



“Integrated Pest Management”

Version 1.0 April 2014



1.0 Introduction

This integrated pest management approach is designed to address the use of chemical pesticides, including herbicides and insecticides, on the Nipissing Forest. In general, Nipissing Forest Resource Management Inc. (NFRM) is the principle proponent of herbicide use while the Ministry of Natural Resources, however, is normally the principle proponent of insecticide use. Herbicide use on the Nipissing Forest is more common than insecticide use. The principles in this integrated use approach are focused on herbicide use but also apply when insecticide use is contemplated or implemented. Those specific situations will be documented.

NFRM believes in applying best management practices to each forest site ensuring that silvicultural prescriptions are effective and Forest Management Planning (FMP) objectives, related to the future forest condition, will be met. NFRM considers that its use of herbicides for forestry purposes is safe and effective, and through implementation of its Integrated Pest Management document, has minimal adverse environmental impacts. Since there are presently no economically feasible non-chemical alternatives for large-scale forestry use, the application of herbicides must remain in NFRM's silvicultural tool kit. NFRM intends to minimize herbicide use through judicious planning and application, while continuing to monitor advances made in field-proven science and technology.

This integrated pest management approach involves steps to characterize and map candidate treatment blocks according to the need for tending, selection of the appropriate application method and equipment, available site specific herbicides, use of the best available technology, careful implementation using all safety precautions, and use of fully trained staff and contractors. This integrated, site-specific approach ensures that the use of herbicides is minimized, while ensuring management objectives are met.

2.0 Insect Management Context

There has been no large scale/aerial application of insecticides on the Nipissing Forest during the period that NFRM has been conducting forest management (April 1996). Part D, Section 6, of the Forest Management Planning Manual for Ontario's Crown Forests, 2009, describes the Integrated approach to developing and implementing Insect Pest Management Programs. In general, if OMNR led monitoring efforts identify a major pest infestation then a program will be developed. An interdisciplinary team, led by OMNR Forest Management Branch, including representation from NFRM and other stakeholders, would consider several possible management options. If the selected course of action involves aerial application of insecticides then a planning/consultation/approval process,

similar to that for herbicides, is engaged. NFRM's role is essentially to facilitate the implementation of the selected management option which may also include modifications to forest harvesting plans.

Biological control agents (e.g., Bt) are used only where other non-chemical pest control methods are, or can reasonably be expected to be, ineffective. The rationale for the use of biological control agents is documented and based on scientific evidence. There has been no recent use (since 1996 when NFRM started managing) of biological control agents on the Nipissing Forest. Use of biological control might be considered under conditions of insect outbreak posing a serious threat to wood supply; any use of biological control is strictly regulated in Ontario by the Integrated approach documented in the referenced Planning Manual.

Tree Improvement activities on the Nipissing Forest SFL are primarily conducted on a site located in Gurd Township. The long term strategies for tree improvement at the Gurd site were originally developed by the MNR but now reside within the Forest Genetics Ontario (FGO) entity. The annual activities that occur at the Gurd Site are generally planned and implemented by a group of interested parties composed of: NFRM, Northeast Seed Management/FGO, MNR District and Science staff, and the Canadian Institute of Forestry through its CIF-SEEK Program. NFRM has facilitated a one-time ground based application of insecticide at the Gurd site consistent with this Integrated Pest Management document.

3.0 Vegetation Management Context

The Nipissing Forest supports many different forest tree species that have a broad range of ecological inputs (sunlight, moisture and nutrients) required for growth. Vegetation management is the means by which a competitive advantage (ability to capture ecological inputs) is afforded to one or more desired forest tree species over other forest vegetation. This mechanism is required to influence development toward a desired condition or structure to meet a number of management objectives. More generally, NFRM has a legal requirement to maintain a variety of forest compositions that include a conifer component.

Five principle elements of the NFRM vegetation management strategy are:

- Autecology Information - knowledge of the reproduction strategies and the ability to compete for resources for both desired and non-desired forest vegetation;
- Response to Disturbance - knowledge of how non-desired forest vegetation responds to harvesting, site preparation, and tending;

- Treatment Options - knowledge of treatment options that can be practically applied through harvest and/or silviculture to either Minimize the development of competing vegetation OR Reduce existing competing vegetation;
- Treatment Efficacy - knowledge of the degree to which a specific treatment can provide a required competitive advantage to desired forest tree species obtained through current research and local monitoring;
- Environmental Impacts - knowledge of the environmental consequences of each vegetation management treatment option.

There are three Silviculture Systems employed on the Nipissing Forest under which forest management activities (harvest and renewal) occur. Each one of these systems (Clearcut, Shelterwood, and Single Tree Selection) is prescribed and implemented based on groupings of forest tree species with similar silvicultural and ecological aspects. Vegetation management traditionally begins with harvesting where varying proportions of the canopy are removed. Those variations of canopy removal distinguish the silviculture systems from each other. Within each system, subsequent treatments (site preparation and tending) are applied to provide competitive advantage to desired tree species.

NFRM applies a suite of vegetation management treatments, which complement harvesting within each silviculture system. These treatments are generally applied post-harvest; however, some are applied concurrent with the harvest.

Vegetation Management Techniques Available

Non – Herbicide

- mechanical site preparation
- brushsaw tending
- conifer pre-commercial thinning
- conifer commercial thinning
- hardwood stand improvement

Herbicide

- aerial spray
- skidder-mounted ground spray
- back pack manual spray

The following table summarizes the amount of vegetation management treatments undertaken on the Nipissing Forest since 1996.

Nipissing Forest Vegetation Management 1996 through 2010

	Concurrent with Harvest		Site Preparation Treatment		As a Tending Treatment before Free Growing Status		Tending Treatment after Free Growing Status		Total Vegetation Management		
	Herbicide	Non Herbicide	Herbicide	Non Herbicide	Herbicide	Non Herbicide	Herbicide	Non Herbicide	Herbicide	Non Herbicide	Totals
HA	0	9,687	3,352	10,473	10,524	3,180	0	6,599	13,876	29,939	43,815
%	0	22.1	7.7	23.9	24.0	7.3	0.00	15.06	31.7	68.3	100

Although herbicide-based treatments account for a minority of the total area treated to date, it remains the most controversial approach to vegetation management. As such, when NFRM prescribes a herbicide-based treatment it is done within the context of Judicious Use. A complete discussion about Judicious Use is documented in section 2.2 (a) of this Strategy.

4.0 Elements of a Herbicide Use Management Strategy

The approach to herbicide use on the Nipissing Forest is composed of several elements. The combination of the five elements provides a strategy that balances social, environmental, and forest resource aspects.

Element #1 restricts NFRM to using only those herbicides specifically regulated for forestry use by Health Canada and are deemed acceptable by third party certification systems.

Element #2 focuses NFRM efforts on implementing processes and actions designed to avoid or minimize herbicide use. This may include factors such as amount of crown opening, season of harvest, or keeping forest floor mat intact. NFRM is firmly committed to a process of Judicious Use which documents all of the steps/aspects of deciding and rationalizing targeted applications.

Element #3 ensures that NFRM continues to test, develop, and implement non-chemical methods of vegetation management. Sole reliance on herbicides for all vegetation management requirements is neither sustainable nor balanced.

Element #4 requires a detailed review of the outcomes of previous vegetation management treatments with respect to their effectiveness in achieving forest management objectives. The emerging trends resulting from these analyses provide the basis for rationalizing the current and future decisions concerning vegetation management.

Element #5 ensures that, when herbicide use is prescribed, NFRM is bound to strict compliance with all laws and regulations related to chemical and herbicide use. Only forestry herbicides approved by Health Canada and deemed suitable by the Forest Stewardship Council are used. Safe and careful use will minimize all potential risks to human health and adverse environmental impacts. Use of only Licensed applicators combined with regular compliance audits ensures careful use. NFRM recognizes that trained and professional staff will be used to assess vegetation management needs, and to provide continuing education opportunities for those personnel.

4.1 Do not use chemical pesticides that are prohibited by our third-party certifier.

Maintaining third party certification requires that we confine our use of pesticides to those not deemed "highly hazardous". NFRM only uses herbicides approved by the Health Canada Pest Management Regulatory Agency as safe and effective. NFRM believes that the PMRA is one of the most rigorous testing system for forestry herbicides in the world, and indicates substantial scientific evidence of environmental safety. NFRM uses primarily glyphosate-based and to a lesser degree triclopyr-based herbicides.

4.2 Implement processes and actions designed to minimize or avoid chemical pesticide use, whenever possible.

a) Strict Adherence to Judicious Use

The process followed by NFRM that supports and guides vegetation management, specifically using herbicides, is documented in the flowchart titled "Decision Making Process for the Judicious Use of Herbicides".

This approach involves steps to characterize and map candidate sites according to the need for vegetation management. At this stage, the question of whether a non-herbicide based method can achieve the management objective is posed. The answer forms part of the rationale for the decision to use herbicides.

If herbicide use is found to be necessary, careful consideration is given to any developing trends appearing from the results of annual efficacy monitoring. The selection of the site-specific herbicide, application rate, application method and equipment is influenced by those emerging trends.

During the process to refine the precise location where herbicide is to be used, opportunities to exclude area from application will be examined.

The OMNR reviews all proposed treatment areas prior to implementation to ensure that other forest values have appropriate protection. Sites prescribed for aerial application pass through an additional level of scrutiny and permitting by the MOE. Examination of the rationale for use and approval of the Implementation Plans is also conducted.

NFRM will make use of the best available application technology (e.g. nozzle and navigation) to ensure that the right amount of product is applied in the right place. NFRM has representatives on site to ensure careful implementation of all safety precautions.

The point of this integrated, site-specific approach is to ensure that management objectives are met and that the use of herbicides is minimized.

b) Continuous Annual Monitoring

NFRM is committed to closely monitoring the effects of prescribed herbicide use. This feedback loop is essential for refining decisions on all aspects of usage: varying rates of herbicide, total mix volumes, threshold levels of tolerable vegetative competition, choice of herbicide, herbicide rate/ha, carrier (i.e. water) rate/ha, droplet size, timing, climate conditions.

Ground surveys are conducted during the following growing season on areas that received herbicide applications to assess the following:

- the efficacy based upon the percent coverage of the site, and the control of the target vegetation;
- any damage to crop trees;
- any evidence of off-target application;
- recommendations for the next action

c) Use and Development of Techniques to Minimize Use

NFRM is committed to using the least amount of herbicide possible and will continually utilize approaches to vegetation management that have been or may be proven to be effective.

Techniques currently being used that do or may result in lower herbicide usage:

- Conduct intensive mechanical site preparation - if soil depth and texture are suitable for heavier mechanical work (no diminishment of forest productivity), the entire surface organic layer which includes the "seedbank" can be removed prior to tree planting.
- Planting of large, vigorous, well balanced, stock capable of tolerating increased levels of competition that would result from less use of herbicide.
- Carefully selecting sites targeted for conifer planting which are not excessively fresh or rich that would require significant levels (more than 2 treatments) of vegetation management.
- Continued use of high volume/low-drift application technology when aerially applying herbicides to white pine shelterwoods. Large droplets resulting from doubling the amount of mix water/ha increases canopy penetration. This allows more mix to reach the target vegetation on the forest floor. This concept has been tested both at the experimental and operational scales. Operational results will be available in 2012, however, preliminary results from 2008 & 2009 indicate that it will likely be possible

- to lower the per hectare rate of herbicide applied and still achieve the same vegetation management objectives.
- Precisely targeted applications using back pack sprayers. These application methods are generally limited to a small scale due to low relative productivity coupled with the short application season. Continued and possible increased use of manual application methods, however, will effectively result in lower total herbicide use.
 - Regular use of GPS guidance systems in both ground-based skidder and aerial applications. This provides real-time navigation to assist the operator/pilot in applying evenly spaced swaths over the project block. In addition, this navigation system provides functionality to the operator/pilot that warns him when block boundary and areas of concern are in his travel/flight path. Digital electronic data showing the project area, from a Geographical Information System (GIS), is typically up-loaded into the skidder/aircraft guidance system and appears on a moving map display within the operator/pilot's view, during application. This essentially eliminates the need for supplemental application aimed at treating the gaps missed during the first application and minimizes the potential for treating areas outside of the approved block.

Possible Techniques to be developed that may result in lower herbicide usage:

- Developing white and red pine restoration strategies/prescriptions where red pine is planted in recent clearcuts followed by density control treatments (pre-commercial and commercial thinning). This could enable the establishment (planting) of white pine approximately 20 years prior to the final harvest of red pine under a partial canopy similar to natural processes. Deep, coarse textured soils, optimal for growth of red/white pine, would likely have a lower amount of competing vegetation.
- Developing prescriptions to establish semi-tolerant conifers (white spruce and white pine) in strips within/between advanced growth intolerant hardwoods (poplar, white birch). Utilize precisely targeted methods of vegetation control versus more broadcast type approaches.
- Conducting spray application modelling work using AGDSP (OMNR SSIS) to explore various application technologies (boom and nozzle) and mix rates that result in the highest amount of spray mix reaching the ground with the least amount of herbicide to satisfy the vegetation management objective.
- Establishing red oak growing stock in the understory of suitable Shelterwood stands prior to conducting Regeneration harvests. Use of improvement cuts to clean out the understory followed by regeneration establishment (natural or artificial) may reduce or eliminate the need for tending treatments.

d) Forest Management & Tree Seedling Nurseries

All of the nurseries that supply seedlings to NFRM are required to have integrated pest management policies, which describe guidelines for minimizing pesticide use and to ensure safe handling. Copies of these documents have been supplied under separate cover as part of NFRM's Forest Stewardship Council (FSC) web documents.

4.3 Test, develop, and implement non-chemical methods of vegetation management.

- Using higher than normal plantation establishment densities to capture sites early and quickly. Planting trees at 0.5-1 meter vs 1.8 meter spacing would result in less growing space being available for non-crop tree competition to develop. This approach would more closely emulate the natural development of conifer stands.
- Using mechanical mulchers, on appropriate sites for tending or site preparation treatments.
- Continued and possible increased use of brush saws and chainsaws (manual tending) when and where suitable.

4.4 Periodic review of Silvicultural Effectiveness

NFRM must conduct detailed surveys of all previously harvested sites to determine the degree to which those areas are successfully regenerating to specific standards. The results of these surveys indicate the effectiveness of the applied silvicultural treatments at achieving the intended outcome. These surveys are conducted from 7 to 20 years after an area has initially been harvested, depending upon the Silviculture System and tree species.

Analysis and reviews of survey results are currently documented in Annual Reports, Year 7 and Year 10 Annual Reports, and within each Forest Management Plan according to direction contained in the "OMNR Forest Management Planning Manual", 2009 version. These reviews document emerging trends and generate recommended changes to improve the effectiveness of renewal and tending operations. They also form an important component in the determination of forest sustainability.

The most recent documented reviews of Silvicultural Effectiveness are present in the 2008/2009 ten-year Annual Report and the 2010/2011 Annual Report. Important trends and recommended changes from those Reports are necessary inclusions to this Strategy. They form the principal rationale for all current and

future vegetation management practices. As subsequent reviews occur, this Strategy will be revised to incorporate any new directions.

Recommendations on record that direct and rationalize vegetation management on the Nipissing Forest:

- Plantations established in clear cuts require further tending treatments to meet silvicultural success requirements.
- For white pine shelterwood regeneration cuts - a comprehensive tending program implemented as soon as competition is present on site will result in achieving a degree of regeneration success more consistent with the modelled FMP rate of 95%.
- Chemical site preparation treatments should be considered on sites where existing competition exists before planting.
- Pure conifer forest units need to be intensively managed to maintain their high conifer component.
- A rigorous monitoring program will ensure proper timing and selection of the most effective type of treatment.

4.5 When applying chemical pesticides, ensure that health and safety risks are minimized through strict compliance with all laws and regulations related to chemical and herbicide use.

The registration of pesticides in Canada is the responsibility of the Pest Management Regulatory Agency (PMRA) of Health Canada. Their mission is to protect human health and the environment, while still allowing access to pesticides necessary for effective pest management. They assess the risks associated with the use of a pesticide, and weigh those risks against the value of that product as part of a sustainable pest management strategy. This risk-benefit analysis is the basis of the regulatory decision to register a product for use, and set constraints on the way the product is used. These regulatory decisions are based on results of required studies, and following a search of relevant related scientific literature. Once registered, pesticides are subject to periodic re-evaluations, to make sure registration of the pesticide is still justified based on current scientific knowledge.

In Canada, four herbicides are registered for aerial application to forests: glyphosate (trade names: Forza, Vantage, Vision, Vision Max), 2,4-D (various trade names), triclopyr (Release), and hexazinone (Velpar). All these herbicides work by interfering with metabolic processes that are unique to plants. Birds and

animals do not have these metabolic processes and these herbicides have little effect on them.

After a herbicide is registered for use in Canada, the Ministry of the Environment regulates its use in Ontario through the Pesticides Act (PA). The PA has extensive requirements regarding public notification and license requirements for users and sellers. The Ontario Pesticides Advisory Committee is to advise the Minister of Environment if a pesticide is compromising human health or environmental quality. The Pesticides Act and the Crown Forest Sustainability Act ensure that registered pesticides are used safely with due consideration for sustainability of the environment. The use of herbicides as a forest management tool was extensively reviewed as part of the Class Environmental Assessment (EA) for Timber Management (1994). This included a broad public hearing and consultation process. The assessment determined that herbicide use is an essential and acceptable practice and that the appropriate public safety and environmental controls are in place.

Forest companies are required to follow the Ontario Ministry of Environment / Ontario Ministry of Natural Resources buffer zone guidelines for aerial application of pesticides in crown forest of Ontario (1992). These guidelines were developed to protect the aquatic values. Current research led by Dr. Dean Thompson of the Natural Resources Canada shows that these guidelines are effective at protecting water bodies. In general, spray equipment is getting more refined, and knowledge of aircraft tracking methodologies and herbicide deposition is improving.

The application of herbicides is restricted to a very short application window dependent on growing season and daily weather conditions. Extensive public consultation is conducted as per the requirements of the FMPM to ensure the public are made aware of the scheduled areas for spray. This starts with the identification of areas proposed for spray during the production of the FMP and associated information centers and public notices. As well, there is public notification at the annual work schedule stage, which entails two newspaper advertisements, the first at least 30 days before scheduled date of spray commencement, and another advertisement at least 7 days before spray commencement. In addition, a mail out to all people listed in the District mailing list for any Township with proposed spraying or any adjacent township within 1 km of spray location is notified. All treatment blocks are posted no earlier than seven days prior to the commencement of spray operations with warning signs that meet the legislated requirements. The signs remain in place for a minimum of thirty days following the herbicide application.

In addition NFRM also carries out additional measures to ensure safety of the public and other stakeholders (i.e. road security and pre-spray check flights to ensure blocks are clear).

All NFRM applicators and contractors, as well as supervisory staff involved in tending programs receive the training necessary to perform their specific tasks. Copies of required Applicator Licences, contractor and supervisory staff training documents, and NFRM staff training records, are available.

All the proper licences, equipment and procedures are in place prior to initiating any tending project. NFRM's Health and Safety Policies and Procedures contain detailed instructions for the safe handling and storage of herbicides and related equipment.

5.0 Conclusion

Vegetation Management is an important tool to successfully carry out forest stand replacement. Third Party Certification, evolving Silviculture Guides, concerned public involvement and a host of other factors are key elements in growing future forests for the People of Ontario. Only through timely "field" proven science, will we be able to move and meet these new challenges. We, as forest managers, have the privilege of working in the forest and must ensure that we operate in a respectful manner. This will prove to be our legacy.