How different tree species impact the spread of wildfire

Needles or leaves?

It is easy to see that different types of trees look different from one another and require different conditions for growing. Did you know they are also unique in their response to wildfire? As a general rule, trees with leaves (deciduous) don't burn nearly as fast or as intense as trees with needles (coniferous).

However, there is one small exception to this rule. Deciduous trees can be extremely flammable in the early spring just before their new leaves emerge. During this period of time the moisture levels in the trees are low, increasing their flammability until their leaves emerge.

Why do trees with needles burn so fast?

Coniferous trees have a large amount of sap in their branches. This sap burns very quickly, and supports fast-moving wildfires. These types of trees also tend to grow much closer together than deciduous trees. Being more tightly packed makes it easier for fire to burn effortlessly through an area of coniferous forest by simply moving from tree top to tree top.

Over time, dead branches and needles accumulate on the forest floor. This debris can provide fuel for wildfires. Since many coniferous trees have low-lying branches, wildfires can easily move from the forest floor to the forest canopy.

Lodgepole pine, black spruce, white spruce and balsam fir are all prominent coniferous species in Alberta. These evergreen trees burn anywhere from five to 10 times faster than other species of leafy trees.

Why do leafy trees burn slower?

Fire behaves differently in different forest cover types. Deciduous stands often act as natural fuel breaks. In the boreal forest, crown fires typically drop to the ground when they enter an aspen stand. Fire spread is dependent on the amount and type of understory plants and shrubs. Because of the usual absence of ladder fuels in deciduous stands, fire does not get carried to the high crowns of these trees. The physical properties of aspen also resist intense fire behaviour; high crown base height, higher moisture content of the leaves and stems, and tight, smooth bark. In coniferous stands, the rough, loose bark can act as a ladder allowing fire to climb into the canopy. It can also produce embers that are carried ahead of the fire front.

Trembling aspen, balsam poplar and white birch are commonly found throughout Alberta. Since the characteristics of these trees do not readily support fast-moving wildfires, they make ideal species to plant in and around FireSmart communities.

Harvesting and wildfire

A forest as fuel

Forest fuels are classified into four categories:

- Ground fuels (includes fine fuels referred to as the litter layer, fine fuels starting to break down referred to as the fermentation layer, and undistinguished organic material referred to as the humus layer).
- Surface fuels (coarse woody debris, and ground-level plant biomass).
- Understory fuels (live and dead shrub and sapling biomass).
- Overstory fuels (live and dead standing trees).

How does harvesting impact the spread of wildfire?

Cut blocks provide a break in what would otherwise be a contiguous expanse of forest, and the openings harvesting creates in the canopy limit the potential for crown fire spread. These factors can help to slow the advance of a wildfire.

However, if the cut block is in an early succession stage, the open areas will be dominated by grasses and seedlings. Woody debris will also be present. Exposed surface fuels can dry more quickly than vegetation in dense stands. When surface fuels are dry, sparks will ignite more easily and wind can push flames quickly through the open area.

Fire behaviour potential can be managed to a large extent by changing the fire environment.

How are harvested sites being managed to reduce the risk?

- One way to change the overall fire environment is through harvest sequencing. For example, harvesting insect-killed trees will reduce the potential intensity of a wildfire.
- At the site level, varying the size and layout of the cut block can also impact the fire environment. Post-harvesting site preparation and slash management are important considerations, reducing the volume of woody debris and available fuel.
- Road access planning and construction can provide important access for a fire-fighting crew, which enhances on-the-ground suppression capability.

The more that is learned about fire behaviour, the more preventive practices can be adopted for all forest management activities.