Forest Health Highlights:

North Dakota 2020

This report summarizes forest health observations and program activities in North Dakota for 2020 and includes an overview of notable forest health issues. The information in this report comes from site visits, forest health surveys and reports, and personal communication with natural resource and community forestry professionals. North Dakota contains approximately 808,701 acres of forestland, which accounts for just under two percent of the state's land area (Forests of North Dakota 2019). The top five tree species in the state by volume are cottonwood, bur oak, green ash, quaking aspen, and Rocky Mountain juniper. Conservation plantings, such as windbreaks and living snow fences, are a significant linear tree resource, totaling as much as 55,000 miles. Community trees provide valuable ecosystem services in the northern Plains environment. Four college campuses have achieved Tree Campus USA designation and fifty-three cities qualify for Tree City USA.

Theodore Roosevelt National Park in September. (Peter Gag, NDFS)

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Forest Health Surveys

- Japanese Beetle (*Popillia japonica*): The North Dakota Department of Agriculture (NDDA) conducts Japanese beetle counts in the state. This pest is a threat to *Tilia* species that can be found in North Dakota's community and native forests. Of the 42 counties surveyed using 516 traps during the 2020 growing season, Japanese beetle was collected in 9 counties. This amounted to 402 beetles in 2020, down from a high of 1,467 in 22 counties in 2017, when larvae were accidentally introduced in nursery containers.
- Emerald Ash Borer (*Agrilus planipennis*): The United States Department of Agriculture (USDA) Animal Plant Health Inspection Service (APHIS) continues to supply the North Dakota Department of Agriculture (NDDA) with trapping materials for surveying. There were 305 traps installed and maintained across 42 of the 53 counties throughout ND in 2020. No EAB were trapped during the 2020 trapping season.
- Gypsy Moth (*Lymantria dispar*): During 2020 USDA APHIS placed 307 traps in North Dakota. Effort to delimit areas adjacent to two 2019 trap sites where moths were found, produced no detections. No beetles were detected during the 2020 trapping season from any of the 307 traps.
- Exotic Wood-boring Insect Surveys: The NDDA Cooperative Agricultural Pest Survey (CAPS) maintained 64 Lindgren traps, collecting 674 total specimens across 65 species. All specimens collected from the families Scolytidae, Cerambycidae, and Curculionidae were identified and recorded. During 2020 there were five new state records recoded, all in the Curculionidae: Scolytinae family and subfamily. There were also 29 county records generated during the 2020 growing season. The total number of collected specimens was approximately 38% of the average collected over the past 14 years.

Weather Trends and Abiotic Issues

The late 2019 growing season weather played a significant role in many forest health issues during the 2020 growing season. The high level of precipitation continued through the winter, creating saturated spring soil moisture conditions. Deep snow over saturated soil conditions waterlogged tree root systems in topographically low positions, reducing root function and shoot growth. Waterlogging played an important role in the browning of all years of foliage held on conifer and juniper species during the 2020 growing season. Trees that did not die from the extensive loss of foliage experienced decreased growth, which likely elevated tree stress in many areas. This circumstance may yet manifest as a myriad of tree health issues during the 2021 growing seasons.

Abiotic Issues

Weather, soil characteristics, and human induced conditions are abiotic variables that have significant impacts on tree health in North Dakota.

Root Disturbance

Tree health issues are frequently challenged by poor planting behavior. Excessive depth drives fundamental root structure problems that become increasingly complicated through time. Machinery use causes compaction of the soil under tree crowns, often leading to mechanical damage on the roots and trunk. Digging around trees damages root structures and can hinder physical and functional processes necessary for tree growth. These are consistent issues encountered in our community forests and conservation plantings. Root disturbance plays a significant role in annual tree health issues throughout North Dakota.

Chemical Applications

Fertilizer, herbicide, and pesticide use have direct influence on foliage, beneficial insects, and competing vegetation. 2020 was consistent with other years, where a large portion of assistance requests were in one way or another complicated by the application of these chemicals.

Disease Issues

Dutch Elm Disease (*Ophiostoma ulmi*)**:** Dutch elm disease (DED) was first detected in North Dakota in 1969. North Dakota elm trees are still at risk for DED. *Ophiostoma ulmi* will remain a persistent issue in North Dakota as long as susceptible elm trees remain on the landscape. Elm trees continue to be removed annually from our community forests, while smaller communities without forestry staff have limited resources to cope with removals.

Diplodia pinae (*Diplodia pinea*): Diplodia tip blight is commonly found in planted ponderosa pine (*Pinus ponderosa*) throughout the state. A latent pathogen of pine, Diplodia is transmitted from mature to young trees, where the fungus can exist without producing any disease symptoms. Most ponderosa pine in North Dakota are off-site plantings, frequently suffering multiple site stresses, reducing tree vigor. The increasing stress associated with climate change will continue to increasing the occurrence of Diplodia.

Fireblight (*Erwinia amylovora*): Fireblight induces a series of signs caused by the bacterium *Erwinia amylovora*. This bacterial disease affects the family Rosaceae, which includes species, such as, apple, crabapple, and serviceberry in North Dakota. The spread of fireblight is precipitated by injury to the young leaves and shoots by mechanisms such as, wind, hail, or insect puncture. During the 2020 growing season, fireblight was a consistent issue in landscape trees. With an increase in sever weather events, there seems to be a correlated increase in the occurrence of fireblight.

Spruce Disease Issues

Diseases of spruce (*Picea spp.*) are a consistent issue in North Dakota, since all spruce are off-site plantings. Two needlescast diseases, Stigmina (*Stigmina lautii*) and Rhizosphaera (*Rhizosphaera kalkoffii*) cause a significant amount of defoliation in community forests and

conservation plantings. Stigmina establishes on the lowest branches of spruce during moist periods, but can spread upward in the crown over successive wet or dry years, eventually defoliating and killing a tree. Rhizosphaera is similar to stigmina, but less aggressive, rarely causes the level of defoliation that can be seen with Stigmina. The third of the pronounced spruce disease issues is Valsa canker, caused by the fungus (*Valsa kunzei*). This canker girdles individual branches sporadically distributed throughout the crown. With the increasing extremes in seasonal precipitation, these issues are expected to become more common.

Insects Issues

Spring (*Paleacrita vernata*) and fall (*Alsophila pometaria*) cankerworm defoliate tree species such as boxelder, elm, and linden. Cankerworm appears to be on a three-year cycle of population growth, that crashes following the third year. 2020 was the third year of the cycle in central ND, while one more year is expected in eastern ND.

Fall webworm (*Hyphantria cunea*) caterpillars are pronounced from July through September in North Dakota. Generally, this insect only has aesthetic implications on deciduous vegetation, where they skeletonize leaves. The occurrence of fall webworm issues was up during 2020.

Yellow-headed spruce sawfly (*Pikonema alaskensis*) is most commonly found on Colorado blue spruce in central and western North Dakota. They feed on newly growing expanding needles, leaving them to die, stunting the year's growth on the affected branch. Yellow-headed spruce sawfly continues to be a small, but consistent problem in North Dakota.

Forest tent caterpillar (FTC) (*Malacosoma disstria*) is a consist issue in native North Dakota forests. The caterpillar indiscriminately feeds on and defoliates deciduous trees. In North Dakota the cyclic nature of FTC has not been determined, but it is consistently present. Periodic monitoring for FTC will continue using ground and aerial surveying to determine more about FTC behavior. Findings in Minnesota demonstrate a 13-15 year cycle.

Large aspen tortix (LAT) (*Choristoneura conflictana*) is a defoliator that has been consistently present in the aspen/birch forests of the Turtle Mountains. Population density and the extent of defoliation has varied markedly, but rarely raising significant concern. With a consistent presence, LAT was positively identified in and around the Turtle Mountains during the 2020 growing season, but no significant defoliation was observed.

Gall mites (*Eriophyidae*) produce many types of galls on various species of deciduous and conifer hosts in North Dakota. During 2020 it was common to find bright-colored bladder, finger, pouch, or bead galls on the foliage of many different landscaped tree species in our community forests. Galls of this nature are generally not a threat to the health of the tree. The cool moist spring conditions in 2020 likely influenced the occurrence Eriophyid species.

Health Assessment in Pine

During the 2020 growing season, pines in the central and south eastern parts of the state experienced high levels of mortality. In most cases, this mortality was influenced by the previous fall and winter precipitation. The percentage of normal rainfall for the month of September 2019 ranged from 150% to 900% of normal, following a growing season that was already experiencing normal or above normal rainfall (Figure 1). This frequently led to extremely high soil moisture content in most soils, but particularly those with fine texture and those found in poorly-drained, low-slope positions.

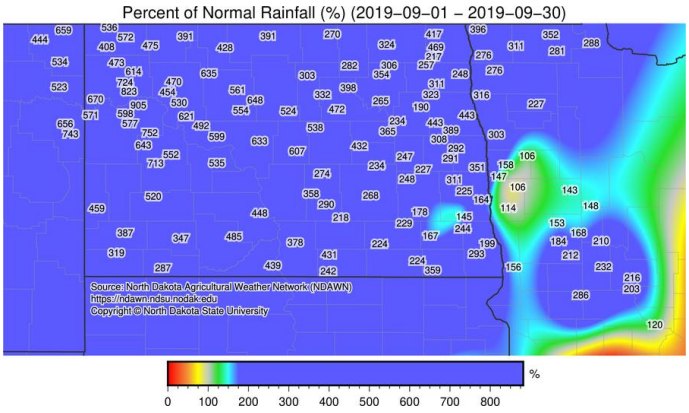

Figure 1: Total rainfall for the month of September of 2019 following a growing season with normal to above normal rainfall and a low occurrence of drought conditions statewide (North Dakota Agricultural Network).

Excessive soil moisture was then covered with a significant October snowfall that effectively insulated saturated soils, adding to the overall total moisture. The combination of available soil moisture, adequate radiation, and air temperature can allow conifer foliage to continue to transpire available water during the winter and early spring. With highly saturated, or waterlogged soil conditions, tree root systems would be unable to perform normal root functions. Soil waterlogging commonly leads to depleted soil oxygen, which induces anaerobic conditions, reducing metabolism and nutrient availability, resulting in severe physiological injuries (Armstrong et al., 2009; Bailey-Serres et al., 2012; Herzog et al., 2016). The onset of these conditions will reduce root function, slowing shoot and needle growth, frequently causing plant death (Amador et al., 2012).

This response to waterlogged soils played an important role in the browning of most years of foliage held on many conifers. Conifers do not have energy stores or produce a flush of foliage following injury, like deciduous trees, so the browning of foliage removes the tissues necessary for growth, leading to death. Conifers that experience partial browning of their crown will have reduced vigor, making them vulnerable to secondary mechanisms of injury from tree insects and pathogens. In some cases, decreased vigor may have encouraged pine tip moth presence on new shoots or a fungal growth in young stem bark and current year needle growth. Trees that did not die from the loss of foliage due to waterlogging, very likely experienced decreased

growth, which elevated tree stress in many locations. This circumstance may yet manifest as continued tree health issues during the 2021 growing seasons.

Figure 2: Image of frequently observed pine mortality in central and eastern North Dakota conservation plantings. Late 2019 growing season rainfall and heavy snowfall caused waterlogging soil conditions through the winter and early spring, resulting in severe physiological injury and death.

Education and Outreach for Tree and Forest Insects

Another Tool for EAB Awareness

In order to further develop our capacity to detect emerald ash borer, a program that integrates citizen scientists with observational surveys for bark foraging birds and the damage they cause, was recently established. Looking for woodpecker damage is an effective and common method to delimit known EAB populations, but can we use the observation of bark foraging birds for early detection? The birding public is a resource for forest health managers, since they are frequently observing avian species within our forests. Creating a phone-based survey using Survey123, the ND Forest Health Program is teaching people how to find and report potential signs of EAB damage as derived from bird behavior, using simple online resources, while they recreate. With Survey123, there is an easy process to collect observable information and submit it online to inform resource managers and prompting us for further investigation; locations that fulfill a set of criteria become sites to investigate. Information can be found through the link below. https://www.ndinvasives.org/learn-about-eab-and-bark-foraging-birds

Training Sessions

During 2020, the Covid-19 pandemic played a significant role in deterring training opportunities. None of the annual training events occurred.

Selected References and More Information

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More information

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