FOREST INSECTS & DISEASE

AWA supports taking a more ecological approach to the role of forest insects/disease in Alberta's forests. Over a relatively short period of time, Alberta's forests have been divided up with cut lines, seismic lines, roads, trails, pipelines, and homes, carving a once unimaginable expanse of forest into smaller and smaller portions. Alberta's forest ecosystems have been stressed and transformed, and many ecosystem services have been lost. A return to a more natural system is critical to restore these services, which will involve large protected areas set aside, as well as a return to forests managed primarily for a host of values, not just timber production. Sustainable forestry needs ecosystem based models that allow natural control mechanisms to function. Allowing infestations to run their natural course will contribute to natural balance and ultimately, to ecosystem restoration.

Points of Emphasis

1. Ecosystems out of balance are a primary contributor to insect and disease epidemics in forests. Forest ecosystem maintenance and restoration are the best preventative measure against such epidemics. Forests must be returned to their natural, complex states. There is a clear need in Alberta for ecosystem-based forest research, planning and management. Provincial budgets must reflect and support this need.

2. Forests that are in poor health often have low biodiversity and are overcrowded due to years of fire and insect suppression. In turn, these unhealthy forests are vulnerable to insect and disease attacks and need to be restored to healthy states. Periodic fire and native insect and disease infestations must be allowed to run their natural courses. Suppressing fires and infestations only encourages worse and larger outbreaks of damaging insects, fungi and mistletoe.

3. Native insects and diseases contribute to overall forest health. Certain insects may stimulate primary productivity in forests by selectivity killing less productive plants or plant parts, thus making available more light, water and nutrients for surviving trees (Romme et al. 1985). They also assist with healthy change and regeneration in forest ecosystems (Natural Resources Canada 2015).

4. Under certain conditions, plants can compensate for the adverse effects of herbivores. This is observed via an increase in photosynthetic rates on damaged plants compared to undamaged ones (Nowak and Caldwell 1984). By inference, it may be possible that insect attack has an ultimately beneficial role in individual tree growth. Even insect outbreaks which cause a reduction in primary productivity may have impacts which are short lived (Romme et al. 1986).

5. The majority of insects, bacteria and fungi that occur in vast numbers in the forest and its soils are involved in a multiplicity of beneficial roles. Indiscriminate spray programs could cause harm to these beneficial organisms, and therefore must not be broadly sanctioned.

6. Wildfires play a large role in keeping insects and diseases in check in forest ecosystems. Fire suppression has significantly altered forest ecosystems, including pest regimes (McRae et al. 2001).

7. Global trade has become a conduit for new, potentially destructive species such as the Asian longhorned beetle (Anoplophora glabripennis) which could become established where our forests have no natural defenses (Natural Resources Canada 2015).

8. Climate warming is already causing measurable changes in our forests and will increase the likelihood of ecosystem instability, which could favour certain species. For example, a series of recent, uncommonly warm winters has favoured survival of the mountain pine beetle and has assisted in its spread (AEP 2015).

9. Forest fragmentation may increase the duration of insect outbreaks. Increased clearing and fragmentation of forests may be exacerbating outbreaks of forest insects and disease (Roland 1993). Breaking up the forest landscape affects the relative dispersal rates of insects and their natural enemies, allowing insects such as tent caterpillars to "escape" from predation, parasitism, or disease. Reducing linear disturbance on the landscape is critical to reduce the severity of outbreaks, as well as to prevent facilitated spread of new outbreaks.

10. FMA holder management plans are currently being altered to reduce the amount of susceptible pine on their operating land base by 75 per cent over the next 20 years. Although these "surge cuts" may provide a short economic boon, such activities are not ecologically sustainable and the effectiveness of cutting in actually preventing mountain pine beetle spread is questionable.

11. Salvage logging after insect and disease infestations pass through an area should not occur, except where it is part of an existing FMU/license and it does not increase the rate of cut. Salvage logging has been shown to exacerbate the negative effects of disturbance and hinders the natural regeneration of the forest. Salvage logging or pre-emptive logging of insect-prone stands is especially inappropriate in species at risk habitat – for example, caribou, native fish, grizzly bear – where roads are a major vector for habitat loss, increased predation and/or human poaching. Caribou still use mountain pine beetle-affected forested areas.

BACKGROUND

Insects, parasitic plants and diseases have evolved for millions of years in synchrony with our forests (Natural Resources Canada 2015). While as part of natural ecosystems they may take a localized toll on forest trees, historically they have not caused large-scale forest die back because of evolved feedback mechanisms. Insects like the mountain pine beetle and plants like the dwarf mistletoe contribute to overall forest health by thinning out weaker trees.

Traditional clearcut logging practices have promoted outbreaks of forest insects and disease (McRae et al. 2001). Clearcut logging increases linear disturbance and habitat fragmentation on the landscape, which may be exacerbating outbreaks of forest insects and disease (Roland 1993). For example, the duration of forest tent caterpillar outbreaks is determined by the ability of their natural enemies (parasites and pathogens) to kill forest tent caterpillars. Breaking up the forest landscape affects the relative dispersal rates of insects and their natural enemies, allowing the tent caterpillars to "escape" from predation, parasitism, or disease. Traditional clearcut logging practices have also shifted species

composition to large stands of forests composed primarily of one species. Therefore, when an insect or disease targeted to that specific tree species sweeps through a forest, the resulting outbreak can be widespread and damaging (Blais 1983). Additionally, clearcut logging favours harvest of larger stands of trees. The remaining "leave blocks" may also be infected with the disease.

Wildfires are a natural disturbance on the landscape which results in mixed-wood stands of varying size and species. Fires help prevent large scale pest outbreaks from occurring. Wildfires may also reduce the presence of host plants (plants which contain the insect/disease). The exclusion of fire coupled with forestry practices which leave young infected trees in remaining tree stands has lead to increased abundance of dwarf mistletoe. Fire, on the other hand, eliminates Dwarf mistletoe if the trees containing the plant are burned (McRae et al. 2001).

Salvage Logging

Salvage logging is a common practice after insect/disease spreads through a forest stand. With the expansion of mountain pine beetle range, Alberta has implemented a mountain pine beetle management strategy that includes salvage logging (ASRD 2007). This practice carries with it a number of detrimental impacts to forests. Salvage logging following a mountain pine beetle attack has been shown in Alberta to result in a decrease in species richness and understory plant cover, a decrease in pH, and differences in microbial properties as compared to un-salvaged stands (McIntosh 2013). On the other hand, there were no effects of the moderate mountain pine beetle attack and only small changes to the microbial communities in a forest following high intensity mountain pine beetle attack if these forests were left unlogged (McIntosh 2013). This lack of change in response to mountain pine beetle attack suggests that forests are resistant to change and have high ecological inertia (McIntosh 2013). In contrast, salvage logging has immediate and dramatic effects.

One of the primary justifications for salvage logging is that it is believed that stands after insect/disease attack are more susceptible to wildfire. However, insect-killed forests have been shown to pose no additional likelihood of wildfire as compared to forests without insect damage (Garrett et al. 2015).

In Alberta, the primary species that attack commercially valuable tree species and which often result in eradication programs and other expensive and ecologically damaging methods of control, are the mountain pine beetle (Dendroctonus ponderosae), spruce budworm (Choristoneura fumiferana), forest tent caterpillar (Malacosoma disstria) and dwarf mistletoes (Arceuthobium spp.).

Mountain Pine Beetle

Mountain pine beetles live most of their lives beneath the bark of a tree. They prefer to attack older trees (60+ years) as the thicker bark and phloem provide more food and better protection. In July the adult beetles bore into trees and tunnel a vertical gallery where they mate and the females lay up to 80 eggs. When the larvae hatch, they spend the winter in the tree. Protected by the bark, larvae can survive winter as long as there are no unseasonably cold temperatures or prolonged cold spells (-30C). If they survive, they will leave the tree in July and the new adults will fly to attack new trees (Alberta Forest Service 1986). Outbreaks of mountain pine beetle are expected to increase with climate warming and the range of the beetle is expected to expand northward.

Mountain pine beetles have a documented number of benefits to our ecosystems. Following an infestation, some trees die which allows more light through the canopy. This aids shrub and understory growth, which in turn promotes food production for a wider range of birds, small mammals and larger ones like the grizzle bear. Tree species diversity is also promoted (Bunnell et al. 2011).

There are a number of concerns surrounding the manner in which current outbreaks of mountain pine beetle are being managed in Alberta. Historically, focus has been on prevention and containment of mountain pine beetle ever since outbreaks became a concern in the late 1990s. In 2005 and 2006, the number of infected trees in Alberta increased dramatically as a massive influx of beetles migrated from B.C. In 2007, the Government of Alberta released an Action Plan and Management Strategy involving aggressive strategies to remove single infected trees from areas where the beetle was not yet established. Salvage cuts and large clearcutting of infected regions, as well as long term strategies were also parts of the strategy (ASRD 2007). The province identified the most susceptible stands, and required Forest Management Agreement (FMA) holders to amend their current management plans to reduce the amount of susceptible pine on their operating land base by 75% in 20 years (ASRD 2007). The high-profile war on pine beetles came with a considerable financial cost, including fire watches, eradication cuts, and controlled burns. In 2005/06, the Alberta government spent $10 million in pine beetle control programs. The three fiscal years following the in-flight of beetles in 2006 resulted in Alberta spending "$210 million to fight infestations in the province" (AEP 2015).

The “surge cut” in the C5 Forest region of SW Alberta is nominally intended to deal with such future pine beetle risks, and harvesting sequences in the Spray Lake Sawmills FMA have also been adjusted to deal with the perceived pine beetle threat to timber production. Measures adopted to “fix” the perceived mountain pine beetle problem (including expanded clearcut forestry operations) could pose more of a threat to the many values of the forests than the beetles themselves. Part of the justification for proposals to increase the Annual Allowable Cut in the C5 Management region (the proposed “surge cut”) is to reduce the burden of large stands of lodgepole pine. Previous industrial forest management (clearcut logging, fire suppression and increased linear density) has helped to create present-day problems. In the short term, this may represent a temporary economic boon to forestry companies, such as the “surge cut” called for in the draft C5 Forest Management Plan, but this is clearly not sustainable. Another important concern about the Alberta government’s dramatic response to the pine beetle threat is that there is little evidence that it will work. Similar responses in British Columbia did little more than delay the advance of beetles. Clearcut forestry practices have historically been the source of many forestry and forest problems and may actually facilitate the dispersal of insects and disease, including mountain pine beetles.

Spruce Budworm

Spruce budworm is a native species to North America. In July, the adult moths deposit eggs onto host trees. The hatched larvae create hibernacula where they overwinter. In the spring, the larvae emerge and feed on new growths of needles. Hot, dry summers tend to induce epidemic outbreaks of spruce budworm, as periods of drought stress tree populations (lowering their resistance) and higher summer temperatures increase budworm reproductive output (Cerezke et al. 2013). In future decades, outbreaks will likely be longer and more severe due to climate warming (Cerezke et al. 2013).

Forest Tent Caterpillar

Forest tent caterpillars are native to North America. They eat the leaves of their host trees and have caused extensive defoliation of trembling aspen, oak, ash, maple and white birch (Natural Resources Canada 2015). Defoliation makes the trees more susceptible to droughts and other pest attacks. Forest fragmentation has been shown to increase the duration of forest tent caterpillar outbreaks in Northern Ontario (Roland 1993). The duration of forest tent caterpillar outbreaks is determined by the ability of their natural enemies (parasites and pathogens) to kill forest tent caterpillars. Breaking up the forest landscape affects the relative dispersal rates of insects and their natural enemies, allowing the tent caterpillars to "escape" from predation, parasitism, or disease. Reducing linear density in Alberta forests would help to reduce the intensity and duration of outbreaks for this insect, as well as for other insects and diseases.

Dwarf Mistletoe

Dwarf mistletoe is a plant which is parasitic and grows on conifers. It robs the host plant of water and nutrients, and it uses the host for support. It affects trees of all ages and results in decreased tree growth in those infected (Cerezke et al. 2013). The infected tree may die if the infection is severe enough. Disruption of wildfire regimes has resulted in an increase in the severity and distribution of dwarf mistletoe (Parker et al. 2006). Dwarf mistletoe increases flammability of infected trees, thus wildfires reduce re-infection of trees as there is a more complete elimination of residual live parasitic plants (Parker et al 2006). A re-introduction of natural wildfire regimes could help to regulate outbreaks of this disease.

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