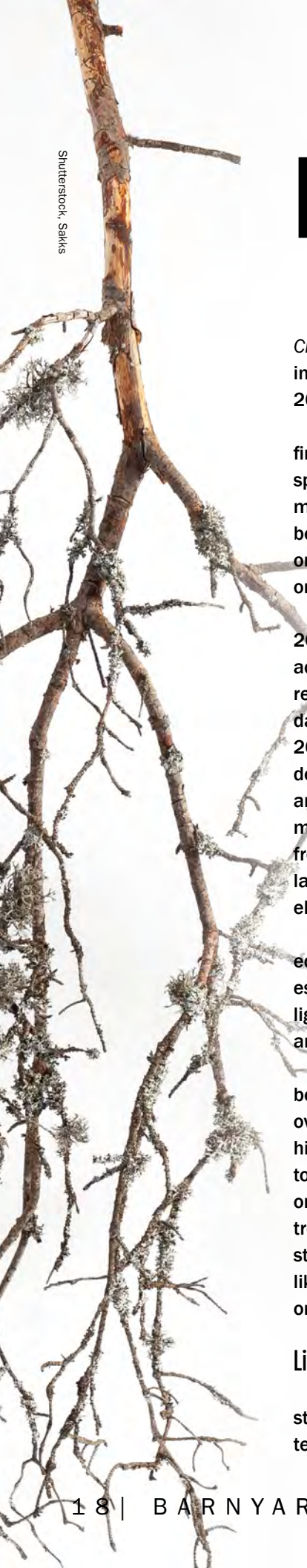

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Meet Wyoming's most prolific

Western spruce budworm (WSBW), *Chroistoneura freemani*, is the most damaging insect pest to Wyoming's forests since 2015.

In Wyoming, the Douglas fir and true fir species are the most affected tree species by WSBW followed by Engelmann spruce. Feeding on pine has been recorded but has little effect on supporting WSBW populations or damaging the trees.

Aerial detection surveys in 2019 recorded over 169,000 acres damaged by WSBW. This represents the highest recorded damage by WSBW in the state in 20 years (Figure 1). In 2020, aerial detection surveys were limited, and accurate comparisons can't be made to previous years, but reports from forest health specialists and land managers indicate similar levels of damage compared to 2019.

Mapped WSBW damage doesn't equate to tree mortality. Many forested areas across Wyoming have experienced light levels of WSBW defoliation for many years and have thrived as healthy resilient ecosystems.

WSBW is a native insect that has always been an active part of forests as they develop over time; however, in recent years repeated higher levels of damage by WSBW has occurred to the point significant mortality is happening on smaller suppressed trees and some mature trees. While mature trees are better able to withstand WSBW, the repeated levels of damage are likely to increase the future amount of mortality on all size classes.

Western spruce budworm adult.

William M. Ciesla, Forest Health Management International, Bugwood.org

Lifecycle and damage

WSBW produces one generation per year starting with eggs that hatch in late summer. After hatching, larvae will move to find places beneath the bark to overwinter. Damage begins in April and goes through June when the larvae emerge and begin to feed on the buds and old needles. As the buds swell and new leaves unfurl and grow larger, the WSBW continues to feed and develop. They prefer the new foliage and will create silken shelters around the new growth to protect themselves.

The evidence of their feeding initially appears on branch tips and tops of the trees. This will often appear orange as in Figures 3 and 4 on page 20. Adults emerge from pupation between July and August and can frequently be seen flying in areas with high levels of damage. Adult WSBW moths are approximately ½-long with a 1-inch wingspan. Coloring can vary from grey to an orange-brown with bands or streaked markings as seen at left.

When populations of WSBW are high, larvae will feed on the older needles of trees, significantly increasing the risk of tree mortality. Trees will be completely devoid of needles, and large areas will have a brownish appearance from a distance. Mature trees are better able to withstand high levels of damage, but defoliation reduces overall vigor, increasing the risk of mortality by other damaging agents including bark beetles, weather, and diseases.

WSBW management

Forest stand structure, the horizontal and vertical distribution of trees, plays a crucial role in the impact WSBW has on individual trees and tree populations. Dense, multi-level forest stands provide an ideal protected habitat for WSBW populations to grow and as a result, defoliate trees. The WSBW cycle begins with adults or larvae landing on the overhead trees and establish-

insect pest of trees

Todd M. Gilligan and Marc E. Epstein, CSU, Bugwood.org

ing a small population. These numbers are often low due to the harsh climatic conditions and abundance of natural predators such as birds in the canopy.

Over time, WSBW will drop down from the overhead canopy onto smaller suppressed trees in the understory, trees below the main canopy. The understory provides ideal protected habitat where WSBW population numbers can increase. Understory trees will often die due to complete defoliation by WSBW. As populations grow, the WSBW move back up into the upper canopy and begin to defoliate the overhead (overstory) trees. Mature overstory trees sustaining three-plus years of heavy feeding will often die.

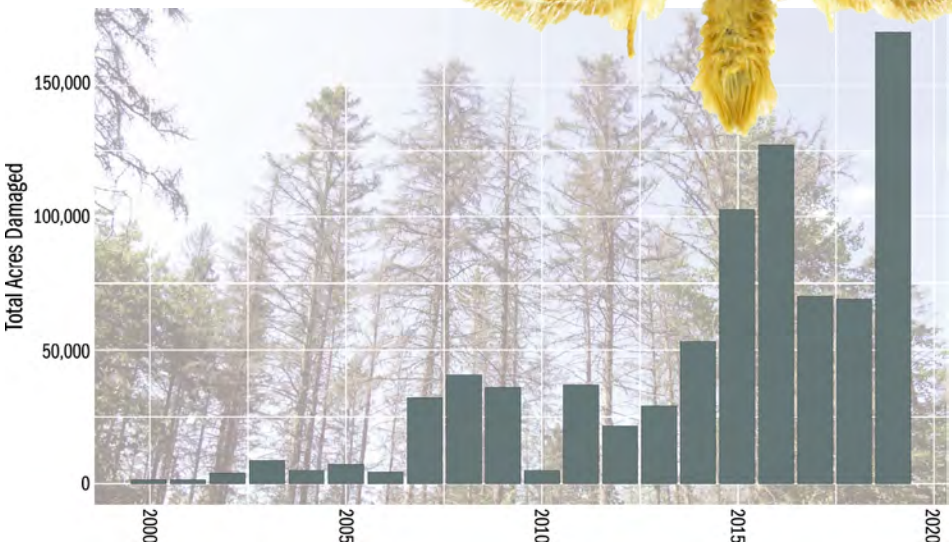

Figure 1. Total acres each year of western spruce budworm damage recorded by aerial surveys from 2000-2019.

Long WSBW outbreaks

Silvicultural forest management provides the control option with the greatest benefit due to the effects of stand structure on WSBW impact. Silvicultural forest management is best described as the art and science of controlling the establishment, growth, composition, health, and quality of forests.

WSBW outbreaks can be long-lasting, with some areas experiencing damage for over 30 years. Spraying insecticides will effectively reduce population numbers of WSBW but will only be effective for two to three years. WSBW will move back in, and conditions will return to the previous state if the area is not retreated.

Chemical insecticides will require professional application to reach the tops of trees with either powerful sprayers or aircraft. They are rarely used due to the high costs of treating

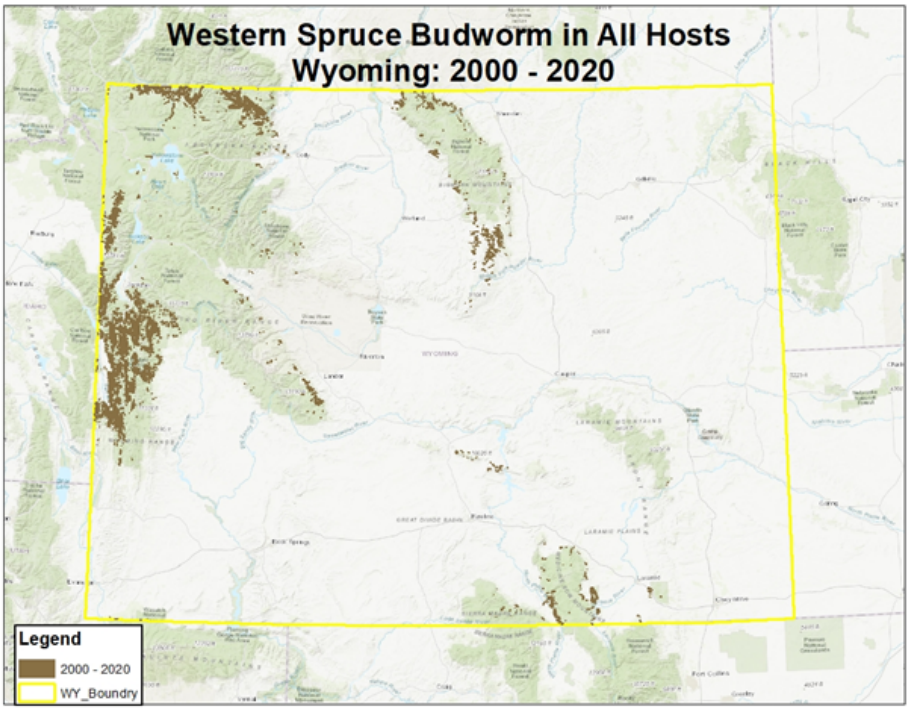

Figure 2. Locations where western spruce budworm damage was recorded from 2000-2020.

William M. Ciesla, Forest Health Management International, Bugwood.org

Figure 3. Western spruce budworm damage on a forest stand.

large areas and short-term results of chemical applications. The use of insecticides can also have detrimental effects on pollinators and other beneficial insects. Insecticide chemical choice and timing can help minimize harmful consequences.

Changing the stand structure and promoting growth of established overstory trees will increase their chances of survival from WSBW and other tree stressors. Decisions can also be made to promote species less susceptible to WSBW damage, like pine.

A stand with a closed canopy of healthy, large, overstory trees and few to no suppressed trees in the understory can reduce WSBW populations and keep damage minimal; however, single-aged stands of mature trees can be susceptible to bark beetles and other age-related stressors. Without regenerating trees and diversity in sizes, ages and, if possible, species, an insect/disease outbreak may result in all trees dying in an area. Silvicultural prescriptions commonly focus on increasing spacing through forest thinning and less on solely promoting mature trees.

Forest thinning by landowners to promote healthy trees will increase resource availability, provide benefits of increased growth, and resilience/resistance to other stressors. Removing large overstory trees in some cases may be beneficial and can help offset the cost of thinning.

Many factors need consideration when planning silvicultural forest management. Developing a forest management plan based on land goals and current conditions is important. Landowners should assess and plan for considerations of wildlife habitat, timber development, fire/fuels management, insect and disease resistance/resilience, and economic factors. "If you fail to plan, you are planning to fail." – Benjamin Franklin

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FUN FACT

Western spruce budworm's scientific name was originally *Choristoneura occidentalis* when first described in 1958. In 2008, Józef Razowski moved the African moth species *Archips occidentalis* to the genus *Choristoneura* giving it the same name as the western spruce budworm. The African moth was first described in 1891 and has precedent to the name. Due to this change, Razowski changed the western spruce budworm to *C. freemani*. While Razowski's work is valid, the name change hasn't been universally accepted, and the more popular western spruce budworm is still commonly called *Choristoneura occidentalis.*

Kenneth E. Gibson, USDA Forest Service, Bugwood.org

Figure 4. Western spruce budworm feeding on branch tips.