April 7, 2005

Re: Sphaeropsis and Hail in the Black Hills National Forest, RCSC-11-05

To: Forest Supervisor, Black Hills National Forest

Cc: Blaine Cook, James Allen, Donald Boone Jr, Dan Roddy, John Ball, Bill Hill, Frank Cross, Jeri Lyn Harris, Kurt Allen

James T. Blodgett and Willis C. Schaupp, Jr. *USDA Forest Service* *Rocky Mountain Region* *Forest Health Management* *Rapid City Service Center*	1730 Samco Road Rapid City, SD 57702 Phone: 605-394-1960 Fax: 605-394-6627 E-mail: jblodgett@fs.fed.us

Hail impacts to pines are often followed by outbreaks of Sphaeropsis shoot blight and canker pathogen (Sphaeropsis) caused by the fungal pathogen *Sphaeropsis sapinea*, formerly known as Diplodia tip blight (*Diplodia pinea*). This Forest Health report is a follow up to our previous report in 2004 regarding hail damage in an area along Highway 385 west of Wind Cave (Blodgett and Allen 2004). This report also presents results from other plots established in the Black Hills National Forest to monitor the health of hail-impacted pines. Management considerations are presented.

In 2004, we observed hail and Sphaeropsis symptoms on several trees approximately one mile west of Wind Cave along Highway 385 and along Sheridan Lake Road. These sites experienced hail damage in 2004 and in 2001, respectively. Similar symptoms were observed in 2000 at Kirk Hill, which experienced hail damage earlier in 2000. However, no symptoms were observed at Kirk Hill in 2004. There were no fungal fruiting bodies observed on branches and needles at any of these three sites in 2004, although cones contained fungal fruiting bodies and spores of Sphaeropsis at all three sites.

Plots were established at the three sites to monitor forest health condition (**Fig. 1**). All plots are circular, 1/10 acre (37.24 ft radius), and all trees 4 inches in diameter at breast height (DBH; 4.5 ft) and larger were tagged. The plots were established approximately one mile west of Wind Cave along Highway 385 in May 2004 (12 plots), along Sheridan Lake Road in March 2001 (11 plots), and at Kirk Hill in June 1999 (12 plots). Plots were remeasured along Sheridan Lake Road and at Kirk Hill in May 2004. A total of 548 ponderosa pine (*Pinus ponderosa*) trees were sampled overall at the three sites.

Observations and measurements recorded for each tree within the plots included: tree species, DBH for trees greater than 4 inches DBH, defoliation level, and the presence of any diseases, insects, and/or major damage.

Branches and needles of ponderosa pines with Sphaeropsis-like symptoms were collected in 2004 and incubated at ambient room temperature and light in plastic bags. Identification of Sphaeropsis, after 4 weeks, was based on examination of resulting fungal fruiting structures and spores on branches and needles. We also collected ponderosa pines branches with both Sphaeropsis symptoms and hail damage (symptomatic branches), and healthy branches with no hail damage (asymptomatic branches) in May 2004. Small shoot segments were cut from

the center of the branches, and were surface-disinfested in ethanol followed by Clorox bleach. Individual segments were incubated on agar plates. Identification of Sphaeropsis was based on examination of resulting fungal fruiting structures and spores.

After 4 weeks of incubation in plastic bags, Sphaeropsis was identified on branches and needles. Sphaeropsis was isolated from all three sites from the small, surface-disinfested, shoot segments with an average recovery of 83% from symptomatic branches at Highway 385 and at Sheridan Lake Road, and 48% from asymptomatic, healthy branches at the three sites. As stated earlier, no Sphaeropsis symptoms were evident in 2004 at the Kirk Hill site, yet Sphaeropsis was isolated from healthy branches at that site. Since isolations were made from only one small segment per branch, Sphaeropsis is likely present in 100% of the healthy branches that are several meters long. This demonstrates that the fungus is already present as a latent pathogen in healthy ponderosa pine trees, and can explain the rapid onset of the disease following hail.

The most common damaging agent observed on trees in these areas was physical damage to branches caused by hail. Most branches had at least one, and frequently many, small scars where they were struck by hail. The scars did not typically girdle branches. A directional aspect to the damage is consistent with hail damage. Most of the dead or dying branches were on the southeast side of the trees. Dead and broken tree tops, potentially due to the hail storm, were observed on 20% of the trees.

Most of the branch mortality and some of the tree mortality is due to hail-induced Sphaeropsis. Because the hail scars observed typically did not girdle branches, hail alone could not cause the observed symptoms without the presence of Sphaeropsis. The drought conditions over the past few years can contribute to this disease. Based on observations from similar events, there will be additional tree mortality associated with these hail events. It's difficult to estimate the amount of mortality at this time. However, most trees will likely survive and recover. Trees with 60% branch mortality or more might not survive. There are only a few trees approaching 60% branch loss.

Western gall rust was only recorded on pines having stem galls or on pines with many galls on main branches (extensive gall rust). Extensive gall rust was observed on 4% of the trees. Galls that girdled branches have caused some of the branch mortality.

These damaged trees could become targets for opportunistic, tree-killing bark beetles, notably *Ips* spp. Ips preferentially attacks stressed trees and were noted in 2% of the sampled trees. Ips is at elevated densities in the Black Hills and may attack additional hail-affected trees in the future. The red turpentine beetle (*Dendroctonus valens*) was observed in 1% of the trees. Although not typically a tree killer, the red turpentine beetle attacks weakened pines.

All tags were removed from the Sheridan Lake Road and at Kirk Hill plots in May 2004. We will remeasure trees in plots along Highway 385 in 2007 to monitor tree health, and relate future tree condition to our observations in 2004. The objective of revisiting the sites is to determine if crown condition can be used to estimate future mortality caused by hail-induced Sphaeropsis blight. All tree tags will be removed in 2007. It would be best if we could have no treatment in those plots, and at least 2 trees around the plots until measurements are complete in 2007. We previously sent plot locations as UTM coordinates.

MANAGEMENT CONSIDERATIONS

Pine mortality caused by Sphaeropsis is enhanced by drought. Anything that reduces water stress should help in reducing losses due to Sphaeropsis. Therefore, planting on drought-prone sites should be avoided. If planting on drought-prone sites, reducing water stress is an important factor in controlling this disease. Competing vegetation has a substantial effect on water status, and can result in increased Sphaeropsis disease (Blodgett et al. 1997). Management options such as reducing competing trees by stand thinning, management of competing ground vegetation, planting techniques that reduce drought, and/or selection of a tree species compatible with a site should reduce losses due to Sphaeropsis. Thinning can also help to reduce susceptibility to Ips beetles. However, proper slash treatment is needed to prevent Ips population increases as a result of thinning. For high value trees, watering during dry periods and/or fungicides can provide protection from this disease. A publication that covers the biology and control of Sphaeropsis using fungicides is available on the Internet (Giesler 2000). Fertilization is often recommended for high value trees to reduce stress, and presumably increase disease resistance. However, fertilization can decrease the resistance of trees to this disease (Blodgett et al. 2005) and is therefore not recommended.

If you have any questions about this survey or other forest health topics please contact Jim Blodgett or Bill Schaupp, Rapid City Service Center.

Sincerely,

/s/ *James T. Blodgett*

James T. Blodgett
Plant Pathologist
Rapid City Service Center

Willis C. Schaupp, Jr.

Willis C. Schaupp, Jr.
Entomologist
Rapid City Service Center

LITERATURE CITED

Blodgett, J. T., and Allen, K. K. 2004. Damaged trees on Highway 385 west of Wind Cave. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., RCSC-08-04.

Blodgett, J. T., Herms, D. A., and Bonello, P. 2005. Effects of fertilization on red pine defense chemistry and resistance to Sphaeropsis sapinea. For. Ecol. Manage. 208:373-382.

Blodgett, J. T., Stanosz, G. R., and Kruger, E. L. 1997. Sphaeropsis sapinea and water stress in a red pine plantation in central Wisconsin. Phytopathology 87:429-434.

Stanosz, G. R., Blodgett, J. T., Smith, D. R., and Kruger, E. L. 2001. Water stress and Sphaeropsis sapinea as a latent pathogen of red pine seedlings. New Phytologist 149:531-538.

Giesler, L. J. 2000. Sphaeropsis Tip Blight of Pines. Cooperative Extension, University of Nebraska. G83-646-A. <http://www.ianrpubs.unl.edu/plantdisease/g646.htm>

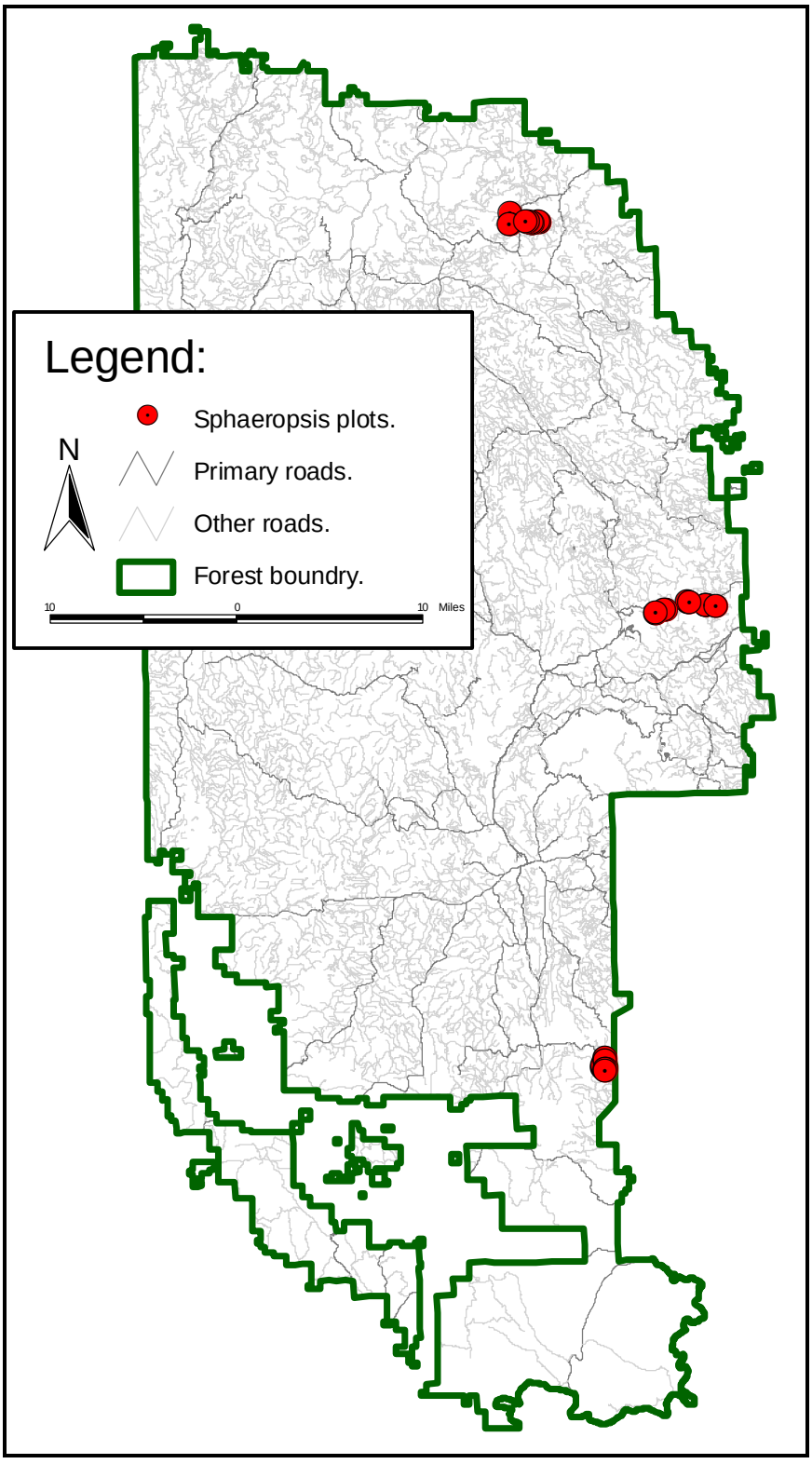

Fig. 1. Location Sphaeropsis plots in the Black Hills National Forest.