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Julie Steinke

Beyond Beetle: Natural regeneration after MPB attack in lodgepole pine forests of west-central Alberta

Lodgepole pine is a wide ranging species throughout western North America, and is an early seral, shade-intolerant species that is able to grow on a variety of forest sites, including nutrient poor sites where other conifers are unable to grow. It is adapted to stand-replacing disturbances, such as wildfire, which provide disturbed mineral soil, which is an ideal germination microsite. This species has serotinous or semi-serotinous cones, which require heat for seeds to be released. Lodgepole pine is a preferred host species of mountain pine beetle (MPB), a forest insect which has recently undergone an unprecedented range expansion from its native range in British Columbia into lodgepole pine forests in west-central Alberta, where no records of previous attacks exist. This has provided a stepping stone for MPB to access pine across North American boreal forests. While previous studies have examined post-MPB stands west of the Rocky Mountains, in BC, impacts on forests in Alberta, which are different in composition, environment, and climatically from those in the historical range of MPB, are still unknown. Understanding how lodgepole pine forests will respond to MPB in this new region can help us understand the potential implications for the future of these forests. The goals of this portion of the project were to: 1) assess the potential for natural regeneration, and 2) determine what best explains pine regeneration after MPB.

To assess natural regeneration after MPB attacks, we examined 33 lodgepole pine dominated stands (≥ 70% pine trees in the canopy) that experienced high levels of MPB-induced mortality (≥ 50% of pine trees at the grey attack stage), had limited regeneration present prior to attack (≤ 400 stems per hectare of advance regeneration), and were untreated. Stands were located throughout west-central Alberta, and represented a variety of lodgepole pine ecosite types. Sites were sampled in 2014, 2015, and 2016. A variety of data characterizing the ground cover, understory vegetation, advanced regeneration, trees, canopy, and site were collected. Naturally occurring cone openness was determined for each site, and a heating experiment was used to determine the potential for cones to open at a variety of temperatures representative of what might occur naturally at a site, given an open canopy that allows the sun to heat the cones below.

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Tel.: (780) 449 – 4416, Email: kmcclain@friresearch.ca or visit www.friresearch.ca

Results

Less than half of the post-MPB sites assessed had any evidence of natural pine regeneration, and when regeneration was observed, the densities were far below full stocking.

Some explanatory variables had positive associations with pine regeneration, while the majority were negatively associated with pine regeneration.

Site characteristics that are associated with higher probability of pine regeneration natural regeneration included sites with: poorer nutrient and moisture regimes, less competing vegetation, more open canopies, some pine advance regeneration already present, and where cones are more likely to open at lower temperatures that can be achieved by the sun on the forest floor.

Moisture and nutrient rich sites were less likely to experience natural regeneration, due to a lack of suitable regeneration microsites, competing vegetation (including broadleaf advance regeneration), overstory shading (including from canopy spruce), and likely a lack of seed source.

Broadleaf advance regeneration was present in 70% of sites, and spruce advance regeneration was found in 90% of sites. Tree species already present in the understory are likely to dominate the future canopies, albeit at low densities.

To regenerate these forest stands to lodgepole pine in a timely fashion will likely require interventions, such as partial harvesting, mechanical site preparation, and vegetation control. This is especially so in richer sites.

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