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The impact of a wide-spread insect outbreak and subsequent timber harvesting on forested rangelands

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Introduction In British Columbia (BC) , ranching and forestry are integrated . Some livestock producers are directly or indirectly employed in the forest industry . Livestock graze nearly 60 million hectares of provincially owned (Crown) land , of which 85% is forested . The unprecedented changes to the forestry industry due to the Mountain Pine Beetle (MPB) (*Dendroctonus ponderosae*) and subsequent harvesting has impacted livestock production in BC . This paper outlines some of the challenges and opportunities the livestock industry is facing because of the MPB outbreak , and some of the actions the government of BC is taking to mitigate the impacts .

The provincial government allocates forage by volume to individuals who hold grazing rights for a given area . The government also allocates resources such as timber , hunting licences and trapping licences over the same area . Therefore , the exploitation of one resource often influences another resource on the same area . Managing livestock on forested range can be challenging . Many grazing areas are not fenced and producers achieve livestock distribution through salting , water developments , and herding . Additionally , on all forested areas , forage supply often changes in space and time as a response to timber harvesting and subsequent planting of harvested areas . The accelerated timber harvesting and blow-down of MPB-killed trees has resulted in unprecedented disruption of livestock distribution and increased fence maintenance costs .

The MPB attacks mature Lodgepole Pine trees (*Pinus contorta*) and Ponderosa Pine trees (*Pinus ponderosa*) . Adult pine beetles burrow through the bark of the tree laying eggs in the phloem . Larva feed on the phloem blocking nutrient transportation while fungi carried by the adult beetles grow within the tree , further reducing transportation within the tree . A combination of warm winters , successful fire suppression and a relatively even-aged stand of trees has allowed for a larger than normal spread of the MPB . Accelerated timber harvesting has threatened the balance between multiple resource users , especially timber harvesters and graziers . There is concern also that increased livestock access to riparian and sub-alpine areas may damage these sensitive ecosystems .

A natural range barrier (NRB) may be a river , rock face , area of dense timber or any other naturally occurring feature that stops or significantly impedes livestock movement to and from an adjacent area . The initial wave of spread-control harvesting opened small holes in dense pine stands functioning as NRBs while subsequent salvage harvesting and attendant roads completely compromised some NRBs increasing livestock movement into previously inaccessible areas . This may increase livestock-vehicle encounters , livestock access to sensitive ecosystems , and livestock trespass .

Methods The first step towards mitigating the effects of MPB on Crown rangeland users has been to identify and map NRBs and to share the information with timber harvesting companies . Livestock producers are encouraged to communicate their concerns about timber harvesting in their area to the timber harvesting companies . Timber companies are required by law to replace fences and mitigate damage to NRBs during timber harvesting operations . Some of the solutions to mitigate the removal of NRBs have included fencing , debris barriers placement , herding , salting , water developments , seeding forage , changing range tenure boundaries , or combining tenures . The government has initiated several pilot projects to test these mitigation options .

Conclusions The rapid growth of herbaceous plants and shrubs in response to accelerated timber harvesting has increased available forage . This has created opportunities for the expansion of the livestock industry , better distribution of livestock and reduced grazing pressure on some sensitive ecosystems , and to rest some areas that are over-grazed . A project is underway to estimate the volume and location of forage created subsequent to harvesting of MPB-killed trees . The government is also exploring alternatives to replanting trees on some of these harvested areas to allow agricultural and grazing expansion , and to reduce the impacts of potential future MPB outbreaks . Other range management initiatives such as ecosystem restoration , invasive plant management and climate change adaptation will further mitigate the effects of the MPB . Although the wide-spread insect outbreak and subsequent timber harvesting has presented unprecedented economic and management challenges to rangeland management , it has also provided an opportunity to review and adapt livestock and forestry practices on forested rangelands in BC .