

**TITLE:** Evaluation Of Spread Characteristics, Stand/Site Attributes, Management and Disturbance Relationships of Black Stain Root Disease In Douglas-fir Plantations in Northern California

**LOCATION:** Happy Camp Ranger District, Klamath National Forest

**DATE:** September 26, 2013

**DURATION:** 1 year    **FUNDING SOURCE:** Base

**PROJECT LEADERS:**

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**COOPERATORS:** Roger Siemers and Todd Drake, Klamath NF

**FHP SPONSOR/CONTACT:** Pete Angwin, 530-226-2436, R5 FHP- Shasta-Trinity NF, Redding

**PROJECT OBJECTIVES:**

1. To continue the re-measurement and analysis of transects and permanent plots to track black stain root disease incidence and impacts in thirty previously-assessed stands on the Happy Camp Ranger District of the Klamath National Forest, and to establish new transects and plots in eleven more, in order to continue to provide data for the validation and calibration of root disease models for the range of stand conditions in Region 5.
2. To provide pre-thinning baseline data for a comparison of how management and site disturbance affects the incidence and impacts of black stain root disease in Douglas-fir plantations in northern California.

**Note: This was submitted as a two-year Base EM project in FY2013. Although it rated very high in the national review process, it was not funded due to a lack of available EM funds. However, Region 5 FHP deemed it an important project and funded its first year. This new proposal allows the project to be fully completed.**

**JUSTIFICATION:**

- a. **Linkage to FHM program.** In 2000, there were only 360 FHM plots in CA, only 5 of these were in the DF-type group, and of these, only 2 had obvious recorded disturbance. FHM plots are not extensive enough at this time to provide information specific to our investigations. Black stain root disease, caused by the vascular wilt pathogen *Leptographium wageneri*, is the most prevalent forest disease of Douglas-fir in northern California (USDA Forest Service 1994, Dale 1995). The disease is a management concern not only in commercial forests, but in 10 to 30-year-old Douglas-fir in plantations and on lands that have been designated as late successional reserves (LSRs) under the President's Northwest Forest Plan. Douglas-fir plantations on the Happy Camp Ranger District of the Klamath NF provide a good representation of the situation in many areas of the Region. In a 1993 black stain root disease detection survey performed throughout the District, 156 of 1,151 surveyed stands were found to contain infection centers. In 1996, 30 of these stands were randomly selected for transect and permanent plot installation and intensive survey. Trees in the selected units were planted between the mid-1960's to late '80's (now approx. 20-50-years, < 12 in. ave. dbh). In FY2000, FHM Evaluation Monitoring funds were provided to re-measure and re-monument these transects and plots.

Because commercial thinning treatments are scheduled to take place within 2-4 years in 3 of the 30 stands that currently have permanent plots, as well as in 11 more of the infested stands that were surveyed in 1993, we have an excellent opportunity to track the distribution and impacts of black stain root disease in thinned (disturbed) and un-thinned (undisturbed) stands. In 2013, transects and plots were re-measured in 20 of the 30 stands with existing permanent plots. This was accomplished using Region 5 FHP funds. Ten stands remain to be re-measured, along with the establishment of new transects and plots for 11 additional ones, in order to complete the data collection for a total of 41 stands. When the data collation/analysis is complete, we will have the baseline pre-treatment data to track the distribution and impacts of black stain root disease in 14 thinned and 27 un-thinned stands. Post-treatment evaluations will occur shortly after the thinning is completed and periodic re-measurements will be done every 5-10 years.

- b. Significance/Impact of forest health issue.** As stated above, black stain root disease is a major forest health concern in Douglas-fir in northern California and western Oregon. Many of the affected areas are within LSRs and thus require special consideration with regard to insects and disease. Information regarding disease behavior and disturbance can help to develop management strategies to lessen the impacts of the disease on LSR and matrix lands alike. It may also be possible, in conjunction with more extensive FIA or NF inventory data, to make further inferences regarding black stain root disease risk across larger landscapes. The information likewise provides further insights on black stain root disease behavior on other hosts (ie, ponderosa and pinyon pine) in other areas of the western United States.
- c. Scientific basis/Feasibility.** Collaborators on this project have experience with monitoring for black stain. Well-established methods and assessment protocols from 1996 and 2000 were followed in 2013, while incorporating technological improvements that have been developed since then (i.e. the use of newer GPS and GIS technologies). In addition, several of the people who established the transects and plots in 1996 and 2000 were available to do this work in 2013, and will continue in 2014. The location of all stands, transect lines, plot centers, and infection centers in the 30 previously-assessed stands were flagged and identified on unit and district transportation maps, enabling the project to be completed quickly, with great accuracy and efficiency.
- d. Cost/Economic efficiency.** As stated above, the use of previously established methods and protocols, together with the experience of the collaborators, will allow this project to be implemented with great accuracy and efficiency. The low cost of the project reflects that efficiency. In addition, any additional time and materials that are needed but are not covered in this proposal will be contributed by the Klamath National Forest and the Forest Health Protection personnel of the Northern California Shared Service Area Office in Redding, CA.
- e. Priority Issues.** This project directly addresses two of the four EM priority issues:  
Validating and filling data gaps in insect & disease risk models: The transects and permanent plots are specifically set up to provide data for the validation and calibration of root disease models for the range of stand conditions in Region 5.  
Tree mortality- deviations from expected levels: This project will provide data to assess the impacts of black stain root disease under various management and disturbance regimes.

#### **DESCRIPTION:**

**a. Background:** Black stain root disease is widely distributed on Douglas-fir on substantial acreages throughout the Forests of northwestern California and western Oregon. Data on the spread and intensification characteristics of the disease is currently lacking. The 41 stands with black stain root disease plots on the Happy Camp Ranger District (30 established in 1996, 11 to be established in 2014)

make up the only long-term plot network in northern California that is specifically set up to track black stain root disease in Douglas-fir plantations. 14 of these stands are scheduled for commercial thinning in the next 2-4 years, while 27 will be left un-thinned. Thinning will be to a 30-35' spacing (approximately 60 TPA), with a feller-buncher and rubber-tired skidder. Analysis of the 2013/2014 pre-treatment data in the 41 stands will provide a baseline for subsequent tracking of growth and disease impacts in thinned and un-thinned stands, starting with the first post-treatment evaluation in approximately 4 years.

As was stated above, transects and plots were established in 30 diseased Douglas-fir plantations in 1996 and re-measured in 2000; there was not a significant difference in detected incidence of black stain root disease during this re-measurement. The transects have known locations and bearings, and at each point in time, determined the area affected by black stain root disease, the size and distribution of infection centers, the number of stems infected, and the current residual stocking. Fixed-radius circular plots (1/50<sup>th</sup>-acre each) were established at a set interval along the transect lines to determine stocking, infection and mortality characteristics. Because black stain root disease is often associated with disturbance, information on stand and site factors that affect the incidence and spread characteristics of the disease was also collected, including planting year, logging history, thinning dates, soils, aspect, elevation and type of yarding. These measurements were repeated in 2013 and will continue in 2014, along with data on tree condition, average DBH and tree height. UTM coordinates of plot centers and transect take-off points were reconfirmed using a newer, more accurate GPS unit than was available in 2000.

**b. Methods:** 20 of the 30 randomly selected permanent plot stands that were established in 1996 were resurveyed in 2013. The remaining 10 will be resurveyed in 2014, while new transects and plots will be established in 11 more stands that are due to be thinned. The following information will be reconfirmed and updated as necessary:

1. Past disturbance or harvest activities including fire history, thinning entries and dates, type of yarding.
2. Site attributes including slope and aspect.

Transect and individual plot surveys were run in 1996, 2000 and 2013 as follows:

Transect Survey- Locate the plantation, the starting corner, and transect #1. Commence transect line, observing trees in the transect for evidence of black stain root disease. Keep track of the length of each transect in the plantation. If a black stain root disease infection center is encountered, estimate its length and width. The boundary of an infection center is defined as the inner faces of healthy appearing trees on the margin. Islands of healthy appearing trees inside a center are not considered in determining the boundary. When a transect is completed, turn 90 degrees and travel the offset distance to the next transect. If you are within the plantation when starting the next transect backtrack to the edge of the plantation before starting. Continue until all transects are completed.

Plots Survey- At a 3-chain interval along each transect, locate a 1/50<sup>th</sup> ac. circular plot. At each plot, count the number of trees by species and record. Record the height, DBH, crown condition class and the number of black stain root disease-infected Douglas-fir.

Thinned and un-thinned comparisons will be completed by comparing the treated and untreated units and the pre and post-thin measurements; an appropriate statistical analysis will be performed.

**c. Products:** Results will be submitted to the California Forest Pest Council for inclusion in the 2014 annual pest conditions report. A poster describing the results will be submitted to the 2014 annual meetings of the California Forest Pest Council and the Western International Forest Disease Work Conference. The information will also be distributed by technology transfer between FHP and land managers. In addition, establishment reports that lay out the pre-thin (2013-2014) and post-thin (2016-

2018) conditions will be produced in the form of Biological Evaluation or Regional Office reports, and future results from post-thin tracking may also be published in peer-reviewed scientific journals. The results may also be used to support the development of a new California black stain root disease/Douglas-fir disease/host model for the next revision of the National Insect and Disease Risk Map.

**d. Schedule of Activities:** The survey and new plot establishment that was started in FY2013 will be completed during the field season of FY2014. Data analysis will also be completed in 2014.

**e. Progress/Accomplishments:** By October 1, 2014, the 10 remaining stands that were assessed in 1996 and 2000 will be re-measured and re-monumented, and transects and plots in the 11 new stands will be installed, monumented, and measured. Data analysis will also be completed by that date.

**f. Relevant Citations:**

Dale, John W., tech. coord. 1995. California forest health in 1994 and 1995. USDA Forest Service, Pacific Southwest Region, Rep #R5-FPM-PR-002. 63p.

USDA Forest Service. 1994. California forest health past and present. USDA Forest Service, Pacific Southwest Region, Rep #R5-FPM-PR-001. 70p.

**COSTS:**

In FY2013, re-measurement of transects and plots in 20 stands was funded with \$32,000 of Region 5 FHP program dollars. In FY 2014, re-measurement/re-monumenting of transects and plots will be done in the remaining 10 stands, along with the establishment of new transects and plots in 11 additional stands. Data collation/analysis will follow.

	Item	Requested FHM EM Funding	Other-Source Funding	Source
<b>YEAR 1</b>	2014			
<b>Administration</b>	Salary	\$30,500 (\$17K plot work; \$13.5K data analysis)	\$3,000	Forest Budget
	Overhead	\$0	\$0	Forest Budget
	Travel	\$500		
<b>Procurements</b>	Contracting	\$0		
	Equipment	\$0		
	Supplies	\$0		
	<b>Total</b>	<b>\$31,000</b>	<b>\$3,000</b>	<b>Forest Budget</b>

Year 1 costs include salary for 1 GS-9 forester and 1 GS-5 forester tech for 30 days each for plot work, plus travel costs for use of Forest fleet vehicle, and salary for 1 GS-11 forest silviculturist and 1 GS-11 forester for 17 days each for data analysis.