Sterilizing Alberta's Forests

By Devon Earl, *AWA Conservation Specialist*

The use of herbicides and pesticides in agriculture is a contentious issue as more and more emerging research elucidates the negative effects that these chemicals have on the environment and human health. However, many people don't realize that forests worldwide are also treated with herbicides, specifically glyphosate, and have been for many years. Given that herbicides are designed to kill living organisms, there is good reason to be concerned about their effects on human health and on the environment. Altering the microbial, fungal, aquatic, and plant communities of our ecosystems can have drastic cascading effects throughout the ecological community.

Although a growing body of research details the potential harmful effects of glyphosate, it continues to be the most widely used herbicide in the world. Glyphosate is often applied to agricultural crops to prevent weed species from growing. Crops like soybean, maize, and cotton are often genetically-modified to be resistant to glyphosate, allowing them to grow while other plant species are killed. The International Agency for Research on Cancer considers glyphosate a probable carcinogen for humans. Its use has been banned or restricted in several countries, including Austria, Oman, and Vietnam.

Glyphosate is not only a concern in our agricultural lands, but also in our forests. Glyphosate-based herbicides are sprayed on regenerating cutblocks to kill deciduous trees like aspen and birch. These trees compete for space, light, and nutrients with the coniferous trees like spruce and pine that many forestry companies want to grow. Planting forests with a single species of conifer, while spraying glyphosate to kill deciduous trees, promotes forests that are much more like plantations than natural ecosystems. This is part of a much larger issue – our forests are managed primarily for their timber value, disregarding the many other vital values that they provide. Applying glyphosate reduces competition for conifers, allowing them to re-establish faster and thus shortening the harvest rotation. In Alberta, over 30,000 hectares of land (300 square kilometres) were sprayed with glyphosate in 2017.

Glyphosate doesn't only have detrimental effects on deciduous trees. It also can alter the survival and growth of understory vegetation. An example of glyphosate's detrimental effects on vegetation is the prickly rose (*Rosa acicularis)*; glyphosate damages its reproductive ability. Research indicates that glyphosate reduces the forage (food) availability for wildlife drastically by killing various shrub species. This may have contributed to the decline in moose populations in British Columbia. Glyphosate is touted as safe because it supposedly breaks down rapidly and doesn't persist in the environment, but research indicates that it is detectable in some understory vegetation species for as long as a year after it has been applied. This raises concerns about potential health effects on species that feed on these plants, including on people who use them as food or medicine.

Perhaps the greatest concern is the effect of glyphosate on the smallest of organisms. Soil bacteria and fungi are vital to the health of a forest, similar to how the gut microbiome is vitally important to human health, and both are affected by glyphosate. Glyphosate alters the bacterial composition of soil, and in some cases glyphosate could lead to nutrient deficiency in soil by suppressing nitrogen-fixing and assimilating bacteria. Mycorrhizal fungi are species that form symbiotic relationships with most plants, allowing plants to communicate with one another and obtain nutrients from the soil. These fungal communities are altered by the use of glyphosate, and in some cases glyphosate may favour the growth of pathogenic fungal species. Fungal and bacterial communities are poorly understood, but are known to be vitally important to ecosystem function.

An important ecosystem function of Alberta's forests is in supporting vital headwaters, which host important aquatic ecosystems and provide drinking water for Albertans. A 2014 study on U.S. waterways found glyphosate and its degradation product AMPA in the majority of rivers, streams, and ditches that the researchers tested. These herbicides are particularly detrimental to amphibians, because shallow ponds and wetlands where they reproduce can accumulate pollutants. One study showed that Roundup, a glyphosate-based pesticide, killed all individuals of two species of tadpoles and nearly wiped out a third species. Glyphosate can also adversely affect fish species such as trout by inducing oxidative stress. In Alberta waterways containing dwindling populations of threatened bull trout, Athabasca rainbow trout, and westslope cutthroat trout, we can't afford to add herbicides to the list of stressors that these species are subjected to.

Glyphosate's impact on invertebrates is another reason for concern. Honeybees are particularly sensitive to glyphosate, and can experience cognitive decline in the presence of this herbicide. The effects of glyphosate

*Fish such as the Threatened westslope cutthroat (*PHOTO: © D. MAYHOOD*) and invertebrate pollinators such as bees (*PHOTO: © K. MIHALCHEON*) are harmed by glyphosate*

on insects and pollinators is important because it adds to the ongoing global decline of pollinators and the biodiversity crisis. Earthworms, another crucial organism to ecosystem health, experience decreased body weight and reproduction in soils treated with glyphosate. Invertebrate species provide food for wildlife, so the effects of glyphosate flow through the food chain, affecting insectivorous species who rely on these organisms as food and then carnivores at the next level of the food chain.

One issue that may hit closer to home following the summer of 2021 is forest fires. All Albertans have been affected in recent years by the terrible wildfires in Western Canada and the accompanying plumes of smoke that cover the sky and suffocate the sun for weeks each summer. Alberta forestry claims that their logging practices are actually designed to reduce forest fires, but this is questionable in important respects. As mentioned above, reforestation practices often involve spraying forest stands with glyphosate to kill deciduous trees, and replanting with conifer monocrops. While these conifers may have a higher timber value, they are much more susceptible to fires than natural, mixed forests. Deciduous trees like aspen keep forests cooler and are less likely to catch fire and to burn. So, by killing all the aspen, we destroy natural fire buffers and create forests that are susceptible to burn hotter and over a larger area. In a world where the climate is warming, and drought is becoming more prevalent, this can hardly be considered a good choice. The government of Alberta and forest companies should understand the importance of allowing deciduous trees to grow in regenerating forests, if only to protect their precious timber supply from wildfire.

Alberta's forests are managed based on the concept of "sustainable yield." This means the annual allowable cut of forests is based on the amount of timber that can be regrown each year. This calculation is made to ensure there will continue to be trees to harvest in the future. The concept of sustainable yield is also a way for the forest industry to convince the public that they are environmentally responsible. In reality, this is a very narrow view of sustainability. It doesn't demand that forests will be sustainable according to biodiversity, water quality, or any other ecosystem service that forests provide aside from timber. Sustainable yield means that the quicker forestry companies can regenerate the type of tree they want to harvest, the more they can harvest each year. This encourages widespread use of glyphosate. Conventional sustainable yield models don't treat seriously enough the increasing risk of forest fire with both climate change and the decrease of deciduous trees like aspen with glyphosate use. The timber-centric focus of forestry overlooks and ignores other forest values.

Glyphosate use should be governed by the precautionary principle. Rather than using glyphosate until its negative consequences are overwhelmingly evident we should not allow glyphosate use until it is proven to be safe. We should not be risking our province's ecological integrity, and the biodiversity of the world, to be able to harvest timber at a faster rate. The more responsible understanding of the value of forests lies well beyond just the economic value of the timber that they provide; A truly sustainable forest management regime should recognize and appreciate all these values. Ecosystems like forests are interconnected in complex ways that aren't fully understood yet. Altering components of the forest like the fungal, microbial, and plant communities is likely to have far-reaching effects that we don't even know to look out for. It is much better to proceed with caution, rather than assume that introducing this toxic herbicide to our forests will have no effect until those effects are undeniable and irreversible.