TITLE: Ecological Impacts of Drought Stress in Alaska Birch Stands

LOCATION: Southcentral and Interior Alaska

DURATION: Year 1 of 1-year project **FUNDING SOURCE:** Base

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PROJECT OBJECTIVES: (1) Characterize site conditions (e.g. slope, aspect, elevation, soil type or site drainage class, indicator plant species) where drought stressed Alaska birch (*Betula neoalaskana*) are identified; (2) Determine the extent to which insect pests may be benefiting from drought stress conditions in Alaska birch stands; (3) Characterize the nature of drought stress conditions in overstory trees and understory plants in Alaska birch stands.

JUSTIFICATION: The proposed project addresses the following selection criteria: (1) Linkage to Forest Health Monitoring (FHM) survey and plot data—this project was identified by utilizing FHM annual aerial detection survey data (i.e. off-site monitoring). Project results will allow for more accurate determination of ground conditions in drought-stressed Alaska birch stands, thereby resulting in more accurate FHM annual aerial detection surveys; (2) Significance of geographic scale—this project involves the state-wide distribution of Alaska birch; (3) Biological impact—Characterization of the ecological impacts of drought stress on vegetation and insect pest populations in Alaska birch stands will provide insights into how these forest stands can be managed to increase their resilience to further drought stress; (4) Feasibility of the project—this project can be successfully completed.

DESCRIPTION:

a. Background: Alaska, like other arctic and subarctic regions, is experiencing a change in its climate, with well-documented increases in mean annual temperatures, maximum daily temperatures, minimum daily temperatures, growing degree days, and the frost-free season. For example, the aggregate mean annual temperature for forested regions of Alaska rose 2.5-3.5^{o}F between 1949 and 2003[1].

The summer of 2004 in Interior and Southcentral Alaska was consistent with this observed

[1] Climate statistics are from the Alaska Climate Research Center, which is part of the Geophysical Institute at the University of Alaska Fairbanks.

warming trend, with record hot and dry weather across much of the two regions. Temperatures in Fairbanks (Interior Alaska) were above normal in June (7.1°F above normal), July (2.0°F above normal), and August (6.0°F above normal), while precipitation was 22% of normal in June; 65.3% of normal in July, and 21% of normal in August (driest August on record). Temperatures in Anchorage (Southcentral Alaska) also were above normal during June (3.3°F above normal), July (3.3°F above normal), and August (5.0°F above normal), while precipitation was 47% of normal for July and 40% of normal for August.

In addition, August 2005 was another record-breaking month in Southcentral and Interior Alaska. A massive high pressure cell persisted over a large part of the state, resulting in near-record and record-breaking temperatures, along with very low precipitation levels[2].

Below normal rainfall in August for two consecutive years is significant. August in Southcentral and Interior Alaska is typically the wettest month during the snow-free period, and a time when ground water tables are re-charged before the onset of winter, especially in the Interior. Spring snow melt in the Interior does not contribute significantly to re-charging ground water tables—the ground is frozen so most snow melt is quickly converted to runoff.

Forest health professionals believe they are beginning to observe the effects of continued warming and drying in Alaska's boreal forests. Beginning in 2003, numerous scattered Alaska birch trees in urban and suburban landscapes exhibited symptoms commonly associated with drought stress (e.g. scorched leaf margins, beginning in the tops of tree crowns; early leaf fall; mortality of individual trees and small groups of trees). Following the record hot, dry summer of 2004 (i.e. summer of 2005) in Southcentral and Interior Alaska, birch trees in native forests were observed for the first time to exhibit signs of drought stress similar to trees in urban/suburban landscapes. Also in 2005 during FHM aerial surveys, stands of Alaska birch trees exhibited symptoms of crown thinning that were attributed to defoliating insects, although the defoliation signature was suspect. Several site visits and anecdotal reports indicated that these birch stands produced leaves a fraction of their normal size or none at all—suggestive of acute drought stress.

Further site visits are necessary to determine to what extent stands of Alaska birch are exhibiting symptoms of drought stress, to characterize the response of the birch stands to drought stress, and to identify site characteristics that will allow FHM aerial surveyors to discriminate between insect defoliation and drought stress.

b. Methods: Four days of aerial surveys will be conducted in early spring in Southcentral (2 days) and Interior (2 days) Alaska when birch stands are leafing out. Aerial surveyors will identify and map birch stands that are not leafing out. These stands will be the ones most likely exhibiting symptoms of drought stress, because significant defoliator activity will not have occurred so early in the season. Aerial surveys will be concentrated along travel corridors so that mapped birch stands can later be visited by forest health personnel. During site visits, the following activities will be conducted: (1) Characterization of site features—slope, aspect, elevation, soil type or site drainage class, overstory and understory plant composition; (2) Determination of the extent to which insect pasts may be benefiting from drought stress conditions in Alaska birch stands; and (3) Characterization of the nature of drought stress conditions in overstory and understory vegetation.

[2] Monthly weather summaries for August 2005 are not yet available from the Alaska Climate Research Center.

c. Products: USDA Forest Service Biological Evaluation. Aerial survey results will also be summarized in the annual "Forest Health Conditions in Alaska" report and in the Forest Health Monitoring GIS database.

d. Schedule of Activities: 2006—(1) Conduct 4 days of aerial surveys in early spring out of Anchorage (2 days) and Fairbanks (2 days) to identify stands of Alaska birch that have failed to leaf out; (2) Conduct 7-10 days of site visits out of Anchorage and Fairbanks during the spring and summer to determine the causal agent responsible for the failure of the birch to leaf out, to describe the birch sites, to determine the extent of drought damage to overstory and understory plants, and to examine insect pest response to the drought stressed birch; (3) Report the project results and distribute them to aerial surveyors and other interested parties during the fall and winter months.

e. Progress/Accomplishments: 2006: None to report—This is a new project proposal

COSTS:

	Item	**Requested FHM EM Funding**	**Other-Source Funding**	**Source**
YEAR—2006				
Administration	Salary	$5,000	$13,523	Base FHP
	Overhead	$677	$797	Base FHP
	Travel	$5370	$	
Procurements	Contracting	$8,000	$0	
	Equipment	$0	$0	
	Supplies	$0	$0	
TOTAL		**$19,000**		