REVIEW OF ALTERNATIVE VEGETATION MANAGEMENT OPTIONS

PROJECT #94-3-04

submitted to:

MANITOBA MODEL FOREST

by:

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EXECUTIVE SUMMARY

In recent years their has been a movement by forest managers to reduce their reliance on the use of herbicides as their primary vegetation management option for a more balanced integrated vegetation management program that includes a variety of non-chemical alternatives. This report reviews and evaluates the alternative vegetation management options being practised or tested in other forest jurisdictions in Canada. The primary focus of this review is on the Vegetation Management Alternative Program (VMAP) in Ontario, but information was also gathered from Quebec, Saskatchewan, Alberta and British Columbia. Based on this review, recommendations for potential research trials are provided for the two remaining years of the current Manitoba Model Forest program.

1.0 INTRODUCTION

The second task associated with Manitoba Model Forest Project #94-3-04 was to complete a thorough review of alternative vegetation management strategies and technologies currently being used or researched in other jurisdictions in Canada. The end product of this review would be a set of recommendations for additional vegetation management trials or demonstrations that could be implemented in the final two years of the existing Model Forest funding. The following report documents this review and provides several recommendations for future vegetation management projects.

2.0 SCOPE AND REVIEW METHODOLOGY

This review focuses on those provinces where forest vegetation types and vegetation competition problems are similar to those found in the Manitoba Model Forest. Information was gathered from Quebec, Ontario, Saskatchewan, Alberta and British Columbia, but the primary focus of the review was on Ontario where the Vegetation Management Alternatives Program (VMAP) has been established by the Ministry of Natural Resources to specifically address the vegetation management issue. VMAP'S mandate to develop approaches in managing forest vegetation that would reduce the forest sector's dependence on herbicides, is very similar to the objective of this Model Forest project. Since establishment, VMAP has completed numerous literature reviews of potential treatment options and installed numerous field trials to compare and evaluate those options with the greatest potential. Much of this information and documentation was utilized for this report. For most other provinces the author relied on direct personal communication with forest managers in both the Ministry and the forest industry.

One of the initial VMAP activities was to document vegetation management alternatives that are currently being employed or under consideration by the forest sector (Bell et al 1992). This document provides an excellent summary of vegetation management options available to a forest manager and the associated advantages and limitations of each of these options. This document will provide the foundation for this review. Other options developed since its publication and/or options employed or being tested in the other provinces are also included in this review.

3.0 INTEGRATED FOREST VEGETATION MANAGEMENT

Over the last ten to fifteen years many forest managers have come to rely on the use of herbicides to solve many of their vegetation management problems. Aerial broadcast herbicide applications have become quite common as they are an effective and economical treatment.

In recent years with the continuing concern by the public over the use of herbicides in the forest environment, most provinces are now attempting to reduce or even restrict their use. There is a definite movement towards the development and practise of alternative vegetation management options that can be incorporated into an integrated forest vegetation management program (IVM). IVM has been defined as "the management of non-crop vegetation to achieve silvicultural objectives using a variety of methods that are environmentally sound, economical and socially acceptable" (Wagner 1993). In most areas this movement is focusing on alternatives which prevent vegetation management concerns instead of treatments that address concerns that have already developed.

The implementation of an integrated vegetation management program does not necessarily eliminate or restrict the use of the herbicide option, but allows for its judicious use as one of many options available to forest managers. As you will see in this review, the herbicide option is still very prevalent, but application timing and applicator technologies under development and evaluation are such that they will likely result in an overall reduced use of herbicides.

4.0 REVIEW OF ALTERNATIVE VEGETATION MANAGEMENT PRACTISES

A summary of the various vegetation management treatment alternatives and specific application techniques being employed or evaluated in other Canadian jurisdictions is presented in Table 1. Treatment alternatives are provided for the four stages of forest management in which vegetation control practices are commonly or potentially used (pre-harvest, harvest, site preparation and brushing & weeding/conifer release). In most cases several application techniques are identified for each alternative. General comments and recommendations for future consideration by the Model Forest are also provided.

TABLE 1: VEGETATION MANAGEMENT OPTIONS

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
PRE-HARVEST	**1.** Girdling with Powered Manual Tools	- chainsaws with girdling bar - L'll Beaver power girdler	- both manual girdling and chemical injection pre-harvest treatments are used to some degree in several other provinces.	- due to safety concerns and the increasing use of aspen in the Model Forest, it is not recommended to pursue this option.
	2. Stem Injection with Herbicides	- hypo-hatchet - sure shot injector - punch and fill - spot gun - hack and squirt - gel caps - Ezject	- hack and squirt appears to be the preferred treatment. - treatments provide varying degrees of control of aspen suckering after harvest. - due to treatment costs these are typically used in stands where aspen composition is less than 20%. - biggest limitations are that treatments must occur 2 - 4 years before harvest and safety liability concerns from snags at time of harvest.	
	3. Pre-Harvest Understory Fire	- light early spring fire to girdle aspen	- pre-harvest understory fires are used to control aspen and other hardwoods in Ontario and British Columbia. - the intensity of the fire is critical. If the fire is too hot and kills instead of girdling the aspen, suckering will not be controlled.	- this option is also not recommended for the same reasons.

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
HARVEST	**1.** Modified Harvest Systems	- seed tree - shelterwood - selective - clearcutting-minimum disturbance	- harvesting or silviculture systems can help control vegetation on the site after harvest. - selective or shelterwood systems generally result in less vegetation difficulties than clearcut systems, but these benefits are not well documented. - alternative or modified harvesting systems are being used across Canada, but typically for other reasons than for vegetation management. - a shelterwood system could be employed on the Model Forest in those mixedwood sites where the softwoods are typically clearcut. - minimizing soil disturbance will reduce those species that rely on seed propagation. The cut-to-length system now being used by Pine Falls Paper Company should reduce this competition.	- a selective or shelterwood harvesting trial should be considered for the future. Additional information is needed to determine the species and site conditions that would be most appropriate. This discussion could be pursued through the National Model Forest Vegetation Management Committee. - the benefits and/or impact on vegetation of the cut-to-length system should be documented. A new trial is probably not required as the information from projects #94-3-01 and 94-3-03 could probably provide you this.

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
HARVEST	**2.** Stump Application with Herbicides	- herbicide applicator attached to felling head - stump injections - backpack sprayer	- aspen suckering can be controlled through direct application of herbicides to the stump during or immediately after harvest (within 2 hours). - historically a liquid herbicide has been manually applied directly to the top of the stump. Stump injection tools (Ezject and Gel Caps) are being tested. Ontario currently has a trial using a herbicide applicator attached to a felling head. - all three techniques have application in the Model Forest, but the latter has the most potential as it combines harvesting and vegetation control all in one activity.	- this option probably has the greatest potential and benefits as harvesting and vegetation control can be combined and by only treating the poorer quality aspen, the quality of the aspen regenerating on the site can be improved. - since the felling head applicator is not yet perfected, it is recommended that a trial with a backpack sprayer be implemented this year. Appropriate cost - $ 6.0.
	3. Post-Harvest Understory Fire	- light early spring fire to girdle aspen	- post-harvest understory fires are also being used to control hardwood suckering. - difficulties arise with fire intensity if slash loads are heavy. - this techniques could be considered on the mixedwood pine sites as slash would be relatively light and it would promote natural regeneration of pine while controlling aspen suckering.	- a trial in a mixedwood pine site should be planned and scheduled for the spring of 1996.

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
SITE PREPARATION	**1.** Manual	- powered scalpers - hand scalping	- site preparation is often used to help control competing vegetation during the plantation establishment phase. It is often a successful preventative treatment that eliminates or reduces the need for subsequent vegetation management treatments.	- most new pieces of site preparation equipment and chemical/mechanical combinations are already being evaluated in Model Forest project 94-3-06. - no additional new treatments were identified in this review for evaluation.
	2. Mechanical	- brush blades and rakes - V-blades - drag scarifiers - plows and rippers - patch scarifiers - disc trenchers and cone scarifiers - drum choppers - mixers - excavators	- there are numerous mechanical, chemical and mechanical/chemical options available. Many of these options have been around for some time and have been tested or are currently being used in the Model Forest. - The primary focus and new research appears to be on mixers and excavators and the use of herbicides in site preparation. Many of these concepts are incorporated into the current Model Forest Difficult Site Trial (Project #94-3-06).	
	3. Ground Chemical a) Manual	- spot guns - motorized & non-motorized backpack sprayers - micron sprayers - granular applicators - various boom or cluster nozzle sprayers		
	b) Vehicle Mounted	mounted on a variety of prime movers		

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
SITE PREPARATION	**4.** Cover Crops (sowing of desirable native forbes and grasses)	- ground application after mechanical site preparation - concurrent with site preparation treatments	- the sowing of cover crops (grasses & forbes) during site preparation is being tested in Ontario, B.C. and Quebec. The objective is to reduce undesirable competing vegetation by growing desirable vegetation on the site instead. Most cover crop species have the added benefit of being preferred by many wildlife species and are nitrogen fixers. Most research to date has been focused on hardwood management in southern Ontario, but recent trials have been established on softwood cuts where grass is anticipated to be a concern. This technique could be applicable in the Model Forest on sites with primarily native grass and herbaceous competition.	- since this is still a relatively new development, a trial is not recommended at this time. The VMAP research is still focusing on sowing rates and species selection. This work should be monitored and evaluated once more results are available.

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**1.** Manual Cutting	- brush saws - chain saws - sandvik axes - shears - machete or brush hook (hockey stick)	- manual cutting with brush saws and chain saws is still a common practise in many areas where the use of herbicides is not allowed or where local employment opportunities are a primary goal. Typically manual cutting results in extensive re-suckering and basal sprouting, subsequently requiring additional treatments. Early summer treatments when the tree is actively growing appears to achieve better results. There is also evidence that the cutting height impacts treatment success. Cutting at about 50 or 75 cm or below the lowest live branch is the most effective. Both factors are currently being evaluated in VMAP trials in Ontario.	- with the excellent results in the VMAP trials, it is recommended that a trial be established this year. - approximate cost $6.0.
	2. Manual Girdling	- chain girdlers - sandvik axe - scorp - machete - kyuquot girdler - hatchet or axe - vrendenburg girdler - battery cables -	- there are numerous manual girdling tools on the market, but their use is not common in the Boreal Forest region. This is due to several reasons including: - the high cost associated with the typical large number of stems per hectare;	- due to the reasons indicated in the general comments, no additional evaluations are recommended.

		chain saws - L'll Beaver power girdler	- ineffectiveness of tools on small diameter stems (3 cm); - the inability of one tool that can treat everything on a site; and - the lag time after treatment before actual release occurs (2-3 years for tree mortality).	

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**3.** Mechanical	- Seppi forestry mower - Silvana Selective/Ford versatile clearing machine - TRH-150 brush cutter	- several trials are underway to evaluate mechanical clearing machines that can be used to release established conifer plantations from hardwood competition. The Seppi forestry mower has been tested in Ontario and in Manitoba in Model Forest project #94-3-04. The Silvana selective has been evaluated in several trials in Ontario and it appears to be an efficient and cost effective tool that warrants further study. The major difficulty could be with the prime mower as it is not designed for use in a forest environment.	- a trial with the Silvana selective is recommended for this year. This could potentially be combined with the manual brush saw trial. Approximate cost $8.0.
	4. Mulches	Various materials including: - paper products - peat moss - polyethylene - felt - plywood - saw dust - bark chips - wood chips - straw	- there are a wide variety of mulches available commercially on the market or that can be created from forest by-products. They do a good job in controlling grass and herbaceous vegetation, but woody vegetation control is somewhat limited. The cost and logistics of applying mulches usually precludes their use in an operational setting. In other provinces they are typically being used in seed orchards, on sites where the herbicide option is not	- no additional trials are recommended for mulches as they are included in project #94-3-06.

			appropriate or on hardwood woodlots. Ontario currently has several trials on hardwood woodlots and one on a black spruce seed orchard. Mulches are also a proposed treatment in the Manitoba Model Forest Project #94-3-06.	

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**5.** Tree Shelters	- protective cylindrical tubes of various materials	- in hardwood management the use of tree shelters has shown to increase initial seedling survival and growth. Ontario is currently evaluating if this rapid early tree growth can reduce the need for vegetation management and herbicide use during plantation establishment. All research to date has focused on high valued hardwoods. The costs and logistics probably precludes their use in an operational softwood management setting.	- no tree shelter trials are recommended unless in the new project to rehabilitate agriculture lands.
	6. Grazing	- cattle - sheep	- cattle have been used successfully for vegetation control in parts of Alberta and British Columbia. Ontario, Saskatchewan, Alberta and British Columbia are all using sheep on an operational or trial basis. Proper site selection and good flock management appear to be the key to a successful sheep grazing program. Much of the Model Forest would not be suitable for the grazing option. However, there are areas where this option could be considered.	- a sheep grazing trial is not recommended at this time. There are insufficient funds in this years program and there is not enough time to develop a well planned program for this season. A trial should be considered in future years as they could be a good option on specific sites as part of a well balanced integrated vegetation management program.

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**7.** Ground Chemical - Manual	- brush saws with ENSO applicator - stem injection - broadcast backpack sprayers - basal treatments - stump application - granular applications - IECO 3000	- there is a wide variety of single stem ground herbicide (Ezject, Gel Caps, Basel Thining with "Release" and Cut-Stump) or ground broadcast (liquid or granular) applications that are quite effective for conifer release programs. The primary difficulty with the single stem treatments is that herbaceous or shrubby vegetation often invades the site after treatment. Broadcast treatments tend to eliminate this concern. Both types of ground treatments are more expensive than vehicle or aerial applications, but are generally more accepted by the public. The majority of the ongoing research is attempting to determine which treatment provides the best vegetation control and crop tree response and to match the treatment to the site. - the IECO 3000 is a new ground broadcast application technique that is being tested on an operational	-it is recommended that a small trial using the IECO 3000 applicator be implemented this year. Approximate cost $2.0.

			basis in several provinces. The strategy behind this applicator is to apply a herbicide/fertilizer or just herbicide mixture while protecting the crop tree with a cone like shelter. The advantage of this system is that the treatment would not have to wait until crop tree budset and it could be used to treat softwood species that are more sensitive to herbicides.	

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**8.** Ground Chemical-Vehicle	- wick application - various boom and cluster nozzles - ForCan 500 - air blast sprayers	- most of the new developments in ground chemical vehicle application techniques has focused around air blast sprayers and combined chemical/mechanical site preparation treatments with the ForCan 500 or Bracke Herbicider. Air blast sprayers create smaller droplet sizes which result in better coverage of the vegetation . This however, creates greater potential for drift. Air blast sprayers have typically been used in seed orchards or nurseries, but there is some work underway to use this technique for stand tending treatments. The ForCan 500, Bracke Herbicider, (both of which are part of the Difficult Site Trial, Model Forest Project #94-3-06) and other combined site preparation treatments are an attempt to move away from traditional broadcast treatments and to use a reduced volume of herbicide at the early plantation establishment stage, thus avoiding herbicide	- no new trials using ground chemical-vehicle application are recommended. - additional developments with this technology should be monitored and trials established if applicable.

			treatments in the future.	

TABLE 1: VEGETATION MANAGEMENT OPTIONS (cont'd)

TREATMENT TIMING	TREATMENT ALTERNATIVES	APPLICATION TECHNIQUES	GENERAL COMMENTS	RECOMMENDATIONS
BRUSHING AND WEEDING OR CONIFER RELEASE	**9.** Seedling Culture	- larger, healthier and faster growing stock	- many forest managers are now using larger planting stock on those areas where vegetation competition is expected to be a problem. It is generally felt that with improved microsite development in the site preparation stage and the use of healthier and bigger planting stock, the reliance on herbicide use can be reduced. This basic principle definitely has application in the Model Forest and is an integral component of Model Forest project #94-3-06.	- no additional work is recommended at this time.
	10. Biological	Classical Biological Control: - use of native insects or disease Bioherbicide Control: - use of natural pathogens such as fungi or bacteria Allelopathic Control: - use of desirable, less	- biological control techniques have been used for some time in the agriculture field, but are a relatively recent development in forest vegetation management. Spearheaded by the Biological Control of Competing Vegetation Research Network (Bicover), there is a significant amount of ongoing research to develop products that	- there appears to be a series of trials instituted by Bicover partners. Most are in the provinces where the laboratory research is also ongoing. These trials should be monitored and once products are registered, they should be tested in the Model Forest.

		competitive or allelopathic plants (cover crops) Biorational Control: - use of natural chemicals derived from micro-organisms or allelopathic plants to control unwanted plants	can be brought forward for registration. The two most promising are the fungus "chondrosterem purpureum" for controlling aspen, alder and other root-sprouting species and the biorational product "bialaphos" which could be used to control raspberry, aspen and Canada blue-joint grass. Both of these products are now being field tested for effectiveness and efficacy.	

5.0 RECOMMENDATIONS

A summary of proposed 1995/96 and future vegetation management projects for the Manitoba Model Forest is provided below:

1995/96

1.Existing project 3-04 (remeasurement and reporting)	$ 3.0
2.Stump Herbicide Application Trial	6.0
3.Manual Brush Saw Trial	6.0
4.Silvana Selective Trial	8.0
5.IECO 3000 Trial	2.0
TOTAL	$ 25.0

Future Projects

1.Existing project 3-04 and remeasurement or 1995/96 projects	$ 15.0
2.Post Harvest Understory Fire	15.0
3.Shelterwood Harvest Trial	30.0
4.Sheep Grazing Trial	30.0
TOTAL	$ 90.0

The above projects are identified and prioritized according to the vegetation management needs in the Model Forest and the potential ability to deliver the projects under existing funding levels and management constraints. The individual project budgets are estimates only at this time and are subject to modifications once the precise project details are finalized.

Participation by the Model Forest partners in the National Model Forest Vegetation Management Committee could impact these recommendations. This initiative could result in cooperative regional or national projects that would be implemented with existing funding. It could also bring out new ideas or practises that were missed in this review that could potentially take on a higher priority than the identified recommendations.

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