2020 Forest Insect & Disease Conditions in the Rocky Mountain Region

Conditions in the Rocky Mountain Region

Weather Summary

In 2020, the Rocky Mountain Region, also known as Region 2, or R2, experienced average precipitation during the winter and spring, followed by a severe drought across the Region in the summer and fall.

These drought conditions, combined with above-average temperatures, resulted in a destructive fire season. Colorado and Wyoming experienced several large fires that burned for months.

In fact, the three largest fires in recorded Colorado history all occurred in 2020.

Conditions in the Rocky Mountain Region

The Region experienced other severe weather phenomena throughout the year, which impacted forest health. Instances of late-spring frosts were documented which damaged budding trees.

There were also several notable instances of wind and hail damage. The Black Hills National Forest experienced hail and tornado events in the spring and in early July. The Medicine Bow-Routt and Arapaho Roosevelt National Forests recorded damage from a rare derecho wind event which formed on June 6th causing damage across Colorado, Wyoming, western Nebraska and the Dakotas. A storm is classified as a derecho if wind damage swath extends more than 240 miles and has wind gusts of at least 58 mph or greater along most of the storm's path. Wind gusts over 110 mph were recorded near Winter Park, CO. Uncommonly high winds were also observed over the Rockies from Montana into the Four-Corners on September 8-10, causing localized damage in forests throughout the area.

Turpin Creek blowdown area on the Medicine Bow National Forest, Wyoming

Background Image: Aerial view of Turpin Creek blowdown area on the Medicine Bow National Forest, Wyoming

Conditions in the Rocky Mountain Region

Aerial Survey Summary

Each year during the summer and early fall, Forest Health Protection (FHP) and its state partners conduct aerial surveys to map forest insect and disease activity in the Rocky Mountain Region.

Aerial surveys provide an annual snapshot of forest health conditions over large areas more efficiently and economically than other methods. To conduct the survey, observers in small aircraft record areas of activity using a digital aerial sketchmapping system that incorporates a tablet computer, geographic information systems and global positioning system technology. Aircraft used for these flights are typically small high-wing planes such as the Quest Kodiak 100 and Cessna T206. Aircraft fly in either a grid pattern over relatively flat terrain or following the contours of the terrain in mountainous or deeply dissected landscapes.

The U.S. Forest Service partners with state cooperating agencies to conduct the annual survey.

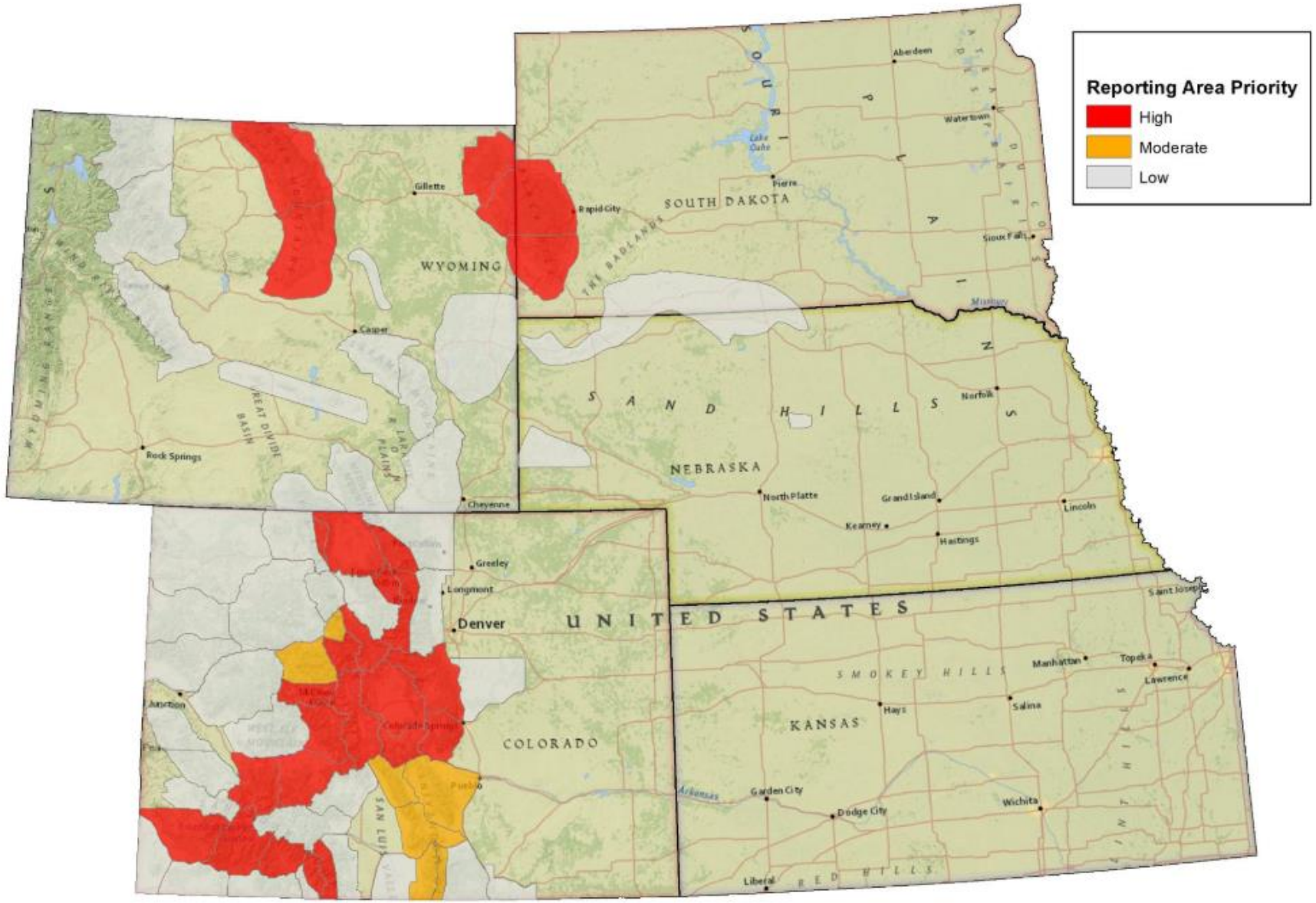
Background Image: Quest Kodiak airplane used for aerial survey missions

In 2020, the aerial survey flight plan and survey areas were modified due to COVID-19.

In a normal year, the goal is to survey all forested lands above the pinyon-juniper forest type, which is about 44 million acres. To reduce possible exposure to the virus, extra precautions were taken, which limited the 2020 survey. All surveys were conducted out of the local airport in Broomfield, CO and personnel were divided into compartmentalized teams. The aerial survey team worked closely with service center personnel and other cooperators to prioritize the areas that were surveyed. The Region was divided into low, medium and high priority areas to direct survey efforts. The aerial survey team covered nearly all the high and medium priority areas and some of the low priority areas, totaling approximately 23 million acres.

Comparing data over time is misleading since not all areas were surveyed in 2020.

2020 Insect and Disease Aerial Survey Preseason Reporting Area Priorities



Map of 2020 aerial survey priority areas

Bark Beetles and Defoliator Insects

Spruce Beetle

Dendroctonus rufipennis
Host: Spruce

Spruce beetle epidemics are still expanding where larger diameter spruce trees are available. Many large areas with ongoing activity are experiencing continued large spruce mortality.

In Wyoming, the Shoshone National Forest has spruce beetle activity on the Wind River District, mostly in the Union Pass and Brent Creek areas. The Bighorn National Forest also has some light spruce beetle activity in the northern Bighorns, from about Burgess Junction to Porcupine Work Center; these populations appear to be building and expanding.

In Colorado, there is still activity in and around Rocky Mountain National Park. On Mt. Evans and Guanella Pass, spruce beetles continue to become more detectable near blowdown areas. The largest expanses of activity continue to be in southern Colorado with notable expansion and increased intensity in the Wet Mountains. New activity was also observed on the north side of the Elk Mountains south of Aspen.

Dying spruce trees fade slowly and spruce beetle mortality can be difficult to detect from the air, particularly when lighting conditions are poor due to weather or smoke from forest fires. Acres of mortality throughout the Region may have been underestimated in 2020 as a result.

Lakewood Service Center is monitoring some 2018 and 2019 avalanche runs for spruce beetle and western bark beetle. The 2020 windthrow will provide additional habitat for building spruce beetle populations. National Forests have been actively removing spruce beetle-affected and windthrown trees in the suitable timber base.

Spruce beetle-infested tree on the Bighorn National Forest, Wyoming

Background Image: Spruce beetle caused tree mortality on the Uncompahgre National Forest, Colorado

Bark Beetles and Defoliator Insects

Mountain Pine Beetle

Dendroctonus ponderosae

Hosts: Ponderosa pine, lodgepole pine, limber pine, whitebark pine, bristlecone pine

Mountain pine beetle activity has returned to endemic levels in much of the Region as the most recent large outbreaks have subsided. A notable exception is a mountain pine beetle outbreak that is expanding in the Wilder-Gunnison Highland communities and surrounding Gunnison National Forest, located in Taylor Canyon of the Gunnison Ranger District. Ground surveys indicate a growing population. Drought stress is reducing tree defenses and contributing to conditions favorable to increasing beetle populations.

This outbreak threatens one of the largest remaining mature lodgepole pine forests in Colorado unaffected by the mountain pine beetle epidemic in the 2000s. Removing currently infested trees and thinning to combat expanding beetle populations is a priority for the Gunnison National Forest and the surrounding community. A rapid response team that includes personnel from FHP, National Forest System, Colorado State Forest Service, and the National Forest Foundation is working to respond to the Wilder-Gunnison Highland outbreak. As a result of the team's efforts, a total of 260 acres were treated by removing infested trees and thinning within a year of FHP reporting the outbreak. End-of-year FHP funds from the Washington Office and the Regional Office helped support the effort. Plans are underway for additional treatments in 2021.

Ground surveys on the Dolores Ranger District on the San Juan National Forest also show that the mountain pine beetle is an active component of a complex of bark beetles in ponderosa pine. The mountain pine beetle is not the primary tree mortality agent in this area, but it is mixed with the more abundant roundheaded pine beetle and western pine beetle.

Mountain pine beetle and one of its predators, a clerid beetle larvae in an infested lodgepole pine in the Taylor Canyon area of the Gunnison National Forest, Colorado

Background Image: Mountain pine beetle caused mortality in lodgepole pine in the Wilder-Highlands Mountain Pine Beetle Project on the Gunnison National Forest, Colorado

Bark Beetles and Defoliator Insects

Roundheaded Pine Beetle and Western Bark Beetle Complex in Ponderosa Pine

Dendroctonus adjunctis and *Dendroctonus brevicomis*

The northern range of the roundheaded pine beetle extends into southern Colorado where it occurs with the western pine beetle and the mountain pine beetle in ponderosa pine. An outbreak of roundheaded pine beetle and, to a lesser extent, western pine beetle on the San Juan National Forest has continued to expand since 2011.

While roundheaded pine beetle outbreaks are typically shorter in duration in southwestern forests, this outbreak has continued to increase in intensity with abundant pine hosts available. In 2020, aerial detection surveys recorded over 3,000 acres on the Dolores Ranger District with varying intensity of beetle-caused tree mortality. The area affected is within the San Juan National Forest suitable timber base and provides a valuable resource for local mills.

Ground surveys on the Dolores Ranger District were completed after the beetle flights in the fall. Surveys indicate that populations are continuing to expand. FHP Gunnison Service Center entomologists have been working in partnership with the Colorado State Forest Service to learn more about the behavior of this beetle complex in southwestern Colorado.

Fresh pitch tubes on a ponderosa pine due to roundheaded pine beetle attack on the San Juan National Forest, Colorado

Background Image: Roundheaded and western pine beetle caused tree mortality on the San Juan National Forest, Colorado

Bark Beetles and Defoliator Insects

Douglas-fir Beetle

Dendroctonus pseudotsugae
Host: Douglas-fir

The Douglas-fir beetle is active across the Region. Current drought conditions and years of heavy western spruce budworm defoliation favor outbreak development.

Aerial surveys detected 2,900 acres with Douglas-fir beetle activity in areas flown. Defoliation in northern Wyoming, on the northern Shoshone National Forest's Clarks Fork, is so severe that the Douglas-fir beetle may be a secondary cause of the mortality. Large 2020 fires will also create scorch and weakened tree habitat for the Douglas-fir beetle.

In 2020, FHP entomologists supported efforts to protect high-value Douglas-fir trees on developed sites in Colorado by using the beetles' own anti-aggregation pheromone, Methylcyclohexenone (MCH). A synthesized formulation of MCH is distributed in high value susceptible stands to confuse the beetles. MCH treatments, proven to be an effective alternative to chemical insecticides, can be used by homeowners as well as forest land managers.

Douglas-fir beetle galleries

Background Image: Douglas-fir beetle caused tree mortality in Douglas-fir on the Gunnison National Forest, Colorado

Bark Beetles and Defoliator Insects

Western Balsam Bark Beetle

Dryocoetes confusus
Hosts: Subalpine fir

Western balsam bark beetle activity was detected on 8,000 acres of subalpine fir in Colorado and Wyoming. These infestations are generally widespread, but kill fewer trees per acre than other bark beetles currently active in the state. The beetles leave a distinctive star-shaped gallery pattern beneath the bark. Western balsam bark beetle activity is often associated with root disease in high elevation forests. Where the western balsam bark beetle occurs in spruce beetle-affected stands, overall stand mortality is increased.

In 2020, FHP Lakewood Service Center entomologists began monitoring subalpine fir broken or uprooted in 2019 avalanche runs to determine if populations in these downed trees will move to adjacent stands.

Subalpine fir mortality caused by western balsam bark beetle on the Bighorn National Forest, Wyoming

Background Image: Hillside with scattered subalpine fir mortality caused by western balsam bark beetle on the Gunnison National Forest, Colorado

Bark Beetles and Defoliator Insects

Western Spruce Budworm

Choristoneura freemani
Hosts: True firs, Douglas-fir, and spruce

Budworm activity continued at high levels on the Shoshone, Bighorn, Pike, San Isabel, Gunnison, San Juan, Rio Grande, Routt and Uncompahgre National Forests and adjoining lands.

In Wyoming, western spruce budworm is active throughout the range of Douglas-fir at varying levels. Many areas have experienced defoliation at epidemic levels for multiple years, causing mortality and predisposing trees to Douglas-fir beetle attack.

Ground observation in higher elevation spruce and subalpine forest types also documented some defoliation in the northern Shoshone and Routt National Forests.

In Colorado, budworm activity intensified and expanded into areas where it has not been seen in many years. Limited aerial surveys detected 128,000 acres with defoliation.

Western spruce budworm feeds on the new needles of white fir, Douglas-fir and less notably on spruce and subalpine fir. Drying needles webbed to twigs impart a brown cast to infested trees. Managing stands by thinning and favoring non-host tree species when possible can increase mortality of dispersing budworm larvae.

Western spruce budworm defoliation on the Gunnison National Forest, Colorado

Background Image: Close up of western spruce budworm defoliation on the Gunnison National Forest, Colorado

Bark Beetles and Defoliator Insects

Aspen Defoliation and Discoloration

Large aspen tortrix, Choristoneura conflictana
Western tent caterpillar, Malacosoma californicum
Marssonina leaf spot, Marsonina brunnea and/or M. populi

Aspen defoliation/foliar damage caused by a combination of defoliators and other biotic and abiotic causal agents was observed over 15,000 acres, primarily in Colorado.

Aspen defoliation can be caused by the large aspen tortrix, western tent caterpillar, Marssonina leaf spot and/or abiotic damage caused by such events as late spring frosts or high winds. All of these produce similar aerial signatures and must be ground-checked to verify the specific damage-causing agents in a particular stand. Aspen typically survives defoliation events; however, repeated defoliation over several years can cause mortality. On the Gunnison National Forest, trees that refoliated after a tortrix outbreak suffered leaf scorch from extreme drought.

Marssonina leaf blight was less common in Colorado, Wyoming and South Dakota in 2020 than in 2019 due to drier than normal spring conditions suppressing the development and spread of the disease.

While conditions were not conducive for the disease, some areas in southwest Colorado had extensive Marssonina leaf blight that was visible during the 2020 aerial surveys. Initial symptoms include tiny blisters or brown lesions often with yellow margins on leaves. Severe outbreaks cause brown lesions to coalesce into large brown leaf spots and premature defoliation. Disease resistance varies with clones, therefore planting or managing for resistant clones is the most effective management technique. Although this pathogen rarely kills trees on its own, affected trees may be more susceptible to other damage agents and growth reduction can be significant.

Leaf scorch on aspen that had refoliated after tortrix outbreak, Gunnison National Forest, Colorado

Background image: Large aspen tortrix and hail damage on aspen, Gunnison National Forest, Colorado

Diseases

Armillaria Root Disease

Armillaria spp., primarily A. solidipes (A. ostoyae)
Hosts: Almost all tree species in the Rocky Mountain Region are susceptible

Armillaria root disease is the Region's most common root pathogen and can occur on every tree species in the Region depending on the pathogenicity of the Armillaria species.

Signs of the pathogen include mycelial fans under the bark, zone lines, melanized root-like rhizomorphs and occasionally clustered honey-mushrooms at the base of trees. Infected hosts may have crown dieback/thinning, basal resinosis and extensive decay of the tree's roots and butt.

In 2020, many *Armillaria* spp. infected stands were identified following an extreme derecho wind event. The high winds caused failures to occur from southwest Colorado into the Dakotas, devastating many recreation areas and campgrounds. On the Grand Mesa, Gunnison and Uncompahgre National Forests, campgrounds had to be temporarily closed to remove downed wood after the storm. Concessionaires and Forest Service staff were inundated with cleaning up tree failures for the majority of the summer and fall seasons. Residual trees were evaluated for symptoms indicative of *Armillaria* spp.

A recent study highlighting subalpine fir in Colorado forests, indicated that Armillaria root disease was associated with increased mortality in conjunction with drought and western balsam bark beetle. Additionally, *A. gallica* was recently identified as the main species in riparian areas within Nebraska, North and South Dakota and Wyoming. It was found to frequently cause root disease, infecting various hardwood tree species.

Background Image: Armillaria root disease on the Grand Mesa National Forest, Colorado

Diseases

White Pine Blister Rust

Cronartium ribicola
Hosts: Limber, whitebark, and Rocky Mountain bristlecone pine
Alternate hosts: Currants and gooseberries (*Ribes* spp.) and species of *Pedicularis* and *Castilleja*

The exotic, invasive fungal disease, white pine blister rust (WPBR), continues to spread and intensify in the Region.

Infected limber pines were confirmed during field surveys in several new locations including the Snowy Range Ski Area and Corner Mountain Trailhead on the Medicine Bow National Forest; near treeline above Rainbow Curve and in Ute Meadows in Rocky Mountain National Park; and near the Mountain Research Station and Fourth of July Trailhead on the Roosevelt National Forest. Branch flagging, top kill and some mortality of seedlings and/or saplings is occurring in each of these areas.

In 2020, permanent plots that date back to the 1980s were revisited on the Bighorn, Black Hills, Medicine Bow and Shoshone National Forests. WPBR continues to intensify in all previously sampled areas.

The combined impacts of WPBR, bark beetles and climate change threaten white pines in the Region. Limber pine is listed as a "species of local concern" on the Black Hills National Forest, a "species of management concern" in Rocky Mountain National Park, and a "BLM sensitive species" in Wyoming. In December 2020, US Fish and Wildlife Service proposed listing whitebark pine, which occurs on the Shoshone National Forest and Wind River Indian Reservation, as threatened under the Endangered Species Act. As a threatened species, protections for whitebark pine will be increased and conservation strategies will be promoted.

FHP is actively collaborating with RMRS, CSU, NPS and other USFS Regions to develop, promote and implement proactive management strategies to protect, conserve and restore these important species.

Background Image: Close up of white pine blister rust cankers on a limber pine branch

Diseases

Diplodia Shoot Blight and Canker Disease

Diplodia sapinea
Hosts: Pines and other conifers

This disease causes shoot blights and cankers in pines and some other conifer species in the Region. The fungal pathogen affects seedlings to mature trees and damage can be severe. Symptoms range from dead needles, new-shoot branch mortality, extensive branch and top kill, to tree mortality. New infections often result in short, light brown, wilting needles that fade to gray and remain attached to stems. Needles and stems are often stunted or crooked.

Diplodia is common and damaging in South Dakota and Nebraska. Symptoms are often discovered during aerial detection surveys. This disease is frequently associated with hail damage. Several hundreds of acres of trees were heavily impacted in Nebraska National Forest in 2020. High mortality is expected in those areas. Stress from root dieback caused by abnormally wet conditions was suggested as a contributing factor in Nebraska. Root diseases and *Ips* beetles have been associated with Diplodia mortality in Nebraska and South Dakota in the past.

In 2019, Diplodia shoot blight and canker disease was confirmed for the first time in Wyoming. Isolates were collected from ponderosa pine and seedings were inoculated in a greenhouse to determine aggressiveness.

Diplodia on ponderosa pine in the Black Hills National Forest, South Dakota

Background Image: Close up of drooping dead needles on a ponderosa pine with Diplodia on the Black Hills National Forest, South Dakota

Diseases

Conifer Needle Diseases

Foliage diseases of conifers are common in the Region, but they are difficult to identify macroscopically and therefore greatly understudied. Native conifer foliar pathogens have become invasive emerging pathogens in some areas of North America, raising concern that more severe and sustained epidemics may occur as climates warm. FHP is collaborating with Colorado State University to develop molecular tools to identify the important needle pathogens in the Region. These tools will greatly enhance our ability to track the distribution and severity of these diseases in the future.

Lophodermella Needlecast

Lophodermella montivaga and *L. concolor*
Host: Lodgepole pine

Lophodermella needle cast is one of the most common foliar diseases of lodgepole pine in the Region. The incidence and severity of the disease tends to increase in the year following a wet spring. Most stands remain unaffected during outbreaks, but impacts can be locally severe. Symptoms include needle discoloration, stunting and death. Growth loss and mortality of younger trees may occur following successive years of infection. Outbreaks of Lophodermella needle cast have been reported on the Gunnison, White River and San Isabel National Forests since 2008. Disease incidence has decreased over the past two years due to extremely dry conditions.

Ponderosa Pine Dieback and Mortality

Unknown Cause
Host: Ponderosa pine

Dieback and mortality of ponderosa pine is increasing in the Region. Damage became obvious and widespread in the Colorado Front Range and southern Wyoming in 2020. Aerial Detection Surveys mapped some damage (150 ac.) in 2020, but the signature was difficult to pick up from the air. Typical symptoms include flagging, resinosis and sometimes mortality. News outlets reported the damage was the result of unusual weather events in 2019 and 2020; however, Doctors Ned Tisserat and Jane Stewart (CSU) isolated *Diplodia* spp. from a symptomatic branch collected from northern Colorado.

Dieback and mortality of ponderosa pine was widespread in Colorado and Wyoming in 2020 but specific causes are currently unknown

Abiotic Damage

Downed Trees from Avalanches and Wind

Avalanches or windthrow can create habitat for damaging beetles, depending on the tree species and the size of broken and uprooted trees.

Spruce beetle, Douglas-fir beetle and western balsam bark beetle are all attracted to downed trees, and could potentially build up populations in their respective hosts, Engelmann spruce, Douglas-fir or subalpine fir. Beetle populations built up in downed trees can move to adjacent standing host trees. Mountain pine beetle is not attracted to downed trees, so the risk of bark beetle outbreaks is less where downed trees occur in lodgepole or ponderosa pine stands. The bark beetle risk intensifies as the size of toppled host trees increases and with an abundance of standing host trees in adjacent stands.

Other beetles such as engraver beetles also attack downed trees and can compete with potentially more serious bark beetles for space beneath the bark. In areas where avalanches are frequent, trees tend to be smaller and present less risk. There may be larger diameter trees taken down in new blowdown events, creating habitat. Weather conditions, stand age, and composition all influence the potential for bark beetles to move into downed trees and eventually adjacent trees.

Windthrown spruce and fir near Rollins Pass, Arapaho National Forest, Colorado

Background Image: Urad Avalanche on the Arapaho-Roosevelt National Forests, Colorado

Forest Health Protection Project Funding

FY 2020 Forest Health Protection Project Funding: Making a Difference on National Forests and other Federal Lands

Limited funding is available from both the Washington Office and the Rocky Mountain Regional Office of the USDA Forest Service to assist with project implementation to prevent or suppress forest insect and disease problems. Regional FHP personnel work with National Forests and other federal agencies in the Rocky Mountain Region to develop proposals for funding consideration. In 2020, eight National Forests used FHP funding to help manage insect and disease problems.

The Black Hills National Forest used FHP funds to complete 202 acres of precommercial thinning on the Northern Hills Ranger District and 42 acres on the Mystic Ranger District. These projects help support fuels targets while improving forest resilience to bark beetles and enhancing timber growth. Treated areas were overstocked with dense regeneration and/or sapling and pole size with some stands showing gall rust and high risk for mountain pine beetle infestation.

The Grand Mesa Uncompahgre and Gunnison National Forests used FHP funds for preventive spraying of healthy trees and removal of spruce beetle-infested trees at the Alpine Guard Station and Big Blue Campground; dwarf mistletoe reduction on 71 acres on the Gunnison Ranger District; deploying MCH to protect high value Douglas-fir from Douglas-fir beetle on over 700 acres in developed sites; monitoring and mitigation of Annosus root rot and removal of fir engraver-infested trees on 34 acres in Ampnitheater and Angel Creek Developed sites; a trap tree project with the Telluride Ski Area; *Ips* beetle trapping near slash piles and decked wood on the Uncompahgre Plateau; and work on the Wilder-Gunnison Highlands mountain pine beetle response. The Wilder-Gunnison Highlands partnership agreement with the National Forest Foundation and Colorado State Forest Service have received significant late funding from the Washington Office and Regional Office.

The Medicine Bow-Routt National Forests used FHP funds to thin and masticate approximately 101 acres on the Pole Mountain Vegetation Project and to begin clean-up of windthrown trees on Elk Mountain.

Background Image: Removal of lodgepole pine in the Wilder-Gunnison Highlands project area, Colorado

Forest Health Protection Project Funding

FHP funds allowed the Rio Grande National Forest to complete additional sale prep on 1,400 acres in the fall of 2019, and to treat 123 acres on South Springs and Whiskey Bottle mastication projects.

The Arapaho-Roosevelt National Forest used FHP funds in Guanella Pass Campground to remove spruce beetle infested trees. The Forest, in collaboration with the Lakewood Service Center, also used FHP funds to deploy and evaluate deploying anti-aggregation pheromone-kairomone combination (MCH + green leaf volatiles (AKB)) to protect standing spruce.

The Pike-San Isabel National Forests used FHP funds to complete marking and cruising work on the Marshall Pass Timber Sale associated with the Marshall Pass Vegetation Management project on the Salida Ranger District. The Forests also used FHP funds to cruise additional volume associated with Morel Salvage Sale, part of the Greenhorn Environmental Assessment on the San Carlos Ranger District.

Funds were also used to protect trees from spruce beetle in four campgrounds on the San Carlos and Salida Ranger Districts. End-of-year Washington Office FHP funds were added to the South Arkansas Stewardship Agreement to treat 28 acres associated with the Monarch Pass Vegetation Management project on the Salida Ranger District. This agreement is with the Arkansas River Watershed Collaborative and utilizes cut-to-length harvest systems that can work on steep terrain. This project involves removal of trees that are infested with or that have been killed by spruce beetle.

Spruce beetle sanitation and salvage on Monarch Pass

The San Juan National Forest used FHP funds to contract for thinning and removal of roundheaded pine beetle-infested pines on 140 acres within the Lone Pine assessment area. Treatments included thinning trees on 70 acres at the Junction Creek Campground and Trailhead near Durango, and deploying MCH to protect Douglas-fir at Treasure Falls Trailhead and Vallecito Creek Campground.

The Shoshone National Forest used FHP funds to remove dwarf mistletoe and *Comandra* rust from infested trees in previously thinned lodgepole pine stands. FHP funds were also used to thin for bark beetle resistance in Douglas-fir stands defoliated by western spruce budworm.

Two other Federal Agencies received 2020 FHP funds from the Washington Office. Rocky Mountain National Park received funds for limber pine protection and bark beetle suppression, and the BLM Field Office in Buffalo, Wyoming received funds for thinning Douglas-fir in areas with ongoing heavy western spruce budworm defoliation.

Background Image: Spruce beetle project on Guanella Pass Campground, Arapaho National Forest, Colorado

Other Entomology and Pathology Activities

Forest Health Trainings

All FHP trainings were canceled in 2020 due to a global pandemic caused by COVID-19. Canceled trainings included three Hazard Tree Management and two Forest Insect and Disease Identification and Management trainings. In a typical year, FHP personnel also contribute to various continuing education programs, certification trainings, new employee orientation trainings, workshops, conferences and more.

For more information regarding Regional trainings please visit the Region 2 training website.

Hazard Tree Management Program and Updates

Various new and updated Hazard Tree Management products were completed in 2020. Those include a new *Tree Failure e-Form* and associated *Tree Failure Form Guide*. Revisions were made to the *Hazard Tree Evaluation Survey123* and *ArcGIS Online Guide*, *Hazard Tree Database User's Guide* and *Trimble Hazard Tree Evaluation Guide*. All Hazard Tree Management Training PowerPoints were updated as was the Region's Hazard Tree Web pages. FHP provided virtual talks, on-site hazard tree survey training and assistance with hazard tree surveys in 2020.

More information is available on the Region 2 hazard tree website.

Background Image: FHP staff taking COVID precautions while working in the field, Colorado

Other Entomology and Pathology Activities

Limber Pine Planting on the Black Hills National Forest

As part of the Limber Pine Restoration Project, limber pine seedlings grown from local seed, were planted in 2017 and 2018 at in the Norbeck Wildlife Preserve, Black Hills National Forest.

Limber pine is a *Species of Local Concern* in South Dakota, with less than 100 mature trees growing naturally in the state. It occurs in isolated areas scattered over the Black Hills National Forest and Custer State Park. Many of the native trees were recently killed by mountain pine beetle and white pine blister rust. Most seedlings are growing well, averaging about seven centimeters of height growth per year over the first four years. Approximately 200 additional limber pines will be planted in 2021.

A five-year-old limber pine at the Norbeck Wildlife Preserve planting site in the Black Hills National Forest, South Dakota

Background image: Limber pine seedling with a Vexar tube on the Black Hills National Forest, South Dakota

Publications and Regional Reports

Alexander, K., Truslove, M., Davis, R., Stephens, S., and Zentz, R. 2019. A collaborative approach to preparing for and reacting to emerald ash borer: a case study from Colorado. Forestry: An International Journal of Forest Research. 93, 239–253, doi:10.1093/forestry/cpz070

Anonymous. 2020. Hazard Tree Database User's Guide. USDA Forest Service, Rocky Mountain Region, Forest Health Protection.

Anonymous. 2020. Trimble Hazard Tree Evaluation Guide. USDA Forest Service, Rocky Mountain Region, Forest Health Protection.

Blodgett, J. T., Burns, K. S. and Lalande, B. M. 2020. Hazard Tree Evaluation Survey123 and ArcGIS Online Guide. USDA Forest Service, Rocky Mountain Region, Forest Health Protection, Tech. Rpt. R2-71.

Blodgett, J. T., Burns, K. S. and Lalande, B. M. 2020. Tree Failure Form Guide. USDA Forest Service, Rocky Mountain Region, Forest Health Protection, Tech. Rpt. R2-72.

Lalande, B. M., Hughes, K., Jacobi, W. R., Tinkham, W. T., Reich, R. M., and Stewart, J.E. 2020. Subalpine fir decline in Colorado is associated with stand density, warming climates and interactions among fungal diseases and the western balsam bark beetle. For. Ecol. Manage. 466. doi:10.1016/j.foreco.2020.118133.

Background Image: Aspen regeneration on the Gunnison National Forest, Colorado

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Background Image: Old spruce beetle caused mortality on the west side of Rocky Mountain National Park, Colorado

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Background Image: Blue stained logs harvested in the Wilders–Highland mountain pine beetle project on the Gunnison Ranger District and adjacent lands

Region 2 Forest Health Protection Staff, Partners, and Links

Online Resources

For more information on forest health related topics please visit the following websites

Region 2 Forest Health Protection

Region 2 Aerial Detection Survey Program

Field Guide to Diseases & Insects of the Rocky Mountain Region

Trainings offered by Region 2 Forest Health Protection Personnel

Hazard Tree Information and further resources

Background Image: FHP Staff hanging mountain pine beetle traps on the Gunnison National Forest, Colorado