April 7, 2005

Re: Sphaeropsis and Hail in the Nebraska National Forest, RCSC-12-05

To: Forest Supervisor, Nebraska National Forest

Cc: Patricia Barney, Charlie Marsh, Jay Dunbar, Diana McGinn, Mark Harrell, Frank Cross, Jeri Lyn Harris, Kurt Allen

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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*). Diana McGinn (Forest Silviculturist, Nebraska National Forest) contacted our office regarding many trees with Sphaeropsis-like symptoms outside of Chadron, Nebraska. This Forest Health report is an investigation into the hail-impacted pines Diana noted at the Pine Ridge Ranger District, as well as the hail damage from a May 2004 storm at the Bessey Ranger District of the Nebraska National Forest. Management considerations are presented.

In 2004, Sphaeropsis shoot blight symptoms were present on many pines at the Bessey and Pine Ridge Ranger Districts. Both areas experienced hail damage prior to our visit in 2004. There were no fungal fruiting bodies observed on branches and needles at either of these sites in 2004, although cones contained fungal fruiting bodies and spores of Sphaeropsis at both sites.

Plots were established in the Bessey and Pine Ridge Ranger Districts in November 2004 to monitor forest health condition (**Fig. 1 and 2**). 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. Nine plots were established at each Ranger District. A total of 187 ponderosa (*Pinus ponderosa*) or jack (*Pinus banksiana*) pine trees were sampled at the Bessey Ranger District, and a total of 171 ponderosa pine trees were sampled at the Pine Ridge Ranger District.

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 and jack pines with Sphaeropsis-like symptoms were collected in November 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 pine branches with both Sphaeropsis symptoms and hail damage (symptomatic branches), and healthy branches with no hail damage (asymptomatic branches) from both locations in November 2004. At the Bessey site we collected both asymptomatic and symptomatic branches from both ponderosa pine and jack pine. Only ponderosa pines were sampled at

Pine Ridge. 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 both sites from the small, surface-disinfested, shoot segments with an average recovery of 84% from symptomatic branches and 28% from asymptomatic, healthy branches at the two sites. 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 both healthy ponderosa and jack 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 northwest side of the trees. Dead and broken tree tops, potentially due to the hail storm, were observed on 1% 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 20% of the trees at Pine Ridge and on 2% of the trees at Bessey. At Pine Ridge, almost all trees had some western gall rust infection. 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 7% of the sampled trees at Bessey. Ips is at elevated densities at Bessey and may attack additional hail-affected trees in the future. Ips was not found in the Pine Ridge plots. The red turpentine beetle (*Dendroctonus valens*) was observed in 5% of the trees at Bessey and in 2% of the trees at Pine Ridge. Although not typically a tree killer, the red turpentine beetle attacks weakened pines.

We will remeasure the plot trees 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.

There is a root disease, *Heterobasidion annosum* (*Fomes annosus*), at the Bessey Ranger District. This disease quickly colonizes freshly cut stumps. Borax treatments of stumps should be done to prevent the spread of this damaging root disease pathogen.

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*
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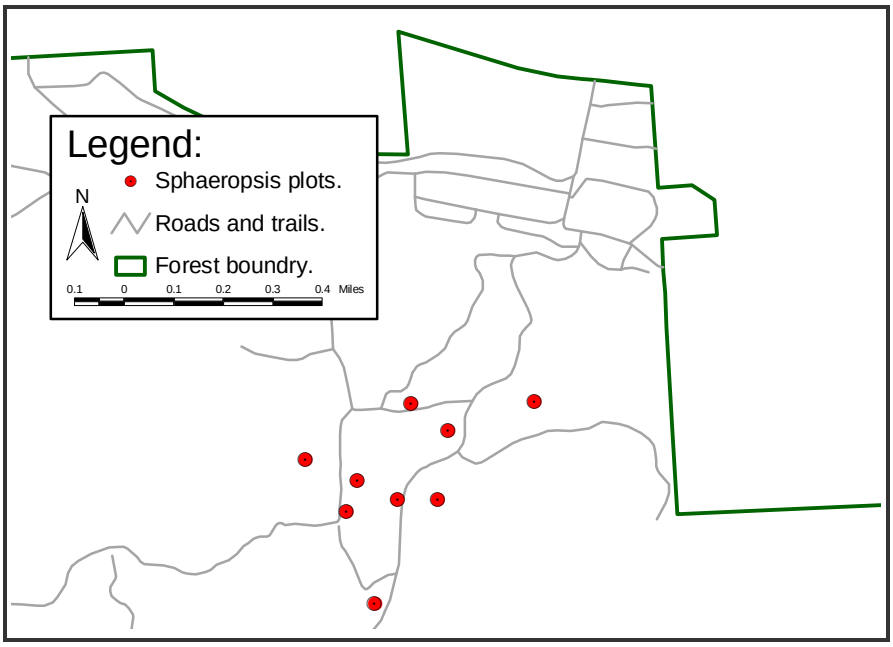

Fig. 1. Location Sphaeropsis plots in the Bessey Ranger District of the Nebraska National Forest.

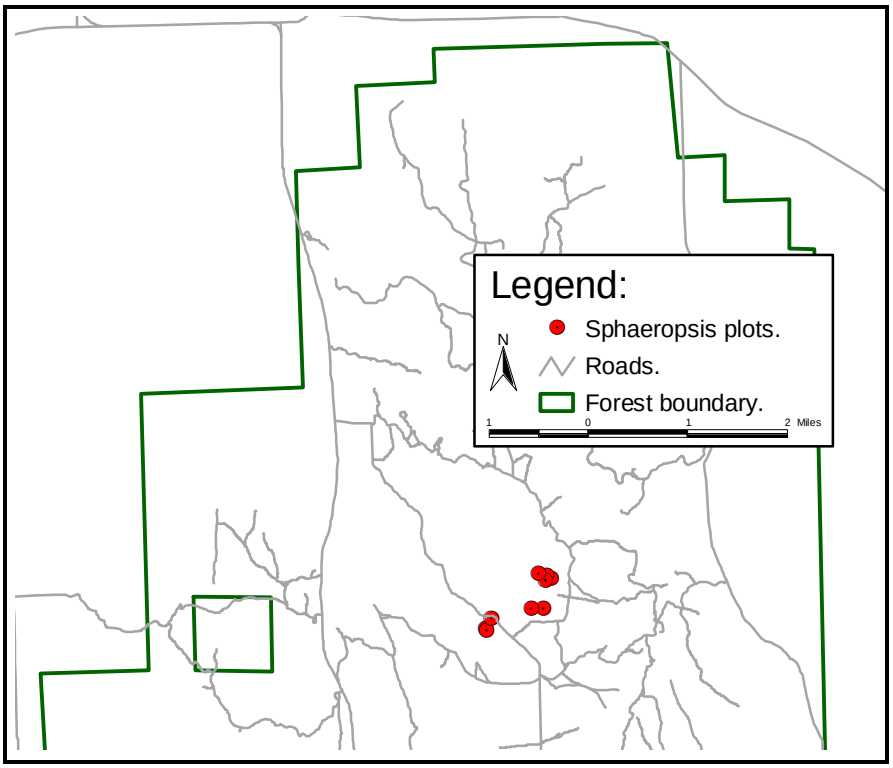

Fig. 2. Location Sphaeropsis plots in the Pine Ridge Ranger District of the Nebraska National Forest.