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Comment

A Comment on "Management for Mountain Pine Beetle Outbreak Suppression: Does Relevant Science Support Current Policy?"

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Abstract: There are two general approaches for reducing the negative impacts of mountain pine beetle, *Dendroctonus ponderosae* Hopkins, on forests. Direct control involves short-term tactics designed to address current infestations by manipulating mountain pine beetle populations, and includes the use of fire, insecticides, semiochemicals, sanitation harvests, or a combination of these treatments. Indirect control is preventive, and designed to reduce the probability and severity of future infestations within treated areas by manipulating stand, forest and/or landscape conditions by reducing the number of susceptible host trees through thinning, prescribed burning, and/or alterations of age classes and species composition. We emphasize that "outbreak suppression" is not the intent or objective of management strategies implemented for mountain pine beetle in the western United States, and that the use of clear, descriptive language is important when assessing the merits of various treatment strategies.

Keywords: *Dendroctonus ponderosae*; direct control; indirect control; *Pinus contorta*; *Pinus ponderosa*; sanitation; thinning

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In a recent review, Six *et al.* [1] question whether relevant science supports current United States policy concerning suppression of mountain pine beetle, *Dendroctonus ponderosae* Hopkins, outbreaks. Their paper addresses an important and timely issue as outbreaks have been severe, long lasting, and well documented, with >27 million hectares impacted in recent years [2,3]. While we do not wish to address policy implications (*i.e.*, our expertise focuses on the ecology and management of bark beetles in western North America), in our opinion several issues merit clarification, four of which we discuss below. Most importantly, we emphasize that "outbreak suppression" is not the intent or objective of management strategies implemented for mountain pine beetle in the western United States [4] as suggested by the title, throughout the paper, and contrary to any assertions that may exist in the scientific literature.

Recently, we reviewed tree, stand, and landscape factors associated with mountain pine beetle infestations, and discussed the effectiveness of treatments for preventing and mitigating undesirable levels of tree mortality attributed to mountain pine beetle [5]. We defined "direct control" as short-term tactics designed to address current infestations by manipulating beetle populations, which includes the use of fire, insecticides, semiochemicals, sanitation harvests, or a combination of these treatments. "Indirect control" was defined as preventive, and designed to reduce the probability and severity of future infestations within treated areas by manipulating stand, forest and/or landscape conditions by reducing the number of susceptible host trees through thinning, prescribed burning, and/or alterations of age classes and species composition [5]. The focus of indirect control is on the residual structure and composition of forests following treatment, and not on direct impacts to the mountain pine beetle population. Six *et al.* [1] use similar designations, as have others. We stress direct and indirect control strategies are implemented to reduce levels of tree mortality attributed to mountain pine beetle to acceptable levels within treated sites, and not to suppress outbreaks. At first glance this might appear a matter of semantics, but in fact is an important distinction critical to properly assessing the effectiveness of associated treatments. To that end, the plurality of the literature addresses the use of treatments for "reducing susceptibility", "to reduce the probability and severity of future infestations", "to alleviate or reduce the amount of bark beetle-caused tree mortality", or for "mitigating the impacts of an epidemic" [5–9]. There is a wealth of scientific literature in support of the use of cultural treatments to achieve these objectives (e.g., see 5 and relevant citations therein), specifically when placing the "focus on the precipitating causes of an outbreak" [6].

Second, the authors state "Although much of our review addresses how well science supports US policy, we use primarily studies conducted in Canada as few studies have been published on direct control measures during the current outbreak in the US." [1]. However, since their review focuses on policy implications in the United States, readers may be inclined to assume that the treatment strategies discussed for Canadian forests are similar to those implemented in the western United States. This is often not the case [4], particularly in reference to the scale and intensity of certain treatments. In particular, large-scale sanitation has not been implemented in the western United States in response to recent mountain pine beetle outbreaks due to a variety of factors ranging from tree mortality not interfering with land management objectives in some areas (e.g., wilderness) to practical limitations concerning the identification, treatment and/or removal of large numbers of infested trees. For example, in Colorado, where a large-scale outbreak of mountain pine beetle has impacted several hosts, management responses have largely focused on protection of individual trees in high-value sites; and removal of hazard trees to protect public safety and critical infrastructure [10].

Third, mountain pine beetle colonizes several tree species, most notably lodgepole pine, *Pinus contorta* Dougl. *ex* Loud., ponderosa pine, *P. ponderosa* Dougl. *ex* Laws., sugar pine, *P. lambertiana* Dougl., limber pine, *P. flexilis* E. James, western white pine, *P. monticola* Dougl. *ex* D. Don, and whitebark pine, *P. albicaulis* Engelm. Although not indicated, the authors focus on lodgepole pine while other common hosts, specifically ponderosa pine, are largely ignored. Ponderosa pine is an integral component of three cover types and a major component of >65% of all forests in the western United States [11]. The first documented use of direct control in response to mountain pine beetle occurred in ponderosa pine in the Black Hills, United States [12]. Significant research has occurred since concerning the effectiveness of direct and indirect control in this host system [5], yet is not adequately addressed by Six *et al.* [1]. For more detailed information on the effectiveness of indirect control in ponderosa pine, we refer the reader to Fettig *et al.* [5] where we concluded “Thinning reduces levels of ponderosa pine mortality attributed to mountain pine beetle, and where various prescriptions have been evaluated, areas of lowest tree density had less tree mortality often on both a numerical and proportional basis” [5]. This relationship is consistent among the wide diversity of stand conditions encountered in forests containing ponderosa pine. Relatedly, it is critical to distinguish among host species (*i.e.*, mountain pine beetle colonizes at least 15 species) when discussing direct and indirect control as mountain pine beetle responses, host responses, and their many interactions differ influencing the use and effectiveness of treatments implemented for various objectives. For example, while the authors discuss “daylighting” [1] it is unclear to the reader that these treatments are focused on the restoration of whitebark pine forests [13].

Finally, we feel it is important to stress that thinning prescriptions vary widely due to various resource objectives which have different effects on residual stand structure and composition, and thus on their effectiveness for reducing future levels of tree mortality attributed to mountain pine beetle. Many thinnings in the western United States are implemented with the primary objective of increasing fire resilience (*i.e.*, reducing fire hazard), which concentrates on reducing surface fuels, increasing the height to live crown, decreasing crown density, and retaining large trees of fire-resilient species [14]. While such treatments may also reduce the susceptibility of forests to bark beetles, including mountain pine beetle, related prescriptions vary from those implemented specifically for bark beetles. Six *et al.* [1] discuss the senior author’s work concerning beetle responses to prescribe fire and thinning in Montana, but fail to indicate these treatments were implemented with the primary objective of reducing fire hazard [15]. In recent years, there have been a number of studies published on the effects of fuel-reduction treatments on levels of tree mortality attributed to several species of bark beetles in the United States [16], and while useful in discussions concerning the effectiveness of indirect control a distinction should be made from publications specifically evaluating indirect control. In the former case, one might expect to see higher levels of tree mortality attributed to mountain pine beetle as infestation rates are positively correlated with tree diameter [5], and fuel-reduction treatments usually promote retention of large fire-resilient trees (e.g., large-diameter ponderosa pine) [14].

Recently, Gillette *et al.* [17] analyzed the consequences of treatments implemented for management of mountain pine beetle. They concluded "Managing for biologically diverse and resilient forests is our best and only available long-term, sustainable response to the multitude of stressors—insects and disease outbreaks, fires that are unprecedented in severity, and drought—that are likely to increase in frequency as the climate changes. In the case of bark beetles and many other stressors, this calls for greater, science-based use of silvicultural treatments that, paradoxically, require some tree mortality for the greater resilience of the entire forest." [17]. Similar, Six *et al.* [1] concluded "Our argument here is not to forgo management, but rather that management should be led by science and informed by monitoring." We argue related discussions are best served by use of clear, descriptive language to reduce ambiguity, and potential misinterpretations of science findings.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Six, D.L.; Biber, E.; Long, E. Management for mountain pine beetle outbreak suppression: Does relevant science support current policy? *Forests* **2014**, *5*, 103–133.
2. *Facts about B.C.'s Mountain Pine Beetle*; British Columbia Ministry of Forests, Lands and Natural Resource Operations: BC, Canada, 2013. Available online: www.for.gov.bc.ca/hfp/mountain_pine_beetle/Updated-Beetle-Facts_April2013.pdf (accessed on 14 February 2014).
3. *Areas with Tree Mortality from Bark Beetles: Summary for 2000−2013*, *Western U.S.*; US Department of Agriculture, Forest Service: Washington, DC, USA, 2014. Available online: http://www.fs.fed.us/foresthealth/technology/pdfs/MpbWestbb_FactSheet.pdf (accessed on 17 April 2014).
4. *Western Bark Beetle Strategy: Human Safety*, *Recovery and Resiliency*; US Department of Agriculture, Forest Service: Washington, DC, USA, 2011. Available online: www.fs.fed.us/ publications/bark-beetle/bark-beetle-strategy-appendices.pdf (accessed on 10 April 2014).
5. Fettig, C.J.; Gibson, K.E.; Munson, A.S.; Negrón, J.F. Cultural practices for prevention and mitigation of mountain pine beetle infestations. *For*. *Sci*. **2014**, *60*, doi:10.5849/forsci.13-032.
6. Amman, G.D.; Logan, J.A. Silvicultural control of the mountain pine beetle: Prescriptions and the influence of microclimate. *Am*. *Entomol*. **1998**, *44*, 166−177.
7. Fettig, C.J.; Klepzig, K.D.; Billings, R.F.; Munson, A.S.; Nebeker, T.E.; Negrón, J.F.; Nowak, J.T. The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. *For*. *Ecol*. *Manage*. **2007**, *238*, 24−53.

8. Whitehead, R.J.; Safranyik, L.; Russo, G.; Shore, T.L.; Carroll, A.L. Silviculture to Reduce Landscape and Stand Susceptibility to the Mountain Pine Beetle. In *Mountain Pine Beetle Symposium: Challenges and Solutions*; Information Report BC-X-399; Shore, T.L., Brooks, J.E., Stone, J.E., Eds.; Natural Resources Canada, Canadian Forest Service: Victoria, BC, Canada, 2004, pp. 233−244.
9. Carroll, A.L.; Shore, T.L.; Safranyik, L. Direct Control: Theory and Practice. In *The Mountain Pine Beetle-A Synthesis of Biology*, *Management*, *and Impacts on Lodgepole Pine*; Safranyik, L., Wilson, B., Eds.; Natural Resources Canada, Canadian Forest Service: Victoria, BC, Canada, 2006; pp. 155−172.
10. Jahnke, J. *2011 Report on the health of Colorado's forests*; *Forest Health Report* Colorado State Forest Service: Fort Collins, CO, USA, 2011. Available online: http://csfs.colostate.edu/pdfs/126850_2011HealthColoForest-www.pdf (accessed on 25 February 2014).
11. Burns, R.M.; Honkala, B.H. *Silvics of North. America. Vol. I. Conifers*; US Department of Agriculture, Forest Service: Washington, DC, USA, 1990; p. 675.
12. Hopkins, A.D. *The Black Hills beetle*; US Department of Agriculture, Bureau of Entomology: Washington, DC, USA, 1905; p. 24.
13. Keane, R.; Erickson, B. *Restoring Whitebark Pine Ecosystems: Effects of Daylighting*, *Thinning and Prescribed Burning (The Daylite Study)*; Rocky Mountain Research Station: Missoula, MT, USA, 2011. Available online: www.firelab.org/ResearchProject_Files/daylite_studyplan.pdf (accessed on 14 February 2014).
14. Agee, J.K.; Skinner, C.N. Basic principles of forest fuel reduction treatments. *For*. *Ecol*. *Manage*. **2005**, *211*, 83–96.
15. McIver, J.D.; Stephens, S.L.; Agee, J.K.; Barbour, J.; Boerner, R.E.J.; Edminster, C.B.; Erickson, K.L.; Farris, K.L.; Fettig, C.J.; Fiedler, C.E.; *et al.* Ecological effects of alternative fuel reduction treatments: Highlights of the national Fire and Fire Surrogate study (FFS). *Intl*. *J*. *Wildl*. *Fire* **2013**, *22*, 63–82.
16. Stephens, S.L.; McIver, J.D.; Boerner, R.E.J.; Fettig, C.J.; Fontaine, J.B.; Hartsough, B.R.; Kennedy, P.L.; Schwilk, D.W. The effects of forest fuel-reduction treatments in the United States. *Bioscience* **2012**, *62*, 549–560.
17. Gillette, N.E.; Wood, D.L.; Hines, S.J.; Runyon, J.B.; Negrón, J.F. The once and future forest: Consequences of mountain pine beetle treatment options. *For*. *Sci*. **2014**, *60*, doi:10.5849/forsci.13-040.