



National Park Service Heartland Inventory and Monitoring Network Fire Ecology Annual Report Calendar Year 2021

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A. Summary

The fire ecology program for the Tallgrass Prairie ecoregion in Regions 3, 4, and 5 is a collaborative effort with the Heartland Inventory and Monitoring Network (HTLN). We completed our 13th year of fire ecology monitoring. There are seven park units within this Network in which fire effects data are collected by HTLN: Wilson's Creek National Battlefield (WICR), Tallgrass Prairie National Preserve (TAPR), Homestead National Monument of America (HOME), Pipestone National Monument (PIPE), Effigy Mounds National Monument (EFMO), Herbert Hoover National Historic Site (HEHO), and George Washington Carver National Monument (GWCA). We have also provided support to Fort Scott National Historic Site (FOSC).

Currently, there are no staff funded by the NPS fire program focused on serving these parks. The Inventory and Monitoring Network provided collateral duty staff via the Plant Ecologist and Botanist since 2016. The Plant Ecologist and Botanists primary roles are on vegetation monitoring projects which benefit from fire effects data and analysis. The current fire ecology data collection includes post-burn mapping at all 7 parks. Although in normal years, we participate in fire operations in the suite of HTLN fire ecology parks we have been unable to do so since the pandemic started.

We completed a variety of analysis and consultation projects over the last year. In 2021 we contributed to fire management plan revisions for TAPR, HOME, and PIPE. We also consulted with HEHO as they worked to revise their prairie management plan. We completed a manuscript describing our process for calculating time since fire from spatial data based on our vegetation monitoring sites. This report draft is in peer review. We made efforts to assist WICR with planning for cedar pile removal, but those efforts were not capitalized upon. We completed a report for GWCA which included interpretation of fire history at the monument. A report for the

prairies at WICR which also included fire ecology interpretation is making its way through the final publication process. A report draft for vegetation at TAPR including fire ecology interpretation is nearing completion as well. The Plant Ecologist also provided feedback on an early draft of a grazing plan for PERI.

In 2021 we were able to conduct our regular vegetation monitoring as well as assisting with bird habitat and invasive plant surveys at PERI. The sampling was one year later than prescribed as a result of the pandemic. We were able to accomplish the work via day-trips but were not able to work in any fuel monitoring because of limitations from the travel schedule.

In December, we traveled to HOME to prepare for summer 2022 monitoring. We number tagged the trees in our monitoring sites and recorded species and DBH. That will reduce error and the amount of effort needed at HOME in 2022. Over the course of the year, we've worked to update some of our field gear to increase consistency as well.

We maintained our role advising the Great Plains Fire Science Exchange via meeting attendance and consultation. We also assisted Missouri State University by providing a fire ecology workshop for their annual Green Leadership Academy for Diverse Ecosystems program. We also included students in our field sampling and office activities.

Table 1. Fire Effects Plot Workload (2021) and Total Plots Installed

Park	Monitoring Unit	Plot Type (FMH Forest/Brush/Grass plot, photo point, Rapid Assessment, CBI, etc.)	Pre-burn 2021	Immed. Post 2021	Postburn (1-20 yrs) 2021	Annual Total (2021)	Total Plots
Pea Ridge NMP*	Oak-hickory woods	I&M-plant community	0	2	5	7	7
Wilson's Creek NB	glades	Rare plant monitoring	0	0	826	826	826
Total			0	2	832	833	833

*Table describes plant community monitoring. At PERI, we also participated in bird habitat sampling: (N = 99) plots, and invasive plant monitoring (N = 400) cells in 2021. We have overlapping responsibility with the OZAR unit for monitoring.

Fire Ecology Staffing 2021

Staff are collateral during I&M staff. No fire division support monitoring that occurred in 2019. The table is inappropriate to categorize our work at this time. Two HTLN staff at CUVA are READ qualified and serve during wildfire severity. The Plant Ecologist is also READ qualified.

Table 3. 2021 Management Objectives and Monitoring Results

Monitoring Unit	Management Objective	Monitoring Results	Progress Towards Meeting Objectives	Year Analysis Completed (Range of Data [Yrs] Included in Analysis)
WICR-grassland areas	Reduce 1-hr fuels by 70% Reduce 10-hr fuels by 50%	Not sampled in 2019 (last burn)	Undetermined	No longer monitored
	Reduce canopy cover of eastern redcedar >1m by 40%.	None found in plots	Yes	2021 (2008-2020)
	Maintain native species richness to within 10% of 2003 level (120).	Gamma diversity= 94 species in 2020.	No	In press: Leis 2022
	Reduce woody plants in grassland areas.	No change over time. repeated measures ANOVA, $F = 0.856$, $df = 3,18$; $P = 0.485$	No	
	Reduce foliar cover of sericea lespedeza	7.9% (+/- 3.2 SE) in 2020	Yes	
WICR-Manley Woods	Reduce fuel loads	2019 fuel loading similar to 2017. For the two sites burned in 2019, fuels increased 3.8 tons/acre post burn.	No	2021 (2003-2020 in peer review)
	Recruit 125 seedlings/400 m ² (Gale et. al. 2004).	Regeneration about 20,000 stems/ha. Greater than 2003-2017	Yes	2021 (2003-2020 in peer review)
	Reduce eastern redcedar seedlings to:50 seedlings/400 m ²	Eastern redcedar seedlings 276 stems/ha in 2020	No	
GWCA	Reduce dead and down fuels (1 & 10 hour fuels) by 20-50%.	No current monitoring.		2015
	Encourage growth of native species by 5-10%.	Species richness similar through time.	No	2021 (Leis and Short 2021)
	Control and diminish exotic species by 5-10%.	Non native species were similar to baseline (2004) but below peak levels (2005-2012).	Undetermined	

TAPR	Maintain cover of the woody plant guild below 5%.	< 2%	YES	2021 (2002-2018 in peer review)
	Maintain high variability in visual obstruction.	Vertical structural diversity 9.83% (+/- 2.07 SD)	Undetermined	2019 (2001-2018 Peitz and Kull 2020)
	Maintain bare soil cover at 30-60%.	At preserve scale, bare soil meets threshold, but is in decline.	Yes at preserve scale. No for Red house pasture.	2021 (2002-2018 Leis and Morrison in preparation)
	Keep Kentucky bluegrass (<i>Poa pratensis</i>) abundance < 5 % (as measured in the permanent sampling sites)	< 1% cover	Yes	2021 (2002-2018 Leis and Morrison in preparation)
HOME	Maintain the diversity of native plant species at levels measured over the baseline period 1998-2002.	H' = 2.3 (+/- 0.2 SD)	Yes	1998-2017 (Leis 2019)
	Maintain shrubs and vines in the prairie at or near the minimum value recorded by the bird habitat data. Structural diversity index should also be <20%.	Undetermined.	Undetermined.	2009-2017 (Peitz et.al. 2019)
	Cool season exotics should be <10 % of prairie area (as measured by HTLN invasive project)	Undetermined	Undetermined.	2006-2017 (Young 2020)
HEHO	Increase diversity and cover of native grasses and forbs, while reducing exotic and invasive species	Forb cover increased, but grass cover decreased. Species richness increased. Exotic plant cover increased.	Diversity: Yes Exotic: No	Leis and Young 2018
	Reduce 1-hour grass litter > 70% immediate post-burn	Monitoring did not occur for the 2011 burn and no burn has occurred since then.	Undetermined	

PIPE	Maintain native shrub cover 1-5% in prairie	(2017: 2% remnant, 5% restored, 4% Sioux quartzite)	Undetermined	1998-2017 (Leis and Morrison 2020)
	In six years, reduce Kentucky bluegrass abundance of class 4 plots by half.	No monitoring has occurred since objective was written. 2017 invasive monitoring: 4.4-60.6% cover.	Undetermined	2006-2017 (Young 2020)
	Maintain H' in remnant and Sioux quartzite prairie and increase in restored prairie based on 2017 levels.	H' (2017) = Remnant 2.9, Sioux quartzite 2.8, restored 2.2	Undetermined	1998-2017 (Leis and Morrison 2020)
EFMO (goat prairie)	Fuel load reduction.	N1 and S1 were monitored in 2013 and 2014 respectively. Mean fuel load in N1 was 23.07 tons/acre (sd 20.1) which was within the range of variability of past monitoring events. S1 fuel load was 43.4 tons/acre (sd 28.3). This was the greatest loading we have recorded in any of the units over the years. Standard deviations indicate a large degree of fuel load variability between plots.	No	2013 (2005-2014)
	Restore species composition	Eastern redcedar and basswood increased while sugar maple and walnut decreased.	No	2001-2017 (Leis 2020)

B. Program Information

Table 4. Planning - 2021

Park	Does Park have written Desired Future Conditions? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans (not just 2021)	Assisted with how many BAER/BAR plans in 2021?
**Effigy Mounds NM	No*	2010 (Draft FMP never finalized)	1	0
**George Washington Carver NM	No*	Revised Rx burn plan objectives published 2017	0	0
**Herbert Hoover NHS	Yes (in RSS not FMP)		0	0
**Homestead NM of America	No (See Rohlfsmeyer for woodland)	Revised Rx burn plan objectives published 2021	0	0
**Pipestone NM	No	2021 (FMP revised 2021)	1	0
**Tallgrass Prairie Nat. Pres.	No	2021 FMP revision and burn plan objectives updated in 2021	1	0
**Wilson's Creek NB	Yes, see EA for CLR*	Burn plan objectives updated in 2017.	0	0

*Management targets rather than DFCs have been drafted in the NRCAs.

**All parks covered under Network monitoring protocols for fire ecology, plant communities, invasive plants, and bird habitat.

Table 5. Monitoring - 2021

Park	% 2021 Data Entered	% 2021 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored *	# BAER/BAR Treatments Monitored*
Effigy Mounds NM	NA	NA	0	0	0	0
Fort Scott NHS	NA	NA	0	0	0	0
George Washington Carver NM	NA	NA	0	0	0	0
Herbert Hoover NHS	NA	NA	0	0	0	0
Homestead NM of America	NA	NA	0	0	0	0
Pipestone NM	**100	**100	0	0	0	0
Tallgrass Prairie Nat. Pres.	**50	**50	0	0	0	0

* Number of treatment units with treatment effects monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring. n/a – no data collected or no monitoring required.

***Remote sensed mapping/fire history only. For TAPR data acquired, but not entered.*

Table 6. Communicating Results - 2021

Park	# of Project Monitoring Reports completed in 2021	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Effigy Mounds NM	0	0	0	Yes
George Washington Carver NM	1	1	0	
Fort Scott Historic Site	0	2	0	
Herbert Hoover NHS	0	2	1	
Homestead NM of America	0	1	1	
Pipestone NM	0	1	1	
Tallgrass Prairie Nat. Pres.	0**	1	1	

* This information will help to assess Minitab multi-user license needs. n/a – no new data to report/present

**Article published in *Frontiers for Young Minds* journal 2021 (Leis and Baldwin 2021).

JFSP Fire Science Exchange Networks – Please indicate if you participate in any Joint Fire Science Program Fire Science Exchange Networks, and if so which one(s).

Great Plains Fire Science Exchange—Ecologist serves as the NPS Advisor

Oak Woodlands and Forest Fire Science Consortium

Tallgrass Prairie Fire Science Exchange

Table 7. Research - 2021

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2021	# of Proposals Funded in 2021	# of Research Projects Supported in 2021*	Additional Comments
Effigy Mounds NM	No	0	0	0	
Fort Scott NHS	yes	0	0	0	
George Washington Carver NM	No	0	0	0	
Herbert Hoover NHS	Yes	00	0	0	
Homestead NM of America	Yes		0	0	
Pipestone NM	No	0	0	0	
Tallgrass Prairie Nat. Pres.	Yes	0	0	0	
Wilson's Creek NB	Yes	0	0	0	

*Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

Reserve Fund Research

If your park(s) received Reserve Fund Research funding or completed a previously-funded project in the last year, please provide the following:

Current project status (short description)

- Expected project completion date
- List of deliverables

NA

C. Fire ecologist accomplishments and areas of focus

This section deals with roles and functions of the ecologist. Identify accomplishments and/or focus areas along with a rough estimate of the amount of time spent in these areas (see table format and example below). This includes planning documents produced or reviewed (e.g. fire management plans, monitoring plans, prescribed fire or mechanical treatment plans, etc.), presentations given and audience, meetings and task groups attended, contracts reviewed, interagency collaboration efforts, volunteer hours managed, and scientific or research publications produced.

Table 8. Fire Ecologist 2021 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	5	FMP : HOME, TAPR, PIPE, FOSC ; HEHO-prairie management plan
Presentations	1	MSU-G.L.A.D.E
NPS Meetings/ task groups	5	I&M climate change, regional fire ecology meetings, network and park meetings
Interagency work	2	Working with MTBS to get fires mapped
Wildfire assignments	0	none
Prescribed fire projects	0	none
Non-fire fuels projects	1	Supported cedar removal by identifying piles to move.
Research	2	Published Frontiers for Young Minds article
Data collection	3	Collected vegetation data at PERI and HOME
Data entry	10	Estimated amount of time spent entering data from paper to PC and quality assurance, data management
Data analysis	20	Estimated amount of time spent performing analyses, including data summaries and statistical tests. (WICR-Manley, prairies, TAPR)
Supervision/Admin	20	Hiring-students, supervision: students and botanist, purchasing, etc.
Training	20	Estimated amount of time spent in training: required annual fire training, botanical training, project training.
Travel out-of-park for plot or project work	2	Include <u>travel time only</u> for distant, multi-day plot/project work requiring a travel authorization (Note: include data collection or project time associated with these trips in the plot or project categories above) PERI and HOME
Miscellaneous	5	Things that don't fit in other categories – assistance to other work groups/projects (e.g. natural resources), etc.

D. Fire effects crew accomplishments and areas of focus

We don't effectively have a crew to base these estimates on.

Table 9. Fire Effects Crew 2021 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots		
WUI plots		
CBI plots		
Other plot work		
Wildfire assignments		
Prescribed fire projects		
Non-fire fuels projects		
Travel out-of-park for plot or project work		
Data entry		
Data analysis		
Supervision/Admin		
Training		
Miscellaneous		

E. 2022 Direction

We hope that budget increases for the fire program will allow for a biotech position to be allocated to HTLN over the coming year. In the meantime, we will continue to tighten up our protocols when reviews for the revision come in. We will focus on our botanical training efforts and interpret park trends with respect to fire ecology when we can. We hope to be able to travel to complete scheduled plant community, bird habitat, and invasive plant monitoring in at EFMO, PIPE, HEHO, and HOME in 2022.

F. Overall Data Entry Status and FFI suggestions

Program Data - In an effort to ensure the longevity of NPS fire effects monitoring data, please provide the following:

- List FFI databases for which no new data were collected this year
TAPR, PIPE, EFMO, HEHO, LIBO, WICR, GWCA, HOSP, FOSC
- Estimate of the percentage of your park/network **total** monitoring program data (including past and present data) that has been entered into FFI, or another application,

and quality checked (e.g., Are there any non-digital, hard copies of data still floating around out there?) 100%

- Do you have a need for migration of any data to FFI? (if so, briefly describe the dataset, e.g., *20 Excel spreadsheets with fuels data*). No

FFI Feedback - To help in the ongoing effort to improve FFI, please include any feedback or suggestions here based on your experiences using FFI or FFI-Lite.

G. Optional Information

Include any additional material not already covered in the sections above:

- Graphics and/or tables of data analysis results or presentations
- Alternative monitoring activities descriptions
- Challenges facing monitoring program

We are continuing to do monitoring with fewer human resources. Because of pandemic restrictions, that wasn't a problem since we were grounded. Now that we are expecting to travel, we are finding that we don't have the field labor resources that make the program work more smoothly and balance out the days away for individuals. We have been waiting on reviews to the vegetation protocol revision for a year. That process may take another year or two to complete. Two of our permanent macroplots were destroyed in construction at HEHO. We'll need to install replacement sites there.

- Unique solutions to problems
- Collaboration with natural resource managers, other federal agencies, or research institutions.

We've been working with a student doing a bird related project at TAPR. We've shared data with her and helped to orient her to monitoring at the park. We are working with MTBS to map our network fires. We then archive them in our local geodatabase. We've drafted a report documenting the development of our fire history.

- Photographs of monitoring and fire activities

Appendix A. Workforce Transformation Supplement

The DOI wildland fire workforce transformation strategy and the NPS Wildland Fire Strategic Plan (2020 – 2024) have increased the funding available for wildland fire positions throughout DOI and NPS. The intent of this supplement is to capture the benefits of those initiatives to the NPS fire ecology program and to the wildland fire program as a whole. Please answer the following questions related to regional, national, and departmental workforce transformation efforts.

- Did your fire ecology program receive additional funding for new positions and/or extended seasons this year? NO

- If so, please list those positions and detail the changes.
- Did the changes in staffing allow fire ecology staff greater opportunity to provide wildland fire incident support (e.g., firefighters, REAFs, GISS, helicopter and engine positions, command and general staff, etc.) to broaden their wildland fire experiences? NA
 - If so, please explain how these opportunities were enhanced. Include information on opportunities for the individuals who were hired or extended with the additional funding as well as opportunities created for other staff because of increased overall staffing.
- Did the changes in staffing allow fire ecology staff greater opportunity for other non-incident support (e.g. planning opportunities, details, leadership and other training courses, etc.) to broaden their wildland fire program management experience? NA
 - If so, please explain how these opportunities were enhanced. Include information on opportunities for the individuals who were hired or extended with the additional funding as well as opportunities created for other staff because of increased overall staffing.
- How would you use an increase in staff funding (if available in the future) to provide incident support and wildland fire career development opportunities for fire ecology staff?
 - How would your efforts support the NPS Wildland Fire Strategic Plan Desired Outcome 1B measurable outcome:

“By 2024, the overall NPS wildland fire workforce has doubled the number of women in the organization and tripled the number of women in leadership positions (i.e., park FMOs, and central office positions) from baseline data gathered in 2019.”

HTLN staff would be more available for fire line work and dedicated fire ecology monitoring. Staff available for this work are currently diverse to meet the strategic plan needs.