Date: January 16, 2013

Re: Disease-Caused Mortality in a Heavily Thinned Pine Stand on the Northern Black Hills, RCSC-8-13

To: Forest Supervisor, Black Hills National Forest

Cc: Bill Coburn (Spearfish Forest Products), Blaine Cook (Black Hills NF), Laura Bosworth (Black Hills NF), Bill Schaupp (Rogue River-Siskiyou NF), Robert Lee (Acting Director R2 RO), Susan E Gray (R2 RO)

By: James T Blodgett, Plant Pathologist
USDA Forest Service
Rocky Mountain Region
Forest Health Protection
Rapid City Service Center
8221 S Highway 16
Rapid City, SD 57702
Phone: 605-716-2783
E-mail: jblodgett@fs.fed.us

Observations and Discussion: In August 2008, Willis C. Schaupp, Jr. (Entomologist) and I examined dead and dying ponderosa pine (*Pinus ponderosa*) in the Black Hills National Forest (NF) that were initially shown to Schaupp by Bill Coburn (Spearfish Forest Products). The site is located just off Custer Crossing Road adjacent to Forest Service Road 256-1G in Lawrence County, South Dakota. The overstory was composed of widely spaced mature ponderosa pine, the result of a seed tree cut at least a decade earlier. A very dense pole-sized understory had been recently thinned to a 14-ft residual spacing using a shredder/chipper device (Fecon® Bio-Harvester™). Although pine engravers (*Ips* spp.) killed some trees in the thinned area, most of the dead and dying pine had no evidence of insect infestation.

Disease symptoms were apparent on five large trees and approximately 33% of seedlings and saplings in a treated area of approximately 10 acres. Symptoms included chlorotic and wilted crowns and mortality, with occasional thin crowns (Figure 1). A gray-to-black stain in the outer sapwood (Figure 1) of roots, root crowns, and lower stems was consistently associated with foliar symptoms and mortality. Stain occurred in all large and small trees with symptoms. Roots of seven symptomatic and two healthy pines were excavated and no evidence of root diseases, root insects, or root resinosis was observed, other than stain in roots of symptomatic trees. Twenty fungal isolations were made from the stained wood. All were identified as *Leptographium terebrantis*, confirming a consistent fungal association with symptoms. No other damage agent was consistently associated with the mortality.

Pine mortality with similar symptoms was observed approximately 2 miles south of this site in 1993 (north side of Forest Service Road 204) by Schaupp and Jenny Holah (Plant Pathologist). Symptoms followed a heavy precommercial thinning in a pole-sized ponderosa pine stand the same year. Samples collected from stained wood of symptomatic trees in 1993 were confirmed by Thomas C. Harrington (Professor, Iowa State University) to be *L. terebrantis*.

This *Leptographium* species is not known to occur in the absence of insect vectors (Wingfield et al. 1993). Red turpentine beetle and root bark beetles (*Hylastes* spp. and *Hylergops* spp.) are often vectors of this fungus, but these beetles do not typically kill trees. In 2008, *L. terebrantis* was confirmed on red turpentine beetles approximately 0.4 miles from the site (Lu, M., Wingfield, M.J., Gillette, N., personal communication). However, no insect association was found at the site of this report.

In this case, there might be insects feeding deep in roots that transmitted the fungus, *L. terebrantis* might be a vascular wilt disease that is spreading from tree-to-tree across root contacts or root grafts, or this might be a human vectored disease. Black stain root disease is reported as the only disease in which a species in the genus *Leptographium* (*L. wageneri*) causes disease independent of an insect vector (Wingfield et al. 1993). It has been demonstrated that *L. terebrantis* can kill ponderosa pine seedlings (Harrington and Cobb 1983, Owen et al. 1987) and several other pine species (Eckhardt et al. 2004, Holah 1993, Rane and Tattar 1987, Wingfield 1986) independent of an insect vector with artificial inoculations. In 1993, it was suggested that *L. terebrantis*, vectored by *Hylastes* spp. and *D. valens*, was the main cause of mortality of many small to large jack pine in planted and regenerated stands recently cut at the Bessey Ranger District in the Nebraska NF (Holah 1993). In Wisconsin, red pine decline is associated with extensive root mortality, xylem stain, and *L. terebrantis* colonization of grafted root systems far from beetle infestations (Klepzig et al. 1991).

With artificial inoculations and previous field observations, disease symptoms included a host resin response at inoculation sites and at sites of insect feeding, respectively. A host resin response was seldom observed in 2008. The *L. terebrantis*-associated mortality is a common element, but recent tree thinning is another common element at this and the other reported pine mortality events in the Black Hills and Nebraska NFs. Significant pine mortality was only found in areas where the shredder/chipper device was used in 2008. A roller-chopper device was used in the Nebraska NF where mortality occurred (Holah 1993). The role these devices might have played in stressing residual trees or acting as a vector of *L. terebrantis* is unknown.

Management Recommendations: Tree removal and planting with non-hosts is the only control option for this type of fungus-associated disease. These actions are unwarranted in this instance, given the localized nature of mortality and rarity of reported *L. terebrantis*-associated mortality. Given the loss of about a third of the residual stand, developing a management approach for thinning dense, young stands in the presence of *L. terebrantis* is warranted. Since mortality occurred in pines of all size classes, future thinning might use a closer residual spacing to compensate for potential pine mortality associated with this fungus. Monitoring areas in and around this site for additional pine mortality is suggested given the reported insect-fungal associations.

References:

Eckhardt, L.G., Jones, J.P., Klepzig, K.D. 2004. Pathogenicity of *Leptographium* species associated with loblolly pine decline. Plant Dis. 88:1174-1178.

Harrington, T.C., Cobb, F.W., Jr. 1983. Pathogenicity of *Leptographium* and *Verticicladiella* spp. isolated from roots of western North American conifers. Phytopathology 73:596-599.

Holah, J.C. 1993. A New Insect-Fungal Complex of Jack Pine at Bessey Ranger District, Nebraska National Forest. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Bio. Evaluation RCSC-93-01.

Klepzig, K.D., Raffa, K.F., Smalley, E.B. 1991. Association of an insect-fungal complex with red pine decline in Wisconsin. For. Sci. 37:1119-1139.

Owen, D.R., Lindahl, K.Q., Wood, D.L., Parmeter, J.R. 1987. Pathogenicity of fungi isolated from *Dendroctonus valens*, *D. brevicomis*, and *D. ponderosae* to ponderosa pine seedlings. Phytopathology 77:631–36.

Rane, K.K., Tattar, T.A. 1987. Pathogenicity of blue-stain fungi associated with *Dendroctonus terebrans*. Plant Disease 71:879-883.

Wingfield, M.J. 1986. Pathogenicity of *Leptographium procerum* and *L terebrantis* on *Pinus strobus* seedlings and established trees. Eur. J. For. Path. 16:299-308.

Wingfield, M.J., Seifert, K.A., Webber, J.F. 1993. *Ceratocystis* and *Ophiostoma*: Taxonomy, Ecology, and Pathogenicity. APS Press, St. Paul, Minnesota. 293 pp.

Figure 1. Five large and several small ponderosa pine were affected in the area (left and center). A gray-to-black stain mostly in the outer three to five annual rings of wood was consistently associated with mortality, which can be seen at the bottom of photo where wood was removed for isolations (right).