

CFLRP Project Name (CFLR#): Missouri Pine-Oak Woodlands Restoration Project CFLR20

National Forest(s): Mark Twain National Forest

1. Executive Summary

Briefly summarize the top ecological, social, and economic accomplishments your CFLRP project participants are most proud of from FY23 and any key monitoring results. This is a space for key take-home points (< 500 words).

Since 2012, this project has been front and center to meeting the Forest Plan goal of restoring Missouri’s natural communities, especially shortleaf pine habitats. This effort would not be possible without support from our collaborative partners. It has developed around the conservation efforts of one of the most biologically diverse ecosystems in the State of Missouri. This project has contributed significantly to our local communities by providing jobs and income related to the States timber and forestry industry through timber sales and other vegetation management contracts. It has also gone a long way to reducing hazardous fuels while also emulating the historical fire regime of the Missouri Ozarks. This proposal also aligns with the Mark Twain National Forest’s Five-year Strategic Plan particularly two of our goal areas. The first being, Success through Collaboration; Leverage capacity to sustain our communities and fulfill our mission and the second, Stewardship of Our Natural Resources; Lead conservation of natural resources in the Ozarks. While the enclosed proposal documents the success of our original proposal within the Missouri Pine-Oak Woodlands landscape, it has also provided us the opportunity, by utilizing timber sale revenues, to increase the pace and scale of restoration across not just it the Missouri Pine-Oak Woodlands Restoration Project area, but across the Forest. Since 2012, we have almost doubled our annual timber volume sold and prescribed burning acres. We are also especially proud that the result of all the hard work in the CFLR landscape has culminated in the reintroduction of the Brown-headed nuthatch which was extirpated from Missouri approximately 100 years ago.

2. Funding

CFLRP and Forest Service Match Expenditures

Fund Source: CFLN and/or CFIX Funds Expended	Total Funds Expended in Fiscal Year 2023
CFLN2023	\$305,621.00
CFLN2020	\$207.45*
CFLN2021	\$6,025.83*

*This amount should match the amount of CFLN/CFIX dollars spent in the FMMI CFLRP expenditure report. These amounts were not captured in the official CFLRP FMMI report.

Fund Source: Forest Service Salary and Expense Match Expended	Total Funds Expended in Fiscal Year 2023
<u>CFSE23</u>	<u>\$264,652.84*</u>

*This amount should match the amount of matching funds in the FMMI CFLRP expenditure report for Salary and Expenses. The official CFLRP FMMI report total was \$0. Staff time spent on CFLRP proposal implementation and monitoring may be counted as CFLRP match – see Program Funding Guidance.

Fund Source: Forest Service Discretionary Matching Funds	Total Funds Expended in Fiscal Year 2023
CWKV22	\$226,601

This amount should match the amount of matching funds in the FMMI CFLRP expenditure report, minus any partner funds contributed through agreements (such as NFEX, SPEX, WFEX, CMEX, and CWFS) which should be reported in the partner contribution table below. Per the [Program Funding Guidance](#), federal dollars spent on non-NFS lands may be included as match if aligned with CFLRP proposal implementation.

Partner Match Contributions¹

Fund Source Partner Match	In-Kind Contribution or Funding Provided?	Total Estimated Funds/Value for FY23	Description of CFLRP implementation or monitoring activity	Where activity/item is located or impacted area
UNIVERSITY OF MISSOURI SUPPLEMENT AL PROJECT AGREEMENT 23-CS- 11090500-032	<input checked="" type="checkbox"/> In-kind contribution <input type="checkbox"/> Funding	New \$15,684.36	Relocation of Brown- Headed Nuthatch from AR to MO with MDC, MU, FS and NRS. Tracking and Monitoring of relocated birds. \$41,999.55 of FS match (CFLN23)	<input checked="" type="checkbox"/> National Forest System Lands <input type="checkbox"/> Other lands within CFLRP landscape:

Total In-Kind Contributions: \$15,684.36

Total partner in-kind contributions for implementation and monitoring of a CFLR project across all lands within the CFLRP landscape.

Goods for Services Match

Service work accomplishment through goods-for services funding within a stewardship contract (for contracts awarded in FY23)	Totals
Total <u>revised non-monetary credit limit</u> for contracts awarded in FY23	\$0
Revenue generated through Good Neighbor Agreements	Totals
	\$0

“Revised non-monetary credit limit” should be the amount in the “[Progress Report for Stewardship Credits, Integrated Resources Contracts or Agreements](#)” as of September 30. Additional information on the Progress Reports available in CFLRP Annual Report Instructions. “Revenue generated from GNA” should only be reported for CFLRP match if the funds are intended to be spent within the CFLRP project area for work in line with the CFLRP proposal and work plan.

¹ Addresses [Core Monitoring Question #13](#)

3. Activities on the Ground

FY 2023 Agency Performance Measure Accomplishments² - Units accomplished should match the accomplishments recorded in the Databases of Record. Please note any discrepancies.

Core Restoration Treatments	Agency Performance Measure	NFS Acres	Non-NFS Acres	Total Acres
Hazardous Fuels Reduction (acres) in the Wildland Urban Interface	FP-FUELS-WUI (reported in FACTS) ³	8,221		
Hazardous Fuels Reduction (acres) in the Wildland Urban Interface - COMPLETED	FP-FUELS-WUI-CMPLT (reported in FACTS) ⁴	8,221		
Hazardous Fuels Reduction (acres) outside the Wildland Urban Interface	FP-FUELS-NON-WUI (reported in FACTS) ³	8,083		
Hazardous Fuels Reduction (acres) outside the Wildland Urban Interface - COMPLETED	FP-FUELS-NON-WUI-CMPLT (reported in FACTS) ⁴	9,649		
Prescribed Fire (acres)	Activity component of FP-FUELS-ALL (reported in FACTS)	16,304	NPS – 5,791 MDC – 5,192 LAD - 813	28,100
Invasive Species Treatments (acres) - Noxious weeds and invasive plants	INVPLT-NXWD-FED-AC (reported in FACTS) ³	48.3	NPS – 206.5 MDC – 20+	274.8
Invasive Species Treatments (acres) - Noxious weeds and invasive plants - COMPLETED	INVPLT-NXWD-FED-AC-CMPLT (reported in FACTS) ⁴	48.3		
Invasive Species Treatments (acres) - Terrestrial and aquatic species	INVSPE-TERR-FED-AC (reported in FACTS) ³⁵	37,000	Feral Hog removal on all ownerships	
Wildlife Habitat Restoration (acres)	HBT-ENH-TERR (reported in WIT)	15,394		
Stand Improvement (acres)	FOR-VEG-IMP (reported in FACTS)	454		
Stand Improvement COMPLETED (acres)	FOR-VEG-IMP-CMPLT (reported in FACTS)	534	LAD – 74 MDC - 109	717
Reforestation and revegetation (acres)	FOR-VEG-EST (reported in FACTS)	1,214		
Reforestation and revegetation (acres) COMPLETED	FOR-VEG-EST-CMPLT (reported in FACTS)	1,081	MDC - 123	1,204
Forests treated using timber sales (acres)	TMBR-SALES-TRT-AC (reported in FACTS)	1,161	LAD – 6,000 MDC-706	7,867

Reflecting on treatments implemented in FY23, if/how has your CFLRP project aligned with other efforts to accomplish work at landscape scales?

² This question helps track progress towards the CFLRP projects lifetime goals outlined in your CFLRP Proposal & Work Plan. Adapt table as needed.

³ For service contracts, the date accomplished is the date of contract award. For Force Account, the date accomplished is the date the work is completed

⁴ New Agency measure reported in FACTS when completed

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There were no appreciable cross-boundary efforts in FY23. The Missouri Department of Conservation (MDC) has completed their Landscape Scale Restoration grant from the Forest Service State, Private and Tribal Forestry awarded in 2020 for the Heart of the Ozarks Landscape Scale Restoration Project. The following restoration work is being currently being implemented on State and Private lands within the Current River COAs with this LSR grant; forest stand improvements on glades and woodlands on 1,000 acres; invasive species treatments on 160 miles of transportation corridors; and numerous Forest Stewardship Plans developed on private lands and additional conservation practices in the Current River Hills Priority Forest Landscape which the Missouri Pine-Oak Woodland Restoration Project falls within. Additionally, feral hog removal occurred in collaboration with the Missouri Feral Hog Elimination Partnership, resulting in 1,369 hogs removed on all ownerships within the CFLRP landscape in 2023.

4. Restoring Fire-Adapted Landscapes and Reducing Hazardous Fuels

Narrative Overview of Treatments Completed in FY23 to restore fire-adapted landscapes and reduce hazardous fuels, including data on whether your project has expanded the pace and/or scale of treatments over time, and if so, how you've accomplished that – what were the key enabling factors?

We accomplished a record number of acres in FY23 including 8,222 acres within CFLR. This is due to the use of Wyden authority with private land partners through agreements which have allowed the relocation of fire lines to county roads or private pastures or other features increasing safety and reducing environmental impacts. The use of helicopters for aerial ignition for these larger landscapes has been very important and kept us successful with timing of our ignitions to achieve restoration objectives during peak burn window. As far as scale and cost reduction, the helicopter used for aerial ignition not only allows us to achieve restoration objectives by being able to complete these large landscape burns within just a few hours of the peak burn day window, they also greatly reduce cost per acre since fewer people are needed for interior ignition. This also greatly reduces risk and smoke exposure to firefighters because they can remain on the perimeter of the burn. Smoke impacts to the public are also reduced because landscape burns are usually accomplished faster during peak windows, thereby avoiding going late into the evening or night when smoke conditions can be problematic.

If a wildfire interacted with a previously treated area within the CFLRP boundary:

- FROM FTEM (can be copied/summarized): Did the wildfire behavior change after the fire entered the treatment? Yes
- FROM FTEM (can be copied/summarized): Did the treatment contribute to the control and/or management of the wildfire? Yes
- FROM FTEM (can be copied/summarized): Was the treatment strategically located to affect the behavior of a future wildfire? Yes
- Please describe if/how partners or community members engaged in the planning or implementation of the relevant fuels treatment. Did treatments include coordinated efforts on other federal, tribal, state, private, etc. lands?

In this project area, we have had good response from the public to help with treating the landscape across boundary lines (public/private). Using Wyden agreements, we have treated over 3,000 acres of this landscape on private property. Cross boundary treatments will help control efforts in the case of a wildfire and overall, they have resulted in improvement of the ecosystem on this landscape. Overall improvement results from treating continuous parcels of land with the same treatments to help enhance the ecological functions on that landscape. There are also similar treatments being completed on federal, state, and private lands located within the landscape. The forest has full suppression responsibility over the lands in the project area, so we have used fuel treatment units to help develop plans for wildfire response. The significant findings based on FTEM are that the treatment either slowed or arrested the spread of the wildfire. Prescribed fire and silvicultural treatments of open and closed woodland communities has restored and improved to varying degrees the function and integrity of these ecosystems.

FY23 Wildfire/Hazardous Fuels Expenditures

Category	\$
FY23 Wildfire Preparedness*	47,000
FY23 Wildfire Suppression**	35,411
FY23 Hazardous Fuels Treatment Costs (CFLN, CFIX)	Not reported
FY23 Hazardous Fuels Treatment Costs (other BLIs)	205,550

* Include base salaries, training, and resource costs borne by the unit(s) that sponsors the CFLRP project. If costs are directly applicable to the project landscape, describe full costs. If costs are borne at the unit level(s), describe what proportions of the costs apply to the project landscape. This may be as simple as Total Costs X (Landscape Acres/Unit Acres).

** Include emergency fire suppression and BAER within the project landscape.

How may the treatments that were implemented contribute to reducing fire costs? If you have seen a reduction in fire suppression costs over time, please include that here. (If not relevant for this year, note “N/A”) N/A

5. Additional Ecological Goals

Narrative Overview of Treatments Completed in FY23 to achieve ecological goals outlined in your CFLRP proposal and work plan. This may include, and isn’t limited to, activities related to habitat enhancement, invasives, and watershed condition.

The area is prioritized in our Land Management Plan as Priority landscape per Forest Plan 1.1 and 1.2 Ecosystem Restoration Areas and designated State Conservation Opportunity Area for Forest/Woodlands and Glades. The area is currently identified on the Forest Wildfire Risk Map found in the Appendix of the Land Management Plan.

In 2023 the 16,304 acres of prescribed fire; 1,161 acres of timber removal and 454 acres of silviculture treatments all contributed to restoring pine and pine-oak communities to a mosaic of open to closed woodlands of 30 to 90 basal area which contribute toward restoring structure and composition of older woodland stands. As demonstrated at numerous restoration sites across the Ozarks the result of opening up overstory canopy and the application of prescribed fire results in a diverse understory of forbs and graminoids. As described previously this strategy fits within the State’s Comprehensive Conservation Strategy along with various partners goals such as the CHJV and NWTF along with National Forests in Arkansas.

6. Socioeconomic Goals

Narrative overview of activities completed in FY23 to achieve socioeconomic goals outlined in your CFLRP proposal and work plan.

The Missouri Pine-Oak Restoration Project is slated for implementation across 126 thousand acres within the Mark Twain National Forest (MTNF). This area corresponds to about 8% of MTNF. About \$20 million will be invested to implement the project with one half funded through the CFLRP national fund and the other half through the Knutson-Vandenberg Fund and nongovernmental sources. The \$20 million invested on MTNF-CFLRP implementation over the 2012-2019 period are expected to support an average of 141 jobs, generate \$33.7 million in labor income and contribute \$44.2 million in added value to the regional 9-county economy. Merchantable tree volume at the end of this period is expected to exceed the initial amount by 14% although growth in timber volume will be lower than if the MTNF-CFLRP had not been implemented. Given the size and scope of the MTNF-CFLRP there were no sizeable or discernable negative effects to the local wood products industry although impacts on industry segments will need further evaluation.

Results from the Treatment for Restoration Economic Analysis Toolkit (TREAT). For guidance, training, and resources, see materials on [Restoration Economics SharePoint](#).⁶ After submitting your data entry form to the Forest Service Washington Office Economist Team, they will provide the analysis results needed to respond to the following prompts.

Percent of funding that stayed within the local impact area: 45 %

Contract Funding Distributions Table (“Full Project Details” Tab):

Description	Project Percent
Equipment intensive work	22%
Labor-intensive work	17%
Material-intensive work	61%
Technical services	0%
Professional services	0%
Contracted Monitoring	0%
TOTALS:	100%

Modelled Jobs Supported/Maintained (CFLRP and matching funding):

Jobs Supported/Maintained in FY 2023	Direct Jobs (Full & Part-Time)	Total Jobs (Full & Part-Time)	Direct Labor Income	Total Labor Income
Timber harvesting component	9	14	446,489	512,263
Forest and watershed restoration component	1	3	69,631	127,696
Mill processing component	9	19	461,777	706,243
Implementation and monitoring	0	0	2,246	3,518
Other Project Activities	0	0	0	0
TOTALS:	19	35	980,142	1,349,721

- **Were there any assumptions you needed to make in your TREAT data entry you would like to note here? To what extent do the TREAT results align with your observations or other monitoring on the ground?**

Please provide a brief description of the local businesses that benefited from CFLRP related contracts and agreements, including characteristics such as tribally-owned firms, veteran-owned firms, women-owned firms, minority-owned firms, and business size.⁷ For resources, [see materials here](#) (external Box folder).

Since 2013 – 2023, there has been 140 contracts totaling over \$8 million dollars for invasive species treatments, timber marking, tree planting, timber stand improvement and road maintenance and improvement work associated with restoration and management activities in the MoPWR project area. Most of this contract work went to local contractors either in the eight-county area or to contracting firms within the state. The economic and social goal is to continue to maximize the number of contracts available to local timber, wood product and natural resource management companies. Some of these contractors are veteran and women owned firms, although the total number is not known.

⁶ Addresses [Core Monitoring Question #7](#)

⁷ Addresses [Core Monitoring Question #8](#)

7. Wood Products Utilization

Timber & Biomass Volume Table⁸

Performance Measure	Unit of measure	Total Units Accomplished
Volume of timber sold TMBR-VOL-SLD	CCF	33,464.2
Green tons from small diameter and low value trees removed from NFS lands and made available for bio-energy production BIO-NRG	Green tons	173.859

- Reviewing the data above, do you have additional data sources or description to add in terms of wood product utilization (for example, work on non-National Forest System lands not included in the table)? No

8. Collaboration

Please include an up-to-date list of the core members of your collaborative **if it has changed from your proposal/work plan (if it has not changed, note below)**.⁹ For detailed guidance and resources, see materials [here](#). Please document changes using the [template](#) from the CFLRP proposal and upload to [Box](#). Briefly summarize and describe changes below.

Collaborative Member/Partner Name	Organizational Affiliation
Jeff Powelson	Central Hardwoods Joint Ventures
Dan Dey, Research Forester	US Forest Service, Northern Research Station
Frank Thompson, Research Wildlife Scientist Emeritus	University of Missouri
Mike Stambaugh, Associate Research Professor, Consortium Lead	Oak Woodland and Forest Fire Consortium
Megan Buchanan	The Nature Conservancy
Nathan Muenks, Natural Resources Planning Section Chief	Missouri Department of Conservation
Neal Humke, Land Stewardship Coordinator	L.A.D. Foundation
John Burk, NWTf State Biologist	National Wild Turkey Federation
Vacant	Natural Resource Conservation Service

9. Monitoring Process

Briefly describe your current status in terms of developing, refining, implementing, and/or reevaluating your CFLRP monitoring plan and multiparty monitoring process.

Brown-headed nuthatch Reintroduction and Monitoring:

Background: The brown-headed nuthatch (*Sitta pusilla*) was likely extirpated from Missouri in the early 1900s because of habitat loss through extensive logging. Conservation partners including the Missouri Department of Conservation, United States Forest Service, University of Missouri, and others, relocated 102 brown-headed nuthatches from Ouachita National Forest in Arkansas to Mark Twain National Forest in Missouri in 2020 and 2021 to establish a local population. We captured and translocated 18 females, 27 males, and 1 brown-headed nuthatch of unknown sex in 2020 and 20 females, 33 males, and 3 birds of unknown sex in 2021. All birds received a federal USGS numbered leg band and one- or two-color bands on the opposite leg to permit individual identification. Approximately half the birds each year were fitted with a radio transmitter that permitted radio-tracking for 25-45 days post release. Monthly point count surveys

⁸ Addresses [Core Monitoring Question #10](#)

⁹ Addresses [Core Monitoring Question #11](#)

have been conducted since November 2020 and spring nest searches and monitoring have been conducted to monitor the population.

Accomplishments: We began conducting monthly point count surveys of brown-headed nuthatches in November 2020 and will continue these at least through August 2023 at which time we will reduce surveys to 4 times per year. Surveys are conducted at ~80 points (Fig. 1) surveyed over two mornings. At each point we use recordings of brown-headed nuthatches to stimulate birds to call and increase our likelihood of detecting them, at which time we view them with binoculars and a super-zoom camera to attempt to identify individuals by their color bands. We summarized the total number of nuthatch detections across all survey points by month to provide a simple index of abundance over time (Fig. 2). This simple calculation has the undesirable trait of sometimes double counting individuals that may move among points during the survey. We are working on or more sophisticated estimates such as probability of occupancy and mean abundance per point that account for variation in the probability of detection. We will also model monthly and annual survival probabilities based on resighting color marked birds.

The simple index of total detections per month, however, suggests some patterns in abundance, but these are also likely confounded by patterns in detectability. Each year abundance seems to be greatest in late fall and early winter but then decreases into spring. This likely reflects the addition of new individuals due to releases in September 2020 and 2021 or of young born in spring. This is likely confounded by detectability because birds seem most responsive to playbacks in winter but less responsive and quieter once nesting in April and May. Nevertheless, it is of some concern that there seems to be a negative trend in detections over the three years (Fig. 2).

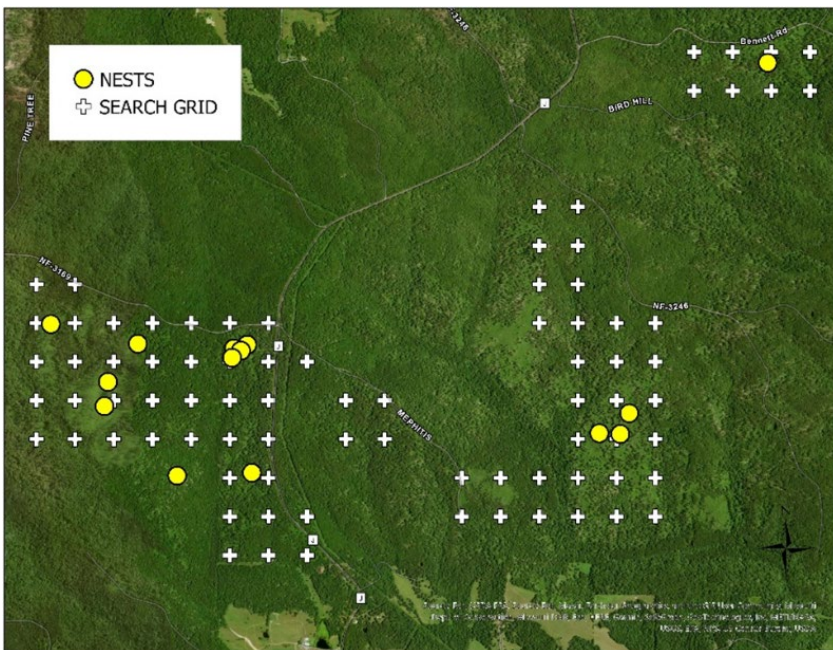


Figure 1 Survey grid used for monthly surveys of brown-headed nuthatches and locations of nest 2021-2023

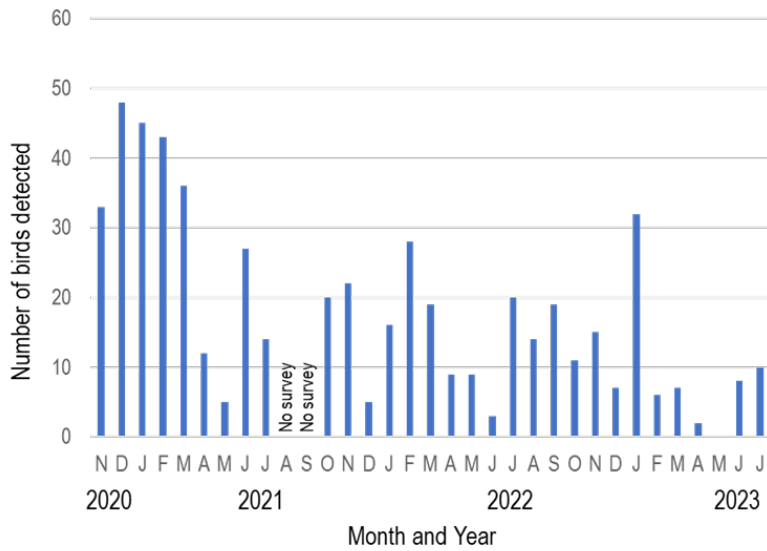


Figure 2 Number of brown-headed nuthatches detected on monthly point-count surveys using play-back calls at 80 points. Number of birds detected can include counts of the same individuals at multiple points and is only a crude index of abundance.

We searched for and monitored nests in spring 2021, 2022, and 2023. The number of nests, the number of nests that fledged, and the total number of young fledged are presented in Table 1. We have seen a decline in the number of nests each year. While the total number of young fledged (i.e. that left the nest) was consistent over the last two years, we suspect six fledglings from one nest died soon after fledging in 2023 because they have never been re-sighted. Apparent nest success has averaged 69%, which is reasonable for a resident songbird. However, it is of concern that we could not find more than 3 nest attempts in 2023. It is possible that birds are nesting outside of our core search area. For example, in 2023 we found one nest south of our search grid (Fig. 1) in oak woodland, and in 2022 a color-banded bird that had not been observed for over a year showed up with an unbanded bird providing some evidence of a successful nest that we were unaware of.

Table 1 Number of brown-headed nuthatch nesting success

YEAR	NEST	NUMBER OF SUCCESSFUL NEST	YOUNG FLEDGED
2021	6	4	18
2022	4	3	11
2023	3	2	11/5*

*11 total young fledged but 6 disappeared 1 day post fledgling and likely perished

In addition to these monitoring efforts, we completed and published our analysis of post-release movements and survival, which is in press in the Wildlife Society Bulletin. This analysis was based on the radio tracking data for 50 individuals tracked for 24 ± 11 (median ± SD) days after release using radio telemetry and we analyzed movements in relation to sex and whether a bird was captured alone or as part of a group. We examined 25-day survival using a spatial Cormack Jolly Seber (sCJS) model to account for likely dispersal outside of our study area. All birds survived translocation including capture, transport, and release. The 25-day survival estimate was 0.56 (95% CI: 0.36–0.78) in 2020 and 0.68 (95% CI: 0.46–0.89) in 2021. Mean total distance moved following release was 5,670 (SD = 3,407) m and mean daily movement was 243 (SD = 135) m which was less than the mean daily dispersal distance estimated from our sCJS model (420 m, SD = 221). Our short-term monitoring suggests initial success of the translocation, but continued monitoring is needed to evaluate long-term success. Our survival analysis approach, which included movement data, illustrates the importance of considering dispersal when estimating survival.

Discussion and Conclusions: There are several important successes and things that we have learned. We now know that we can safely capture and translocate brown-headed nuthatches. Translocation resulted in no known mortalities or signs of stress during or immediately following translocation. We’ve learned that birds move more than perhaps we

expected and accounting for dispersal is important when estimating survival. We now know that birds can successfully nest in Missouri.

However, we do have concerns about the apparent decline in abundance. There are several possible explanations for the decline in detections over the last three years. We have evidence that at least some birds are leaving the core area where the monitoring is focused. Six birds that disappeared during radiotracking were not resighted for 228-518 days before being resighted again on the study area. One of these returned along with an unbranded bird, suggesting a possible successful nest we were unaware of. These observations suggest birds were either undetectable or outside of the searched area and grid-survey area for extended periods. In response to the disappearance of birds, we made efforts to search potential habitat outside the core area at distances up to 5 km. However, no birds have been detected during these searches.

Another explanation for apparent declines is that detectability is declining. A mechanism for this is that birds could be becoming habituated to the use of playbacks. Our observations suggest this could be occurring to some extent, but we have not formally evaluated this. Another potential explanation of declines in detections is that abundance is truly declining due to some combination of inadequate survival or productivity. Or, given some of the large dispersal movements we saw immediately following releases, perhaps we did not translocate enough birds to establish a viable core population in the release area.

The results of monitoring to date suggest there is uncertainty in the current status of the population and its ability to sustain itself. We suggest continued monitoring and additional analyses are needed to address these uncertainties. We are planning the following actions to address this:

1. Continue point count surveys at a frequency of 4 times per year to track abundance and continue spring nest searching and monitoring to track productivity. (Ongoing)
2. Complete analyses of monthly and annual survival from the three years of point count surveys and re-sighting data. (6 months)
3. Complete more rigorous estimates of abundance and trend that account for detectability. (6 months)
4. Combine abundance, survival, productivity, and movement data into an integrated population model to assess population viability. (2-3 years)
5. Relate bird abundance from point count surveys to measured habitat attributes and map potential habitat in region. (M.S. study, 2-3 years)
6. Convene a partner's meeting to update everyone and raise the question of considering additional, supplemental releases of birds. (6 months)

Vegetation Monitoring: Several ecological monitoring projects have occurred in MOPWR, including birds, vegetation, and a small amount of pollinator surveys. Based on these monitoring projects, in particular, analysis through the Community Health Index (CHI), it appears that the treatments of fire and fire with thinning are moving stands towards more functional ecosystems – as well as actively providing benefits for certain focal species. Please refer to the attached report “Monitoring the Ecological Response to Restoration Treatments in the Missouri Pine-Oak Woodlands Restoration Project of the Mark Twain National Forest.”

There is some uncertainty as to whether current pine-oak restoration process can achieve the full range of variability found in historical reference conditions in every setting, but this monitoring has shown significant improvement in the functionality of this natural community across the MOPWR landscape.

It is evident that restoration treatments conducted by the MTNF, MDC, and Pioneer Forest (L-A-D) in the MOPWR landscape are helping to restore a functional ecosystem. Focal bird and bee species are responding positively to the treatments. Ground cover of native plants and key indicator groups have increased. The remaining overstory stocks of shortleaf pine and white oak species have been released to grow with less competition, which should increase drought resiliency based on both lower stocking and better adapted species remaining in the stands. This will assist with climate change resiliency. Treated stands with high CHI scores are less likely to burn as severely during wildfires compared to dense, overstocked stands. The treated stands may burn more readily (i.e., contain more fine fuels), but will have lower intensity overall, versus stands that are overstocked and drought-stressed, leaving them susceptible to overstory

mortality. The restored stands should also experience less soil sterilization, as fuel loads are abated. In addition, the treated stands will be less susceptible to southern pine beetle (*Dendroctonus frontalis*), an emerging threat to Missouri shortleaf pine-oak sites (USFS 2022).

Nevertheless, based on field experiences and discussions with resource managers and other ecologists, the authors wonder if ecological restoration (as defined) is achievable in the MOPWR landscape in terms of returning stands back to FRR1 reference conditions. Within sampling units, only small patches (typically three acres or less) had mature pine-oak canopies, ideal midstory and understory structure, and requisite cover of matrix and conservative ground flora). It is currently an open question whether present management regimes in MOPWR can achieve true reference conditions across large landscapes. Various historic land uses occurred between 1880 and 1930 - exploitative logging, intense slash fires, cultivation attempts, and open range grazing resulted in many areas of this region being heavily impacted and altered (Cunningham 2007). This recent land use history may preclude the attainment of specific attributes, such as species composition, found in the natural range of variation prior to European settlement. However, restoration processes can and continue to improve the functionality of this ecosystem, while providing goods and services with biologic, economic, and social benefits.

Further discussions are needed on the next steps in restoration treatments. Questions remain as to how to combat the problems associated with super-canopies of oak/hickory sprouts and overgrowth of sumac and blackberry, all of which may inhibit return to reference conditions. NNIS have not gained much ground within these treatment units, and in comparison, to surrounding regions, the Ozarks in general (The Nature Conservancy 2003). Continued effort will be needed to maintain this status, and it should be fully expected that NNIS will continue to become problematic as climatic changes occur.

Bee Survey: Preliminary pollinator (bee) inventories were conducted by the University of Massachusetts-Amherst through co-production with another project happening in the MOPWR area (Fassler unpublished). This work was limited to units within the Pine knot project area on MTNF. Fassler and her crew sampled bees in five pine-oak woodland sampling units that spanned a range of scores, including those from the first (units 11 and 12), fourth (units 9 and 20) and fifth quintiles (unit 15). Utilizing bee bowl techniques for sampling they captured a total of 482 bees (Droege et al. 2016). The average bee abundance was highest in sampling unit 20 which scored in the second lowest quintile for CHI (Figure 3). This site was a large opening, created by high intensity prescribed fire, with less than 10% stocking which contributed to the low CHI score, around 50% woody ground cover, and around 40% native forb cover, with abundant blooms. Given the cover, habitat structure, and copious blooming of the native forbs, it's not surprising this unit had the greatest bee abundance. Units included from the top quintile had intermediate bee abundance, and were characterized by 53 and 76% stocking, 37-63% woody ground cover, and 37-63% native forb cover. Units 9 and 15 had low bee abundance. Unit 9 is unmanaged and contained 82% stocking, 37% woody ground cover and 15% native forb cover. Unit 15 was unmanaged as well, and obtained the lowest CHI score out of all 59 sites and contained 111% stocking, 62% woody ground cover, and only 3% native forb cover.

Higher scoring CHI units showed the highest bee species richness, and six times that of the lower scoring units (Figure 3). Twenty-two individuals of the native bee species called *Lasioglossum raleighense* (no common name) were found across CHI units 11, 12 and 20. This species was previously known from only one record in Missouri. In the southeast, it has been identified as a possible indicator species of mature open pine woodlands (Hanula et al. 2015). Several other habitat specialist bee species were also collected in these units. Additional bee sampling is currently in progress.

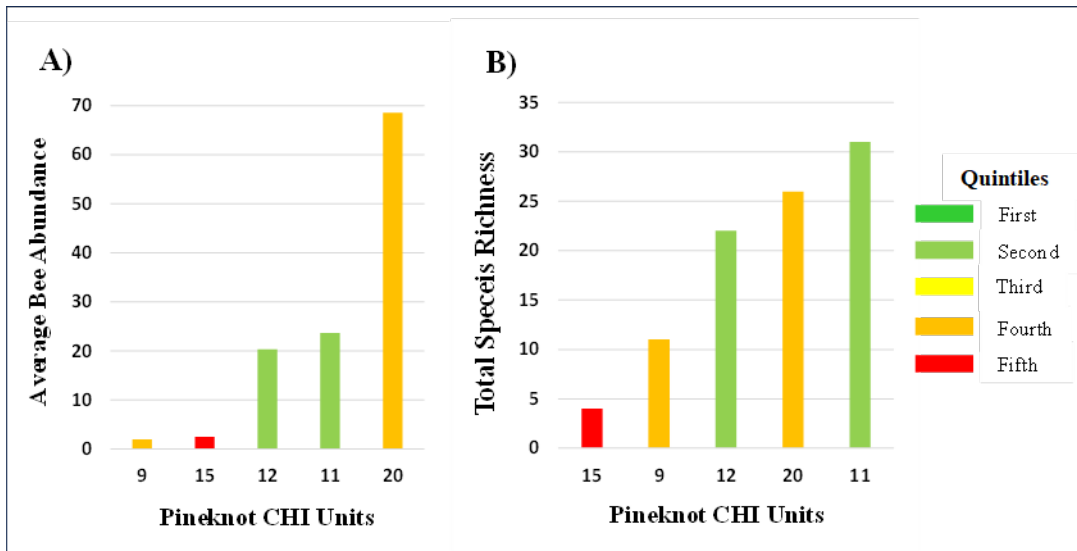


Figure 3. A) Average bee abundance and B) Species richness across five sampling units in Pineknott project area. A range of site conditions were included with CHI scores in the top, fourth, and fifth quintiles.

While preliminary, these results show that a key factor in pollinator abundance is effective flowering potential, which requires management of sunlight conditions. Although not typically part of silvicultural prescriptions, the mechanical creation of openings may be considered for future protocol.

A complete summary report “Monitoring the Ecological Response to Restoration Treatments in the Missouri Pine-Oak Woodlands Restoration Project of the Mark Twain National Forest” prepared in collaboration with Missouri Department of Conservation and the Northern Research Station is attached. A more formal publication of the CHI process is expected soon.

10. Conclusion

Describe any reasons that the FY 2023 annual report does not reflect your proposal or work plan. Are there expected changes to your FY 2023 plans you would like to highlight? Proceeding as planned. Progressing slower than expected with invasive weed treatments due to a lack of capacity with the Scenic River Invasive Species Partnership.

Optional Prompts

FY 2023 Additional Accomplishment Narrative and/or Lessons Learned Highlights

Media Recap

Fire Science Interpretive Signs: Cane Ridge Pinery - Oak Fire Science

<https://www.ksmu.org/post/dozens-more-brown-headed-nuthatches-reintroduced-missouri#stream/0>

<https://www.allaboutbirds.org/news/brown-headed-nuthatches-return-to-missouris-ozark-mountains-after-100-years/>

<https://mdc.mo.gov/magazines/conmag/2021-04/squeak-back>

U.S. Forest Service - Mark Twain National Forest | Facebook

Northern Research on Twitter: "Meet super scientist Frank R. Thompson, a research wildlife biologist with a passion for conservation of songbirds and other wildlife. <https://t.co/IOloIgg5ko> <https://t.co/hybNlvxohw>" / Twitter

<https://www.facebook.com/fsresearch/videos/353039813271013/>

Signatures

Recommended by (Project Coordinator(s)): /s/ Brian Davidson

Approved by (Forest Supervisor(s)): /s/ Michael A. Crump

Draft reviewed by (collaborative representative): /s/Nate Muenks, MDC Natural Resource Planning Section Chief

Attachment: CFLRP Common Monitoring Strategy Core Questions

Please refer to summary report “Monitoring the Ecological Response to Restoration Treatments in the Missouri Pine-Oak Woodlands Restoration Project of the Mark Twain National Forest” prepared in collaboration with Missouri Department of Conservation and the Northern Research Station is attached.

The 2022 cohort will complete the Common Monitoring Strategy questions in FY23. The 2022 cohort includes:

Lakeview, Missouri Pine Oak Woodlands, North Yuba, North Central Washington, Northeast Washington, Rio Chama, Rogue Basin, Shortleaf Bluestem, Southern Blues, Southwest Colorado, Western Klamath, Zuni

2021 funded projects (Deschutes, Dinkey, Northern Blues) will only need to address the annual questions (Q1, Q5, Q7, Q10, Q11, Q13). For CFLRP projects awarded (or extended) in FY23, the Attachment is NOT required. However, please note it will be required in FY24.

The CFLRP Common Monitoring Strategy is designed to reflect lessons learned from the first ten years of the program, expand monitoring capacity, and improve landscape-scale monitoring. It is intended to strike a balance between standardization and local flexibility and to be responsive to feedback that more guidance and capacity are needed. Questions are standardized nationally and indicators are standardized regionally. Many CFLRP projects have been implementing restoration treatments and monitoring progress prior to the Common Monitoring Strategy. This effort may not capture the progress of every project over its lifetime but provides an opportunity for all projects to take a step together in a unified monitoring approach.

- Question 1: “What is the reduction in fuel hazard based on our treatments?”
- Question 2: “What is the effect of the treatments on moving the forest landscape toward a more sustainable condition?”
- Question 3: “What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLRP project area”
- Question 4: “What is the status and trend of watershed conditions in the CFLR area, with a focus on the physical and biological conditions that support key soil, hydrologic and aquatic processes?”
- Question 5: “What is the trend in invasive species within the CFLRP project area?”
- Question 6: “How has the social and economic context changed, if at all?”
- Question 7: “How have CFLRP activities supported local jobs and labor income?”
- Question 8: “How do sales, contracts, and agreements associated with the CFLRP affect local communities?”
- Question 9: “Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?”
- Question 10: “Did CFLRP increase economic utilization of restoration byproducts?”
- Question 11: “Who is involved in the collaborative and if/how does that change over time?”
- Question 12: “How well is CFLRP encouraging an effective and meaningful collaborative approach?”
- Question 13: “If and to what extent have CFLRP investments attracted partner investments across the landscapes?”

The tables in the section below are copy/pasted from the suggested monitoring tracking templates to help organize data across CFLRP projects. Adapt the reporting tables as needed to align with regional monitoring indicators.

**Monitoring Question #1: “What is the reduction in fuel hazard based on our treatments?”
(Reported Annually)**

For detailed guidance, training, and resources, see corresponding reporting template [here](#). Use it to respond to the following prompts:

Table 1. Fire intensity (predicted flame lengths) from IFTDSS

IFTDSS Auto-97 th percentile flame length output	1 - 4 ft. flame lengths	>4 - 8 ft. flame lengths	>8 - 11 ft. flame lengths	>11 - 25 ft. flame lengths	>25 ft. flame lengths
Initial landscape model (Baseline under CMS)	517,789	49,343	5,477	4,868	401
Area treated in FY22	14,879	2,304	4	0	0

- **Briefly describe monitoring results in table above – include an interpretation of the data provided and whether the indicator is trending toward or away from desired conditions for your landscape.** If the data above does not accurately reflect fire and fuel hazard on your landscape please note and provide context. While generally smaller flame lengths are desirable, this isn’t the case in all ecosystems – please note if this applies. Our expectations are to reduce the adverse effects of fire on the landscape by reducing the fuel loading and change the fuel source. To describe a change in fuel source would converting a completely woody leaf litter fuel bed towards a mixed grass/woody/leaf fuel bed. The data is representative of the fire intensity of a surface fire on a moderate to high fire day in the current and future fuel type. Our plans is to manage for fire in lighter fuel types compose of mostly finer fuels. The other measurables related to fire intensity that are not recorded is energy (heat) release and residential time that should be considered when it comes to fire effects.

Table 2. Crown fire activity from IFTDSS

N/A

- **Briefly describe monitoring results in table above – include an interpretation of the data provided, and whether the indicator is trending toward or away from desired conditions for your landscape.** If the data above does not accurately reflect fire and fuel hazard on your landscape please note and provide context.
- **Does your CFLRP project have additional hazardous-fuels related monitoring results to summarize and interpret?** If so, please provide that here.
- **Based on the information in this section, (and any other relevant monitoring information and discussion), what (if any) actions or changes are you considering?**

Monitoring Question #2: “What is the effect of the treatments on moving the forest landscape toward a more sustainable condition?” (Reporting frequency determined by regional indicator)

For detailed guidance, training, and resources, see corresponding reporting template [here](#). Use it to respond to the following prompts:

Regions have standardized on one of the four following metrics to address Indicator 1 for ecological departure. For your region's chosen metric, please insert the matching table that corresponds with your indicator from the reporting template (abbreviated examples below).

Please refer to summary report "Monitoring the Ecological Response to Restoration Treatments in the Missouri Pine-Oak Woodlands Restoration Project of the Mark Twain National Forest" prepared in collaboration with Missouri Department of Conservation and the Northern Research Station. We are currently determining how to use the results of this monitoring to answer this question.

A total of 2,457 acres across 59 sampling units were sampled within the MOPWR footprint. Based on vegetation structure and composition, number of fires, soil conditions, and the scoring profile of sampling units in the top two quintiles, it can be reasonably stated that restoration treatments in those areas have been successfully moved from FRCC 3 to FRCC 2 (LANDFIRE 2023). Sampling units from the lower two quintiles are still in FRCC 3, and these areas have received no or little restoration treatments. Sampling units from the middle quintile are units that are currently transitioning from FRCC 3 to FRCC 2.

These samples represent a modern-day reference point and provide a side-by-side comparison of the range of site conditions we believe is currently achievable. Whether this subsample of acreage within MOPWR is indicative of conditions on other project areas, including those of the MTNF, MDC, and Pioneer Forest, is unclear. A goal of future work will be to determine the appropriate CHI sample size to adequately characterize restoration effort at project and MOPWR scales.

It is important to verify whether these management-based changes can be considered restoration of reference condition in Ozark pine-oak woodlands, and if such reference conditions are even attainable. U.S. Forest Service distinguishes ecological restoration from functional restoration as described below (USFS 2012, 2016):

"Ecological restoration typically focuses on recreating the ecosystem conditions that were present prior to European influences. However, some ecosystems may have been altered to such an extent that reestablishing pre-European conditions may be ecologically or economically infeasible. In such circumstances, management goals and activities should create functioning ecosystems in the context of changing conditions through the process called functional restoration." (USFS 2016)

"Functional restoration focuses on the underlying processes that may be degraded, regardless of the structural condition of the ecosystem. Functionally restored ecosystems may have a different structure and composition than the historical reference condition. As contrasted with ecological restoration that tends to seek historical reference condition, the functional restoration focuses on the dynamic processes that drive structural and compositional patterns." (USFS 2012)

It is evident that restoration treatments conducted by the MTNF, MDC, and Pioneer Forest in the MOPWR landscape are helping to restore a functional ecosystem. Focal bird and bee species are responding positively to the treatments. Ground cover of native plants and key indicator groups have increased. The remaining overstory stocks of shortleaf pine and white oak species have been released to grow with less competition, which should increase drought resiliency based on both lower stocking and better adapted species remaining in the stands. This will assist with climate change resilience. Treated stands with high CHI scores are less likely to burn as severely during wildfires compared to dense, overstocked stands. The treated stands may burn more readily (i.e., contain more fine fuels), but will have lower intensity overall, versus stands that are overstocked and drought-stressed, leaving them susceptible to overstory mortality. The restored stands should also experience less soil sterilization, as fuel loads are abated. In addition, the treated stands will be less susceptible to southern pine beetle (*Dendroctonus frontalis*), a potentially emerging threat to Ozark shortleaf pine-oak sites (USFS 2022).

Based on field experiences and discussions with resource managers and other ecologists, the authors wonder if ecological restoration (as defined) is achievable in the MOPWR landscape. In terms of returning stands back to FRCC 1,

at this time, we believe that the CHI scores that fall within the 1st quintile have enough of the intact key ecosystem components to say that they are FRCC1. Within sampling units, only small patches (typically three acres or less) had mature pine-oak canopies, ideal midstory and understory structure, and requisite cover of matrix and conservative ground flora; described in Table 1 and Nelson (2010). It is currently an open question whether present management regimes in MOPWR can achieve true reference conditions across large landscapes. Various historic land uses occurred between 1880 and 1930 - exploitative logging, intense slash fires, cultivation attempts, and open range grazing resulted in many areas of this region being heavily impacted and altered (Cunningham 2007). This land use history precludes the attainment of reference conditions throughout much of the MOPWR area. However, restoration treatments can and continue to improve the functionality of this ecosystem, while providing goods and services with biologic, economic, and social benefits.

Further discussions are needed on the next steps in restoration treatments. Questions remain as to how to combat the problems associated with super-canopies of oak/hickory sprouts and overgrowth of sumac and blackberry, all of which may inhibit return to reference conditions. NNIS have gained limited ground within these treatment units, and in comparison to surrounding regions, the Ozarks in general (The Nature Conservancy 2003). Continued effort will be needed to maintain this status, and it should be fully expected that NNIS will continue to become problematic as climatic changes and additional land development occur.

QUINTILE	SAMPLING UNIT	BURN	THIN	SCORE	RANK	MAT-SPP	CONS-SPP	F-M	GROUND	SAP-M	SEED-M	RUB-M	% BA PINE	% BA WO	CLOSE	STOCK	FRCC	
1st	Chilton Creek	10	17	N	66	1	72	23	25-50	32	25-May	5-25*	1-5*	26-50	> 75	55*	48*	FRCC1
	Pineknott	12	6	Y	66	1	30	14	25-50	32	25-May	25-50	25-50	51-75*	51-75*	76	76	FRCC1
	Chilton Creek	1	7	N	65	3	70	24	25-50	31	1-5*	25-50	25-May	25-Nov	25-Nov	72*	55*	FRCC1
	Pineknott	45	6	Y	65	3	70	19	25-50	32	25-May	25-50	1-5*	51-75*	51-75*	67*	57*	FRCC1
	Chilton Creek	3	7	N	64	5	72	22	50-75*	31	25-May	25-50	25-May	25-Nov	25-Nov	58*	40*	FRCC1
	Chilton Creek	9	17	N	63	6	71	19	25-50	29	25-May	5-25*	1-5*	25-Nov	26-50*	71*	40*	FRCC1
	Pineknott	34	7	Y	62	7	64	18	50-75*	29	1-5*	50-75	25-May	> 75	26-50*	57*	60*	FRCC1
	Pineknott	11	7	Y	60	8	68	22	50-75*	33	25-May	50-75	25-May	> 75	26-50*	50*	53*	FRCC1
	Chilton Creek	5	7	N	59	9	63	16	25-50	25	25-May	25-50	1-5*	25-Nov	25-Nov	64*	73*	FRCC1
	Pineknott	43	7	Y	59	9	61	13	25-50	31	25-May	5-25*	25-May	25-Nov	> 76	73*	45*	FRCC1
2nd	Pineknott	35	7	Y	59	9	62	22	25-50	27	25-May	50-75	25-May	51-75*	26-50*	72*	64*	FRCC1
	Chilton Creek	15	7	N	59	9	65	20	50-75*	32	25-50	25-50	25-May	25-Nov	25-Nov	64*	103	FRCC1
	Chilton Creek	7	17	N	58	13	57	15	25-50	25	25-May	25-50	1-5*	0-10	26-50*	77	62*	FRCC2
	Pineknott	26	6	Y	58	13	62	14	25-May	26	25-May	25-50	1-5*	26-50	51-75*	80	59*	FRCC2
	Chilton Creek	16	17	N	58	13	61	17	50-75*	31	25-May	5-Jan	25-May	25-Nov	26-50*	78	84	FRCC2
	Fremont	1	1	N	57	16	66	20	25-50	31	50-75	5-25*	1-5*	> 75	25-Nov	87	85	FRCC2
	Pineknott	39	6	Y	56	17	56	13	25-May	23	25-May	25-50	1-5*	51-75*	51-75*	76	59*	FRCC2
	Chilton Creek	8	17	N	56	17	53	15	25-50	25	25-May	25-50	25-May	26-50	25-Nov	62*	64*	FRCC2
	Pineknott	32	6	Y	56	17	63	16	25-50	24	1-5*	25-50	25-May	25-Nov	51-75*	73*	72*	FRCC2
	Pioneer Forest	-	4	N	54	20	34	17	25-May	34	25-50	25-50	50-75	> 76	> 76	87	56*	FRCC2
3rd	Pineknott	22	6	Y	54	20	68	16	25-May	28	25-50	5-25*	1-5*	26-50	> 76	78	94	FRCC2
	Chilton Creek	11	7	N	53	22	55	12	25-50	26	25-May	25-50	1-5*	25-Nov	26-50*	67*	81	FRCC2
	Pineknott	10	6	N	52	23	29	10	50-75*	26	25-May	25-50	50-75	> 75	> 76	29	29	FRCC2
	Pineknott	8	6	N	52	23	33	9	25-50	26	25-May	25-50	-	> 75	> 76	60*	45*	FRCC2
	Pineknott	36	4	Y	51	25	54	14	25-May	24	25-May	5-25*	1-5*	0-10	26-50*	75*	99	FRCC2
	Pineknott	14W	6	Y	50	26	67	18	25-50	25	25-May	25-50	25-May	51-75*	51-75*	82	73*	FRCC2
	Pineknott	25	6	Y	49	27	54	12	25-May	21	25-May	5-25*	1-5*	0-10	51-75*	77	76	FRCC2
	Chilton Creek	2	7	N	48	28	59	14	25-50	29	25-May	25-50	25-50	0-10	25-Nov	45*	61*	FRCC2
	Pineknott	13	6	N	48	28	61	20	75-95	26	25-50	25-50	25-50	> 75	0-10	50*	43*	FRCC2
	Pineknott	14E	6	Y	48	28	63	13	25-May	24	25-May	50-75	25-50	26-50	25-Nov	78	69*	FRCC2
4th	Chilton Creek	6	7	N	48	28	50	9	25-50	23	50-75	25-50	1-5*	0-10	26-50*	75*	73*	FRCC2
	Cane Ridge	34	7	Y	47	32	59	22	25-50	30	50-75	25-50	25-May	> 75	0-10	73*	29	FRCC2
	Chilton Creek	13	7	N	47	32	56	8	25-50	21	25-May	25-50	25-May	0-10	26-50*	75*	81	FRCC2
	Rocky Creek	6a	6	Y	46	34	26	8	25-May	22	50-75	25-50	25-50	26-50	51-75*	-	68*	FRCC2
	Cane Ridge	33	5	Y	46	34	58	16	50-75*	29	50-75	25-50	25-50	> 75	25-Nov	83	53*	FRCC2
	Pineknott	28	4	N	45	36	42	12	25-May	20	25-May	5-25*	25-May	26-50	> 76	68*	67*	FRCC2
	Pineknott	21	6	Y	44	37	32	12	< 1	22	25-May	25-50	25-May	26-50	51-75*	67*	66*	FRCC3
	Cane Ridge	35	3	Y	44	37	50	15	25-May	21	25-May	25-50	25-May	26-50	51-75*	68*	84	FRCC3
	Rocky Creek	7	5	Y	43	39	29	9	25-May	24	25-May	5-25*	50-75	51-75*	51-75*	87	56*	FRCC3
	Pineknott	44	4	N	42	40	42	13	25-May	19	25-50	25-50	25-May	26-50	26-50*	75*	75*	FRCC3
5th	Fremont	4	1	N	42	40	48	6	25-May	19	50-75	5-25*	1-5*	> 75	0-10	86	89	FRCC3
	Pineknott	20	7	N	41	42	23	10	25-50	23	25-50	5-25*	50-75	> 75	0-10	6	6	FRCC3
	Chilton Creek	12	17	N	41	42	45	10	25-May	18	25-50	25-50	25-May	0-10	51-75*	81	76	FRCC3
	Pineknott	37	4	Y	39	44	63	11	25-May	18	25-May	50-75	25-50	0-10	26-50*	15	15	FRCC3
	Pineknott	19	7	Y	39	44	15	7	25-50	24	25-May	5-25*	50-75	> 75	0-10	77	90	FRCC3
	Pineknott	9	1	Y	38	46	23	8	25-May	19	25-50	25-50	-	26-50	26-50*	82	82	FRCC3
	Rocky Creek	5	4	Y	38	46	31	8	25-May	23	75-95	25-50	25-50	> 75	51-75*	-	44*	FRCC3
	Pineknott	31	7	N	37	48	40	8	25-May	18	-	5-25*	25-May	-	26-50*	75*	85	FRCC3
	Pineknott	40	0	Y	36	49	36	4	5-Jan	14	25-50	5-25*	25-May	> 75	51-75*	81	72*	FRCC3
	Pineknott	29	0	Y	36	49	39	4	5-Jan	12	25-50	5-25*	1-5*	26-50	26-50*	78	70*	FRCC3
5th	Pineknott	24	0	Y	34	51	30	7	5-Jan	15	25-50	5-25*	25-May	> 75	26-50*	80	88	FRCC3
	Fremont	7	1	N	33	52	41	6	5-Jan	15	50-75	5-25*	25-May	25-Nov	26-50*	87	75*	FRCC3
	Pineknott	41	0	Y	32	53	41	5	5-Jan	13	25-50	25-50	25-May	0-10	0-10	77	59*	FRCC3
	Pineknott	47	2	Y	32	53	40	4	5-Jan	13	50-75	5-25*	1-5*	> 75	51-75*	78	93	FRCC3
	Rocky Creek	6b	6	Y	32	53	25	7	25-May	20	50-75	25-50	25-50	> 75	51-75*	93	102	FRCC3
	Pineknott	30	6	Y	31	56	37	5	5-Jan	15	25-50	5-Jan	25-May	26-50	51-75*	81	95	FRCC3
	Pineknott	27	4	N	28	57	49	10	25-May	21	75-95	25-50	50-75	51-75*	51-75*	91	51*	FRCC3
	Pineknott	23	0	Y	28	57	32	4	< 1	13	75-95	5-25*	25-May	> 75	25-Nov	79	65*	FRCC3
	Pineknott	15	0	Y	26	59	25	5	5-Jan	13	75-95	75-95	1-5*	> 75	25-Nov	74*	111	FRCC3

Table 2: SCORE: Total CHI score, BURN: Burns within the last 20 years, THIN: mechanically thinned or not, MAT-SPP: matrix species "hits" along transect meanders, CONS-SPP: conservative species "hits" along transect meanders, G - M: Graminoid cover, F - M: Forb cover, SAP-M: Sapling cover, SEED-M: seedling cover, RUB-M: Rubus and Rhus cover, GROUND: Ground flora (section II) score, % BA PINE: percent of total basal area in shortleaf pine, % BA WO: percent of total basal area in white or post oak, CLOSE: Average canopy closure of unit, STOCK: Percent stand stocking of unit.

- Briefly summarize how your landscape has departed from historic ecological conditions including disturbance.
- Briefly describe monitoring results – include an interpretation of the data provided above, and whether the indicator is trending toward or away from desired conditions for your landscape (including resiliency to future disturbances and climate projections). If the data above does not accurately reflect condition on your landscape, please note and provide context.

If Region is reporting on indicator 2 (acres burned by wildfire and by prescribed burning annually), fill in this table:

Report in acres and % of total project area	Fire Regime I	Fire Regime II	Fire Regime III	Fire Regime IV	Fire Regime V
Suppression only fires	243 (0.1%)				
Fires managed for multiple resource objectives	0				
Prescribed Fire	43,998 (35%)				
Total Acres Burned	44,241 (35%)				
Natural Range of Variation (NRV)					
Departure					

- Briefly summarize how your landscape has departed from historic ecological conditions including disturbance.
- Briefly describe monitoring results – include an interpretation of the data provided above, and whether the indicator is trending toward or away from desired conditions for your landscape (including resiliency to future disturbances and climate projections). If the data above does not accurately reflect condition on your landscape, please note and provide context.

Monitoring Questions #3: “What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLRP project area?” (Reporting frequency determined by Regional indicator)

If reporting on indicator 3 (wildlife populations and/or diversity indicators), fill in this table:

Wildlife Species Name(s)	Indicator and Unit of Measure	Target Range	Value in Initial Year of CMS*	Value in Next Reporting Year of CMS* N/A in 2022	Desired or Undesired Change? N/A in 2022	Percent Change N/A in 2022	Acres of Habitat Treated to Improve this Indicator
1. Brown-headed nuthatch	Number of birds on project area		0 prior to Aug 2020	54/20	TBD	>100	67,192

2. Eastern Whip-poor-will	Total birds detected on 385 survey points		534 in 2014-2015	N/A	TBD		
3. Chuck-wills-widow	Total birds detected on 385 survey points		186 in 2014-2015	N/A	TBD		
4. Blue-winged warbler	Total detections on 247 points		5 in 2013	19 in 2020	TBD	280.0	67,192
5. Eastern towhee	Total detections on 247 points		38 in 2013	34 in 2020	TBD	-10.5	67,192
6. Prairie warbler	Total detections on 247 points		73 in 2013	77 in 2020	TBD	5.5	67,192
7. Red-headed woodpecker	Total detections on 247 points		50 in 2013	46 in 2020	TBD	-8.0	
8. Summer tanager	Total detections on 247 points		50 in 2013	66 in 2020	TBD	32.0	67,192
9. Yellow-breasted chat	Total detections on 247 points		145 in 2013	104 in 2020	TBD	-28.3	67,192

Acres of Habitat Treated to Improve this Indicator – Is subject to change as further refinement is completed

For the table or table(s) above:

- **Briefly interpret the monitoring results in the table above, including whether the indicator is trending toward or away from desired conditions for your landscape.** If the data above does not accurately reflect conditions on your landscape, please note that and provide context.

1) Prior to August 2020 there were no brown-headed nuthatches in the project area. In August 2020 and 2021 46 and 56 birds, respectively, were translocated here. A population projection model based on observed survival and reproduction rates indicates there are likely 54 birds alive in the area. The number of birds known alive on project area based on resighting is approximately 20 in 2022.

2) Eastern Whip-poor-will surveys conducted in 2014-2015. Follow up survey will be conducted in 2023-2024. Habitat analyses based on 2014-2015 surveys indicates positive response to burning and thinning (see Thompson, F. R. III, M. C. Roach, and T. W. Bonnot. 2022. Woodland restoration and forest structure affect nightjar abundance in the Ozark Highlands. Journal of Wildlife Management 1–15. <https://doi.org/10.1002/jwmg.22170>).

3) Chuck-wills-widow surveys conducted in 2014-2015. Follow up survey will be conducted in 2023-2024. Habitat analyses based on 2014-2015 surveys indicates positive response to burning and thinning (see Thompson, F. R. III, M. C. Roach, and T. W. Bonnot. 2022. Woodland restoration and forest structure affect nightjar abundance in the Ozark Highlands. Journal of Wildlife Management 1–15. <https://doi.org/10.1002/jwmg.22170>).

4-9) Reported here are total numbers of detections from 247 survey points across the project area which can be confounded by year and observer effects and whether a point received management or not. Furthermore, regional trends for the state and region are negative for these species, and this needs to be considered in analyses. Ongoing analyses are underway to appropriately analyze these data and report trends and response to restoration efforts. Roach et al. (2019) reported on these data for 2013-2015 and showed positive responses to fire and/or thinning for all these species (Roach, Melissa C.; Thompson, Frank R.; Jones-Farrand, Todd. 2019. Effects of pine-oak woodland restoration on breeding bird densities in the Ozark-Ouachita Interior Highlands. Forest Ecology and Management. 437: 443-459. <https://doi.org/10.1016/j.foreco.2018.12.057>).

Acres of Habitat Treated to Improve this Indicator

- **Does your CFLRP project have additional wildlife-related monitoring results to summarize and interpret?** If so, please provide that here. Not Currently.

Monitoring Question #4: “What is the status and trend of watershed conditions in the CFLRP area?” (Reported every 5 years)

For detailed guidance, training, and resources, see corresponding reporting template [here](#). Use it to respond to the following prompts:

Summary of Watershed Condition Scores for the priority HUC12 watersheds within CFLRP boundary:

Priority Subwatershed Name and 12-digit HUC	Affected by Treatment, Disturbance Events, or Both?	Date Before Treatment and/or Disturbance Event	Watershed Condition Score in Initial Year of CMS*
Headwaters Big Barren Creek - 110100080605	Commercial Harvest = 3,413 Non-Commercial Silviculture =2,193 Prescribed Fire = 55,697 acers (Initial and maintenance), Road Closures = 30 miles	2011 – 2022 (past CFLRP treatment activities)	Functioning Properly (1.5)
Big Barren Creek - 110100080606	Non-commercial Silviculture = 449 Commercial Harvest = 2,512 Prescribed Fire = 7,173	2011-2022 (past CFLRP treatment activities)	Functioning at Risk (1.8)

Watershed Condition Score averaged across all affected identified subwatersheds within CFLRP boundary:

Aquatic Physical (Weighted 30%)

Indicator Number	Indicator Name	Avg. Indicator Value	Date
1	Water Quality	1	2022
2	Water Quantity	2.5	2022
3	Aquatic Habitat	2	2022

Aquatic Biological (Weighted 30%)

4	Aquatic Biota	1	2022
5	Riparian/Wetland Vegetation	2	2022

Terrestrial Physical (Weighted 30%)

6	Roads & Trails	2	2022
7	Soils	1	2022

Terrestrial Biological (Weighted 10%)

8	Fire Regime or Wildfire	2.5	2022
9	Forest Cover	1	2022
10	Rangeland Vegetation	2	2022
11	Terrestrial Invasive Species	2	2022
12	Forest Health	1	2022
Avg. Watershed Condition Score		1.8	

- **Briefly interpret the monitoring results in the table above, including whether the indicator is trending toward or away from desired conditions for your landscape.** If the data above does not accurately reflect watershed condition on your landscape, please note that and provide context.

There are two priority watersheds within the CFLRP project area: Big Barren Creek (26,321 acres, 70% of Watershed) and Headwaters of Big Barren Creek (26,321 acres, 89% of Watershed). Both have a watershed condition rating of 1 – Functioning. Water Quality is Functioning at Risk due to past land management practices and current agricultural practices. Headwaters Big Barren Creek watershed condition rating remained the same with a score of 1.5. The watershed condition rating is currently 1.8, a decrease slightly compared to the 2010 assessment rating of 1.6. These changes are due collecting and analyzing on the ground conditions. At the time of the 2010 assessment was no information collected on channel condition and aquatic species presence. Please refer to the FY2021 Watershed Restoration Action Plan for more details.

- **Does your CFLRP project have additional watershed condition-related monitoring results to summarize and interpret?** If so, please provide that here.

Due to public concerns that prescribed burning was negatively impacting water quality through increased soil erosion while also increasing flood frequency due to the removal of leaf litter and ground vegetation cover, the MTNF partnered with Missouri State University’s Ozark Environmental and Water Resources Institute (OEWRI) to conduct monitoring studies which assessed soil, sediment, channel, and flooding conditions to better understand the effects of forest management on water quality and flooding. The 2015, 2016 and 2018 monitoring showed no negative effects of prescribed burning. Overall, results of the monitoring studies support the conclusion that prescribed fire does not negatively affect soil and vegetation characteristics that effect runoff rates. In some cases, burned areas had soil organic matter and bulk density values that should result in higher rates of infiltration than unburned forest soils. Results of this monitoring study can be found at:

<https://oewri.missouristate.edu/big-barren-creek-watershed-monitoring.htm>

Residents concern regarding flooding in the Big Barren watershed because of MTNF management activities. OEWRI completed a study that analyzed the historical rainfall in the Big Barren Creek Watershed from 1955-2015. From 2005-2014, total annual rainfall increased about 7% over the previous 20 years (1985-2004). These data suggest over the last 10 years the Big Barren Creek watershed has experienced a relatively wet period compared to the previous 50 years. Analysis of the 60-year rainfall record in 5-year intervals shows that high magnitude rainfall events appear to be occurring more frequently over the last decade. Intense rainfall events have increased in frequency over the past decade as shown in other studies in the Midwest. It is highly probable that more intense storms and climate change in general is contributing to the hydrologic problems observed in the Big Barren Creek watershed including the increased frequency of flooding. Results of this study can be found at https://oewri.missouristate.edu/Assets/OEWRI/Final_Report_2016_BigBarrenCreek_Rainfall.pdf

- Does your CFLRP project have additional watershed condition-related monitoring results to summarize and interpret? If so, please provide that here.

Monitoring Question #5: “What is the trend in invasive species within the CFLRP project area?” (Reported Annually)

For detailed guidance, training, and resources, see corresponding reporting template [here](#). Use it to respond to the following prompts:

Treatment data for priority invasive species:

Common Name	Treatment Action	Acres Treated ¹	Acres Monitored	Avg. “Percent Efficacy”	Acres Restored ²	Response of Desirable Species ³
Sericea lespedeza, Japanese honeysuckle, beefsteak plant, Japanese stiltgrass	Herbicide - Foliar	48.3	15	85	48.3	Native weedy species and beefsteak response with Sericea treatment. Desirable species response is low along ROW.
Feral Hog 154 hogs removed on NFS lands	Traps/Shooting	772	47,160 acres HUC12 Monitored	Feral Hog 154 hogs removed on NFS lands	Traps/Shooting	772

¹“Treated” is defined as prevented, controlled or eradicated.

²Agency performance accomplishment code INVPLT-INVSpe-REST-FED-AC, which is calculated in FACTS.

³“Desirable Species” includes everything that is not an undesirable species or bare ground. If not monitored, write N/A.

Please insert table 2 from the reporting template if you are using field plots.

For reporting on plot-based field monitoring, please include a summary of the results here:

- **Briefly interpret the monitoring results in the table above, including whether the indicator is trending toward or away from desired conditions for your landscape.** The most serious invasive species locally are sericea lespedeza, beefstake, callery pear, spotted knapweed and Japanese stiltgrass. These are pervasive along roadsides throughout the project area and are poised to spread throughout Ozark woodlands in the absence of the highly competitive and resilient grass-forb groundcover associated with higher-quality restored pine and oak woodlands. Since 2012, CFLRP funding has allowed the Forest to completed 3,146 acres of invasive plant inventory and treated 5,489 acres. In FY2023 the Forest is updating efficacy monitoring and invasive plant inventory.
- **Does your CFLRP project have additional invasives-related monitoring results to summarize and interpret? No**

The following questions apply across the topics addressed across Questions 1-5:

- Are there accomplishments towards long-term goals which may not be reflected in short-term monitoring? Are there short-term treatments that work towards long-term goals which may be reflected adversely in short-term monitoring? Briefly summarize short- & long-term tradeoffs of your landscape treatments and goals.

Monitoring Questions #6: “How has the social and economic context changed, if at all?” (Reported every 5 years)

Describe the current social and economic context for your CFLRP landscape. For detailed guidance, training, and resources, see corresponding reporting template [here](#). Use it to respond to the following prompts:

Indicators	Response for Initial Year of Common Monitoring Strategy	Notes (Optional)
“Population” most recent year available (tab 1, Forest Service report)	99,050	Ripley, Shannon, Wayne, Reynolds, Butler, and Oregon Counties
“Percent of total, race & ethnicity” most recent year available (tab 11, Forest Service report)	White alone – 93,234 Black or African American - 2,395 American Indian - 782 Hispanic ethnicity - 2,032 Non-Hispanic Ethnicity - 98,207	Ripley, Shannon, Wayne, Reynolds, Butler, and Oregon Counties
“Unemployment rate” most recent year available (tab 1, Forest Service report)	6.5%	Ripley, Shannon, Wayne, Reynolds, Butler, and Oregon Counties
“Per capita income” most recent year available (tab 1, Forest Service report)	\$38,648	Ripley, Shannon, Wayne, Reynolds, Butler and Oregon Counties
“Wildfire Exposure, % of Total, Homes” most recent year available (see Wildfire Risk report)	Homes Directly Exposed – 73.7% Homes Indirectly Exposed – 24.10% Homes Not Exposed – 2.1%	Ripley, Shannon, Wayne, Reynolds, Butler, and

		Oregon Counties
Add in additional indicators used as needed		

- **Provide a brief, narrative context for the data provided above, including any other key socioeconomic conditions to highlight for your landscape.** If the data above does not accurately reflect socioeconomic conditions in/around your landscape please note and provide context.
- **Would you expect CFLRP activities to directly or indirectly impact any of these social and/or economic conditions?** To respond to stakeholders’ concerns, the Mark Twain National Forest commissioned an economic analysis of the project. The results showed that the \$20 million investment spanning the Missouri Pine-Oak Woodlands Restoration Project 2012 to 2019 was expected to support 138 jobs annually and generate an eight-year total of \$34 million in labor income. Moreover, there would be an additional \$10 million in value added as workers spent wages on food, entertainment, fuel, housing, and other items that would help the expenditures on forest management to ripple through the local economy (Song and Aguilar 2015). The net result was approximately \$2.20 of local economic activity for every dollar invested in the project.
- **Does your CFLRP project have additional socioeconomic monitoring results to summarize and interpret?** No.
- **Based on the information reported, (and any other relevant monitoring information and discussion), what (if any) actions or changes are you considering?** None, at this time.

(Monitoring Questions #7 & #8 covered earlier in annual report template)

Monitoring Questions #9 “Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?” (Reported every 5 years)

- Data will be provided to 2022 cohort projects to address this question in the FY23 report. If your CFLRP project has data available about the current timber harvest by county and/or product, the number of active processing facilities in the area, or other data about forest products infrastructure please provide here.

(Monitoring Questions #10 & #11 covered earlier in annual report template)

Monitoring Questions #12: “How well is CFLRP encouraging an effective and meaningful collaborative approach?” (Reported every 2-3 years)

Data will be provided to 2022 cohort projects to address this question in the FY23 report. For detailed guidance, training, and resources, see corresponding reporting template [here](#). Please upload your completed assessment summary provided by the Southwestern Ecological Restoration Institutes [here](#) and use it to respond to the prompts below:

- Reflecting on the summary provided, do you have any additional context for the results to share?
- Do you have any feedback about the assessment process?
- What have you done, or plan to do, in response to the challenges, needs, and recommendations identified in the collaboration assessment? Please provide up to 3 specific actions.

- What types of support or guidance do you need to address any of the challenges, needs, and recommendations identified in the collaboration assessment?

(Monitoring Question #13 covered earlier in annual report template)