Forest Ecosystem Monitoring Cooperative

2023 Work Plan

Updated September 27, 2022

The Forest Ecosystem Monitoring Cooperative 2023 Work Plan provides a guide for program goals to be achieved by the FEMC staff in support of the Cooperative for the calendar year of 2023. This document summarizes key activities FEMC staff will undertake to complete projects and develop outputs that align with the 2021-2026 Strategic Plan and the identified needs of the Cooperative. The work plan was developed with consultation from the Steering Committee and State Partnership Committees, as well as input from the State Coordinators and FEMC staff.

The activities in this work plan are funded by the USDA Forest Service through an appropriation in the federal fiscal year 2021 budget. The University of Vermont, Vermont Department of Forests, Parks and Recreation, Connecticut Agricultural Experiment Station, Maine Forest Service, Massachusetts Department of Conservation and Recreation, New Hampshire Division of Forests and Lands, and Rhode Island Division of Forest Environment and cooperating partners provide matching funds.

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States Included in the Cooperative

The seven-state region of New England and New York are included in the regional synthesis efforts and completion of requested state-specific projects. Funds are directly available to states to support state participation in the Cooperative through the FEMC State Coordinator program. If any state(s) chooses not to engage, the Steering Committee will reprogram the funds.

Summary of the FEMC Work Plan Structure

Each year the FEMC allocates its budgets and associated efforts in four distinct ways:

- 1. **Regional Projects:** Leading synthesis efforts around pressing regional forest health issues identified and selected through consultation with state partnership committees and the FEMC Joint and Steering Committees;
- 2. **Monitoring:** On-the-ground monitoring of forest ecosystems. Included in this activity is a competitive grant opportunity to support ecosystem monitoring efforts;
- State Sprint Projects: Delivery of state-specific projects identified by state partnership committees to address needs that cannot currently be filled by state agencies and partnering organizations;
- 4. **Core Activities:** Maintenance of FEMC core activities such as data management, archiving and accessibility, and work building collaborative networks around key experts and stakeholders across the region.

Regional Projects

The regional work topics are developed each year in consultation with the leadership of the Cooperative and refined during State Partnership Committee meetings. The Joint Committee meeting was held as a virtual event over two days in which five priority topics were identified. In summer of 2022, each State Partnership Committee met to discuss the topics and prioritize the topics of interest for their state and regional projects that may be developed from the topics. This year, FEMC will focus resources on two projects, with one Regional Development Project and a smaller Exploration Project for potential development in the future as a regional project. The selected Regional Development Project for the 2023 workplan is a continuation of the 2022 regional exploration project, *Monitoring the Impacts of Recreation on Forest Ecosystems*. Committee members continued to express interest in this topic and would like to expand the project to develop resources for the Cooperative. The 2023 Exploratory Project will identify available resources, data and information to investigate *Trends in Tree Mortality*, identify gaps in understanding, and explore how FEMC can support the Cooperative in understanding these trends.

Regional Development Project: Monitoring the Impacts of Recreation on Forest Ecosystems

Forests in the Northeast are facing pressures from recreation, an important economic service forests provide. These pressures can be concentrated (e.g., mountain bike trails) or diffuse (e.g., cutting for ski glades), with potential impacts on forest hydrology, soils, invasive species propagation, wildlife movement, tree regeneration and health. Efforts to monitor recreational intensity and the effects of recreation on these key ecosystem processes is fragmented, and its utility for planning is not always consistent.

During the 2022 Exploration Project, a <u>literature review</u> was completed to gather information about types of recreation activities and ecological impacts. Additionally, <u>interviews</u> of regional experts in recreation were conducted to capture their perspective on the impacts of recreation and needs of the community. A comprehensive data census was not conducted during this phase; however, availability of data appears to be limited to specific locations and short-term projects. Monitoring of recreational impacts in the northeast is more commonly focused on exploring the social and economic benefits of recreation, rather than directly monitoring changes in forest health. Western states more commonly have monitoring methods and data available for different types of recreation. An opportunity exists to review monitoring methods used in other regions and develop recommendations for implementation here in the Northeast. Data that is available, such as trail counter data, will also be documented and when possible, gathered for use in analysis.

Trail network data may be available for across the northeast region but is not currently easily accessible for the purposes of understanding recreation impacts on forest health. To create a resource for forest managers, trail network data will be aggregated from various sources to develop a comprehensive GIS map for the region, categorizing primary trail use types (e.g. hiking, ATV, mountain biking). A risk assessment of the trails will be conducted to identify areas with higher risk of forest health impacts, such as trails with steep slopes, hydric soils or sensitive habitats. Further review of the literature will provide information about the relative levels of impact for different types of recreation. For example, a high density of hikers, may have a greater level of impact than a low use of mountain biking trails, for which an individual hiker is expected to create a lower level of impact than an individual mountain biker. The matrix will be available to forest managers and planners to support decisions about trail activities.

The outputs of this project will include:

- 1. A GIS map of trail-based recreation, categorized by primary uses
- 2. A risk assessment to identify high-risk areas for trail-based recreation
- 3. Relative analysis of and matrix of impacts based on recreation type and level of use
- 4. A review and summary of monitoring methods for assessing impacts
- 5. Method testing to develop monitoring recommendations
- 6. A report and webpage with access to monitoring recommendations, data, maps, and relative impacts by recreation type and level of use
- 7. Regional workshop to establish long-term recreation monitoring efforts with state partners.

These activities and outputs will provide the basis for forest managers, planners, and researchers to further analyze and evaluate impacts of recreation on forest health. FEMC will share these resources with the Cooperative to support the implementation of recreation monitoring activities and analysis of recreation impacts. Longer-term impacts from this project work may include the development of recreation planning recommendations and recreation education material to reduce forest health impacts by recreation.

This project plan is detailed in the below logic model.

and types of recreation;

• Forest managers implement

• Forest managers review matrix

understand how type and level of use can result in forest

monitoring activities;

of relative impacts to

impacts

Problem Statement: Forest-based recreation activities are increasing. People are taking part in both motorized and nonmotorized activities. Different types of activity place varying levels of pressure on forests. Level of use is also an important factor to consider in how forests are being impacted. Types of impact include soil erosion, invasive plant transport and establishment, and disruptions to wildlife. Forest managers and landowners are interested in evaluating the impacts of recreation on forests. Monitoring data is limited, with most information focused on the societal and economic impacts of recreation. The FEMC will gather resources to provide information to Cooperative members to conduct these evaluations and analyses, to lead to decision-making recommendations.

Inputs:	Activities:	Outputs:			
 Completed <u>literature review</u> of activity types and impact types; <u>Interviews</u> of regional recreation experts for topics of interest; GIS expertise to develop trail maps; Monitoring expertise to review and/or develop methods recommendations; Resources to seek use data; Partners and State Coordinators available to support monitoring activities; Project planning and staff time 	 Collect AllTrails data to develop GIS map of use-type categorized trails; Risk assessment of trails for steep slopes and other risks; Conduct further lit review of monitoring methods used in other regions; Conduct data census to gather available data, including use- data; Analyze relative impacts of different recreation types; 	 GIS map of use-type categorized trails; Identified high-risk trail types/areas; Matrix of relative impacts by recreation type; Monitoring method recommendations; Pilot study of monitoring method implementation; Report with monitoring recommendations and summary of recreation impacts Regional workshop to establish a region wide recreation monitoring network 			
Assumptions: The literature review is complete and exhaustive; There is sufficient data available for the region; Monitoring methods are able to be implemented to evaluate impacts of recreation;					
 Outcomes: Forest managers use the GIS man to explore trail networks 	 Short-term Impacts (Learning) Researchers use GIS trail map and monitoring data to 	Mid-term Impacts (Actions)	Long-term Impacts (Conditions)		
map to explore trail networks	and morning data to		• necication types		

External Factors: Forest managers and landowners use the resources developed; Monitoring is implemented by managers and landowners; Data is made available to researchers; Recreationists are educated about the impacts and behaviors they can change to reduce impacts; Recreationists change behavior

evaluate forest health impacts

recreation educate users and

change behaviors to reduce

• People using trails understand

how their use impacts forest

impacts to forest health;

health

as a result of recreation;

recommendations for

• Researchers/planners make

results in planning

and policy change

recreation benefits

with forest health

to balance

impacts

and levels of use are

conducted in such a

health is minimally

people are able to

way that forest

impacted while

recreate.

Regional Exploration Project: Exploring Trends in Tree Mortality as a Response to Disturbance Drivers

The FEMC community has expressed interest in exploring patterns of tree mortality and how regional coordination of monitoring for both acute events and delayed responses following chronic stress can lead to a better understanding of regional impacts. The information currently available from FIA data does not provide the level of detail needed by the community. Cooperators have expressed interest in development of a working group to develop a rapid response plan following acute events. The working group would be tasked with identifying a regionally targeted rapid response group to act as early responders during and following outbreaks and mortality events. The working group would also identify best practices for responding to events, including implementation of monitoring plans for long-term tracking of potential mortality events.

Additional opportunities exist to review and compare tree mortality data currently available, including FIA, NEFIN CFIand ADS, to evaluate how well mortality patterns compare to each other, and if there are any trends or risks that can be determined from the long-term data.

The outputs of this project will include:

- 1. A regional stakeholder first responder list
- 2. Monitoring plans to implement during and following a mortality event or disturbance
- 3. Comparison and analysis of FIA, NEFIN CFI and ADS mortality data
- 4. Report and outreach materials, including web page, to share resources, rapid response monitoring data and recommendations to expand the monitoring network
- 5. Workshop to train and plan for response to potential mortality episodes region wide.

These activities and outputs will be available to forest managers to implement monitoring plans to better track and predict mortality events, understand long-term impacts of mortality events. With better tracking of mortality and implications, managers will be able to determine best management practices to follow and understand other risks to future mortality events.

This project plan is detailed in the following logic model:

Problem Statement: The FEMC community has expressed interest in exploring the topic of tree mortality and how to evaluate long-term impacts, for both acute events and delayed responses following disturbance or defoliation. The information currently available from FIA data does not provide the level of detail needed by the community. Following an acute event, funding is often available, but long-term tracking does not typically occur.

Inputs:	Activities:	Outputs:			
 Forest Health Atlas mortality filter; FIA mortality data (when available); NEFIN CFI regional mortality data Availability as a facilitator/hub for community management; ForWarn tool; Project planning and staff time 	 Review of FIA, ADS data available for evaluating mortality events; Formation of working group; Development of monitoring response plans following varying acute events or ongoing disturbance to track short- and long-term changes; Create stakeholder list and gain agreements from organizations to serve as tree mortality first responders to implement monitoring plans; 	 Analysis of mortality events from FIA, NEFIN CFI and ADS data; Monitoring plans for different mortality event types; stakeholder list Workshop to train and plan for response to potential mortality episodes region wide 			
Assumptions: Stakeholder and partner groups will agree to serve as first responders;					
 Outcomes: Forest managers will have monitoring plans available to implement following various mortality events; Data analysis (FIA, ADS) will help managers compare remote sensing to what is seen on the ground 	 Short-term Impacts (Learning) Monitoring of mortality events will provide managers with important information about managing for long-term impacts 	 Mid-term Impacts (Actions) Analysis of monitoring data may reveal trends and identify regions/forests at risk of mortality events 	 Long-term Impacts (Conditions) With understanding of mortality risks, management plans can be developed to lower risk of mortality events 		

External Factors: Monitoring is implemented following mortality events; Monitoring data is analyzed; Mortality trends are identified, and risks determined; Management plans are implemented in response to mortality trends

Monitoring

Ecosystem Monitoring Fund

FEMC will administer a competitive request for proposals where Cooperators can apply to access monitoring funds. These funds have been made available for the past two years, funding a total of 11 projects and providing support for the collection, aggregation, analysis, and utilization of forest ecosystem monitoring information to better understand the current threats, historical trends, and future directions of the forested landscape in the Northeast. We will seek proposals that meet the strategic objectives of the FEMC, which may include novel assessments or analyses of already-collected monitoring data, expansion of existing monitoring efforts, piloting a new monitoring program, upgrading a monitoring program to increase comparability with others in the region, covering a short-term gap in funding, funding for monitoring programs that occur less than annually, or upgrading data logging equipment. FEMC staff will:

- 1. Work with the Steering Committee to establish fund priorities and mechanics, and advertise the request for proposals;
- 2. Coordinate with state FEMC staff and Committee members to review, rank, and recommend projects for funding;
- 3. Administer the funded proposals;
- 4. Compile results and data from funded proposals for promotion and dissemination to the Cooperative.

Forest Health Monitoring

FEMC has been responsible for establishing, monitoring, and interpreting annual forest health measurements in Vermont for 31 years. This monitoring network is designed to capture a range of tree health and structural stand metrics on a network of permanent plots that were selected to represent the larger population of forested ecosystems across the state. Annual measurements follow published methods that emphasize objective, quantitative measures in addition to traditional forest health metrics to enable detection of subtle decline symptoms as well as standardization and cross-walking with other forest health data sets. These plots provide substantial insight into annual fluctuations in tree and stand condition and stand alone in the region for their long-term history and frequency of measurements. The metrics used on these plots combine techniques from multiple systems to give a broad range of complementary metrics that are useful in tracking trends in forest health over time.

Forest Phenology Monitoring

FEMC will collect tree phenology measurements from sites on Mt. Mansfield, VT, maintaining a significant long-term record. These will include spring phenology measurements one to two times weekly from one site and fall phenology measurements weekly from three sites. The state of Vermont will also evaluate establishing a forest invasive plant phenology monitoring system, and, if feasible, pilot a system.

Forest Inventory and Monitoring

Provided additional direct costs are available from other sources, FEMC will provide field support for the Urban Forest Inventory and Analysis program in Vermont. The State of Vermont will investigate the establishment of a continuous forest inventory plot network across Vermont Agency of Natural Resource

(ANR) lands to answer relevant and timely questions on a variety of topics including regeneration and climate change to help public land managers make informed land management decisions.

Other Forest Health Monitoring and Information Sharing

Continued monitoring is needed to understand forested ecosystems and projects supported by this grant will include monitoring of tree phenology, forest pests and forest damages. Results are provided through a searchable website and database, publications, and the FEMC Annual Conference. Aerial survey detection data for 2023 will be archived and accessible through FEMC website and the <u>Northeastern</u> <u>Forest Health Atlas</u>, and a summary of trends to date will be published in the FEMC long-term monitoring updates. In addition, FEMC will continue data collection for a long-term record of pear thrips populations in Vermont.

Montane Meteorological and Air Quality Monitoring

FEMC collects meteorological data from montane areas to develop a long-term record of weather conditions and climatic changes over time. This includes two remote meteorological stations on Mt. Mansfield and a forest canopy tower at Underhill, Vermont. FEMC will continue to maintain an air quality monitoring site that houses a number of state and national efforts at Proctor Maple Research Center, including monitoring of acid precursors (CASTNET), ammonia (AMon), mercury (MDN), UVB radiation and wet acid deposition (VAPMP and NADP/NTN). This effort is largely funded by other sources. In addition, FEMC will maintain a CAMNET HazeCam in Burlington, Vermont. Operations of these sites will be maintained in full for 2023.

Avian and Amphibian Monitoring

FEMC partners with two groups in Vermont to monitor and understand trends in forest avian and amphibian diversity and condition. Resources will partially support monitoring of diversity and population trends in amphibians, reptiles and forest songbirds at Mount Mansfield through subawards to Vermont Family Forests and Vermont Center for Ecostudies in 2023.

State Sprint Projects

Each year, several state-directed sprint projects are identified by state partners at the State Partnership Committee meetings. These projects typically focus on state-specific gaps in information, tools, or analysis that FEMC resources are needed to fill. Recent sprint projects have included the development of Forest Indicators Dashboards for New Hampshire and New York; a data rescue project to collect and digitize historic spongey moth data from Rhode Island, and a preliminary recreation review program in Connecticut.

FEMC will continue to provide sprint project support to states in 2023 with participating governance structures and state-based staff to assist in execution, either through the advice of FEMC State Partnership Committees or an existing state committee or board serving in this capacity. FEMC will provide equal support through staff time to regional state partners according to their needs and priorities. This typically equates to about \$13,000 of FEMC staff FTE per state per year. Vermont does not participate in these sprint projects because funding is made available to other monitoring programs that are conducted annually (amphibian and avian monitoring). The final project plans will be completed in Fall 2022 to prepare for activities to be conducted in 2023.

Core Activities

Maintenance Project: Maintaining and Enhancing Existing FEMC Regional Resources

FEMC has developed several tools and resources for its regional projects over the past years. Continuing to maintain these resources, ensure their currency, and in some cases, expand their functionality is part of the Core Activities of FEMC. The grantee will work with staff in each state to maintain the following resources:

- 1) FragNet: Addition of new resources to Northeast Forest Fragmentation Information Network (FragNet) through regular structured searches and input by cooperators.
- 2) NEFHA: Addition of new monitoring and research data to the Northeastern Forest Health Atlas (NEFHA) as it becomes available.
- 3) Disturbance Regimes: Additional of monitoring and trend information to the current Disturbance Regimes project.
- 4) Climate Indicators: Review and addition of new studies, protocols, or data relevant to the Climate Indicators tool.
- 5) Climate Connection: Addition of new climate impact exploration tools and keeping documentation of existing tools updated on the Climate Connection.
- 6) REGEN: Addition of new datasets to the Northeast Forest Regeneration Data Network.
- 7) The DendroEcological Network: Continue to support input of data and engagement with researchers in building the resource.
- 8) Indicators Dashboards: Update the Vermont, New York, and New Hampshire Forest Indicators Dashboards with updated data and trends.
- 9) Other existing state sprint projects and regional projects:
- 10) Maintain or update completed or ongoing sprint projects as requested by state committees;
- 11) Maintain or expand additional regional projects as directed by the Steering Committee.
- 12) Promotion of these tools through regular trainings, tabling and product promotion campaigns.

Network Development: Stakeholder Engagement and Collaborative Outreach

FEMC will aid communication among state, regional, and national program managers and scientists to facilitate interdisciplinary cooperation in conducting studies around key forest health and ecosystem condition issues. FEMC staff will assist in securing additional funding to support ongoing long-term monitoring and related research, and will provide technical transfer to policy groups, natural resource managers and non-FEMC scientists.

In addition, FEMC staff will regularly travel to participating states to work with state FEMC staff to present the work of the Cooperative and engage new and current Cooperators.

FEMC will facilitate networking and information sharing between scientists and natural resource managers through its committee work, data archiving partnerships with the environmental Monitoring and Management Alliance and Catskill Science Collaborative in New York and the Holt Research Forest in Maine, continued involvement in the development of the Mt. Mansfield Science and Stewardship Center, and regional collaborations with adjacent states and others.

FEMC will organize and host an annual conference with forest ecosystem study results, workshops, and material relevant to scientists, natural resource managers, and educators. In addition, FEMC will develop, execute and monitor the success of a communications and engagement strategy and maintain a number of communication channels to facilitate outreach, including the development of stories for various newsletters and outlets, as well as maintaining a Facebook page, Instagram feed, Twitter account, and email newsletter. Additional outreach materials will be developed for FEMC projects, as needed. Materials may include fact sheets, video tutorials, webinars, and case studies to convey information to target audiences.

FPR Program Administration and Monitoring Support

FPR provides administrative and field work support in coordination with FEMC staff, including program coordination with partners by participating in Committee meetings, implementation of the FEMC Annual Conference, and expansion of FEMC through planning and participation on conference calls, surveys and meetings with FEMC partners in Vermont and in adjacent states. In addition, FPR staff provide training and methods standardization for State and UVM field crews involved in forest health monitoring field work and collect forest health and spring and fall phenology measurements. FPR staff also contribute to data processing, analysis and reporting for FEMC long-term monitoring updates.

Core Program Operations

Vermont will maintain infrastructure within the Division of Forests that allows for long-term monitoring and cooperative efforts with partners, maintain program infrastructure to continue to document ecological monitoring data and study site oversight, and serve as the conduit for federal funding that will support core FEMC staff.

FEMC administration will be supported at UVM, including: a Principal Investigator funded by other sources; a Director who will provide scientific oversight and analysis, program planning, budgeting, and outreach and engagement; a Program Operations Manager to facilitate implementation of FEMC projects and oversee daily operations; a Database and Web Developer; a Monitoring and Services Coordinator to oversee the FEMC's field monitoring and service work, a Data Analyst to support data analysis on projects, and additional temporary staff as necessary, and State Coordinators as outlined below.

FEMC staff will work with partners and cooperators to monitor trends and improve understanding of the role forested ecosystems play in providing important services such as clean air, clean water, aquatic biodiversity, carbon storage and mitigation of pollution impacts on soil chemistry. FEMC staff will continue to compile, store and link to monitoring data from partners in a centralized database that can be accessed via the internet, providing substantial regional information on biological diversity to support citizen education, land conservation, planning and natural resource management. FEMC will maintain and improve its core website infrastructure to meet this need and deliver online tools, dashboards and other information access products.

FEMC will maintain its core web-based archive and currently existing infrastructure, including: The <u>DendroEcological Network</u>, the <u>Northeastern Forest Health Atlas</u>, <u>FragNet: The Northeast Forest</u> <u>Fragmentation Information Network</u>, the <u>Climate Connection</u>, the Northeast Forest Regeneration Data Network, the FEMC Forest Health Monitoring database, the FEMC Long-Term Soils Monitoring database (Vermont), the Vermont State Lands Research Atlas, the <u>Vermont Forest Indicators Dashboard</u> and <u>ecoNEWS VT</u>. In addition, FEMC will offer training and internship opportunities for students and new professionals.

State Coordinators and Activities in Partnering States

Funding will be made available to each state to support staff participation in the Cooperative. Participating states will provide the following support as part of the Cooperative:

- Work with FEMC staff and other Cooperative partners to deliver the outputs of the regional work plan as identified above.
- Work with the FEMC Director to populate, convene and support the work of a State Partnership Committee. This will include identifying and inviting members as needed to build and maintain the Committee, helping to develop agendas for meetings, convening the Committee at least once per year to advise on and review work of the FEMC, working with Committee members to define and execute state 'sprint' projects, and responding to Committee needs and requests.
- Work with FEMC staff and partners to execute state sprint projects defined by the State Partnership Committee through gathering needed data, convening stakeholder meetings, performing data analysis and/or promoting the outputs of the sprint projects to interested parties.
- Participate in the collection of forest health monitoring data as part of the regional FEMC forest health monitoring network described above. Staff will attend a training and calibration session, coordinate with FEMC crews to complete plot measurements, assist with quality control efforts, review summary reporting, and promote the network and its findings to the broader community.
- Promote the tools and outputs of the FEMC through trainings, workshops and presentations to stakeholders. FEMC staff will work with state staff to develop appropriate and tailored materials for promoting the work of the FEMC, and provide additional support as needed in conducting this outreach. State staff will identify appropriate venues and methods of delivery to get FEMC products and tools to the manager, decision makers and planners that need them.
- Participate in a review of applications to the Ecosystem Monitoring Fund for alignment with FEMC strategic goals and objectives, relevance, and impact using criteria developed by the Steering Committee, and make recommendations for funding.
- Participate in regular FEMC staff/team meetings related to the development and execution of regional and state sprint project work.
- Engage in the governance of the FEMC by participating in the Steering Committee and Joint Committees meetings.

To deliver this aspect of the program, FEMC Committees, staff, and State Coordinators will conduct an annual evaluation of the program in summer 2023.