

**TITLE:** Assessment of the severity and impact of alder dieback and mortality in Alaska

**LOCATION:** Alaska

**DURATION:** Year 2 of 2-year project    **FUNDING SOURCE:** Base

**PROJECT LEADER:** Lori Trummer, USFS R10, FHP, 907-743-9460, ltrummer@fs.fed.us

**COOPERATORS:** Roger Ruess, University of Alaska – Fairbanks, Professor of Biology

**PROJECT OBJECTIVES:**

1. Determine the severity of alder dieback and mortality across Alaska through installation and monitoring of permanent transects. Describe the site and stand variables that contribute to the dieback including moisture stress, diseases, and insect defoliation. This project was partially completed in 2005 and will be finished in 2006.
2. Determine changes to soil conditions, particularly a loss of nitrogen fixing capacity, in areas with low to high levels of alder dieback and mortality. Fieldwork for this project was completed in 2005 and no further funding is anticipated.

**JUSTIFICATION:** Alaska's FHM detection monitoring program is still in the development phase and, to date, information on the condition of alder is lacking. Dieback and mortality of thin-leaved alder (*Alnus tenuifolia*) was recently detected through observations and ground surveys in riparian areas across south-central and interior Alaska. Although first noted in 2003, the onset of symptoms was likely several years prior based on the deterioration of the dead stems. While some branch dieback and stem mortality is not uncommon in dense older alder stands, these symptoms appear to be above "normal" levels, occur in relatively young stands of alder, and are considered severe in some locations where genet mortality has occurred. Alder dieback and mortality is not unique to Alaska. Several western states including Colorado, New Mexico, and Wyoming are also experiencing a similar dieback and mortality of *A. tenuifolia* in riparian areas (Jim Worrall, personal communication). Alder species are considered keystone species in floodplain and upland landscapes due to the nitrogen fixing ability of these plants from an association with the actinomycete *Frankia*. In Alaska, it is believed that up to 70% of the nitrogen accumulated during the 200 year successional development of boreal forests is derived through atmospheric fixation by these species. Therefore, decline and mortality of alder is expected to alter soil nitrogen accumulation, forest stand development, and likely forage quality to harvestable subsistence species, such as moose.

The second year of this monitoring project will focus on determining the severity of alder dieback and describing the factors that contribute to this phenomenon through remeasurement of permanent transects installed in 2005. A high level of success is expected.

**DESCRIPTION:**

**a. Background:** Dieback and mortality of *A. tenuifolia* in riparian areas in Alaska has been reported since 2003. The damage is recent, continuing, and widespread within riparian alder communities. Dieback appears to intensify within ramets, resulting in mortality of multiple branches and stems, and can result in death of the genet. Long, narrow stem and branch cankers are conspicuous and consistently associated with dieback and mortality. Dr. Gerry Adams, Michigan State University, and Jim Worrall visited Alaska in 2005 and isolated and

identified the canker pathogen as *Valsa melanodiscus* (anamorph *Cytospora umbrina*). This is the same canker pathogen identified in Colorado.

A complex of other factors and host stressors are present at affected sites. At some locations, multiple years of severe defoliation by the introduced alder wooly sawfly (*Eriocampa ovata*), and perhaps other native sawflies have occurred. These defoliators may contribute both to host stress and outright stem mortality. However, dieback and mortality caused by canker fungi is occurring at sites with minimal defoliator activity. South-central and interior Alaska have also experienced hot, dry record-breaking summers since 2003. The role of increased summer temperatures contributing to host stress or favoring the life-cycle of the canker fungi is poorly understood. Since, the spread and intensification of dieback and mortality within alder communities is expected to continue at high levels, installation and monitoring of permanent transects is key to describing insect and disease relationships and stress factors that contribute to this phenomenon.

**b. Methods:** The monitoring project installed 100 ft permanent transects. Methods were similar to those used by Jim Worrall to assess alder dieback and mortality in Colorado (2004/2005 funded EM project). Transect locations were randomly selected from road accessible riparian areas. Along each transect, 3 – 1m square microplots were installed to characterize understory communities. Ocular estimates of the dominant overstory species were also made. Site characteristics recorded include: elevation, aspect, slope, and soil drainage. For each alder genet whose canopy intersects the transect, the following was recorded: distance to stream, distance to road, number of stems >2 cm diameter for dead, live-no dieback, live with dieback, number of dieback stems with canker, abundance of sprouts. Additionally 3 genets per transect were randomly selected and all of the stems marked. For each stem, additional data were collected including diameter, proportion of stem with dieback, and canker location. Assessments of roots and root collars were made to determine the presence of root rot pathogens including *Phytophthora*. Rooting depth measurements were also made.

**c. Products:** A technical report will be produced from the monitored transects data for distribution to forest managers, related staffs, and those managers concerned with alder communities. The report will highlight severity and potential future impacts of dieback and mortality of alder. A peer reviewed paper will be produced from the soil condition project.

**d. Schedule of Activities:**

Year 1. Locate, establish and collect transect measurements in south-central and interior Alaska. Revisit permanent transects established in 2004. Locate and install plots to determine changes to soil condition. Complete assessment of soil condition project.

Year 2. Revisit all transects. Complete final report

**e. Progress/Accomplishments:**

The first project undertaken in 2005 was installation of permanent transects at 15 locations in south-central Alaska. Five transects were to be established in interior Alaska but early fall leaf-drop prevented the field work. Interior transects will be installed in 2006. Within the south-central transects, all stems within 224 genets were examined. All transects have some level of dieback occurring. Stems were classified in three categories: live and healthy, live with dieback, and dead. The 1,195 stems examined were about evenly divided across the categories (36% healthy, 29% dieback, 35% dead).

Additionally, five transects established in 2004 were revisited (440 stems within 84 genets). Healthy stems comprised 47% of the total in 2004, and decreased to 33% in 2005. Live stems with dieback remained nearly the same (28% in 2004 and 26% in 2005). Dead stems comprised 25% of the total in 2004 and increased to 41% in 2005. With substantial decreases in healthy stems and increases in dead stems, dieback and mortality is clearly continuing at a rapid rate.

Approximately one-fourth of the live genets lacked sprouts or seedling establishment. Additionally, in 10% of the genets (8 of 84) where all stems were dead in 2005, however some sprouting was evident at the base of 5 of those genets. This suggests that the genet may not be dead and continued monitoring of the regeneration will elucidate the potential for recovery. Monitoring of all transects will occur in year 2. EM request in year 2 is \$7,500 salary, \$2,000 travel.

The second project undertaken in 2005 was an assessment of changes to soil conditions, particularly a loss of nitrogen fixing capacity, in areas with low to high levels of alder dieback and mortality. This project was conducted in cooperation with Roger Ruess, University of Alaska Fairbanks (UAF) and completed in 2005. Paired plots were located at three sites across south-central and interior Alaska to represent varying levels of alder dieback. At each site, nitrogen fixing capability was determined on 5 plants from each plot using  $^{15}\text{N}_2$ -uptake methods developed at UAF including an assessment of nodule biomass. The UAF group coordinated measurements on this project with their ongoing study examining the influence of *Frankia* genetic structure on nitrogen fixation in alder.

Preliminary analysis suggests that in the very early stages of dieback, nodule biomass is unaffected. As dieback and mortality progress, dead nodules are readily apparent. With severe dieback and mortality, there are very few nodules either live or dead, as most dead nodules have decomposed. Analysis is underway to more precisely determine the thresholds at which dieback and mortality impact nodule biomass and fixation. DNA analysis of *Frankia* is also underway. Fieldwork for this project is completed and no additional EM dollars are requested in year 2.

#### **COSTS:**

	<b>Item</b>	<b>Requested FHM EM Funding</b>	<b>Other- Source Funding</b>	<b>Source</b>
<b>YEAR 2 - 2006</b>				
<b>Administration</b>	Salary	7,500	5,000	FHP base
	Overhead			
	Travel	2,000	1,000	FHP base
<b>Procurements</b>	Contracting			
	Equipment			
	Supplies			
<b>TOTAL</b>		<b>9,500</b>	<b>6,000</b>	

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