ATTS Group

Aspen dieback

By Toso Bozic

Trembling aspen is one of the most widespread and ecologically important native tree species in North America. In Alberta it is most dominant species on private forest that provides significant environmental, economic, and social benefits. They contribute to biodiversity conservation, improve soil health, store carbon, regulate water cycles, provide wildlife habitat, and support the forest industry through timber supply. Annually, between 10-20 % of total aspen timber supply to forest industry comes from private aspen forest-woodlots. However, since mid-1990 extensive aspen dieback has become an increasing concern across many regions of western Canada and the United States. Aspen dieback is a complex decline syndrome caused by the interaction of multiple environmental and biological stressors rather than a single disease or insect.

Aspen dieback cause and symptoms

Aspen dieback refers to the gradual decline of tree health characterized by progressive branch mortality, canopy thinning, reduced annual growth, stem deterioration, and eventual tree death. Unlike sudden mortality caused by severe storms or wildfire, dieback develops over several years as repeated stress weakens tree vigor and reduces its ability to defend itself against insects, diseases, and environmental extremes. Although mature and overmature stands are generally more susceptible, younger trees growing under severe environmental stress may also experience dieback. As stress continues, mortality can expand into groups or patches of trees and, under severe conditions, result in substantial stand-level and many cases landscape mortality. Following tree death, standing stems gradually deteriorate and become susceptible to breakage from wind and snow, eventually contributing large amounts of coarse woody debris to the forest floor.

There are multiple predisposing, inciting, and contributing factors for aspen dieback including drought stress, soil moisture deficiency, age of trees and climate change.

Picture 1. Aspen dieback and mortality reduce tree density and forest functions while increasing fuel loads and wildfire risk.

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Drought Stress

Even with record braking amount of rain in 2026 that central Alberta has experienced, years and decades of drought is considered the primary driver of widespread aspen decline and mortality. Extended periods of below-average precipitation combined with increasing summer temperatures reduce available soil moisture. One of the major impact of drought causes reduced photosynthesis and carbohydrate(sugars) production and most impactful it causes fine root mortality.

Alberta has experienced significant aspen dieback, particularly in areas affected by prolonged drought. Following the severe 2001–2002 drought, 2009, 2015, 2021 (July Heat Dome), 2023 and 2024 drought; widespread mortality of aspen was documented in Alberta.

Picture 2. Symptoms of drought on aspen leaves and forest

Following years of drought-stressed and defoliated aspen are also more susceptible to secondary insects and diseases. Wood-boring insects can colonize weakened trees and accelerate structural deterioration. Fungal pathogens, canker diseases, and heart rot can further compromise tree health and structural stability.

Soil moisture deficiency

Aspen is relatively sensitive to water limitations, and prolonged periods of insufficient soil moisture can significantly reduce tree physiological function. During drought(moisture deficiency), trees experience reduced water availability, impaired nutrient uptake, decreased photosynthetic activity, and reduced production and storage of carbohydrates. Due to soil moisture deficiency, the biggest impact is on new fine roots production, root and shoot growth. Severe and prolonged water stress can eventually damage the vascular system and reduce the tree's ability to transport water and nutrients between the roots and crown.

Age of trees

Most aspen forests on private land originated from wildfires and agricultural clearing during the early 1900s to 1940s. Consequently, many stands are now mature to over-mature (90–120 years), with increasing natural decline and mortality. As stands age, growth and energy reserves decrease, increasing susceptibility to insects and disease. However, younger stands (40–70 years) are also experiencing dieback and mortality due to drought and climate-related stress.

Site conditions

Aspen dieback is not uniform across the landscape(agricultural vs boreal forest vs urban forest). Trees growing on dry sites, south- or southwest-facing slopes, shallow soils, compacted soils, or areas with limited water availability are generally more vulnerable to drought stress. Stand age and genetic characteristics(clones) can also influence susceptibility to dieback. Landscape forest fragmentation and isolation from continues forest as well as weeds infestation also increases stress to aspen forest

Human activities such soil compaction, livestock trampling through grazing, changes in drainage patterns, vegetation removal and root damages can further increase stress where they alter soil conditions, rooting areas, or natural regeneration. These impacts may be especially important in private land, environmental reserves, recreational areas, and urban-interface forests where natural forest processes are affected by development or public use.

Ecological, environmental and economic impacts of dieback

Aspen dieback can have significant ecological consequences. Aspen stands provide nesting, feeding, and shelter opportunities for numerous birds, mammals, insects, and other organisms. Loss of mature aspen can reduce the availability of suitable habitat and alter forest structure. As trees die, canopy openings increase, which can initially encourage regeneration and understory growth. However, severe or prolonged mortality may change species composition if young aspen cannot successfully establish or if competing vegetation becomes dominant.

Tree mortality also increases the amount of standing dead wood and downed woody debris. Dead trees are valuable components of healthy forest ecosystems and provide habitat for cavity-nesting birds, insects, fungi, and decomposers. However, excessive accumulation of aspen dead woody material can increase surface fuel loads and depending on moisture conditions and stand structure, may contribute to wildfire risk. Therefore, dead trees should not automatically be removed; management decisions should consider ecological value, tree hazards, fuel conditions, and proximity to infrastructure or public-use areas.

Lastly, economic impacts include lost of fibre supply to forest industry, wildfire costs, and the long-term costs of clearing and converting aspen forests to agricultural land.

Picture 3. It is very common to see land use changes that due to aspen dieback-, land clearing and conversion into agricultural production (pasture or crops) occurs

Management

Overall, there are limited management options for addressing climate- and weather-related factors contributing to aspen dieback. Factors such as stand age, site conditions, drought, flooding, and pests stresses must be considered when developing management strategies. While these factors cannot be directly controlled, some forest management practices can help improve stand resilience, encourage natural regeneration, and maintain long-term aspen health.

- **Encourage natural regeneration through small-scale harvesting**: Aspen has a strong natural capacity for regeneration through both seed production and, more importantly, its extensive interconnected root system. Small-scale clearcuts of approximately 0.1 hectares within areas containing healthy or approximately 50% live trees can stimulate vigorous root suckering and natural regeneration. The creation of small canopy openings increases sunlight penetration and allows solar radiation to warm the soil, which can stimulate dormant aspen root systems and produce large numbers of root suckers.
- **Minimize soil compaction and root damage:** Activities that compact soil or damage aspen roots should be minimized. Aspen regeneration depends heavily on the health and connectivity of its root systems; therefore, heavy equipment, repeated vehicle traffic, excavation, and other activities that disturb the rooting zone should be carefully controlled.
- **Manage livestock access:** Livestock grazing and trampling within aspen stands can damage young suckers, compact soil, and reduce successful natural regeneration. Where regeneration is a management objective, livestock should be excluded or appropriately managed within affected aspen forests. Reducing grazing pressure can allow newly emerging suckers to establish and develop into healthy young trees,
- **Planting spruce or pine in understory** of existing aspen forest will create more resilient mixedwood forest

- Where practical, maintaining healthy soil conditions, protecting root systems, minimizing unnecessary disturbance
- Protect natural regeneration from mowing, trampling, grazing, etc.
- Hazardous dead or severely compromised trees located near roads, trails, buildings, or recreational facilities should be assessed individually and managed according to their risk to people and property.

These management practices will not eliminate the underlying climatic and environmental causes of aspen dieback; however, they can improve stand resilience and help maintain a sustainable age structure. Management should focus on protecting surviving healthy trees, encouraging natural regeneration, minimizing disturbance, and maintaining sufficient young and mature aspen to support long-term forest health.

For more information:

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