DIVERSIFICATION *of* CLEARCUTS

Woody Debris Structures

Tree and Patch Retention

Riparian Systems






Mustelids & Small Mammals

Marten and Weasels

Maintenance of furbearer populations and their prey species is a major goal of wildlife conservation in BC. The American marten and short-tailed weasel (ermine) are small mustelids and common inhabitants of forests. Marten occupy forest landscape mosaics that include older (> 80 years) conifer-dominated stands with relatively high levels of canopy closure (minimum of 30% - 50%), particularly spruce and true firs, as well as riparian forests. A major prey species for marten is the southern red-backed vole which is an important indicator species of closed-canopy forests. The short-tailed weasel is broadly distributed in various forest successional stages, edge habitats, and riparian woodlands where dense understory vegetation provides habitats for small mammal prey, particularly microtine voles. The long-tailed weasel also occupies these habitats and has a wider range of prey species that include voles and other less common rodent and avian species.

Red-backed vole.

Long-tailed vole.

Large openings in forests created by clearcutting has reduced the abundance of small mustelids because of a loss of preferred prey species, cover, and other components of stand structure. Loss of security cover on clearcuts, in particular, is crucial as these mustelids may be prey species for other carnivores. In terms of a major prey species, the red-backed vole also disappears from clearcuts within a year of harvest, presumably because of a loss of food and cover and does not return to abundance levels of mature or old-growth forest for many decades after clearcutting. However, other forest-floor small mammals such as the deer mouse, chipmunk, some species of microtine voles, and shrews occur as habitat generalists on clearcuts for variable periods. Regenerated forests take many decades to provide sufficient habitat for furbearer species and their prey. Thus, habitat creation is much needed in these large openings to provide food and cover during the many decades of forest recovery.

What enhancements of stand structure could be done at the time of clearcutting to provide food and cover for mustelids and prey species?

(1) Woody debris structures
(2) Tree and patch retention
(3) Riparian systems
(4) A combination of structural retention treatments.

Woody Debris Structures

Both marten and weasels use woody debris structures as cover, den sites, travel corridors, and focal points for finding prey species such as the red-backed vole and other small mammals.

Short-tailed weasel in debris pile.

Long-tailed weasel in debris pile.

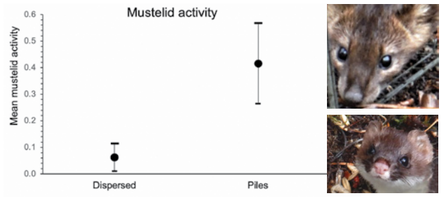
Structures built from post-harvest woody debris (e.g., piles and windrows) at the time of forest harvesting and log processing, or immediately thereafter, have generated some important networks for mustelids and prey species. Woody debris structures need to be large-scale: at least 2 m in height and 5-7 m in width or diameter, arranged as continuous windrows or in a linear array of piles, to provide sufficient habitat for forest-floor small mammals and their predators on clearcuts.

Construction of piles or windrows at time of harvesting & log processing.

Excavator building structures after harvest completed.

Woody Debris Structures on Large Clearcuts

Four project areas (2 at Golden and 2 at Summerland) compared linear arrays of debris piles with dispersed woody debris on new large (30-50 ha) clearcuts. After 2 years post-construction of piles, responses of small mustelids to debris piles was 6.7 times higher in piles than dispersed debris. Counts of activity (observations, scats, predation) included 70 weasels and 14 marten in piles; and 12 weasels and 0 marten in dispersed debris. Responses of small mammal prey species also followed this pattern. Mustelid activity and total small mammal populations were similar across the linear array of piles on these large clearcut units.

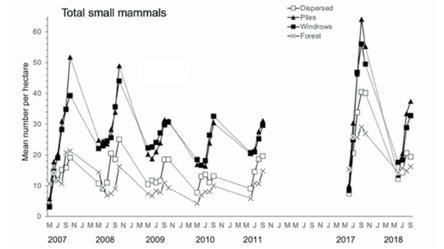


Mustelid activity in sites with woody debris in dispersed and piles on large clearcut openings (mean ± 95% CIs).

Longevity of Responses

In terms of longevity of responses, red-backed voles and associated small mammals will persist in debris structures for at least 12 years, at or near abundance levels found in uncut forest. At least some mammalian carnivores will presumably continue to use these structures for this same period.

Longevity of woody debris structures for (a+b) piles and (c+d) windrows constructed in 2006 and 12 years later in 2018. Connectivity of piles and a windrow (e) across a forest plantation in 2018 are indicated with arrows



Mean number of total small mammals in the dispersed, piles,windrow, and forest sites up to 12 years after construction.

Options for Construction of Debris Structures

Establishment of these habitat networks is site-specific for wherever connectivity among forest reserves and patches is required. On sites with substantial debris, these structures may use only 10-15% of excess post-harvest woody debris, thereby leaving material for other uses such as biofuels and alternative functions. Piles of post-harvest woody debris in a linear configuration already dominate forest harvesting regimes on clearcuts and conservation of this debris provides immediate habitat for various mammal species.

Several options for construction of woody debris habitats.
(a) Poorest option - minimal vertical structure to habitat (b) Good option - piles
(c) Better option - linear array of piles (d) Best option - piles connecting to riparian
(e) Best option - piles connecting to forest

What to do, when, and where during the creation of habitat structures and connectivity via debris piles.

WHEN

During harvesting/log processing
Situations where biofuel production is not viable
On sites where seedling microsites are limited
Cutblocks < 10 ha CWD should be evenly distributed vs piled
Cutblocks with average distances between forest edges < 50 m need not have piles

WHERE TO PLACE

Connect residual patches to each other or riparian areas
In areas remote from human activity to reduce fire risk
Preferably on roads perpendicular to the main haul roads
Particularly important on ≥ 10-ha openings
In areas requiring protection from soil erosion at road ways
Avoid vole "hot-spots" due to seedling predation

CHARACTERISTICS

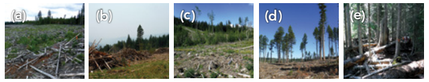
2 m in height + 5-7 m in width or diameter
≥ 1 windrow or series of piles per 10 ha of cutblock
Leave openings every 100 m for ungulates and silvicultural activity
On large, wide cutblocks (> 50 m) connectivity should include patches/riparian to cross wide areas
On irregularly shaped cutblocks use narrower portions of cutblock
Piles should be 5 m from forest or riparian edges

Structural Retention on Clearcuts

Diversification of new clearcuts with a range of structural retention was investigated for responses of mustelid activity and prey populations in a study west of Summerland, BC from 2017-2020.

STUDY DESIGN

Dispersed • Piles • Riparian • Green-tree retention • Uncut forest



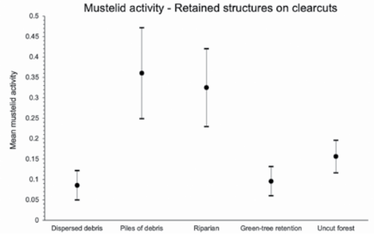
Five treatment sites in the study of structural retention on new clearcuts.
(a) Dispersed (b) Piles of woody debris (c) Riparian
(d) Green-tree retention (e) Uncut forest

Abundance of herbaceous vegetation was 5 to 13 times higher in the riparian than the other sites. Abundance of shrubs was 3 to 35 times higher in the riparian than the other sites.

Herbs, shrubs, and conifers in riparian zone.

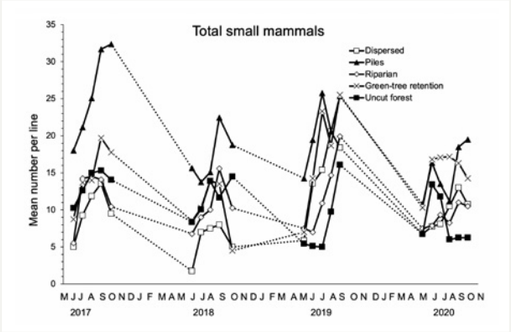
Structural diversity of herbs and shrubs was similar in the riparian, dispersed, and uncut forest but 3 to 4 times higher than in the piles and GTR. Structural diversity of understory conifers was highest in the uncut forest and riparian sites.

Activity of mustelids was statistically similar (P = 0.10) among sites. However, in terms of overall mustelid activity, the piles and riparian sites had 2.0 to 4.0 and 1.8 to 3.7 times as many counts, respectively, as the other three sites and this result likely has biological significance. Counts of activity (observations, scats, predation) included 82 weasels and 6 marten.



Mustelid activity on new clearcuts (mean ± SEs).

Mean abundance of total small mammals was significantly different among sites with consistently higher numbers (1.4 to 2.0 times) in the piles than other sites. Mean annual peak numbers of total mammals reached 32 and 26 per line in 2017 and 2019, respectively, in the piles sites.

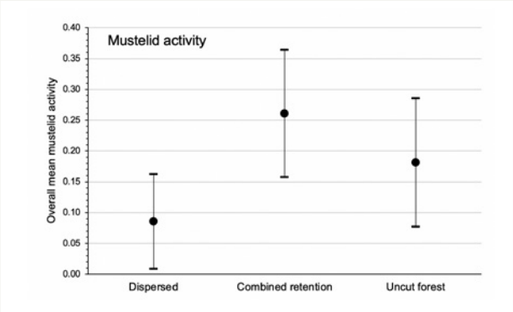


Mean number of total small mammals.

Combined Structures

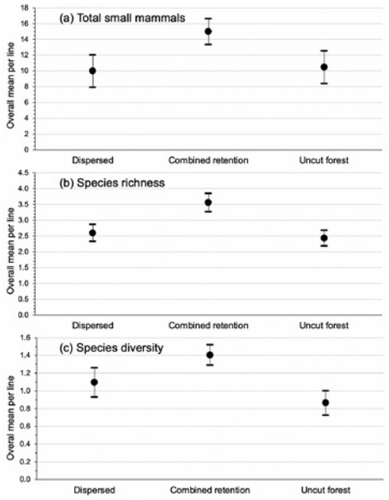
(piles + riparian + green-tree retention)

Mean presence of mustelids was statistically similar ($P = 0.08$) among the combined structural treatments and the dispersed and uncut forest sites. It is likely biologically important that the overall mean mustelid presence in the combined treatments was 2.9 and 1.4 times higher than that in the dispersed and uncut forest sites, respectively.



Mustelid activity in the dispersed, combined retention , and uncut forest (mean ± 95% CIs).

Similarly, mean total abundance, species richness, and species diversity were all significantly different among sites with the combined retention sites at a range of 1.3 to 1.6 times higher than the dispersed and uncut forest sites.



Overall number of (a) total small mammals, and measurement of (b) species richness, and (c) species diversity (mean ± 95% CIs).

Forest Patch Retention

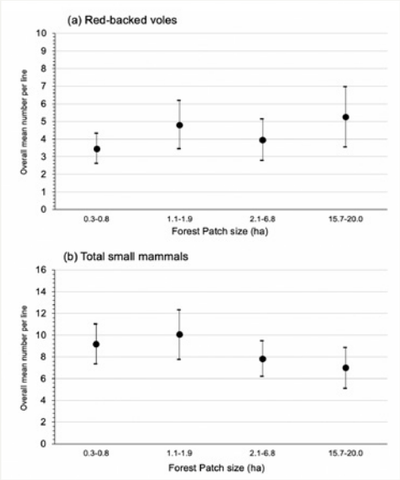
Loss of habitat for mustelids and prey species may also be ameliorated by aggregated retention harvests that leave unlogged patches on clearcuts. A comparison of mustelid activity and prey populations in four sizes (ha) of retention patches (means of 0.53, 1.50, 4.13, and 18.73) was conducted near Elkhart, BC during 2014-2016.

Landscape view of forest patch retention among clearcuts.

Interior of forest patch.

Activity of mustelids was similar among the different-sized patch sites with overall mean counts ranging from 0.83 to 1.50. Counts of activity (observations, scats, predation) included 34 weasels and 15 marten over the 3-year period.

Overall abundance of red-backed voles was similar among sites and ranged from 3 to 5 per line. This prey species was extirpated on clearcut sites (i.e., no forest patches). Overall abundance of total forest-floor small mammals was also similar among sites and ranged from 7 to 10 per line.



Overall abundance of (a) red-backed voles and (b) total small mammals, in the four sizes of forest patch sites in 2014-2016 (mean ± 95% CIs).

Conclusions

- On large clearcuts, activity of small mustelids was 6.7 times higher in woody debris piles than dispersed debris. Responses of small mammal prey species also followed this pattern. Mustelid activity and abundance of prey species were similar among piles across the length of these clearcuts.
- In terms of longevity of responses, red-backed voles and associated small mammals will persist in debris structures for at least 12 years, at or near abundance levels found in uncut forest.
- Abundance of herbaceous and shrub vegetation was substantially higher in riparian than other sites. Structural diversity of understory conifers was highest in uncut forest and riparian sites. Activity of mustelids and abundance of total small mammals was highest in the combined retention sites.
- Among unlogged patches on clearcuts, activity of mustelids and total abundance of small mammal prey were similar among different-sized patch sites.

Management of Woody Debris

The current forest management system of disposing of excess post-harvest woody debris by burning is exacerbating climate change by releasing greenhouse gases into the atmosphere and causing a human health problem.

In terms of wildfire risk, there is no scientific evidence showing that post-harvest debris piles are ignition points for forest fires, other than those caused by humans.

This practice removes biomass that could be used for bioenergy production and habitat for wildlife, thereby compromising our attempts to conserve wildlife and biodiversity in managed forests.

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HABITAT CONSERVATION TRUST FOUNDATION

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