TITLE: Monitoring Riparian Forest Stand Attributes and Fuel Loads in Mountain Pine Beetle Infested Watersheds INT-EM-F-11-01

LOCATION: National Forests in Colorado, Wyoming, and Utah

DATE: September 30, 2010 (original proposal submission)

DURATION: 2 year project (2010-2011) **FUNDING SOURCE:** Fire Plan EM

PROJECT LEADER: Kathleen Dwire, USFS Rocky Mountain Research Station (RMRS), Fort Collins,CO; 970-498-1016; kadwire@fs.fed.us.

COOPERATORS: Robert Hubbard (rhubbard@fs.fed.us),RMRS and Fraser Experimental Forest Arapaho-Roosevelt NF, CO; Carol Purchase (cpurchase@fs.fed.us), Medicine-Bow NF, WY; Liz Schnackenberg (lschnackenberg@fs.fed.us), Routt NF, CO; Christine Brown (christineabrown@fs.fed.us), Wasatch-Cache NF, UT.

FHP SPONSOR/CONTACT: Jeri Lyn Harris (jharris@fs.fed.us), Forest Health Monitor, Region 2, Golden, CO 80401; 303-275-5155.

PROJECT OBJECTIVES:
Within selected watersheds (CO, WY, UT) infested by Mountain Pine Beetle (MPB):

1. Quantify riparian forest characteristics (species composition, structure, age, extent of insect-caused mortality) and characterize riparian fuel profiles;
2. Compare riparian fuel loads with those of adjacent uplands;
3. Utilize the data collected to evaluate and inform ongoing fuel reduction treatments, including those focused on riparian areas (hazardous tree removal along roads, etc.) and upland treatments that incorporate streamside areas.

JUSTIFICATION:
Fuel characteristics can vary widely across landscapes, including those dominated by a common forest cover type. Riparian forests occur as narrow linear features in the landscape mosaic and contribute to the spatial heterogeneity of fuels. Riparian vegetation is generally characterized by higher plant diversity, biomass, basal area, stand density, and higher rates of production than adjacent upland vegetation. These vegetation features contribute to the wide recognition of riparian areas as critical habitat that support the diversity and functions of both terrestrial and aquatic ecosystems. Despite the ecological importance of riparian forests, few data exist on riparian fuel characteristics. This lack of knowledge, combined with administrative regulations for riparian management, has resulted in conflict among resource specialists regarding treatment options for streamside areas in MPB infested watersheds. Basic information on distribution of fuels in riparian forests is sorely needed to inform management decisions.

a. Linkage to FHM detection Monitoring: FHM and FIA data continue to document the extent of MPB-caused canopy mortality throughout the Rocky Mountains. However, additional plot level data are needed in riparian areas (1) to assess streamside fuel loading, especially in relation to upland fuels in different forest types, and in areas with planned or ongoing fuel reduction treatments; (2) to address concerns regarding impacts of fuel treatments and wildfire on riparian and aquatic habitats.

b. Significance in terms of geographic scale: The proposed work would be conducted in areas of the Interior West with high levels of MPB-caused canopy mortality. Fuel reduction treatments, including mechanical approaches and prescribed fire, are being implemented throughout this region and frequently incorporate riparian areas (Dwire, unpublished data). However, since so little is known regarding the distribution and characteristics of riparian fuels, effectiveness of fuel treatments for streamside areas is not currently possible. Quantification of riparian fuel profiles will complement fuel estimates for different upland forest types, thus contributing to watershed-scale and landscape-scale evaluation of fuel distribution, fire hazard, and risk to terrestrial and aquatic habitat.

c. Biological impact and/or political importance of the issue: Fuel treatments in riparian areas pose distinct challenges. Riparian areas are generally protected by administrative regulations, many of which are largely custodial and restrict active management. However, the MPB epidemic has caused considerable mortality in some riparian forests, and fuel levels are perceived to be particularly high. In riparian areas that occur along roads, 'hazard trees' (mostly lodgepole pine, killed by MPB) are being removed (Medicine Bow-Routt NF). In other areas, manipulative treatments of riparian fuels are implemented to maintain riparian biodiversity and protect streamside areas from severe wildfire (Stone et al. 2010). These treatments are being planned and conducted with little quantitative information on riparian forest structure and fuel loading, leading to conflicts among resource specialists and stakeholders regarding impacts on wildlife habitat (snags, nesting and foraging resources) and streams (shade, potential recruitment of large wood).

d. Scientific Basis/Feasibility: Standard protocols for forest and fuels measurements and plot design will be used. Riparian plot locations will be selected to maximize comparison with existing upland plots. The project has very high probability of success and will yield needed information regarding the condition and fuel loading of riparian forests.

e. Priority Issues addressed from Request for Proposals: This proposal directly addresses 'fire risk and fuel loading' with focus on streamside areas. Permanently-established riparian plots in areas that are planned for fuel treatments will also address 'ecological impacts of fire' (prescribed) through comparison of pre-and-post treatment data.

DESCRIPTION:

a. Background: <Brief description of the project including scientific basis.>

MPB has caused extensive canopy mortality in forests of the Interior west dominated by lodgepole and ponderosa pine. Assessment and monitoring of forest condition — both plot-based and remotely sensed — has emphasized MBP impacts on upland forests. Comparable information on forest attributes, mortality, and fuel loads in riparian areas is lacking, despite the importance of streamside areas for provision of wildlife habitat and other ecological functions. Determination of current fuel conditions for a range of riparian forests and plant associations is needed to inform decisions on streamside management, including evaluation of using mechanical fuel treatments as surrogates for low-intensity wildland fire in riparian areas and risk assessment of 'no action options' for cases in which riparian fuel loads are perceived as hazardous.

b. Methods: <Brief description of methods including data availability.>

The proposed work builds on preliminary data collected in plots (GPS,300m2) established on the Arapaho-Roosevelt NF, CO; Routt NF, CO; and Wasatch-Cache NF, UT (Dwire, unpublished data), which suggest notable differences in forest and fuel characteristics between upland and riparian areas. These data include standard silvicultural measurements: (1) elevation, aspect, percent slope at plot center; (2) for each tree (>5 cm DBH): species, DBH, crown class and condition (live, live and attacked by MPB or spruce beetle, dead from MPB or spruce beetle, dead not from insects); (3) stem count of saplings and pole-sized trees. Notes on snag characteristics and obvious wildlife use (esp. nesting) were also recorded.

We propose to revisit, re-measure, quantify fuels, and characterize fuel profiles in existing riparian plots and establish additional riparian plots along selected stream reaches in the Medicine Bow-Routt NF (CO, WY), and Wasatch-Cache NF (UT), focusing on areas with planned fuel treatments. Canopy and surface fuels will be quantified using standard methods (Brown 1974, Fule et al. 2001, FIREMON 2006). Understory shrub and herbaceous vegetation will be sampled in nested sub-plots. Efforts will be made to co-locate riparian plots with existing upland plots. In some locations, we may be required to establish upland plots to strengthen riparian-upland comparisons.

c. Products: Final products: peer-reviewed scientific journal article, presenting fuels characteristics and MPB-related mortality estimates for riparian forests (target journals: *Canadian Journal of Forestry, Forest Ecology and Management, International Journal of Wildland Fire*); final report to FHM Regional Manager.

Interim products: annual reports and presentation of results to FHM Working Group (poster). Data collected will likely be used in NEPA and planning documents for fuels treatments that incorporate streamside areas.

d. Schedule of Activities:
Year 1:
Contact forest/district/FHM staff re: locations of relevant upland plots; coordinate field activities.
Select locations for new riparian plots on each national forest; determine need to sample upland plots.

Staff on the Medicine-Bow (MBNF, Laramie and Brush-Creek Districts) and Routt National Forests (RNF) were contacted regarding locations for establishing permanent riparian plots. In August, 2011, potential plot locations were visited along 3 drainages in the MBNF and 2 drainages in the RNF; 16 potential plot locations were selected. Four of these locations are near riparian areas that have undergone fuel reduction treatments, which will allow for additional comparisons between treated and untreated riparian areas. Selection for study plots will be finalized in winter-spring 2012; plots will be established and sampled in summer 2012.

Dwire also examined the locations of existing Forest Inventory and Analysis (FIA) plots on the MBNF and RNF to determine which could be utilized as upland comparisons. Criteria are: (1) reasonable proximity to riparian plots (50 – 100 m); (2) similar elevation, aspect; (3) well-defined upland location, beyond the microclimatic riparian influence (i.e. not transitional). During the winter (2011-2012), she will work with FIA staff to obtain plot-level data for FIA plots selected to provide the strongest comparisons with riparian plot locations. Dwire has contacted a colleague at University of Wyoming (Dr. Dan Tinker), who has established upland plots in mountain-pine beetle infested watersheds on the MBNF, regarding sharing data from his study plots as upland comparisons. For some drainages, however, it will be necessary to establish and sample upland plots to obtain valid upland-riparian comparisons.

Revisit, re-measure, quantify fuels, and characterize fuel profiles in existing riparian plots.

Eighteen (of 22) existing riparian plots on the Arapaho-Roosevelt National Forest (ARNF) were revisited in 2011. These 300 m2 plots were established in 2007; at that time, each tree (>5 cm DBH) was tagged, and the following information recorded: species, DBH, crown class and condition (live, live and attacked by MPB, dead from MPB, dead not from insects). In 2011, each tree was re-located, and current condition was recorded. In addition, 2-3 fuels transects (25m, run along the diagonal) per plot were measured, and understory biomass was clipped in 5 quadrats (0.5 x 0.5 m) along each fuel transect. Adjacent upland plots (n=15) were also revisited and remeasured. These plots are located in watersheds dominated by dead lodgepole pine due to mountain-pine beetle. Because the riparian plots are largely dominated by subalpine fir and Engelmann spruce, the amount of standing dead is lower than surrounding uplands. Since 2007, the lodgepole trees and approximately 5% of the subalpine fir in the riparian plots have died. In 2011, we also noted that about 35% of the riparian Engelmann spruce trees show evidence of spruce beetle attack, although actual spruce mortality is not yet evident. Preliminary analysis of the fuel loading (does not include standing dead) in the sampled plots suggests that: (1) all fuel components, with the exception of 100-hr fuels, are higher in the riparian plots than adjacent uplands; (2) duff and litter are consistently higher in the riparian plots.

Establish additional riparian plots (and upland plots, where needed) along selected stream reaches in each national forest; sample newly established plots.

We were unable to make progress on this 2011 objective due to timing of receipt of funding; a shortened field season due to high snow pack and road inaccessibility/ passage; inaccessibility of some sites due to high stream flows. In particular, we repeatedly postponed our visit to the Wasatch-Cache NF, UT due to site inaccessibility; then cancelled because seasonal field staff returned to college.

Compile and analyze data; prepare Year 1 progress report/ poster.

Data collected in 2011 have been electronically entered, and are currently being analyzed.

Year 2: In year 2, we will complete the work initiated in the first year, add more plots so that different forest and valley bottom types are represented in the sampling. In addition, if fuel treatments have been successfully implemented in the paired upland-riparian plots, we will re-measure all attributes to assess treatment effectiveness (note: assessment of fuel treatment effectiveness is not listed as a specific objective in this proposal because timing of treatment implementation is uncertain).

Since we made less progress in 2011 than expected, we will have an expanded 2012 field season to accomplish the three project objectives. We will focus on establishing and sampling additional riparian and upland plots along selected stream reaches in the Medicine-Bow NF, Routt NF, and Wasatch-Cache NF. Final selection of locations for upland-and-riparian paired plots will focus on providing a representation of the range of conditions in mountain-pine beetle impacted watersheds.

COSTS:

In 2011, necessary field equipment and supplies was purchased. Because 2011 funding was received fairly late for optimal field planning and preparation, we hired only one seasonal employee. A portion of the 2011 funding was transferred to the Mountain Studies Institute, Durango, CO (via a Cost-Share Agreement through the Rocky Mountain Research Station) to be used in 2012 to assist in covering travel and salary for field staff. We will need the entire 2012 funding allocation ($41K) to accomplish the goals of this project.

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR		FY2011	FY2011	
Administration	Salary	$24,000.00	$22,000	RMRS
	Overhead			
	Travel	$11,000.00		
Procurements	Contracting			
	Equipment	$ 1500.00		
	Supplies	$ 1500.00		
Total		$38,000.00	$22,000	

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR		FY2012	FY2012	
Administration	Salary	$26,000.00	$24,000	RMRS
	Overhead			
	Travel	$12,000.00		
Procurements	Contracting			
	Equipment	$ 1500.00		
	Supplies	$ 1500.00		
Total		$41,000.00	$24,000	