



Black Hills Regional Mountain Pine Beetle Strategy Collaborative Accomplishments 2012-2017

***Prepared by:
Black Hills Regional Mountain Pine Beetle Working Group***

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Executive Summary

The Black Hills of South Dakota and Wyoming experienced a landscape level mountain pine beetle epidemic from 1996 to 2017. Concerned citizens, companies and agencies developed a collaborative, all-lands response. This document summarizes the actions taken and lessons learned for consideration in future epidemics.

Beginning as early as 1996 mountain pine beetle (*Dendroctonus ponderosae*) populations in the Black Hills grew exponentially. Despite active forest management and an active forest industry, much of the ponderosa pine across all ownerships had become overstocked creating ideal conditions for mountain pine beetles. Early on landowners and managers took aggressive “independent actions” within their jurisdictions, but beetles expanded across the Black Hills. To coordinate efforts, in 2010 a group of “Conservation Leaders” including local, state and federal agencies, conservation/natural resource districts, and private industry, landowners and citizens developed the Black Hills Regional Mountain Pine Beetle Strategy that provided for a collaborative approach across all land ownerships.

During the period 2012-2017 partners non-commercially treated 1.3 million infested trees and sawmilled 1.4 million infested trees. Partners also created more resilient forests by commercial harvest (thinning) 188,000 acres and pre-commercial thinning 73,000 acres. Nearly 1,100 private landowners treated infested trees and/or thinned residual trees. About 2,300 landowners attended educational workshops. In total over \$106 million was invested by partners, an average of \$17.7 million annually, 74% to create long-term resilient forests, and 26% for prevention and direct control. Partners learned and adjusted practices as forest entomologists advised and monitored progress. At the end of the collaborative effort in 2018 conservation leaders compiled twenty-four lessons learned and recommendations to inform future land managers faced with a similar landscape-level epidemic.

The epidemic ended due to a variety of reasons including loss of suitable beetle habitat through tree mortality and harvest and natural population controls. Partner actions reduced populations in localized areas thus protected key resources and properties. Additionally, they built relationships and an understanding that shared stewardship and partnerships is critical in managing complex forest landscapes.

Finally, partners created a resilient forest strategy to continue collaboration to strive for heterogeneous stand and landscape conditions that “appear to be a worthwhile alternative for producing wildfire resilient forests, producing wildlife habitat, maintaining functioning watersheds, producing forest products, and producing bark beetle-resistant forests in the face of a changing climate” (Graham et al 2016). Such vision should be implemented through strong relationships in a collaborative framework.

Black Hills Regional Mountain Pine Beetle Working Group

Black Hills Forest Resource Association; Crook, Custer, Fall River, Lawrence, Meade, Pennington, and Weston Counties; State of South Dakota; State of Wyoming; USDI-Bureau of Land Management; USDI-National Park Service, USDA-Natural Resources Conservation Service, and USDA-Forest Service.

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Cover Photos (top-bottom; l-r)

Mechanical tree falling on Tiger Timber Sale on the Mystic Ranger District, Black Hills National Forest, September 2010. Photo by Kari Greer, USDA Forest Service.

Timber Tour. Photo by Dave Thom, Black Hills Regional Mountain Pine Beetle Working Group Coordinator.

Aerial photo showing Minnex Timber Sale surrounded by mountain pine beetle, 2005. Photo by Ben Wudtke, Black Hills Forest Resource Association.

Mountain pine beetle, September 2010. Photo by Kari Greer, USDA Forest Service.

Sheridan Lake Campground mountain pine beetle tree spraying, Black Hills National Forest, April 2016. Photo by Beth Doten, USDA Forest Service.

Aerial photo of Silver City, SD, June 2015. Photo by Beth Doten, USDA Forest Service.

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(Vestal thinning project around Custer, SD, June 2015. USDA Forest Service photo)

I. Introduction

Purpose – The purpose of this paper is to document the implementation of the Black Hills Regional Mountain Pine Beetle Strategy (2012, rev 2014) (BHRMPBS) from 2012 to 2017. Included is the rationale for the strategy, scientific and technical basis for the strategic actions, partners involved, actions taken, investments made, and lessons learned. It is the intent of the organizing group of approximately 50 Black Hills Conservation Leaders to provide this summary so that land owners and managers addressing future epidemics can learn from actions taken during this period. This paper does not address actions taken from 1996 through 2012.

Beetle Biology – The mountain pine beetle (*Dendroctonus ponderosae*) is a native insect and is the most significant cause of mortality in ponderosa pine in the Black Hills. In the Black Hills, the mountain pine beetle has one generation per year and the adult flight period to new host trees typically occurs in July and August, peaking in early August. Larvae overwinter under the outer bark of host trees. Beetle maturation is completed the following spring. Timing of the life cycle guided treatments done under this strategy.



The adult beetles host several blue staining fungi that they carry to their new host newly infested trees. The combined efforts of these two organisms, the beetle and the fungi, are why a tree dies within a year of the attack.

Epidemic History and Beetle Trends – Mountain pine beetle populations are generally at endemic levels, killing and reproducing in stressed or weakened trees, such as those struck by lightning or affected by root disease. For reasons not fully understood, beetle pop-

ulations can increase dramatically to epidemic levels. Populations can be categorized as endemic, incipient or epidemic depending on the number of infested trees per acre (Schmid et al. 2007).

As a native species, the mountain pine beetle has always been a part of the Black Hills forest ecosystem, with periodic epidemics. The first, and largest, recorded epidemic in the Black Hills occurred from the late 1890's through the early 1900's and killed an estimated 90 percent of merchantable timber. Epidemics also occurred in the 1930's, 1940's, 1960's and 1970's, each lasting 8-20 years. The current epidemic began in 1996 and returned to endemic status in 2016.

Inventory Methods – Partners used a number of remote and on-ground methods to monitor beetle activity. Monitoring information proved critical in communicating with the public and policy makers as well as informing partners planning treatment. Large scale identification of beetle activity was done by USFS-Forest Health aerial observers from 1996-2010 that detected areas with relatively large polygons of

1-year old dead trees. Aerial photography (NAIP *) was used in 2010 and 2011 by Neiman Timber Company to further refine MPB infested acreage.

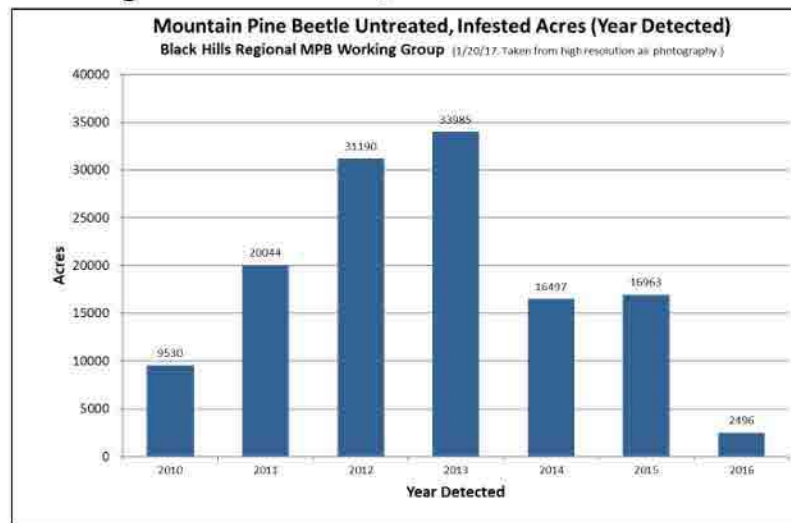
Between the years 2012 and 2016 the South Dakota Department of Agriculture, Resource Conservation & Forestry Division (RCF) coordinated an effort on behalf of partners to acquire high-resolution aerial photography to more accurately assess the location, progression, and severity of the epidemic. Contracts for aerial photography were awarded to Surdex Corporation (2012: \$74,950; 2013: \$80,900; 2016: \$72,500), Fugro Geospatial (2014: \$59,215), and the Sanborn Map Company, Inc. (2015: \$54,722). Funding sources included RCF, US Forest Service, National Park Service, Bureau of Land Management, and Weston County Natural Resource District, Wyoming. Staff from RCF, US Forest Service, WY State Forestry Division, Weston County Weed & Pest, and Neiman Timber Company analyzed the photos using ArcGIS to visually digitize each faded tree (Van Vlack, 2012). This analysis detected faders on nearly 131,000 acres from 2010 to 2016. This practice was continued into 2017 on the Wyoming side by Crook County Natural Resource District and Wyoming State Forestry Division at an estimated cost of \$45,000 (Surdex Corp.), but data is not included.

Detection with high resolution aerial photography provided a more precise estimate of acres affected than air survey, however both only identify faded trees killed the previous year and did not include infested trees that were treated or removed before fading. Results, 2010-2016, shown on Figure 1.

Currently infested trees were monitored through ground surveys. After the beetle flight, each fall about 20 miles of transects were walked across the Black Hills and Bear Lodge Mtns. to count the number of current, green-infested trees and 1-year old red trees. This gave a red-to-green ratio and an estimate of increasing or decreasing tree mortality for a given year. It also gives the best idea of where the most active new infestations occurred as opposed to aerial detection methods.

The final method used on a yearly basis was brood sampling. This involved removing a piece of bark from infested trees, generally in late June or early July, and counting the number of live, new generation beetles. This method gave an estimate of beetle reproduction success, as opposed to counts of tree mortality. It is estimated that over the course of this epidemic 448,000 acres were affected to varying degrees by mountain pine beetles on the Black Hills National Forest and adjacent lands (Schotzko and Allen 2017).

Figure 1- Untreated, Infested Acres 2010-2016



* National Agriculture Imagery Program – USDA, Farm Service Agency. <https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/>

Research and Effective Treatments – Use of latest scientific understanding was important in development and implementation of the Strategy. Fettig et al (2014) emphasize that sanitation is likely to be effective if the following criteria are followed: (1) early detection, (2) rapid response, (3) continued monitoring to identify current attacks, and (4) persistent application of treatments until *D. ponderosae* populations return to endemic levels. (Carroll et al. 2006, Coggins et al. 2008)

Aggressive thinning (reducing stand density) with frequent stand entries may reduce the susceptibility to attack. Less aggressive or extensive thinning may not reduce stand susceptibility and stands that have been thinned to around 80-90 square feet of basal area have incurred heavy beetle associated mortality (over 50%) when surrounded by unmanaged forest (Schmid and Mata 2005). Lower residual stand density leads to greater reduction in beetle caused mortality in both even and uneven aged stands (Schmid et al. 2007, Negrón et al. 2008). Large scale treatments, such as thinning, even during an epidemic can help abate mountain pine beetle caused mortality (Negrón et al 2017).

The use of the anti-aggregation pheromone Verbenone has been tried multiple times in the past and during the most recent epidemic. Generally, the results have been poor for providing protection to ponderosa pine in the Black Hills (Negrón et al 2006 and Ball and Allen, personal communication). However, Verbenone did appear to have a preventive effect when used on the relic population of limber pine found in the Black Hills.



(Black Hills aerial photo, June 2009. USDA Forest Service photo)

II. Mountain Pine Beetle Strategies – West-wide & Black Hills

A number of MPB strategies throughout the west were used to guide actions in the Black Hills. Each utilized the best available science and research in formulating their respective goals, objectives, and strategic implementation and included some type of strategic response zone. See: Canadian Province of Alberta (2007); The Black Hills and Surrounding Lands MPB Strategy (12/20/11*); states of South Dakota and Wyoming, Statewide Forest Resource Assessments and Statewide Forest Resource Strategies; Western Bark Beetle Strategy (US Forest Service, 2011); US Forest Service Black Hills National Forest Mountain Pine Beetle Strategy draft; Across the Western Landscape: Priority Issues and Strategies for Western Forests

(Western Forestry Leadership Coalition, 2011).

In 1999 Lawrence, Meade, and Pennington County Weed & Pest Boards added MPB to their locally declared pest list. Their Boards of Commissioners declared the MPB a public nuisance in 2010 as per SDLC 41-21-3. Such declaration required the State to establish provisions to ensure that an adequate level of MPB control is accomplished on all privately-owned lands, and to establish the maximum state-federal cost share assistance to a private landowner for such control. As a result of these declarations MPB enforcement and control costs were the responsibilities of the state of South Dakota. A few counties in the Black Hills also developed their own mountain pine beetle management plans prior to the BHRMPBS.

* Prepared by the Black Hills Forest Resource Association.

III. The Black Hills Regional Mountain Pine Beetle Strategy & Collaborative Accomplishments

The first outbreak of the epidemic was detected about 1996 in the Beaver Park Roadless Area of the northern Black Hills and spread mostly on national forest system lands for a decade. The USFS responded to the growing epidemic through adjustments in their timber sale program. States and counties responded through their jurisdictional authority, all entities taking what fire managers call uncoordinated “independent actions”. In 2010 the Black Hills National Forest supervisor convened a group of conservation-minded citizens, community and business leaders, legislators and agency officials in South Dakota and Wyoming. Dubbed the “Conservation Leaders”, the group recognized the potential for efficiencies and greater efficacy by coordinating actions across all private, state and federal lands in the greater Black Hills, including the Bear Lodge Mountains. Those leaders prepared and adopted the Black Hills Regional Mountain Pine Beetle Strategy, 5/7/2012 (BHRMPBS) with the goal “...not to eradicate the MPB from the Black Hills, but instead reduce the epidemic populations down to endemic levels.” The Strategy was revised in 2014 with a mission: “To reduce and mitigate the current mountain pine beetle epidemic towards endemic levels that promotes long-term economic, social and ecologic sustainability of the Black Hills region.” The Working Group guided implementation of four (4) goals, ten (10) objectives and thirty (30) actions contained in the BHRMPBS (see Appendix 4) to protect people and communities and key resources while at best buying time until the epidemic subsides or long-term steps could be taken to create more resilient forests.

Accomplishments and Investments

Following is a summary of the major implementation actions and accomplishments organized by the goals, objectives and action items contained in the BHRMPS.

Goal 1 – Reduce mountain beetle populations to endemic levels in strategic areas.

Plan and coordinate human, financial and physical resources...to combat current and future infestations. (Objective 1.1) -

Develop and support a list of accepted MPB reduction management tactics (Action 1.1.1):

A complete list of practices prepared by SDRCF (Appendix 7) was accepted by the Working Group. Following are the most used practices and accomplishments.



(Figure 2 “Cut/Chunk” direct control to speed desiccation of MPB larva in infested trees)

Direct control – The most frequently used non-commercial, direct control method was a solar treatment, commonly termed “cut and chunk”, involved felling of infested trees and cutting them into pieces less than 24” long prior to March 1 to allow adequate time for phloem drying and larval death before emergence typically in August the following year (Allen and Foss, 2010; Ball and Taecker 2013). In this tactic, all infested trees in an area must be treated. Cutting and chunking is most effective when applied to medium sized spots of infested trees (spots of roughly 10-100 trees). Spots larger than this will likely still expand as the population is high enough that there will still be sufficient beetle emergence. Spots smaller than 10 require large amounts of effort to locate and with just a few trees there is an equal likelihood of the spots not expanding regardless if any treatments are done. This method is accepted as a stop-gap measure or “holding action” for localized, important areas until indirect methods (commercial thinning) is completed (Fettig et al 2014). Treated areas must be re-visited annually to treat any new infested trees.

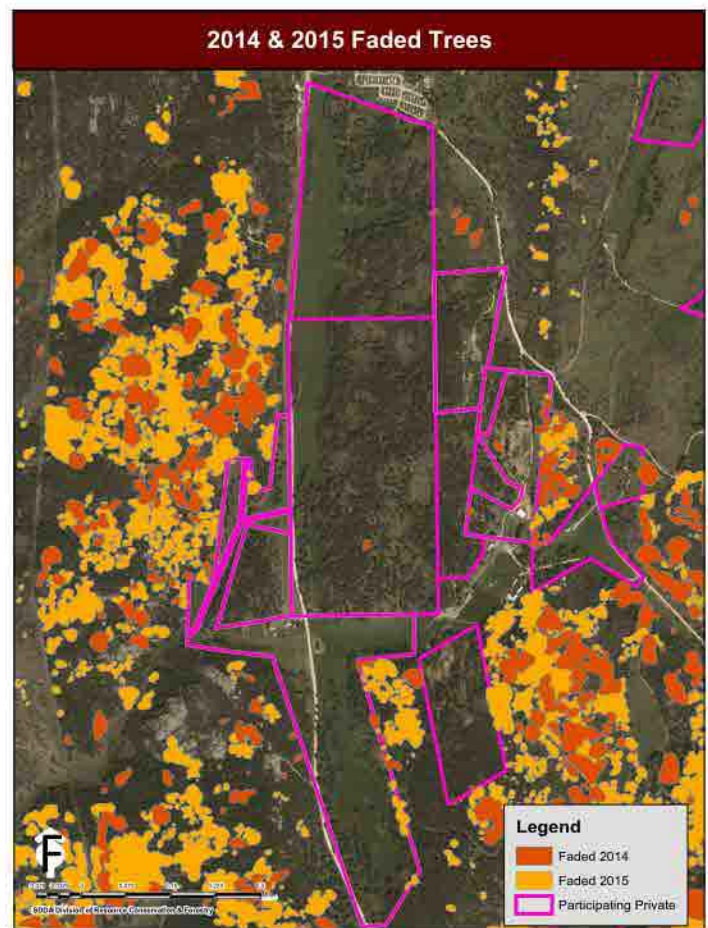
An example of direct control implementation was completed by the USFS-Mystic Ranger District and Pennington County Weed & Pest in the Buck Mountain Timber Sale Area. The area had 3,547 acres included in the USFS’s Mountain Pine Beetle Response Project (PBR) Record of Decision. In December 2012

Pennington County, in cooperation with USFS-Mystic Ranger District agreed to implement MPB landscape treatment for the Buck Mountain sale area.

Salvage sale options were explored but not considered viable, thus cut and chunk treatment was pursued. Funding was donated by Neiman Timber Company. The project was a “holding action”, until the area could be commercially thinned to a lower basal area – reducing susceptibility to future infestations. A total of 3,217 trees were cut and chunked by Pennington County contractors from 2/14/13 – 3/8/13. In agreement with USFS, the county did not cut trees identified in pockets of 10 or less, resulting in cost savings and providing reference sites for future evaluation of the treatment. A February 2014 survey of the 25 units found that of the 3,095 MPB infested trees previously identified, 2,875 were cut and chunked and 220 were left standing in groups of 10 or less. The following year 1,917 newly infested MPB trees were identified within the same survey units. The average MPB infested trees per acre dropped from 1.35 to 0.76 within the survey units, a 38% decrease of infested trees compared to previous year, and on average a 43% decrease in MPB infested trees per acre. The survey found that one year following treatment, cut and chunk was successful at “holding” this area for further treatment. Isolated MPB infested tree pockets of 10 or fewer decreased and dispersed and did not expand. (Guffey, 2014)

Across the Black Hills, over the 6-year period 2012-2017 cooperators non-commercially treated nearly 1.3 million infested trees across a cumulative 864,000 acres (Table 1) that includes some untreated areas amongst treated infested trees and patches. Annually an average of nearly 1,100 private landowners in SD and WY signed up for cost-share (SD) or full payment (WY) programs to survey their property for infested trees and have them treated (cut and chunked). Agencies worked with other landowners and the USFS, to ensure infested trees on both sides of property boundaries were treated, i.e. an “all-lands” approach. Initial monitoring found that in some areas the direct control, cut and chunk tactic, was not implemented correctly nor consistently. Some areas were treated that had hundreds of infested trees, too many for effective treatment. In other cases, infested trees were missed or un-infested trees were cut. While this problem was largely corrected through training, in some cases addi-

tional direction from and coordination with the Forest Service was needed. Thereafter, the state forestry agencies (SD & WY) assumed more direct involvement with counties in training field workers and contractors across the Black Hills. The RCF and USFS-FHP developed a pocket card “MOUNTAIN PINE BEE-TLE INFESTED TREE IDENTIFICATION ON PONDEROSA PINE TREES”, i.e. a “infested tree ID card” (see Appendix 5) to help field crews more accurately determine which trees were infested and where non-commercial direct control methods would be effective.



(Figure 3- 2014 & 2015 infested areas mapped from aerial photography. Land in middle had direct control “cut/chunk” treatment annually until epidemic ended in 2016.)

Wyoming State Forestry Division used hand axes to determine presence of blue stain and thus actual mortality. Some Forest Service timber contracts or administrators permitted timber purchasers to remove trees with as few as one beetle “hit” (pitch tube) per tree that would be cut and hauled to a mill. That direction was appropriate in a timber sale since the trees were paid for, utilized, and the residual stand was thinned.

However, one pitch tube on the bole does not lead to mass attack mortality, thus the effort and expense of a stand-alone cut and chunk or other non-commercial direct control treatment was not appropriate.

Some fire/fuel managers not involved in the collaborative discussions were concerned about creating downed fuel during cut and chunk operations (see Figure 2). Land managers considered those concerns but opted to continue with direct MPB control. The benefits of direct control included fewer standing dead trees, slower MPB population growth that if unchecked would lead to exponential increases, sometimes 6x, in the number of infested trees across a larger area, and eventual jackstraw configuration of downed tree-length pieces that are difficult to handle during fire suppression. The extent and complex configuration of fuels was reduced in the long-term by cut and chunk (Figure 2 & Figure 4).



(Figure 4 - Untreated "beetle kill", Black Elk Wilderness, 2016)

Sanitation – Removal of infested trees was done through timber harvest, which proved to be the most effective and economical method of treatment. Over 6 years, this method removed an estimated 1.4 million infested trees, about 16% of total harvested trees (Table 1), concurrent with harvest thinning thus reducing infested tree density and improving resistance to future attack via thinning.

Some counties in cooperation with the Forest Service surveyed and treated timber sale areas prior to being sold, as a holding action to maximize total timber harvest. Large infested areas were salvaged through small sale agreements.

Others – Other variations of direct control available for cost-share for South Dakota landowners included: cut/chunk/split, cut/peel, cut/chip, and cut/remove (harvest). The most effective treatment was commercial harvest (thinning) and cut and chunk (and leave in place).

Baiting and removal – The use of aggregation pheromones (tree baits) was tried on an experimental basis using two approaches: 1) bait trees and then destroy them after insect attack, or 2) spray trees with pesticide then apply pheromones to attract beetles to the treated trees. Both appeared to have value on a small scale, however were never intended for mass use. The main deterrent on baiting techniques is the concern over use of tree baits and their high likelihood of creating new mini epidemics if the baited areas were not treated in a timely fashion.

Solar treatment – Cutting and covering infested trees with plastic was an option investigated, but not usually recommended due to higher cost and frequent incorrect application which limited its effectiveness.

Preventive spraying – Public land management agencies treated over 32,000 trees in recreation areas and administrative sites over the 6-year period, an average of nearly 5,400 trees annually to protect aesthetically valued trees (Table 1). In addition, private landowners treated thousands of trees, mostly via private contractors, to protect trees around homes and property. This method, although effective, was expensive and limited logistically by the need to spray each tree to a height of approximately 50 feet or 5" top



(Figure 5 - solar treatment MPB infested trees. Note need to thoroughly cover edges. Photo: BeattheBeetles.com)

diameter ensuring all portions of the bole were sprayed. Three insecticides are labeled for bark surface application that kill beetles contacting it when boring into bark. Each of these has label restrictions to consider when using: **Bifenthrin** is the active ingredient found in Baseline, Bifen XTS, and Onyx. **Carbaryl** is the active ingredient found in Carbaryl 4L, Sevin XLR Plus and Sevin 4L. **Permethrin** is the active ingredient found in Astro and Tenugard SFR (Ball, 2012). The preventive treatments proved very effective when used according to label direction to protect individual trees but was not intended for use as a large scale MPB control technique. A few counties offered equipment for private landowners to use to spray their trees, other counties offered a cost-share program if a certified commercial applicator did the treatments.

Problems developed in the preventive spraying program. As the epidemic progressed, the number of spray vendors in the area jumped and the increased competition caused application prices (per tree) to drop markedly. Some contractors began applying the insecticide at below-label rates, subsequently some trees were successfully attacked. In some instances, this led to litigation between property owners and contractors.

Table 1

MOUNTAIN PINE BEETLE ACCOMPLISHMENT SUMMARY 2012 - 2017 (2/6/2018)								
"All Lands" - Black Hills Regional MPB Working Group (SD & WY)								
	2012	2013	2014	2015	2016	2017	6-Year Total	Mean (/yr)
Direct Control MPB Treatment (acres) ¹	136,386	165,973	244,810	175,311	113,554	28,407	864,441	144,074
Direct Control MPB Treatment (# trees)	314,970	342,575	337,936	221,683	62,602	14,694	1,294,460	215,743
No. Private Landowners Surveyed (SD&WY) ²	1,781	1,156	1,325	821	826	649	6,558	1,093
Timber Harvest (acres)	39,655	26,888	26,571	30,982	31,139	32,750	187,985	31,331
Timber Harvest (infested trees) ³	625,000	330,598	187,224	229,219	50,314	9,500	1,431,855	238,643
Timber Harvest (total est # trees harvested)	1,525,821	1,504,311	1,254,079	1,720,000	1,500,000	1,500,000	9,004,211	1,500,702
Sawmilled Trees Infested (%)	41%	22%	15%	13%	3%	0.6%		16%
Non-Commercial Thinning (acres)	13,016	9,245	9,269	15,544	11,093	14,851	73,018	12,170
Preventive spraying (# trees, public) ⁴	9,473	1,520	3,311	7,010	5,524	5,454	32,292	5,382
Road ROW treated (miles) ⁵	NA	34	212	158	290	150	844	141
Public Information Workshops (no.)	12	12	11	22	25	16	98	16
Total Attendees (no.)	365	225	312	550	590	247	2,289	382

1 - "Non-Commercial MPB Treatment (acres)" is area traversed and treated by workers & does not mean an infested tree treated on every acre; treatment often overlaps from year to year and is not cumulative, and is mostly on private and adjacent lands.
2 - Number is actual tally of pvt landowners in SD + an estimated 150 landowners for each year in WY.
3 - Timber harvest (infested trees) in 2012 is estimated. Harvest 2012-2014 includes only NTC producers. 2015-2017 includes all producers. Mostly commercial thinning, the most effective MPB treatment and improves long-term resiliency.
4 - Preventive spraying data only done by public entities, i.e. does not include that done by private landowners.
5 - SD Dept. of Transportation and Pennington County (other entities not reporting).

Identify and leverage varied funding sources in addition to current levels (Action 1.1.2)

In total over \$106 million was invested by partners from 2012-2017 for prevention, direct control and treating for long-term healthy and resilient forests, an average of \$17,741,388 annually. All partners investments shown on Table 2. Note that seventy-four (74%) percent of investments were for long-term forest health and resiliency (approximately the normal non-MPB budgeted program for harvest and thinning) and about a quarter (26%) was for MPB prevention, direct control and some remediation. Partners pursued and used various funding sources available including specific appropriations from the SD and WY legislatures for mountain pine beetle programs directed through states and counties. Federal congressional delegations strongly supported increased appropriations to the USFS National Forest System for mountain pine beetle work through timber sale appropriations.

The USFS, with the largest land base, invested nearly \$75 million mostly for long-term forest health via commercial (timber sales) and non-commercial thinning and lesser amounts for preventive spraying in recreation sites.

In December of 2010, SD-RCF in cooperation with Custer, Lawrence, Meade and Pennington Counties received a \$170,000 grant from USFS. The funds were used to identify and remove or treat MPB infested trees on private and USFS lands. SDRCF trained county weed & pest crews to identify and mark MPB infested trees, was the first point of contact for private landowners that wanted their lands inspected, coordinated marking efforts with county crews, and reimbursed landowners at agreed rates for treatments completed. Some counties continued to reimburse landowners after the USFS funds were depleted.

In 2011 the SD governor launched the Black Hills Forest Initiative followed in 2012 when the SD legislature approved \$6.1 million (\$4.0 million for BHFI and \$2.1 million for Custer State Park) for a three-year period. In 2013, the Black Hills Forest Resource Association and MPBWG worked with the SD legislature to appropriate \$2.0 million for additional funding for MPB suppression work done by counties (House Bill 1050). In 2014 the SD legislature appropriated \$1.95 million (Senate Bill 28) and in 2015 appropriated \$750,000 (Senate Bill 152) for MPB work to be done by the RCF through a collaborative all lands response. State appropriations were supplemented by USFS Forest Health Protection Western Bark Beetle Suppression grant funds and Landscape Scale Restoration Competitive Grant funds which totaled \$1,000,600 over the five years. South Dakota private landowners invested \$1.5 million for their cost-share match.

The USDA Natural Resources Conservation Service made funding available through the Environmental Quality Incentives Program for participating private landowners. The USDA appropriated additional funds thru the USFS and NRCS for the Vestal Area Joint Chief's Landscape Restoration Partnership Project. Counties (SD) allocated available funds for direct control when available through various funding sources. Some counties tapped the Secure Rural School Act Title II and III funds for use on National Forest lands. Donations were also made to counties to assist in the effort. Crook and Weston County Weed & Pest Departments along with their natural resource districts (WY) cooperated with the Wyoming State Forestry Division in sponsoring marking crews using State and Federal funding. Electric utilities ramped up expenditures for treating dead and infested trees along power line rights-of-way. Last, private landowners, with their own funds, or supplemented by public funds did treatment on or adjacent to their lands. Because of the thousands of acres of private lands and goal for all-lands treatment, the State of SD provided 50/50 cost share in the first two years, and in subsequent years provided 75/25 reimbursement to landowners for the cost of direct control to ensure buy-in. The State of WY, had fewer private landowners, and thus was able to reimburse and/or directly contract the full cost of gridding and treating infested trees on about 40,000 acres of private land to ensure effective, landscape-level treatment.

Private timber industry (Neiman Timber Company) contributed nearly \$1 million for sanitation and direct control work done by county weed and pest departments. The City of Spearfish, City of Custer, Silver City, Spearfish Canyon Foundation and others made investments to treat infested trees in their areas. Meade County solicited private contributions for treatment efforts and, using BLM fire preparedness grants, developed a "Veteran's in the Woods" program to employ veterans in a work-readiness and transition program to help homeowners. A Spearfish Canyon group hosted bake-sales, that financially supported the effort in a small way and garnered public awareness and support for localized treatments. The tribes through the Bureau of Indian Affairs invested nearly \$170,00 to treat beetle-killed trees and fuels at Pe' Sla, their recently acquired lands.

Critical support was provided by Governor Daugaard (SD) and Governor Meade (WY), individual legislators and local government officials who worked with resource managers and legislative specialists to obtain additional State funding and the US congressional delegation who successfully advocated for adequate federal funding.

Table 2 – Investment Summary 2012-2017, All Partners

Annual Investments 2012-2017								
Black Hills Regional Mountain Pine Beetle Strategy (11/16/17)								
Working Group Entity	INVESTED FY2012	INVESTED FY2013	INVESTED FY2014	INVESTED FY2015	INVESTED FY2016	INVESTED FY2017	Total 6-Year Investment	Average Annual Investment
Custer County (county funds & CCCD)	\$ 22,948	\$ 101,155	\$ 68,155	\$ 19,238	\$ 19,800	\$ 19,956	\$ 251,251	\$ 41,875
Fall River County, SD (county funds)	\$ 5,000	\$ 5,000	\$ 2,500	\$ 500	\$ 500	\$ 500	\$ 14,000	\$ 2,333
Lawrence County, SD (county funds)	\$ 700,000	\$ 590,000	\$ 500,000	\$ 438,605	\$ -	\$ -	\$ 2,228,605	\$ 371,434
City of Deadwood	\$ -	\$ 100,000	\$ 50,000	\$ -	\$ -	\$ -	\$ 150,000	\$ 25,000
Neiman Timber Company	\$ 100,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ -	\$ -	\$ 250,000	\$ 41,667
City of Spearfish	\$ 90,000	\$ 60,000	\$ 60,000	\$ -	\$ -	\$ -	\$ 210,000	\$ 35,000
Spearfish Canyon Foundation	\$ 330,000	\$ -	\$ -	\$ 20,000	\$ -	\$ -	\$ 350,000	\$ 58,333
Other Contributors	\$ 50,000	\$ -	\$ 10,000	\$ -	\$ -	\$ -	\$ 60,000	\$ 10,000
Lawrence County - subtotal	\$ 1,270,000	\$ 800,000	\$ 670,000	\$ 508,605	\$ -	\$ -	\$ 3,248,605	\$ 541,434
Meade County SD (county funds)	\$ 15,000	\$ 136,319	\$ 217,000	\$ 92,340	\$ 8,895	\$ -	\$ 469,554	\$ 78,259
Pennington County SD (county funds)	\$ 73,238	\$ 22,955	\$ 342,018	\$ -	\$ 129,221	\$ 89,425	\$ 656,857	\$ 109,476
Title II/III	\$ 398,870	\$ 121,381	\$ -	\$ -	\$ 38,000	\$ 14,613	\$ 572,864	\$ 95,477
Neiman Timber Company	\$ -	\$ 50,000	\$ 50,000	\$ 50,000	\$ 25,000	\$ -	\$ 175,000	\$ 29,167
State Grant	\$ -	\$ 25,300	\$ -	\$ 321,116	\$ -	\$ -	\$ 346,416	\$ 57,736
Private & Silver City VFD	\$ 81,427	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 81,427	\$ 13,571
Pennington County - subtotal	\$ 553,535	\$ 219,636	\$ 392,018	\$ 371,116	\$ 167,221	\$ 104,038	\$ 1,807,564	\$ 301,261
SD Counties (Total)	\$ 1,866,483	\$ 1,262,110	\$ 1,349,673	\$ 991,799	\$ 196,416	\$ 124,494	\$ 5,790,974	\$ 965,162
State of South Dakota								
Custer State Park (CSP)	\$2,107,247	\$ 1,232,233	\$ 824,280	\$ 540,933	\$ 346,072	\$ 177,590	\$ 5,228,355	\$ 871,393
Private Lands (for pvt. cost-share)	\$678,561	\$ 1,936,415	\$ 1,228,288	\$ 851,921	\$ 477,588	\$ 285,568	\$ 5,458,341	\$ 909,724
Spec. Appros. (incl work NFS & co. pmts.)	-	\$ 570,000	\$ 894,946	\$ 850,655	\$ 292,975	\$ 31,951	\$ 2,640,527	\$ 440,088
SD Dept of Transp (ROWS)	-	-	-	\$ 134,000	\$ 452,136	-	\$ 586,136	\$ 97,689
State of SD sub-total	2,785,808	3,738,648	2,947,514	2,377,509	1,568,771	495,109	13,913,359	2,318,893
Private Landowner cost-share	\$ 726,645	\$ 269,560	\$ 274,292	\$ 162,961	\$ 62,545	\$ 14,110	\$ 1,510,113	\$ 251,686
State of Wyoming								
WY Div. of Forestry- via Federal Funding	\$ -	\$ -	\$ 300,000	\$ 300,000	\$ -	\$ 67,085	\$ 667,085	\$ 111,181
State WY grants via: WDA, WSFD, WVNRT, WWTF	-	-	-	-	-	-	-	-
Crook/Weston NRD (*WY State Funded Grants)	-	\$ 919,000	\$ 1,078,601	\$ 1,099,876	\$ 1,856,000	\$ 334,087	\$ 5,287,564	\$ 881,261
Forest Health (NRCS for Crook & Weston)	-	-	\$ 500,000	\$ 285,000	\$ 306,079	\$ 409,485	\$ 1,500,564	\$ 250,094
Neiman Timber Co. (to WY counties)	\$ -	\$ 100,000	\$ 100,000	\$ 100,000	\$ -	\$ -	\$ 300,000	\$ 50,000
Black Hills National Forest	\$ -							
Timber Sales	\$ 10,254,600	\$ 7,800,000	\$ 8,640,900	\$ 9,300,000	\$ 10,588,000	\$ 11,366,000	\$ 57,949,500	\$ 9,658,250
Forest Health	\$ 420,000	\$ 244,000	\$ 166,300	\$ 208,600	\$ 156,000	\$ -	\$ 1,194,900	\$ 199,150
Thinning (Forest Veg)	\$ 2,068,046	\$ 2,131,000	\$ 3,782,592	\$ 2,350,000	\$ 2,124,021	\$ 3,347,000	\$ 15,802,659	\$ 2,633,777
Black Hills NF subtotal	\$ 12,742,646	\$ 10,175,000	\$ 12,589,792	\$ 11,858,600	\$ 12,868,021	\$ 14,713,000	\$ 74,947,059	\$ 12,491,177
USDA-NRCS (SD pvt land prog)	\$ 225,148	\$ 241,218	\$ 149,061	\$ 53,049	\$ 89,046	\$ 106,241	\$ 863,763	\$ 143,961
USDA-NRCS (Jt. Landscape Rest.Proj.)	\$ -	\$ -	\$ -	\$ 40,686	\$ 96,242	\$ 38,426	\$ 175,354	\$ 29,226
USDA-NRCS (WY pvt land prog)	-	-	\$ 220,215	-	\$ -	\$134,629	\$ 354,844	\$ 59,141
Bureau of Land Mgt (SD)	\$ -	\$ 22,000	\$ 114,000	\$ 117,000	\$ 130,200	\$ 66,000	\$ 449,200	\$ 74,867
Bureau of Land Mgt (WY)	\$ 30,000	\$ 108,000	\$ 119,000	\$ 122,000	\$ 40,000	\$ -	\$ 419,000	\$ 69,833
Bureau of Indian Affairs - (Pe' Sla)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 169,600	\$ 169,600	\$ 28,267
Nat'l Park Service (WICA, MORU, JECA)	\$ 27,200	\$ 8,000	\$ 10,000	\$ 24,650	\$ 2,500	\$ 500	\$ 72,850	\$ 12,142
TOTAL PARTNER INVESTMENT	\$ 18,403,930	\$ 16,843,536	\$ 19,752,148	\$ 17,533,130	\$ 17,240,820	\$ 16,674,766	\$ 106,448,329	\$ 17,741,388
TOTAL - 6 YEARS: Invested 2012 through 2017 =	\$ 106,448,329							
Proportion MPB Suppression/Forest Resilience								Mean/Year
Forest Resilience (harvest & thinning)	\$ 12,927,868	\$ 10,705,786	\$ 14,119,610	\$ 12,425,588	\$ 13,445,867	\$ 15,566,921	\$ 79,191,641	\$ 13,198,607
MPB Suppression (direct control & spraying)	\$ 5,476,062	\$ 6,137,749	\$ 5,632,537	\$ 5,107,542	\$ 3,794,953	\$ 1,107,845	\$ 27,256,688	\$ 4,542,781
Forest Resilience (%)	70%	64%	71%	71%	78%	93%	74%	
Suppression (%)	30%	36%	29%	29%	22%	7%	26%	

Leverage resources and implement policies, processes and programs (Actions 1.1.3 and 1.1.4)

Land managers pursued several administrative mechanisms to accomplish additional work.

Through an agreement process, RCF paid for marking crews hired by the Custer, Lawrence and Pennington Conservation Districts. The South Dakota Association of Conservation Districts (SDACD) contracted with RCF to provide administrative assistance to the conservation districts, and employed a full-time supervisor to run the crews. A total of \$2,125,849 was spent to hire up to 80 markers and forestry technicians on “bug-tree marking crews”. Those workers marked over a million infested trees. Treatment and removal of infested trees, and preventive spraying were completed by contractors.

Cooperative Agreements – All counties in the Black Hills region were active in MPB mitigation efforts depending on severity within their county. Custer County Weed & Pest had an agreement with the USFS that permitted the county to mark infested tree on national forest system lands up to 100’ from the center line of county roads. A county contractor cut the infested trees, decked them, and the USFS then sold the decks.

Lawrence County arranged agreements with the Northern Hills Ranger District to do mitigation efforts anywhere on national forest system lands and to also treat commercially along infested roadsides and assisted in marking timber sales. Some counties employed tree cutters as seasonal employees of the county, while other counties retained tree cutters as independent contractors to reduce workers compensation costs. The contracted tree cutters were required to have their own insurance and were reimbursed on the number of trees they cut.

Meade County, through agreement with the USFS, treated (direct control – cut/chunk) targeted areas of concern on national forest system land including valued natural resources and public rights-of-way. They were able to work closely around several small timber sales, directly targeting MPB inside and out of timber sale boundaries. Through the agreements, and with assistance from the State of SD, they created a buffer adjacent to private lands, limiting the MPB pressure felt by landowners.

Pennington County arranged through agreements with USFS ranger districts to cut and chunk MBP infested trees in 300-foot buffers next private landowners and additionally to salvage MPB and dead standing trees along county roads. They also had an agreement in place to enter upcoming timber sale areas to cut and chunk MPB trees and in some cases have small salvage sales before the area was sold.

The US Forest Service response was multi-faceted. Their first priority was the annual timber sale program implemented through the 5-year plan/schedule. Commercial thinning to reduce stocking was priority as the most effective treatment for MPBs. The MPB Working Group annually provided recommendations to the Forest Service on where to locate out-year sales. Often these recommendations were difficult for the Forest Service to implement in a timely manner as many sales were already in preparation. All timber sales were under an accelerated timeframe to meet timber sold targets. The sale schedule could not keep pace with the expanding MPB epidemic. This resulted in areas being hit by beetles and landscapes being impacted, in some cases heavily.

The Forest Service adjusted timber sale contract provisions to provide flexibility and speed up production. Timber sale area boundaries were extended further than the typical ¼ mile beyond cutting unit borders to provide more flexibility to treat newly discovered infested trees. The timber purchasers provided input to the Forest Service to identify those areas of susceptible “add-on” volume within sale areas. Marking of add-on volume did affect sale preparation production by shifting employees from sale preparation to sale administration work. Financial deposits for surface rock replacement on Forest Service system roads was waived for private landowners to expedite removal of infested timber from private lands. Timber sale contract termination dates were shortened in efforts to recover more infested trees. Timber industry had capability limits which lead to logging operations moving around more.

After concluding that the Forest Plan and project environmental documents were sufficient, the US Forest

Service authorized private landowners to cut and chunk infested trees on NFS lands within 300 feet of private property. The landowner could remove the tree under a firewood permit. This proved to be an effective means for the agency to respond to landowner concerns and meet land objectives. However, some individuals removed and unlawfully sold the trees, leading the Forest Service had to withdraw all such future authorizations.

Perhaps most significantly the USFS developed the Pine Beetle Response Project (PBR) to reduce environmental review time and improve responsiveness across a million-acre landscape with adaptive features to more swiftly address expanding pine beetle populations and reduce hazardous fuels (Bobzien and Van Alstyne 2014). The project saved up front analysis, but still required post-decision time for field verification, specifically for sensitive species and archeologic resources. This is an example of planning innovation that was critical for increased response.

RCF and USFS entered into multiple cooperative agreements during the five-year period. In addition to the aerial photography acquisition and analysis, other agreements included marking and treating MPB infested trees on BHNH lands adjacent to state and private lands, marking timber sales, and an agreement for the State to fund and complete cultural resource surveys and assessments in at least one project area (adjacent to STAR Academy south of Custer) to expedite sale and removal of infested trees. The cultural resource survey was paid for by RCF and completed by the office of the State Archeologist. With assistance from the State of SD the Forest Service was able to prepare the sale and sell the infested timber before the beetle flight.

Establish collaborative processes among interested local, state, private, tribal and federal entities (Objective 1.2) -

MPB Coordinator (Action 1.2.1) – a coordinator was retained via a consulting service agreement (contract) through the Black Hills Resource Conservation and Development Association, Inc. to serve as an information hub and facilitator for agencies, organizations and other stakeholders involved in MPB mitigation efforts. The intent was that the coordinator would not be affiliated with and not have other duties that would conflict if employed by one of the entities. The coordinator averaged 4-12 hours/week from 2013 through 2017, with funding provided by counties, Neiman Timber Company and the State of Wyoming.

MPB Working Group (Action 1.2.2) – a group of about eight entities was established to represent and guide actions on behalf of the larger “Conservation Leader” group and to make more efficient use of collaborative time. The MPB Working Group was responsible for creating and reviewing the annual MPB Action Plan identifying and coordinating specific agency and private activities to manage MPB populations for that season. The Action Plan was tiered to the Black Hills Regional MPB Strategy and other strategic documents including the Annual MPB Strategic Map. They also provided input and guidance to the MPB Coordinator on how to move forward with the Strategy. Working Group members initially included representatives of each of the area county weed & pest departments, county commissioners (3 representatives (2 SD, 1 WY)), WY and SD state forest management divisions (1 each), federal government (represented by the US Forest Service), and timber industry (2 representatives). The group met monthly during the peak of the collaborative MPB response 2013-2016 and less often thereafter, supplemented by occasional committee work. Over time the Working Group expanded to about 15 regular participants.

Education and public outreach (Action 1.2.3) regarding the issues, opportunities, resources risks and other information on the MPB epidemic.

Public workshops started in about 1999 at the beginning, but interest waned as damage was mostly in the center of the Black Hills and not readily visible. As the red trees of the MPB epidemic expanded into back yards, vistas and recreation areas in the 2000's, public interest grew markedly and the need for increased engagement became apparent. The Mountain Pine Beetle Working Group communication strategy was prepared and coordi-

nated by the USFS public information office on behalf of the MPBWG. It was designed and implemented to inform the public on the status, issues, risks and work being done using an “all lands, all hands” approach. The public affairs officer ensured that appropriate entities were represented in media activities thus reinforcing the collaboration. Elected officials, federal, state, county and city leaders as well as industry, tourism, business professionals, landowners and the public in general were informed. Many non-standard approaches to communication were used, the point being to ‘keep at it’.

With three-four million visitors to the Black Hills annually, WG partners designed a brochure, “Why are the Trees Dead?” to inform visitors at tourism venues (see Appendix 6). The NPS-Mt. Rushmore National Memorial and Dakotas Society of American Foresters prepared a very popular MPB display that interpreters regularly referred visitors to in the Mt. Rushmore Lincoln Borglum Visitor Center for about four years during the peak of the epidemic. Two items of most interest to visitors were vials containing dead beetles and photos showing beetle mortality progressing across a landscape. The NPS also interpreted the preventive spraying operation that occurred along the Presidential Trail and Avenue of Flags.

Concerns and responses by the tourism industry were studied by Cayhanto (2014). The study can inform future managers on public outreach and mountain pine beetle response.

Columns and media releases were written for news-



(Figure 6 - MPB interpretation sign, Custer State Park)

papers, messaging was done through radio talk shows, morning television shows and SD Public Broadcasting. Landowner meetings and public information workshops were held to share information about MPB biology and management. Media days were held throughout each calendar year to take the media to forest locations where MPBs were active. Reporters were also taken on sawmill and timber sale tours to see how infested trees were utilized. Booths were set up at county fairs, Central States Fair, and garden expos. Information was provided to electric cooperatives and power companies to insert in monthly newsletters.



(MPB Media Day, Oct. 2014. USDA Forest Service photo)

Seasonal safety messages were shared on social media and through news releases to inform hunters and recreationists of the dangers of standing dead trees. Briefings were held to update state legislators and an airplane was chartered several years to provide an aerial view of the problem for interested legislators. To help prevent the spread of mountain pine beetles, messages were placed with firewood permits to ensure people did not move infested logs for at least a year.

Finally, a video was produced entitled “Restoring Large Landscapes Across the Black Hills” that had 19 different spokespersons from federal, state, county and local agencies as well as business leaders, timber industry experts and private landowners. The message was simple; beetles do not know boundaries and we all have to work together to ensure strategies were consistent across all boundaries. <https://www.facebook.com/blackhillsnf/videos/1606187906308473/>

Public education workshops were held every year during the epidemic to inform landowners how to identify and treat infested trees, the value of spraying trees to prevent infestation, and the importance of timing to complete these activities. Almost 2,300 landowners attended about 98 workshops that were offered

over the five years.

RCF maintained a website specific to MPB called Beatthebeetle.com. The website contained press releases, scheduled workshops, infestation maps, and fact sheets describing insect biology, treatment options, cost-share programs, techniques for identifying MPB and infested trees, pesticides used for preventive spraying, the history of the epidemic, contact information, links to publications, and links to other applicable websites.

The community of Custer, in response to the MPB epidemic, used the arts as a vehicle to build awareness, understanding, and constructive responses to the changes occurring in their forested environment*. Under the umbrella of the Custer Area Arts Council, the Bark Beetle Blues committee with technical help from MPBWG members organized landowner workshops, trips to logging areas and beetle infested sites, a book discussion group**, and a variety show/bug crawl where beetle-themed live music, limericks, poetry, story starters, grief surveys and celebration filled the streets of downtown Custer. Bark Beetle Blues also partnered with the South Dakota Arts Council to bring puppeteers to the local YMCA to help children understand the changes going on in our forest. Since January 2014, Bark Beetle Blues has sponsored the annual Burning Beetle festival, that includes a beetle-themed variety show, torch march, fireworks, the burning of a 20-foot-long beetle effigy perched on an 8' tall stack of dead pines, and Bug Crawl event in downtown Custer featuring live music at eight venues. The community is pursuing an artist to create an art installation to continue the conversation about the relationship between the beetles, fire, climate, the forest and community. <https://www.facebook.com/barkbeetleblues/>



(Bark Beetle Blues, January 2015)

Conservation Leaders (Action 1.2.4) – per the Strategy conservation leaders met about twice annually to review progress and coordinate communication at a policy level. As the epidemic proceeded, participants became mostly the Working Group members, plus a few government officials and legislative staffers. These meetings were important in keeping the collaborative effort moving.

Create and review an annual action plan to guide MPB suppression efforts (Objective 1.3) –

* This paragraph provided by Hank Fridell, Chairperson, Custer Bark Beetle Blues Committee, Custer, SD, March 2018.

** The group reviewed *Empire of the Beetle* by Andrew Nikiforuk, 2011. Greystone Books, Vancouver, BC, Canada

Annual Action Plan and Map (Action 1.3.1) – The MPB Working Group developed a written annual action plan and a map (Appendix 2) to guide the location of direct (cut/chunk) and indirect (timber sales – thinning treatments). Forthright, extensive conversations were critical in targeting individual limited resources into a collective, coordinated suppression effort. Given the size of the Black Hills, partners had individual maps of their treatment areas that are not shown. The document was an important communication tool internally and with external groups, policy makers and legislators. The map included infested areas based on aerial reconnaissance, high resolution photos, and field crews. Priority treatment areas shifted throughout the five-year period. However, areas of prior treatments were not ignored. For example, in Custer State Park RCF removed or treated nearly 100 percent of MPB infested trees found every year, but continued to look for and treat infested trees until the epidemic ended. Partners learned from forest entomologists it was important to monitor and re-treat infested areas in successive years if needed.

Annual progress report (Action 1.3.2) – the MPB Working Group reported annually to policy makers and legislators on the progress of goals and objectives (see Appendix 3 – 2017 Accomplishment Report).

Goal 2 – Create and maintain healthy forests with diverse forest stand conditions that are resilient to future MPB epidemics and catastrophic wildfires.

Implement silvicultural practices to improve forest health and reduce susceptibility to future MPB infestations. (Objective 2.1) -

Increase diversity of tree age, size, and species, and reduce stand density (Action 2.1.1) – Working Group partners focused on reducing stand density consistent with research recommendations (numerous studies cited in Graham et al 2016).

Perform MPB sanitation and suppression efforts to protect individual trees and stands in a landscape context (Action 2.1.2) – During the period 2012 to 2017 partners harvested nearly 188,000 acres on all lands, consisting mostly of thinning mature ponderosa pine in the “resiliency” (1) and “restraining” (2) zones. An additional 73,000 acres of

non-commercial sized (<5.0-inch diameter) trees were thinned to improve growth and vigor to reduce fire hazard (see Table 1). Most harvest plans prescribed residual stocking less than 60-80 ft.² basal area/acre, in some cases as low as 40 ft.² where beetle density was high, and to retain hardwoods and spruce for diversity. Historically prescriptions had residual stocking of 120 ft.² for timber yield. Of the total sawmilled trees harvested from 2012-2017 about 16% were infested. This number was affected by the value of blue-stained boards at approximately half non-stained boards and many projects designed to improve long-term stand conditions via thinning while concurrently reducing beetle levels by cutting and removal (Table 1).

Implement actions to conserve and restore natural resources during and following this epidemic. (Objective 2.2) –

Treat noxious weeds (Action 2.2.1) – Noxious weeds were treated on about 7,900 acres in 2013 by the US Forest Service and area agencies, the only year when data was collected and is substantially less than what all partners likely treated. Conservation Leaders subsequently formed the Black Hills Invasive Plant Partnership in 2016 to emphasize and coordinate weed treatment across all ownerships and increase education efforts. Their work is progressing and they have developed a tiered invasive plant priority management list for the Black Hills region.



(Weed treatment on Forest. USDA Forest Service photo)

Reforest/reseed selected areas (Action 2.2.2) – Revegetation via grass/forb seeding is standard in state and federal contracts and for most operators. Although the MPB Working Group did not collect data for this work, anecdotal evidence points to forested

stands impacted by MPB were regenerating naturally through natural seed sources.

Sensitive habitats (Action 2.2.3) – Treatments done for MPB mitigation and future prevention were done only where authorized by the managing entity or owner under applicable objectives. Partners had detailed discussions early on whether and how to proceed with preventive thinning within northern goshawk nest stands in order to protect nesting habitat. Some suggested no disturbance, while others suggested that some careful thinning would retain current nesting structure and may provide for long-term nest tree survival consistent with USFS forest plan objectives. Anecdotally, some nest stands were lost to MPB. No treatment was done within research natural areas.

National Parks/Monuments – National Park Service policy often limits the opportunity for mechanical vegetation manipulation in broad areas. In this case the NPS at Mt. Rushmore National Memorial realized the importance of retaining large ponderosa pines as a key feature that adds visual character and framing to this national treasure. Thus, the NPS thinned pines on about 30 acres in selected areas throughout the Memorial to reduce dense trees and restore some degree of resilience, and also preventive sprayed several hundred trees near buildings to retain character, protect structures and provide for visitor experiences. The NPS at Wind Cave NP used prescribed fire to thin pines on 2,600 acres to improve resiliency. Jewel Cave National Monument cut infested trees in the administrative areas for several years.



(Mount Rushmore National Memorial June 2009. USDA Forest Service photo)

Maintain sufficient quantity and quality of water in local community watersheds. (Objective 2.3) –

Use Best Management Practices (Action 2.3.1) – BMP implementation is a contractual part of timber harvesting and forestry operations. A periodic field audit of BMP implementation was last completed in 2014. The audit team reported, “The audited timber sales scored highly in both application and effectiveness across all ownerships. Audited timber sales on all ownerships met or exceeded BMP application standards on 97 percent each of the total rated points. No instances of gross neglect in BMP application were cited on any timber sale, nor was there any instance of major departures from BMP application recorded. Across all ownerships, BMP

application standards were met or exceeded on 229 of 236 total rated items.” (Rupert, 2014).

Monitor research on watershed effects caused by the MPB (Action 2.3.2) – It was reported by USGS that beetle mortality is not a watershed problem as the mortality leaves a ‘rough surface’ that filters run-off, but severe fire has potential runoff problems” (USGS at RC&D workshop 2012). The USGS further reported there is “minimal hydrologic effect in non-snow influenced watersheds of the Black Hills but there are effects caused by severe wildfire...” (USGS at DSAF conference, 4/2014). “Effects caused by MPB mortality are minimal (1-2%) and are masked by an increase in understory vegetation and tree regeneration as mortality proceeds in a given area over a several years period. In contrast, fire may cause an immediate change in vegetation resulting in increased run-off that is more detectable. In 2015 the Black Hills area had a lot of rain and snowpack, at the same time as heavy MPB mortality, so the increase in runoff may have been attributable to MPB mortality, when in fact, when the precipitation level was factored out, there was little change due to MPB.” “...these observations are specific to the Black Hills region, where runoff/streamflow is driven largely by rainfall and spring flow. There are some different MPB hydrology research results out of Colorado, where runoff is much more driven by snowpack melt. The loss of trees seems to have a greater impact on snowmelt processes due to loss of canopy, etc.... (personal conversation and e-mail, 2/14/18, Galen Hoogestraat, USGS, Water Science Center, Rapid City, SD). Using modeling data from three Black Hills watersheds Freed (2016) reported, “The changes to streamflow from the mountain pine beetle infestation during normal or dry climatic conditions are perceived to be negligible, as they are well within one standard deviation of the mean annual streamflow in each of the watersheds.”

Preliminary results from water quality analyses between MPB impacted and unimpacted portions of the Rapid Creek, SD watershed with respect to sodium, sulfate, magnesium and dissolved organic carbon are not conclusive (Punsal, Sieverding et al, 2018).

Goal 3 – Ensure the viability of the current and/or expanded forest products infrastructure within the Black Hills region.

The timber industry is a significant component of the economy in western South Dakota and northeastern Wyoming, contributing about \$120 million to the local economy and supporting an estimated 1,400 direct jobs with additional indirect and induced jobs throughout the Black Hills. Timber operations remain the most cost-effective means to treat the mountain beetle and to create healthy and resilient forests in a ponderosa pine disturbance-oriented system with over 300,000 acres of intermixed private lands. Thus, this goal was important to a Hills-wide MPB strategy.



(Figure 8 - Bearing Timber Sale, Feb. 2016. USDA Forest Service photo)

Maintain a sustainable timber supply based on needs to existing infrastructure. Objective 3.1

Utilize timber sales to thin over-stocked stands of ponderosa pine (Action 3.1.1) **and remove infested trees (sanitation)** (Action 3.1.2) During the period 2012 to 2017 partners on all lands harvested nearly 188,000 acres most being thinning of mature ponderosa pine. An estimated 1.4 million of the harvested trees were infested, i.e. “sanitation cut” via removal. An additional 73,000 acres of non-commercial sized (<5.0-inch diameter) trees were thinned



(Figure 7 – Local sawmill with blue-stained boards ready to ship.)

to improve growth and vigor to reduce fire hazard (see Table 1).

Provide a means of communication regarding harvesting activities (Action 3.1.3) – partners met monthly to share information, discuss operations, prioritize treatment and share results.

Develop and implement timber sale programs to supply the current forest products industry (Action 3.1.4) - Each partner developed timber sale programs commensurate with their land base, management direction and funding. Total outputs in Action 3.1.2, above). The USFS, the largest land manager, prepared and offered timber for sale as per annual funding direction. The State of SD offered timber for sale from Custer State Park. SD and WY agencies worked with private landowners on management plans and prescriptions for timber sales. The USDI-BLM offered several sales in the Deadwood and eastern Wyoming areas.

Support utilization of woody material that is currently being under-utilized. Objective 3.2

Promote and develop new markets ... specifically underutilized and blue-stain ponderosa pine (Action 3.2.1) - During the epidemic there were several efforts by private businesses/investors to utilize small material and blue stained pine. A private company developed and marketed a promising market for wood pellets for oil field remediation and livestock bedding, although the operation was short-lived with limited success. Another private company attempted increased in-woods chipping for cabinet panels with promising but limited results. Lumber producers sorted out blue-stained boards and developed a successful market for blue-stained, tongue-groove paneling. During this same time, there was an increase in post-pole production as a local company shifted sourcing to use more Black Hills pine trees. This increased market provided a major change in the ability for landowners, particularly the USFS, to sell small trees from thinning (“POL”) projects. The most profitable stumpage center remains sawtimber, which drives most other markets in the Black Hills area.

Goal 4 - Ensure people and community infrastructure are protected from the hazard created by standing dead trees killed by MPB and

the resulting elevated hazardous fuels which lead to catastrophic wildfires. Mitigate falling tree hazards to people and community infrastructure. Objective 4.1

Remove hazard trees along the highest priority roads, emergency routes, trails, power lines, recreation areas and facilities (Action 4.1.1) - The SD Department of Transportation and Custer and Pennington Counties treated 844 miles of road ROW removing dead and infested trees and, in some cases, thinning the residual trees to create fuel breaks. Additional unreported ROW work was completed by Meade and Lawrence counties.



(Figure 9 - MPB killed trees, Pennington Co. Rd. photo: S. Guffey)

Develop and implement means to warn the public of falling tree hazards in untreated areas or sites (Action 4.1.2) - Partners posted warning signs in recreation sites, along trails and roads, used media releases, and included information in brochures and on websites/social media.



(Figure 10 - Trail warning sign. photo: D. Thom)

Coordinate with local utilities to treat dead and infested trees next to infrastructure (Action 4.1.3)

- Black Hills area utilities paid careful attention to beetle killed trees along power lines. Black Hills Electric Cooperative spent \$1.85 million dollars cutting bug trees 2012-2017 on approximately 920 miles of distribution lines. Butte Electric Cooperative, Inc. in 2012 created a work order and spent \$84K to treat MPB infested/dead trees. In 2013 and 2014 they spent about \$75K annually, and 2016-2017 averaged \$65K annually on about 50 miles of overhead powerlines within forested areas. Black Hills Energy spent significant funds to treat powerlines within the Black Hills area, although detailed figures were not reported.

Decrease risk of catastrophic fire associated with elevated fuel loadings following beetle infestation, particularly in the Wildland Urban Interface. Objective 4.2

Implement fuel break treatments in strategic locations that complement Community Wild-

fire Protection Plans (CWPP) (Actions 4.2.1, 4.2.2 & 4.2.3) - The Meade County Firewise “Veteran in the Woods” program started mid-way through the project using USDI-Bureau of Land Management grant funding to treat 48 properties totaling 71 acres to Firewise standards and employed returning veterans. Private landowners under the Custer County Conservation District thinning cost-share program treated 139 acres with a focus on property protection. The Bureau of Indian Affairs – Rosebud agency as the administrator for a combined tribal property (Pe’ Sla) did thinning and fuel work on 336 acres. They joined the collaborative group after acquiring the property later in the MPB epidemic. The State of Wyoming and cooperators thinned 3,684 acres for forest health and fuel reduction. Additional treatments occurred under the State of South Dakota, Division of Wildland Fire, program for treating identified high priority fuel treatment areas, and for enrolled private landowners, but were not recorded as a part of the collaborative effort. While partners in public information workshops provided some information on Firewise programs it was not a specific emphasis during the MPB epidemic. Other entities did much of that information distribution. In August of 2015 Mystic Ranger District and Pennington County entered into a 10-year Stewardship Agreement, only the second time this type of agreement had been utilized in the entire Region 2 of the Forest Service. The agreement allows Pennington County to construct shaded fuel breaks, with proceeds from commercial products harvested within the fuels breaks used to offset the cost of the fuel mitigation work. Additional collaborative fuel treatment work will be done and reported under the newly forming Black Hills Resilient Forest Partnership.



(Silver City Stewardship Agreement May 2017. USDA Forest Service photo)

IV. Discussion

Mountain pine beetles expanded beyond endemic levels in the Black Hills starting as early as 1996. Despite a thriving forest industry and a national forest that led the nation in timber harvest, much of the forested land across all ownerships was overstocked with ponderosa pine setting the stage for epidemic mountain pine beetle populations. Landowners and managers responded within their jurisdictions, but the beetles expanded across the Black Hills. Recognizing the need to coordinate efforts, in 2010 a group of “Conservation Leaders” including local, state and federal agencies, private industry, conservation/natural resource districts, private landowners and interested citizens gathered to share their concerns and actions needed to address a worsening beetle epidemic. It became apparent that more could be done by coordinating efforts. They developed a strategy that provided for a collaborative approach across all lands.

Over the following six years partners non-commercially treated over 1.3 million infested trees and sawmilled about 1.4 million infested trees, thus limiting spread in key localized areas. Partners worked to create more resilient forests through commercial harvest (thinning) on 188,000 acres and pre-commercial thinning on about 73,000 acres. Nearly 1,100 participating private landowners protected their lands by treating infested trees and thinning residual trees. About 2,300 landowners attended workshops to learn about insects and forest management. During this process partners learned and adjusted practices and policies as forest entomologists monitored progress. Perhaps a more enduring result is the relationships built and the understanding that collaboration and partnerships across landscapes is critical given the complexity of forest land management. At the end of the 6-year effort those Conservation Leaders believed it important to share what they learned to inform future managers of the actions taken. Following are observations on what was learned, taken from a 12/8/17 meeting of Conservation Leaders and a subsequent review team.

V. Lessons Learned and Recommendations

- a. The foundational goal of the MPWG and stakeholders was to accomplish more forest management and MPB suppression activities by combining local, state, and federal entities, along with the timber industry.
- b. Define the overall strategy up front. View the strategy as using various measures to protect the most critical lands over the course of the epidemic. The use of “response zones” and “action planning” was critical. Must follow-up treatments in successive years to reduce the beetle pocket. It is not possible to treat every acre.
- c. Science and experience told us that proactively managing for resilient forests, i.e. generally keep forests thinned and diverse, is less expensive than having to react to unhealthy forest conditions.
- d. An established forest industry is critically necessary to cost effectively carry out treatments.
- e. A collaborative process brought all those with a vested interest together to work on problem solving. Recognize the potential for a Hills-wide event and start the collaborative work earlier. Also, have clear leadership and better define the roles of collaborators.
- f. If treatments are proposed on NFS lands, there needs to be one voice/decision on how they will be applied to reduce confusion among ranger districts and collaborators and loss of effectiveness. Be sure there is clear understanding of priority (“leaders’ intent”) from the top to the lower levels.
- g. Opportunities exist to “stretch” forest products capacity to treat acres through varying treatment methods or prescriptions. Not every prescription will be of value in every location, i.e. one size does not fit all.

h. It was critical to work on all lands since the beetle does not stop at boundary lines. The FS private landowner authorization letter to cut infested trees on NFS land adjacent to private land was successful in increasing treatment effectiveness and reduced landowner complaints. The USFS needs some on-the-ground checking to ensure property owners are following the terms of their permit, i.e. not selling trees. Use this tool early-on.

Funding:

i. Funding was made available through a variety of sources. Legislators reported that a key factor in appropriating funds was that the entities were all working together across boundaries for greatest efficacy. Initially State-level (SD) funding for MPB control was appropriated directly to counties. After several years legislators appropriated funding to the SD Department of Agriculture to administer and implement the program. This change necessitated increased communication to ensure counties remained engaged.

j. A collective, unified approach to State legislators is important in explaining the situation and gaining policy and financial support for this State-wide (SD and WY) issue.

k. Wyoming Governor's Task Force on Forests was critical to securing funding.

Research/science/monitoring:

l. Research informed managers that stand density and diversity is the driver in MPB epidemics in the Hills, not a changing climate.

m. Research and science were regularly presented during planning and implementation and added credibility. Forest health specialists and entomologists should identify effective practices and make recommendations for application in the Black Hills.

n. National and regional-level research formed a science foundation and was modified that applied using specific research and experience from the Black Hills.

o. Forest health specialists/entomologists conducted monitoring checks to see that prescribed practices were correctly implemented. In several instances they found that on-the-ground direct control treatments cut marginally infested trees or missed some infested trees that would reduce effectiveness. Their reports led to improved practices.

p. Partners learned that broad scale aerial reconnaissance and high-resolution aerial photography have different purposes. Continue to track detection method technology.

Processes:

q. The "Working Group" of the Conservation Leaders was helpful in forming a smaller group of people, i.e. about 12-15, to work on strategic and tactical issues. It's important to have the right person/s at the table. Engage the USFS district rangers to provide more field level perspective and ensure field-level buy-in.

r. An independent coordinator who knew the various entities and facilitative processes was important to keeping the project moving.

s. The Forest Service conducted a Forest-wide environmental analysis for MPB treatment ("Pine Beetle

Response Project”) to expedite treatments. While it significantly reduced time spent on what would have been 3-5 separate project analyses, the need for post-decision field review remained before a project could be implemented. Steps to further expedite NEPA planning and implementation should be explored.

t. All parties gained an understanding of other’s administrative policies and processes and worked to overcome barriers to reach solutions.

u. Interagency or cooperative agreements served useful in getting additional work done. Pursue them readily in the next epidemic, or other management situations for that matter.

Communication/Media/Education:

v. The Forest Service public affairs office prepared a media plan and coordinated most media work. All parties participated depending on the topic. “All Hands” was a consistent message. Telling the story = public support = funding = more work.

w. Partners regularly discussed media points and insisted on a single spokesperson (the coordinator) so the messages were consistent and there was no finger pointing among partners.

x. The relationships built through this process were critical and can endure!

VI. The Future

Conservation Leaders in the Black Hills have taken this experience to heart and are working to set the stage for more diverse forests that are resilient to insects and fire. They have completed a Black Hills Resilient Forest Strategy to be implemented by the Black Hills Resilient Forest Partnership and the Black Hills Invasive Plant Partnership. These future efforts will also engage fire managers for more emphasis on protecting homes and property and are engaging weed managers to address the increasing prevalence of invasive plants. The lessons of collaboration across all lands sets a foundation for these future efforts. Graham et al 2016 summarize the vision for Black Hills forests, “...such heterogeneous stand and landscape conditions (throughout the life of the forest) appear to be a worthwhile alternative for producing wildfire resilient forests, producing wildlife habitat, maintaining functioning watersheds, producing forest products, and producing bark beetle-resistant forests in the face of a changing climate.” This vision is implemented through strong relationships in a collaborative framework.



(Black Hills Aerial Photo. USDA Forest Service photo)

VII. References Cited:

- Alberta Sustainable Resource Development (ASRD). December 2007. Alberta mountain pine beetle strategy. ISBN No. 978-0-77-85-6545-1. Publ. No. T/154. 14 p.
- Allen, Kurt and Coe Foss. 2010. Mountain Pine Beetle in the Black Hills and Control Methods for Single Trees. Forest Health Tip, 9/12/2010. USDA-Forest Service, Rapid City, SD.
- Ball, John. 2012. South Dakota State University Extension Service. <http://igrow.org/gardens/trees-and-forests/spraying-for-mountain-pine-beetle/>
- Ball, John and Chad Taecker. 2013. The Survival of Mountain Pine Beetle in Unpeeled Logs. West. J. Appl. For. 28(4): 154-157.
- Bobzien, Craig and Katie Van Alstyne. 2014. Silviculture across Large Landscapes: Back to the Future. Journal of Forestry, Vol. 112, No. 5, pp. 467-473(7).
- Cayhanto, Ignatius. 2014. Presentation: Tourism Business Perspective on Mountain Pine Beetle Infestation on Black Hills Forest, South Dakota. Funded by the 2013 Black Hills Research, Scholarship and Creative Activity Seed Grant Program.
- Fettig, Christopher J., Kenneth E. Gibson, A. Steven Munson, and Jose´ F. Negro´n. 2014. Cultural Practices for Prevention and Mitigation of Mountain Pine Beetle Infestations. For. Sci. 60(3):450–463
- Freed, Brian L. 2016. Hydrologic Impacts of the Mountain Pine Beetle in Headwater Streams in the Black Hills of Western South Dakota. M.S. thesis. SD School of Mines and Technology, Rapid City, SD. March 28, 2016.
- Graham, Russell T.; Asherin, Lance A.; Battaglia, Michael A.; Jain, Theresa B.; Mata, Stephen A. 2016. Mountain pine beetles: A century of knowledge, control attempts, and impacts central to the Black Hills. Gen. Tech. Rep. RMRS-GTR-353. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 193 p. https://www.fs.fed.us/rm/pubs/rmrs_gtr353.pdf
- Guffey, Scott. 2014. Evaluation of Buck Mountain Timber Sale Area Mtn. Pine Beetle Suppression Effort 2012 – 2013. Unpublished report, Pennington County Weed & Pest Department. Rapid City, SD.
- Negron, Jose, Kurt Allen, Blaine Cook, John Withrow, Jr. 2008. Susceptibility of *ponderosa pine*, *Pinus ponderosa* (Dougl. ex Laws.), to mountain pine beetle, *Dendroctonus ponderosae* Hopkins, attack in uneven-aged stands in the Black Hills of South Dakota and Wyoming USA. Forest Ecology and Management. 254:327-334.
- Punsal, Jesse, Heidi Sieverding, J. Stone, S. Kenner, C. Rhoades, & T. Fegel, 2018. Impact of mountain pine beetle infestation on surface water quality within the upper Rapid Creek watershed of the Black Hills National Forest. Presentation at Western South Dakota Hydrology Conference, Rapid City, SD, 4/19/18. Rapid City, SD.
- Schmid, John and Steven Mata. 1992. Stand density and mountain pine beetle-caused tree mortality in ponderosa pine stands. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Note, RM-515.
- Schmid, John, Steven Mata and Robert Obedzinski. 1994. Hazard rating ponderosa pine stands for mountain pine beetles in the Black Hills. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station,

Schmid, John, Steven Mata, Richard Kessler, and John Popp. 2007. The influence of partial cutting on mountain pine beetle-caused tree mortality in Black Hills ponderosa pine stands. Res. Pap. RMRS-RP-68 Fort Collins, CO: USDA, Forest Service, Rocky Mountain Research Station. 19 p.

Schotzko, Kendra and Kurt Allen, 2016. Evaluation of mountain pine beetle activity on the Black Hills National Forest. USDA Forest Service, Rocky Mountain Region, Report R2-17-01. Golden, CO.

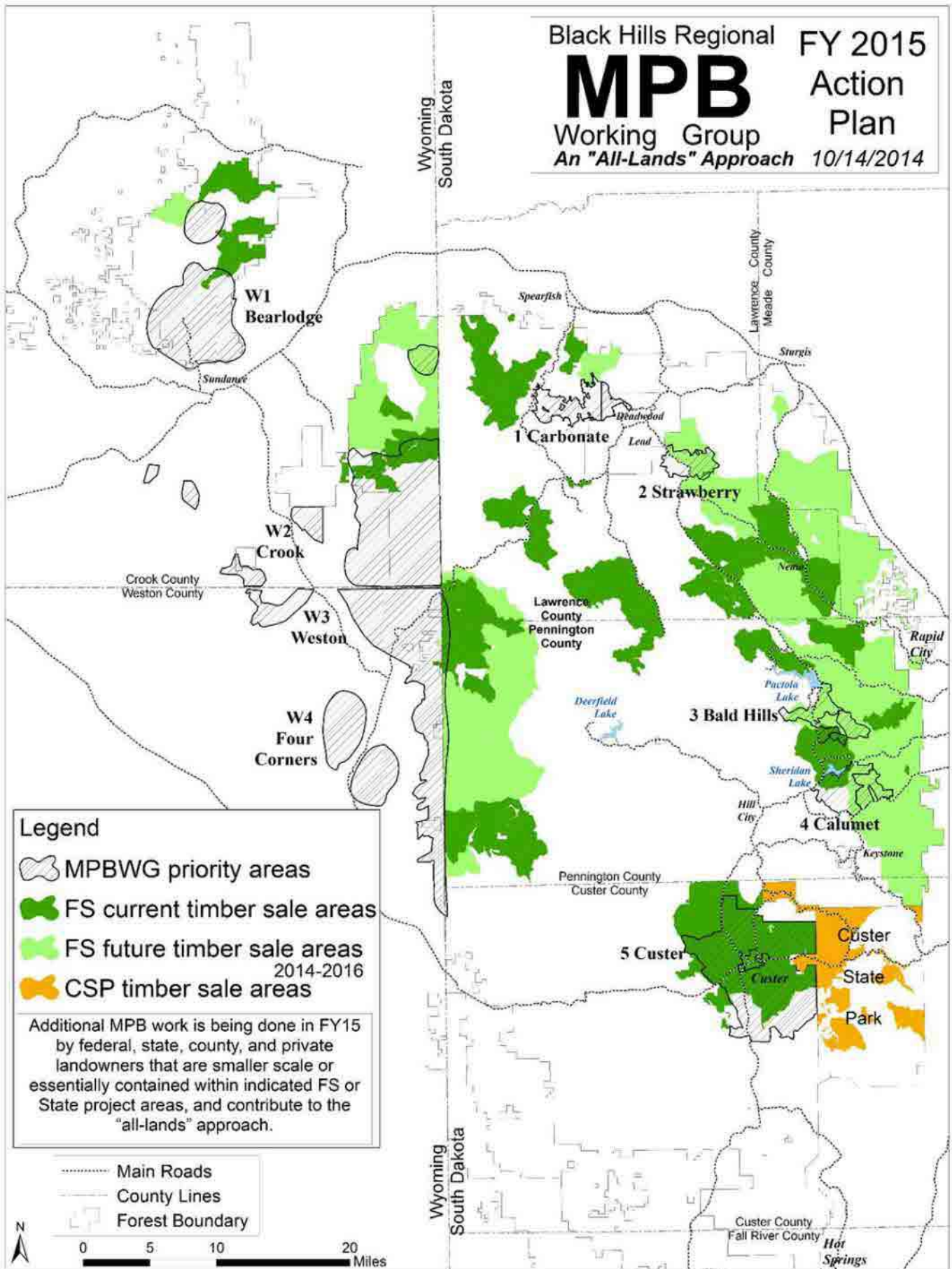
Schotzko, Kendra and K. Allen, 2017. Highlights from the 2016 Black Hills Aerial Photography Interpretation Project and Ground Observations of Mountain Pine Beetle Activity in the Black Hills. USFS Forest Health. USDA Forest Service, Rocky Mountain Region, Golden, CO.

Stevens, Robert, William McCambridge and Carl Edminster. 1980. Risk rating guide for mountain pine beetle in Black Hills ponderosa pine. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Note, RM-385.

Van Vlack, Josh, 2012. Mountain Pine Beetle Digitization Protocol and 2012 Survey Results. Unpublished paper revised 2/15/2013. Neiman Timber Company, Spearfish, SD.

Appendix 1 - Acreage of mountain pine beetle infestation, 2009-2015 (year infested)

Mountain Pine Beetle Infested Acres by County & Year Infested (prepared 1/20/17)														
(compiled by Neiman Timber Company from photo work done by Neiman Timber Co, US Forest Service, SD Division of Resource Conservation & Forestry, and Wyoming State Forestry Division)														
COUNTY	2009			2010			EXPANSION 2009 to 10		2011			EXPANSION 2010 to 11		
	Patch Count	Average Patch Size	Total Acres	Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)	Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)	
Crook	1,562	0.06	89	6,087	0.06	352	263	294%	9,403	0.06	609	257	73%	
Custer	4,834	0.24	1,168	14,887	0.17	2,552	1,384	119%	27,608	0.13	3,483	931	36%	
Lawrence	12,292	0.15	1,890	14,117	0.20	2,837	947	50%	41,264	0.24	10,073	7,235	255%	
Meade	480	0.03	17	1,209	0.06	70	53	322%	2,539	0.05	126	56	80%	
Pennington	20,805	0.30	6,337	30,969	0.46	14,166	7,829	124%	41,640	0.40	16,819	2,653	19%	
Weston	421	0.07	29	741	0.09	67	38	133%	1,345	0.06	81	14	21%	
SUM	40,394	0.24	9,530	68,010	0.29	20,044	10,514	110%	123,799	0.25	31,190	11,146	56%	
COUNTY	2012			EXPANSION 2011 to 12		COUNTY	2013			EXPANSION 2012 to 13				
	Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)		Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)			
Crook	18,353	0.03	621	12	2%	Crook	12,638	0.06	789	168	27%			
Custer	27,989	0.14	3,986	504	14%	Custer	12,033	0.24	2,889	-1,097	-28%			
Lawrence	55,147	0.13	6,918	-3,155	-31%	Lawrence	52,252	0.08	4,230	-2,688	-39%			
Meade	2,874	0.02	62	-64	-51%	Meade	2,767	0.01	40	-22	-35%			
Pennington	56,051	0.40	22,259	5,440	32%	Pennington	31,923	0.26	8,452	-13,807	-62%			
Weston	4,218	0.03	139	58	71%	Weston	2,770	0.03	97	-42	-30%			
SUM	164,632	0.21	33,985	2,795	9%	SUM	114,383	0.14	16,497	-17,488	-51%			
COUNTY	2014			EXPANSION 2013 to 2014		COUNTY	2015			EXPANSION 2014 to 2015		TOTAL (7 years) Acres by County		
	Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)		Patch Count	Average Patch Size	Total Acres	GROWTH (Acres)	GROWTH (%)			
Crook	13,528	0.10	1,322	533	68%	Crook	6,109	0.06	353	-969	-73%	4,135		
Custer	18,401	0.16	3,030	141	5%	Custer	6,442	0.10	648	-2,382	-79%	17,756		
Lawrence	36,403	0.15	5,513	1,283	30%	Lawrence	14,269	0.06	833	-4,680	-85%	32,295		
Meade	2,052	0.06	126	86	216%	Meade	933	0.03	24	-102	-81%	464		
Pennington	24,752	0.28	6,920	-1,532	-18%	Pennington	9,129	0.06	591	-6,329	-91%	75,544		
Weston	3,463	0.02	52	-45	-46%	Weston	1,495	0.03	47	-5	-10%	510		
SUM	98,599	0.17	16,963	466	3%	SUM	38,377	0.07	2,496	-14,467	-85%	130,705		



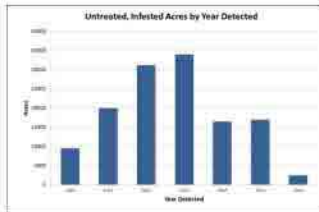
Appendix 3 - 2017 Accomplishment Report

Black Hills Regional "All Lands" Mountain Pine Beetle Accomplishments - 2017

"Epidemic Is Over!"

COLLABORATION - A group of Conservation Leaders prepared *The Black Hills Regional Mountain Pine Beetle Strategy* in 2012 (rev. 10/17/14), a collaborative "all-lands" approach to address the mountain pine beetle epidemic. A 15-member Working Group implemented the strategy. Beetles spread readily without regard to property ownership, thus a coordinated effort across all ownerships has been critical.

POPULATION TREND - Forest health surveys found that after nearly 20 years the mountain pine beetle epidemic is over as populations dropped to naturally occurring levels in 2016. However, beetles remain active in isolated areas.



ACCOMPLISHMENTS -

Work in 2017 was much reduced from past years reflecting the end of the epidemic. Accomplishments were completed in four strategic areas.

Goal 1 - Reduce mountain pine beetle populations. Due to reduced beetle numbers, the accomplishments in 2017 continued a downward trend at about one-fourth of that done in 2016. About 15,000 infested trees were non-commercially treated across 28,400 acres. An additional 9,500 infested trees were removed through timber sales (only about 0.6% of the 1.5 million trees processed at sawmills). Work was concentrated almost entirely on private lands, in Custer State Park, and along major roads. These treatments, when combined with thinning, are effective in reducing beetle spread in localized areas and also reduces future fire hazard, particularly near valued properties.

Goal 2 - Create and maintain healthy, diverse forest conditions. Over 1.5 million ponderosa pine trees were thinned from 32,750 acres of forest at high risk for MPB attack leaving more open growing trees with better vitality, resistance to crown fire and beetle attack, and more diverse habitat. Overcrowded small, unmarketable trees were thinned on 18,700 acres. The BIA did restoration treatments at Pe'Sia, important for Lakota people and others.

Goal 3 - Ensure viability of forest products infrastructure. Commercial timber sales supported about 1,400

direct jobs and additional indirect or induced jobs. The direct economic contribution to the local economy is an estimated \$120 million. Cutting and removing infested trees via commercial timber sale is the most cost effective method and slash is treated concurrently for later disposal. Removing infested trees now reduced fuels created when dead trees would fall.

Goal 4 - Protect people & communities. The State of SD surveyed 499 properties, with most treating infested tree patches. The State of WY had a similar program through Natural Resource Districts. The USDA-Natural Resources Conservation Service (SD & WY) helped 34 land-owners thin 2,175 acres. Property values were maintained and fire and beetle reduction was more effective. Pennington County treated infested trees on 150 miles of road ROW facilitating public and emergency safety. About 5,400 high valued trees were sprayed and infested trees removed near facilities in Custer State Park and National Forest recreation areas. Media announcements and notices warned about falling trees. Partners hosted 16 MPB workshops for 247 attendees.

INVESTED FUNDING
Partners (18 sources of funding including private landowners) invested \$16.7 million in mountain pine beetle suppression and forest health in 2017, just below the 6-year average (\$17.8 million). 7% was for direct-control of MPBs and 93% was for long-term forest

resiliency.

CONCLUSION

Since adopting the *BH Regional MPB Strategy* in 2012, the entities have:

- Coordinated non-commercial treatment of 1.3 million infested trees across 864,000 acres (some overlap).
- Harvested 1.4 million infested trees on 187,000 acres, supporting 1,400 jobs. 16% of harvested trees were infested and removed concurrent with thinning to improve long-term forest resilience.
- Thinned over 79,000 acres of small, non-sawtimber trees.



- Invested \$106.5 million to limit beetles (26%), improve forest resiliency and protect resources (74%).
- Improved scientific applications.
- Worked with hundreds of private landowners to protect trees, homes and businesses.
- Worked to retain aesthetic, recreational, and ecologic values on park and forest lands valued by millions of residents, visitors and users.
- Collaborative efforts among entities was key to successful implementation.

(prepared 11/30/17)

...the impressive work we
accomplish working together...

Black Hills Regional MPB Accomplishments - 2017 July 1, 2016 to September 30, 2017 (11/17/17)		Acres Surveyed and Infested Trees Marked		Infested Trees Treated (non-commercial)		Trees Sprayed	Commercial Timber Sales		Trees Sawmilled ¹		Non-Commercial Thinning (acres)	Workshops (no. & attendees)
		(Acres)	(Number)	(Acres)	(Number)		Sold (acres)	Harvested (acres)	Infested (No.)	Total (No.)		
Custer County (incl. CC Cons. Dist.)	County crews/program	-	-	-	-	-	-	-	-	-	64	1(70)
Fall River County - Private Land	County crews/program	-	-	-	-	-	-	-	-	-	-	-
Lawrence County	County crews/program	-	-	-	-	-	-	-	-	-	-	-
Meade Co. - Pvt. Land (-24 properties)	Meade Co. Firewise Veteran Prog.	-	-	-	-	-	-	-	-	-	43	-
Pennington County - Private Land	Accomplished by County	-	-	-	-	-	-	-	-	-	-	-
- BKNF	NFS land next to pvt properties	-	-	-	-	-	-	-	-	-	-	-
- Landscape	Landscape (Pre-timber sale) Areas	-	-	-	-	-	-	-	-	-	-	-
- Road Safety	200ft ROW Buffer (150 Miles)	3,600	3,401	3,600	3,401	-	307	200	-	4,000	140	-
Crook County	Private, BLM and NFS lands	16,461	103	-	103	-	-	-	-	-	304	2(30)
Weston County	Private lands	-	-	-	-	-	-	-	-	-	577	3(32)
State of Wyoming	State funding; counties implement	-	-	-	-	-	1,350	1,596	-	-	846	3(70)
State of South Dakota	State crews (499 properties surveyed)	-	-	-	-	-	-	-	-	-	-	7(85)
Custer County	State crews (175 landowners)	8,332	1,298	5,687	1,178	-	-	-	-	-	-	-
Lawrence County	State crews (146 landowners)	9,281	233	5,454	161	-	-	-	-	-	-	-
Meade County - on BKNF	State crews (3 landowners)	167	11	162	11	-	-	-	-	-	-	-
Pennington County	State crews (175 landowners)	5,245	105	2,131	85	-	-	-	-	-	-	-
Custer State Park (CSP)		19,700	414	11,373	239	1,604	-	790	-	-	-	-
Game, Fish and Parks	Game production areas	-	-	-	-	-	-	145	-	-	28	-
Dept. Transportation (no tm in 2017)	SD 87&89, Sylvan Lake -ROW	-	-	-	-	-	-	-	-	-	-	-
South Dakota (sub-total)		40,725	2,061	24,807	1,674	1,604	-	935	-	-	28	-
Black Hills National Forest (BKF)		-	-	-	-	3,700	22,459	22,717	-	-	13,377	-
Bureau of Land Management (SD)		10	-	-	-	150	-	-	-	-	902	-
Bureau of Land Management (WY)		-	-	-	-	-	-	-	-	-	-	-
Bureau of Indian Affairs (Pe'Sia)	Comprehensive fuel & thinning prog.	-	-	-	-	-	-	-	-	-	336	-
NPS: Wind/Jewel Cave & Mt. Rushmore		-	-	-	16	-	-	-	-	-	-	-
Natural Res. Conservation Service (SD)	\$145,000 new (22 properties trtd)	-	-	-	-	-	-	-	-	-	491	-
NRCS (Crook = 1,326; Weston = 358)	EQUIP contracts (12) \$285,000/blgd	-	-	-	-	-	-	-	-	-	1,684	-
Forest Products Companies (on private)	Commercial Timber Harvest	-	-	-	9,500	-	-	6,367	9,500	1,500,000	-	-
TOTALS		60,796	5,565	28,407	14,694	5,454	24,116	32,750	9,500	1,500,000	18,728	16 (247)

1. Nearly all sawmilled trees were for long-term, resilient forests. Percentage sawmilled trees infested = 0.6%

The Black Hills Regional Mountain Pine Beetle Strategy

May 7, 2012 (Revised 10/17/2014)



Figure 1 - Thinned trees (center of photo) effective in slowing beetle attack. (B. Wudtke, 2013).

A collaborative “all lands” approach to combating the mountain pine beetle in the Black Hills.

Mission

To reduce and mitigate the current mountain pine beetle epidemic towards endemic levels that promotes long-term economic, social and ecologic sustainability of the Black Hills region.

Introduction

The Black Hills Regional Mountain Pine Beetle Strategy (RMPBS) is a five year strategy that identifies the response to the current mountain pine beetle (MPB) epidemic in Wyoming and South Dakota. This epidemic has grown exponentially and continues to require a comprehensive and strategic approach that identifies goals and objectives and prioritizes mitigation efforts through an Action Plan. The driving cause behind this epidemic continues to be large acreages of dense, mature trees.

Many forest resources and socio-economic values are at risk, including watersheds, forest ecosystems, high-value & sensitive sites, public safety, state & local economies, recreation, wildlife, tourism, aesthetics, and sustainable long-term fiber supply for communities dependent on forest resources. In addition, pine stands killed by MPB will have increased fuel loading creating the potential for forest fires that are larger, more intense, and less predictable.

The potential consequences of the current MPB epidemic make development and implementation of comprehensive mitigation measures urgent and complex. It will be impossible to achieve long-term desired future conditions unless all stake holders commit and remain committed to a comprehensive and aggressive strategy for treating the current epidemic. The goal of the RMPBS is not to eradicate the MPB from the Black Hills, but instead reduce the epidemic populations towards endemic levels.

As the result of the periodic Conservation Leader meetings, a diverse subcommittee volunteered to draft a comprehensive strategy to address the current MPB epidemic, to be agreed to by the larger Conservation Leaders group. This document is referred to as the Black Hills Regional Mountain Pine Beetle Strategy (RMPBS).

Background

Landownership

The greater Black Hills region comprises approximately 1.5 million forested acres of interspersed federal, state, and private lands according the most recent Forest Inventory and Analysis numbers. The largest landownership is the Black Hills National Forest (BHNF), comprising 899,000 acres of forestland, followed by private lands at 475,000 acres of forestland, State lands of Wyoming and South Dakota at 99,000 acres of forestland, and the Bureau of Land Management at 24,000 acres of forestland. Ponderosa pine is the predominant tree species throughout all ownerships in the Black Hills.

The mountain pine beetle (MPB), *Dendroctonus ponderosae*, is a native insect to the Black Hills, first discovered in early 1900s. Historically the MPB existed in the Black Hills at endemic levels, with periodic outbreaks coinciding with favorable conditions. Thriving in the abundant even-aged, high density ponderosa pine stands, which are continuous across much of the Black Hills, the MPB mass attacks green host trees in late summer, boring under the bark and also spreading a blue-stain fungus, both of which can eventually lead to tree mortality if the mass attack was successful. The current MPB epidemic has affected more than 430,000 acres in the Black Hills National Forest area of SD and WY since 1996.¹



For the purposes of this strategy, endemic MPB levels are defined as 1-2 MPB attacked trees per 5 or more acres per year. Epidemic MPB levels are defined as several groups of four or more MPB attacked trees per group over 2-3 consecutive years, especially if the number of trees per group is increasing and groups are coalescing (Schmid 2007).

Strategies

There have been a number of helpful strategies produced over the past several years in response to the MPB epidemic plaguing the west. Each utilizes the best available science and research in formulating their respective goals, objectives, and strategies. These strategies are summarized below and components are incorporated into the RMPBS.

The Canadian Province of Alberta has developed a *Mountain Pine Beetle Management Strategy (2007)* based on the following three principles: (1) assessing the current status/risk of MPB spread; (2) determining immigration of beetle populations; and (3) pursuing achievable objectives which help determine beetle management priority zones at the provincial level. The three management zones are: leading-edge, holding, and salvage zones. Compared to the Black Hills, the Canadian situation differs in land ownership, industry capacity, laws, tree species, and management. While not the solution, the Alberta Strategy offers some very useful information and concepts that can be incorporated into the RMPBS.

The Black Hills Forest Resource Association, representing the forest products industries in Wyoming and South Dakota, has developed *The Black Hills and Surrounding Lands MPB Strategy*. It incorporates components from the Alberta Strategy and identifies three management zones: (1) Resiliency Zone, (2) Restraining Zone, and a (3) Recovery Zone along with treatment methods for each of these zones. The Resiliency Zone (R1) has the highest priority and would involve aggressive single or group tree removal from small infestation patches. The Restraining Zone (R2) focuses control efforts primarily on harvesting infested trees in patches too large for individual/group treatments, mainly through timber sales. The

¹From: <http://www.fs.usda.gov/detail/r2/forest-grasslandhealth/?cid=stelprdb5447305>

Recovery Zone (R3) focuses on hazardous fuel reduction, wildfire protection, and short term timber supply protection.

Both South Dakota and Wyoming State Forestry agencies have completed Statewide Forest Resource Assessments identifying common issues such as forest health, viability of the forest products industry, wildfire, wildland-urban interface, water quality and quantity, and invasive species. Many of these issues have been addressed in the RMPBS.

The U.S. Forest Service's *Western Bark Beetle Strategy (2011)*, addresses three facets of the bark beetle problem: human safety, forest recovery, and long-term recovery. While appropriate to many forests impacted by the MPB throughout the West, this broad strategy falls short in fully addressing the unique situations present in the Black Hills.

More locally, the Black Hills National Forest prepared the *Black Hills National Forest Mountain Pine Beetle Strategy (2/15/2012)*, which builds on the *Western Bark Beetle Strategy*, and includes more specific objectives pertinent to the Black Hills. The strategy includes components from the Alberta Strategy identifying three management zones: Safety Zone, focusing on people and community infrastructure; Recovery Zone, addressing re-establishment of healthy forests damaged by MPB; and the Resiliency Zone, focused on preventing and mitigating future MPB outbreaks, mainly through green timber sales.

The Western Forestry Leadership Coalition (WFLC), whose members consist of state and federal forestry leaders, has produced a document titled *Across the Western Landscape: Priority Issues and Strategies for Western Forests (2011)*. It contains a six-point plan for a way forward in successful implementation of a forest action plan. The six points are:

1. Strengthen partnerships and collaborative approaches
2. Build adequate and flexible capacity and funding
3. Capitalize on "co-benefits"
4. Actively manage all forest lands
5. Support research to inform science-based decision making
6. Gain support through effective engagement

This strategy, while not specific to MPB, uses these six points to formulate a strategy that focuses on conserving and managing working forest landscapes, protecting forest from threats and enhancing public benefits from forests and trees. All of these components are relevant and integrated into the RMPBS.

Current Actions

Over the last 15 years of the epidemic, there has been a lot of good work done in reducing the negative impacts associated with this epidemic. While these collaborative efforts have substantially improved, the treatments have slowed, but not stopped the spread of the epidemic as it continues to expand annually. Following, is a summary of some of the most recent efforts being conducted that can increase future success.

The State of South Dakota has invested considerable funding and treatment effort into MPB treatment in Custer State Park that has been very successful. The State is also assisting private landowners throughout the Black Hills. The extent of technical assistance, infested tree identification, and cost-share programs are contingent on funding. More information is available at www.beatthebeetles.com.

The State of Wyoming has conducted similar efforts. In cooperation with over twenty entities, State appropriated dollars are leveraged with Federal and private dollars to treat infested trees across all ownerships. Landowners are not charged for this service, but are strongly encouraged to apply long term management practices to develop resilient forests. Beyond direct control, educational programs, management plan development, and timber management practices are important components of the program. Wyoming State Forestry Division, Weston and Crook County Natural Resource



Figure 2 - Industry, Forest Service and private landowners discuss mountain pine beetles and forest management.

Districts, Weston and Crook County Weed and Pest Districts, Weston and Crook County NRCS offices, Weston and Crook County Road and Bridge Departments, Neiman Timber Company, Crook County Office of Emergency Management, University of Wyoming Extension Service, Weston County Fire Protection District, Wyoming Tree Farm Committee, Bureau of Land Management, Hell Canyon and Bearlodge Ranger Districts of the Black Hills National Forest, Wyoming Governor's office, private landowners, and others are committed to a unified campaign to protect the forest resource in Wyoming, and the benefits it creates. More information is available at www.lands.state.wy.us.

Counties within the Black Hills have assisted in the MPB mitigation efforts through agreements with the states, Black Hills National Forest, and private landowners. Counties have used various funding sources to perform on the ground mitigation practices. Their mitigation practices on BHNF have focused along private lands and priority landscape treatment areas often within pre-thinned timber sale areas. Public safety is being addressed by the counties as well, through the removal of dead MPB trees along road rights-of-way.

The BHNF continues to provide timber sale projects that focus on pro-active thinning. This type of landscape thinning at the leading edge the MPB infestation is the most effective treatment for MPB, reducing the susceptibility to future infestation. Another significant effort is the sanitation of infested trees within current timber sale boundaries. This helps in reducing beetle numbers and the inherent spread to adjacent timbered stands. The agency does preventive spraying in certain recreation areas and invests substantial funding in non-commercial thinning of sapling and pole stands to reduce fire and insect hazard in the long run. The BHNF is implementing the *Mountain Pine Beetle Response Project* (12/10/2012). This project is designed to allow Integrated Pest Management techniques in high risk

stands on the forest that were not previously covered for treatment under other NEPA decisions. This project is helping to streamline efforts in responding to MPBs in at-risk stands.

The Black Hills has prominent forest industry that contributes substantially to the economic and social fabric of local communities. The 25-35,000 acres of annual treatment completed by timber purchasers and contractors has been essential to slowing the epidemic. With the ability to thin and treat only a portion of acres across the forest, it is important that these efforts are targeted through this strategy to be as effective as possible.

Purpose

The RMPBS is a comprehensive strategy that uses the various strategies, assessments and ongoing activities mentioned above, but is modified to account for the unique situation surrounding the MPB epidemic in the Black Hills area and its affected stakeholders. This strategy defines goals, objectives and actions to collaboratively address the MPB epidemic across all ownerships in the Black Hills. While several variables exist such as funding at the local, state and federal levels, the intent is to create strategic framework that results in the effective expenditure of funds.

Goals, Objectives, Actions

Goal 1 - Reduce mountain pine beetle populations to endemic levels in strategic areas.

Objective 1.1 – Annually develop and coordinate the allocation of human, financial, physical resources to federal, local, state governments/agencies and private landowners to combat current and future infestations

Action 1.1.1 – Develop and support a list of accepted MPB reduction management tactics for the Black Hills region. Ongoing

Action 1.1.2 – Identify and leverage traditional and non-traditional federal, state, local and private funding sources in addition to current levels. Ongoing

Action 1.1.3 – Identify and leverage human and physical resources to accomplish goals and objectives. Ongoing

Action 1.1.4 – Draft, support, and implement proven and beneficial policies, processes and programs specific to the MPB epidemic. Ongoing

Objective 1.2 - Establish and maintain regular and timely communication between interested local, state, private, tribal and federal entities

Action 1.2.1 – Retain a MPB Coordinator to serve as an information hub and facilitator for agencies, organizations and other stakeholders involved in MPB mitigation efforts. The MPB Coordinator will assist in developing cooperative efforts whenever possible and with respect to each entity's policies, goals and objectives. Ongoing

Action 1.2.2 – Maintain a MPB Working group of interested parties to facilitate the efficient implementation of group activities as outlined in Objective 1.3. Ongoing

Action 1.2.3 – Provide education and public outreach regarding the issues, opportunities, resources risks and other information on the MPB epidemic. Ongoing

Action 1.2.4 – Continue Conservation Leaders meetings and further facilitate communications between affected parties including SD and WY elected officials. Ongoing

Objective 1.3 – Create and review an annual action plan for the purpose of guiding MPB suppression efforts.

Action 1.3.1 – The MPB Working Group will create and review an annual MPB Action Plan identifying specific agency and private entity activities to treat MPB populations for that season and coordination among agencies and private industry. Ongoing

Action 1.3.2 – Develop and review the Annual MPB Strategic Map to accompany the Annual MPB Action Plan. This map will identify and prioritize specific areas for MPB treatment and will use available information including recent Aerial Insect and Disease Surveys, air photo fader analysis, ground marking data, and/or other technologies. Ongoing

Action 1.3.3 – MPB Working Group will report annually on the progress of goals and objectives. Ongoing

Goal 2 – Create and maintain healthy forests with diverse forest stand conditions that are resilient to future MPB epidemics and catastrophic wildfires.

Objective 2.1 – Implement silvicultural practices to improve forest health and reduce susceptibility to future MPB infestations.

Action 2.1.1 - Increase diversity of tree age, size, and species, and reduce stand density where necessary to increase resistance to future MPB infestations. Ongoing

Action 2.1.2 - Perform MPB sanitation and suppression efforts to protect individual trees and stands within a landscape context. Ongoing

Objective 2.2- Implement actions to conserve and restore natural resources during and following this epidemic.

Action 2.2.1 – Treat noxious weeds within areas that have been impacted by MPB Ongoing

Action 2.2.2 – Reforest/reseed selected areas of disturbance where needed with native vegetation. Ongoing

Action 2.2.3 - Provide for conservation of sensitive habitats where the MPB is active. Ongoing

Objective 2.3 - Maintain sufficient quantity and quality of water in local community watersheds.

Action 2.3.1– Use Best Management Practices during MPB treatments to protect watersheds from sedimentation, excessive runoff and flooding caused by large scale disturbances. Ongoing

Action 2.3.2 – Monitor research on watershed effects caused by the MPB. Ongoing (note: previous Action 2.3.2 to map watersheds was deleted).

Goal 3 – Ensure the viability of the current and/or expanded forest products infrastructure within the Black Hills region.

Objective 3.1 – Maintain a sustainable timber supply based on needs to existing infrastructure.

Action 3.1.1 – Utilize timber sales to thin over-stocked stands of ponderosa pine on federal, state and private lands based on MPB Action Plan and Map. Ongoing

Action 3.1.2 – Utilize timber sales to remove MPB infested trees (sanitation). Ongoing

Action 3.1.3 – Provide a means of communication regarding harvesting activities between the BHNF, States, Counties and current/potential purchasers. Short term

Action 3.1.4 - Develop and implement timber sale programs to supply the current forest products industry. Ongoing

Objective 3.2 – Support utilization of woody material that is currently being under-utilized.

Action 3.2.1 – Promote and develop new markets and a marketing strategy to utilize woody material - specifically underutilized and blue-stain ponderosa pine. Long term

Goal 4 - Ensure people and community infrastructure are protected from the hazard created by standing dead trees killed by MPB and the resulting elevated hazardous fuels which lead to catastrophic wildfires.

Objective 4.1 – Mitigate falling tree hazards to people and community infrastructure in areas identified in the annual MPB action plan.

Action 4.1.1 - Remove hazard trees along the highest priority roads, emergency routes, trails, power lines, recreation areas and facilities. Ongoing

Action 4.1.2 - Develop and implement a mechanism to adequately warn the public of falling tree hazards in untreated areas or sites. Ongoing

Action 4.1.3 - Coordinate with local utility companies to plan and facilitate treatments of dead and infested trees adjacent to infrastructure. Ongoing

Objective 4.2 - Decrease risk of catastrophic fire associated with elevated fuel loadings following beetle infestation, particularly in the Wildland Urban Interface.

Action 4.2.1 - Implement fuel break treatments in strategic locations that complement Community Wildfire Protection Plans (CWPP). Ongoing

Action 4.2.2 - Develop an integrated fuel reduction plan that assesses and implements fuels reduction projects in MPB killed stands across ownerships. Long term

Action 4.2.3 – Provide information and encourage private landowners to implement *Firewise* principles on their lands. Ongoing

Action 2.3.2 – Monitor research on watershed effects caused by the MPB. Ongoing (note: previous Action 2.3.2 to map watersheds was deleted).

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“Black Hills Restoration Strategy” – The Conservation Leader group considered a proposal on 5/15/14, and adopted on 10/17/14, a recommendation as follows: the Conservation Leaders develop a *“Black Hills Restoration Strategy”*, or as appropriately entitled, when conditions shift from an emphasis on MPB suppression to an emphasis on healthy forests, fire hazard and public safety. Such a restoration strategy, continuing the collaborative approach, may include different entities and disciplines than the current BHRMPB Strategy. Objectives 4.1, 4.2 and perhaps other objectives and their actions would shift to a new strategic document.

Authorities and Limitations

The Black Hills Regional Mountain Pine Beetle Strategy (RMPBS) has no legal authority and is not recognized as a corporate entity. Individual partners are not bound by any decision of the RMPBS to expend financial resources, exceed legal limitations imposed by applicable statutes, or limitations imposed by individual governing boards.

We the undersigned, in the interest of the health of the Black Hill’s forested lands, the protection of the Black Hill’s forest-dependent communities, and in review and understanding of the considerations put forward by this document agree to voluntarily participate, in good faith, in the Black Hills Regional Mountain Pine Beetle Strategy. Furthermore, we commit to working with one another in the spirit of cooperation and collaboration in mutual respect to each other to advance the goals set forth in the strategy.

The following Conservation Leaders adopted the *Black Hills Regional Mountain Pine Beetle Strategy* (dated 5/7/2012) and/or the revised strategy dated 10/17/14):

- 1) Meade County Commission
- 2) Baker Timber Products, Inc.
- 3) USDA-Forest Service, Black Hills National Forest
- 4) Weston County Commissioners
- 5) Rare Elements Resources, Inc.
- 6) William & Patricia Cafruny, Canyon Lake Hts. (homeowners)
- 7) Lawrence County Commissioners
- 8) Pennington County Weed and Pest Board
- 9) Crook County Commissioners
- 10) Black Hills Resource Conservation and Development Association, Inc.
- 11) Save Our Black Hills Coalition
- 12) Custer County Conservation District
- 13) James R. Johnson, PhD, South Dakota State University (Canyon Lake Hts., homeowner)
- 14) Neiman Enterprises, Inc.
- 15) Pennington County Commission
- 16) Dakotas Society of American Foresters
- 17) Rapid City Area Chamber of Commerce
- 18) South Dakota Department of Agriculture, Division of Resource Conservation & Forestry
- 19) Bureau of Land Management – South Dakota
- 20) Bureau of Land Management - Wyoming

- 21) Weston County Natural Resource District
- 22) Wyoming Farm Bureau Federation
- 23) Black Hills Forest Resource Association
- 24) Thomas and Ruth Carol Udager (homeowners, Rapid City)
- 25) E. Pennington Grazing District
- 26) Association of National Grasslands
- 27) Weston County Weed and Pest
- 28) Custer County Commissioners
- 29) Jim Scherrer, private landowner (certified *Tree Farm*®)
- 30) USDA-Natural Resources Conservation Service (pending as of 10/6/15)


This ***Revised Black Hills Regional Mountain Pine Beetle Strategy*** was prepared by the Black Hill Regional Mountain Pine Beetle Working Group and presented and discussed at a meeting of Conservation Leaders on May 16, 2014. It was formally approved at a Conservation Leader meeting on October 17, 2014.

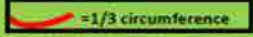
MOUNTAIN PINE BEETLE


INFESTED TREE IDENTIFICATION ON PONDEROSA PINE TREES



A ponderosa pine tree can be classified as infested if one or more of the following applies:


- Five or more brown/pink pitch tubes between 5ft. and 8ft. above ground level and spanning greater than 1/3 the circumference of tree .









- Brown boring dust in bark crevices and on the ground immediately adjacent to the tree base.



- Evidence of woodpecker feeding on trunk > 3 ft above ground. Patches of bark are removed and bark flakes lie on the ground or snow below tree. (Usually appearing around November or later.)



One of the most visible signs are popcorn-shaped masses of resin, called "pitch tubes," on the trunk where beetle tunneling begins. Pitch tubes may be brown, pink, or white.
 White —unsuccessful attack at that point
 Pink—usually unsuccessful attack at that point
 Brown—successful attack at that point

COMMON MISLEADING SIGNS

<p>Large pitch tubes located only in bottom 4 feet of trunk – red turpentine beetle</p>	<p>Tree with large pitch masses on old wound, on stem canker, or on branch collar – Zimmerman pine moth</p>	<p>Tree fading before January with no pitch tubes – pine engraver beetle</p>
<p style="text-align: center; border: 1px solid black; margin: 0;">Red turpentine beetle attack</p> 	<p style="text-align: center; border: 1px solid black; margin: 0;">Zimmerman pine moth</p> 	<p style="background-color: #FFD700; padding: 5px;">Woodpecker feeding activity on upper 1/3 of tree and branches – pine engraver beetle</p> <p style="background-color: #FFD700; padding: 5px;">Sapsuckers make small (1/8-inch) holes in parallel lines around the trunk.</p> 

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Mountain Pine Beetle FAQs

Where did the beetle come from?

Mountain pine beetles (MPB) are native to the Black Hills and were first documented as the “Black Hills beetle” in the late 1800s.

What does a Mountain Pine Beetle look like?

The adult is about 1/4 inch and is black or dark brown. The larvae are white and the size of a grain of rice.



Mountain Pine Beetle

How long do they live?

Mountain pine beetles live and reproduce on an annual cycle and live the majority of their lives in the inner bark of pine trees.

How do you suppress the spread?

The use of commercial timber sales, thinning, and timber harvests are effective and economical tools that help reduce MPB spread and promote long-term forest health.



Thinned forests help suppress the beetle spread.

BLACK HILLS REGIONAL **MPB** WORKING GROUP

The Black Hills Regional Mountain Pine Beetle Working Group is comprised of the Black Hills Forest Resource Association; Custer, Fall River, Lawrence, Meade, and Pennington Counties; Crook and Weston County Natural Resource Districts; State of South Dakota; State of Wyoming; USDA-Forest Service; USDI-Bureau of Land Management; USDI-National Park Service; USDA-Natural Resources Conservation Service.

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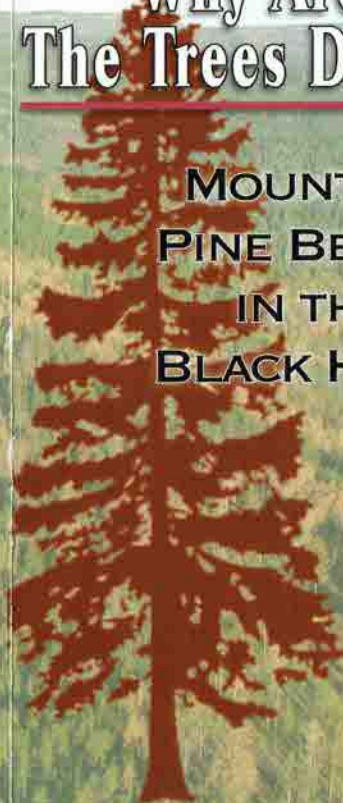
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Why Are The Trees Dead?

MOUNTAIN PINE BEETLE IN THE BLACK HILLS



How did they kill the trees?

When beetles attack a tree in large numbers they are able to overcome the tree's natural defense. This is accomplished by a relationship between the mountain pine beetle (MPB) and blue stain fungus. Beetles carry the blue stain spores on their body and appendages. Once inside, the blue stain fungus blocks the water pathways. Tunnelling adult beetles and their larvae disrupt the flow of nutrients the tree needs to survive. These two invaders working together ultimately starve the trees within the year, causing the needles to turn brownish red.



Galleries created by beetle adults and larvae.



Blue stain fungus in harvested timber.

Dealing with Disaster



The mountain pine beetle epidemic has killed millions of mature pine trees across the western United States, including the Black Hills. The native mountain pine beetle was able to sweep through the hills because of the over abundant number of trees in the forest. Efforts are now being shifted to mitigate the impact of large areas of dead trees. Increased light and disturbance to the forest floor has resulted in establishment of invasive weeds in many areas. Noxious weed species such as Canada Thistle compete with native grasses and seedling trees for nutrients and can over-take an area intended for forested regrowth.



Canada Thistle
(*Cirsium arvense* L.)

Partners in the Black Hills

A group of 50 conservation leaders convened in the Black Hills in 2010 to develop a coordinated strategic approach to address the MPB epidemic across all land ownerships. Partners have since inspected over 720,000 acres and treated 2.6 million infested trees to suppress beetle spread. Additional trees have been removed through timber harvests to create more resilient forests in the future.

Working together, across all lands, we're making a difference.

Support has come from SD and WY governors and legislators, the federal congressional delegation, county and local governments, associations, Neiman Enterprises, Inc., and private businesses and individuals. County governments, including conservation districts and weed and pest departments, are working with state forestry agencies in Wyoming and South Dakota to host timber marking crews, develop operational agreements to mark and treat infested trees, and to protect overall public travel and safety. Collaboration has been key in addressing this critical natural resource issue that will affect residents and visitors to the Black Hills for many years to come. Working together, across all lands, makes a difference.

**Appendix 7 – Description of Accepted Mountain Pine Beetle Treatments
(adopted by MPB Working Group)**

**2015-2016 Program Definitions and Terms of Reimbursement for
Mountain Pine Beetle Control Treatments**



Cut/Chunk - Cutting the trunk (up to 50 feet from base of tree at the ground or to a 5 inch diameter top) into pieces 24 inches or less in length and scattering the pieces—the pieces cannot be piled. The length of tree above 50 feet will be cut into six foot lengths.

Cut/Chunk/Split - Cutting the trunk (up to 50 feet from base of tree at the ground or to a 5 inch diameter top) into pieces 24 inches or less in length and splitting the pieces so that no more than a width of 6 inches of bark remains attached to the pieces and scattering the pieces—the pieces cannot be piled. The length of tree above 50 feet will be cut into six foot lengths.

Cut/Peel - Cutting the tree down and peeling all bark from the trunk (up to 50 feet from base of tree at the ground or to a 5 inch diameter top) of the tree. The length of tree above 50 feet will be cut into six foot lengths.

Cut/Wrap (Solar Treatment) – Cutting the trunk (up to 50 feet from base of tree at the ground or to a 5 inch diameter top) into pieces 4 feet or less in length, placing the logs no more than 2 rows high, wrapping the pile with not less than 6-mil plastic sheeting, and piling enough soil on the sheeting edges to make it as air tight as possible. The plastic will need to stay in place until September of 2016. The length of tree above 50 feet will be cut into six foot lengths.

Cut/Chip - Chipping of the trunk (up to 50 feet from base of tree at the ground or to a 5 inch diameter top) and scattering the chips to a depth of 3 inches or less. The length of tree above 50 feet will be cut into six foot lengths.

Cut/Remove – Cutting the tree and removing all trunk material up to 50 feet from base of tree at the ground or to a 5 inch diameter top. The length of tree above 50 feet will be cut into six foot lengths.

Salvage – Cutting the tree and removing all commercial trunk material to sawmill. Trunk material greater than 5 inches in diameter not taken out of the woods will be bucked into pieces 2 feet or less in length.

***All tree tops and branches must be treated to meet the state slash law and rules: lopped and scattered to a depth not greater than 18 inches from the ground or piled and burned.**

***Failure to treat all of the infested trees marked may disqualify you from future mountain pine beetle program assistance.**

Treatment	Cost Share (\$20,000/landowner or group maximum)	Deadlines
Cut/Chunk – Landowner (20 tree minimum)	\$10.50 per tree	No reimbursement for trees not treated by 3/01/2016
Cut/Chunk – Contractor (20 tree minimum)	75% of total cost not to exceed (NTE) \$11.25 per tree	No reimbursement for trees not treated by 3/01/2016
Cut/Peel (20 tree minimum)	75% of total cost NTE \$25.50 per tree	No reimbursement for trees not treated by 5/01/2016
Cut/Wrap (Solar Treatment) (20 tree minimum)	75% of total cost NTE \$13.50 per tree	No reimbursement for trees not treated by 5/01/2016
Cut/Chip (20 tree minimum)	75% of total cost NTE \$20.00 per tree	No reimbursement for trees not treated by 5/01/2016
Cut/Chunk/Split (20 tree minimum)	75% of total cost NTE \$11.25 per tree	No reimbursement for trees not treated by 6/01/2016
Cut/Remove (20 tree minimum)	75% of total cost NTE \$7.50 per tree	No reimbursement for trees not treated by 6/01/2016
Salvage (1 load minimum)	75% of incurred cost (log value minus logging cost) NTE \$7.50 per tree	No reimbursement for trees not treated by 6/01/2016