

How disturbances shape our forests

Since trees grow slowly to our eyes, we don't often realize how much forests change over time. A typical sequence of forest change (called succession) looks like this:

1. After a fire or other disturbance, seedlings of light-loving species such as pine and aspen establish, grow up and form a tree canopy that shades the ground. These forests at first look fairly simple with trees of the same age and size.
2. Shade-tolerant species like spruce and fir establish and grow well under the canopy of these original trees.
3. Eventually pine and aspen die and are replaced by spruce and fir. These older forests are much more diverse with trees of different species, sizes and ages and include dying, dead and fallen trees.

This whole process can take 100 years or more. Eventually, a disturbance event (like a wildfire) will remove most of the vegetation; returning nutrients back to the soil and allowing the cycle to begin again.

Does the type of disturbance matter?

The variety, frequency and severity of disturbance in a forest contribute to its basic structure, composition and function, as well as its unique species and processes. A forest's capacity to sustain disturbance is described as resilience, which is a key indicator of a healthy forest. In Alberta, the most common natural disturbances in the forest are wildfire, insects and disease.

Wildfire

Low intensity fires are stand-maintaining disturbances in which larger fire-resistant lodgepole pine and Douglas fir trees survive while smaller trees and non-fire-resistant trees like spruce and subalpine fir are killed. These stand-maintaining disturbances often create open, widely-spaced stands of large trees. Crown fires are stand-replacing disturbances that kill most of the trees

and understory vegetation and create the environment where a new young forest can establish itself.

Insects and disease

Mountain pine beetle is another stand-replacing disturbance, but one that selectively removes only pine trees. Other types of insects and tree diseases tend to also kill trees selectively, creating gaps in the forest canopy that frees space and resources for new trees to grow.

What happens if natural disturbances are prevented?

The removal of all disturbances from forests would reduce the diversity of forest ecosystems and those of forest-dependent wildlife species. Yet the devastating impact of large-scale disturbance like wildfires on homes, communities, and other irreplaceable natural resources requires ongoing suppression and exclusion efforts.

Choosing either the forest's need for disturbance or Albertans' need for personal safety and resource stability could present a problem for forest managers, but the fact is that (even if we wanted to) we couldn't eliminate disturbances from forest ecosystems over the long term. The longer a forest landscape goes without any disturbance, the more susceptible it becomes to disturbance on a large scale. Fire-resistant species like pine are replaced by fire-susceptible species like spruce and subalpine fir. An increase of dead wood on the forest floor creates more fuel for fire. Large expanses of old pine trees create ideal habitat for mountain pine beetle outbreaks.

The choice need not be either/or, but rather to implement purposeful disturbances that will provide desired forest health benefits with fewer of the negative consequences to people and the environment that occur with disturbance on an uncontrolled scale.



Controlled disturbance through harvesting or prescribed fire

Harvesting and prescribed fires each have similarities to wildfire. Harvesting removes the tree canopy, allowing new species to establish and continue the growth cycle. Prescribed fire may also remove tree canopy, and organic material on the forest floor and in the soil.

The key difference is that harvesting and prescribed fire are planned. Managers can emulate natural disturbance in a way that provides the benefits of change, but with a better chance of maintaining the full range of native species. This supports the conservation of plant and animal biodiversity within that particular region.

How does disturbance impact watersheds?

Catastrophic disturbances like wildfire and large-scale insect outbreaks can affect the timing and magnitude of seasonal flows and the amount of sedimentation, nutrients and contaminants in the water. This can affect large areas of watersheds that Albertans rely on for drinking water, recreation, economic health and other ecological goods and services. Once watershed processes have been impacted or changed, watershed recovery can be slow and can result in undesirable outcomes like water quality issues.

Harvesting and prescribed fire will also affect watershed processes, but only at the stand- or site-level and only temporarily. As the new forest grows, these site-level effects recover. This is known as stand hydrological recovery. Forest managers aim to keep the cumulative watershed-scale disturbance low, so that the watershed level processes will not be negatively affected. For more information, see "Forests and Water."

How does disturbance impact carbon capture and release?

Trees have been described as the lungs of the planet—taking in carbon dioxide and 'exhaling' oxygen. When a tree is lost, so is its capacity to process these elements. But the natural disturbances that have shaped Alberta's forest ecosystems since the end of the last glacial period (15,000 years before present) prove that whatever disturbance takes out, a healthy forest can generally put back given time and space to regenerate. In the case of purposeful disturbance like harvesting, established regeneration within 14 years is a legislated condition of operation.

In a newly carbon-conscious world, the full implications of a forest as a carbon sink or 'capture' site are still being explored. When a forest burns, it releases carbon dioxide. However, prescribed fire usually produces lower carbon dioxide emissions than wildfire. For example, prescribed fires conducted in the spring are less severe because they do not burn deep into the

ground fuels. The reduced fuel consumption results in fewer emissions. As well, the strategic location of prescribed fires create important "fire doors" that mitigate the risk of very large, multi-day run wildfires that release large amounts of carbon dioxide and other emissions into the atmosphere.

What about other impacts to air quality?

Prescribed fires do produce smoke that can impact nearby highways and communities by reducing visibility and potentially impacting individuals with respiratory ailments.

However, fire managers attempt to burn only when conditions will allow smoke to vent high into the atmosphere and dissipate quickly with as little impact to people and communities as possible. Extensive communication efforts are also implemented to ensure individuals with health concerns are given as much notice as possible prior to operations commencing.

Containing wildfires through strategic landscape design increases suppression success and reduces the amount of pollutants and their subsequent impact on air quality.

What is important to note is that wildfires burning out of control will almost always produce more smoke, more concentrated smoke, and longer-lasting smoke than a prescribed fire.