



Forest Regeneration Monitoring (FRM) Program Overview

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Background

The Forest Regeneration Monitoring (FRM) program was initiated to better assess the status of naturally regenerating forests across the state and to further provide data reflecting forest regeneration success or failure to be used in Wisconsin's deer population goal setting process.

Prior to FRM, existing forest inventory tools, such as USDA Forest Inventory & Analysis (FIA) were used to provide regeneration data. However, the need for more detailed county-level data was often requested by natural resource managers and policy makers as well as forest and wildlife researchers, to escape the trap of trying to defend numeric estimates by moving to a system where deer management goals are expressed as a range of acceptable conditions across a set of criteria (harvest success or harvest levels, crop damage claims, deer vehicle collisions, forest regeneration success, etc.) within each Deer management Unit (DMU).

In 2014, the NRB requested that the Division of Forestry provide county level regeneration data to assist in County Deer Advisory Council (CDAC) deer population goal setting decisions. In June of 2016, FRM was proposed and discussed at an NRB meeting field tour in SW Wisconsin. In July of 2017, the initial proposal for the FRM program was further developed through a collaborative effort between the Forestry Division and the Fish, Wildlife and Parks (FWP) Divisions. This proposal included the allocation of federal Pittman-Robertson funds to collect, analyze, and share county level regeneration and deer browse data to the CDACs to help inform committee members as part of their deliberations. It was decided that this project would be conducted in counties with greater than 30% cover and only in the forest types most greatly affected by deer browse, commonly referred to in Wisconsin as Northern Hardwoods (NH), pine (White Pine (PW), Red Pine (PR), and Jack Pine (PJ)), and Oak (O). Funding and support for the FRM program was finalized in early 2018 and the first LTE Forest Regeneration Coordinator was hired by the Forestry Division to prepare for the 2018 field season. FRM has now been adopted as a required metric for State land forest Inventory and is detailed in the Public Lands Handbook.

History of Data Collection

Annually, the Division of Forestry hires seasonal LTE staff to complete forest regeneration data during the growing season. FRM data is currently collected on a three-year cycle, where stands are scheduled to be resampled every three years. Data for the first three-year cycle was collected between 2018 and 2020; data from the second cycle was collected between 2021 and 2023. Each year, hundreds of stands are visited for remeasurement, providing valuable data on regeneration over time. We are currently on our third cycle which began in 2024, and will be ending after the 2026 field season, where many stands have now seen data collected on three different occasions, which will aid us greatly in understanding how Wisconsin forest habitat is changing. Recently harvested stands across all ownerships have been sampled using the Forest Regeneration Metric, a standardized protocol for assessing stocking and regeneration by species and height class. To date, division staff have exceeded data collection goals, collecting over 50,000 plots across 45 counties, on county forests, state lands, private MFL lands, private non-MFL lands, and lastly, federal lands including Good Neighbor Authority (GNA) and Fort McCoy.

The Value of Forest Regeneration Monitoring

Data from forest regeneration monitoring contributes to a growing understanding of Wisconsin forests and their impact on deer populations, helping to provide for a wide range of goals in forestry and wildlife management in the future. Data collected from FRM program efforts have already provided important snapshots of current forest habitat conditions throughout Wisconsin. Sustainable forest management is a long-term endeavor, and the data collected from the FRM inventory is incredibly valuable for both short and long-term forest habitat management on public and private lands. Alongside Wisconsin's other forest inventory efforts, FRM monitoring allows better tracking of long-term changes to our forests. It also gives us insight into how cover types are regenerating in different areas, in response to different silvicultural practices, and the rate at which they are regenerating. Over time, FRM allows us to identify hotspot regions undergoing significant regenerative successes or struggles, providing information to adjust management. At a larger scale, FRM data also facilitates refinement of Wisconsin-specific regeneration guidelines, something previously only informed by regional data or literature review. This monitoring ultimately allows us to challenge or reinforce our understanding of Wisconsin forests, and better assess the efficacy of our forestry practices, helping to inform economically and ecologically sustainable management plans.

Our forest ecosystems, including their structure and composition, are fundamental to wildlife habitat. Understanding the history and considering the future of Wisconsin forestry is also integral to understanding the challenges that we face and the successes that we have had with wildlife management. Successful forest regeneration is critical to forests reaching a stage where they can provide ecological and economic benefits in the form of sustained outdoor recreation, wildlife habitat, and timber production. For deer, these seedling and sapling trees provide food and cover. As a result, measuring regeneration is an important measure of the sustainability of a forest, but it is also a measure of available food and cover that benefit deer and other wildlife (Rosenberry et al, 2009). While browsing is a natural forest process, too much browsing can eliminate palatable tree seedlings like oaks, often an ecologically and economically preferred species, from the next generation forest. FRM monitoring can allow for the analysis of palatability preferences for deer. Trends in the diversity, density, and spatial availability of preferred species may be important for understanding deer browse availability (McWilliams et al, 2015). Management of deer should focus on managing the ecosystems of which deer are a part, as deer population densities are closely intertwined with full forest structure, diversity, ecological processes, and ecosystem function (Latham et al, 2005). FRM data allows us to accurately monitor and illustrate trends in forest health and regeneration at the county level to understand how these young forests provide for deer populations, as the measurements we take give detailed analytics on the quality and quantity of the seedling component of the forest ecosystem.

In Pennsylvania, a long-term forest regeneration monitoring study has been underway for over 25 years ([Deer Forest Study | Game Commission | Commonwealth of Pennsylvania](#)). Data from this monitoring is used directly for the deer population objective setting process. Forest regeneration trends are used to determine the quality of the forest habitat for deer. The question of forest quality is answered by looking at plot-to-plot trends from the Pennsylvania Regeneration Study. If adequate regeneration is observed, along with increased trends in seedling counts, forest quality is considered good, and the PA Game Commission declares a stabilized deer population. If the monitoring results show inadequate and/or decreasing seedling availability, this would indicate a potentially increasing deer population, and the Commission would set an objective to increase harvest to stabilize the population. See the Pennsylvania Game Commission Bureau of Wildlife Management Deer and Elk Section's Annual Deer Population Report & 2024-25 Antlerless License Allocation Recommendations for more detailed information ([2024 deer population report and antlerless allocations \(1\).pdf](#)). Wisconsin's FRM plot protocol, as well as the USFS FIA program's seedling survey protocol, was in part modeled off of the early, formative work done in Pennsylvania.

Previous forest monitoring methods were not intensive enough to tell a precise, county-level story of the impacts of deer browse on forest regeneration or the quality of the forest habitat available to deer. An accurate picture of forest regeneration is crucial to understanding what a sustainable deer herd looks like based on the quality of the available forested habitat. The FRM program is a valuable contributor to the recommendation by the Deer Trustee Report to develop a set of metrics to be used to manage deer population density. These metrics include deer density, hunter success, deer vehicle collisions, agricultural damage, and forest regeneration problems to name a few. While there are many factors that can affect forest regeneration, research has regularly shown that deer browse levels that result from high deer densities can have negative impacts on Wisconsin's forests. This data will help us uncover deer browse severity, future habitat considerations, and inform CDACs of the impacts of deer on forest regeneration, helping to guide the deer population goal setting process.

Reporting on Data

Stand-level reports are provided for landowners and land managers after FRM data has been collected. These reports have been developed and improved upon over time and are currently undergoing revisions as we learn more about how to interpret this rich database. These reports are tailored to the two different audiences, with landowner reports providing more background than the reports land managers use to assess the regenerating forest. These reports, focused on trees per acre and browse pressure by species, come with a caveat that our sampling intensity does not allow us to make stand level decisions solely on FRM data, but is used to help foresters better inform management decisions. The reports have already proven to be a valuable management tool for both public and private land managers.

December of 2020 marked the first opportunity for FRM data to be used to inform CDACs of county-level forest regeneration success for their 2021-2023 population objective setting meetings. DNR Forestry staff held focus groups with CDAC forestry representatives that resulted in the development of a reporting tool and county-specific reports. A second round of reports were generated in 2022, once again detailing the relationship between deer browse intensity and forest regeneration success. These reports have been used by CDAC members, and we expect the quality and accuracy of future reporting to continue to improve over time as additional data is collected.

The Future of FRM

Looking ahead, the FRM program seeks to maintain current data collection goals while incorporating new sample sites, along with the collection of data on previously visited sites, ending sampling on a stand when it has met the guidelines to be considered free to grow after the third cycle. Further spatial analysis and dissection of the dataset will lead to a greater understanding of regional and ecological differences in the impacts of browse on forest regeneration and the complex interactions of other ecological processes (such as invasive species, shading, earth worms, etc). The FRM program is committed to increasing partner engagement and use of FRM both within the DNR and with external partners.

2025 ended with multiple internal discussions on how to better utilize FRM data to serve the DNR and beyond, with the understanding that there are many areas in forestry and wildlife management that the program has potential to provide value. Because the FRM program collects data across a variety of ownerships and a wide array of ecological, agricultural, and socio-economic regions, we have a unique opportunity to assess forest dynamics in these different groupings. Understanding these relationships will help forestry and wildlife professionals plan for the future of our landscape, both in an ecological and an economic sense.

Beginning in 2026, we will have an annual DNR internal FRM update detailing how successful various tree species have been regenerating in recently harvested stands throughout the state. Also to be developed in 2026 is an ArcGIS Online (AGOL) dashboard to help visualize spatial relationships between our changing forests and the intensity that will be of interest to both forestry and wildlife management. Updated CDAC reports will be

developed to fit the changing deer management units (DMUs). We also plan to present future FRM findings in coming years to various possible outlets like the Natural Resources Board, Wisconsin Conservation Congress Deer and Elk committee, Deer Management Assistance Program, and the Wisconsin Woodland Owners Association.

FRM in Literature and Ongoing Trials and Research

There is currently no published literature utilizing FRM. However, there are several ongoing trials and research studies that utilize FRM data and/or protocol. One of the primary ongoing research studies within the Division Forestry is at Sandhill Wildlife Area where we are investigating the relationships between deer density, habitat selection, and forest vegetation, especially as it relates to woody species regeneration. The objectives of this study are:

- To better understand deer response to active forest management
- To better understand tree regeneration as it relates to active forest management in several forest types
- To better understand tree regeneration as it relates to active forest management techniques and deer habitat selection
- To better understand tree regeneration as it relates to changes in deer abundance.

This collaborative effort between the Wildlife and Forestry Divisions was initiated in July of 2022 and is planned to wrap up in December of 2028.

The DNR also has an active MOU with former DNR Forest Management and Ecology research scientist Amanda McGraw, now with MN DNR, to:

- a. utilize the FRM data to map browse resources for deer and moose across northeast Minnesota and forested counties in Wisconsin.
- b. publish a spatial data layer of browse resources with the US Forest Service.
- c. finish an analysis to determine deer browse preferences and risk of over-browsing by deer.

Several completed and ongoing silviculture trials, highlighted in the table below, also use the FRM protocol and resulting data to inform sustainable forest management practices.

Study / Trial	Description
Driftless Area Adaptive Silviculture for Climate Change (ASCC) Study	This three-state study (MN, IA, and WI) is assessing resistance, resilience, and transition treatments for oak management accounting for climate instability. FRM was used to establish baseline conditions in study stands.
White Pine Uneven-Aged Management Study	White pine has been managed on an even-aged basis historically in WI. This study is looking at how harvest opening size influences regeneration. FRM is the primary tool used on this study.
HRD Study	Heterobasidion root disease (HRD), is one of the most destructive diseases of conifers in both WI and the world. FRM is being used to track pine seedling survival on sites treated for this study.
Slash Wall for Deer Exclusion	Slash walls are a largely untested technique for excluding deer from timber harvest areas. FRM was used to quantify post treatment inside and outside slash wall enclosures.
Blue Mounds Direct Seeded Oak Trial	Direct seeding of oak acorns can be used to perpetuate oak. This trial followed up on a 2008 oak direct seeding at Blue Mounds State Park.
Avon Bottoms Enrichment / Assisted Migration Tree Planting Trial	With ash mortality due to EAB on the horizon, this trial examined enrichment planting in anticipation of overstory mortality. FRM has been used to measure post planting stocking since 2017.

Radley Creek EAB Enrichment / Assisted Migration Tree Planting Trial	This trial is similar to previous work tracking tree planting prior to ash mortality. FRM was used to measure post planting stocking.
Forest Exploration Center Climate Change Trials	This trial is assessing northern hardwood gaps as a natural climate solution. FRM is being used to assess baseline and ongoing regeneration recruitment
GNA Oak Scarification Trial	Scarification is an underutilized tool for helping establish oak regeneration. This trial used FRM to assess post treatment seedling establishment.
Lake Kegonsa SDP Black Locust Control Trial	Parks staff used a timber harvest and herbicide to control black locust. FRM was employed to assessment post treatment black locust stocking.
Hartman Creek Uneven-Aged White Pine Mgmt. Trial	Local managers used a group selection harvest to release advance white pine regeneration. FRM was used to quantify baseline regeneration and post timber sale survival.
Brule River SF Goat Efficacy Trial	This trial reviewed using goats as tool to control buckthorn. FRM was used to quantify buckthorn pre and post treatment.

After the 2026 field season, we will have a robust dataset with enough site revisits to warrant a deep dive and investigation of the data. We will be planning a scientific article, focused on findings of FRM in terms of forest dynamics over time through ecoregions, agricultural and socioeconomic regions, with consideration to harvest types. We can use the last three FRM cycles to deepen our understanding of the relationship of deer browse to forest regeneration, and how one may impact the future of the other.

Ongoing Research within FRM

Within Wisconsin forests and silvicultural systems, there is a tremendous amount of variability, introducing the inherent error that occurs in our data. To assess the origin of this statistical error, we are conducting a high-intensity internal study on seven diversely managed young stands across 4 counties, sampled three times per year, using both fixed and random plots. The goal of this study is to understand:

1. Statistical error from random plot sampling versus user error shown on fixed plots
2. Seasonal variability in reported canopy cover, herbaceous and woody competition, stem counts, and deer browse intensity
3. Season to season changes in regeneration regarding weather patterns

Another study currently being conducted within our annual data collection is taking semi fixed plots in 100 deer exclosures in 20 stands throughout Bayfield, Shawano, and Marathon counties, and overlapping sampling on these stands with random sampling. The goal of this study is to investigate the difference in forest regeneration where deer are excluded.

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