

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

LOCATION: Alaska

DURATION: Year 1 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 extent and severity of alder dieback and mortality across Alaska through installation of permanent transects. Describe the site and stand variables that contribute to the dieback including moisture stress, diseases, and insect defoliation.
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.

JUSTIFICATION: Alaska's FHM detection monitoring program is still in the development phase and has no data for alder. The dieback and mortality of thin-leafed alder (*Alnus tenuifolia*) was recently detected through observations and ground surveys across south-central and interior Alaska. Dieback and mortality of thin-leafed alder is also occurring in Colorado and several other western states (Jim Worrall pers. comm.). The branch dieback and stem mortality are widespread across Alaska, substantially above the "normal" expected damage levels for thin-leafed alder, and considered severe in some locations. Modest dieback was also noted on *Alnus crispa*, an upland alder species, in 2004 in both south-central and interior Alaska. Dieback and mortality appear to be associated with a complex of factors including canker diseases, moisture stress, and severe defoliation by the introduced alder woolly sawfly (*Eriocampa ovata*), and perhaps other stress factors. In 2004, south-central and interior Alaska experienced the hottest summer on record which likely contributed to the observed dieback. Both 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*. 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 proposed monitoring project has two aspects: determine the extent and severity of alder dieback through establishment of permanent transects and determine potential changes to soil condition in affected areas. Both aspects are expected to have a high level of success.

DESCRIPTION:

a. Background: Dieback and mortality of *A. tenuifolia* in riparian areas in Alaska has been reported since 2003. Observations suggest that the damage is very recent in most locations, occurring within the last 5 years. Symptoms on individual plants begin with branch dieback on stems that show no prior foliar, branch or stem problems. Leaves on affected branches wilt and die primarily after the leaves are fully extended in late spring or early summer. In nearly all cases, long narrow cankers are present on affected branches or stems. Identification of the

canker-causing fungi is underway. Dieback appears to intensify within an individual, resulting in mortality of multiple branches and stems, and may lead to death of the individual. Surveys in 2004 indicated that multiple plants within alder communities are experiencing continued dieback and mortality. Monitoring of 200 alder stems in 2004 (tagged in 2003) indicated a 31% increase in stems with dieback and associated canker, and a 4% increase in stem mortality. Most affected alder communities also appear to be under stress from severe insect herbivory and/or drought from the unprecedented hot dry summers of 2003 and 2004. Thus, the spread and intensification of dieback and mortality within affected alder communities is expected to continue at a high levels. Since the cause of the dieback and mortality is likely a complex of factors that is difficult to determine conclusively, this project focuses on the extent, severity, and impact of alder dieback and mortality rather than the cause.

b. Methods: Surveys were conducted in 2004 across Alaska and 5 - 100 ft long permanent transects were installed in the Matanuska/Susitna Valley of south-central Alaska where dieback was first noted. Those preliminary surveys and transects showed that the alder dieback and mortality are widespread. This project will, therefore, install permanent transects in southern, south-central and into interior Alaska using the same methods. Methods are similar to those used by Jim Worrall to assess alder dieback and mortality in Colorado (2004 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. Dominant tree riparian species were estimated ocularly. Site characteristics recorded include: elevation, aspect, slope, and soil drainage. For each alder clump whose canopy intersects the transect, the following will be 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 clumps per transect will be randomly selected and all of the stems marked. For each stem, additional data will be collected including diameter, proportion of stem with dieback, and canker location. Assessments of roots and root collars will be made to determine the presence of root rot pathogens including *Phytophthora*. EM request for this project in year 1 \$7,500 salary, \$2,000 travel. EM request in year 2 is \$7,500 salary, \$2,000 travel.

The second project, an assessment of soil condition, will provided needed preliminary information on the influence of the severity of dieback and mortality of alder on whole stand nitrogen accumulation rates. To determine changes to soil condition, paired plots (damage vs. undamaged) will be located at four sites in interior Alaska to represent low, moderate, or severe levels of dieback. At each site, nitrogen fixing capability will be determined on 5 plants from each plot using $^{15}\text{N}_2$ -uptake methods developed at the University of Alaska, Fairbanks (UAF). This project will be conducted in cooperation with Roger Ruess (UAF). The UAF group will coordinate these measurements with their ongoing study examining the influence of *Frankia* genetic structure on nitrogen fixation in alder. Funding for this project will be matched through the University of Alaska ecology program. EM request for this project in year 1 is \$7,500 salary, \$2,500 overhead.

c. Products: A technical report will be produced for distribution to forest managers, related staffs, and those managers concerned with alder communities. The report will highlight extent, severity, cause, and potential future impacts of dieback and mortality of alder.

d. Schedule of Activities:

Year 1. Locate, establish and collect transect measurements in southern, 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. Complete progress report with initial findings.

Year 2. Revisit all transects. Complete final report

e. Progress/Accomplishments: new project, no progress to report

COSTS:

| | Item | Requested FHM EM Funding | Other-Source Funding | Source |
|-----------------------|-------------|---------------------------------|-----------------------------|------------------|
| YEAR 1 - 2005 | | | | |
| Administration | Salary | 15,000 | 12,500 | UAF and FHP base |
| | Overhead | 2,500 | | |
| | Travel | 2,000 | 1,000 | FHP base |
| Procurements | Contracting | | | |
| | Equipment | | | |
| | Supplies | | | |
| TOTAL | | 19,500 | 13,500 | |

COSTS:

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