Making Connections:
Pine Beetles, Water, Climate, Fire, and the Future Forest

NOAA David Skaggs Research Center

Boulder, CO – December 7, 2009

Western Water Assessment

Colorado
University of Colorado at Boulder

Colorado Forest Restoration Institute
www.cfri.colostate.edu

Colorado State University

Who we are... Western Water Assessment (WWA)

Western Water Assessment

Colorado
University of Colorado at Boulder

"...to identify and characterize regional vulnerabilities to, and impacts of, climate variability and change, and to develop information, products, and processes that assist decision-makers throughout Colorado, Utah, and Wyoming."

- Joint CU-NOAA program, researchers from many science disciplines assisted by 4 full-time staff
- Work directly with stakeholders to frame research questions and develop climate planning strategies
- Recent projects: *Climate Change in Colorado* report, TreeFlow paleohydrology, Aurora water demand study

Jeff Lukas, Eric Gordon, et al.

Who we are... Western Water Assessment (WWA)

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Three **research themes** for 2009 and beyond:

- Decision support for the Colorado River basin and headwaters
- Ecological impacts and vulnerabilities
- Emerging initiatives and adaptation strategies to inform climate services

WWA Project: “Forests, Climate, and Change”

Year 1 Objectives:

- Outreach to connect WWA and water managers to other MPB stakeholders
- Convene scientist-stakeholder meeting (TODAY)
- Compile database of stakeholders and their information needs, and researchers and their ongoing projects
- Write science synthesis reports on (1) MPB impacts on water supplies and (2) The role of recent climate trends on the MPB infestation
- Develop web pages at WWA to serve as info clearinghouse on MPB-water-fire-climate issues
- Identify stakeholder-relevant research projects to support in Year 2 and beyond

Who we are... Colorado Forest Restoration Institute

COLORADO FOREST RESTORATION INSTITUTE
www.cfri.colostate.edu

Colorado State University

"…to compile, translate, and apply the most current scientific information relevant to the needs of forest managers and communities in taking action to mitigate wildfire risk and restore healthy forest conditions."

- Collaborative monitoring and adaptive management assistance (e.g., Colorado Bark Beetle Cooperative)
- Information synthesis, outreach, and application through meetings, workshops, and reports (e.g., Romme et al. 2006)
- Enhancing wood biomass utilization
- Collaboration assistance and support

Tony Cheng, Jessica Clement

Goals for the day...

- Provide a forum for a varied group of scientists and stakeholders to interact and share information
- Share some of the latest research findings on MPB, fire, water, and climate
- Identify gaps and inconsistencies in the research
- Discuss how the science could be made more responsive and applicable to stakeholder needs
- Identify new mechanisms for coordination, synthesis and dissemination of MPB research--if needed
  - What is an appropriate role for Western Water Assessment?

Agenda

Introductions

Panel 1 – MPB and fire

Break

Panel 2 – MPB and water supplies

Lunch

Panel 3 – MPB, changing climate, and the future forest

Break

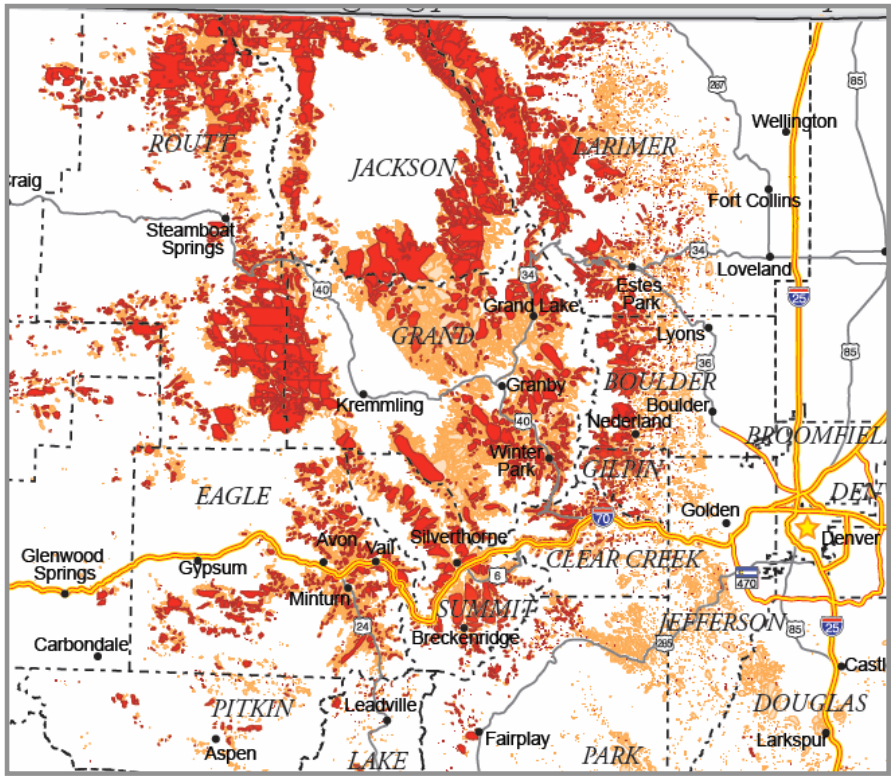
Panel 4 – Forest management, policy, and politics

Summary and Next Steps

Who are you?

What is the status of the MPB infestation?

- Large areas of high mortality on Western Slope
- Overall, Front Range spread and mortality in lodgepole not a repeat of Western Slope
- Spread/erupted in ponderosa on Front Range, but less new activity in 2008?

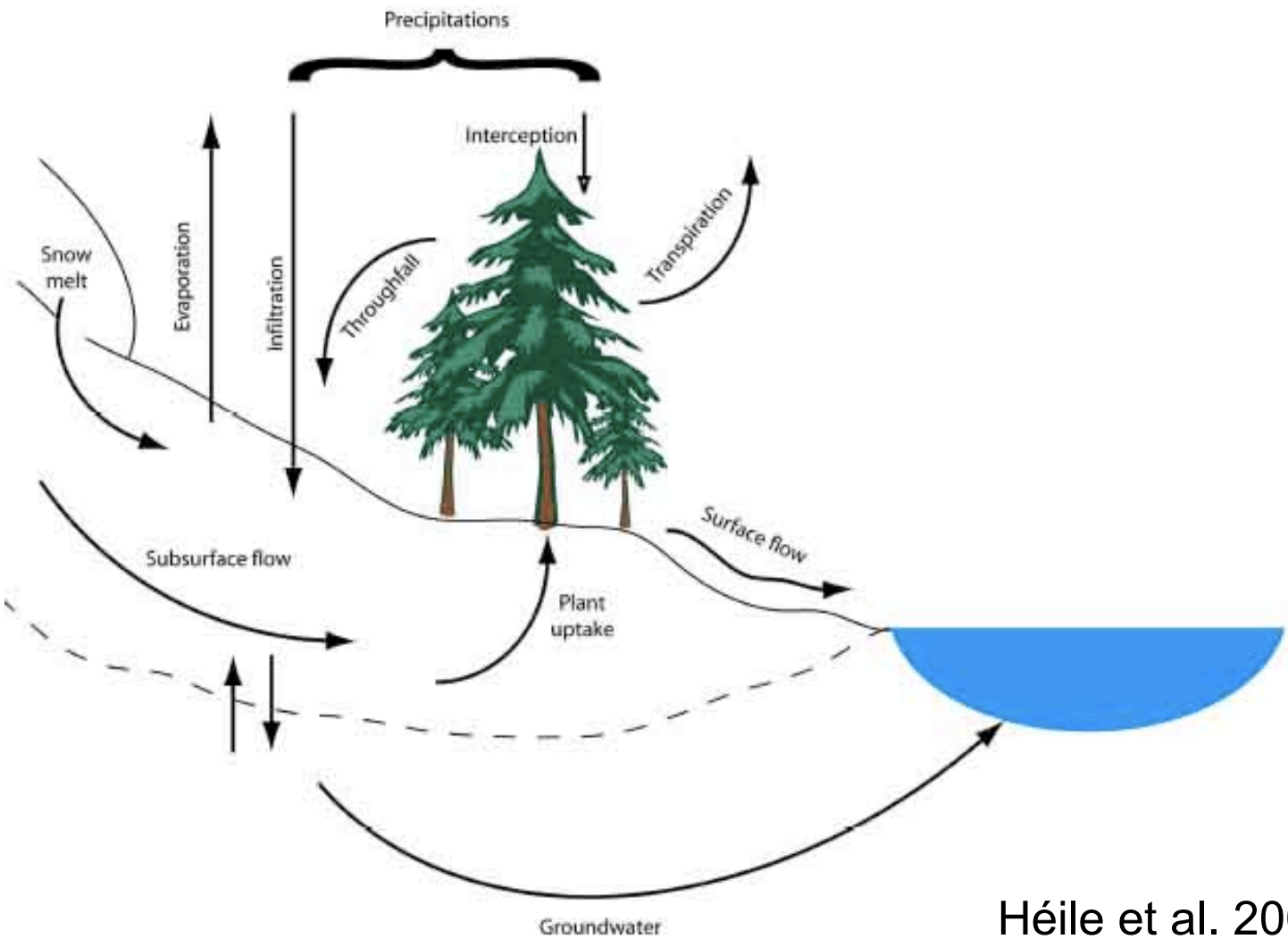


CSFS overflight compilation

Red = 2008 MPB activity

Orange = pre-2008 MPB activity

Forests as “Water towers of the West”



Héile et al. 2005

Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?

- Widespread public perception of high risk--if not inevitability--of severe fire after MPB infestation, as reflected in statements from public officials
- Letter from CO congressional delegation to federal land management agencies, February 2009:

  "We cannot overstate the threat to communities and our fellow Coloradans' way of life posed by these dead and dying federal forests."

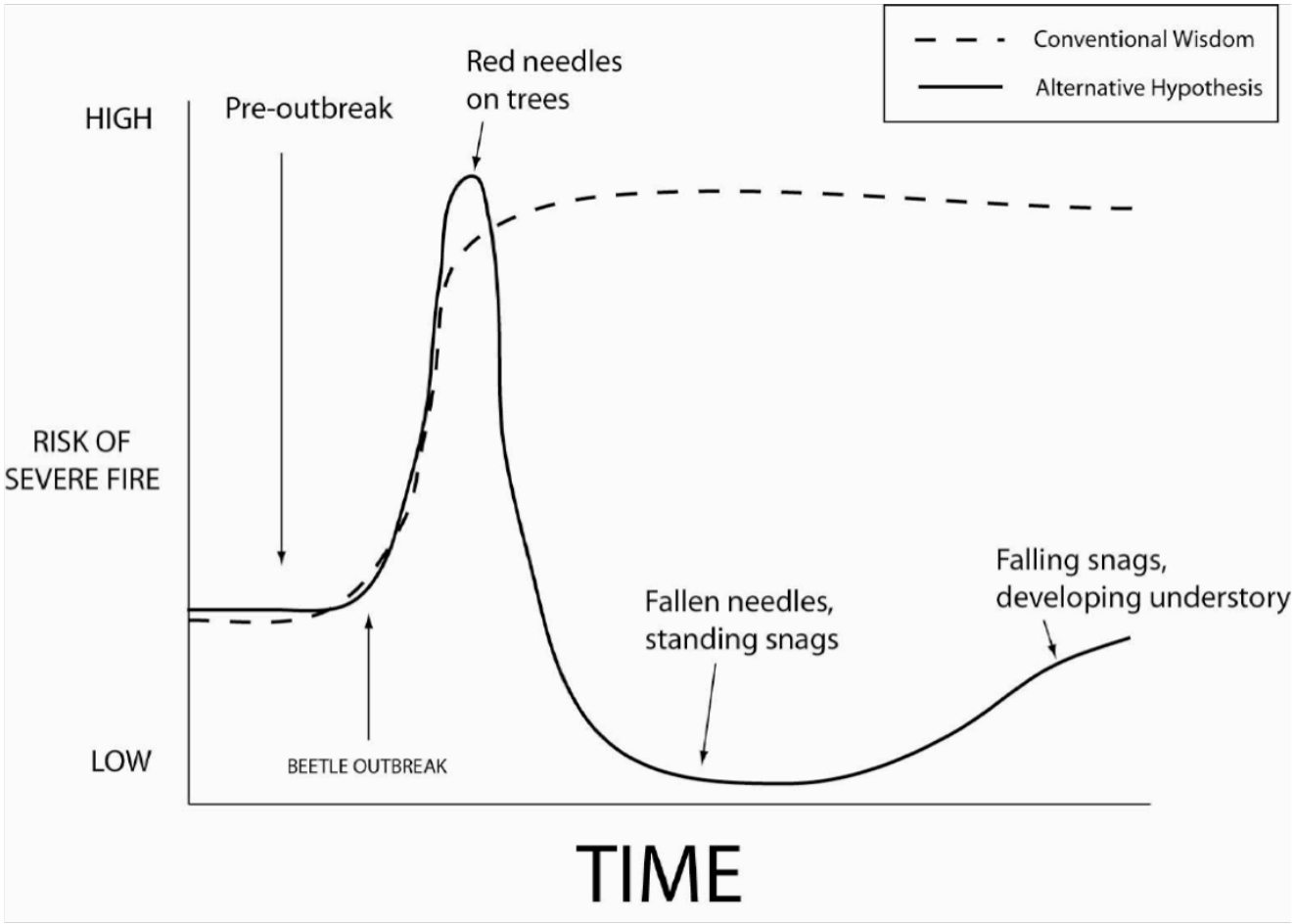
Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?

- Romme et al. CFRI report (2006) assessed literature on MPB-fire linkage in lodgepole and proposed 3 post-infestation phases:
  - Red phase – maybe higher risk of crown fire ignition, if not spread
  - Gray phase – lower risk of ignition and spread
  - Downed phase – higher risk of intense surface fire
- *"Based on current knowledge, the assumed link between insect outbreaks and subsequent fire is not well supported…"*

Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?



Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?

- Kaufmann et al. TNC report (2008) also assessed literature on MPB-fire linkage in lodgepole
- Reiterated the Romme et al. 3-phase schema
- *"…the extensive epidemic now occurring is precipitating enormous changes in fuel structure…"*
- *"Empirical data are very limited."*
- *"There is considerable uncertainty about fire behavior following a mountain pine beetle epidemic on this scale."*

Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?

- Simard et al. USFS report (2008) assessed literature on insect-fire linkage in multiple species
- *"The effect of [MPB] infestations on fire occurrence and severity in lodgepole pine forests* ***are unclear****; research results are ambivalent."*
- *"Effect of bark beetle outbreaks on fire in other forest types are unknown (ponderosa pine, pinyon-juniper)…"*
- *"…time-since-outbreak is critical…"*

Panel 1:

MPB and Fire: Tightly coupled or kissing cousins?

- What are the latest findings and other thoughts on MPB and fire in lodgepole--any clarity? How about ponderosa/ mixed montane forests?
- How are we managing for MPB-fire risk? How does it differ from fire risk management in the absence of MPB?
- Is our perception of watershed risk overly conditioned by the Hayman & Buffalo Creek fires?
- If the MPB-fire risk is being overstated, is that really a problem?

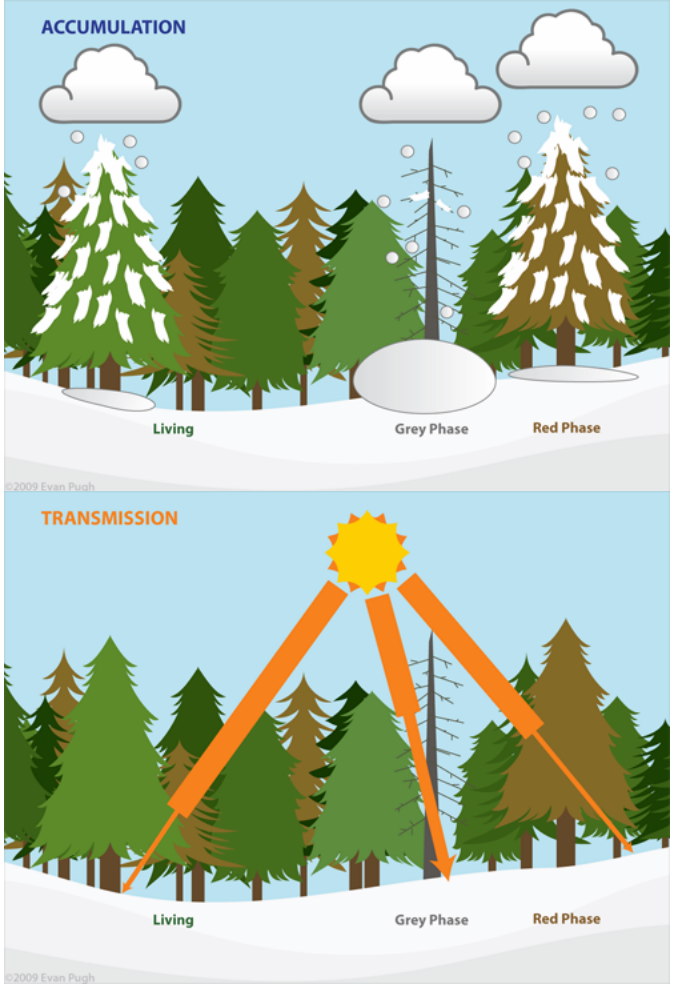
Panel 2:

Beetles and Water: Threat, Opportunity, or Both?

- Theory:
  - Reductions in forest cover = increases in water yield
  - Reductions in leaf area = faster snowmelt

- Review of 94 paired-watershed studies shows 40mm increase in yield per 10 percent reduction of cover in conifer forests (Bosch and Hewlett 1982)

- Increase in yield may not be detectable in areas of low precipitation and/or with minor loss of forest cover



Graphics by Evan Pugh, CU

Panel 2:

Beetles and Water: Threat, Opportunity, or Both?

- Paired-watershed post-infestation studies (Love 1955, Bethlamy 1974, Bethlamy 1975, Potts 1984)
  - Annual yield increases of 13-26 percent
  - Low flow increases 10-31 percent
  - High flow increases 14-52 percent
  - Impacts increase with precipitation levels
  - Few studies, little generalizability

- Needles on snow decreases albedo and advances hydrograph up to one week (Pugh and Small, in press)

- Impacts on water quality unclear—nutrient loading may increase, but enough to matter?

- Loss of canopy in riparian areas may increase stream temperatures

Panel 2:

Beetles and Water: Threat, Opportunity, or Both?

- How confident are we that we will see an overall increase in yield from affected watersheds? Should water managers be prepared to store additional water during spring runoff?

- Is there reason to be concerned about impacts on water quality in affected watersheds?

- From a water quality perspective, what are the pros and cons of harvesting and other active forest management in affected watersheds?

- What do we know about the impacts of pesticide spraying on water quality?

Panel 3:

MPB, Changing Climate, and the Future Forest

Climate and MPB

- The MPB life-cycle is strongly modulated by temperatures; warmer temperatures enhance MPB reproduction (warm season) and survival (cool season)
- Extreme and prolonged water stress from drought and warm temperatures make trees more susceptible to MPB
- Widely assumed that the severity and scale of current bark beetle infestation(s) is a consequence of anthropogenic global warming (AGW)—some support for this

Panel 3:

MPB, Changing Climate, and the Future Forest

Future Climate and MPB

- Temperatures in Colorado projected to increase by ~4°F (over 1950-2000 baseline) by 2050; change in precipitation very uncertain
- Under this scenario, both beetle reproduction/survival and tree moisture stress would likely increase
- Given the extent of the current MPB infestation, availability of host trees will be limiting factor in lodgepole for some time

Panel 3:

MPB, Changing Climate, and the Future Forest

The Future Forest (post-MPB, warming climate) – what will it look like?

- Large uncertainties in projecting future forest conditions
- Species in mixed-conifer likely to shift, but how much?
- Ecotones likely to have the greatest changes
- Limber and bristlecone more likely to lose ground?

Panel 3:

MPB, Changing Climate, and the Future Forest

- Would it help to better understand the specific climatic drivers of the current infestation?
- Does it matter whether the current infestation can be attributed to AGW?
- Are we concerned about post-MPB forest regeneration?
- Can management help make the post-MPB forest more resilient to climate change (i.e., warming) and its secondary impacts?

Panel 4:

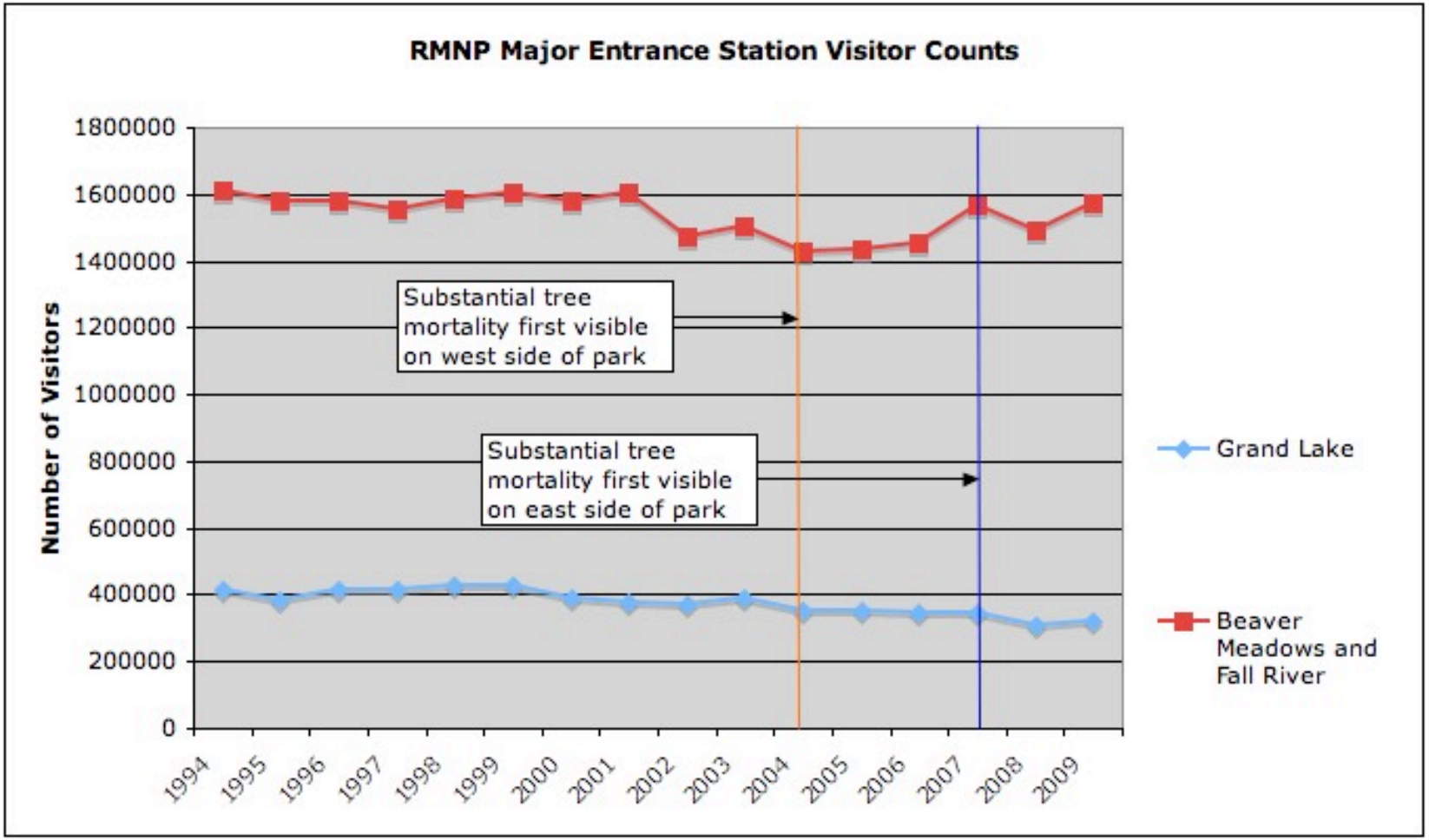
Forest Management, Policy, and Politics

- Possible socioeconomic impacts of the beetle epidemic:
  - Aesthetics
  - Tourism revenues
  - Property values
  - Loss of recreation opportunities (hunting, skiing, hiking, etc.)
  - Loss (or increase?) in timber value

(Vail Resorts Website)

Panel 4:

Forest Management, Policy, and Politics



Panel 4:

Forest Management, Policy, and Politics

- What does the public think of the beetle epidemic?
  - Outbreak as a natural cycle vs. outbreak as a "disaster"
  - Community concerns may decrease over time (Flint 2006)
  - Pesticide use and forest "engineering" on private lands
  - Overwhelming concern about forest fire—has epidemic increased awareness and preparedness?

- Creation of quasi-governmental and non-governmental coordinating bodies: CBBC, For the Forest, Forest Health Task Force, Northern Front Range Pine Beetle Working Group

- Similar groups in Canada a "promising institutional adaptation" (Parkins 2008)

Panel 4:

Forest Management, Policy, and Politics

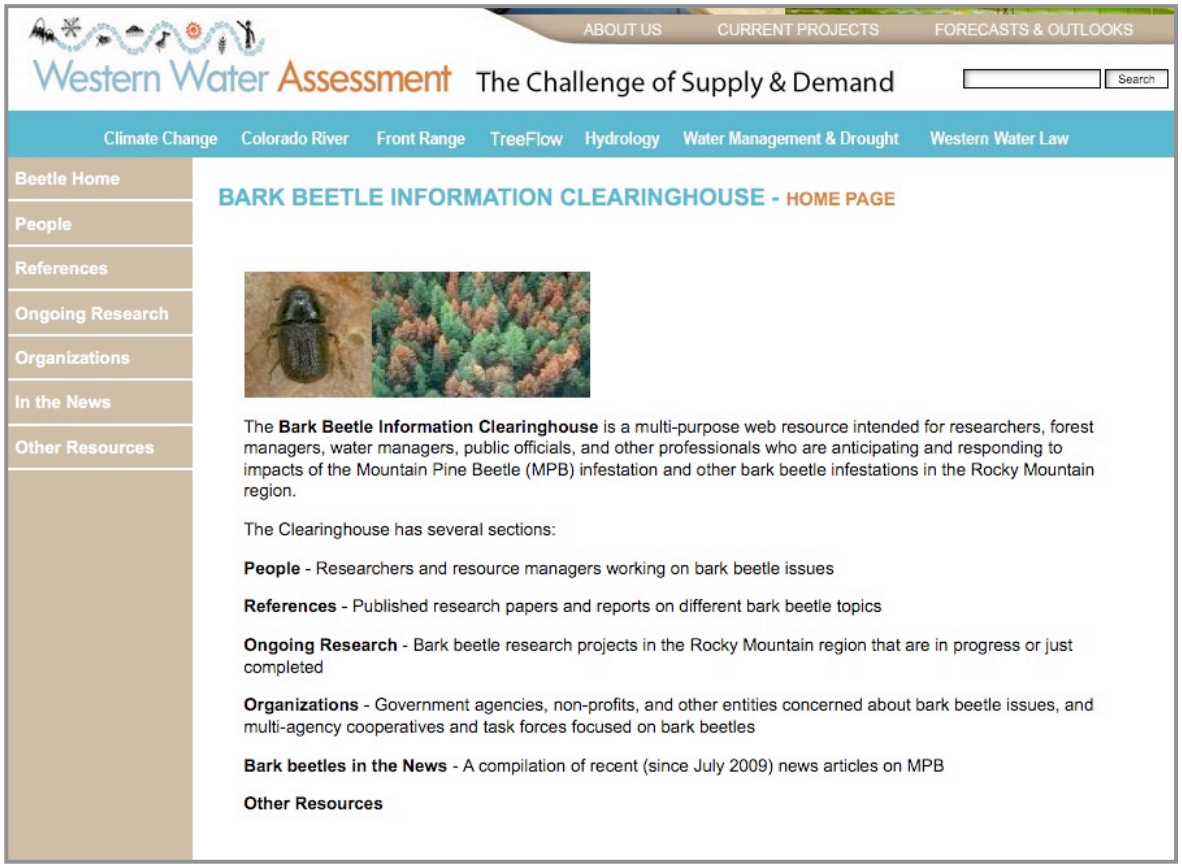
- Do we need more coordination in our MPB response strategies?
- Are we facing an institutional problem, a funding problem, or both?
- Do we need better public education about the MPB epidemic and what we can or should do about it?
- What unaddressed research needs do decisionmakers still have?

Next Steps

Please fill out our survey!

Next Steps

Bark Beetle Information Clearinghouse



Proposed Sections:

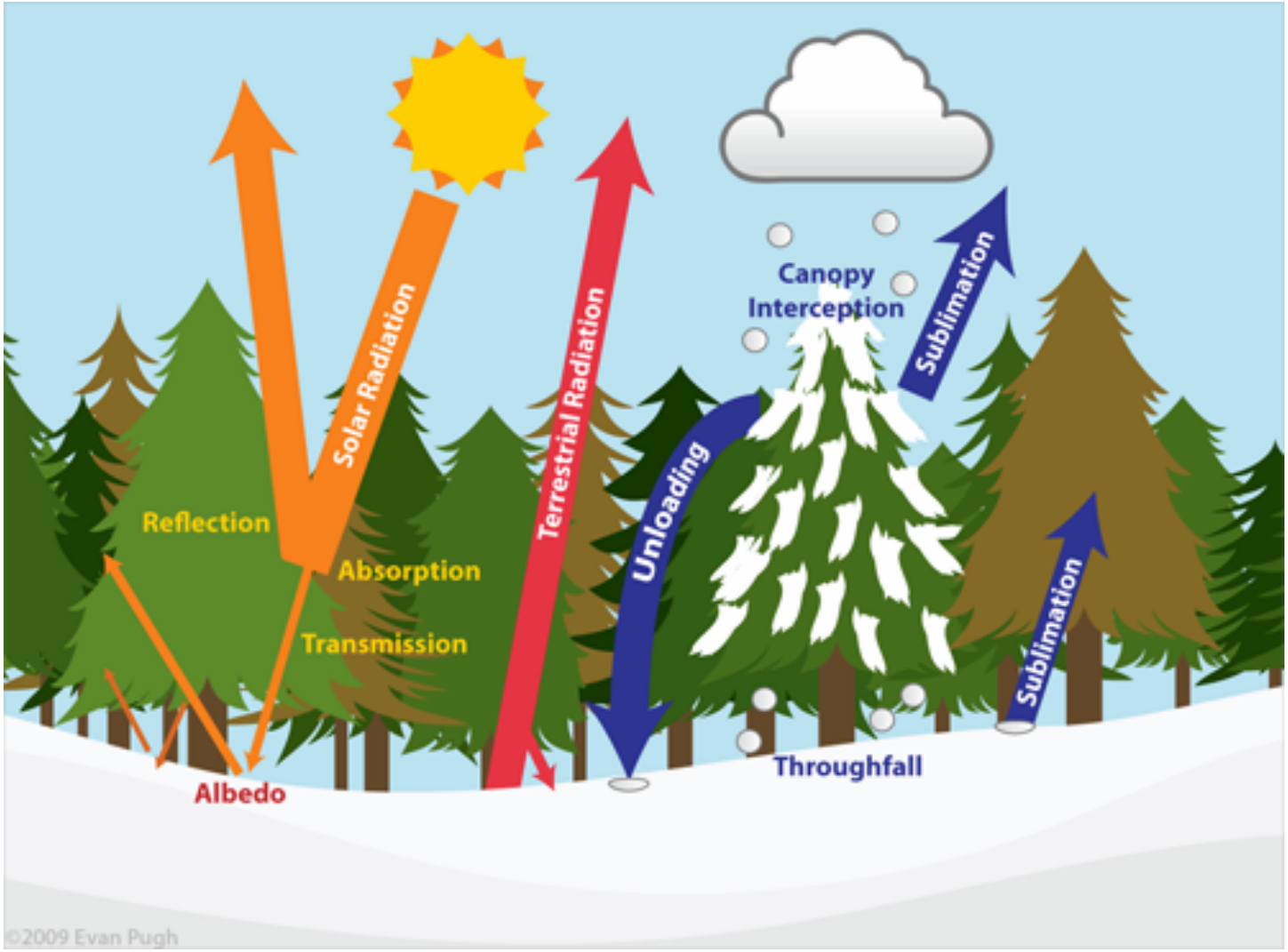
- People
- References
- Research projects
- Organizations
- In the News
- Other resources

Next Steps

- What are the next logical steps?
  - December 11th CSU Forest Ecology Symposium
  - Other science symposia
  - CFRI April 21-23, 2010 science-stakeholder symposium
  - Topic-specific science-stakeholder meetings
  - Stakeholder workshops

- Crafting new research questions developed in conjunction by researchers and stakeholders

Thank You!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