



The Effects of Logging on Understory Plants Status Report

by

Alexandra Wrobel
Forest Ecologist

Administrative Report 20-07
September 2020

**Great Lakes Indian Fish
& Wildlife Commission**
Biological Services Division
P.O. Box 9
Odanah, WI 54861
(715) 682-6619

INTRODUCTION

The late 1800's and early 1900's saw extensive logging within the Ceded Territories that came to be known as "the cut-over." Transforming forests that were once old-growth consisting of gaagaagimizh (eastern hemlock), wiinizik (yellow birch), and aninaatig (sugar maple) to that of an early successional community dominated by azaadi (aspen) and wiigwaasaatig (paper birch).

While many cultures might "see the forest for the trees," the Anishinaabe lifeway is deeply woven with all natural resources and all things that grow from the earth, specifically the trees and all wild plants. In addition to altering forest composition, the logging that occurred during the cut-over likely affected the smaller herbaceous plants in a less visible but more significant way.

The understory plants within the pre-cut forests of the Ceded Territories evolved in shady, moist environments where the most common disturbance included small canopy gaps created by individual tree death or other natural disturbances. Stand-destroying disturbances were rare. With the introduction of modern timber management practices, there also developed an urgent need to understand the impacts that logging has on the non-timber components of the ecosystem.

Prompted by concerns from tribal members, GLIFWC designed a study with the goals of understanding the lasting impacts of logging on the understory plant communities and developing recommendations for public land managers. Recommendations to reduce any negative impacts that may occur in the herbaceous community within the Ceded Territories a result of timber harvesting activities.

The original Study Plan "GLIFWC-USFS Study on the Effects of Logging on Understory Plants" was prepared by then GLIFWC Botanist Beth Lynch in 1997 and it details the purpose, scope and methodology of the study.

While there are various other projects in the region that monitored the effects of logging on the understory communities, it was noted that these projects were limited by the absence of "pre-cut surveys." Meaning there was a significant data gap in information needed to prove the magnitude of the impact that logging had on the site.

To accommodate for the limitations of these other projects, the main objective of this particular study was to "examine the effects of selection cutting on the understory plant community through monitoring plant populations, before, during and after selection harvesting over several decades." And to address these specific questions:

- 1) How do the understory plant communities change in the stands that were subjected to selection cutting using typical logging practices?
- 2) How are the plants that are used by the Great Lakes Ojibwe affected by periodic selection cutting?
- 3) How do different logging operators and equipment impact the understory plant communities?

Location of stands within the Medford District of the Chequamegon-Nicolet was based on two factors.

- 1) It was believed that "the understory plant communities growing on the highly compactable, silty soils on this district are particularly sensitive to logging impacts."
- 2) The Medford District perceived a need for this type of research and expressed commitment to work cooperatively throughout the project.

MOA WITH THE USFS

In the “Memorandum of Understanding Regarding Tribal-USDA Forest Service Relations on National Forest Lands within the Ceded Territories of 1836, 1837 and 1842” (MOU) the signatory parties (GLIFWC member tribes and the USDA Forest Service) agreed to an obligation of co-management on National Forests Lands within the Ceded Territories. In partial fulfillment of this obligation in 1997 the Chequamegon-Nicolet National Forest (CNNF) Medford-Park Falls District entered into an additional “Memorandum of Agreement” (MOA) with the GLIFWC member tribes to “establish the conditions and material obligations of the parties hereto, under which the CNNF and the Commission shall cooperate on the study *Effects of Logging on Understory Plants.*”

The term of the MOA is intended to be indefinite with the understanding that useful information will only be obtained after at least 10-15 years. The Commission agreed to carry the overall responsibility to conduct the research project with technical assistance provided by the USFS. In return, the commission retains the copyright and all rights in data produced by this study, however, neither parts will publish any results without consulting the other.

Among the terms agreed to by the Commission and the USFS, the only obligation that hasn't been fulfilled is the USFS providing the housing for Commission Staff while conducting the surveys. It seems the MOA has not expired and has not been terminated by either party.

PROJECT REPORTING 1997 – 2019

1997 Original Study Design

Detailed information on the initial study design can be found in Appendix A. Originally there were 6 sites of paired treatment and control plots. Treatment plots were scheduled for selection cutting with the individual tree selection method.

Criteria for selected sites were:

- 1) Minimum age of 60-70 years with minimal disturbance
- 2) Silt Loam soils
- 3) Acer-Hydrophyllum habitat type
- 4) Will be logged
- 5) Large enough to accommodate treatment and control plots

Each plot (50x90 meter square) was delineated by a 90-meter baseline with 50-meter perpendicular transects spaced every 15 meters along the baseline. This results in 7, 50-meter transects per plot (Figure 1).

Using a stratified random sample design, 42 quadrats (1-meter²) were located within each plot placed at random intervals along each transect. Within each 1-meter² transect the original study design aimed to collect:

- 1) Percent cover of plants less than knee high.
- 2) In a 1x3m quadrat (including original 1m² quadrat) all species present are recoded and assigned a value of 1, 2, or 3 depending on whether they occur in 1, 2 or 3 of the 1-meter segments.
- 3) Tree cover and percent canopy cover at 21 sampling points using densitometer
- 4) Species composition, density and basal area of trees >10cm dbh at 21 sampling points
- 5) Shrubs and tree samplings > knee high and <1” dbh are counted in 1x50m transects running perpendicular to the baseline at 0, 30, 60 and 90 meters

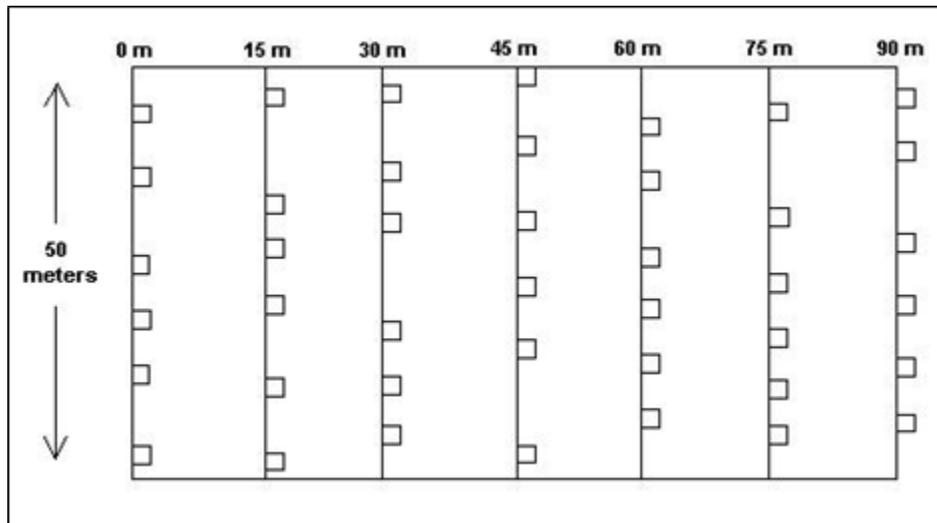


Figure 1: Plot Design – seven transects, measuring 50 meters each were laid out every 15 meters along a 90-meter baseline. Data were collected within 6 randomly placed 1m² quadrats along each transect.

The 1997 study design states “data on the cover and frequency of plants in the herbaceous layer will be gathered for 3 years prior to logging to establish a record of pre-cut understory community composition. Plant surveys are conducted in Late-May and again in July-August to ensure that all species are represented. After the initial logging, stands will be surveyed for understory vegetation at 1, 2, 5 and every 5 years thereafter. It is anticipated that stands will undergo selected harvest every 15-20 years. Data will be analyzed after each survey to provide periodic information about the composition of understory plants in control and treatment plots.”

2002 Report

The study design and sampling methods remained unchanged.

In a section on “future analysis” they write “data for tree and shrub later were gathered during 1996 and have been entered into a separate database. Data for the understory plants were gathered during May and July of 2000. These data are being incorporated into a larger database consisting of survey data from previous years.

“Data gathering will resume the spring and summer following the implementation of logging activities. The baseline description will be an important tool to separate logging impacts and associated changes in forest structure.”

2005 Report

“Data have been gathered since 1997, except for the years 2001, 2003 and 2005 due to logistical problems. (Table 1)

Table 1: Sites Sampled by Year and by Season

Year	Season	Site					
		1	2	3	4	5	6
1997	Spring						
	Summer	X	X	X	X	X	X
1998	Spring		X	X	X		X
	Summer	X	X	X	X	X	X
1999	Spring	X	X	X	X	X	X
	Summer	X	X	X	X	X	X
2000	Spring	X	X	X	X	X	X
	Summer	X	X	X	X	X	X
2001	Spring						
	Summer						
2002	Spring	X					
	Summer	X					
2003	Spring	Treatment					
	Summer						
2004	Spring	X	X	Treatment			
	Summer	X	X				
2005	Spring						
	Summer						

The 2005 report also states “confusion regarding the sampling of Site 3 has caused uncertainty regarding the validity of data sampled before 2004. Consequently, Site 3 has been eliminated from the study. Furthermore, Site 5 had to be eliminated also because the USFS decided not to log within the treatment plot.”

Therefore, in 2005 the number of sites in the study was reduced from 6 to 4, and they completed an analysis to show that “treatment” and “control” plots were more similar in species composition within a site than across other sites.

2007 Administrative Report 07-09

The 2007 is the most comprehensive report since the initiation of the project. It contains detail information on study design and thorough descriptions of the forest types and plot characteristics.

Using species occurrence and percent cover values, an analysis was conducted on Species Richness and Species Composition. Using these measures of community structure, they were able to determine that plots are more similar within sites than between sites with the exception of sites 2 and 3, but that could be due to the close proximity of the site.

2008 Administrative Report 08-13

This report summarized survey work conducted in the sampling season of 2007 and the data that were collected. Tables included species data on richness, composition and importance values. Summary compared species information across plots, sites and across sampling period (spring vs. summer).

2011

Sampling efforts resumed in 2011 as a result of personnel changes in 2010. This report summarizes sampling effort and project familiarization.

2012

In 2012 there was discussion about the status of the project and about whether or not we were adequately sampling enough sites and enough quadrats to draw powerful conclusion. Two methods were used to address these discussion items and yielded the following results.

- 1) Ordination techniques to visualize differences in plant community composition between treatments and seasons. Result: No significant difference existed between treatment and control understory plant communities in either season.
- 2) Permutation-based multivariate analysis of variance (PerMANOVA) to test for differences in understory vegetation. Result: No significant difference existed between treatment and control understory vegetation communities in either season.

The analyses were conducted on 2011 data and seem to infer that the treatment sites had returned to pre-logging conditions, in the understory plant community. However as there were still visible differences in the site, it begged the question about whether we were sampling enough sites to draw this conclusion.

Sample size was assessed at two levels and yielded the following results:

- 1) Within-plot, to determine how many quadrats are necessary to adequately measure the understory community at each plot. Result: Using 80% as the goal, the number of quadrats necessary to sufficiently represent the plant community in a plot is 40 quadrats. The current sampling intensity of 42 quadrats per plot accounted for 82% of the estimated overall species richness.
- 2) Between-plot, to determine how many paired control-treatment plots are necessary to quantify the effect of logging. Result: Given the current sampling efforts, a statistically significant difference between logged and unlogged plots for most species does not exist. Suggesting the sample size is not large enough.

Despite these results it was determined to continue sampling efforts and develop other analytical techniques in future years.

Summaries 2013-2019

These reports simply summarize sampling effort for project status updates.

DATA

We currently have Species occurrence and percent cover data on 4 sites for the following years: 1997; 1998; 1999; 2000; 2002; 2004; 2007; 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; and 2019.

The years 1997 through 2012 are included in a Microsoft Access Database with the years 2013 through 2017 waiting to be entered. Years 2018 and 2019 were recorded using the KoBoToolbox and are located on GLIFWC's server. I am working with the Database manager to migrate Access data to the GLIFWC server and organizing paper surveys that will be entered into the GLIFWC database.

RECOMMENDATIONS

Moving forward there are various approaches we could pursue to both utilize and evaluate existing data. Some suggestions that have been discussed include:

- 1) Conduct similar analysis to the 2007 report and compare rates of change across years.
- 2) Conduct a Principal Component Analysis comparing sun loving vs shade tolerant species. The hypothesis being before treatment fewer sun loving plants would be present.
- 3) Evaluation of invasive species.
- 4) Summarize species specific data: Species Richness; Species Composition; Importance Values for spring v. summer.
- 5) Assist in species specific requests. For example: We had received a request to evaluate leeks and the length of time it took for them to bounce back following a logging activity.
- 6) Indicator Species Analysis to detect which species are most affected by logging.