

THE MOUNTAIN PINE BEETLE: CAUSES AND CONSEQUENCES OF AN UNPRECEDENTED OUTBREAK

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ABSTRACT

The mountain pine beetle (*Dendroctonus ponderosae*) is native to the pine forests of western North America where it normally exists at very low densities, infesting only weakened or damaged trees. Under conditions conducive to survival, populations may erupt and spread over extensive landscapes, killing large numbers of healthy trees. Although several significant eruptions by mountain pine beetle occurred during the past century in western North America, the ongoing epidemic is unprecedented in its size and severity. For a mountain pine beetle outbreak to occur, there must be an abundance of large, mature pine trees (the beetle's preferred resource) combined with several years of favorable weather for beetle survival. Due to fire suppression and selective harvesting (for species other than pine) during the latter half of the previous century, there was more than three times the amount of mature pine in western Canada at the start of the current outbreak than 100 years earlier. Furthermore, as a result of climate change, conditions relevant to mountain pine beetle survival have improved over much of its range during recent decades, allowing populations to invade formerly climatically unsuitable pine forests. Thus, both required conditions for an

outbreak have coincided with sufficient magnitude to cause the largest outbreak in recorded history.

The current mountain pine beetle epidemic has had extensive direct ecological and economic impacts, affecting wildlife habitat, water quantity/quality, recreational values, and timber quantity/quality. Furthermore, the widespread tree mortality inflicted by the mountain pine beetle has also caused significant longer term impacts to regional carbon dynamics. The loss of carbon uptake and the increased emissions from decaying trees have converted the forests of western Canada from a small net carbon sink to a large net carbon source to the atmosphere. Also as a consequence of the unprecedented outbreak, large numbers of beetles have blown across the northern Rocky Mountains and established across the Alberta Plateau in close proximity to the boreal jack pine forests that extend across the continent. High host susceptibility, coupled with anticipated increases in climatic suitability as a result of global warming, suggests there is a significant risk of additional eastward expansion by the mountain pine beetle and eventual invasion of the boreal forest.