas. These were intended to reduce woody invasive plants (especially non-native species such as autumn olive, bush honeysuckle and multiflora rose), and increase forb coverage, to maintain open, grassy habitat on the Forest. We collected preburn data in 2017 and monitored these burns in 2018 and 2019.

Woody species were reduced in all plots, though for trees, numbers had increased by year 2 post burn. Forb coverage increased greatly after the fire but lost some of those gains by year 2.

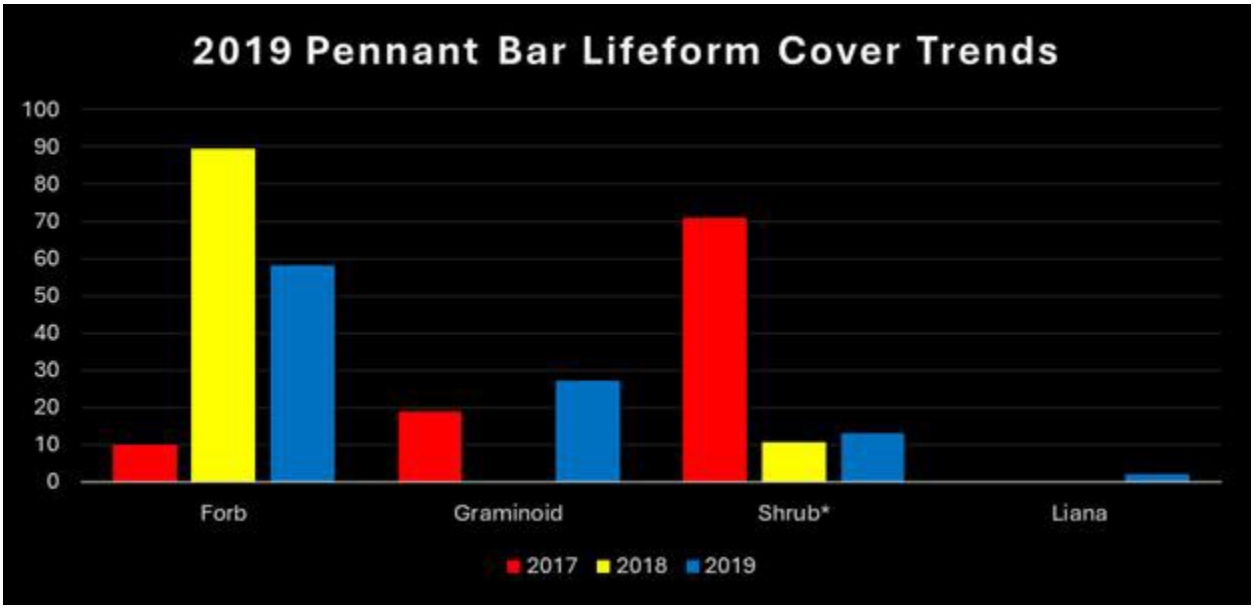


Figure 17-2019 Pennant Bar Lifeform Cover Trends

Among trees, many species were dramatically reduced. In the following chart, winged elm, white ash, eastern hophornbeam, and tulip poplar trees were all dead after the 2017 growing season burn. Persimmon and eastern redcedar lost about half of their standing live stems but persisted. Increased stem counts in persimmon are likely from getting multiple sprouts off one stem.

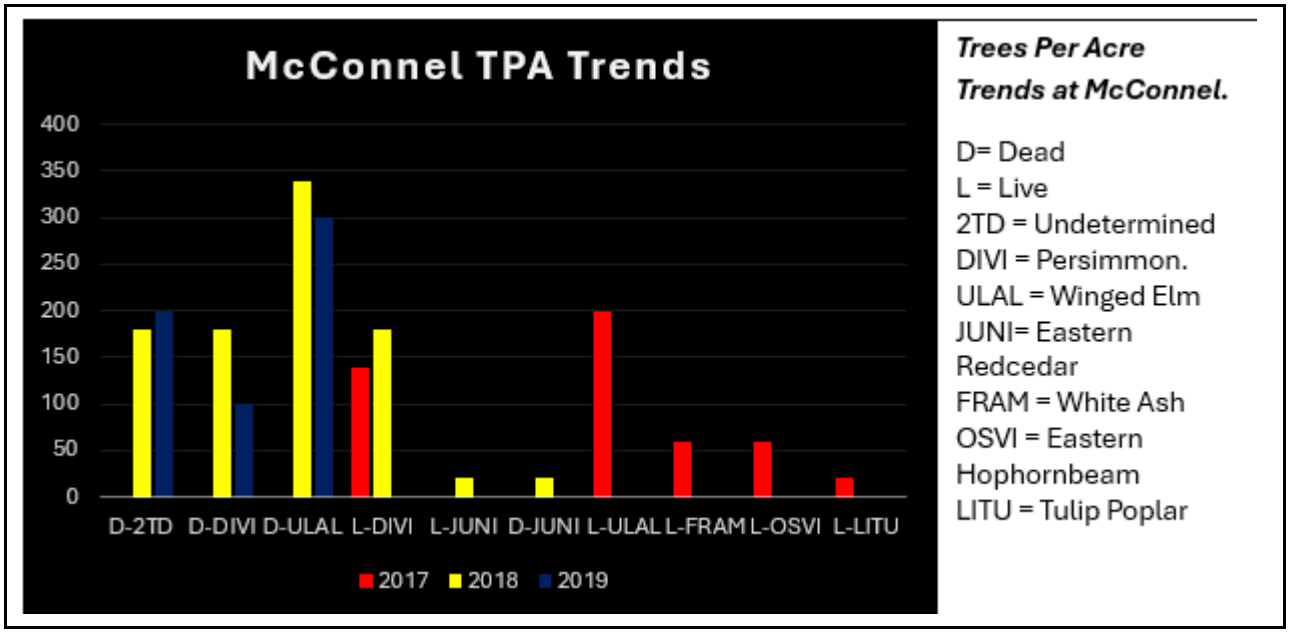


Figure 18-McConnel Tract Trees Per Acre Trends

Invasive species were also strongly reduced, though for some species this effect was ephemeral. Sericea lespedeza (LECU), for instance, was much reduced in the year 1 post-burn, but had nearly recovered by year 2. Multiflora rose (ROMU) was not seen within the plots by year 2.

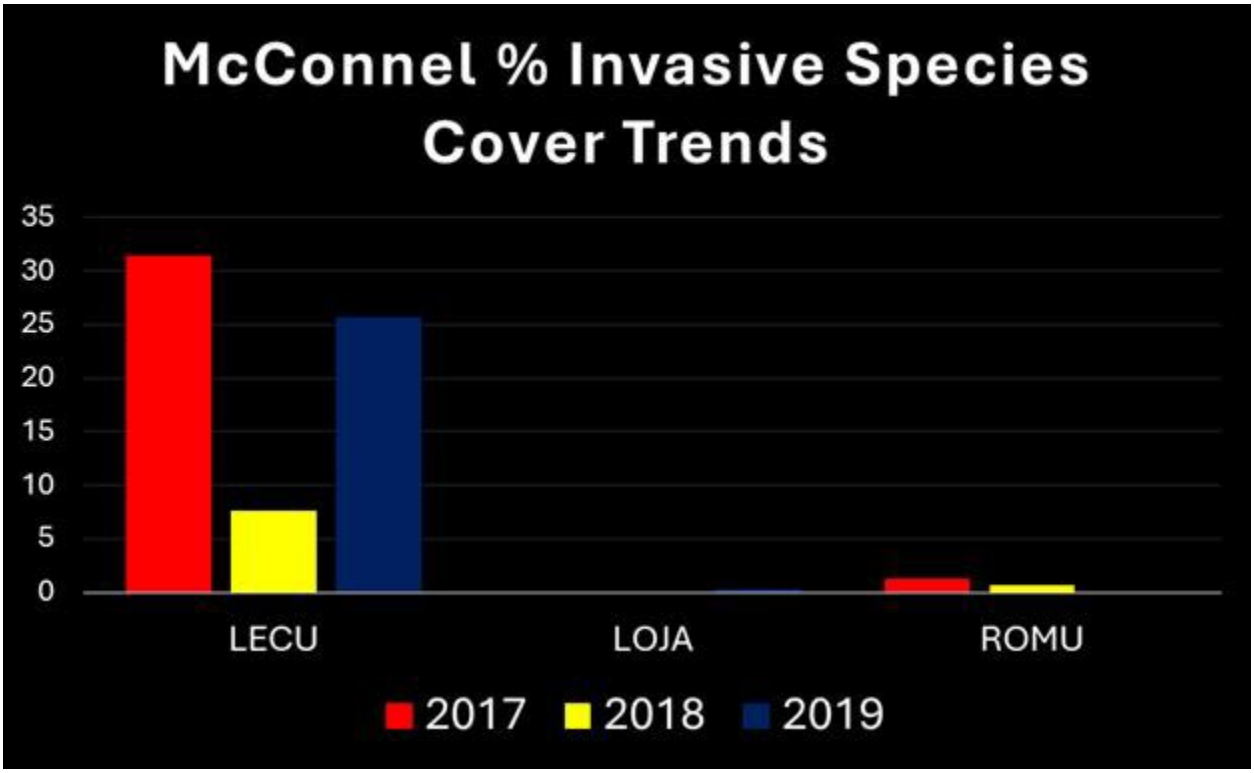


Figure 19-McConnel Tract Percent Invasive Species Cover Trends

Compliance with Forest Plan Standards and Guidelines

Forest Plan Standards and Guidelines are rules and policies that guide National Forest management. Some of these address safety or management response to wildfires and are accordingly not considered in this section. However, a few of these do deal with restoring and maintaining natural communities.

FW51.1.2.1 directs the Forest to carry out all prescribed fires according to burn plans, to manage smoke to mitigate the effects of smoke emissions, to meet air quality standards, and consider smoke-sensitive areas downwind of the burn, including Indiana and Grey bat hibernacula. The Forest does indeed complete robust smoke management planning as part of the burn plan development and part of the decision whether to implement a burn. Many times each year the Forest decides not to conduct a burn, or switch to smaller burns or those with lighter fuels, to minimize the potential for smoke impacts. This has been working. Of the 142 burns conducted in

this time frame, we received less than 10 complaints from the public, and none from the Illinois or US EPA. Further, though the Forest and other agencies and landowners in the region have been increasing their prescribed fire programs in recent decades, particulate matter has actually decreased in this time frame (US EPA).

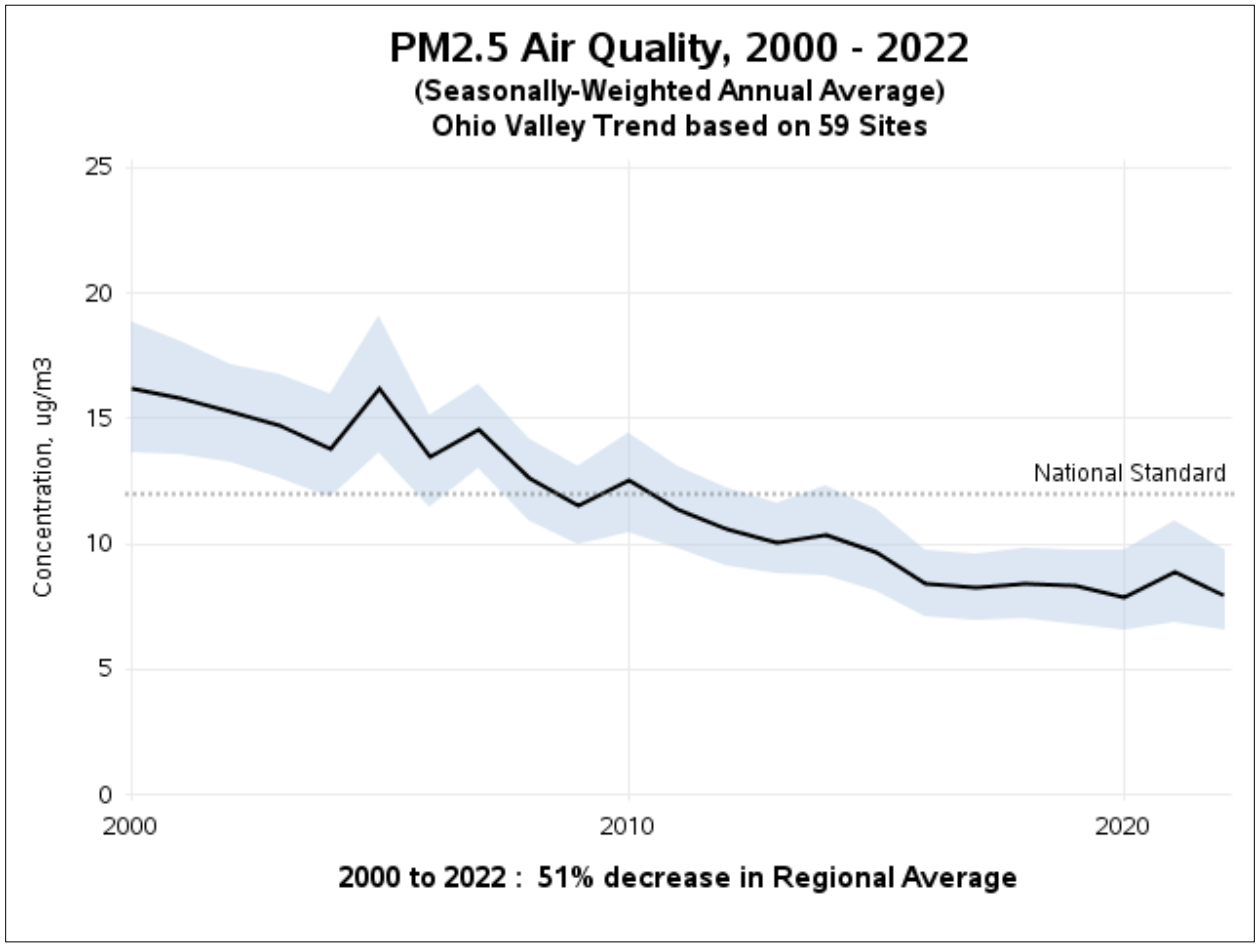


Figure 20-Air Quality data from 2000-2022

FW51.1.2.4 restricts the timing of burns to protect endangered bats. All burns were conducted within the prescribed timelines.

FW51.1.2.5 limits the amount of burning that can occur within 4 and 8 km from known bat hibernacula (20% and 50% of the area, respectively). The Forest tracks the amount of burning of each hibernaculum. In no case did the Forest burn more than allowed. The highest percentage was 14 percent of the land within 8 km of one cave in 2021. Since the burns in question were only 80 and 85 percent blackened, however, the total impact to bat foraging was even less.

FW51.1.2.6 restricts timing of prescribed burns to protect nests and nestlings of migratory birds. Burns should be conducted before April 15 or after August 1. All burns were conducted within the allowable timeframe.

Conclusions:

Fire adapted communities across the Forest are being maintained generally as prescribed in the forest plan.

Burn plan objectives were almost always met. An individual burn may not see the increases in oak regeneration or floral diversity desired, but after several burns these objectives are typically met. As noted in the Mill Creek Monitoring report, a study from Higgins, Warning and Thode found that tree composition and structure did not change after a single, low-severity burn compared with unburned areas in their experimental area. "This research suggests that repeated entries and an increase in burn severity may be necessary for prescribed fire or wildlife to be effective in meeting management objectives" (Higgins, Warning, & Thode 2015). First-entry burns typically produce lower intensities due to compacted, moist fuel conditions with a stagnant mid-story and a canopy that allows limited sunlight to pass through. Anecdotal evidence and observation of many years of burning in the region suggest that the forest structure and related fuels conditions can only be expected to begin their shift after several burns, with each successive burn resulting in improved fuels conditions and vegetative response.

Prescribed burning provides an opportunity for the establishment of all species including invasive ones. Coordination of burns and other management activities, for example timing and sequencing of treatments, may result in better mitigation of invasive species. Japanese stiltgrass, known for being a receptive fuel with flashy fire behavior, is a particular concern as it invades the very trails and fire lines that serve to stop fire spread. As noted in the Ozark Hill Prairie monitoring report, research indicates that "the small scale of natural dispersal suggests that human-mediated dispersal, likely influenced by forest road management, is responsible for the rapid spread of this invasive species" (Rauschert et al. 2009).

However, a single burn can have positive impacts to fuel loads and continuity, which can reduce potential fire behavior in subsequent wildfires, at least for a few years.

All forest plan standards and guidelines were met during the monitoring period.

Recommendations:

1) Prescribed burning has moved the Forest closer to desired conditions, but to meet forest plan objectives, an increase in burn acreage is needed. In areas that have already experienced burns, continued burning is needed to maintain the improved conditions. It may be useful to vary the seasonality of burns in certain areas that may result in an increase in vegetative diversity.
2) The coordination of NNIS mitigation with fire use is an important element in prescribed fire planning.
3) Our smoke management techniques appear to be effective and should be continued.
4) Continued monitoring of prescribed fire projects will add clarity and help describe trends and track benefits for future use.

References:

Brown, J.K. 1974. Handbook for inventorying downed woody material. USDA Forest Service General Technical Report INT-16.

Freyman, W.A., L.A. Masters, and S. Packard. 2016. The Universal Floristic Quality Assessment (FQA) Calculator: an online tool for ecological assessment and monitoring. Methods in Ecology and Evolution. 7(3): 380–383.

Higgins, A.M., Waring, K.M. and Thode, A.E. 2015. The effects of burn entry and burn severity on ponderosa pine and mixed conifer forests in Grand Canyon National Park. *International Journal of Wildland Fire*, *24*(4), pp.495-506.

Rauschert, E.S., Mortensen, D.A., Bjørnstad, O.N., Nord, A.N. and Peskin, N. 2010. Slow spread of the aggressive invader, Microstegium vimineum (Japanese stiltgrass). *Biological Invasions*, *12*(3), pp.563-579.

Taft, J. B., Wilhelm, G. S., Ladd, D. M., & Masters, L. A. 1997. Floristic quality assessment for vegetation in Illinois, a method for assessing vegetation integrity. Erigenia. No. 15. 95 pp.

U.S. Environmental Protection Agency, Regional Trends, Website accessed July 12, 2024.

Question 12: Species Richness - Based on monitoring results, is biodiversity is being protected by Forest Plan Standards and guidelines?

Objective:
The objective of this question is to determine effectiveness of applying best management practices and forest plan standards and guidelines in maintaining or improving species richness in Forest habitat-types.

Methods:
Indicators for this are collected with survey data

Observations, results, trends:
Species richness is increasing on the Shawnee National Forest due to management at sites in Hardin and Pope counties. Bird data collected and analyzed at Harris Branch, Lee Mine, and Robnett Barrens (Creek) indicate that species like red-headed woodpecker, blue-winged warbler, prairie warbler, yellow-breasted chat, and mourning dove are all benefiting from pine thinning and conversion of planted pines to hardwoods. Future forest management will ensure species richness will continue to increase.

We published an article in the Meadowlark that mentions the changes in species richness associated with timber management in planted pine habitats.

32.1 Meadowlark final 150.pdf - Google Drive

Six plants on the Regional Forester's Sensitive Species list are no longer extant on the forest, American bluehearts (*Buchnera americana*), manyflower flatsedge (*Cyperus lancastriensis*), plain gentian (*Gentiana alba*), autumn bluegrass (*Poa alsodes*), procession flower (*Polygala incarnata*), and whorled rosinweed (*Silphium trifoliatum*). Loss of these rare species suggests that their habitat and perhaps associated species are being lost.

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#8 **Aquatic Habitat Quality** – What is the species distribution in sampled streams, ponds and lakes?	Yes, but more research is needed on water quality of creeks and water features on the Shawnee National Forest. The fragmented and intertwined nature of the forest with private lands, which many parcels are active agricultural businesses, makes pesticide contamination a real concern.	Option #4 use specific locations from IL EPA in certain creeks on federal property every time this question is answered so that biologists through and across time answer the question in a similar fashion that is comparable to the past.
MQ#9 **Mississippi River Bottomland Hydrologic Regime** – How many acres have improved wetland characteristics?	Yes. Flooding compartments in Oakwood Bottoms will continue but may become reduced in the future as another project may begin implementation.	Option #2 and #4. Assess overwintering bat populations and bird populations as a proxy to monitor habitat condition.
MQ#10 **Natural Areas' Unique Features** - Are natural area characteristics being conserved?	Yes. More management in the natural areas is recommended to move the forest to desired conditions.	No changes to the monitoring question or indicators are recommended.
MQ#11 **Fire Adapted communities -** How many acres are under burning prescriptions? Are fire-adapted communities being conserved?	Yes. Prescribed burning has moved the Forest closer to desired conditions, but to meet forest plan objectives, an increase in burn acreage is needed.	No changes to the monitoring question or indicators are recommended.
MQ#12 **Question 12: Species Richness -** Based on monitoring results, is biodiversity is being protected by forest plan Standards and guidelines?	Yes. Species richness is increasing on the Shawnee National Forest due to management at sites in Hardin and Pope counties.	No changes to the monitoring question or indicators are recommended.

Table 14-Monitoring question recommendations for the status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems

4.3 Status of Focal Species to Assess Ecological Conditions

Question 13: Pileated woodpecker, Red-headed woodpecker, Prothonotary warbler – What are the population trends for these species?

Objective:
The objective of this question is to assess the populations of these species as they serve as indicators of health of upland and bottomland central hardwood oak-hickory forests.

Methods:
Indicators for this are collected with survey data

Observations, results, trends:
Pileated woodpeckers have been detected in active or future projects annually (n= 8 silvicultural projects), this includes pre- and post-implementation of these projects, during bird point-counts (SNF unpublished data). Their population is stable and unaffected by management.

Conclusions:
Red-headed woodpeckers are increasing on the Shawnee National Forest due to management and conversion of pines. One pair of red-headed woodpecker occurs for every 26 acres of thinned pines (post-implementation; Vukovich and Dodson 2024). Active management of planted pines has immediate positive benefits for red-headed woodpecker populations, a conservation species of concern.

Prothonotary warblers inhabit swampy and forested wetland conditions and are rarely observed during annual bird point counts on the SNF (SNF unpublished data). Since bird survey efforts are focused on future or completed silviculture projects and mostly upland habitats, the status of their population is currently unknown. However, we expect little changes to their habitats from management since wetlands, riparian areas, floodplains, and other wet margins will not be an important part of the timber base and in the implementation of silvicultural projects.

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#13 **Pileated woodpecker, Red-headed woodpecker, Prothonotary warbler –** What are the population trends for these species?	Yes, Bird survey efforts are focused on future or completed silviculture projects and mostly upland habitats, the status of their population is currently unknown. However, we expect little changes to their habitats from management since wetlands, riparian areas, floodplains, and other wet margins will not be an important part of the timber base and in the implementation of silvicultural projects.	Options #2 and #4. Biologists here should be conducting bird surveys annually to answer this question. And the answer can be derived from our bird survey database. A question should be addressed for the cerulean warbler. We have a specific management area designated for them and swainson's warblers.

Table 15-Monitoring question recommendations for status of focal species to assess ecological conditions

4.4 Status of Select Set of Ecological Conditions to Contribute to Recovery of At-Risk Species (Federally Listed, Regional Forester Sensitive, Species with Viability Evaluation)

Question 14: Barrens, Glades and Prairies - Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of barren, glade and prairie habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on barrens and glades.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities

Observations, results, trends
There are thirteen Regional Forester's Sensitive Species that occur in barrens, glades, and prairie habitat, American bluehearts (*Buchnera americana*), soft thistle (*Cirsium carolinianum*), hyssopleaf thoroughwort (*Eupatorium hyssopifolium*), plain gentian (*Gentiana alba*), spiked crested coralroot (*Hexalectris spicata*), white wand beardtongue (*Penstemon tubaeflorus*), sunbright (*Phemeranthus parviflorus*), procession flower (*Polygala incarnata*), Nuttall's prairie parsley (*Polytaenia nuttallii*), fewflower nutrush (*Scleria pauciflora*), whorled rosinweed (*Silphium trifoliatum*), spring lady's tresses (*Spiranthes vernalis*), and heartleaf noseburn (*Tragia cordata*).

Four of these species, American bluehearts, plain gentian, procession flower, and whorled rosinweed have not been observed on the forest within the last 25 years and are therefore no longer considered extant.

Monitoring data of all extant species is presented in Table 16 below; however not all populations were regularly monitored over time.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
soft thistle	Pope Co, pop 1			1 (PoC)[a]
soft thistle	Saline Co, pop 1		50 (PoC)	P in 2022; P in 2023
soft thistle	Johnson Co, pop 1			24
hyssopleaf thoroughwort	Pope Co, pop 1		> 50 in 2020; > 100 in 2021	> 100
hyssopleaf thoroughwort	Pope Co, pop 2		21 (PoC)	49 (PoC)
spiked crested coralroot	Hardin Co, pop 1		13 (PoC)	10 in 2022 (PoC); 4 in 2023 (PoC)
spiked crested coralroot	Hardin Co, pop 2	3 in 2018 (Biotics)[b]; 8 in 2019 (Biotics)	3 in 2020 (Biotics); 7 in 2021 (PoC)	16 in 2022 (PoC); 10 in 2023 (PoC)
spiked crested coralroot	Hardin Co, pop 3, E		93 (PoC)	40 in 2022 (PoC); 41 in 2023 (PoC)
spiked crested coralroot	Hardin Co, pop 3, W		6 (Biotics)	9 in 2022 (PoC); 6 in 2023 (PoC)
spiked crested coralroot	Pope Co, pop 1		snf[c] (PoC)	
spiked crested coralroot	Pope Co, pop 2		snf (C. Benda, pers. comm.)	
spiked crested coralroot	Pope Co, pop 3			2
white wand beardtongue	*No observations*			
sunbright	Johnson Co, pop 1		nearly 1500+ (2 sub pops) (PoC)	1000+ (Biotics)
sunbright	Johnson Co, pop 2		snf	
sunbright	Johnson Co, pop 3	150-200 in 2018 (Biotics); 143 in 2019 (Biotics)	36	
sunbright	Johnson Co, pop 4		5-10 (Biotics)	P

sunbright	Johnson Co, pop 5		30 (PoC)	
sunbright	Pope Co, pop 1		>500 (PoC)	119 (PoC)
Nuttall's prairie parsley	Saline Co, pop 1		P	
fewflower nutrush	Jackson Co, pop 1	80 (Biotics)		
fewflower nutrush	Pope Co, pop 1	snf		
fewflower nutrush	Pope Co, pop 2			Snf
fewflower nutrush	Pope Co, pop 3	snf	18 (PoC)	> 100
fewflower nutrush	Pope Co, pop 4		~24	
fewflower nutrush	Saline Co, pop 1		P	
fewflower nutrush	Saline Co, pop 2			50 (PoC)
spring lady's tresses	Jackson Co, pop 1, S			108 (PoC)
spring lady's tresses	Jackson Co, pop 1, N			75 (PoC)
heartleaf noseburn	Hardin Co, pop 1		658 (PoC)	
heartleaf noseburn	Pope Co, pop 1			12 (PoC)

Table 16-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in barrens, glades, and prairies over three 2-year monitoring cycles

a: monitored by Plants of Concern staff and/or volunteers
b: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
c: searched for, but not found

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

Most populations of these species were not consistently monitored over time, making it difficult to examine trends. Here are a few instances in which patterns have been observed.

Spiked crested coralroot is an orchid that does not photosynthesize, rather it relies on fungal associations. It is only observed when flowering, typically in dry, sunny habitats with limited competition from other plants (Herkert & Ebinger 2002). Spiked crested coralroot populations are relatively consistent in size at Hardin Co populations 1, 2, and 3 W. The high count at Hardin Co population 3 E in 2021 is likely a positive response to prescribed fire that year. Future prescribed burns are planned at all Hardin Co populations.

Figure 21-Spiked crested coralroot

Figure 22-Sunbright growing in glade

Hyssopleaf thoroughwort is in the aster family and grows throughout the southeast United States in primarily dry and open areas (Herkert & Ebinger 2002). Both populations are in Pope County and appear relatively consistent in size.

Sunbright is a small succulent that grows on exposed sandstone (Mohlenbrock 2014). This habitat makes this species vulnerable to trampling by recreators. Populations of this species appear to be persistent; some sites have been known since the late 1940s and 1950s, and plants are still present. Populations such as Johnson Co population 1 and Pope Co population 1 are both persistent and abundant suggesting suitable habitat is being maintained.

Conclusion:
Generally, for species that have been repeatedly monitored, populations appear relatively stable. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, thinning, and designated trail usage) that benefit barrens, glades, and prairie habitats.

Is the ecological value of barrens, glades, & prairies habitats being maintained?
As noted above, 4 Regional Forester's Sensitive Species (American bluehearts, plain gentian, procession flower, and whorled rosinweed) that occur in barrens, glades, and prairies are no longer extant on the Shawnee NF. Loss of these sun loving species is likely due to a history of lack of management, specifically prescribed fire, which has allowed typically open habitats to be encroached by woody species.

However, 8 other Regional Forester's Sensitive Species have been monitored and are persisting in these habitats. Thus, ~2/3 of the rare plant species assigned to be monitored in these habitats are still present, though loss of 4 Regional Forester's Sensitive Species plants from the Shawnee shows a level of vulnerability. Care should be taken to maintain these typically open habitats

through regular disturbance that favors herbaceous communities and disfavors woody plants.

Recommendations: No changes to the forest plan, management activities or monitoring are needed.

References:

Herkert, James R., and John E. Ebinger (editors). 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1: Plants. Illinois Endangered Species Protection Board. Springfield, Illinois.

Mohlenbrock, Robert H. 2014. Vascular Flora of Illinois, a Field Guide. Fourth Edition. Southern Illinois University Press, Carbondale, Illinois. 536 pp.

Question 15: Upland and Oak-Hickory 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 upland and oak-hickory forest habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on upland forest habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities

Observations, results, trends:
There are eight plants on the Regional Forester's Sensitive Species list that occur in upland and oak-hickory habitats, Porter's reedgrass (*Calamagrostis porteri* ssp. *insperata*), black edge sedge (*Carex nigromarginata*), Ravenel's rosette grass (*Dichanthelium ravenelii*), butternut (Juglans cinerea), chestnut oak (*Quercus montana*), Blue Ridge catchfly (*Silene ovata*), buffalo clover (*Trifolium reflexum*), and deerberry (*Vaccinium stamineum*). Monitoring data of all species is presented in Table 17 below; however not all species have been regularly monitored over time.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
Porter's reedgrass	Pope Co, pop 1		32 (PoC)[a]	
black edge sedge	Alexander Co, pop 1		P	
black edge sedge	Alexander Co, pop 2		45 (PoC)	
black edge sedge	Jackson Co, pop 1	P	6 (PoC)	
black edge sedge	Johnson Co, pop 1			18 (PoC)
black edge sedge	Pope Co, pop 1		36 (PoC)	92 (PoC)
black edge sedge	Pope Co, pop 2		40 (Biotics)[b]	
black edge sedge	Pope Co, pop 3		4 (PoC)	4 (PoC)
black edge sedge	Pope Co, pop 4		12 (Biotics)	P (PoC)
Ravenel's rosette grass	Hardin Co, pop 1			5 (PoC)
Ravenel's rosette grass	Hardin Co, pop 2			P (PoC)
butternut	Jackson Co, pop 1		1 (PoC)	
butternut	Jackson Co, pop 2		1 (PoC)	
butternut	Alexander Co, pop 1	P		
chestnut oak	Alexander Co, pop			918 in 2 sub

	1			pops (PoC)
chestnut oak	Saline Co, pop 1		1000s (Biotics)	
chestnut oak	Saline Co, pop 2	P (Biotics)	P	
chestnut oak	Alexander Co, pop 2			P
chestnut oak	Union Co, pop 1		P (Biotics)	< 100 (PoC)
Blue Ridge catchfly	Hardin Co, pop 1			11 (PoC)
Blue Ridge catchfly	Hardin Co, pop 2			29 (PoC)
Blue Ridge catchfly	Hardin Co, pop 3		223 (PoC)	
Blue Ridge catchfly	Hardin Co, pop 4		snf[c] (PoC)	101-200 (PoC)
buffalo clover	Johnson Co, pop 1		snf	snf
buffalo clover	Jackson Co, pop 1	several dozen	3 (Biotics)	2 (PoC)
deerberry	Hardin Co, pop 1		P (Biotics)	

Table 17-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in upland and oak-hickory forests over three 2-year monitoring windows.

a: monitored by Plants of Concern staff and/or volunteers
b: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
c: searched for, but not found

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

Most populations of these species were not consistently monitored over time, making it difficult to examine trends. Here are a few instances in which patterns have been observed.

Black edge sedge grows in dry rocky woods (NatureServe 2024) and is somewhat cryptic (like many sedges) because it is best identified when reproductive. Though this species has been known to occur on the Shawnee NF for a few decades many populations are recent discoveries, which is most likely due to an increase in surveys by botanists with the expertise to identify this species without reproductive characteristics. Though all the Pope County populations listed in Table 17 are newly observed it is likely that they have been present but undetected and their discovery does not reflect a change in habitat.

Figure 23-Black edge sedge, reproductive structures upper right.

Chestnut oak grows in dry rocky upland woods (Mohlenbrock 2014) and continues to be present on the Shawnee NF landscape. All the sites listed in Table 17 have been known for decades. At one site, Saline County population 2, large trees are declining, while small stems are abundant and persisting. Abundant regeneration has been observed at Union County population 1 following prescribed fire.

Buffalo clover is typically found in open upland forests (Herkert and Ebinger 2002); one significant threat to this species is lack of fire (Taft 2005). Though it was once known from 20 Illinois counties it is now found in only 6 (Taft 2005). This species is likely gone from Johnson County population 1, though this site has experienced repeated prescribed fire it may not have been sufficient to maintain buffalo clover. Jackson County population 1 is in decline from several 100 hundred plants in 1994 to < 20 plants since the early 2000s and now single digits in recent years.

Is the ecological value of upland and oak-hickory forest habitats being maintained?

Conclusion:
Limited conclusions can be drawn from the small number of species and locations monitored here. All 8 at-risk species within this community type (upland and oak-hickory forest) are still present on the Shawnee NF, suggesting that rare species are being retained. One population of buffalo clover (Johnson County, population 1) has been lost.

Generally, the Regional Forester's Sensitive Species plants monitored here are continuing to persist on Shawnee NF lands. Upland and oak-hickory forest communities as a whole are typically benefited by prescribed fire like the at-risk species discussed above, chestnut oak and buffalo clover. Standards and guidelines within the forest plan encourage maintenance of oak-hickory forest and regeneration, thus continued activities in this vein should assist in the

continued persistence of at-risk plant species within this community type.

Recommendations: No changes to the forest plan, management activities or monitoring are needed.

References:

Herkert, James R., and John E. Ebinger (editors). 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1: Plants. Illinois Endangered Species Protection Board. Springfield, Illinois.

Mohlenbrock, Robert H. 2014. Vascular Flora of Illinois, a Field Guide. Fourth Edition. Southern Illinois University Press, Carbondale, Illinois. 536 pp.

NatureServe. 2024. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: November 25, 2024).

Taft, John B. 2005. Conservation Assessment for *Trifolium reflexum* L., Technical Report 2005(7), January 5, 2005. Prepared for Eastern Region of the Forest Service, Threatened and Endangered Species Program. Milwaukee, Wisconsin.

Question 16: Dry-Mesic and Mesic Hardwood Forests - Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of dry-mesic and mesic hardwood forest habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on dry-mesic and mesic hardwood forest habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities

Observations, results, trends:
There are 28 plants on the Regional Forester's Sensitive Species list that occur in dry-mesic and mesic hardwood forest, Appalachian bugbane *(Actaea rubifolia)*, black chokeberry (*Aronia melanocarpa*), sparselobe grapefern (*Botrychium biternatum*), Cherokee sedge (*Carex cherokeensis*), sharpscale sedge *(Carex oxylepis* var. *pubescens)*, sand hickory (*Carya pallida*), striped prince's pine (*Chimaphila maculata*), Kentucky yellowwood *(Cladrastis kentukea)*, manyflower flatsedge (*Cyperus lancastriensis*), Greater yellow lady's slipper *(Cypripedium parviflorum* var. *pubescens)*, eastern leatherwood (*Dirca palustris*), Goldie's woodfern *(Dryopteris goldiana)*, goldenseal (*Hydrastis canadensis*), Turk's-cap lily *(Lilium superbum)*, southern crabapple (*Malus angustifolia*), Illinois woodsorrel *(Oxalis illinoensis)*, American ginseng *(Panax quinquefolius)*, autumn bluegrass *(Poa alsodes)*, Maryland meadowbeauty (*Rhexia mariana*), Sullivant's coneflower (*Rudbeckia fulgida* var. *sullivantii*), Small's blacksnakeroot *(Sanicula smallii)*, Early saxifrage *(Saxifraga virginiensis)*, littlehead nutrush *(Scleria oligantha)*, Star chickweed *(Stellaria pubera)*, Bigleaf snowbell *(Styrax grandifolius)*, Guyandotte beauty *(Synandra hispidula)*, wood wakerobin (*Trillium viride*), and Threebirds *(Triphora trianthophora)*.

Two of these species, manyflower flatsedge and autumn bluegrass, have not been observed on the forest within the last 25 years and are therefore no longer considered extant.
Monitoring data of most extant species is presented in Table 18 below; however not all species have been regularly monitored over time. Small's blacksnakeroot is not included below because it has not been monitored during the monitoring window covered in the table. American ginseng and goldenseal are both known from numerous locations but have rarely been monitored multiple times and therefore were not included for brevity.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
Appalachian bugbane	Gallatin Co, pop 1	P (Biotics)[a]		
Appalachian bugbane	Hardin Co, pop 1			20 (PoC)[b]
Appalachian bugbane	Hardin Co, pop 2	P (Biotics)		
Appalachian bugbane	Hardin Co, pop 3		20 (Biotics)	
Appalachian bugbane	Jackson Co, pop 1	> 100 (Biotics)		
Appalachian bugbane	Johnson Co, pop 1		100 (Biotics)	
Appalachian bugbane	Pope Co, pop 1		~10 in 2020 (Biotics); ~25 in 2021 (Biotics)	
Appalachian bugbane	Pope Co, pop 2		15+ in 2020 (Biotics); 20+ in 2021 (Biotics)	
Appalachian bugbane	Pope Co, pop 3		21 (Biotics)	
Appalachian bugbane	Pope Co, pop 4		~15 (PoC)	
black chokeberry	Saline Co, pop 1		2x3 m in 2020; < 100 in 2021 (PoC)	
sparselobe grapefern	Gallatin Co, pop 1		snf[c]	
sparselobe grapefern	Gallatin Co, pop 2			P (PoC)
sparselobe grapefern	Hardin Co, pop 1			P
sparselobe grapefern	Johnson Co, pop 1		P	
sparselobe grapefern	Johnson Co, pop 2		11	
sparselobe grapefern	Pope Co, pop 1		8	
sparselobe	Pope Co, pop 2	P		

grapefern				
sparselobe grapefern	Pope Co, pop 3		4	1
sparselobe grapefern	Pope Co, pop 4		P (PoC)	
sparselobe grapefern	Pope Co, pop 5			40
Cherokee sedge	Pope Co, pop 1		3 (PoC)	3 (PoC)
sharpscale sedge	Hardin Co, pop 1			201 (PoC)
sand hickory	Union Co, pop 1		P (PoC)	P
striped prince's pine	Gallatin Co, pop 1		7 (PoC)	
striped prince's pine	Hardin Co, pop 1			41 (Biotics)
Kentucky yellowwood	Alexander Co, pop 1	P (Biotics)	46 (PoC)	P (PoC)
greater yellow lady's slipper	Alexander Co, pop 1			15 in 2022; 5 in 2023 (PoC)
greater yellow lady's slipper	Alexander Co, pop 2			2
greater yellow lady's slipper	Gallatin Co, pop 1		4 (PoC)	
greater yellow lady's slipper	Gallatin Co, pop 2		19 (PoC)	
greater yellow lady's slipper	Jackson Co, pop 1, several subpopulations	P (PoC)	46 (PoC & FS monitoring)	56 in 2022; 16 in 2023 (PoC)
greater yellow lady's slipper	Jackson Co, pop 2		5 (PoC)	3 (PoC)
greater yellow lady's slipper	Pope Co, pop 1	P	4 in 2020; 5 in 2021 (PoC)	
eastern leatherwood	Pope Co, pop 1, subpop a		51 (PoC)	
eastern leatherwood	Pope Co, pop 1, subpop b			206 (PoC)
eastern leatherwood	Pope Co, pop 2		524 (PoC)	
Goldie's woodfern	Jackson Co, pop 1			60 (PoC)
Goldie's woodfern	Pope Co, pop 1		1 (PoC)	
Turk's-cap lily	Pope Co, pop 1			10 in 2022; 38 in 2023 (PoC)

southern crab apple	Pope Co, pop 1		4 (Biotics)	
southern crab apple	Pope Co, pop 2		snf (Biotics)	
Illinois wood sorrel	Pope Co, pop 1		P (PoC)	
Illinois wood sorrel	Pope Co, pop 2			400-800 (PoC)
Illinois wood sorrel	Pope Co, pop 3			2500 (PoC)
Maryland meadowbeauty	Massac Co, pop 1	snf		
Maryland meadowbeauty	Pope Co, pop 1	P in 2018 (Biotics); snf in 2019	97 (PoC)	
Maryland meadowbeauty	Pope Co, pop 2			74
Sullivant's coneflower	Gallatin Co, pop 1		22 (PoC)	
Sullivant's coneflower	Hardin Co, pop 1		P (PoC)	
early saxifrage	Hardin Co, pop 1		1000s (Biotics)	
early saxifrage	Hardin Co, pop 2		200-400 (Biotics)	
early saxifrage	Hardin Co, pop 3		>28,000 (PoC)	
early saxifrage	Hardin Co, pop 4		800+ (PoC)	
little nutrush	Alexander Co, pop 1		31 (PoC)	
little nutrush	Hardin Co, pop 1		42	P
star chickweed	Hardin Co, pop 1			snf (PoC)
star chickweed	Johnson Co, pop 1			1000 (Biotics)
star chickweed	Pope Co, pop 1		100s (Biotics)	101-200 (PoC)
bigleaf snowbell	Alexander Co, pop 1	P (Biotics)	125 (PoC)	
bigleaf snowbell	Pope Co, pop 1	1900 (C Evans email)	40 (Biotics)	
Guyandotte beauty	Jackson Co, pop 1			
Guyandotte beauty	Jackson Co, pop 2		P in 2020 (Biotics); >1000 in 2021 (Biotics)	>100 (PoC)
Guyandotte	Jackson Co, pop 3		< 800 (PoC)	

beauty				
wood wakerobin	Union Co, pop 1			>100
threebirds	Jackson Co, pop 1	P (project surveys)	> 6000 (PoC)	
threebirds	Jackson Co, pop 2	P (project surveys)		

Table 18-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in dry-mesic and mesic hardwood forests over three 2-year monitoring windows.

a: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
b: monitored by Plants of Concern staff and/or volunteers
c: searched for, but not found

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

Most populations of these species were not consistently monitored over time, making it difficult to examine trends. Here are two instances in which patterns have been observed.

Appalachian bugbane is an herb in the buttercup family (Herkert and Ebinger 2002) known from numerous sites on the forest, including the 10 that were monitored in the 2018-2023 window. It grows in mesic forests, particularly under closed canopies (Heikens 2003) and has a limited range in the Cumberland Plateau and Ohio River Valley (NatureServe 2025). Many of these populations have been known for a few decades and are continuing to persist, suggesting that suitable habitat conditions remain.

Figure 25-Appalachian bugbane

Figure 24-Greater yellow lady's slipper in flower

Greater yellow lady's slipper is an orchid that grows in mesic forests (Mohlenbrock 2014). Four of the 7 populations included in this monitoring report have been monitored more than once in the monitoring period. These populations are either consistent in size or declining, though it is possible that the orchids are remaining dormant for one or more seasons after having previously emerged (Danderson 2004).

Is the ecological value of dry-mesic and mesic hardwood forest habitats being maintained?

Conclusion:
Limited conclusions can be drawn, particularly from species that are only known from a few locations or from populations that haven't been monitored repeatedly overtime.
Two species occurring in these communities, manyflower flatsedge and autumn bluegrass, have not been observed in more than 25 years and are no longer considered extant on the forest, indicating some loss of habitat and ecological value. However, other species like American ginseng and goldenseal, are known from dozens of locations; while other Illinois woodsorrel, early saxifrage, and Guyandotte beauty have particularly large and likely robust population sizes.

Generally, the Regional Forester's Sensitive Species plants monitored in dry-mesic and mesic hardwood forests are continuing to persist. Some have large population sizes like Illinois woodsorrel, early saxifrage, and Guyandotte beauty, while others are limited to handfuls on individuals. Mesic forest habitat is likely to persist with or without active management due to mesophication, whereas dry-mesic habitat may shrink and transition to more mesic forest without management activities. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, and timber harvest) that could maintain dry-mesic forest.

Recommendations: No changes to the forest plan, management activities or monitoring are needed.

References:
Danderson, C.A. 2004. Unreviewed Draft Conservation Assessment for Large Yellow Lady's-Slipper (*Cypripedium pubescens* Willd.). Provided to the USDA Forest Service, Shawnee and Hoosier National Forests, October 2004. Illinois Natural History Survey, Center for Biodiversity, Champaign, Ill. 31 pp.

Heikens, Alice Long. 2003. Conservation Assessment for Appalachian Bugbane (*Cimicifuga rubifolia Kearney*). USDA Forest Service Eastern Region, Threatened and Endangered Species Program. Milwaukee, Wisconsin. 19 pp.

Herkert, James R., and John E. Ebinger (editors). 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1: Plants. Illinois Endangered Species Protection Board. Springfield, Illinois.

Mohlenbrock, Robert H. 2014. Vascular Flora of Illinois, a Field Guide. Fourth Edition. Southern Illinois University Press, Carbondale, Illinois. 536 pp.

NatureServe. 2025. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: February 13, 2025).

Question 17: Wetlands, Swamps, Forested Wetlands, Floodplain Forests, 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?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on wetlands, swamps, forested wetlands, floodplain forests and caves.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities

Observations, results, trends:
There are 25 plants on the Regional Forester's Sensitive Species list that occur in wetlands, swamps, forested wetlands, floodplain forests, and caves, shining false indigo (*Amorpha nitens*), Alabama supplejack (*Berchemia scandens*), Nottoway Valley brome (*Bromus nottowayanus*), broadwing sedge (*Carex alata*), cypress-knee sedge (*Carex decomposita*), giant sedge (*Carex gigantea*), greater bladder sedge (*Carex intumescens*), false hop sedge (*Carex lupuliformis*), red turtlehead (*Chelone obliqua* var. *speciosa*), finger dogshade (*Cynosciadium digitatum*), variable panic grass (*Dichanthelium joorii*), Yadkin's panic grass (*Dichanthelium yadkinense*), Wolf's spikerush (*Eleocharis wolfii*), creeping eryngo (*Eryngium prostratum*), Arkansas mannagrass (*Glyceria arkansana*), kidneyleaf mudplantain (*Heteranthera reniformis*), American featherfoil (*Hottonia inflata*), one-flowered false fiddleleaf (*Hydrolea uniflora*), Guadeloupe cucumber (*Melothria pendula*), wreath lichen (*Phaeophyscia leana*), palegreen orchid (*Platanthera flava* var. *flava*), clustered beaksedge (*Rhynchospora glomerata*), eastern featherbells (*Stenanthium gramineum*), American snowbell (*Styrax americanus*), and pale false mannagrass (*Torreyochloa pallida*).

Monitoring data of most extant species is presented in Table 19 below though not all species have been regularly monitored over time. Nottoway Valley brome is not included below because it was not monitored during the monitoring window covered in the table.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
shining false indigo	Saline Co, pop 1		300-400 (Biotics)[a]	118 (PoC)[b]
shining false indigo	Pope Co, pop 1		~12 in 2020 (PoC); 49 in 2021 (PoC)	
Alabama supplejack	Johnson Co, pop 1		80 (PoC, Biotics)	

Alabama supplejack	Pope Co, pop 1	42 (PoC)		
broadwing sedge	Pope Co, pop 1			1000s of plants, circumference of lake
cypress-knee sedge	Jackson Co, pop 1			2 (PoC)
cypress-knee sedge	Union Co, pop 1	>200 (Biotics)		
giant sedge	Johnson Co, pop 1		8 (PoC)	7 (PoC)
giant sedge	Union Co, pop 1	snf[c], flooded	snf, flooded	
greater bladder sedge	Jackson Co, pop 1	<50 (Biotics)	snf	
greater bladder sedge	Johnson Co, pop 1		25 (PoC)	>200 (PoC)
greater bladder sedge	Pope Co, pop 1		19 (PoC)	
false hop sedge	Jackson Co, pop 1			101-200 (PoC); 100s (monitoring)
false hop sedge	Johnson Co, pop 1			287 (PoC)
red turtlehead	Johnson Co, pop 1		340 (PoC)	
finger dogshade	Jackson Co, pop 1	P (Biotics)	1000s (Biotics)	100s
finger dogshade	Jackson Co, pop 2	P		1000s
variable panic grass	Johnson Co, pop 1		3	
variable panic grass	Saline Co, pop 1			few plants
variable panic grass	Union Co, pop 1	snf		
Yadkin's panic grass	Pope Co, pop 1	snf		
Yadkin's panic grass	Pope Co, pop 2			100s of plants
Wolf's spikerush	Jackson Co, pop 1			P
creeping eryngo	Hardin Co, pop 1			P (Biotics)
Arkansas mannagrass	Jackson Co, pop 1			100s
kidneyleaf mudplantain	Alexander Co, pop 1		1000s (PoC)	1000s
kidneyleaf mudplantain	Pope Co, pop 1		P in 2020 (Biotics); 100-	100s in 2022 (PoC); 1286 in

			200 in 2021 (PoC)	2023 (PoC)
kidneyleaf mudplantain	Pope Co, pop 2		<100 in 2021 (PoC)	400-800 in 2022 (PoC); 519 in 2023 (PoC)
kidneyleaf mudplantain	Pope Co, pop 3		10 (PoC)	<100 in 2022 (PoC); 71 in 2023 (PoC)
kidneyleaf mudplantain	Pope Co, pop 4			208 (Biotics)
kidneyleaf mudplantain	Pope Co, pop 5			~65 in 2023 (PoC)
American featherfoil	Jackson Co, pop 1		<100 (PoC)	
American featherfoil	Union Co, pop 1			1 (PoC)
American featherfoil	Johnson Co, pop 1		100-200 (PoC)	
one-flowered false fiddleleaf	Jackson Co, pop 1	snf		687 (Biotics)
one-flowered false fiddleleaf	Johnson Co, pop 1		12 (PoC)	P (PoC)
Guadeloupe cucumber	Alexander Co, pop 1			> 70
Guadeloupe cucumber	Alexander Co, pop 2	P (Biotics)	P (Biotics)	
Guadeloupe cucumber	Hardin Co, pop 1			4 (PoC)
Guadeloupe cucumber	Hardin Co, pop 2	P		
Guadeloupe cucumber	Johnson Co, pop 1		P (Biotics)	
Guadeloupe cucumber	Pope Co, pop 1		P (Biotics)	
Guadeloupe cucumber	Pope Co, pop 2		3 (Biotics)	
Guadeloupe cucumber	Pope Co, pop 3		P (Biotics)	
Guadeloupe cucumber	Pope Co, pop 4		P (Biotics)	
Guadeloupe cucumber	Pope Co, pop 5			P (Biotics)

wreath lichen	Hardin Co, pop 1			P
palegreen orchid	Johnson Co, pop 1	875 across 2 subpops (PoC)	967 across 2 subpops (PoC)	
clustered beaksedge	Johnson Co, pop 1	6 (Biotics)	112 (PoC)	
clustered beaksedge	Pope Co, pop 1		several dozen (Biotics)	
eastern featherbells	Gallatin Co, pop 1		35 (PoC)	211 (PoC)
eastern featherbells	Jackson Co, pop 1	P (Biotics)		
eastern featherbells	Jackson Co, pop 2			247 in 2022 (PoC); 162 in 2023 (PoC)
eastern featherbells	Johnson Co, pop 1		26 (PoC)	17 (PoC)
eastern featherbells	Pope Co, pop 1		snf	
eastern featherbells	Pope Co, pop 2		snf	
eastern featherbells	Pope Co, pop 3		128 (PoC)	243 (PoC)
eastern featherbells	Pope Co, pop 4		18 (PoC)	18 (PoC)
eastern featherbells	Pope Co, pop 5			~200
American snowbell	Johnson Co, pop 1		505 (PoC)	
American snowbell	Johnson Co, pop 1		1090 (PoC)	
American snowbell	Johnson Co, pop 2		5 (PoC)	
American snowbell	Alexander Co, pop 1		45 (PoC)	
pale false mannagrass	Jackson Co, pop 1			P

Table 19-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in wetlands, swamps, forested wetlands, floodplain forests, and caves over three 2-year monitoring windows

a: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
b: monitored by Plants of Concern staff and/or volunteers
c: searched for, but not found

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

Most populations of these species were not consistently monitored over time, making it difficult to examine trends. Here are two instances in which patterns have been observed.

Kidneyleaf mudplantain is an herb that grows in shallow water and mudflats, including roadside ditches and alongside ponds (NatureServe 2025). It can grow abundantly and then may be shaded out and lost from a site due to succession, though its seeds can germinate for up to 15 years, allowing it to reappear at a site (Hill 2006). At the six sites where this species was monitored, it is present in relatively large numbers and was observed during more than 1 monitoring visit at 4 of those 6 sites. This suggests that suitable habitat for this species is generally persisting on the landscape.

Figure 26-Eastern featherbells in bloom

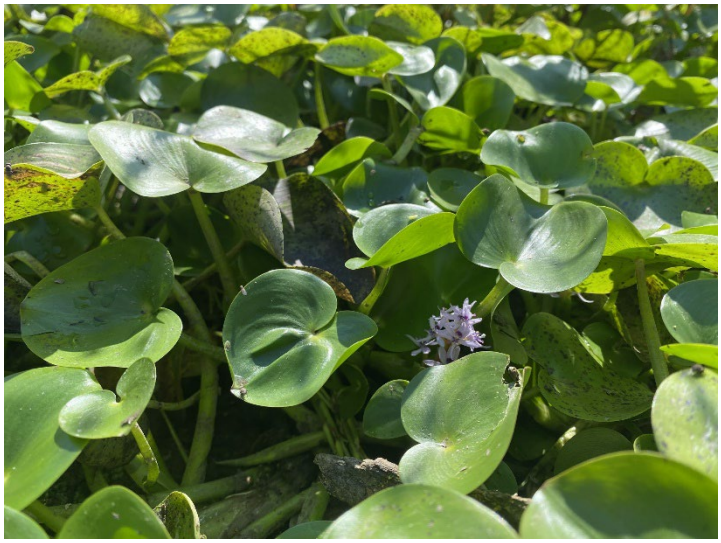


Figure 27-Kindneyleaf mudplantain

Eastern featherbells is an herb that grows in moist woods, floodplains, meadows, and streambanks (Godfrey & Wooten 1979). Although it can persist under shade, it benefits from canopy gap openings and increased light (Phillipe 2005). Of the nine populations of eastern featherbells monitored between 2018 and 2023, two were searched for but not found; five of the sites were visited twice and had relatively consistent population sizes across those two monitoring visits. The exception to this is the Gallatin County site, which increased from 35 to 211 between 2021 and 2022 (Table 19). Generally, eastern featherbells populations appear to be stable in size, indicating persistence of suitable habitat, though two populations have been lost.

Generally, the Regional Forester's Sensitive Species monitored in wetlands, swamps, forested wetlands, floodplain forests, and caves are continuing to persist. Population sizes vary widely depending upon species, but some are quite large and range into 1000s of individuals including 1 population for broadwing sedge, 2 populations for finger dogshade, and 1 population for kidneyleaf mudplantain.

Is the ecological value of wetlands, swamps, forested wetlands, floodplain forests, and cave habitats being maintained?

Conclusion:
Limited conclusions can be drawn, particularly from species that are only known from a few locations or from populations that haven't been monitored repeatedly overtime. Of the 25 Regional Forester's Sensitive Species plants that occur in wetlands, swamps, forested wetlands, floodplain forests, and caves, 24 were monitored and still found to be present on the landscape between 2018 and 2023 suggesting that some ecological value of these habitats is being maintained.

Recommendations: No changes to the forest plan, management activities or monitoring are needed.

References:
Godfrey, Robert K., and Jean W. Wooten. 1979. Aquatic and Wetland Plants of Southeastern United States, Monocotyledons. The University of Georgia Press. Athens, Georgia. 728 pp.

Hill, S.R. 2006. Conservation Assessment for the Kidneyleaf Mud-plantain (*Heteranthera reniformis* Ruiz & Pavón). Prepared for the USDA Forest Service, Shawnee and Hoosier National Forests. 12 May 2006. Illinois Natural History Survey, Center for Wildlife and Plant Ecology. Champaign, Illinois, 34 pp.

NatureServe. 2025. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: February 19, 2025).

Phillippe, L.R. 2005. Conservation Assessment for *Stenanthium gramineum* (Ker Gawler) Morong. Center for Biodiversity Technical Report 2005 (5). Eastern Region of the Forest Service, Threatened and Endangered Species Program. 19 pp.

Question 18: Streams - Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of stream habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on-stream habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities

Observations, results, trends:
There is one Regional Forester's Sensitive Species listed plant that occurs in stream beds, heartleaf plantain *(Plantago cordata)*.

Heartleaf plantain is a perennial, aquatic herb. It is found in gravelly or rocky, shallow, clear streams or springs, their adjacent floodplains, swampy woods, and around tidal flats, usually on calcareous substrates (Hill 2007). Heartleaf plantain has a narrow habitat preference and is highly sensitive to water quality changes.
On Shawnee National Forest lands, heartleaf plantain is known from 5 extant populations in 4 counties, Jackson, Johnson, Pope, and Saline.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
heartleaf plantain	Jackson Co, pop 1, N	snf[a]		
heartleaf plantain	Jackson Co, pop 1, S	358	480 (Biotics)[b]	673 in 2022 (PoC)[c]; 886 in 2023
heartleaf plantain	Johnson Co, pop 1, NW		34	32
heartleaf plantain	Johnson Co, pop 1, S		153	156
heartleaf plantain	Pope Co, pop 1		79 in April 2021 (Biotics); ~150 in August 2021	
heartleaf plantain	Saline Co, pop 1, E		127 (PoC)	88
heartleaf plantain	Saline Co, pop 1, W		2 (PoC)	snf
heartleaf plantain	Saline Co, pop 2		84 in 2020 (Biotics); 201-400 in	100s

			2021 (PoC)	

Table 20-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plant that occurs in streams over three 2-year monitoring windows

a: searched for, but not found
b: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
c: monitored by Plants of Concern staff and/or volunteers

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

Generally, population sizes of heartleaf plantain have been consistent between 2018 & 2023, when monitored (Table 20). However, some populations were lost or are shrinking over time. The Jackson Co pop 1 N site no longer has suitable habitat and Saline Co pop 1 W was disturbed during a flooding event that washed out a nearby road culvert. Most heartleaf plantain populations are experiencing some level of siltation and subsequent competition with other vegetation, often twisted sedge (*Carex torta*). Build up of silt is likely the greatest threat to heartleaf plantain because this plant is highly sensitive to changes in water quality (NatureServe 2024). However, much of the silt is likely originating from nearby non-Forest Service lands and cannot be remedied through the standards and guidelines of the forest plan.

Figure 28-Heartleaf plantain growing alongside creek not experiencing siltation

A recent project rerouting a trail at Kinkaid Lake modified a trail crossing near a heartleaf plantain population. The old trail route crossed through this sensitive plant population. The new

trail route has been shifted to pass upstream of the population and now keeps trail users on slopes well above the stream bed, which reduces the likelihood of user-created crossings. Construction of the new trail may produce temporary negative effects on the heartleaf plantain population through increased erosion. However, the new trail route likely benefits heartleaf plantain population long term.

Is the ecological value of stream habitats being maintained?

Conclusion:
Monitoring of heartleaf plantain represents a small sampling of stream habitats. However, as a species that is highly sensitive to changes in water quality, it is a valuable indicator of the ecological value of stream habitats. The ongoing siltation of streams where heartleaf plantain occurs suggests that high quality, clear-flowing, rocky stream habitat is degrading.

Recommendations: No changes to the forest plan, management activities or monitoring are needed.

References:
NatureServe. 2024. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: October 24, 2024).

Question 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?

Objective:
The objective of this question to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on openland habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities.

Observations, results, trends:
Mastication work at Pennant Bar occurred in 2022 and 2023, south of highway 146. Results of the mastication were immediate with increased occurrence of milkweed plants, which are important to the federal candidate species, the Monarch butterfly. The recent purchase of a masticator by the Shawnee National Forest will help create a mosaic of early successional habitats in selected managed openlands. Currently, Pennant Bar is among the best areas for northern bobwhite and bell's vireo on the Shawnee National Forest (M. Vukovich, pers. observation). However, woody encroachment will increase and those bird species may be lost without management of Pennant Bar.

Conclusion:
Currently, prescribed fire is the cheapest and main tool used by the Shawnee National Forest in managing our openlands. Wildlife monitoring in openlands is lacking and mostly incomplete due to lack of personnel and an active silviculture program which is the priority for monitoring.

Recommendations:
Management through prescribed fire will continue but the use of a masticator will help ensure a mosaic of early successional habitats in our openlands. M ost of the focus on our openlands will be on Pennant Bar, Rothamel, and White Tract due to their importance to the public and proximity to active silviculture projects.

Question 20: Cliffs - Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of cliff habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on cliff habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities.

Observations, results, trends:
There are nine plants on the Regional Forester's Sensitive Species list that occur in cliff habitats, Bradley's spleenwort (*Asplenium bradleyi*), blackstem spleenwort (*Asplenium resiliens*), eastern hay-scented fern (*Dennstaedtia punctilobula*), French's shootingstar (*Dodecatheon frenchii*), rock clubmoss (*Huperzia porophila*), Allegheny stonecrop (*Hylotelephium telephioides*), limber honeysuckle (*Lonicera dioica* var *glaucescens*), yellow honeysuckle (*Lonicera flava*), and Appalachian bristle fern (*Trichomanes boschianum*). Monitoring data of all species is presented in Table 21 below; however not all species have been regularly monitored over time.

Blackstem spleenwort, French's shootingstar, and Appalachian bristle fern will be discussed in detail because they are each known from several locations and some of these locations have been observed repeatedly.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
Bradley's spleenwort	Saline Co, pop 1		17	P in 2022; P in 2023
blackstem spleenwort	Jackson Co, pop 1		91 (PoC)[a]	
blackstem spleenwort	Union Co, pop 1		32	72
blackstem	Union Co, pop 2		6	

spleenwort				
blackstem spleenwort	Union Co, pop 3		137	500
French's shootingstar	Jackson Co, pop 1		24 (Biotics)[b]	
French's shootingstar	Jackson Co, pop 2		15 populations (Biotics)	
French's shootingstar	Jackson Co, pop 3		> 35 (Biotics)	
French's shootingstar	Jackson Co, pop 4		P (Biotics)	
French's shootingstar	Johnson Co, pop 1			100 (Biotics)
French's shootingstar	Johnson Co, pop 2	P in 2018 (Biotics); 3 in 2019 (Biotics)		>800 (PoC)
French's shootingstar	Johnson Co, pop 3		~1000	
French's shootingstar	Johnson Co, pop 4			250 (Biotics)
French's shootingstar	Johnson Co, pop 5		~200 (Biotics)	
French's shootingstar	Johnson Co, pop 6		100 (Biotics)	
French's shootingstar	Johnson Co, pop 7		~150 (PoC)	
French's shootingstar	Johnson Co, pop 8		10 (Biotics)	
French's shootingstar	Pope Co, pop 1		~450 in 2020 (Biotics); > 800 in 2021 (PoC)	
French's shootingstar	Pope Co, pop 2			280 (Biotics)
French's shootingstar	Pope Co, pop 3	~350 (Biotics)		
French's shootingstar	Pope Co, pop 4		192 (PoC)	
French's shootingstar	Pope Co, pop 5		1000s (Biotics)	

French's shootingstar	Saline Co, pop 1		Dozens (Biotics)	
French's shootingstar	Union Co, pop 1	35 (Biotics)		63 (Biotics)
French's shootingstar	Union Co, pop 2	300-500		
rock clubmoss	Gallatin Co, pop 1		26 (Biotics)	
rock clubmoss	Jackson Co, pop 1		~20 (Biotics)	
rock clubmoss	Johnson Co, pop 1	P (Biotics)	175 (PoC)	
rock clubmoss	Pope Co, pop 1		2 (PoC)	
rock clubmoss	Pope Co, pop 2			snf[e] (PoC)
rock clubmoss	Pope Co, pop 3			10 (PoC)
rock clubmoss	Pope Co, pop 4			< 100 (PoC)
Allegheny stonecrop	Gallatin Co, pop 1		222 (Biotics)	
Allegheny stonecrop	Gallatin Co, pop 2		P (Biotics)	
Allegheny stonecrop	Gallatin Co, pop 3	P (Biotics)	59 (PoC)	
Allegheny stonecrop	Gallatin Co, pop 4		21 (Biotics)	
Allegheny stonecrop	Hardin Co, pop 1			P (N. Seaton, pers. comm.)
Allegheny stonecrop	Pope Co, pop 1			20 (PoC)
Allegheny stonecrop	Pope Co, pop 2		1 (PoC)	
Allegheny stonecrop	Pope Co, pop 3			83 (PoC)
Allegheny stonecrop	Saline Co, pop 1	P (Biotics)	P	P
Allegheny stonecrop	Saline Co, pop 2		70 (PoC)	
Limber honeysuckle	Jackson Co, pop 1	snf		
yellow honeysuckle	Jackson Co, pop 1, E	snf		

yellow honeysuckle	Jackson Co, pop 1, W		P (Biotics)	
yellow honeysuckle	Pope Co, pop 1		2 (Biotics)	
Appalachian bristle fern	Hardin Co, pop 1			100-200 (PoC)
Appalachian bristle fern	Johnson Co, pop 1	P (Biotics)		~500-900 (PoC)
Appalachian bristle fern	Pope Co, pop 1	P (Biotics)		
Appalachian bristle fern	Pope Co, pop 2	P (Biotics)		3 clumps (PoC)
Appalachian bristle fern	Pope Co, pop 3	2 patches in 2018 (Biotics); P in 2019 (Biotics)		
Appalachian bristle fern	Pope Co, pop 4		2 clumps (PoC)	

Table 21-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in cliff habitats over three 2-year monitoring windows.

a: monitored by Plants of Concern staff and/or volunteers
b: monitored by non-Forest Service staff, data retrieved from Illinois Natural Heritage Database
c: searched for, but not found

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

Blackstem spleenwort is a wiry evergreen fern that grows on limestone cliffs (Mohlenbrock 2014). It reaches the northwest extent of its range in southern Illinois (Herkert and Ebinger 2002). Thorough searches in 2021 and 2022 at the Union Co sites revealed that this species continues to persist on the cliff faces. Several of the Union Co. subpopulations were newly discovered during these searches, others were updates from records ranging from the 1950s to 1980s.

Figure 29-French's shootingstar in bloom

Figure 30-Blackstem spleenwort

French's shootingstar grows under sandstone ledges, often abundantly, and is known from a small collection of Midwest and southeastern states (NatureServe 2024). Most populations on the forest are substantial in size (>100 individuals), many are new observations.

Appalachian bristle fern has specialized habitat deep in overhanging sandstone cliffs with consistent moisture and low light. Prolonged drought is a threat to this species (Hill 2003). Most of the populations observed during the three most recent monitoring periods are re-visits to populations found in the 1950s to 1970s, this demonstrates the continued persistence of this species on the forest. Pope Co population 3 is the site most impacted by users, primarily hikers and horseback riders; long term observations indicate that this population is slowly decreasing. This is the same site French's shootingstar Pope Co population 3, which is also impacted by users and decreasing in size.

Figure 31-Appalachian bristle fern under cliff overhang

Conclusions:
Generally speaking, at-risk species are persisting on cliff faces, under ledges, and in cracks and crevices. Some species, like French's shooting star, are at risk from trampling by users walking along bluff spaces, however French's shooting star remains relatively abundant in many locations in suitable habitat on the forest. Other species that occupy cliff faces are maintaining their occupancy. Management of areas around cliff faces, particularly with fire or timber harvest, likely reduces competition, increases access to light, and some invasive plants, thereby helping cliff-dwelling at-risk species to persist.

Is the ecological value of cliff habitats being maintained?

Recommendations:
Most of the nine at-risk species that occupy cliff habitats are present on the forest in multiple locations and persisting over time. This indicates the resilience of these species and/or their habitat. Limited active management has occurred that directly affects cliff habitats during this monitoring period. However, efforts to reduce encroachment of invasive plants and maintain suitable light environments for these species by managing nearby habitat would be beneficial. Trampling of French's shootingstar by recreators should be limited to the extent practical. The Pope Co population 3 location for Appalachian bristle fern and French's shootingstar is degrading due to user impacts.

Literature Cited:
Herkert, James R., and John E. Ebinger (editors). 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1: Plants. Illinois Endangered Species Protection Board. Springfield, Illinois.

Hill, Steve R. 2003. Conservation Assessment for Appalachian Bristle Fern (*Trichomanes boschianum Sturm*). Center fir Biodiversity Technical Report 2003 (5). Illinois Natural History Survey, Champaign, IL. Prepared for USDA Forest Service, Vienna Ranger District, Shawnee National Forest, Vienna, IL. 31 pages.

Mohlenbrock, Robert H. 2014. Vascular Flora of Illinois, a Field Guide. Fourth Edition. Southern Illinois University Press, Carbondale, Illinois. 536 pp.

NatureServe. 2024. NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: December 9, 2024).

Question 21: Seeps, Springs, 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 seep, spring and cave habitats being maintained?

Objective:
The objective of this question is to determine the effectiveness of management in protecting and promoting the recovery of at-risk species dependent on seep, spring and cave habitats.

Methods:
Indicators for this are collected by monitoring species that are associated with these communities.

Observations, results, trends:
There are 11 plants on the Regional Forester's Sensitive Species list that occur in seeps, springs, and cave habitats, twining screwstem (*Bartonia paniculata*), prickly bog sedge (*Carex atlantica*), brome-like sedge (*Carex bromoides*), dropping sedge (*Carex prasina*), fairywand (*Chamaelirium luteum*), swamp sunflower (*Helianthus angustifolius*), larger whorled pogonia (*Isotria verticillata*), small green wood orchid (*Platanthera clavellata*), longbeak arrowhead (*Sagittaria australis*), leafy bulrush (*Scirpus polyphyllus*), and New York fern (*Thelypteris noveboracensis*).

Monitoring data of most extant species is presented in Table 22 below; however not all species have been regularly monitored over time. New York fern is not included below because it was not monitored during the monitoring window covered in the table.

RFSS Plant Name	Site Name	2018-2019	2020-2021	2022-2023
twining screwstem	Pope Co, pop 1	64		
twining screwstem	Pope Co, pop 2	>360	>700	2
prickly bog sedge	Pope Co, pop 1	133		P (Biotics)
prickly bog sedge	Pope Co, pop 2	~200	Hundreds	100+ in 2022; ~250 in 2023
brome-like sedge	Johnson Co, pop 1	P	25 (PoC)	5 (Biotics)
brome-like sedge	Pope Co, pop 1			~24
brome-like sedge	Pope Co, pop 2	P (Biotics)		
brome-like sedge	Pope Co, pop 3		16 (PoC)	snf

drooping sedge	Pope Co, pop 1			3 in 2022; 47 in 2023 (PoC)
drooping sedge	Pope Co, pop 2		P (PoC)	16 (PoC)
fairywand	Pope Co, pop 1	P (Biotics)	4 (Biotics in 2020); 1 (PoC)	P
swamp sunflower	Pope Co, pop 1	snf		
swamp sunflower	Pope Co, pop 2		P	100s in 2022, 157 in 2023
large whorled pogonia	Pope Co, pop 1	P in 2018 (Biotics); 10-20 in 2019	8 (PoC)	81 (PoC)
large whorled pogonia	Pope Co, pop 2		~100 (incidental)	14
small green wood orchid	Pope Co, pop 1	P in 2018 (Biotics); 1 in 2019	42 (PoC)	
small green wood orchid	Pope Co, pop 2	P in 2018 (Biotics); 10 in 2019	28	46 in July 2022 (PoC); 32 in August 2022
longbeak arrowhead	Pope Co, pop 1	~20	193 (Biotics)	
leafy bulrush	Hardin Co, pop 1	snf (Biotics)		15 (PoC)
leafy bulrush	Massac Co, pop 1	~12		
leafy bulrush	Pope Co, pop 1	> 140	>200 (PoC)	P (Biotics)
leafy bulrush	Pope Co, pop 2	>200	~210	
leafy bulrush	Pope Co, pop 3	P in 2018; ~200 in 2019	>100	48

Table 22-Monitoring records for the Regional Forester's Sensitive Species (RFSS) plants that occur in seeps, springs, and cave habitats over three 2-year monitoring windows.

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

Several of the species that occur in seep, spring, and cave habitats have been monitored repeatedly during the 2018-2023 monitoring period. A few will be discussed in detail.

Twining screwstem is an herbaceous plant found growing within and adjacent to acid gravel seeps and springs on the Shawnee (USDA FS 2005). It is a diminutive plant that can be difficult to observe due to its size and relatively brief time period (~August - October) when it is visible aboveground. Pope County population 2 of this species appears to have grown between 2018-2019 and 2020-2021, but then drastically declined in the following 2-year monitoring period to only 2 individuals. Regular treatment of an invasive plant, stiltgrass (*Microstegium vimineum*), since 2017 around this population may have allowed this twining screwstem to grow by reducing

competition. It is unclear why twining screwstem numbers fell substantially in 2022-2023 it could be related to differences in search effort, a decline in habitat, or annual fluctuations in population size.

Figure 32-Leafy bulrush

Figure 33-Twining screwstem, 3 flowering plants

Large whorled pogonia is an orchid that grows near seep springs and near the bottom of forested ravines (Herkert & Ebinger 2002). This orchid has been consistently found at Pope County population 1 since the late 1960s. Population sizes have varied widely over the years and generally seem to be declining from > 100 plants in several subpopulations in the early 2000s though a small resurgence to 81 plants occurred in 2022-2023. Pope County population 2 was discovered in 2021.

Leafy bulrush is a sedge typically encountered in low woods or forested seeps (Herkert & Ebinger 2002, Mohlenbrock 2014). Of the 5 populations of leafy bulrush monitored from 2018-2023, 4 were monitored more than once. Two of these populations appear consistent in size (Pope County populations 1 & 2); one may be decreasing (Pope County population 3), and one was relocated (Hardin County population 1).
Is the ecological value of seep, spring, and cave habitats being maintained?

Conclusion:
Limited conclusions can be drawn from species that are only known from a few locations. Most of the monitored plants occur in or near acid seep springs, which is a rare habitat type on the forest. The continued persistence of Regional Forester's Sensitive Species plants in these rare habitats demonstrates some level of maintenance of ecological value.

Recommendations:
Many of the populations of Regional Forester's Sensitive Species plants in seeps, springs, and caves have been monitored repeatedly and are clearly persisting on the landscape. Some management tools, including treatment of invasive species, prescribed fire, and removal of small trees and shrubs, are being implemented at these sites to reduce competition. Standards and guidelines within the forest plan allow for continued use of these management tools.

References:
Herkert, James R., and John E. Ebinger (editors). 2002. Endangered and Threatened Species of Illinois: Status and Distribution. Volume 1: Plants. Illinois Endangered Species Protection Board. Springfield, Illinois.

Mohlenbrock, Robert H. 2014. Vascular Flora of Illinois, a Field Guide. Fourth Edition. Southern Illinois University Press, Carbondale, Illinois. 536 pp.

USDA Forest Service. 2005. Shawnee National Forest Biological Evaluations of Regional Forester's Sensitive Plant Species. forest plan Revisions. Shawnee National Forest. Harrisburg, Illinois. Available at: Shawnee NF Forest Plan Biological Evaluation-Plants

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 14 **Barrens, Glades and Prairies -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of barren, glade and prairie habitats being maintained?	For species that have been repeatedly monitored, populations appear relatively stable. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, thinning, and designated trail usage) that benefit barrens, glades, and prairie habitats.	No change to the monitoring question. Care should be taken to maintain these typically open habitats through regular disturbance that favors herbaceous communities and disfavors woody plants.
MQ# 15 **Upland and Oak-Hickory 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 upland and oak-hickory forest habitats being maintained?	All 8 at-risk species within this community type (upland and oak-hickory forest) are still present on the Shawnee NF, suggesting that rare species are being retained.	No change to the monitoring question. Upland and oak-hickory forest communities as a whole are typically benefited by prescribed fire like the at-risk species discussed above, chestnut oak and buffalo clover. Standards and guidelines within the forest plan encourage maintenance of oak-hickory forest and regeneration, thus continued activities in this vein should assist in the continued persistence of at-risk plant species within this community type.
MQ# 16 **Dry-Mesic and Mesic Hardwood Forests -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of dry-mesic and mesic hardwood forest habitats being maintained?	Limited conclusions can be drawn, particularly from species that are only known from a few locations or from populations that haven't been monitored repeatedly overtime.	No change to the monitoring question. Mesic forest habitat is likely to persist with or without active management due to mesophication, whereas dry-mesic habitat may shrink and transition to more mesic forest without management activities. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, and timber harvest) that could maintain dry-mesic forest.

MQ# 17 **Wetlands, Swamps, Forested Wetlands, Floodplain Forests, 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?	Of the 25 Regional Forester's Sensitive Species plants that occur in wetlands, swamps, forested wetlands, floodplain forests, and caves, 24 were monitored and still found to be present on the landscape between 2018 and 2023 suggesting that some ecological value of these habitats is being maintained.	No change to the monitoring question.
MQ# 18 **Streams -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of stream habitats being maintained?	The ongoing siltation of streams where heartleaf plantain occurs suggests that high quality, clear-flowing, rocky stream habitat is degrading.	No change to the monitoring question.
MQ# 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?	Management through prescribed fire will continue but the use of a masticator will help ensure a mosaic of early successional habitats in our openlands.	Option #2. Most of the focus on our openlands will be on Pennant Bar, Rothamel, and White Tract due to their importance to the public and proximity to active silviculture projects.
MQ# 20 **Cliffs -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of cliff habitats being maintained?	At-risk species are persisting on cliff faces, under ledges, and in cracks and crevices.	No change to the monitoring question. Efforts to reduce encroachment of invasive plants and maintain suitable light environments for these species by managing nearby habitat would be beneficial.
MQ# 21 **Seeps, Springs, 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 seep, spring and cave habitats being maintained?	The continued persistence of Regional Forester's Sensitive Species plants in these rare habitats demonstrates some level of maintenance of ecological value.	No change to the monitoring question. Management tools, including treatment of invasive species, prescribed fire, and removal of small trees and shrubs, are being implemented at these sites to reduce competition. Standards and guidelines within the forest plan allow for continued use of these management tools.

Table 23-Monitoring question recommendations for status of select set of ecological conditions to contribute to recovery of at-risk species (federally listed, regional forester sensitive, species with viability evaluation)

4.5 Status of Visitor Use, Visitor Satisfaction, and Progress Toward Meeting Recreation Objectives

Question 22: Recreation Demand - Are recreational users satisfied with their experience?

Objective:
The objective of this question is to determine if recreational user needs are met, if responsive to future recreation trends, and protective of resources

Methods:
Indicators for this question include NVUM, user satisfaction and RSA

Observations, results, trends:
Visitor-use monitoring was completed in FY2018 and FY2023 as part of a scheduled effort to collect site, use, and other demographic information. Visitors were randomly and voluntarily asked a series of questions pertaining to their current and previous Forest experiences as well as other geographic, economic, and social details. Overall satisfaction was generally high among visitors that the Shawnee National Forest is meeting their outdoor recreation opportunity and expectation standards. Similar monitoring, albeit sporadic with more anecdotal/informal results, was also completed during other years. These efforts typically stemmed from significant Forest projects or other user-driven improvements (ex. trail reroutes, trailhead and/or parking area expansion, restroom upgrades, etc…). See tables and figures below for most recent data and/or visit this link for additional information**:** **https://www.fs.usda.gov/about-agency/nvum**

Conclusions:
The Shawnee National Forest offers a vast array of both developed and dispersed recreational opportunities to the public. Activities such as hiking, hunting, and birdwatching are some of the most popular among visitors. Others seek out RV camping, equestrian, and scenic driving experiences. Regardless of visitor preference, the Shawnee NF strives to provide safe, enjoyable, and functional outdoor recreation opportunities and infrastructure that not only aligns with the Forest Service mission but also meets (or exceeds) the public's satisfaction and/or expectations. It's important for FS staff to continually monitor trend, technology, and maintenance indicators that could negatively impact or enhance a visitor's experience. The Forest Service utilizes several tools including National Visitor Use Monitoring (NVUM), Wilderness Stewardship Monitoring (WSM), and Trail Assessment and Condition Overview Surveys (TACOS, formerly TRACS) to collect data, analyze results, and make decisions to better serve the public's outdoor recreation needs.

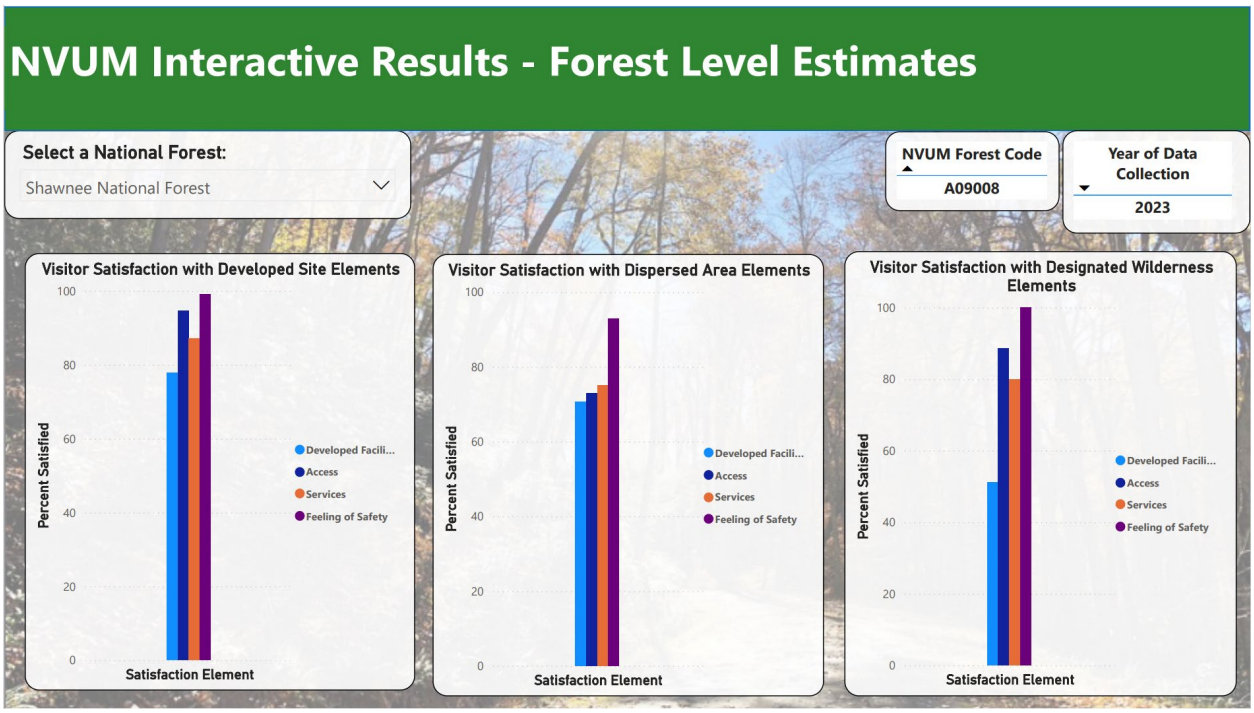


Figure 34-2023 NVUM interactive results for Shawnee. Satisfaction by activity

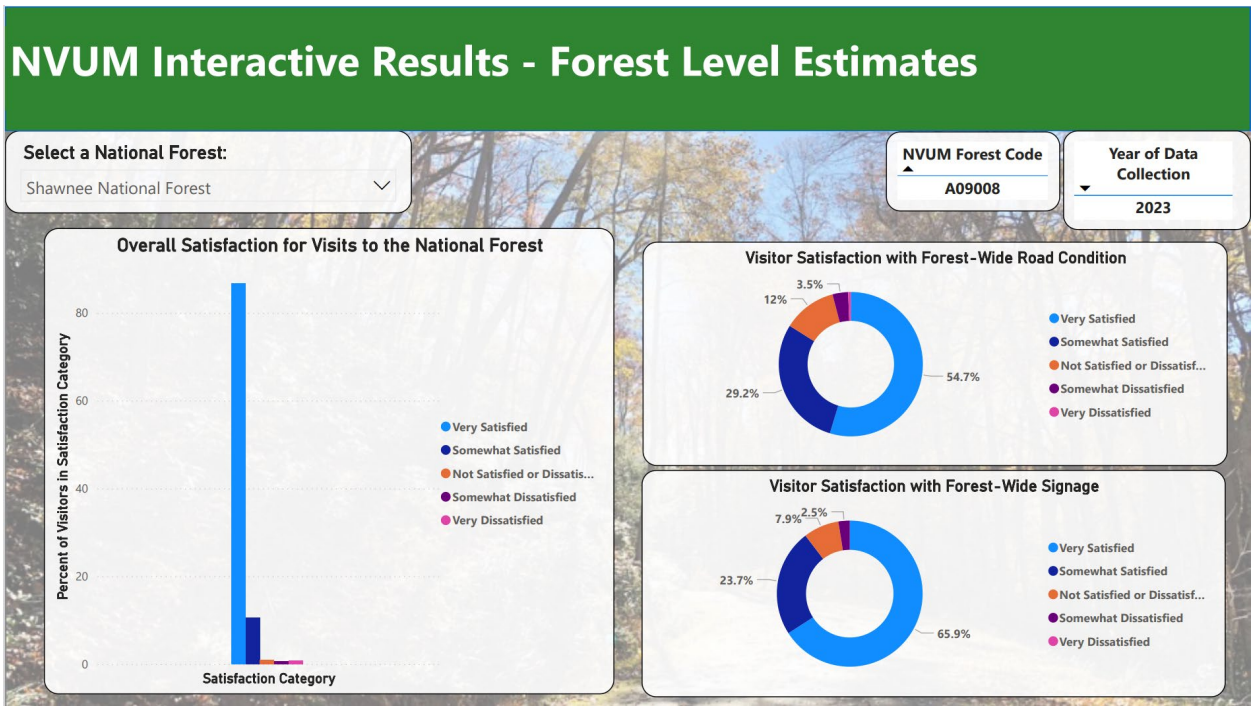


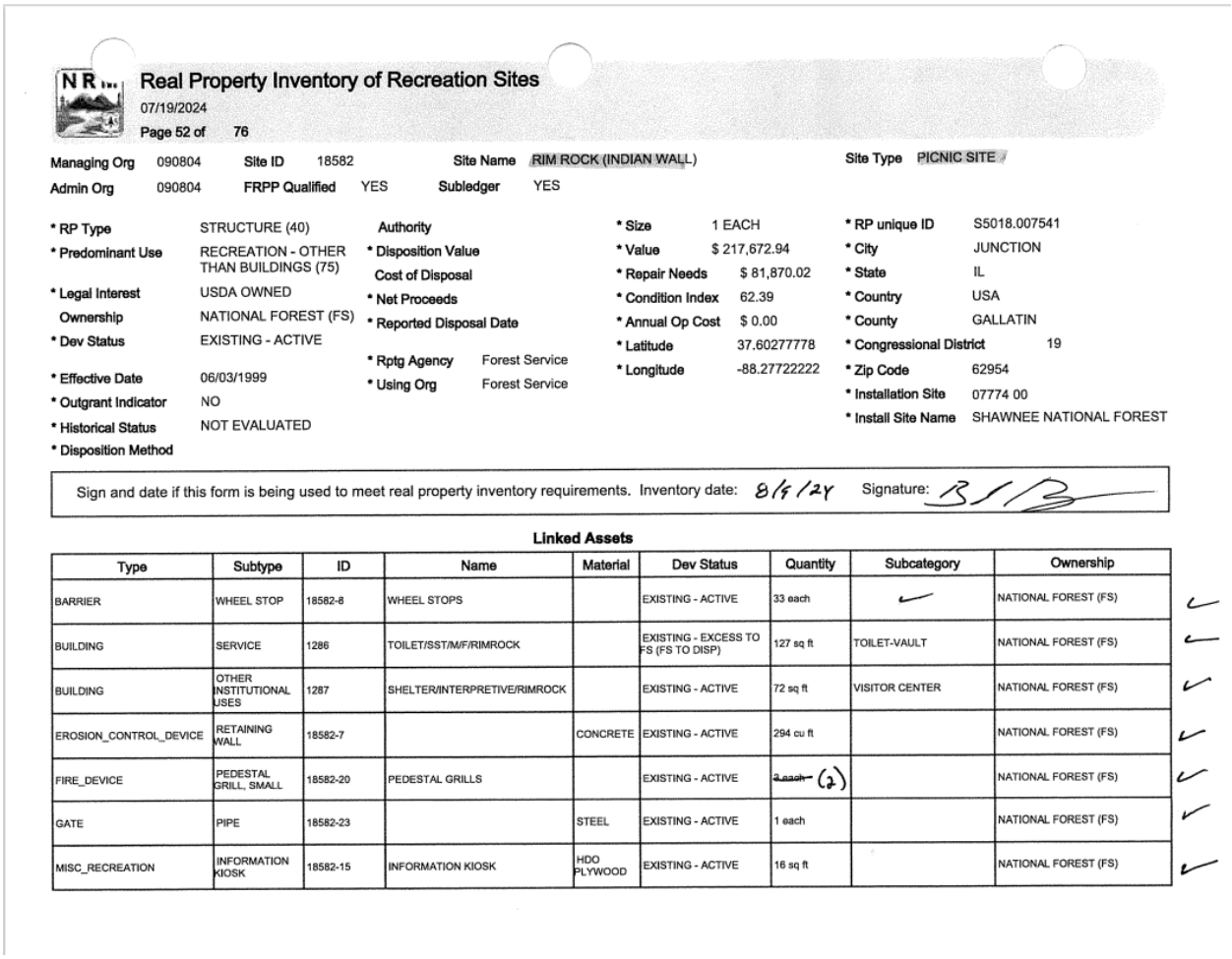
Figure 35-2023 NVUM interactive results for the Shawne. Satisfaction overall

Question 23: Recreation Facility Health and Safety – Are facilities managed to standard?

Objective:
The objective of this question is to determine if recreational facilities (structures, excluding trails) provide adequate health and safety for visitors

Methods:
Indicators for this question include facility surveys, and referencing the deferred maintenance list

Observations, results, trends:
Shawnee National Forest recreation facilities and associated amenities were inspected and maintained to meet public health and safety standards throughout FY2018-FY2023. Facilities and amenities include but are not limited to campsites, potable water sources, sewage treatment infrastructure, grills and tables, access roads, parking areas, restrooms, trash receptacles, and signs. Forest staff conduct both random and scheduled Condition Survey Reports (CSR), Real Property Inventories (RPI), and monthly water samples to identify and document any changes and prioritize maintenance needs. FY2023 was the first year of a 5-year effort to complete RPI's for the Shawnee's 31 total recreation sites (completed example below). The Shawnee NF recreation staff also implemented a shared platform to identify, prioritize, and document seasonal maintenance needs occurring throughout the year.



Real Property Inventory of Recreation Sites

07/19/2024

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Managing Org	090804	Site ID	18582	Site Name	RIM ROCK (INDIAN WALL)	Site Type	PICNIC SITE
Admin Org	090804	FRPP Qualified	YES	Subledger	YES		

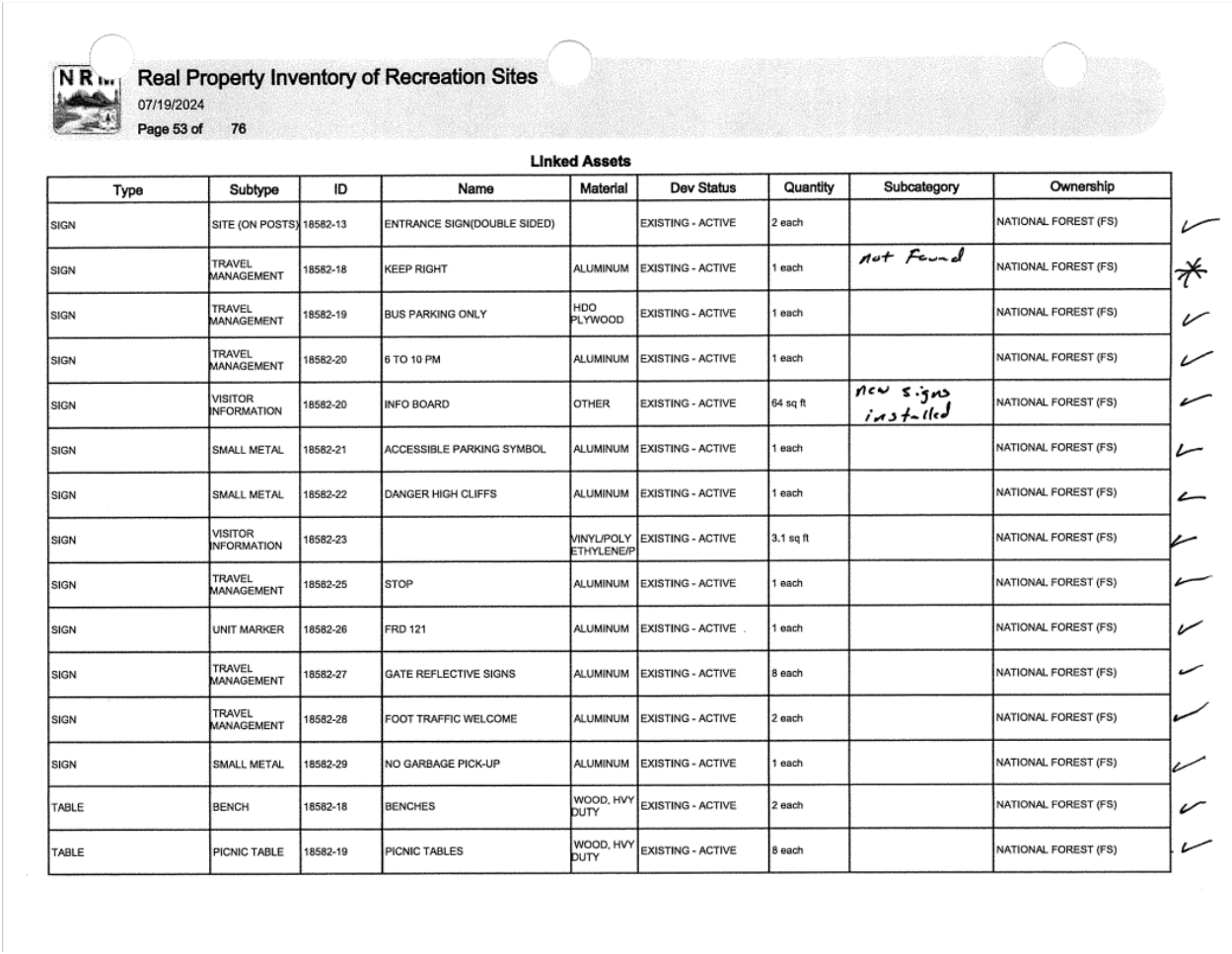
* RP Type	STRUCTURE (40)	Authority		* Size	1 EACH	* RP unique ID	S5018.007541
* Predominant Use	RECREATION - OTHER THAN BUILDINGS (75)	* Disposition Value		* Value	$ 217,672.94	* City	JUNCTION
* Legal Interest	USDA OWNED	Cost of Disposal		* Repair Needs	$ 81,870.02	* State	IL
Ownership	NATIONAL FOREST (FS)	* Net Proceeds		* Condition Index	62.39	* Country	USA
* Dev Status	EXISTING - ACTIVE	* Reported Disposal Date		* Annual Op Cost	$ 0.00	* County	GALLATIN
		* Rptg Agency	Forest Service	* Latitude	37.60277778	* Congressional District	19
* Effective Date	06/03/1999	* Using Org	Forest Service	* Longitude	-88.27722222	* Zip Code	62954
* Outgrant Indicator	NO					* Installation Site	07774 00
* Historical Status	NOT EVALUATED					* Install Site Name	SHAWNEE NATIONAL FOREST
* Disposition Method							

Sign and date if this form is being used to meet real property inventory requirements. Inventory date: 8/5/24 Signature:

Linked Assets

Type	Subtype	ID	Name	Material	Dev Status	Quantity	Subcategory	Ownership
BARRIER	WHEEL STOP	18582-8	WHEEL STOPS		EXISTING - ACTIVE	33 each		NATIONAL FOREST (FS)
BUILDING	SERVICE	1286	TOILET/SST/M/F/RIMROCK		EXISTING - EXCESS TO FS (FS TO DISP)	127 sq ft	TOILET-VAULT	NATIONAL FOREST (FS)
BUILDING	OTHER INSTITUTIONAL USES	1287	SHELTER/INTERPRETIVE/RIMROCK		EXISTING - ACTIVE	72 sq ft	VISITOR CENTER	NATIONAL FOREST (FS)
EROSION_CONTROL_DEVICE	RETAINING WALL	18582-7		CONCRETE	EXISTING - ACTIVE	294 cu ft		NATIONAL FOREST (FS)
FIRE_DEVICE	PEDESTAL GRILL, SMALL	18582-20	PEDESTAL GRILLS		EXISTING - ACTIVE	~~2 each~~ (2)		NATIONAL FOREST (FS)
GATE	PIPE	18582-23		STEEL	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
MISC_RECREATION	INFORMATION KIOSK	18582-15	INFORMATION KIOSK	HDO PLYWOOD	EXISTING - ACTIVE	16 sq ft		NATIONAL FOREST (FS)

Figure 36-Real property inventory of recreation site structures



Real Property Inventory of Recreation Sites
07/19/2024
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Linked Assets

Type	Subtype	ID	Name	Material	Dev Status	Quantity	Subcategory	Ownership
SIGN	SITE (ON POSTS)	18582-13	ENTRANCE SIGN(DOUBLE SIDED)		EXISTING - ACTIVE	2 each		NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-18	KEEP RIGHT	ALUMINUM	EXISTING - ACTIVE	1 each	not found	NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-19	BUS PARKING ONLY	HDO PLYWOOD	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-20	6 TO 10 PM	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	VISITOR INFORMATION	18582-20	INFO BOARD	OTHER	EXISTING - ACTIVE	64 sq ft	new signs installed	NATIONAL FOREST (FS)
SIGN	SMALL METAL	18582-21	ACCESSIBLE PARKING SYMBOL	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	SMALL METAL	18582-22	DANGER HIGH CLIFFS	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	VISITOR INFORMATION	18582-23		VINYL/POLY ETHYLENE/P	EXISTING - ACTIVE	3.1 sq ft		NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-25	STOP	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	UNIT MARKER	18582-26	FRD 121	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-27	GATE REFLECTIVE SIGNS	ALUMINUM	EXISTING - ACTIVE	8 each		NATIONAL FOREST (FS)
SIGN	TRAVEL MANAGEMENT	18582-28	FOOT TRAFFIC WELCOME	ALUMINUM	EXISTING - ACTIVE	2 each		NATIONAL FOREST (FS)
SIGN	SMALL METAL	18582-29	NO GARBAGE PICK-UP	ALUMINUM	EXISTING - ACTIVE	1 each		NATIONAL FOREST (FS)
TABLE	BENCH	18582-18	BENCHES	WOOD, HVY DUTY	EXISTING - ACTIVE	2 each		NATIONAL FOREST (FS)
TABLE	PICNIC TABLE	18582-19	PICNIC TABLES	WOOD, HVY DUTY	EXISTING - ACTIVE	8 each		NATIONAL FOREST (FS)

Figure 37-Real property inventory of recreation site signs

Question 24: Level of Use of Trail Systems – Is usage consistent with planned usage?

Objective:

The objective of this question is to determine if use-level is appropriate to protect resources and manage user encounters

Methods:

Indicators for this question include trail surveys and NVUM

Observations, results, trends:

The trail management program on the Shawnee National Forest encountered various changes between FY2018 and FY2023. Trail maintenance crew staffing, equipment, and funding availability fluctuated. Agency directives and guidance emphasized utilizing more volunteer-based trail maintenance efforts. Local groups proposed new trail opportunities, reroutes, and infrastructure improvements. These and other indicators reflect an increase in trail usage. This also correlates with the most recent NVUM data.

NVUM data from 2013 and 2018 show an upward trend of Forest visitation (2013- 248,000 v/s 2018- 595,000 site visits) with hiking being, by far, the activity most visitors are participating in (71 percent of visitors in 2018 up from 67 percent in 2013). Other authorized trail uses on the Shawnee includes horseback and bicycle. Biking activities are slowly trending upward from 3.3 percent of visitors in 2013 to 3.4 percent in 2018, while horseback has greatly decreased in recent years (2018- 6.8 percent down from 18.4 percent in 2013) according to NVUM data.

In more recent years (2020-2022), the general consensus, based on observations, has been that recreational visitation has noticeably increased through the Covid pandemic, has dropped off since, but has remained higher than years prior. The 2023 NVUM data should provide some information,but a report has yet to be assembled regarding that survey year.

Since April of 2021, the Forest has begun authorizing trails for bicycle use. Lake Glendale trails was the first set of established trails. Lake Kinkaid and Cedar Lake trail systems followed, with mountain bike trail systems being authorized in 2023 and 2024. Mountain bike use seems to continue to trend upward as communities have been building their own bike trails and are working to tie them into the Shawnee NF bike trails.

To identify and address ever-changing trail usage, priority, and maintenance needs, trail program staff utilized a variety of tools. These include developing and implementing a 5-year trail program of work (excerpt below), addressing maintenance items identified through annual Trail Condition Survey reports (accomplishments below) and working directly with local trail advocacy and partner groups to perform significant trail maintenance and/or construction projects (project pics below).

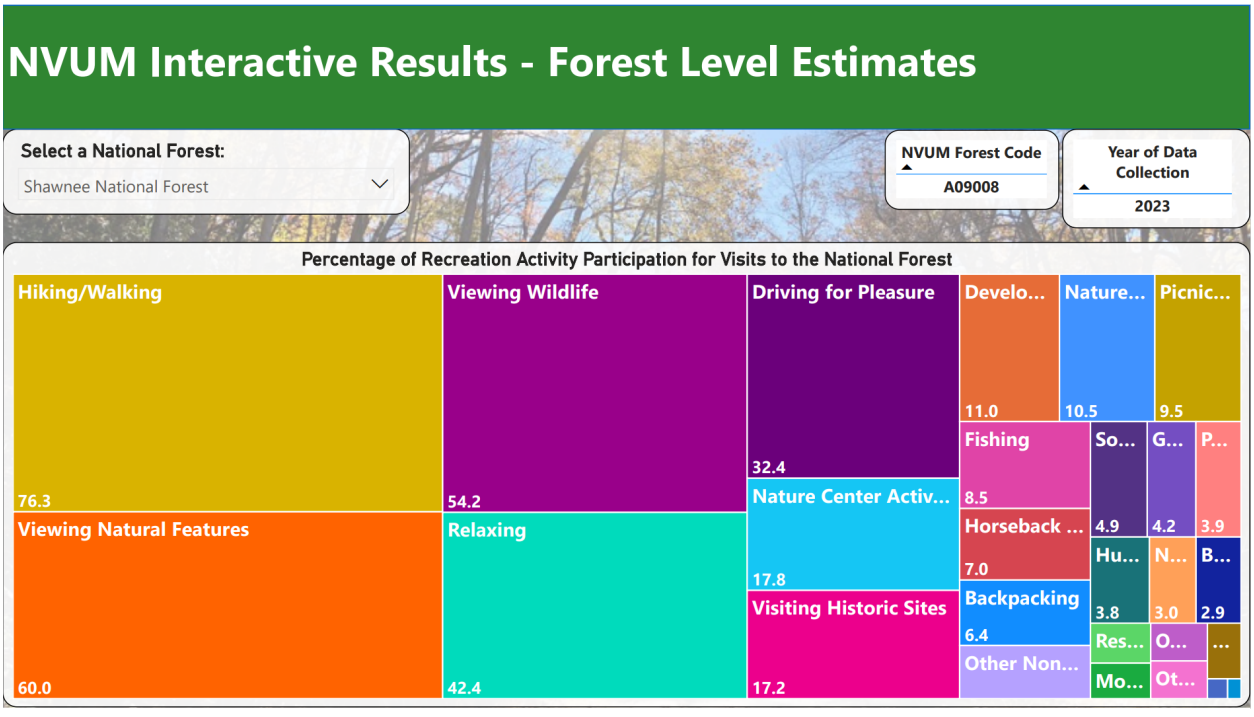

Figure 38-2023 NVUM interactive results for percent recreation activity participation visits to Shawnee

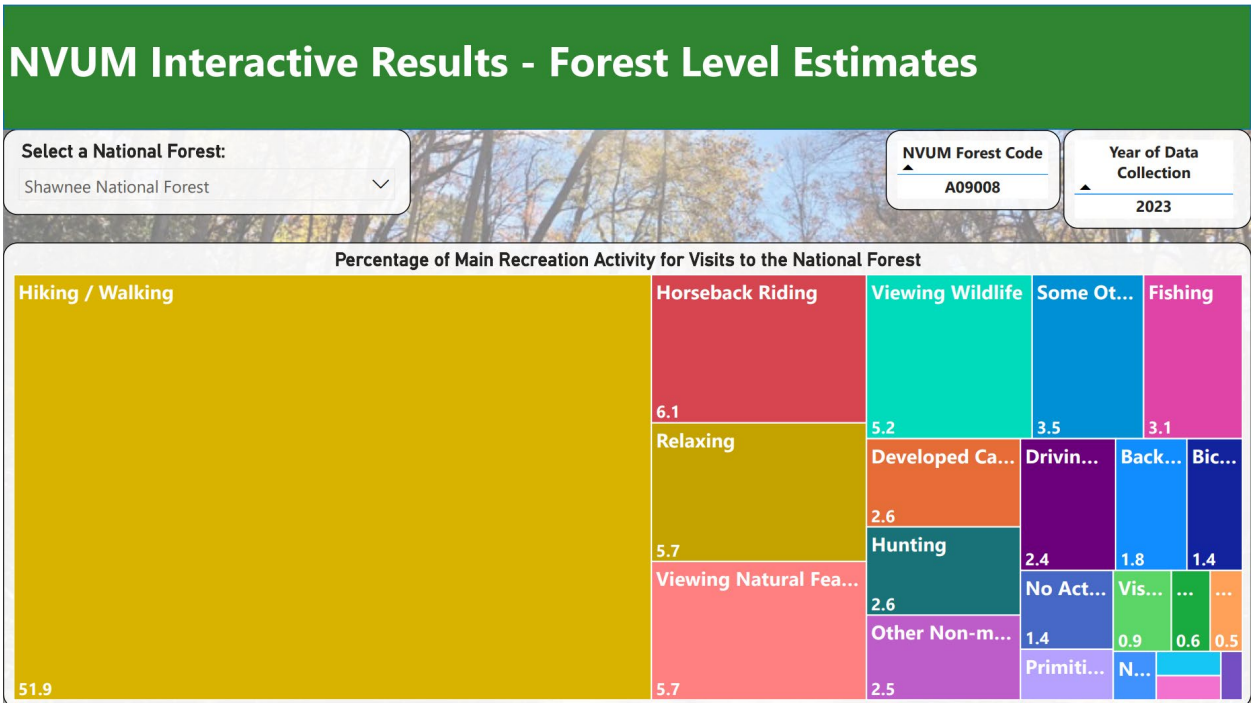

Figure 39-2023 NVUM interactive results for percent of main recreation activity for visits to Shawnee

Shawnee NF Trail Schedule 5 Year Plan						
Fiscal Year	Trail Number	Trail Name	Estimated Mileage		Scope of Work	Notes
2024	0					
eTRACS	TBD	TBD	10		Complete assigned condition surveys during winter months to avoid having to conduct them during the dry	winter work
annual maintenance	431(half trails)	Bell Smith Springs	5		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	Winter hand work, summer trash blasts
annual maintenance	50-64	Lake Glendale Bike Trails	17		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	MTB Partners - primary
annual maintenance	001, 481, 481A, 481B, 487, 457, 457D, 459, 480, 492D, 425, 486,	Lusk Creek	30	Multi-day Hike Map	log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-created trails	Feb-March (use partners and volunteers too)
annual maintenance	440	Millstone Bluff	0.5		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, clean culverts	Winter, Partners and volunteers too
annual maintenance	107	GOG Observation	0.3		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, clean culverts	Winter, Spring
annual maintenance	109, 006 to beach	Rim Rock	3		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	105, 105A	High Knob	1		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	381	Little Grand Canyon	3.6		log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	108G	GOG Indian Point Trail	1.5		tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	384	Pomona Natural Bridge	0.3		tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	236	Inspiration Point	0.8		tread/drainage work where needed, closing user-	Winter, Spring
annual maintenance	264	Lincoln Memorial	0.8		tread work, drainage, clean culverts, etc..	Winter, Spring
annual maintenance	048, 049	Jackson Falls	7		tread/drainage work where needed, closing user-	Winter/Spring, Partners and volunteers too
5-year maintenance	001, 001T, 032, 030, 035	Trigg-Sand Cave Trails	15	Multi-day hike map	tread/drainage work where needed, closing user-created trails	Winter/Spring
4-year maintenance	112	Tower Rock	0.2			
4-year maintenance		Stoneface	1	Stoneface Trail Map	log out, brush, reassurance markers, junctions signs, tread/drainage work where needed, closing user-	Winter/Spring
Reconstruction	TBD	Lake Glendale MTB Trails	1	Bike Trail Map	route around heritage sites as identified in the EA/DN	Reroutes identified in EA
Reconstruction	49	Jackson Falls 049	1		work with climbing, hiking and equestrian partners to identify tie-up locations, move equestrians away from bluff, terrace climbing areas around 'Gallery"	Partners and Trail Crew
Reconstruction	382	Kinkaid Lake Trail	10	Proposed Action Map	$900K to be used to reestablish and reroute lake trail from Krisenberry Dam to J-Creek over a couple of years.	Parrtner and Contractor
Reconstruction	TBD	Various WildernessTrails	2		Volunteer Packing Operations and Hand Crew Work	BCH, Greencorps, trail crew, Americorps, etc..
Reconstruction	1	Dutchman Lake	2	Project Map	Reroute of 001 identified. Some mech work is needed.	Mech Crew
Reconstruction	TBD by above trail maintenance and eTRACS		0		The above annual and other maintenance through the winter and spring should produce our priority listing of trails to return to for reconstruction work (wilderness or mech) during summer and fall months.	

Figure 40-Shawnee 5-Year Trail Maintenance Plan Excerpt

Trail Annual Accomplishments by Managed Use for Fiscal Year 2023

TRAILANNUALACCOMP_MGUSE

Managed Use : HIKER_PEDESTRIAN
Region : 09
Forest : 0908 SHAWNEE NF
District : 090804 HIDDEN SPRINGS RD

Accomplished By	BLI	PAS Initiative	Accomp NFST Maintained	Accomp non-NFST Maintained	Reported NFST Maintained	Reported non-NFST Maintained	Accomp NFST Improved	Accomp non-NFST Improved	Reported NFST Improved	Reported non-NFST Improved	NFST Meeting Standard	non-NFST Meeting Standard	% NFST Meeting Standard
FORCE ACCOUNT	ACAC		0.6853		0.6853								
FORCE ACCOUNT	CMTL		73.5311	0.0225	54.9326	0.0225	0.9614		0.7567				
FORCE ACCOUNT	NONE										3.8654		1.27
FORCE ACCOUNT - FIRE CREW	CMTL		7.6224		2.5488								
VOLUNTEER/PARTNER	PTNR		25.0421		10.7282		0.4094		0.2047				
Totals : District 090804 - HIDDEN SPRINGS RD			106.8809	0.0225	68.8949	0.0225	1.3708		0.9614		3.8654		1.27

HIKER_PEDESTRIAN Managed Use NFST Miles: 303.5195

Totals : Forest 0908 - SHAWNEE NF

HIKER_PEDESTRIAN Managed Use NFST Miles: 405.9542

Figure 41-FY2023 trail accomplishments report (hiker and pedestrian)

Trail Annual Accomplishments by Managed Use for Fiscal Year 2023

TRAILANNUALACCOMP_MGUSE

Managed Use : PACK_SADDLE
Region : 09
Forest : 0908 SHAWNEE NF
District : 090804 HIDDEN SPRINGS RD

Accomplished By	BLI	PAS Initiative	Accomp NFST Maintained	Accomp non-NFST Maintained	Reported NFST Maintained	Reported non-NFST Maintained	Accomp NFST Improved	Accomp non-NFST Improved	Reported NFST Improved	Reported non-NFST Improved	NFST Meeting Standard	non-NFST Meeting Standard	% NFST Meeting Standard
FORCE ACCOUNT	ACAC		0.6853		0.6853								
FORCE ACCOUNT	CMTL		71.8488	0.0225	54.0914	0.0225							
FORCE ACCOUNT	NONE										8.4047	10.5164	2.59
FORCE ACCOUNT - FIRE CREW	CMTL		7.6224		2.5488								
VOLUNTEER/PARTNER	PTNR		23.3598		9.8871								
Totals : District 090804 - HIDDEN SPRINGS RD			103.5163	0.0225	67.2126	0.0225					8.4047	10.5164	2.59

PACK_SADDLE Managed Use NFST Miles: 324.7816

Totals : Forest 0908 - SHAWNEE NF

PACK_SADDLE Managed Use NFST Miles: 421.6516

Figure 42-FY2023 Trail accomplishment report (pack and saddle)

Figure 43-Trail volunteer chainsaw training

Figure 44-Trail tread and drainage feature maintenance

Figure 45-Wilderness trail pack day

Figure 46-YCC installing trail junction sign

Question 25: Wilderness Management – Are wilderness users satisfied with their experience?

Objective:
The objective of this question is to determine if visitor experience needs (primitive recreation, solitude), biophysical requirements, and goals for management presence are being met

Methods:
Indicators for this question come from NVUM, user satisfaction surveys and NNIS Inventories

Observations, results, trends:
NVUM data from 2013 and 2018 show an upward trend of Wilderness site visitation (2013- 32,000 v/s 2018- 91,000 site visits) with hiking being, by far, the activity most visitors are participating in (71 percent of visitors in 2018 up from 67 percent in 2013). The 2023 NVUM preliminary data shows the trend is continuing at even greater pace. The 2023 report has not been published as of yet, but the preliminary data show there was an estimated 134,000 visits to wilderness sites in 2023, up from 91,000 in 2018. Since the COVID pandemic, there has been a noticeable increase in visitation to the Forest and wilderness trail hiking seems to be a popular activity. This increase in visitation implies that users are more comfortable visiting wilderness areas. This could be due to the increase in information provided on social media and easy navigation made available through smartphone maps. Depending on what the visitor is

expecting or seeking, this increase in visitors may or may not reduce user satisfaction with their wilderness experience. Comparing user satisfaction data between 2013 and 2018 NVUM surveys, satisfaction with their wilderness experience has increased in some categories (restroom cleanliness and rec information availability), decreased in other categories (parking lot condition, road condition, developed facilities), and stayed relatively steady in other categories.

Satisfaction Element	Percent Rating Satisfaction as:					Mean Rating§	Mean Importance†	No. Obs‡
	Very Dissatisfied	Somewhat Dissatisfied	Neither Satisfied nor Dissatisfied	Somewhat Satisfied	Very Satisfied			
Restroom Cleanliness	32.8	13.4	14.5	16.7	22.6	2.8	3.3	25
Developed Facilities	0.0	0.0	2.3	24.7	72.9	4.7	4.6	17
Condition of Environment	0.0	0.0	0.0	9.7	90.3	4.9	4.8	64
Employee Helpfulness								4
Interpretive Displays	0.0	8.0	22.0	43.4	26.6	3.9	3.5	41
Parking Availability	0.0	4.8	5.3	11.6	78.2	4.6	4.2	53
Parking Lot Condition	0.0	0.0	6.1	5.6	88.4	4.8	3.7	53
Rec. Info. Availability	0.5	16.1	17.6	32.2	33.5	3.8	4.3	51
Road Condition	0.0	0.0	18.4	9.7	71.9	4.5	3.6	41
Feeling of Satefy	0.0	0.0	7.1	9.0	84.0	4.8	4.4	64
Scenery	0.0	0.0	0.0	4.7	95.3	5.0	4.9	64
Signage Adequacy	0.4	15.7	7.9	24.0	52.1	4.1	4.3	63
Trail Condition	0.4	0.0	0.4	42.8	56.4	4.5	4.3	61
Value for Fee Paid								1

Figure 47-2013 NVUM Data -User Satisfaction of Wilderness Sites

Satisfaction Element	Percent Rating Satisfaction as:					Mean Rating§	Mean Importance†	No. Obs‡
	Very Dissatisfied	Somewhat Dissatisfied	Neither Satisfied nor Dissatisfied	Somewhat Satisfied	Very Satisfied			
Restroom Cleanliness	0.0	15.0	27.5	15.0	42.5	3.8	4.3	10
Developed Facilities	0.0	0.0	0.0	40.7	59.3	4.6	4.3	15
Condition of Environment	0.0	0.3	0.0	14.1	85.6	4.9	4.8	46
Employee Helpfulness							4.4	9
Interpretive Displays	0.0	13.2	8.8	23.2	54.8	4.2	4.0	30
Parking Availability	0.0	0.3	15.2	19.1	65.5	4.5	4.3	42
Parking Lot Condition	0.0	0.0	5.9	25.2	68.9	4.6	3.7	43
Rec. Info. Availability	0.0	11.0	14.1	14.7	60.2	4.2	4.5	39
Road Condition	3.1	0.0	12.9	38.0	46.0	4.2	4.2	40
Feeling of Satefy	0.0	0.0	0.0	9.1	90.9	4.9	4.9	44
Scenery	0.0	0.0	2.8	5.8	91.4	4.9	4.9	46
Signage Adequacy	0.0	6.0	11.7	23.4	59.0	4.4	4.3	45
Trail Condition	0.0	2.9	8.9	37.7	50.5	4.4	4.5	44
Value for Fee Paid								3

Figure 48-2018 NVUM Data -User Satisfaction of Wilderness Sites

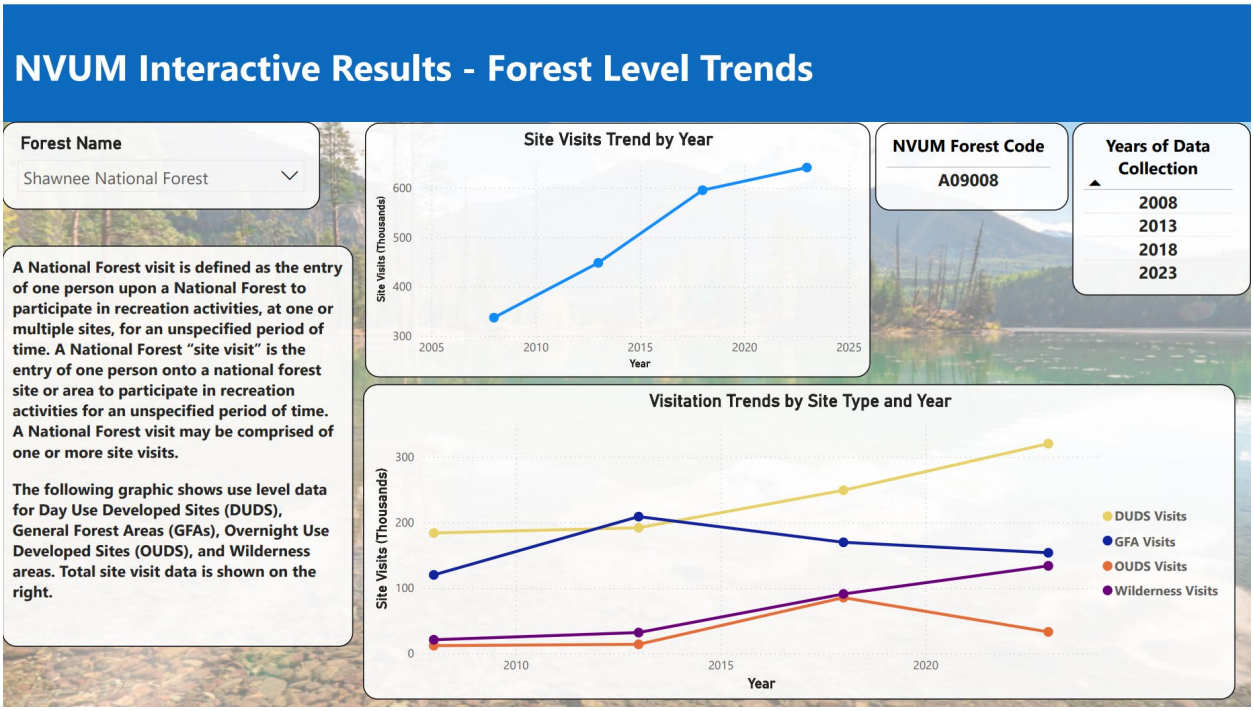

Figure 49-NVUM Interactive results - Forest level results for site visit trends and visitation trends 2008-2023

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#22 Are recreational users satisfied with their experience?	Yes. Recent recreation survey data indicates high user satisfaction.	No changes to this question recommended.
MQ#23 Are facilities managed to standard?	Yes. Recreation facilities and infrastructure continue to be inspected, maintained, and improved to meet visitor health and safety standards.	No changes to this question recommended.
MQ#24 Is (trail) usage consistent with planned usage?	Yes, but we're starting to see and plan for changing use types on some trail systems.	No changes to this question recommended.
MQ#25 Are wilderness users satisfied with their experience?	Yes. Recent wilderness survey data indicates high user satisfaction.	No changes to this question recommended

Table 24-Monitoring question recommendations for status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives

4.6 Measurable Changes in The Plan Area Related to Climate Change and Other Stressors

Question 26: Long-Term Stream Temperature Monitoring – Are Stream Temperatures Changing?

Objective:
The objective of this question is to determine if stream temperatures are changing over time.

Methods
Indicators for this question are measured using stream-temperature survey data
Hobo stream Temperature Monitors – Deployed temperature probes gather information hourly. The first five years of data will provide baseline information.

Observations, Results, Trends
In 2014, we deployed eleven long-term temperature monitors in streams spread across the forest (Table 25). Nearby air temperature monitors were also installed. These record temperature hourly and are periodically checked (once or twice a year) to make sure they are functioning

properly and to download the data. The first 5-10 years of data collection will be used as a baseline to measure long-term change against. Data was not collected in 2020 to 2023. Data is presented from a site on Lusk Creek from September 2014 to July 2018 (Figure 50). The graph shows the daily and seasonal fluctuations. This graph is typical of the type of information being gathered. Once baseline is established, we will compare the stream temperature and air temperature to see if conditions are changing.

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

Table 25-Locations of long-term stream temperature probes

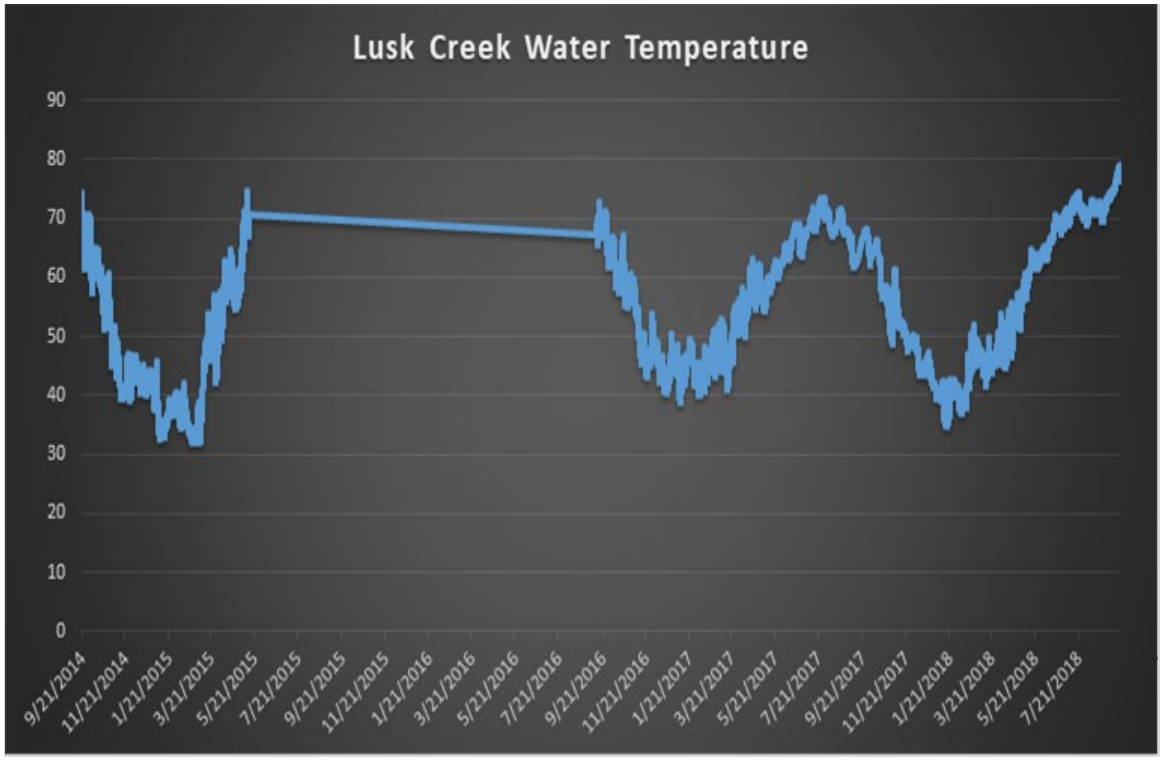

Figure 50-Stream water temperatures on Lusk Creek from 9/21/14 to 7/21/2018. No data was collected where the line is straight due to malfunction with the device or battery.

Monitoring stream temperature is not an easy task. Securing the probes in the turbulent environment of large streams subjected to major flooding is difficult. The outflow from Cedar Creek reservoir can cause water level fluctuations up to 20 feet. We will need several more years to establish baseline data for later comparison.

Conclusion: Long-term monitoring will have value after many years of data are compiled. Establishing baseline temperatures should take at least five to ten years or more.

Recommendation: No changes to the forest plan, management or monitoring are needed.

Question 27: Invasive Species Control - Are we losing biodiversity in our natural areas from invasive species?

Objective:
The objective of this question is to determine if natural areas are being protected from invasive species.

Methods:
Indicators for this question come from survey data collected at natural areas

Observations, results, trends:
Stiltgrass infestations in and surrounding seeps within Massac Tower, Snow Springs, and Kickasola natural areas have been treated with herbicide annually since 2017. Visually, this has led to a stark reduction in stiltgrass cover. Herbicide use (gal/ac) has been lower than 2017 levels in all following years of treatment and treatments have expanded to tackle outlying stiltgrass pockets and corridors by which stiltgrass could spread and re-infest the seeps. Twining screwstem may have been extirpated from one subpopulation within Pope Co pop 2 (Table 22) due to competition with stiltgrass. We have insufficient data to remark on biodiversity of these sites as a whole.

Conclusions:
Though we do not have data to directly assess whether native species are being replaced by invasive species within natural areas, some monitoring results are suggestive. Several acid seep springs are present in natural areas in south Pope County. These seep springs are rare features on the landscape and possess many plants that are state-listed or RFSS. Flora of these springs was surveyed in 1969 by John Schwegman and 2009 by Mark Basinger (citations). No non-native

invasive plants were recorded in the 1969 surveys, but several invasive species have been found since then. The greatest threat comes from stiltgrass (*Microstegium vimineum*), which can rapidly outcompete much of the seep vegetation.

Recommendations:
Recommended change-swap out question:
Are treatments effectively reducing invasive species?

References:
Basinger, Mark A. 2009. Survey of Some Seep Springs in the Cretaceous Hills of Pope and Massac Counties in Southern Illinois. Southern Illinois University Press, Carbondale, IL.

Schwegman, John E. 1969. Vegetation of some seep springs in the cretaceous hills region of southern Illinois. Master's thesis. Southern Illinois University, Carbondale, IL.

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 26 **Long-Term Stream Temperature Monitoring –** Are stream temperatures changing?	Long-term monitoring will have value after many years of data are compiled. Establishing baseline temperatures should be take at least five to ten years or more.	No changes to the forest plan, management or monitoring are needed.
MQ# 27 **Invasive Species Control -** Are we losing biodiversity in our natural areas from invasive species?	Though we do not have data to directly assess whether native species are being replaced by invasive species within natural areas, some monitoring results are suggestive.	Option #4 change question to "Are treatments effectively reducing invasive species?"

Table 26-Monitoring question recommendations for the measurable changes in the plan area related to climate change and other stressors

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

Question 28: Quantitative performance, comparing outputs / services with those projected in the Plan Is the plan being implemented?

Objective:
The objective of this question is to compare anticipated/projected and actual accomplishments

Methods:
Indicators for this question are quantified by calculating the number of acres managed

Observations, results, trends:

Shawnee National Forest: Forest Plan Monitoring (2016-2023)
2018-2019*

Timber Harvest Management Practice/Activity completed <0.01 percent of probable acres in the second decade. Pine Shelterwood treatment accounts for 100 percent of treated acres at 81 acres.

Reforestation Management Practice/Activity completed approximately 0.08 percent of probable acres in the second decade. Timber Stand Improvement work makes up a majority of these treatments at 81 percent of the total Reforestation acres.

Equestrian-Hiking Trail Construction exceeded probable miles in the second decade of construction by 400 percent. (Note: probable miles were 0.)

Wildlife Habitat Maintenance completed 18 percent of probable acres in the second decade. Large openland maintenance was majority of the treated acres at 811 acres.

Prescribed Burning completed 21 percent of probable acres in the second decade. Management practices are distributed evenly over Landscape-scale site prep for oak and Large openland management. Site preparation/brush disposal and Ecological for barrens in Natural Areas make up a lesser majority of acres by practice.

Years 2016-2019 completed roughly 17 percent of total probable units in the second decade.
2016-2021

Timber Harvest Management Practice/Activity completed <0.02 percent of probable acres in the second decade. Pine Shelterwood treatment accounts for 100 percent of treated acres at 258 acres.

Reforestation Management Practice/Activity completed approximately 0.1 percent of probable acres in the second decade. Timber Stand Improvement work was a majority of these treatments

at 73 percent of the total Reforestation acres.

Equestrian-Hiking Trail Construction exceeded probable miles in the second decade of construction by 1500 percent with 15 miles of construction. (Note: probable miles were 0.)

Wildlife Habitat Maintenance completed 49 percent of probable acres in the second decade. Large openland maintenance is majority of the treated acres at 2419 acres.

Prescribed Burning completed 40 percent of probable acres in the second decade. Management practices are distributed evenly over Landscape-scale site prep for oak and Large openland management. Site preparation/brush disposal and Ecological for barrens in Natural Areas make up a lesser majority of acres by practice.

Overall years 2016-2021 completed roughly 32 percent of total probable units in the second decade.
2016-2023

Timber Harvest Management Practice/Activity completed 0.05 percent of probable acres in the second decade. Pine Shelterwood treatment accounts majority of treated acres at 703 acres. Hardwood Shelterwood treatments were completed in 2023 in addition to some Intermediate treatments in years 2022 and 2023.

Reforestation Management Practice/Activity completed approximately 0.1 percent of probable acres in the second decade. Timber Stand Improvement work was a majority of these treatments at 67 percent of the total Reforestation acres.

Equestrian-Hiking Trail Construction exceeded probable miles in the second decade of construction by 2000 percent with 20 miles of construction. (Note: probable miles were 0.)

Wildlife Habitat Maintenance completed 70 percent of probable acres in the second decade. Large openland maintenance is majority of the treated acres at 3554 acres.

Prescribed Burning completed 53 percent of probable acres in the second decade. Management practices are distributed evenly over Landscape-scale site prep for oak and Large openland management. Site preparation/brush disposal and Ecological for barrens in Natural Areas make up a lesser majority of acres by practice.

Overall years 2016-2023 completed roughly 43 percent of total probable units in the second decade.

Question 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?

Objective:
The objective of this question is to determine how Forest management affects species of recreational interest

Methods:
Indicators for this question are determined by monitoring species of recreational interest

Observations, results, trends:
In the United States, wildlife viewing of large mammals accounts for 50 percent of wildlife-watching trips away from home and is participated in by 11.8 million people, of which 75 percent are not hunters or anglers (USFWS and USCB 2018). Almost $76 billion was expended on all types of wildlife watching in 2016 in the USA, and the non-consumptive enjoyment of wildlife dwarfed the $14.8 billion spent related to the consumptive use of big game species (USFWS and USCB 2018). Consumptive use of big game species funds most wildlife conservation. Nearly 8 of 10 hunters hunt deer (Fuller 2016) and hunting license sales provide more than a third of wildlife agency funding (AFWA 2017).

Deer and turkey hunting is among the most important recreational activities on the Shawnee National Forest in southern Illinois. Deer and turkey harvests are regulated by Illinois Department of Natural Resources (IDNR). Deer harvest did not change from 2021 to 2022 in southern Illinois and is still an important economic driver in the region (Figure 51). Turkey harvest remained relatively stable in southern Illinois as well (Figure 52) but there was a significant drop in harvest in Hardin County. Antlered deer harvest and age structure has remained stable throughout Illinois and since 2013 (Figure 53). There are no current metrics on numbers of out-state hunting licenses for southern Illinois nor economic activity during the deer hunting season. However, it is likely that serious economic gains occur in southern Illinois during the deer hunting season and that Shawnee National Forest property is an important driver for gains.

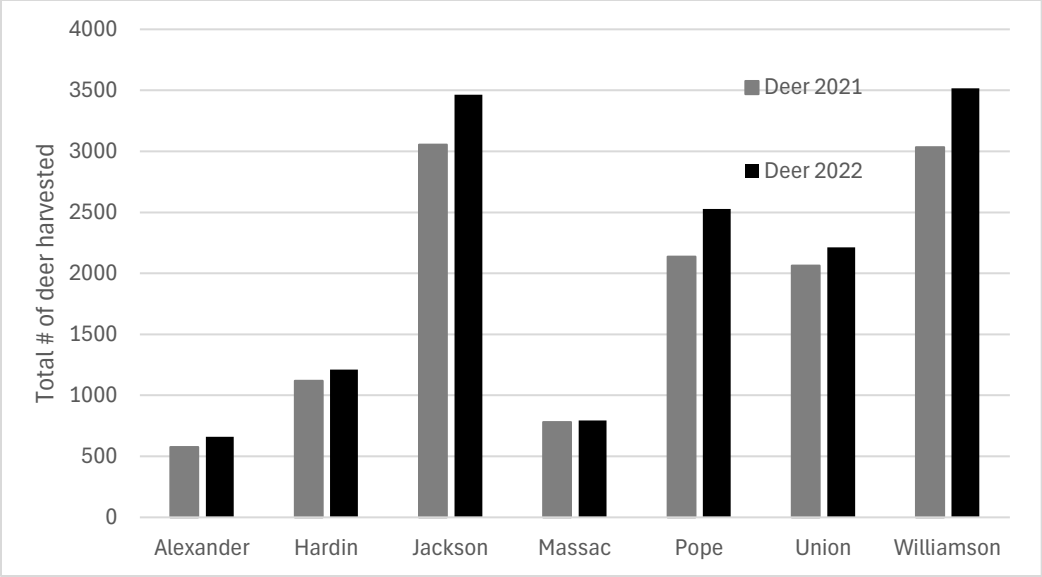

Figure 51-Total number of deer harvested in seven selected southern counties (Alexander, Hardin, Jackson, Massac, Pope, Union, and Williamson) that mostly consist of the Shawnee National Forest, IL.

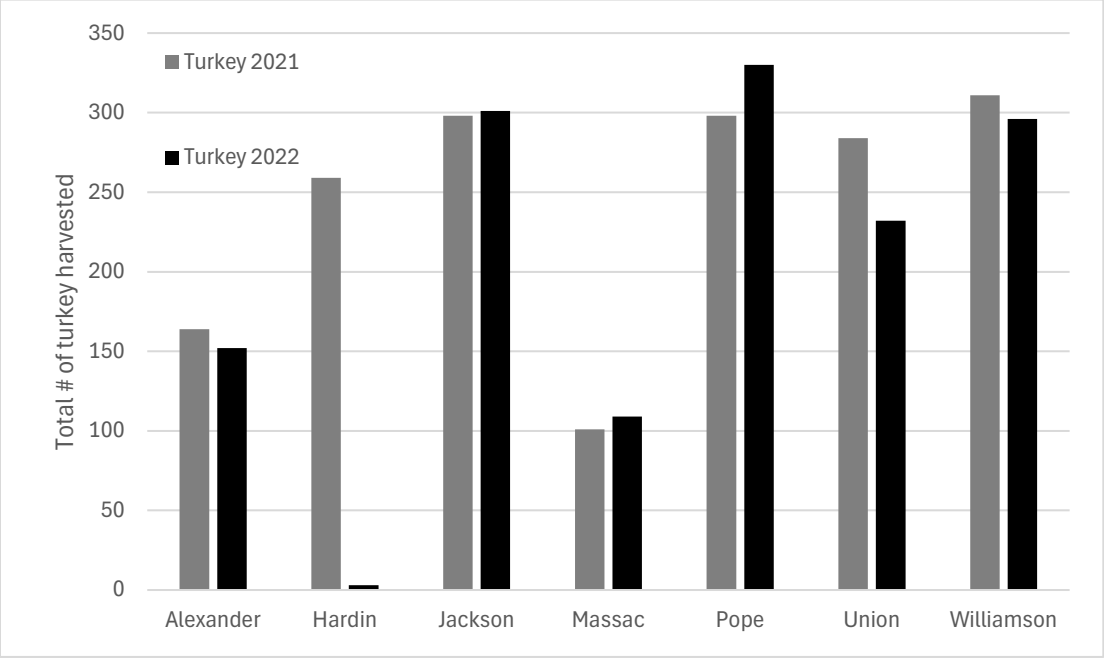

Figure 52-Total number of turkeys harvested in seven selected southern counties (Alexander, Hardin, Jackson, Massac, Pope, Union, and Williamson) that mostly consist of the Shawnee National Forest, IL.

Proportion of antlered deer harvest by number of antler points								
	Number of Points							
	Spike	3-4	5-6	7-8	9-10	11-12	13-14	>14
Archery Season	3.6%	6.5%	9.4%	35.7%	31.0%	9.9%	2.8%	1.2%
All Gun Seasons	5.5%	9.1%	11.9%	38.7%	25.6%	6.9%	1.6%	0.7%
All Seasons	4.7%	7.9%	10.8%	37.4%	27.9%	8.2%	2.1%	0.9%

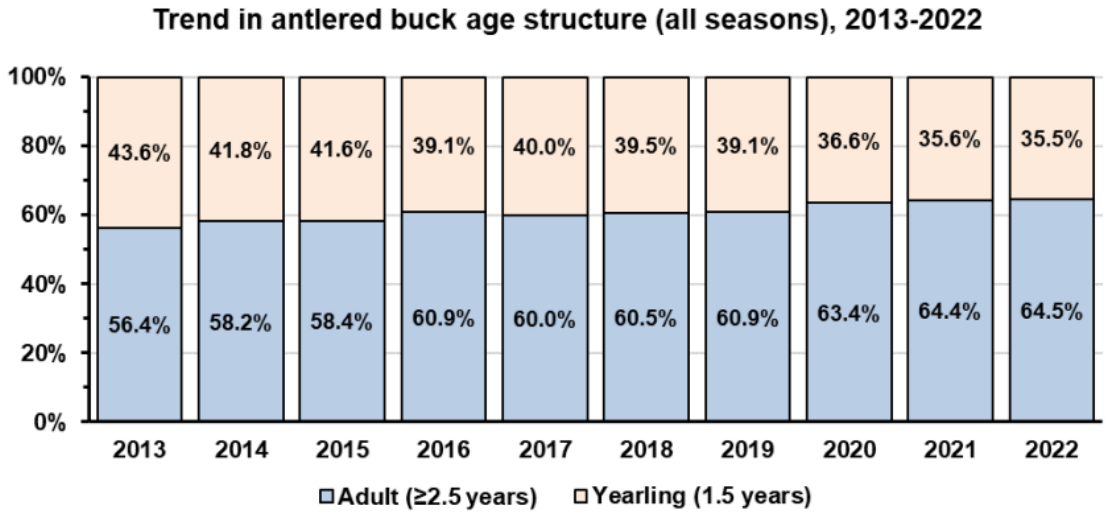

Figure 53-Proportion of antlered deer harvest by number of antler points and trend in antlered buck age structure, 2013-2022. Taken for IDNR 2022-23 harvest report.

Conclusions:

Deer and turkey hunting will remain an important recreational activity in southern Illinois in the future. Many out-of-state hunters come to the region to harvest game and the local economies benefit. However, non-consumptive use of wildlife is also a very important recreational activity in southern Illinois. For example, a total of 1,199 visitors were counted at Snake Road in the fall of 2023 by volunteers, which was only a snapshot or portion of the perceived use of that area.

Recommendations:

Snake watchers and bird-watchers frequent Snake Road every spring and fall and so continuing attention and management of that area is recommended, especially since youth hunter recruitment in the United States is declining.

References:

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Fuller, M. 2016. Deer hunting in the United States: demographics and trends. Addendum to the 2011 national survey of fishing, hunting, and wildlife-associated recreation. Report 2011–10.

U.S. Fish and Wildlife Service, Falls Church, Virginia, USA.

U.S. Fish and Wildlife Service [USFWS] and U.S. Census Bureau [USCB] 2018. 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, Washington, D.C., USA.

Question 30: Heritage Resources: Are heritage resources being protected?

Objective:
The objective of this question is to determine how Forest management affects heritage resources.

Methods:
Indicators for this question are determined by identifying the sites protected

To determine if heritage resources are being adequately protected. Implements Management Goal F: Heritage Resource Management.

1. *Are significant heritage resources (archaeological and historical properties) being identified prior to project decisions through inventories conducted in consultation with the Illinois State Historic Preservation Office (SHPO) according to the National Historic Preservation Act?*
2. *Are heritage resources potentially affected by FS activities being evaluated for significance and potential listing on the National Register of Historic Places?*
3. *Are heritage resources (unevaluated, eligible and listed properties) being protected from earth-disturbing activities?*
4. *Are heritage resources potentially affected by the application of prescribed fire being protected?*

Method: Heritage resources have been monitored both proactively using protocols set forth in Section 110 of the National Historic Preservation Act (NHPA), as well as during standard compliance activities carried out under Section 106 of the NHPA. When necessary, historic properties have been protected using a number of different methods, including direct protection and project modification.

Observations, Results, Trends: Heritage inventories for standard Section 106 compliance were conducted on 458 acres of the Shawnee National Forest (SNF) in 2022. This resulted in the identification of 4 new heritage resources, as well as revisits to 4 previously identified heritage resources. Identification and monitoring of these sites was carried out as part of projects relating to special use permits, recreation enhancement projects, facility improvements, and vegetation management. Consultation with the Illinois State Historic Preservation Office was completed for all projects. In addition, 8 new heritage resources were identified through Section 110 inventories. There were no adverse effects to heritage resources during 2022.

Priority Heritage Assets (PHA) are those heritage resources that have been determined to have distinct public value related to the prehistory and history of the nation. Condition assessments were conducted on 10 Priority Heritage Assets and all were in good condition with no preservation issues or concomitant protection needs. Stewardship activities were carried out on one PHA in order to provide direct protection against existing conditions that could result in potential damage.

Prescribed fire was applied to 13,100 acres containing a total of 210 heritage resources. Post-burn monitoring found no heritage resources were affected during project implementation. There were no incidents of site vandalism in 2022.

Activity	Acres Inventoried	New Sites Recorded	Previously Recorded Sites Monitored	NRHP Listed
106 Inventories	458	4	4	-
110 Inventories	-	8	-	-
PHA Monitoring	-	-	10	-
Rx Fire Inventories	13,100	-	30	-
Vandalism	-	-	-	-
Total	13,558	12	44	-

Table 27-Monitoring activities carried out by the Heritage Program

Conclusions/recommendations: Continue standard Section 106 and 110 inventory and monitoring protocols. Conduct post-burn monitoring on controlled burns (and wildfire situations as needed). Work toward the evaluation of all heritage resources against National Register criteria. Continue to conduct condition assessments on historic properties determined to have Priority Heritage Asset status. Incorporate Section 110 survey into plan of work whenever possible. Work with tribal partners to determine additional categories of historic properties to monitor, such as sacred sites and traditional cultural properties.

Recommendations:

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 28 **Quantitative performance, comparing outputs / services with those projected in the Plan -** Is the plan being implemented?	Yes. Overall years 2016-2023 completed roughly 43 percent of total probable units in the second decade.	No change recommended.
MQ# 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?	Yes. Deer and turkey hunting will remain an important recreational activity in southern Illinois in the future. Snake watchers and bird-watchers frequent Snake Road every spring and fall and so continuing attention and management of that area is recommended	Option #2 alteration to the monitoring plan.
MQ# 30 **Heritage Resources:** Are heritage resources being protected?	Yes. Continue to conduct condition assessments on historic properties determined to have Priority Heritage Asset status.	No changes recommended, continue standard Section 106 and 110 inventory and monitoring protocols

Table 28-Monitoring question recommendations for the progress toward meeting forest plan desired conditions and objectives, including providing multiple-use opportunities

4.8 Effects Of (Timber) Management Systems To Determine They Do Not Substantially and Permanently Impair Productivity Of The Land

Question 31: Timber Harvest Program – Is soil productivity being protected?

Objective:
The objective of this question is to determine if the timber program is accomplishing its' objectives while protecting soil productivity.

Methods:
Indicators for this question are determined with soil surveys

All active sales are routinely checked by a qualified harvest inspector, sale administrator, or Forest Service representative. Erosion control measures, such as water bars or slash pads, are identified by the sale administration team member. The SA then tells the logger where they need to put erosion control measures at and when it needs to be completed. The logger's work is inspected for approval by a sale admin team member. Inspection reports that state the ground operability conditions (dry, wet, frozen, etc.) are included with each sale visit.

Subjective analysis and documented observations of effects of management. Soil survey is used when laying out timber sales. In addition to this information, 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.usda.gov/t-d/pubs/pdf/08191815.pdf

There are many different soil types throughout the forest, each unique and each may react differently to disturbance from heavy machinery. Soil surveys are used to help locate soils best suited for log landings, roads, and the most erodible soils. The following standard is listed in the forest plan: FW25.5 (Standard) Equipment Limitations – Soil-type, land-slope and soil-moisture—content shall be considered in determining equipment-use restrictions.

Year	Total Acres Harvested	Sale	Acres per sale
2018	88	Copperhead Road	88
2019	131	Kinkaid Salvage Sale Agropelter	64 67
2020	291	Kinkaid Salvage Sale Copperhead Road Flumewalker Agropelter Dog Hook	48 65 39 59 80
2021	294	Agropelter Iron Duke Pine Reoffer Crazy Chain Dog Hook King Pin	41 30 95 128 0
2022	358	Crazy Chain King Pin Equalizer Stewardship Reoffer Near Ox Hootenanny Pine	105 98 67 41 47
2023	182	Hootenanny Pine Bullwinkle Parbuckle	17 146 19

Table 29-Active timber sales from 2018-2023

Observations, Results, Trends

Copperhead Road: Pictures and data for soils/water were collected from Purchase Unit 1 at Copperhead Road Timber Sale to prepare this report. Pre- Forest Soils Disturbance Monitoring was done on 5/8/2018, before project activities began and Post-Forest Soils Disturbance Monitoring was done after the commercial timber sale on 9/3/2019 and 9/5/2019, about 1 year after the unit was closed (closed on 8/22/2018).

Field visits during project activities and after project activities have shown the use of best management practices to be implemented and effective. Water bars are located appropriately to slow overland flow and disperse sediment. Bare-soil limitations are in place. Below are pictures of the same locations over 1 year in the project area. Pictures on the left are from 8/27/18. Pictures on the right are from 9/3/2019. Site visits, and the pictures below, reveal that lateral skid trails and much of the surface area in the main skid trails are revegetated after 1 year. Pre- Forest Soils Disturbance Monitoring and Post-Forest Soils Disturbance Monitoring was not completed in 2020 to 2023.

Figure 54-The photos show side by side comparison of a lateral equipment trail. Lateral equipment trails receive less use than the main trails and are expected to have less compaction and revegetate quickly. These photos show the lateral trail right after harvest (left) and revegetated in 1 growing season (right).

Figure 55-The photos show side by side comparison of a main equipment trail. Main equipment trails are expected to have more compaction and revegetate in 1 to 2 growing seasons. The photos show the main trail during harvest (left) and that after 1-year, the main trail has begun to revegetate partially (right).

The Forest Soils Disturbance Monitoring Protocol uses the disturbance classes "as a proxy to determine whether observed soil disturbances could be considered detrimental to soil productivity or hydrologic function. Ideally, validation of vegetative response or changes in hydrologic function will occur for various soil types, logging practices, and forest types" (Page-Dumroese, 2009). After a soil disturbance class is determined at each sample point within an activity area, the information can be used to understand what the detrimental soil disturbance could mean for long-term productivity.

Parameter Measured	Pre-data	Post-data	
Average forest floor depth	2 cm	1 cm	The forest floor protects the topsoil and provides organic matter and leaf litter.
Forest floor Impacted?	0%	31%	
Live Plant?	70%	90%	Cover on the forest-floor displays erosion potential and nutrient cycling. No concern here because high percentages of plant material. Invasive plants were not sampled in pre-data but were likely similar to post-data levels.
Invasive Plant?	N/A	47%	
Fine Woody? <7 cm	60%	77%	
Coarse Woody? >7cm	0%	13%	
Rock?	0%	3%	
Bare Soil?	0%	3%	This rating describes bare soil, which is susceptible to rain drop erosion.
Topsoil displacement?	0%	20%	Topsoil tends to have higher infiltration rates, be more fertile, and erode less than subsoil. Less displacement and erosion would be better
Erosion?	3%	7%	
Mixed topsoil/subsoil	0%	17%	
Rutting? <5cm	0%	0%	Compacted ruts can channel water downslope and slow regeneration. Minimal rutting translates to minimal concern.
Rutting? 5-10cm	0%	0%	
Rutting? >10cm	0%	0%	
Burning light	N/A	N/A	Helps determine if increased erosion or amount of remaining forest-floor nutrients are a concern. We have not burned at this location yet.
Burning moderate	N/A	N/A	
Burning severe	N/A	N/A	
Compaction? 0-10 cm	0%	27%	Compaction reduces pore space in soils and therefore infiltration, biologic activity, and plant root growth. Less compaction is desired.
Compaction? 10-30 cm	0%	17%	
Compaction? >30cm	0%	0%	
Platy/Massive/Puddled structure 0-10 cm	0%	20%	Shows if soil structure is changed and tells if porosity is decreased. Less platy/massive/puddled soils are desired.
Platy/Massive/Puddled structure 10-30 cm	0%	13%	
Platy/Massive/Puddled structure >30 cm	0%	0%	
Estimated Disturbance 0 = Undisturbed 1 = Light disturbance	Proportion 0: 100%	Proportion 0: 81%	Disturbance was evident post-harvest as expected. Soil compaction is expected to decrease

2 = Medium disturbance 3 = Heavy disturbance	Proportion 1: 0% Proportion 2: 0% Proportion 3: 0%	Proportion 1: 12% Proportion 2: 7% Proportion 3: 0%	over time. Further monitoring of the sites will determine if the disturbance will affect long-term site sustainability.
Detrimental Soil Disturbance	0%	0%	

Table 30-Forest Soils Disturbance Monitoring Results for Copperhead Road Sale

**N = 30. The sample size has a Confidence Level of 70.*

Figure 56 shows a sample location on a main equipment trail. A hole was dug about 8 inches deep, where increased bulk density and roots made it difficult to continue digging. The darker soils towards the top of the soil profile have taken on a platy structure, and below that the soils are massive, or structureless, due to compaction. Over time, compaction is expected to decrease. Existing plant and tree roots will decompose, soil biota and frost will aid in decompaction, as well as new roots as the area revegetates.

Figure 56-Soil sample point on a main equipment trail.

The Forest Soils Disturbance Monitoring Protocol manual says if the areal extent of these features is over the regional limit for detrimental disturbance, additional monitoring may or may

not be needed (Page-Dumroese at al., 2009). Though no detrimental disturbance was recorded, additional monitoring on the effects of harvests on vegetative growth, soil compaction over time, erosion and runoff, and other parameters listed would be beneficial to understand the impacts to productivity and health of the Shawnee National Forest.

Agropelter: Monitoring of the forwarder trail along the intermittent stream in Agropelter payment unit 7 revealed that best management practices were followed during harvest operations (Figure 57). Only three of the plots would have fallen within the recommended IL SMZ zone. No trees were cut on streambanks. Basal area at all plots was well above the 50-60 ft^2 minimum with an average of 102 ft^2. Bare soil was calculated on average to be 4,356 ft^2 and within the allowable 12,650 ft^2. The trail would need to be 17ft wide and all soil exposed within the trail to exceed the bare soil threshold. The trail never crosses the stream by design and only runs parallel. No sedimentation was noticeable during monitoring and revegetation is starting to occur. It should be noted that final blading, seeding, slashing, and water bar installation for payment unit 7 has not been completed.

Figure 57-Forwarder trail at Purchase Unit 7 of Agropelter sale

Conclusion: Monitoring of timber sales showed that the best management practices for erosion control were followed, though a clearer direction for soil-moisture content and equipment-limitation operability would be beneficial. Soil productivity is mostly being protected during project implementation and more monitoring will show the recovery over time.

Recommendation: A clearer direction on limiting equipment based on soil-moisture content would be beneficial. Collect Forest Service Disturbance Monitoring Protocol (FSDMP) data to build a richer database for understanding soil impacts. More monitoring is needed over time to see how quickly disturbed areas uncompact and productivity is restored to support plant growth. Monitoring soils in the Timber-program is redundant with other questions. This data should be addressed under watershed conditions.

References

Duiker, S. W. (2002). Diagnosing soil compaction using a penetrometer (soil compaction tester). *Agronomy facts*, *63*(4).

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

Recommendations

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 31 **Timber Harvest Program –** Is soil productivity being protected?	Yes. Monitoring of timber sales showed that the best management practices for erosion control were followed, though a clearer direction for soil-moisture content and equipment-limitation operability would be beneficial.	Option #2. Monitoring soils in the Timber-program is redundant with other questions. This data should be addressed under watershed conditions.

Table 31-Monitoring questions recommendations for effects of (timber) management systems to determine they do not substantially and permanently impair productivity of the land

5.0 Summary of Results and Recommendations

Shawnee National Forest monitoring questions and evaluation addressed in this report. Possible types of recommendations include changes to the land management plan or monitoring plan, changes in management activities, or recommendations for a new focused assessment.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#1 **Public Water-Supply Reservoir** Is upstream agricultural runoff being mitigated? Is water quality being maintained. Improved?	Yes. Monitoring in water-supply watersheds showed that the best management practices and standard/guidelines were followed during erosion project implementation.	No changes to the forest plan, management activities or monitoring are needed. Continue to work on BMPs in timber sales to identify adaptive practices if needed.
MQ#2 **Water Quality** – Is water quality being maintained/improved?	Yes. Monitoring showed that best management practices and standards/guidelines were properly implemented and were effective at minimizing construction impacts from installation of the habitat, erosion stabilization and water control structures.	No changes to the forest plan, management activities or monitoring are needed. Installing more erosion control at stream crossings (e.g. silt fences, berms, slashing or hardening at the crossings, etc.) would help reduce sedimentation in the short-term.
MQ#3 **Water Quantity** – How many miles/acres of stream-channel or watershed have been improved? Water flow un-impeded?	Yes. Stream channel and watershed work has improved instream conditions and reduce streambank erosion thus improving water flow. Wetland restoration also improved the watersheds and water flow. These projects are moving these areas toward the desired condition.	No changes to the forest plan or management activity are needed. The monitoring question should be revised or combined with other questions. This question looks at water quantity, which is not a concern in southern Illinois and is not discussed in the forest plan. The answer is repetitive and is very similar to the answer above (Water Quality Item #2).
MQ#4 **Aquatic Biota** - What is the species distribution in sampled streams, ponds, lakes?	Yes. Volunteers can play a long-term integral role in monitoring the snake populations at Snake Rd temporally and spatially but also protect populations from potential threats.	Option 4 use specific locations from IL EPA in certain creeks on federal property every time this question is needed to be answered so that biologists through and across time answer the question in a similar fashion that is comparable to the past.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#5 **Riparian/wetland vegetation** - Is native vegetation maintaining dominance near waterbodies, streams or wetlands?	This question was not answered during FY18-FY23 monitoring cycles	NA
MQ#6 **Travelways** - Are travelways located and maintained to prevent erosion?	Yes, but budget limitations have resulted in decreasing road maintenance mileage to the point that less than one-third of the active Shawnee NF road system is receiving regular road maintenance, and the trend is toward decreasing funding which will further reduce our ability to maintain the road system.	No changes to the forest plan, management activities or monitoring are needed.
MQ#7 **Soils** – Is soil protected during management, recreation activities?	Yes. The forest is properly implementing best management practices to mitigate erosion	Option #4 Other soil properties that influence soil quality and the productivity of the forest should be considered (e.g. compaction). The forest plan has a standard on equipment limitations, but a clear standard is not defined. Soil moisture criteria should be developed to better guide when soil is too moist that equipment operation can cause detrimental impacts to the soil.
MQ#8 **Aquatic Habitat Quality** – What is the species distribution in sampled streams, ponds and lakes?	Yes, but more research is needed on water quality of creeks and water features on the Shawnee National Forest. The fragmented and intertwined nature of the forest with private lands, which many parcels are active agricultural businesses, makes pesticide contamination a real concern.	Option #4 use specific locations from IL EPA in certain creeks on federal property every time this question is needed to be answered so that biologists through and across time answer the question in a similar fashion that is comparable to the past.
MQ#9 **Mississippi River Bottomland Hydrologic Regime** – How many acres have improved wetland characteristics?	Yes. Flooding compartments in Oakwood Bottoms will continue but may become reduced in the future as another project may begin implementation.	Option #2 and #4. Assess overwintering bat populations and bird populations as a proxy to monitor habitat condition.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#10 **Natural Areas' Unique Features** - Are natural area characteristics being conserved?	Yes. More management in the natural areas is recommended to move the forest to desired conditions.	No changes to the monitoring question or indicators are recommended.
MQ#11 **Fire Adapted communities -** How many acres are under burning prescriptions? Are fire-adapted communities being conserved?	Yes. Prescribed burning has moved the Forest closer to desired conditions, but to meet forest plan objectives, an increase in burn acreage is needed.	No changes to the monitoring question or indicators are recommended.
MQ#12 **Question 12: Species Richness -** Based on monitoring results, is biodiversity is being protected by forest plan Standards and guidelines?	Yes. Species richness is increasing on the Shawnee National Forest due to management at sites in Hardin and Pope counties.	No changes to the monitoring question or indicators are recommended.
MQ#13 **Pileated woodpecker, Red-headed woodpecker, Prothonotary warbler –** What are the population trends for these species?	Yes, Bird survey efforts are focused on future or completed silviculture projects and mostly upland habitats, the status of their population is currently unknown. However, we expect little changes to their habitats from management since wetlands, riparian areas, floodplains, and other wet margins will not be an important part of the timber base and in the implementation of silvicultural projects.	Options #2 and #4. Biologists here should be conducting bird surveys annually to answer this question. And the answer can be derived from our bird survey database. A question should be addressed for the cerulean warbler. We have a specific management area designated for them and swainson's warblers.
MQ# 14 **Barrens, Glades and Prairies -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of barren, glade and prairie habitats being maintained?	For species that have been repeatedly monitored, populations appear relatively stable. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, thinning, and designated trail usage) that benefit barrens, glades, and prairie habitats.	No change to the monitoring question. Care should be taken to maintain these typically open habitats through regular disturbance that favors herbaceous communities and disfavors woody plants.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 15 **Upland and Oak-Hickory 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 upland and oak-hickory forest habitats being maintained?	All 8 at-risk species within this community type (upland and oak-hickory forest) are still present on the Shawnee NF, suggesting that rare species are being retained.	No change to the monitoring question. Upland and oak-hickory forest communities as a whole are typically benefited by prescribed fire like the at-risk species discussed above, chestnut oak and buffalo clover. Standards and guidelines within the forest plan encourage maintenance of oak-hickory forest and regeneration, thus continued activities in this vein should assist in the continued persistence of at-risk plant species within this community type.
MQ# 16 **Dry-Mesic and Mesic Hardwood Forests -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of dry-mesic and mesic hardwood forest habitats being maintained?	Limited conclusions can be drawn, particularly from species that are only known from a few locations or from populations that haven't been monitored repeatedly overtime.	No change to the monitoring question. Mesic forest habitat is likely to persist with or without active management due to mesophication, whereas dry-mesic habitat may shrink and transition to more mesic forest without management activities. Standards and guidelines within the forest plan allow for use of management tools (such as fire, selective tree and shrub removal, and timber harvest) that could maintain dry-mesic forest.
MQ# 17 **Wetlands, Swamps, Forested Wetlands, Floodplain Forests, 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?	Of the 25 Regional Forester's Sensitive Species plants that occur in wetlands, swamps, forested wetlands, floodplain forests, and caves, 24 were monitored and still found to be present on the landscape between 2018 and 2023 suggesting that some ecological value of these habitats is being maintained.	No change to the monitoring question.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 18 **Streams -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of stream habitats being maintained?	The ongoing siltation of streams where heartleaf plantain occurs suggests that high quality, clear-flowing, rocky stream habitat is degrading.	No change to the monitoring question.
MQ# 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?	Management through prescribed fire will continue but the use of a masticator will help ensure a mosaic of early successional habitats in our openlands.	Option #3. Most of the focus on our openlands will be on Pennant Bar, Rothamel, and White Tract due to their importance to the public and proximity to active silviculture projects.
MQ# 20 **Cliffs -** Based on at-risk species monitoring are the standards and guideline adequate to protect these habitat features on the landscape? Is the ecological value of cliff habitats being maintained?	At-risk species are persisting on cliff faces, under ledges, and in cracks and crevices.	No change to the monitoring question. Efforts to reduce encroachment of invasive plants and maintain suitable light environments for these species by managing nearby habitat would be beneficial.
MQ# 21 **Seeps, Springs, 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 seep, spring and cave habitats being maintained?	The continued persistence of Regional Forester's Sensitive Species plants in these rare habitats demonstrates some level of maintenance of ecological value.	No change to the monitoring question. Management tools, including treatment of invasive species, prescribed fire, and removal of small trees and shrubs, are being implemented at these sites to reduce competition. Standards and guidelines within the forest plan allow for continued use of these management tools.
MQ#22 Are recreational users satisfied with their experience?	Yes. Recent recreation survey data indicates high user satisfaction.	No changes to this question recommended.
MQ#23 Are facilities managed to standard?	Yes. Recreation facilities and infrastructure continue to be inspected, maintained, and improved to meet visitor health and safety standards.	No changes to this question recommended.
MQ#24 Is (trail) usage consistent with planned usage?	Yes, but we're starting to see and plan for changing use types on some trail systems.	No changes to this question recommended.

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ#25 Are wilderness users satisfied with their experience?	Yes. Recent wilderness survey data indicates high user satisfaction.	No changes to this question recommended
MQ# 26 **Long-Term Stream Temperature Monitoring –** Are stream temperatures changing?	Long-term monitoring will have value after many years of data are compiled. Establishing baseline temperatures should be take at least five to ten years or more.	No changes to the forest plan, management or monitoring are needed.
MQ# 27 **Invasive Species Control -** Are we losing biodiversity in our natural areas from invasive species?	Though we do not have data to directly assess whether native species are being replaced by invasive species within natural areas, some monitoring results are suggestive.	Option #4 change question to "Are treatments effectively reducing invasive species?"
MQ# 28 **Quantitative performance, comparing outputs / services with those projected in the Plan -** Is the plan being implemented?	Yes. Overall years 2016-2023 completed roughly 43 percent of total probable units in the second decade.	No change recommended.
MQ# 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?	Yes. Deer and turkey hunting will remain an important recreational activity in southern Illinois in the future. Snake watchers and bird-watchers frequent Snake Road every spring and fall and so continuing attention and management of that area is recommended	Option #2 alteration to the monitoring plan to focus on species more specified to the forest.
MQ# 30 **Heritage Resources:** Are heritage resources being protected?	Yes. Continue to conduct condition assessments on historic properties determined to have Priority Heritage Asset status.	No changes recommended, continue standard Section 106 and 110 inventory and monitoring protocols

Monitoring question (MQ)	Progress Toward Land Management Plan Desired Conditions and Objectives	Recommended Actions/Next Steps
MQ# 31 **Timber Harvest Program** – Is soil productivity being protected?	Yes. Monitoring of timber sales showed that the best management practices for erosion control were followed, though a clearer direction for soil-moisture content and equipment-limitation operability is needed.	Option #2 and #4. Monitoring soils in the Timber-program is redundant with other questions. This data should be addressed under watershed conditions.

Table 32-Monitoring questions, results, and recommendations

6.0 Appendix

Appendix 1: Listed Streams and Lakes in the Shawnee National Forest's Proclamation Boundary on IL EPAs 303(d) List for Impaired Waters

Support Code	Use Support Level
F	Fully Supporting
N	Not Supporting
I	Insufficient Information
X	Not Assessed
Use ID	**Use Description**
582	Aquatic Life
583	Fish Consumption
584	Public and Food Processing Water Supplies
585	Primary Contact
586	Secondary Contact
587	Indigenous Aquatic Life
590	Aesthetic Quality

Name	Use Attainment	Causes	Sources
BAY CREEK	F582, X583, X585, X590	N/A	N/A
BAY CREEK DITCH	F582, X583, X585, F590	N/A	N/A
BAY CREEK LAKE NUMBER 5	F582, X583, X585, N590	Total Suspended Solids (TSS), Phosphorus (Total)	Runoff from Forest/Grassland/Parkland
BIG MUDDY RIVER	N582, N583, X585, F590	Oxygen, Dissolved, Total Suspended Solids (TSS), Phosphorus (Total), Mercury	Source Unknown, Crop Production (Crop Land or Dry Land), Natural Sources, Atmospheric Deposition - Toxics

Support Code		Use Support Level	
BRADSHAW CREEK	N582, X583, X585, X590	Alteration in stream-side or littoral vegetative covers, Loss of Instream Cover	Channelization
BRIER CREEK	N582, X583, X585, X590	Iron, Manganese, Oxygen, Dissolved, Sulfates, Total Suspended Solids (TSS)	Acid Mine Drainage, Surface Mining, Source Unknown
CACHE RIVER	F582, N583, F590	Mercury	Source Unknown
CAVE CREEK	N582, X583, X585, X590	Oxygen, Dissolved	Source Unknown
CEDAR (JACKSON)	F582, N583, F584, X585, F590	Mercury	Atmospheric Deposition - Toxics, Source Unknown
CEDAR CREEK	N582, X583, X585, F590	pH	Other Recreational Pollution Sources
CEDAR CREEK	N582, X583, F585, F590	Fish-Passage Barrier, Low flow alterations, Other flow regime alterations, Oxygen, Dissolved, Sedimentation/Siltation, Total Suspended Solids (TSS)	Dam or Impoundment, Impacts from Hydrostructure Flow, Loss of Riparian Habitat
CLEAR CREEK	N582, N583, X585, F590	Alteration in stream-side or littoral vegetative covers, Alterations in wetland habitats, Oxygen, Dissolved, Changes in Stream Depth and Velocity Patterns, Mercury	Channelization, Drainage/Filling/Loss of Wetlands, Habitat Modification - other than, 4, Source Unknown, Irrigated Crop Production, Agriculture
CYPRESS DITCH	N582, X583, X585, F590	Alteration in stream-side or littoral vegetative covers, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover	Channelization, Loss of Riparian Habitat, Crop Production (Crop Land or Dry Land), Agriculture
DEVILS KITCHEN	F582, N583, X585, F590	Mercury	Atmospheric Deposition - Toxics, Source Unknown
DUTCH CREEK	F582, X583, X585, F590	N/A	N/A
DUTCHMAN	F582, X583, X585, N590	Total Suspended Solids (TSS), Phosphorus (Total), Aquatic Algae	Runoff from Forest/Grassland/Parkland
EAGLE CREEK	N582, X583, X585, X590	Manganese, Oxygen, Dissolved, Sulfates	Surface Mining, Source Unknown
EAGLE CREEK	N582, X583, X585, F590	Alteration in stream-side or littoral vegetative covers, Loss of Instream Cover	Acid Mine Drainage, Surface Mining, Crop Production (Crop Land or Dry Land), Agriculture, Channelization, Streambank Modifications/destabilization, Habitat Modification - other than
EAGLE CREEK	N582, X583, X585, X590	Manganese, Oxygen, Dissolved, Sulfates	Surface Mining, Source Unknown

Support Code		Use Support Level	
EAST PALZO CREEK	N582, X583, X585, X590	Copper, Iron, Manganese, pH	Acid Mine Drainage, Surface Mining
HERRIN NEW	F582, X583, X585, F590	N/A	N/A
KINKAID	F582, N583, F584, X585, F590	Mercury	Atmospheric Deposition - Toxics, Source Unknown
LAKE OF EGYPT	F582, N583, F584, X585, F590	Mercury, Polychlorinated biphenyls	Atmospheric Deposition - Toxics, Source Unknown
LITTLE CEDAR	F582, X583, X585, N590	Total Suspended Solids (TSS), Phosphorus (Total), Aquatic Algae	Littoral/shore Area Modifications (Non-riverine), Runoff from Forest/Grassland/Parkland
MISSISSIPPI RIVER	274, 348, 400	Mercury, Polychlorinated biphenyls, Fecal Coliform	Atmospheric Deposition - Toxics, Source Unknown
NEW COLUMBIA DITCH	N582, X583, X585, F590	Alteration in stream-side or littoral vegetative covers, Alterations in wetland habitats, Oxygen, Dissolved, Changes in Stream Depth and Velocity Patterns	Channelization, Loss of Riparian Habitat, Irrigated Crop Production, Crop Production (Crop Land or Dry Land), Agriculture
PILES FK.	N582, X583, X585, F590	Alteration in stream-side or littoral vegetative covers, Methoxychlor, Other flow regime alterations, Oxygen, Dissolved	Highway/Road/Bridge Runoff (Non-construction), Impacts from Hydrostructure Flow, Streambank Modifications/destabilization, Urban Runoff/Storm Sewers, Upstream Impoundments (e.g., P1-5Irrigated Crop Production NRCS)
ROSE CREEK	N582, X583, X585, X590	Oxygen, Dissolved, Sulfates	Source Unknown, Surface Mining
S. FK. SALINE RIVER	N582, X583, X585, X590	Alteration in stream-side or littoral vegetative covers, Manganese, pH	Channelization, Streambank Modifications/destabilization, Surface Mining
S. FK. SALINE RIVER	N582, X583, N585, X590	Alteration in stream-side or littoral vegetative covers, Cadmium, Oxygen, Dissolved, Fecal Coliform	Channelization, Surface Mining, Source Unknown
S. FK. SALINE RIVER	N582, X583, X585, F590	Cause Unknown	Source Unknown
S. FK. SALINE RIVER	N582, X583, N585, N590	Alteration in stream-side or littoral vegetative covers, Cadmium, Iron, Nickel, Oxygen, Dissolved, Zinc, pH, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover, Fecal Coliform, Debris/Floatables/Trash	Channelization, Surface Mining, Crop Production (Crop Land or Dry Land), Agriculture, Loss of Riparian Habitat

Support Code		Use Support Level	
SALINE RIVER	N582, N583, X585, N590	Alteration in stream-side or littoral vegetative covers, Boron, Oxygen, Dissolved, Loss of Instream Cover, Mercury, Bottom Deposits, Odor	Channelization, Loss of Riparian Habitat, Municipal Point Source Discharges, Surface Mining, Agriculture, Atmospheric Deposition - Toxics, Source Unknown
SALINE RIVER	N582, N583, N585, F590	Iron, Oxygen, Dissolved, Mercury, Fecal Coliform	Source Unknown, Atmospheric Deposition - Toxics
SALINE RIVER	N582, N583, X585, X590	Alteration in stream-side or littoral vegetative covers, Manganese, Oxygen, Dissolved, Sedimentation/Siltation, Sulfates, Total Suspended Solids (TSS), pH, Phosphorus (Total), Mercury	Channelization, Streambank Modifications/destabilization, Surface Mining, Source Unknown, Crop Production (Crop Land or Dry Land), Atmospheric Deposition - Toxics
SANDY CREEK	N582, X583, X585, F590	Oxygen, Dissolved, pH	Source Unknown
SUGAR CREEK	N582, X583, F585, N590	Alteration in stream-side or littoral vegetative covers, Cadmium, Iron, Manganese, Nickel, Oxygen, Dissolved, Sulfates, Total Suspended Solids (TSS), Zinc, pH, Phosphorus (Total), 160, Bottom Deposits	Acid Mine Drainage, Mine Tailings, Surface Mining, Source Unknown
SUGAR CREEK	F582, X583, N585, X590	Fecal Coliform	N/A
SUGAR CREEK LAKE	F582, X583, X585, N590	Total Suspended Solids (TSS)	Crop Production (Crop Land or Dry Land), Runoff from Forest/Grassland/Parkland

Appendix 2 – Management Activities by Shawnee Natural Areas

Atwood Ridge RNA (1005 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	995.4	0.0	0.0	0.0	995.6	1991.1	FACTS
	0.0	995.4	0.0	0.0	0.0	995.7	1991.1	Total

Ava (188 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Site Preparation for Natural Regeneration - Burning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	FACTS
Site Preparation for Natural Regeneration - Manual	0.0	0.0	0.0	0.0	0.0	0.0	0.0	FACTS
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	10.4	0.0	185.6	196.1	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	0.0	0.8	0.0	1.0	1.9	Invasives
INVASIVES - PESTICIDE APPLICATION	1.0	0.0	0.0	0.0	0.0	0.5	1.5	Invasives
	1.0	0.0	0.0	11.3	0.0	187.1	199.5	Total

Barker Bluff RNA (60 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	59.8	0.0	0.0	0.0	0.0	59.8	119.6	FACTS
	59.8	0.0	0.0	0.0	0.0	59.8	119.6	Total

Bell Smith Springs NNL (1134 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	0.0	0.0	250.9	250.9	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	0.0	0.1	0.0	0.0	0.1	Invasives
INVASIVES - PESTICIDE APPLICATION	0.2	0.2	0.1	0.0	0.0	0.0	0.6	Invasives
	0.2	0.2	0.1	0.1	0.0	250.9	251.6	Total

Big Creek (bank to bank)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	0.0	0.0	0.0	0.0	0.0	0.1	FACTS
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	0.0	0.0	7.1	7.1	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.5	0.5	0.0	0.0	0.0	0.0	1.1	Invasives
INVASIVES - PESTICIDE APPLICATION	0.3	0.0	0.0	0.0	0.0	0.0	0.3	Invasives
	0.8	0.5	0.0	0.0	0.0	7.1	8.5	Total

Bulge Hole (102 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Marking/Designation	0.0	0.0	0.0	0.4	0.0	2.1	2.5	FACTS
	0.0	0.0	0.0	0.4	0.0	2.1	2.5	Total

Burke Branch RNA (335 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	255.2	0.0	0.0	255.2	FACTS
	0.0	0.0	0.0	255.2	0.0	0.0	255.2	Total

Cave Hill RNA (1063 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	288.7	0.0	0.0	0.0	0.0	0.0	288.7	FACTS
	288.7	0.0	0.0	0.0	0.0	0.0	288.7	Total

Chimaphila Site (2 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	1.9	0.0	0.0	0.0	1.9	Invasives
InvasiveSpeciesMgmt -Feral Hogs	0.0	0.0	1.9	1.9	0.0	0.0	3.8	WIT
	0.0	0.0	3.8	1.9	0.0	0.0	5.7	Total

Copperous Branch Limestone Barrens (38 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	37.8	0.0	0.0	0.0	0.0	37.8	FACTS
Tree Release	0.0	0.0	0.0	0.0	0.0	37.8	37.8	WIT
	0.0	37.8	0.0	0.0	0.0	37.8	75.5	Total

Cretaceous Hills (203 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - PESTICIDE APPLICATION	0.0	0.1	0.0	0.0	0.0	0.0	0.1	Invasives
	0.0	0.1	0.0	0.0	0.0	0.0	0.1	Total

Crow Knob (19 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	0.2	0.0	0.0	0.2	FACTS
	0.0	0.0	0.0	0.2	0.0	0.0	0.2	Total

Dean Cemetery East Barrens (21 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Tree Release	0.0	3.3	0.0	0.0	0.0	0.0	3.3	WIT
	0.0	3.3	0.0	0.0	0.0	0.0	3.3	Total

Dennison Hollow RNA (462 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	2.2	0.0	0.0	0.0	462.1	0.0	464.4	FACTS
	2.2	0.0	0.0	0.0	462.1	0.0	464.4	Total

Double Branch Hole (100 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	92.3	0.0	0.0	92.3	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.2	0.2	0.2	0.8	1.1	1.4	3.9	Invasives
INVASIVES - PESTICIDE APPLICATION	0.0	0.0	0.0	0.0	0.0	0.0	0.1	Invasives
Trail Stormproofing	0.0	0.0	0.0	3.1	0.0	0.0	3.1	WIT
	0.2	0.2	0.2	96.2	1.1	1.4	99.4	Total

East Fork Oxalis Illinoensis (2 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	1.6	0.0	0.0	0.0	1.6	Invasives
InvasiveSpeciesMgmt -Feral Hogs	0.0	0.0	1.6	1.6	0.0	0.0	3.3	WIT
	0.0	0.0	3.3	1.6	0.0	0.0	4.9	Total

Fink Sandstone Barrens (283 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	282.9	0.0	0.0	282.9	0.0	565.7	FACTS
Tree Release	0.0	0.0	0.0	0.0	0.0	25.6	25.6	WIT
	0.0	282.9	0.0	0.0	282.9	25.6	591.3	Total

Gibbons Creek (87 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	0.0	29.1	0.0	0.0	0.0	29.1	FACTS
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	42.7	0.0	0.0	42.7	FACTS
	0.0	0.0	29.1	42.7	0.0	0.0	71.8	Total

Greentree Reservoir (129 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Flooding Artificially	39.9	39.9	0.0	39.9	0.0	39.9	159.8	WIT
	39.9	39.9	0.0	39.9	0.0	39.9	159.8	Total

Hayes Creek/Fox Den Creek (112 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	28.2	0.0	0.0	28.2	FACTS
Trail Stormproofing	0.0	0.0	0.0	0.1	0.0	0.0	0.1	WIT
	0.0	0.0	0.0	28.2	0.0	0.0	28.2	Total

Jackson Hole (158 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	124.0	0.0	0.0	124.0	FACTS
	0.0	0.0	0.0	124.0	0.0	0.0	124.0	Total

Kickasola Cemetery (102 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	101.2	0.0	0.0	0.0	0.0	101.2	FACTS
INVASIVES - PESTICIDE APPLICATION	4.5	14.6	1.5	3.5	10.2	0.9	35.2	Invasives
	4.5	115.8	1.5	3.5	10.2	0.9	136.5	Total

LaRue-Pine Hills/Otter Pond RNA/NNL (3,699 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	0.0	531.1	0.0	0.0	0.0	531.1	FACTS
Underburn - Low Intensity (Majority of Unit)	531.1	562.3	0.0	0.0	0.0	562.3	1655.7	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.2	1.0	1.2	1.6	0.1	0.2	4.3	Invasives
INVASIVES - PESTICIDE APPLICATION	0.8	0.6	1.5	0.0	0.0	0.0	2.9	Invasives

Native Pest Control-TerrAnimal	1407.1	1407.1	0.0	0.0	0.0	0.0	2814.2	WIT
Native Pest Control-TerrPlant	0.0	0.0	0.0	0.0	0.0	0.7	0.7	WIT
	1939.2	1971.1	533.8	1.6	0.1	563.2	5009.0	Total

Leisure City Barrens (7 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	0.0	6.5	0.0	6.5	FACTS
Tree Release	0.0	2.4	0.0	0.0	0.0	0.0	2.4	WIT
	0.0	2.4	0.0	0.0	6.5	0.0	8.8	Total

Lusk Creek	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	13.5	0.0	0.0	0.0	0.0	13.5	FACTS
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	2.0	0.0	0.0	2.0	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	225.9	0.0	0.0	0.0	225.9	Invasives
INVASIVES - PESTICIDE APPLICATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Invasives
InvasiveSpeciesMgmt -Feral Hogs	0.0	0.0	225.9	1.7	0.0	0.0	227.6	WIT
Trail Stormproofing	0.0	0.0	0.0	0.3	0.0	0.0	0.3	WIT
	0.0	13.5	451.9	4.0	0.0	0.0	469.4	Total

Lusk Creek North NNL (3 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	2.7	0.0	0.0	0.0	2.7	Invasives

InvasiveSpeciesMgmt -Feral Hogs	0.0	0.0	2.7	0.0	0.0	0.0	2.7	WIT
	0.0	0.0	5.5	0.0	0.0	0.0	5.5	Total

Martha's Woods NNL (43 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	43.4	0.0	0.0	0.0	43.4	Invasives
InvasiveSpeciesMgmt -Feral Hogs	0.0	0.0	43.4	43.4	0.0	0.0	86.8	WIT
	0.0	0.0	86.8	43.4	0.0	0.0	130.3	Total

Massac Tower Springs (36 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	35.9	0.0	0.0	0.0	0.0	35.9	FACTS
INVASIVES - PESTICIDE APPLICATION	6.4	18.7	0.0	0.0	6.0	0.0	31.0	Invasives
	6.4	54.5	0.0	0.0	6.0	0.0	66.9	Total

Odum Tract (57 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Precommercial Thin	0.0	0.0	0.0	0.0	0.0	0.7	0.7	FACTS
	0.0	0.0	0.0	0.0	0.0	0.7	0.7	Total

Opossum Trot Trail (200 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	200.4	0.0	0.0	0.0	200.4	0.0	400.8	FACTS
	200.4	0.0	0.0	0.0	200.4	0.0	400.8	Total

Ozark Hill Prairie RNA (550 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database

Broadcast Burning - Covers a majority of the unit	0.0	0.0	0.0	537.9	0.0	0.0	537.9	FACTS
	0.0	0.0	0.0	537.9	0.0	0.0	537.9	Total

Pine Hills Annex (9 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	0.1	0.2	0.1	0.4	0.8	Invasives
INVASIVES - PESTICIDE APPLICATION	0.8	0.5	0.0	0.0	0.0	0.0	1.2	Invasives
	0.8	0.5	0.1	0.2	0.1	0.4	2.0	Total

Pleasant Valley Barrens (8)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	8.4	0.0	8.4	0.0	0.0	16.7	FACTS
	0.0	8.4	0.0	8.4	0.0	0.0	16.7	Total

Poco Cemetery East (36 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	35.6	0.0	0.0	0.0	0.0	35.6	FACTS
	0.0	35.6	0.0	0.0	0.0	0.0	35.6	Total

Poco Cemetery North (29 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	29.2	0.0	29.2	0.0	0.0	58.4	FACTS

	0.0	29.2	0.0	29.2	0.0	0.0	58.4	Total

Reddick Hollow (4 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Broadcast Burning - Covers a majority of the unit	0.0	4.0	0.0	0.0	0.0	0.0	4.0	FACTS
	0.0	4.0	0.0	0.0	0.0	0.0	4.0	Total

Robnett Barrens (106 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Improvement Cut	0.0	0.0	0.0	0.0	2.7	0.0	2.7	FACTS
INVASIVES - PESTICIDE APPLICATION	0.0	0.1	0.0	0.0	0.0	0.0	0.1	Invasives
Monitoring-Wildlife	0.0	0.0	0.1	0.0	0.0	0.0	0.1	WIT
	0.0	0.1	0.1	0.0	2.7	0.0	3.0	Total

Russell Cemetery Barrens (35 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	35.3	0.0	0.0	70.5	0.0	105.8	FACTS
	0.0	35.3	0.0	0.0	70.5	0.0	105.8	Total

Schwegman (26 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Marking/Designation	0.0	0.0	0.0	0.0	0.0	0.4	0.4	FACTS
	0.0	0.0	0.0	0.0	0.0	0.4	0.4	Total

Simpson Township Barrens (186 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	186.1	0.0	186.1	0.0	372.3	FACTS
INVASIVES - MECHANICAL /PHYSICAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Invasives

INVASIVES - PESTICIDE APPLICATION	0.0	0.0	0.1	0.0	0.0	0.0	0.1	Invasives
Tree Release	0.0	2.4	0.0	0.0	0.0	0.0	2.4	WIT
	0.0	2.4	186.3	0.0	186.1	0.0	374.9	Total

Snow Springs (1 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - PESTICIDE APPLICATION	0.0	1.1	0.2	0.1	0.0	1.1	2.5	Invasives
	0.0	1.1	0.2	0.1	0.0	1.1	2.5	Total

Stoneface RNA (157 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	0.0	0.0	0.0	113.3	0.0	113.3	FACTS
Native Pest Control-TerrPlant	0.0	0.0	0.0	0.0	0.0	0.1	0.1	WIT
	0.0	0.0	0.0	0.0	113.3	0.1	113.4	Total

Teal Pond (1 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
INVASIVES - PESTICIDE APPLICATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Invasives
Lake Habitat Improvement	0.0	0.4	0.0	0.0	0.0	0.0	0.4	WIT
Tree Release	0.0	0.4	0.0	0.0	0.0	0.0	0.4	WIT
	0.0	0.8	0.0	0.0	0.0	0.0	0.9	Total

Whoopie Cat Mountain RNA/EAs (107 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Control of Understory Vegetation	0.0	7.4	0.0	0.0	0.0	0.0	7.4	FACTS
Underburn - Low Intensity (Majority of Unit)	0.0	32.7	72.3	0.0	72.3	0.0	177.3	FACTS

Broadcast Burning - Covers a majority of the unit	0.0	0.0	0.0	32.7	0.0	0.0	32.7	FACTS
Tree Release	0.0	7.4	0.0	0.0	0.0	0.0	7.4	WIT
	0.0	47.5	72.3	32.7	72.3	0.0	224.8	Total

Wolf Creek (526 ac)	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Underburn - Low Intensity (Majority of Unit)	0.0	252.2	0.4	0.0	0.0	0.0	252.5	FACTS
	0.0	252.2	0.4	0.0	0.0	0.0	252.5	Total
	2018.0	2019.0	2020.0	2021.0	2022.0	2023.0	Total	Database
Total	2544.2	3934.7	1375.4	1262.9	1414.4	2174.0	12705.7	