



# Rocky Mountain Research Station

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*Providing scientific knowledge and technology to sustain our nation's forests, rangelands, and grasslands*

## Using HIGRAD/FIRETEC to explore impacts of bark beetle outbreaks on fire behavior

### ISSUE

Bark beetle outbreaks result in drastic changes to forest stand structure and fuels, which impact wind flow as well as fuel load distribution and moisture. The effects of outbreaks on fire hazard depend on the species of beetle, forest type, intensity and rate of tree mortality, time since the mortality, topography, and weather. Dynamic physics-based fire behavior models such as HIGRAD/FIRETEC can explore the impacts and interactions among these factors.

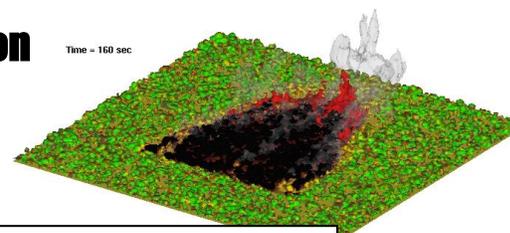
### IMPORTANCE

HIGRAD/FIRETEC simulations allow us to explore questions that operational models cannot address, such as:

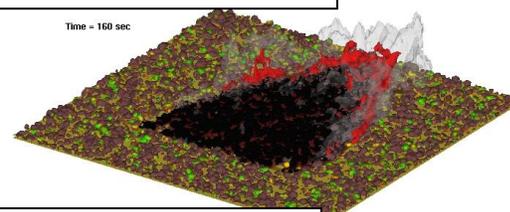
- How does the mixture of alive, weakened, dead, and defoliated trees in a stand affect fire behavior?
- Does the pattern of tree mortality affect fire behavior?
- How does intensity and rate of tree mortality effect fire hazard?
- How do outbreaks affect thresholds where fuels will burn?
- How does post-outbreak fuels management effect fire hazard?

### OUTCOMES

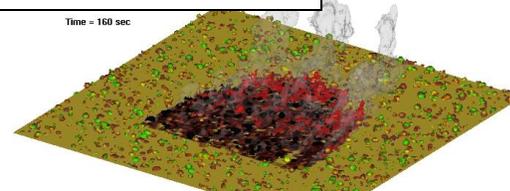
Simulations to date have helped us better understand the implications of bark beetle outbreaks on fire hazard through time in different forest types, under varying wind conditions.



*PRE-OUTBREAK*



*NEEDLES ON TREES*



*NEEDLES ON GROUND*

Tree mortality from bark beetle outbreaks can sometimes be very high and synchronous. Following a severe drought and bark beetle outbreak in Arizona, piñon tree mortality was over 90% in some areas. Simulations show that under these conditions, compared to pre-outbreak conditions (top image), fire rate-of-spread increased when needles remained on dead trees (middle image), but decreased when needles fell to the ground (bottom image).

### PARTNERS AND COLLABORATORS

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- University of Idaho, College of Natural Resources
- USDA Forest Service, Forest Health Management

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