WEASEL SCENT AS A PREDATOR ATTRACTANT TO REDUCE VOLE NUMBERS IN NEW PLANTATIONS

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1.0 Summary

This project was part of a FIA-sponsored program with Louisiana-Pacific Canada Ltd. in 2005-06 and adhered to an “innovative project plan”. The project was designed to use odour of the short-tailed weasel (Mustela erminea) to: (1) lengthen the period of low numbers (abundance) of voles (Microtus) by maintaining mustelid scent, and potentially small mustelids, in treatment areas; and (2) reduce feeding damage by voles to tree seedlings during the overwinter period.

The project is located at Glenogle Creek, 25 km east of Golden. There are three replicate control (no treatment) and three replicate treatment (predator attractant) sites on openings that are 2- to 3-years post-harvest. Experiment A was conducted from May to September 2005 and assessed the response of vole populations in terms of abundance and survival of voles to the treatment. Experiment B commenced in mid-September 2005 and will continue through to June 2006. This experiment is also assessing the response of voles in terms of abundance and survival overwinter, as well as the survival of planted seedlings on control and treatment sites. These measurements will be made in May-June 2006.

Mean abundance of vole populations to weasel odour in experiment A indicated that, at least at these population densities (averaging 30-47 voles/ha in September), total numbers of voles (Microtus) were not affected by the treatment. There were no significant differences in mean abundance of total voles between control and treatment sites before or after the weasel odour application. Mean survival estimates up to one month after the start of experiment A were also similar for control and treatment populations of long-tailed voles. The response of total small mammals also followed this pattern with no significant difference in mean abundance of small mammals between control and treatment sites after the weasel odour application.

Vegetation (food and cover) is the major determinant of vole abundance and on the treatment sites on CP 818-1, in particular, was well developed and provided excellent conditions for voles. Thus, the cover of plant growth and coarse woody debris likely provided sufficient habitat for voles to persist despite the odour of weasel predators. However, we must wait for the results of experiment B before concluding that weasel odour at these vole densities is not effective. Although vole numbers appear unaffected, tree seedling survival may still be higher on treatment than control sites if voles avoid the predator odour associated with treatment trees.

Future investigations could include testing of weasel odour on 1- to 2-year-old sites with few voles such as those on CP 821 (44, 46, 47, 48, 49, and 50). These blocks were all harvested in winter 2004-05 and planted in the spring of 2005. Vole numbers averaged < 6/ha on 821-46 in 2005. Thus, it might be prudent to test this predator scent method during 2006 when vole numbers will likely remain low (< 20/ha). A second line of investigation might be some degree of vegetation management (manual cutting) as a means to lower carry capacity for voles on certain sites. Several sites on CP 818-1, 821, 825, and 814 might be candidates.
2.0 Background

Voles of the genus *Microtus* are considered one of the major mammalian pests in coniferous tree plantations in the Golden TSA. The diet of voles consists primarily of grasses, sedges, and forbs. However, these rodents will feed on tree seedlings and saplings, particularly during winter months of peak years in abundance. Voles may feed on bark, vascular tissues, and sometimes roots of trees. This damage may result in direct mortality from girdling and clipping of tree stems or reduced growth of surviving trees which have sub-lethal injuries. In terms of conservation and sustainability of temperate forests, this feeding damage may limit regeneration of appropriate tree species in certain forest ecosystems. In addition, this damage increases the cost to reforest these stands in time for Free Growing Status, decreases net productive forested area, and results in loss of Mean Annual Increment. Feeding damage appears to be associated with high populations of voles in early successional habitats that develop after harvesting. The problem is widespread throughout the southern and central interior of B.C.

The direct influence of mustelids (weasel family of predators) on vole populations has received much attention. Predation risk appears to be directly involved in population lows. High predation risk during the low phase, particularly from small mustelids, limits reproduction by voles. Vole populations will begin to increase again when weasel numbers decline. Several studies have concluded that the presence of small mustelids (or their scent) may limit reproductive rates and movements of voles in terms of anti-predatory behavior. A prudent approach would be to test this method during periods of low vole numbers to try to prevent or reduce the buildup of high populations of voles.

By the time voles have reached high densities, it may be too late to reduce numbers or curtail feeding damage, regardless of weasel odor-induced anti-predatory behavior and attraction of predators. Application of weasel odor during the low phase of the vole population cycle would be a critical test that weasel scent and the presence of small mustelids could lengthen the period of low numbers and potentially protect forest plantations from vole damage.

3.0 Objectives

This proposal outlines a project designed to use synthetic odour of the short-tailed weasel (*Mustela erminea*) applied during (A) low numbers of voles in early summer; and (B) high numbers of voles in early winter, to:

1. Lengthen the period of low numbers (abundance) of long-tailed voles (*Microtus longicaudus*) by maintaining mustelid scent, and potentially small mustelids, in treatment areas;

2. Reduce feeding damage by voles to tree seedlings during the overwinter period.
4.0 Study areas and design

This project is located at Glenogle Creek, 25 km east of Golden, in the Golden TSA. It has a completely randomized design with three replicate control (no treatment) sites and three replicate “predator attractant” sites with weasel odour. All sites are selected on the basis of operational scale, reasonable proximity to one another, and are 2- to 3-years post-harvest with the potential for substantial vole populations (e.g. > 30 voles/ha). All sites are far enough apart to be statistically independent. The three treatment sites were all located on CP 818-1. The control sites were located on CP 818-5, 825-1, and 821-58.

Experiment A was conducted from May to September 2005 and assessed the response of vole populations in terms of abundance and survival of voles to the treatment. Experiment B commenced in mid-September 2005 and will continue through to June 2006. This experiment is also assessing the response of voles in terms of abundance and survival overwinter, as well as the survival of planted seedlings on control and treatment sites. These measurements will be made in May-June 2006.

5.0 Methods

5.1 Population monitoring

Vole populations (and other forest floor small mammal species) were sampled at 4-week intervals from May to September 2005. Trapping grids (1 ha) have 49 (7 x 7) trap stations at 14.3-m intervals with one Longworth live-trap at each station. Traps are supplied with whole oats, and cotton as bedding. Traps are set on the afternoon of day 1, checked on the morning and afternoon of day 2 and morning of day 3, and then locked open between trapping periods. Forest floor small mammal species sampled by this procedure include the long-tailed vole, as well as the meadow vole (*Microtus pennsylvanicus*), heather vole (*Phenacomys intermedius*), southern red-backed vole (*Clethrionomys gapperi*), deer mouse (*Peromyscus maniculatus*), northwestern chipmunk (*Tamias amoenus*), montane shrew (*Sorex monticolus*), common shrew (*S. cinereus*), and short-tailed weasel (*Mustela erminea*). Abundance estimates of long-tailed voles, total Microtus, and total small mammals are derived from the Jolly-Seber (J-S) stochastic model. Survival estimates for long-tailed voles are also derived from the Jolly-Seber model. These survival estimates are complete through July 2005, but require the overwinter survival data (collected in May and June 2006) to calculate the estimates for August-September 2005 and May-June 2006.

Inventory Methods for Small Mammals: Shrews, Voles, Mice & Rats (Version 2.0)

3.7.1 Recommended Method: Mark Recapture
3.7.2 Objectives of Surveys
3.7.3 Open vs. closed populations
3.7.4 Models of estimation and methods of analysis
3.7.5 Recommended Models
3.7.6 Office Procedures
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3.7.8 Sampling Effort
3.7.9 Equipment
3.7.10 Field Procedures

Data will be housed with NRIN in the format of Inventory Methods for Small Mammals (Version 2.0).

5.2 Application of weasel odour

Each of the three 1-ha treatment grids was divided into an 8 x 8 checkerboard that yielded 64 quadrants. One 140-μl capillary tube with 50 mg of weasel odour was attached, by a plastic twist-tie, to a metal flag near the center of each quadrant. The capillary tubes protected the compounds from adverse weather conditions and maintained the odour within that quadrant and over the area of the treatment grid. The treatment for Experiment A was applied on June 27, 2005. An identical treatment, except capillary tubes with weasel odour were attached to planted lodgepole pine or Douglas fir trees, one tube on a tree near the center of a quadrant, was applied to treatment grids on September 17, 2005. All capillary tubes from Experiment A were retrieved and removed from the treatment grids prior to the initiation of Experiment B.

5.3 Survival of planted trees

For Experiment B, the location of 64 planted lodgepole pine or Douglas fir trees was selected and marked by coloured flags in each of the quadrants on a control and treatment grid. These trees will be sampled for evidence of feeding damage during the 2005-06 overwinter period. Clipping of terminal and lateral shoots will be recorded for each sample seedling in the spring (May-June, 2006). Removal of the terminal shoot will be considered mortality unless another vigorous lateral shoot is available to replace it.

5.4 Statistical analysis

A one-way analysis of variance (ANOVA) was used to determine the effect of weasel odour on vole numbers in Experiment A. The same analysis will be used in Experiment B, for vole numbers and on percentage of tree seedlings eaten overall and per vole. Proportional data are arcsine-transformed prior to analysis. In all analyses, the level of significance will be at least $P = 0.05$. 
6.0 Results and Discussion

6.1 Experiment A

The response of mean abundance/ha of vole populations to weasel odour in Experiment A indicated that, at least at these population densities, total numbers of voles (*Microtus*) were not affected by the treatment (Fig. 1). There were no significant differences in mean abundance of total voles between control and treatment sites before \((F_{1,4}=0.15; P=0.72)\) or after \((F_{1,4}=2.96; P=0.16)\) the weasel odour application in this experiment. Mean survival estimates up to one month after the start of Experiment A were also similar for control and treatment populations of long-tailed voles (Fig 2).

The response of total small mammals also followed this pattern with no significant difference \((F_{1,4}=0.47; P=0.53)\) in mean abundance of small mammals between control and treatment sites after the weasel odour application (Fig 2).

6.2 Experiment B

The results for this second experiment will be available in the spring of 2006.

6.3 Conclusions, to date

The population densities of voles (*Microtus*) encountered on the 2- to 3-year-old sites in this project were already too high (averaging 30-47 voles/ha in September) in the relatively rapid regrowth of vegetation that develops up to 3 years post-harvest. Vegetation (food and cover) is the major determinant of vole abundance and on the treatment sites on CP 818-1, in particular, was well developed and provided excellent conditions for voles. Thus, the cover of plant growth and coarse woody debris likely provided sufficient habitat for voles to persist despite the odour of weasel predators. However, we must wait for the results of Experiment B before concluding that weasel odour at these vole densities is not effective. Although vole numbers appear unaffected, tree seedling survival may still be higher on treatment than control sites if voles avoid the predator odour associated with treatment trees.

A lack of food and cover in the immediate post-harvest years are likely the key to maintaining low numbers of voles, and hence protection of planted trees from feeding damage. As indicated in Fig. 3, populations of voles are quite low (< 10/ha) in the first year after harvest. Numbers in the second post-harvest year usually range from 13 to 20 (grids E and F), and occasionally higher (to 30/ha on grid D), if vegetation cover is suitable. Thus, the optimum time to address the vole problem is in the first two years after harvesting.

7.0 Future Investigations

A further testing of weasel odour, to prolong low numbers of voles to protect tree seedlings, could be tried on the six blocks associated with CP 821-44, 46, 47, 48, 49,
and 50. These blocks were all harvested in winter 2004-05 and planted in the spring of 2005. Vole numbers averaged < 6/ha on 821-46 in 2005. Thus, it might be prudent to test this predator scent method during 2006 when vole numbers will likely remain low (< 20/ha).

A second line of investigation might be some degree of vegetation management (manual cutting) as a means to lower carry capacity for voles on certain sites. Several sites on CP 818-1, 821, 825, and 814 might be candidates.

8.0 List of Figures

Figure 1. Mean (n=3) abundance per ha of vole (Microtus) populations and total small mammal populations on control and treatment (weasel odour) sites in Experiment A. Weasel odour was applied to the treatment grids on June 27 after the third sampling session. For the start of Experiment B, weasel odour was applied again on September 17 after the final sampling session for 2005.

Figure 2. Mean (n=3) survival of total long-tailed voles (Microtus longicaudus), and males and females separately, on control and treatment (weasel odour) sites in Experiment A. Weasel odour was applied to the treatment grids on June 27 after the third sampling session. For the start of Experiment B, weasel odour was applied again on September 17 after the final sampling session for 2005.

Figure 3. Mean (n=3) abundance per ha of long-tailed vole (Microtus longicaudus), total vole (Microtus), and total small mammal populations on the long-term monitoring sites from the time of harvesting (overwinter 2003-04) to the present.
Figure 1.

**Total Number of Microtus**

- Control
- Weasel

**Total Number of Small Mammals**

- Control
- Weasel
Figure 2.

Mean survival of *Microtus longicaudus*

![Graph showing mean survival of Microtus longicaudus from 3-May to 27-Jul 2005. The graph compares control and weasel treatments for males and females.](image)

Mean Survival of Males and Females

![Graph showing mean survival of males and females from 3-May to 27-Jul 2005. The graph compares control and weasel treatments.](image)
Figure 3.

**Microtus longicaudus**

- Grid 1
- Grid 2
- Grid 3

Harvesting

**Total Microtus spp.**

- Grid 1
- Grid 2
- Grid 3

**Total Number of Small Mammals**

- Grid 1
- Grid 2
- Grid 3