WESTERN BARK BEETLE MITIGATION
FY 2012 ACCOMPLISHMENT REPORT

January, 2013

U.S. Forest Service

EXECUTIVE SUMMARY

The US Forest Service is aggressively implementing projects to mitigate the effects of the bark beetle in Regions 1-6 under the 2011 Western Bark Beetle Strategy (WBBS). The strategy is being achieved through three well-defined goals: human safety, forest recovery, and long-term forest resiliency. This report presents bark beetle mitigation accomplishments during FY 2012.

During the fiscal year, the US Forest Service made significant progress in implementing the strategy. Mitigation efforts resulted in a total of 287,064 treated unified acres across the three goals. The majority of the accomplishments (65%) achieved the resiliency goal. In addition, 618 miles of roads and 638 miles of trails had hazard trees removed to improve human safety. All the activities resulted in 313.1 million board feet of timber sold and 206,478 green tons of biomass produced.

A total of 36 research tools, including 22 publications, were developed, and these are expected to increase the effectiveness of forest management practices towards bark beetle mitigation.

The Forest Service spent $114.1 million supporting safety, recovery and resiliency activities in FY 2012.

CONTENTS

2 Executive Summary

4 Background

4 Accomplishments

4 Treated acres
7 Timber volume sold
7 Bio-energy production
7 Road and trail maintenance
7 Research Tools Developed and Applied to Management

9 Funding

10 Conclusion

BACKGROUND

For the period of 2000-2010, over 43 million acres in the west had trees infested with bark beetles, of which nearly 32 million acres were National Forest System lands. During the same period the infestation was growing at approximately 600,000 acres/year, threating the safety of people and infrastructure. Current information, however, indicates that tree mortality caused by western bark beetles has declined significantly since 2011.

On July 11, 2011, the Forest Service released the Western Bark Beetle Strategy (WBBS), which identified how the Forest Service is responding to and will respond to the western bark beetle epidemic. The strategy covers a five-year period: FY 2011 to FY 2016. The strategy is being achieved through well-defined goals, objectives, and action items, to address each of the three prongs of the bark beetle problem: human safety, forest recovery, and long-term forest resiliency across Regions 1 - 6.

The annual report is intended to be a brief synopsis of the western bark beetle mitigation accomplishments for FY 2012.

ACCOMPLISHMENTS

The top priority goal of the Forest Service in responding to the western bark beetle epidemic is to ensure that people and community infrastructure are protected from the hazards of falling bark beetle-killed trees and elevated wildfire potential (*Safety Goal*). Work performed included the removal of standing hazardous trees as well as dead and down trees near roads, along trails, and in campgrounds that supported the most user traffic. After the priority of safety, forested areas with severe mortality were reforested (*Recovery Goal*) with the appropriate species. The overall goal was to regenerate healthy forest ecosystems in beetle-killed areas. Some of this recovery work occurred in areas that were treated for safety issues. Other recovery work occurred in areas that did not have public safety concerns, but still needed attention to restore ecosystem functioning condition. Forests were thinned to reduce the number of trees per acre in order to create more diverse stand structures as well as minimize future extensive epidemic bark beetle attack (*Resilience Goal*). Generally, thinning reduces the relative competition for moisture, nutrients, and sunlight between trees, enabling trees to withstand stress causing situations, such as bark beetle attack.

Acres treated

In this report unified accomplishments are reported. Unified accomplishments are a combination of core, integrated, partnership, and unspecified accomplishments. Core accomplishments are achieved through direct expenditure of Forest Service funds that are associated with the same resource as the specific budget line item (BLI). Integrated

accomplishments are those that were achieved using funds from a BLI that is not associated with the resource program tied to that particular accomplishment measure. Partnership accomplishments are achieved through partnership funds or reimbursable agreements, volunteer agreements, or in-kind contributions. When the system of record does not have a BLI or valid BLI, these accomplishments are known as unspecified accomplishments.

Table 1. FY 2012 treated acres

Goal	Performance measure	Region					
		1	2	3	4	5	6
Safety	FP-FUELS-ALL (Acres of hazardous fuels treated)	1371	8087	0	5150	0	8693
	TMBR-SALES-TRT-AC (Acres of forestlands treated using timber sales)	923	2658	0	3214	0	474
Recovery	FOR-VEG-EST-IMP (Acres of vegetation established& improved)	750	2401	0	7829	377	3403
	FP-FUELS-ALL (Acres of hazardous fuels treated)	0	3252	0	1298	90	5567
	INVPLT-NXWD-FED-AC (Acres treated for noxious weeds and invasive plants)	440	4152	0	2523	0	1743
	TMBR-SALES-TRT-AC (Acres of forestlands treated using timber sales)	0	219	0	60	0	0
Resilience	FOR-VEG-EST-IMP (Acres of vegetation established& improved)	3157	3951	3727	11478	15331	16803
	FP-FUELS-ALL (Acres of hazardous fuels treated)	9112	7051	2131	27788	32681	48527
	SP-NATIVE-FED-AC (Acres treated for native pests)	6544	8890	0	2179	1789	2015
	TMBR-SALES-TRT-AC (Acres of forestlands treated using timber sales)	3447	633	65	5032	5759	4300

Table 1 shows the unified accomplishments. A total of 30,570 acres were treated to improve human safety (safety goal), 34,104 acres were reforested (recovery goal), and 222,390 acres were thinned to improve resilience (resiliency goal). The total number of

unified accomplishments across all goals was 287,064 acres. This number includes State and Private Forestry (S&PF) funded suppression and prevention projects on State and private lands (21,417 acres).

Region 6 had the largest number of treated acres and region 3 the least (Figure 1).

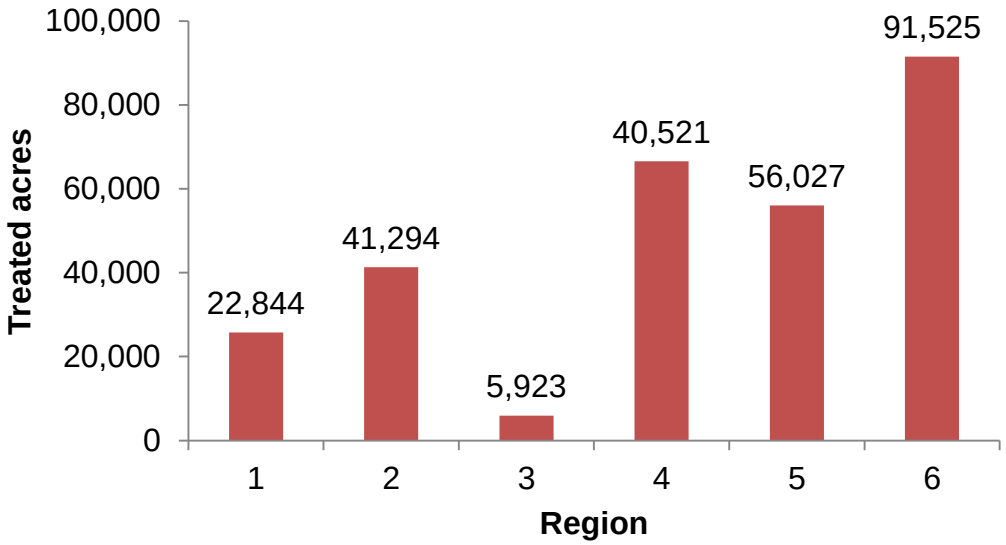

Figure 1. Unified accomplishments by region.

The majority of the unified accomplishments (56%) were through fuels treatments, followed by those for forest vegetation establishment and improvement (24%), and a small proportion was accomplished through timber sales activities (9%) (Figure 2).

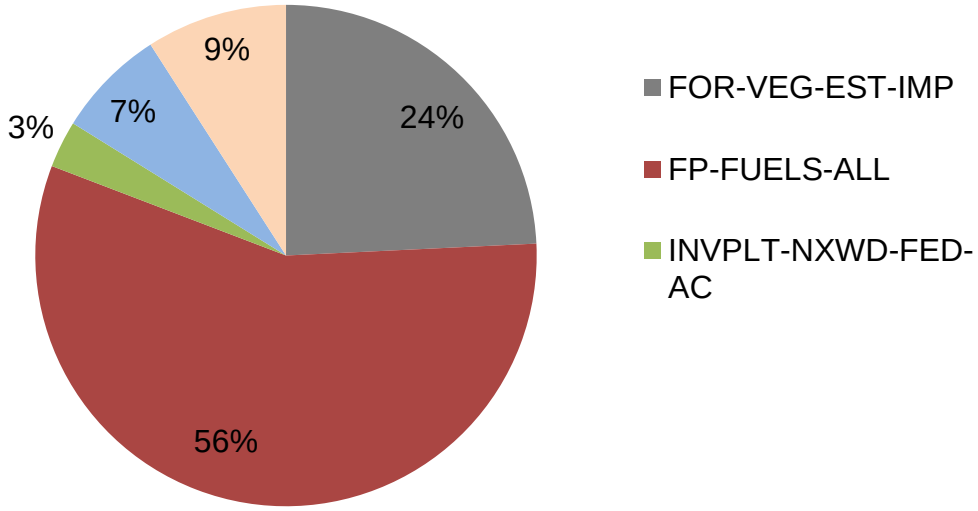

Figure 2. Unified accomplishments by performance measure.

Timber volume sold
During the report period, a total of 313.1 million board feet (594,112 CCF) of timber were sold across all goals. As expected, most (65%) of the timber sold was from areas treated for resiliency. Areas treated for safety comprised 17% of the timber sold, while those treated for recovery comprised 18% of the volume.

Bio-energy production
During the report period, a total of 206,478 green tons of biomass were produced across all goals. As expected, the majority (73%) of the bio-energy came from areas treated for resiliency. Areas treated for safety comprised 24% of the bio-energy produced, while those treated for recovery produced only 3%.

Road and trail maintenance
During the report period, a total of 618 miles of roads and 638 miles of trails had hazard trees removed to improve safety.

Research Tools Developed and Applied to Management
Research and Development (R&D) scientists continued to study the biology, ecology, and management of the principal species of tree-killing bark beetles. Scientists worked through a long list of questions, including examining 1) the effects of vegetation management, especially forest thinning, to reduce the amount or occurrence of bark beetle-caused tree mortality, 2) the interactions between bark beetles and forest fires, 3) ecological, economic, and social consequences of bark beetle outbreaks, 4) the effects of climate change on beetle biology and outbreaks and 5) use of pheromones and insecticides-based management strategies for mitigating bark beetle-caused mortality in high value areas.

R&D scientists developed 36 new tools that will be used to improve the efficiency and effectiveness of management in bark beetle infested western forests. These tools included 22 publications listed below. R&D highlights included development of:

- A conceptual model correlating changes of fuels and fire behavior following bark beetle outbreaks. This review of 39 previously published studies provided a more complete picture of the relationship between wildfire and bark beetle outbreaks. Bark beetle outbreaks were found to affect fuels and fire behavior but the types of change depend on time since outbreak and fuels or fire characteristic of interest. These findings suggest that it is not possible to reliably generalize about the effects of bark beetle-caused tree mortality on fuels or fire characteristics.
- A non-toxic, pheromone-based approach to prevent bark beetle attacks and protect whitebark and limber pines that is suitable for use in locations such as campgrounds, administrative sites, ski areas, and rust-resistant stands used for genetic conservation.

- Process-based phenology models to analyze eruptive insect population behavior and their response to changing climate conditions.
- Models of temperature and forest stand conditions, such as density and species composition, impacts on the likelihood of spruce beetle infestation over time.

Publications

Burnside, R.E., E.H. Holsten, C.J. Fettig, J.J. Kruse, M.E. Schultz, C.J. Hayes, A.D. Graves, S.J. Seybold. 2011. The northern spruce engraver, Ips perturbatus. U.S. Department of Agriculture, Forest Service, Forest Insect and Disease Leaflet 180. 12 p.

Fettig, C.J. 2012. Chapter 2: Forest health and bark beetles. In: M. North (Ed.), Managing Sierra Nevada Forests. PSW-GTR-237. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 184 p.

Fettig, C.J., C.J. Hayes, K.J. Jones, S.R. McKelvey, S.L. Mori, S.L. Smith. 2012. Thinning Jeffrey pine stands to reduce susceptibility to bark beetle infestations in California, U.S.A. Agricultural and Forest Entomology 14: 111-117.

Fettig, C.J., S.R. McKelvey, C.P. Dabney, D.P.W. Huber. 2012. Dendroctonus brevicomis responses in behavioral assays: Implication to development of a semiochemical-based tool for tree protection. Journal of Economic Entomology 105: 149-3160.

Hicke, J.A., M.C. Johnson, J.L. Hayes, H.I. Preisler. 2012. Effects of bark beetle-caused tree mortality on wildfire. Forest Ecology and Management 271:81-90.

Lu, M., M.J. Wingfield, N.E. Gillette, J.H. Sun. 2011. Do novel genotypes drive the success of an invasive bark beetle–fungus complex? Implications for potential reinvasion. Ecology 92: 2013-2019.

Millar, C.I., R.D. Westfall, D. Delany, M. Bokach, L. Flint, A. Flint. 2012. Forest mortality in high-elevation whitebark pine (Pinus albicaulis) forests of eastern California, USA; Influence of environmental context, bark-beetles, climatic water deficit, and warming. Canadian Journal of Forest Research 42: 749-765.

Stephens, S.L., J.D. McIver, R.E.J. Boerner, C.J. Fettig, J.B. Fontaine, B.R. Hartsough, P.L. Kennedy, D.W. Schwilk. 2012. Effects of forest fuel reduction treatments in the United States. Bioscience 62: 549-560.

Hudak, A.T., B. Bright, J. Negron, R. McGaughey, H.-E. Andersen J.A. 2012. Hicke. Predicting live and dead basal area in bark beetle-affected forests from discrete-return LiDAR. Silvilaser Conference Proceedings, Vancouver, British Columbia, Canada, 16-19 Sep 2012.

Bright, Benjamin C., J.A. Hicke, A.T. Hudak. 2012. Estimating aboveground carbon stocks of a forest affected by mountain pine beetle in Idaho using lidar and multispectral imagery. Remote Sensing of Environment. 124: 270-281

Jain, T. B., M. A. Battaglia, H-S. Han, R.T. Graham, C.R. Keyes, J.S. Fried, J.E. Sandquist. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States; Gen. Tech. Rep. RMRS-GTR-292. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 331 p.

Collins, B.J., C.C. Rhoades, M.A. Battaglia, R.M. Hubbard. 2012. The effects of bark beetle outbreaks on forest development, fuel loads and potential fire behavior in salvage logged and untreated lodgepole pine forests. Forest Ecology and Management 284: 260–268

Crabb, B.A., J.A. Powell and B.J. Bentz. 2012. Development and assessment of 30-meter pine density maps for landscape-level modeling of mountain pine beetle dynamics. USDA Forest Service Res. Pap. RMRS-RP-93www. 42 p.

Hoffman, C., C. Sieg, J. McMillin, P. Fule. 2012. Fuel loadings 5 years after a bark beetle outbreak in south-western USA ponderosa pine forests.International Journal of Wildland Fire 21:306-312.

Koo, E., R.R. Linn, P.J. Pagni, C.B. Edminster. 2012. Modeling firebrand transport in wildfires using HIGRAD/FIRETEC. International Journal of Wildland Fire. 21: 396-417.

Régnière, J., J. Powell, B. Bentz, V. Nealis. 2012. Effects of temperature on development, survival and reproduction of insects: Experimental design, data analysis and modeling. Journal of Insect Physiology 58:634-647

Kaufmann, M.R., G.H. Aplet, M.G. Babler, W.L. Baker, B. Bentz, M. Harrington, B.C. Hawkes, L.S. Huckaby, M.J. Jenkins, D.M. Kashian, R.E. Keane, D. Kulakowski, W. McCaughey, C. McHugh, J. Negron, J. Popp, W.H. Romme, W. Shepperd, F.W. Smith, E.K. Sutherland, D. Tinker, T.T.Veblen. 2008. The status of our scientific understanding of lodgepole pine and mountain pine beetles - a focus on forest ecology and fire behavior. GFI technical report 2008-2. Arlington, VA: The Nature Conservancy. 13 p.

Graham, R., M. Finney, C. McHugh, J. Cohen, D. Calkin, R. Stratton, L. Bradshaw, N. Nikolov. 2012. Fourmile Canyon Fire Findings. Gen. Tech. Rep. RMRS-GTR-289. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 110 p.

Lynch, A.M. 2012. What tree-ring reconstruction tells us about conifer defoliator outbreaks. In: Barbosa, Pedro; Letourneau, Deborah K.; Agrawal, Anurag A., eds. Insect Outbreaks Revisited. Hoboken, NJ: Blackwell Publishing Ltd. p. 126-154.

Costello, S.L., J. F. Negron, W. R. Jacobi. 2012. Wood-boring insect abundance in fire-injured ponderosa pine. Agricultural and Forest Entomology. 13: 373-381.

Schoennagel, T., T.T. Veblen, J.F. Negron, J.M. Smith. 2012. Effects of Mountain Pine Beetle on Fuels and Expected Fire Behavior in Lodgepole Pine Forests, Colorado, USA - - PLoS ONE.

Jolly, W.M., R.A. Parsons, A.M. Hadlow, G. Cohn, S. McAllister, J.B. Popp, R.M. Hubbard, and J.F.Negron. 2012 Relationships between moisture, chemistry, and ignition of Pinus contorta needles during the early stages of mountain pine beetle attack – Forest Ecology and Management.

FUNDING

There is not a dedicated budget line item exclusively for bark beetle management; however, the agency is committed to providing a stable level of funding from existing budget line items to support safety, recovery and resiliency activities. In FY 2012, the Forest Service spent $114.1 million for bark beetle mitigation activities of which $2.4 million was dedicated to developing research tools. The Forest Service spent $12.5 million over the budgeted amount (Table 2).

Table 2. FY 2012 Investment Levels ($ million)

Region	Budget	Expenditure	Difference (Expenditure-Budget)
1	$24.0	$24.6	$0.6
2	$33.0	$39.0	$6.0
3	$2.8	$2.9	$0.1
4	$9.0	$12.0	$3.0
5	$18.4	$20.0	$1.6
6	$11.9	$13.1	$1.2
Research	$2.4	$2.4	$0
Total	$101.5	$114.1	$12.5

Conclusion

The FY 2012 accomplishments were excellent:

- Treated acres in wildland/urban and non-wildland/urban interfaces – 287,064 acres
- Removal of hazard trees near roads – 618 miles
- Removal of hazard trees along recreation trails – 638 miles
- Harvested forest products - 313.1 million board feet and 206,478 green tons of biomass
- Development of research tools – 36 tools

Success in mitigating the effects of the bark beetle has been the result of continued collaboration between Deputy Staff areas of the Forest Service (National Forest System, Research and Development, and State and Private Forestry) as well as partnerships between Forest Service and other agencies.