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State, Private, and Tribal Forestry

Forest Health Protection
1617 Cole Blvd
Lakewood, CO 80401

Trip Report GSC-25-01 November 2024

White Pine Blister Rust Identification in La Plata and Archuleta Counties – San Juan National Forest

Bradley Lalande, Plant Pathologist
James Blodgett, Plant Pathologist
Kelly Burns, Plant Pathologist

Gunnison Service Center
216 N. Colorado St.
Gunnison, CO 81230

On July 25, 2022, Nick Wilhelmi (Plant Pathologist – Flagstaff) informed the Gunnison Service Center (GSC) Forest Health Protection (FHP) staff that he identified white pine blister rust (WPBR) on limber pine at the confluence of Flagler Fork and Junction Creek along the Colorado Trail, north of Durango, CO (La Plata County). This is over 125 miles from the nearest known outbreak areas in the Santa Clara Mountains of northern New Mexico and the Sangre de Cristo Mountains of southern Colorado (Schoettle et al. 2023). Unfortunately, Nick was off duty and unable to collect verifiable evidence of the find. Prior to confirming Nick's observation, GSC FHP staff collaborated with Colorado State University (CSU) to establish WPBR spore trapping plots in the vicinity of this observation in remote La Plata County. During the 2023 field season, a network of spore traps was deployed along Junction Creek Road north of Durango, adjacent to Williams Fork Trailhead north of Pagosa Springs, and along FR 140 southwest of Antonito, to passively monitor WPBR aerial inoculum (Figure 1). DNA of *Cronartium ribicola*, the fungus that causes WPBR, was detected at only the Pagosa Springs plot, an area not known to have WPBR but about 20 miles northwest of the East Fork outbreak in Hinsdale County (Figure 1).

On April 26, 2024, Adam Tlachac, TMA Pagosa Springs Ranger District, observed WPBR sporulating on limber pines along the East Fork San Juan River, east of Pagosa Springs. This location is about 90 miles west of the nearest outbreak area in the Sangre de Cristo Mountains and about 40 miles east of the Durango outbreak (Figure 1). On May 15, 2024, Plant Pathologists Bradley Lalande and Kelly Burns assessed the extent of WPBR infections along the East Fork location. On June 4, 2024, Region 2 Plant Pathologists Bradley, Kelly, and Jim Blodgett, along with Mountain Studies Institute (MSI) staff hiked along the Colorado Trail, north of Durango, to confirm and document the extent of WPBR infections in and around the confluence of Flagler Fork and Junction Creek.

Our spore trap results, and the occurrence of these disjunct outbreak areas suggest widespread aerial spore dispersal.

Key Finding

- White pine blister rust was positively identified in limber pines north of Durango and east of Pagosa Springs for the first time in La Plata and Archuleta counties, respectively.

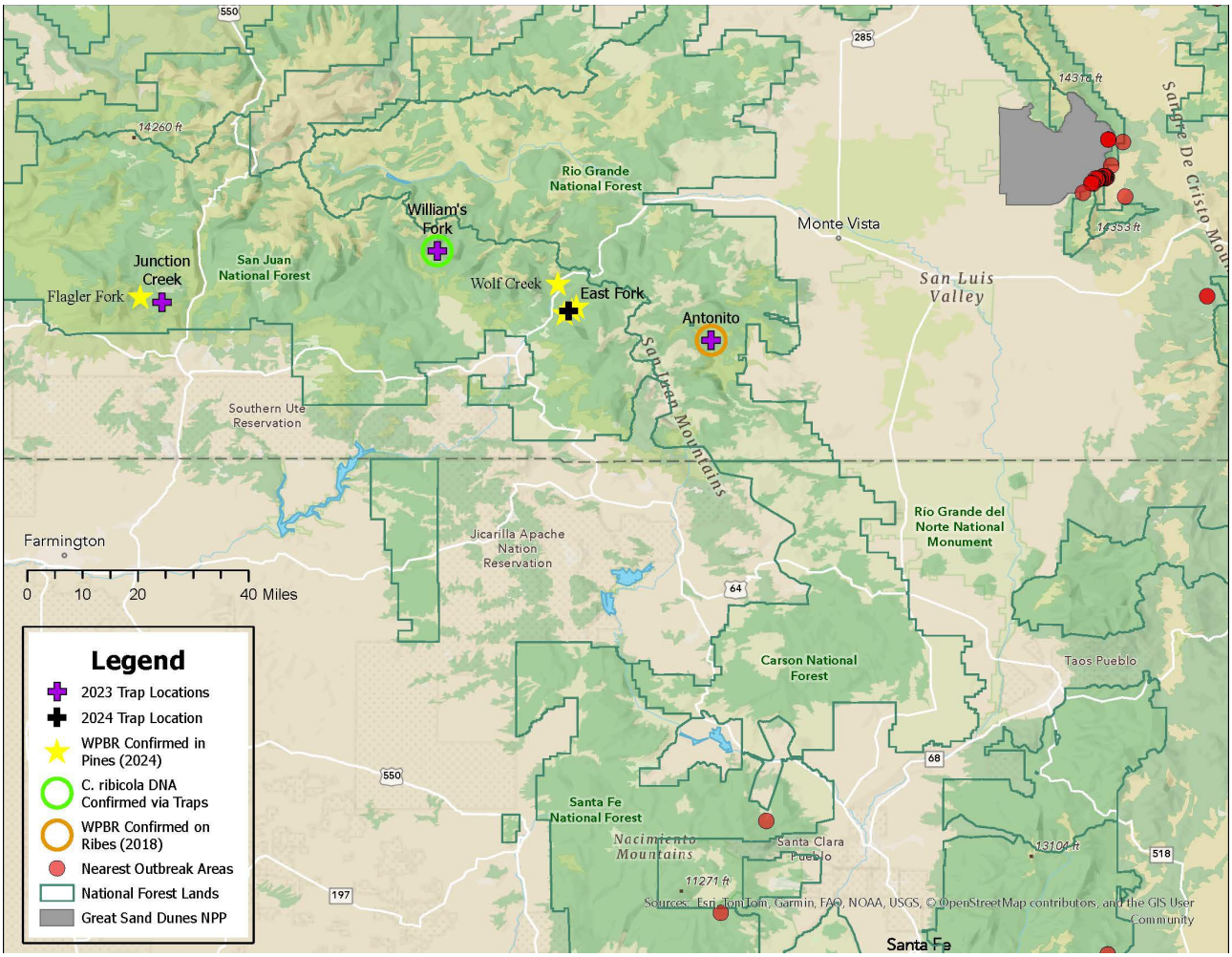

Figure 1: Map indicating known white pine blister rust (WPBR) infections in southern Colorado and northern New Mexico (red dots). Before WPBR was found in the San Juan National Forest, the closest known infection was ~100 miles away. Newly identified infections are labeled with yellow stars, east of Pagosa Springs and north of Durango. White pine blister rust spore traps from 2023 and 2024 are shown using plus (+) symbols.

White Pine Blister Rust

White pine blister rust (*Cronartium ribicola*) is a non-native, lethal fungal disease of five-needle pines (limber, Rocky Mountain bristlecone, and limber-southwestern white hybrids) in Colorado. Five-needle pines in Region 2 play a crucial role in ecological processes including, but not limited to, maintaining wildlife and vegetation in high elevation areas.

The life cycle for WPBR consists of five spore stages spanning two hosts: five-needle pines and alternate hosts (*Ribes* spp., *Pedicularis* spp., and *Castilleja* spp.). The five spore stages are pycnia and aecia (pines) with aeciospores infecting alternate hosts and uredinia, telia, and basidia (alternate hosts) with basidiospores infecting the pine hosts. Due to the disease's complex life cycle, it is difficult to manage (Burns et al. 2008). Although, natural disease resistance has been confirmed in limber pine (Schoettle et al. 2014). Genetic resistance is key to the management of WPBR to reduce the ecological impacts resulting from five-needle pine mortality (Schoettle, 2020).

The disease was initially observed in the Colorado Front Range on the Roosevelt National Forest in 1998 (Johnson & Jacobi, 2000). In 2003 and 2004, surveys identified the disease in the Wet and Sangre de Christo Mountains of southern Colorado on the San Isabel National Forest and Great Sand Dunes National Park and Preserve. At that time, a single infected limber pine was also identified on the Rio Grande National Forest adjacent to the southern border of the Park. More recent surveys have found further expansion of WPBR in Colorado within Rocky Mountain National Park and the Pike National Forest. A 2018 survey in southern Colorado found five-needle pines to be predominantly healthy and no infected trees were detected on the Rio Grande and San Juan National Forests (Burns and Dudley in review). However, *C. ribicola* was confirmed on *Ribes inerme* near the Antonito spore trapping site suggesting that pine infection may be present in the area (Figure 1).

White Pine Blister Rust Spore Trapping – Southern Colorado

Spore trapping for WPBR is a collaborative effort with CSU and FHP Plant Pathologists in Regions 2, 3, and 4. Spore traps consist of four glass slides coated in petroleum jelly, fixed to a motor to passively collect spores spreading via aerial dispersal. Slides are replaced weekly, then DNA extraction and qPCR are performed at Dr. Jane Stewart's lab at CSU to determine presence and abundance of *C. ribicola* DNA. Surrounding each spore trap, field data is collected within 1/5-acre circular plots to assess stand composition and alternate host species. Tree data collected included diameter at breast height (DBH), tree health status, and WPBR infection status. Alternate host data collected included species, location within plot, and percent ground cover. Alternate host phenology and disease progression on pines and alternate hosts were assessed weekly over the course of the field season. In 2023, no rust was detected on pines or alternate host species at the three sites. However, *C. Ribicola* DNA was identified on slides at the William's Fork site (Figure 1).

East Fork Outbreak, Pagosa Springs Ranger District, Archuleta County

During the initial assessment on May 15, 2024, FHP staff identified seven trees infected with WPBR along the East Fork San Juan River and subsequent drainages. An additional single infected tree was observed along Highway 160 about five miles north of East Fork along Wolf Creek (Figure 1). Positive identification was based on the presence of aecial blisters on branches and main stems (Figure 2). To monitor *C. ribicola* inoculum presence and abundance, three spore traps were placed in vicinity of the East Fork outbreak. Plots are visited weekly from May through October 2024 to collect and replace slides and monitor disease progression and phenology on pines and alternate hosts.

Flagler Fork Outbreak, Durango Ranger District, La Plata County

As FHP and MSI staff traveled to the reported infection center along Flagler Fork, limber pines were assessed for signs and symptoms of WPBR and alternate host species were identified and monumented. WPBR was not observed along the trail until the crew reached infected pines at Flagler Fork about 3 miles north of Junction Creek. The limber pine had numerous (20+) infections on the stem and branches. The oldest infection was estimated to be at least 10-years old (Figure 3). Eight additional limber pine, infected with WPBR were identified in the area. Once a month, from June through October, a MSI crew will

hike to the Flagler Fork location and assess disease progression and phenology on limber pines and alternate hosts.

Figure 2: Left: large white pine blister rust branch infection on limber pine along East Fork. Center: smaller WPBR branch infection on limber pine along the river. Right: WPBR stem canker on limber pine up small drainage near initially identified infections along East Fork.

Figure 3: Left: heavily infected limber pine with extensive WPBR blisters (aecia) on main stem and branches. Center: numerous WPBR branch infections associated with same limber pine on the Colorado trail. Right: numerous WPBR branch and stem infections with old canker on main stem of limber pine.

Management/Recommendations

Historically, management focused on restoration of severely impacted areas, yet the southern Rockies are in a unique position in that WPBR has not invaded large portions of the landscape. Proactive management offers a great opportunity to prepare the landscape for resilience before extensive ecological impacts occur (Burns et al. 2008). The proactive strategy focuses on promoting *ex situ* and *in situ* conservation; increasing population sizes to offset future mortality and sustain genetic diversity; maintaining the durability of qualitative resistance; developing and deploying sources of quantitative resistance; monitoring pines and rust; and coordinating management actions within and among agencies (Schoettle et al. 2019). Genetic resistance is key to managing the impacts of

WPBR (Schoettle, 2020). Limber pine seeds collected from East Fork drainage seed sources have been tested and have been shown to have complete (qualitative) resistance. To increase stand resilience, cone collections should be considered during high cone crop yields, such as this year, to preserve genetic diversity, especially in association with WPBR resistant seed. Planting resistant seedlings and other native limber pine will increase genetic and age diversity within these stands (Schoettle & Sniezko 2007). Planting sites and spacing should be carefully considered to provide adequate cover against snow loads and to prevent intraspecies competition (Keane & Schoettle, 2011).

Long-term recommendations to proactively manage WPBR on the Pagosa Springs Ranger District consists of cone collections, sending cones for resistance testing, increasing genetic diversity by planting, and monitoring active WPBR infections (Burns et al. 2008, Schoettle et al. 2019). Cone collections were conducted in September 2024 along the East Fork and Williams Creek areas, with 2,000 limber pine seedlings available in Spring 2027. Continued cone collections are recommended to increase overall genetics within the stands, especially during mast years. Performing genetic resistance testing can take time, therefore preemptive plantings should be done to increase the genetic diversity of limber pine populations before known resistance is identified in southern Colorado. Outplanting limber pine seedlings within localized limber pine pockets/stands, while planting limber pine in high elevation areas that may be affected by bark beetles will improve overall stand resilience. Plantings can be performed in either the spring or fall, but spring is typically more beneficial as spring weather can be more conducive in high elevation stands. The GSC FHP staff will continue to monitor for new WPBR infections and will assist in cone collections and plantings, if needed.

Short-term recommendations include pruning infected branches to reduce the potential spread to the main bole, thinning, or the removal of infected trees (Burns et al. 2008). These recommendations may only provide minimal effects as there are established infections in the Pagosa Springs area. The preference for long-term management strategies decreases the likelihood of establishing treeless areas and may reduce the disruption of ecological properties, most notably hydrologic changes and slope instability (Schoettle et al. 2019).

Outreach events can be conducted by the GSC FHP staff to increase the knowledge of limber pine ecosystems and WPBR biology and management. If you have any additional questions, please contact Brad Lalande (970-787-0443, bradley.lalande@usda.gov).

Funding opportunities may be available for thinning, sanitation, and salvage through Forest Health Western Bark Beetle Initiative sources. The deadline for applications is November 1st. If you have any questions or need the application material, please reach out to the Gunnison Service Center Lead John Nelson (970-652-3233, john.nelson3@usda.gov).

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