

# Outbreak Mountain Pine Beetle-Caused Tree Mortality and Subsequent Fire Occurrence in Colorado

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## Introduction

Throughout many coniferous forests of the West, varying mountain pine beetle (*Dendroctonus ponderosae* Hopkins) outbreak intensities have resulted in widespread tree mortality in a multitude of forest types. A need for empirical knowledge exists on the interactions between fire occurrence and post-epidemic beetle stands. Post-outbreak fuel accumulation has generally been thought to increase fire hazard in terms of severity and extent<sup>4,5</sup>. Recent work modeled increases in surface fire spread rates and fireline intensities in post-epidemic versus endemic lodgepole pine stands<sup>3</sup>. Studies conducted in northern Colorado spruce-fir type resulted in no detected relationship between beetle-caused mortality and subsequent fire<sup>1,6</sup>. However post-epidemic beetle-caused mortality in lodgepole dominated forest type had an 11% increase in extent burned in the 1988 Yellowstone fires<sup>2</sup>. In addition to fuels, localized weather and long term climate patterns such as drought may play a significant role in fire occurrence post-outbreak<sup>6</sup>. Weather variables have been shown to be the most important factors when large fires occur in Southern Canada<sup>7</sup>.



## Objectives

- Determine if correlations exist between mountain pine beetle outbreaks and subsequent fire occurrence.
- Determine if relationships may exist between weather and fire occurrence in mountain pine beetle outbreak locations and outside the outbreak mortality.
- Determine temporal occurrence of fires since outbreak initiation.

## Methods

- Historic Fire Data (Early 1900's – present; Fire atlas & digital compilation)
  - Stratified to elevation, slope, and aspect
- Aerial Detection Survey (ADS) Maps
  - Georectified and digitized aerial survey data dating back to 1980
  - Mountain pine beetle outbreak spatial occurrence guided by aerial survey maps
- USDA Forest Service Region 2 Annual Reports
  - Outbreak mountain pine beetle records used as a guide for spatial and temporal occurrence.



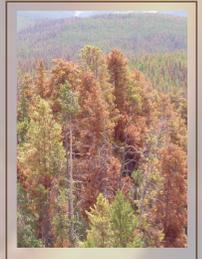
Historic fire data and digitized ADS maps were overlaid in a geographical information system (GIS) for detecting fires in mountain pine beetle-affected areas. Using stratified fire records, site verification will be conducted in summer 2008 for mortality confirmation. Evidence of mountain pine beetle galleries on relic trees within fire perimeters that occurred inside and outside of historic outbreak locations will be recorded for analysis.

Regional and local temperature and precipitation records will be collected for comparison with fire dates

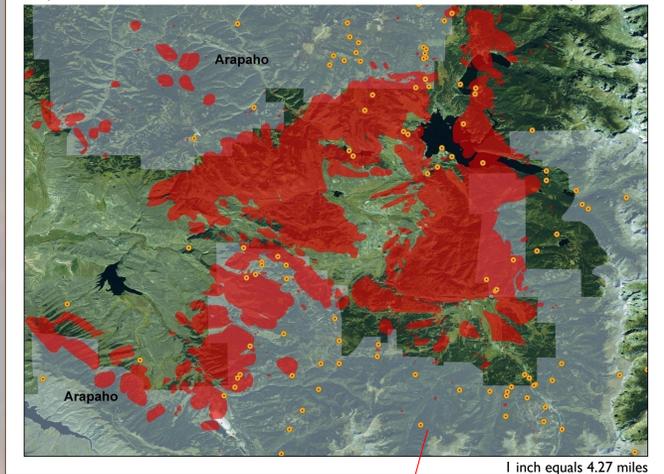


## Future Work

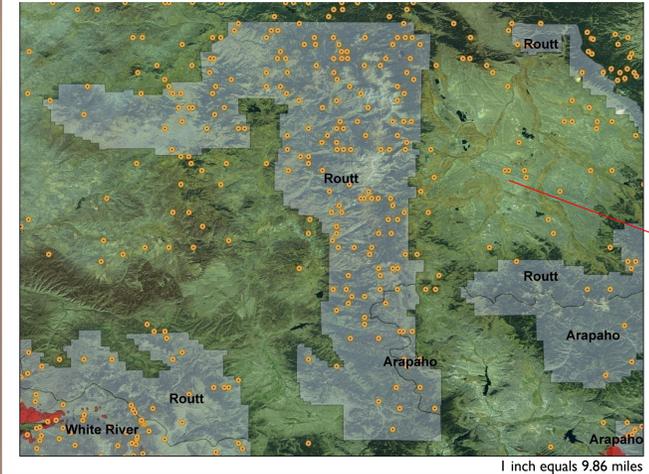
- Completion of georectification and digitizing of historic aerial detection maps for Uncompahgre, Routt, and White River National Forests will be completed prior to field verification in 2008.
- Field confirmation of bark beetle-caused mortality prior to fire - summer 2008.
- Analysis of field confirmation data between fires occurring within and outside of delineated outbreaks is planned to occur in late 2008 into early 2009.
- Comparisons will be made between fire occurrences that union historic mountain pine beetle-caused outbreak mortality and those lacking evidence of prior mountain pine beetle-caused mortality.



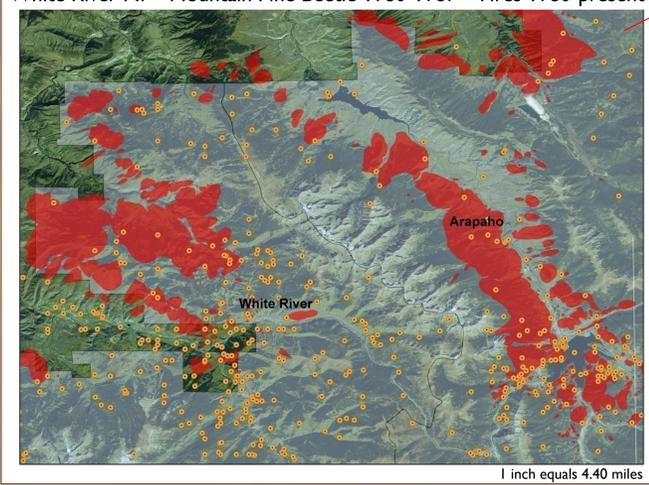
Arapaho NF - Mountain Pine Beetle 1980-1987 – Fires 1980-present



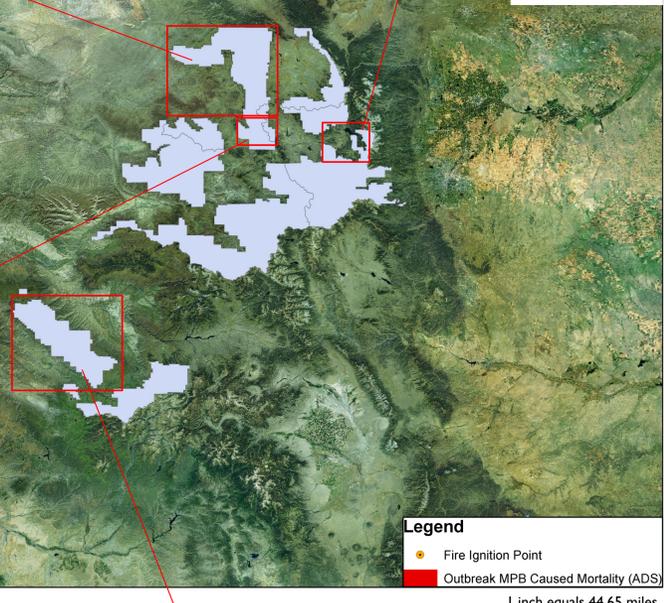
Routt NF – MPB Outbreak Digitizing in progress – Fires 1973-present



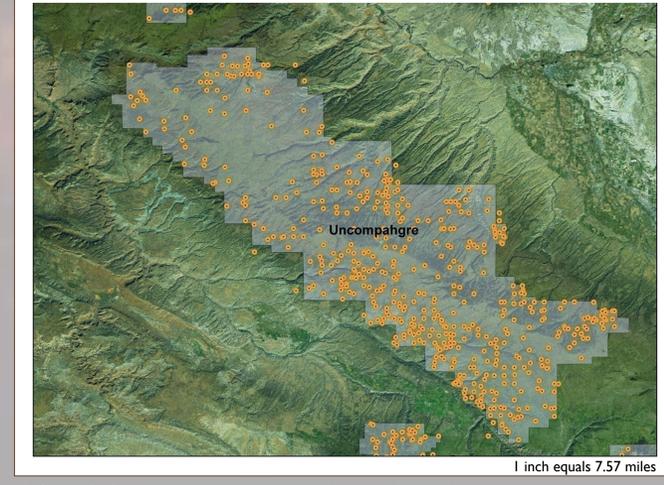
White River NF - Mountain Pine Beetle 1980-1987 – Fires 1980-present



Colorado



Uncompahgre NF – Outbreak Digitizing in Progress – Fires 1920-present



## References

<sup>1</sup>Kulakowski, D., T.T.Veblen, and P.Bebi. 2003. Journal of Biogeography. 30 (9): 1445-1456  
<sup>2</sup>Lynch et al. 2006. Ecosystems 9: 1318-1327  
<sup>3</sup>Jenkins et al. 2008. Forest Ecology and Mgt. 254: 16-34  
<sup>4</sup>Hopkins A. 1909. USDA Bureau of Entomology, Technical report. Bulletin 83.  
<sup>5</sup>Furniss, R., Carolin, V. 1977. Western Forest Insects. Washington D.C.: U.S. Dept. Agric. Forest Service. Misc. Publ. No. 1339.  
<sup>6</sup>Bebi et al. 2003. Ecology 84 (2): 362-371  
<sup>7</sup>Bessie, W.C., Johnson, E.A. 1995. Ecology 7(3):747-762

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