ELECTRIC FENCE PROJECT

Purpose: To investigate the possibility of using a low cost portable fencing method to control cattle use of tree planted cut blocks.

Selection of Site: The experimental block was chosen by the Merritt District Silviculture section. Parameters considered included 1) a 1983 plantation, 2) cattle will use the area in 1983, 3) proximity to Merritt and 4) early access. The site chosen was polygon 753 on map sheet 92I007.

Costs: Materials such as the battery, energizer and ground rods can be amortized over longer fences. Materials such as the second battery, charger, and energizer (if blocks are close together) could be amortized over additional projects.

<table>
<thead>
<tr>
<th>Table 1 - Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Materials</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1.1) Posts 2 1/2-3&quot; X 6' Pressure treated 156 @ $2.17</td>
</tr>
<tr>
<td>1.2) Wire 12 1/2 gauge high tensile high tensile smooth 5 1/2 rolls @ $54.62</td>
</tr>
<tr>
<td>1.3) Insulators - Gallagher Type W 310 @ 0.22 Statite Corner 6 @ 0.20</td>
</tr>
<tr>
<td>1.4) Tighteners - Ezy Way 14 @ $3.55</td>
</tr>
<tr>
<td>1.5) Energizer Gallagher E 12 1 @ $179.05</td>
</tr>
<tr>
<td>1.6) Batteries - 12 Volt 2 @ $66.00</td>
</tr>
<tr>
<td>1.7) Charger 1 @ $30.00</td>
</tr>
</tbody>
</table>

....../page 2
The costs incurred by our trial are summarized below. We constructed 1250 m of electric fence for $3000. ($2400/km). This cost can be easily reduced by 60% maybe more.

In the spring of 1983 we constructed our fence with 4 wires (2 hot, 2 ground). After the successful results observed during the 1983 field season we removed one hot and one ground wire. The 2 wire fence has operated successfully from 1984 through 1986.

Further cost savings can be accrued by clearing the right of way in conjunction with post treatment site preparation, using less expensive wire that is easier to handle, using pounded wood posts at corners or on long spans only (less expensive and easy to install metal rods serve as an effective post), using proper tools (i.e. spinning jenny for rolling wire) and an experienced electric fencing crew. These recommendations will result in large labor savings.

Electric Fence Project Intern Report

Table 1 - Costs (cont.)

<table>
<thead>
<tr>
<th>Materials</th>
<th>Our Costs (1280 m)</th>
<th>Estimated Operational Cost/km on 2 km enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8) Ground Rods with Clamps</td>
<td>$21.00</td>
<td>$10.00</td>
</tr>
<tr>
<td>3 @ $7.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.9) Staples</td>
<td>$5.00</td>
<td></td>
</tr>
<tr>
<td>325</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.10) Freight</td>
<td>$29.95</td>
<td></td>
</tr>
<tr>
<td>Line Clamps</td>
<td>$12.60</td>
<td>$10.00</td>
</tr>
<tr>
<td>20 @ $0.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.11) Vandal Box</td>
<td>$100.00</td>
<td></td>
</tr>
<tr>
<td>1.12) Total</td>
<td>$1268.09</td>
<td>$709.00 or less</td>
</tr>
</tbody>
</table>

2. Labor

9 man days @ 10.70 hr. (laborer) ($674.10 $270.00
(7 hr. day including travel time)

3. Machinery

Right of way

$1000.00 $20.00

....../page 3
4. Grand Total $2942.19 899.00 or less

Discussion

An average cutblock is approximately 25 ha in size and would require approximately 2 km of perimeter fencing. If we estimate the life span of a fence to be 24 years and we require 4 years protection on each plantation, the same fencing materials could be used on 6 separate blocks. The cost of moving the fence 6 times would be about $3,000.00. This means the cost to protect 150 ha of tree plantations (25 ha/blk. X 6 blks.) would be approximately 4,800 \( \frac{2 \text{ km of fence} \times \$900/\text{km} + 3,000 \text{ to move the fence 6 times}}{6} \). Additional maintenance costs are unknown but if we suggest $100/year, the total cost would reach $7,200 ($4,800 + ($100/yr. X 24 yrs.)).

Replanting a cutblock costs approximately $600/ha. Therefore if the grazing use could be meticulously controlled on 150 ha of high risk plantations, there is a potential $90,000 saving (150 ha X $600/ha). The benefit cost ratio of 12.5:1 ($90,000 - $7,200) appears very favorable.

Survival Survey

The 1986 Regen/Survival survey was carried out in three separate areas; 17 plots were established within the confines of the electric fence, 6 plots were established immediately outside the fence, and 6 plots were established outside and approximately 200 metres away from the fenced area. These will be referred to as Areas 1, 2 and 3 respectively. Conditions in the three areas can be described as follows:

AREA 1 - little slash overall
- high grass competition (100 cm tall, 70% cover)
- no cattle damage

AREA 2 - little slash
- no grass competition
- very heavy cattle grazing
- heavy browsing and scarring of the trees by cattle (on 25% of the planted trees)
- no shade protecting the trees
- soil highly compacted

....../page 4
AREA 3 - moderate slash (protects the seedlings from cattle damage and provides some shading)
- moderate grass competition (50 cm tall, 30 % cover)
- moderate cattle grazing

The following table describes the numerical data collected during the survey:

<table>
<thead>
<tr>
<th>AREA</th>
<th>PLANTED &amp; NATURALS</th>
<th>PLANTED</th>
<th>SURVIVAL %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total trees/ha</td>
<td>W.S./ha*</td>
<td>Total/ha</td>
</tr>
<tr>
<td>AREA 1 (inside fence)</td>
<td>1294</td>
<td>659</td>
<td>659</td>
</tr>
<tr>
<td>AREA 2 (immediately outside fence)</td>
<td>600</td>
<td>333</td>
<td>367</td>
</tr>
<tr>
<td>AREA 3 (outside &amp; away from fence)</td>
<td>767</td>
<td>367</td>
<td>367</td>
</tr>
</tbody>
</table>

* W.S./ha = Well spaced acceptable trees per hectare.

Survival is higher within the fenced area than either of the two areas outside the fence. Although the survival survey indicates no difference in survival between Areas 2 and 3 the number of well-spaced trees per hectare was different between these two areas. The trees in Area 2 were in very poor condition, whereas the trees in Area 3 were in good condition. The trees in Area 1 were in good condition also, but throughout the area high grass competition was observed to be causing some mortality.

Another view of the cost and benefits is the cost per seedling. 25 ha @ 1200 stems/ha = 30,000 seedlings. The amortized cost of protecting each plantation is $7200 - 6 = $1200. $1200. - 30,000 seedlings = $0.04 per seedling.

Problems Encountered:

The most serious problem encountered was vandalism. The battery was stolen less than 10 days after it was placed in the field. This problem has been corrected by the installation of a vandal resistant housing (see Appendix A) which was securely bolted to a cement block. Both the energizer and battery remained safe for the following 3 1/2 years. The battery is retrieved at the end of each field season. A second problem encountered was a faulty electric circuit module within the energizer. This module was replaced by the supplier at no cost. However, the energizer had to be returned to the supplier to ascertain the problem. With the acquisition of a voltmeter we are now able to
successfully undertake this troubleshooting task. Wildlife and snow tend to knock down some sections of the wire each winter (up to 1/4 of wire). However the task of restringing the wire is quick and easy.

Other problems include the logistics of purchasing, installing and maintaining the electric fences on an operational scale. Appendix D explains our districts approach to this problem.

Conclusion

Our electric fencing project was attempted as a "long shot" to assist in finding solutions to the cattle/tree plantation conflict. To date results have exceeded our expectations. The electric fence while operating held cattle off the plantation. These cattle were previously unexposed to electric fences but quickly learned to respect the fence without causing damage to it.

Require Research

In the future further refinement of the electric fencing method of protecting tree plantations from cattle damage should be undertaken as operational research. Concepts requiring investigation includes:

1) Determine the cheapest materials and methods which are effective
2) Test the electric fence in an area of extremely high cattle pressure.
3) Test the technology for electric fencing across roads, creeks, with gates and other special challenges.
4) Determine the proper intensity and timing (time of season, length of time, forage utilization, stocking rate) of controlled livestock (class of stock, species of animals) use with the electrified exclosure on various sites (type of stock planted, biogeoclimatic subzone). This will facilitate the prescribed use of the livestock as silvicultural tool to reduce forage competition without damaging planted seedlings.
2) on Licencee plantations where proper cattle management is logistically impossible under present conditions as determined by the Ministry Range Section, have the Ministry Silviculture Section supply and the Timber Licencee install and maintain perimeter electric fencing. The District Manager shall pursue having plantation protection measures such as electric fencing made an eligible Section 88 cost. If such a pursuit proves successful Timber Licences shall be expected to supply install and maintain electric fencing implemented in these circumstances.

3) on all plantations where proper cattle management is feasible as determined by the Ministry Range Section, the Ministry Silviculture Section shall supply and the Range Tenure Holder shall install and maintain perimeter electric fencing. Where a Range Tenure Holder fails to adequately install and maintain the perimeter fencing to prevent cattle damage to the plantation the Ministry may recover the cost of all cattle damaged seedlings under Section 138 of the Forest Act. The District Manager may under Section 27 or Section 30 of the Range Act choose to suspend and cancel a portion or all of a Range Tenure in addition to or in lieu of action taken under Section 138 of the Forest Act. If seedling cattle damage exceeds ten percent (10%) in any given year prior to the "free to grow" stage and silvicultural objectives are compromised the District Manager shall take action.
DRILL 4 HOLES 3/8"

NOTE: BOX TO BE CONSTRUCTED OF 1/4" E. ALL WELDED

NOTCH OUT 1/2" DEEP BY 1/2" WIDE - BOTH ENDS

HINGES TO BE WELDED ON INSIDE.

HASP

DRILL 3/4" Φ
ISOMETRIC VIEW OF LID

NOTE: OUT 1/4 DEEP BY
1/4 WIDE BOTH ENDS

HINGES TO BE WELDED ON INSIDE.

DRAIN HOLE

Appendix A - Vandel Resistant Energizer and Battery Housing
Map Of

Outlined

U.T.M. Grid

Zone 106 64 50 05 5 4 5 0 0 2 5 1 5

Area

Forest Region

Reg. Compl. L

District

Land District

MANAGEMENT UNIT

Type

Number

TIMBER SUPPLY AREA

Pulpwood Agreement

Cascades

Number

Block

Sub-B

LEGEND

Plantation Boundary

Survival Assessment Transects

Electric Fence

Conventional Fence

Hydro Line

Drawn by

F.S. 357 (Revised June, 1979)
APPENDIX D - GRAZING/TREE PLANTATION INTERACTION REPORT

85 APRIL 30
The prompt establishment of well managed and vigorously growing commercially valuable trees on forest sites denuded through logging or wildfire is basic to maintaining the yield and value of forest stands in the Merritt T.S.A.

Effective forest renewal can not be achieved without careful planning and close coordination with other forest resource users who might otherwise conflict with this basic silvicultural objective.

The following recommendations are proposed to help ensure that new stands can be protected from unacceptable damage which could result from cattle grazing through trampling and seedling browse.

The basic objectives in the analysis of this issue were:

1. to propose a procedure whereby the potential for grazing/reforestation conflicts could be minimized through a formal referral procedure and prior corrective measures.

2. given that no system is foolproof, propose a procedure for monitoring cattle damage to plantations and determine post corrective measures. This requires that cattle damage be defined and quantified.

Some related issues associated with the underutilization of forage within plantations have also been briefly addressed.

Throughout this report, a plantation is defined as any area or part of an area that has been reforested by artificial means and that is large enough to be treated in isolation (greater than 4 ha).
1. PROCEDURE FOR MINIMIZING CATTLE/PLANTATION CONFLICTS AND PLANTATION REFERRALS TO RANGE TENURE HOLDERS

Once the new Preharvest Prescription and Development Plan process is implemented, procedures will be developed to incorporate plantation proposal referrals from the Timber Licencee to the Ministry of Forests and to preplan plantation protection measures. In the interim a detailed planting plan identifying all blocks to be planted, (tenure, cutting permit, block, map sheet, 1:15000 sketch) shall be submitted to the Ministry Range Section prior to September 1 of each year. Licencees shall submit licencee plans and Ministry Silviculture Section shall submit Forest Service plans. These plans will be circulated to the Resource Assistants Range who will assign a high priority to utilization inspections on those ranges with proposed plantations. Staff time allowing, these high priority inspections will be conducted by the applicable R.A. Range and the Grazing Tenure Holder. On inspected ranges the R.A. Range will verbally advise the Grazing Tenure Holder of the likelihood of a plantation being established the following spring. The R.A. Range will ascertain the expected cattle use on the proposed plantation site in the following three years and assess the degree of potential problems associated with cattle use on the proposed plantation.

During the following winter, the R.O. Range will call a "Plantation Conference" to review potential cattle/plantation conflicts, formulate alternative solutions on those areas where conflicts are expected to result, and choose a course of action for those areas. Options may include:

1. an alteration to the Grazing Plan
2. a change in planting microsite selection prescription to avoid the potential hazards of cattle
3. a change in planting density
4. the installation of plantation protective structures to be supplied, installed and maintained as described under Section 2.4
5. deferment of planting.

Mandatory attendees will be the R.O. Range, R.A. Range and a representative of the Silviculture Section with the authority to act on discussed options. In addition, a representative from any affected Timber Licencee and Range Tenure Holder should attend. The Silviculture Section will be responsible to advise the Timber Licencees of the "Plantation Conference" meeting date the Range Section will be responsible to advise the Range Tenure Holders of the Plantation Conference meeting date.
Once an action plan for each expected conflict area is agreed upon, the responsibility to forward any necessary information to the Grazing Permittees shall be as follows:

Licencee Plantations - Company administering that plantation

Forest Service Plantation - Ministry of Forests, Range Section

The method of referral to the Range Permittee shall be:

1. by letter prior to March 1st with a copy to Forest District Office (mandatory)

2. by announcement at the spring Livestock Association Meeting or Range Unit meetings (mandatory)

3. by a field trip jointly with the Range Permit Holder prior to planting (optional)

Proposed action plans must be flexible to be workable and may be modified during on-site inspections with Range Permittees. If Licencees experience an unreasonable lack of cooperation from the Grazing Tenure Holder or vice versa, they shall notify the Range Section who will arbitrate the difficulty.
2. PROCEDURE FOR MONITORING AND QUANTIFYING CATTLE DAMAGE

2.1 MONITORING

The primary responsibility for monitoring plantations lies with the Timber Licencee for Licencee plantations and the Ministry Silviculture Section for Ministry plantations. In addition the Ministry Range Section will endeavor to make a brief inspection of every plantation shortly after cattle have entered the area. On those plantations of higher risk, more frequent inspections should occur. All Ministry Staff shall be expected to compliment this occular monitoring.

If cattle damage is noted during the course of any plantation inspection, the Ministry of Forests Silviculture Section on Forest Service plantations and the Timber Company (to be checked by M.O.F. Silviculture Section) on Timber Company plantations will establish sufficient clearly marked plots to determine if the damage is in excess of set critical limits. It should be noted that prior to assigning cattle as the probably cause of seedling damage or mortality, there must be evidence to prove within reasonable doubt that the damage was caused by cattle. Some indicators are:

1. Direct evidence of cattle responsibility
   - actually observed damage occurring
   - cattle track over scarred trees

2. Indirect evidence
   - tracks
   - manure
   - degree of forage utilization
   - observed cattle presence
   - history of grazing patterns (utilization inspection reports)
   - longitudinal basal scars
2.2 THE CRITERIA FOR DAMAGE

The following physical criteria for damage are mainly intuitive as the long term effects of various forms of damage are largely unknown.

1. BROWSE

Browse can be categorized as light or heavy

light - any browse on less than 50% of laterals

heavy - terminal removed and/or browse on greater than 50% of laterals

2. SCARRING

Any basal scarring regardless of size or percent of circumference scarred is considered heavy damage. Those seedlings that do not die as a result of the girdling effect or from disease organisms entering through the scar, will have significant reductions in growth during the healing period.

3. SHALLOW ROOTS

Stems pulled more than 2.5 cm out of the planting medium is considered heavy damage as mortality is almost sure to result.

4. BURIED SEEDLINGS

Seedlings planted within prepared furrows are particularly vulnerable to burying by the displacement of soil as cattle naturally tend to travel these cleared depressions. Therefore furrows are not a recommended site preparation treatment on grazing tenure areas.

light - seedling buried to less than one quarter of its height

heavy - seedling buried to a depth greater than one quarter of its height.
2.3 QUANTIFYING DAMAGE

Data will be collected on Silviculture Survey forms modified as attached. Plots should be .005 ha with a radius of 3.99 m and the following data should be collected:

TS - estimate of total seedlings originally in the plot including well spaced naturals (plantable spots)

OK - undamaged healthy planted seedlings

HD - heavy damage which is expected to prevent a seedling from becoming free to grow where HDc is suspected cattle damage and HDo is other damage (insect, disease, rodents, weather, etc.)

LD - light damage which should not prevent the seedling from becoming free to grow where LDc and LDo are as described under HD above

D - dead seedlings identified by agent responsible for mortality as Dc of Do as described above.

M - missing seedlings where a plantable spot exists but no evidence of a tree exists

The above data can then be summarized into various categories which will give an indication of the type and amount of damage, mortality and stocking. This data, accompanied by a clear and detailed map shall be submitted to the Ministry Silviculture Section. (See Appendix A)

2.4 POST DAMAGE CORRECTIVE MEASURES

In the event that occular monitoring inspections indicate cattle damage appears greater than five percent (5%) in the current year an immediate plot assessment shall be conducted. In the event that damage is measured and proves greater than five percent (5%) the Timber Licencees shall forward their findings in the manner prescribed under Section 2.3, to the Ministry Silviculture Section for verification.

Late notification will reduce the effectiveness of any post damage corrective measures (ie: measurements taken in September for damage occurring in July will do little to save a plantation). Assessments made after the year of damage are of dubious value.
If cattle damage exceeds five percent (5%) in the current year prior to the "free to grow" stage, the Range section will send a suspension warning letter to the Range Tenure holder(s) and call a meeting of all concerned parties, chaired by the District Manager to discuss future action.

The District Manager, shall

1) On Ministry plantations where proper cattle management is logistically impossible under present conditions as determined by the Ministry Range Section, have the Ministry Silviculture Section supply, install and maintain perimeter electric fencing,

2) On Licencee plantations where proper cattle management is logistically impossible under present conditions as determined by the Ministry Range Section, have the Ministry Silviculture Section supply and the Timber Licencee install and maintain perimeter electric fencing. The District Manager shall pursue having plantation protection measures such as electric fencing made an eligible Section 88 cost. If such a pursuit proves successful Timber Licencees shall be expected to supply install and maintain electric fencing implemented in these circumstances.

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3. UNDERUTILIZATION OF FORAGE WITHIN PLANTATIONS

Underutilization of forage within plantation can result from:

1. a lack of appropriate cattle distribution
2. an overabundance of range
3. non use
4. overseeding

The underutilization results in unacceptable vegetative competition from grasses for moisture, nutrients and light. In addition, seedlings may be smothered when snow folds over underutilized grasses.

It is recommended that:

1. sowing rates do not exceed 3.5 Kg/ha except for erosion control (steep slopes particularly)
2. grass seeding be commensurate with the demand for range
3. the Merritt District's eleven step procedure for prioritizing and referring the annual grass seeding program be adopted on an annual basis
4. INSTALLATION AND MAINTENANCE OF PLANTATION PROTECTION STRUCTURES

Structures for the protection of plantations from cattle damage include:

1. cattleguards
2. electric fencing
3. conventional fencing

These structures if properly constructed and maintained, could protect plantations from unacceptable cattle damage. However, they should be considered only where they are the most cost effective management option available. Purchase, installation and maintenance of such structures shall be as described under Section 2.4.
APPENDIX A

PLANTATION DAMAGE SURVEY

AREA DESCRIPTION

Ministry Opening No.

Tenure

Geographic Area

Range Tenure Holder

Ministry Planting Report No./

Section 88 Project No.

Block Size

History Symbol

Species & Stock Type

Minimum Stocking Standard/ha

Initial Stocking/ha (well spaced)

Present Stocking/ha (well spaced)

Comments:

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PLOT DATA

Point of Commencement: ____________________________

Distance Between Plots: ________________________


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Total

% 100

0691R