



## North America's Mountain Pine Beetle Pandemic

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*Bruce Melton*



Scientists have been saying, for literally decades now, that insect infestations will increase as our climate warms. The mountain pine beetle killed twenty million acres of trees in British Columbia



between the mid 1990s and 2006. This was the largest outbreak of mountain pine beetle ever recorded. As these dead trees decay, they will emit nearly as much CO<sub>2</sub> as all of Canada's forest fires combined in the last 50 years of the twentieth century. On average, over the next twenty one years, before the new young trees get large enough to offset the emissions, these dead trees will emit carbon dioxide



equal to twenty percent of the annual carbon dioxide emissions of Canada's entire transportation sector.

This is what the scientists mean when they say insect infestations will be worse on a warmer planet. And this event is frighteningly small compared to the risks of even greater kill from the bark beetle. In the next ten years, another 20 million acres of forest will likely succumb to the effects of the beetle in British Columbia. The infestation in British Columbia will stop then, because virtually all of the trees will be dead.

## Three to Four Years Will Determine our Future

The Chair of the IPCC (Intergovernmental Panel on Climate Change), Rajendra Pachauri, has this to say about the 2007 IPCC Fourth Assessment Report and today's state of climate change:

He said that since the panel began its work five years ago (on the Fourth Assessment), scientists have recorded "much stronger trends in climate change," like a recent melting of polar ice that had not been predicted. "That means you better start with intervention much earlier." He said "If there's no action before 2012, that's too late. What we do in the next two to three years will determine our future. This is the defining moment."

This pine beetle infestation is a sign of our future on a business as usual planet. This infestation and other surprises that continue to unexpectedly defy the scientists' predictions do not constitute alarmism. They are truly an alarm sounding loud and clear. Climate change is here, and for some time to come it will continue to get worse at an even more rapid rate than it has in the past.

In July 2, 2008, James Hansen, Director of the NASA Goddard Institute for Space Studies – America's foremost climate modeling agency - said in a personal letter to the Prime Minister of Japan before his speech at the



annual G8 summit meeting: The safe atmospheric concentration for carbon dioxide is 350 ppm. (Today's CO<sub>2</sub> concentration is 385 ppm.) Hansen listed one of the reasons why this is the safe level for CO<sub>2</sub> as "... progressive, unstoppable global sea level rise..."

Climate surprises like this bark beetle pandemic should rightly be scaring the public silly. They happen fast, before the models predict, sometimes by as much as 100 years, and sometimes they are completely unanticipated. Their impacts feed back into even more climate change like an avalanche. They are unstoppable and irreversible. They are, for the most part, completely ignored in the climate models.

This essay about the great pine beetle pandemic is just one example of this new breed of climate catastrophes. These catastrophes aren't like the global warming that we grew up with – they are not and have not been predicted for the future. And they are happening now.

## All the Trees are Red



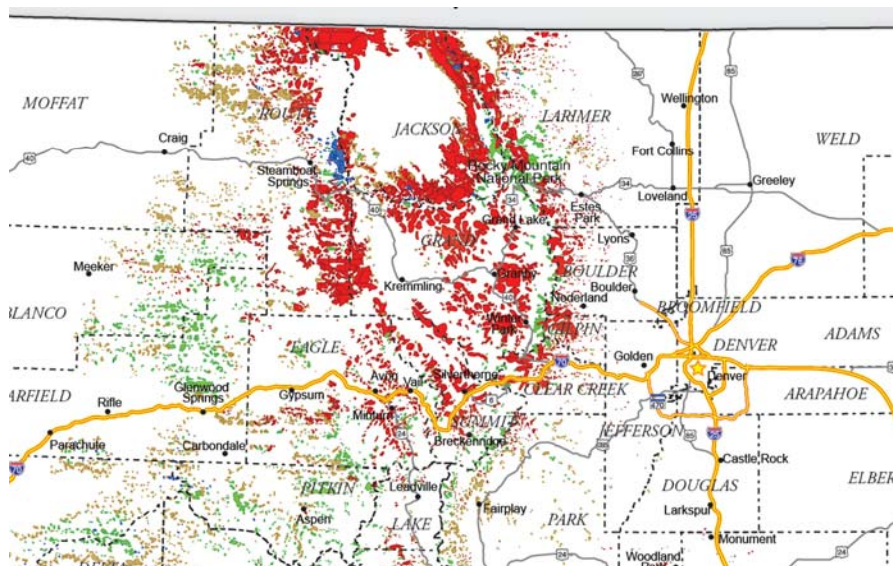
In three to five years, by the year 2013, The National Forest Service says that all of the lodgepole pine forests in the American Rockies will be dead. This includes 3.6 million acres of forest, or about 11% of the evergreen conifers of the American West. Bark beetle outbreaks of this size have never happened before – at least not during normal climactic periods. We are now entering a period of change that the scientists have been talking about since the 1980s. Long term drought and warmer winter temperatures have created an environment where the beetles can reproduce explosively. This outbreak has already killed one million acres of lodgepole in Colorado since the mid 1990s and one



and a half million acres totals in the American Rockies. (For comparison, 800,000 acres were burned in Yellowstone in 1988.) In British Columbia 20 million acres have been killed (ten billion trees). This is an area three times the size of Maryland. The Canadian Forest Service calls it the largest known beetle infestation in North American history. The beetle became established to the east of British Columbia in the province of Alberta in 2002 and has killed three million acres so far.



In Colorado, this year was particularly hard for the north central part of the state. In Steamboat Springs, just a couple of years ago all the trees were green. There were very few who thought that the bark beetles would soon turn the mountainsides red with dead trees all across this part of the Rockies. But it has happened. The people here are in shock.



The visual spectacle is startling. Entire ranges of mountains are red with dead trees. This is nothing like the last major outbreak in the 1970s where single mountainsides were infested. The vast majority of the forested areas in northern Colorado are affected, or will be in just a few years. Most of the trees in these areas are lodgepole pines. The forests will be changed for generations. In Rocky Mountain National Park, the change from 2007 to 2008 is extreme as the images

from the Timber Creek Campground on the west side of the park shows. In Grand Lake at the west entrance to Rocky Mountain National Park, the scene is worse than that presented by the fires in Yellowstone. Almost all of the trees are dead.

In Vail, and Winter Park and Silverthorne and Hayden and Grand Lake and Breckenridge and Walcott and Walden and Frasier and into Wyoming in the Snowy Range and as far west as Craig and Hamilton, the trees are mostly all dead.

Just a few years ago, the continental divide – the front range of the Rocky Mountains - was thought to be a natural barrier to the beetle. But now Georgetown, just up the road from Denver and on the eastern side of the divide, is heavily infested. The beetle has jumped the divide and is headed for the immense forests north of Denver.

## Climate Crisis

So far in Colorado about one and a half million acres have been killed; as per the incident commander of the US Forest Service response to the beetle infestation, that is 750 million trees.

We have no record of any kind showing an outbreak of this severity has ever taken place before, but we



can infer from ecosystem shifts in the prehistoric past that abrupt climate changes have caused this kind of ecosystem destruction before.

The drought has been too long, the trees have become too stressed, and most importantly, the winters have become much too warm. It is the opinion of the US Forest Service, the Colorado State Forest Service and the Canadian Forest Service that climate change is significantly to blame for this unprecedented outbreak. The mountain pine beetle is out of control. The size of this outbreak is so large that efforts at control are almost completely ineffective. There is just not enough money or other resources available to make a dent in this massive infestation. This is truly a tree pandemic.

## Beetle Life

The beetles swarm individual trees in a coordinated mass attack. They release pheromones (natural beetle attractants) to bring in even more beetles. When the tree is full they release a different pheromone to tell the rest of the beetles to pick another tree. In historic infestations, entire mountainsides would be killed. Today, entire forests and entire mountain ranges are being attacked and killed.

Healthy trees can repel the attack by pushing the boring beetles from their holes with sap. Mature trees are the main targets of the bark beetles because the younger trees rapid growth allows efficient production of sap.



The beetles feed on the thin cambium layer between the bark and the sapwood. (This is the part of the tree that grows and carries water and nutrients from the roots to the leaves and energy from photosynthesis to the roots.) The boring beetles quickly girdle the attacked tree; their feeding destroys the conduits for water and nutrients, and it the tree dies. It difficult to tell which trees have been attacked until the year after their death because the needles stay on the tree and stay green for quite some time - like a fresh cut Christmas tree. The year after the tree is killed it turns the characteristic bright red color. Then within another year or two, all of the needles fall off of the tree and it turns a desolate gray.



Another reason why these infestations have surpassed all other recorded attacks is warming winter temperatures. When the temperature falls below 30 to 40 degrees Fahrenheit below zero for extended periods, most bark beetles are killed. These temps were once common in winter in most of the higher regions of the North American Rockies, but not any longer. Even if we had a really cold winter there



are so many beetles now that too few would be killed and the pandemic would continue.



The continued drought since the 1990s and steadily warming temperatures are mostly blamed for this outbreak. This is climate change in action. Scientists have been warning us about this kind of impact from climate change with their predictions of increased insect infestations on a warmer planet. Some studies say that fire suppression has created a “perfect storm” for the beetles. Of course this is at least partially valid however; the predominant conditions that have made this event unparalleled in history and to our knowledge even in prehistory are increased drought and increased temperatures. Scientists have forecasted increased insect infestations for decades now. We know that global warming has increased temperatures to as warm as or nearly as warm as have occurred in the last 100,000 years. In some places the temperatures have increased more than others. We know that drought takes just a few years to weaken forests to the point of susceptibility. And we know that once the forest is attacked, only extreme cold will limit the damage or stop the attack until all of the trees have been killed.

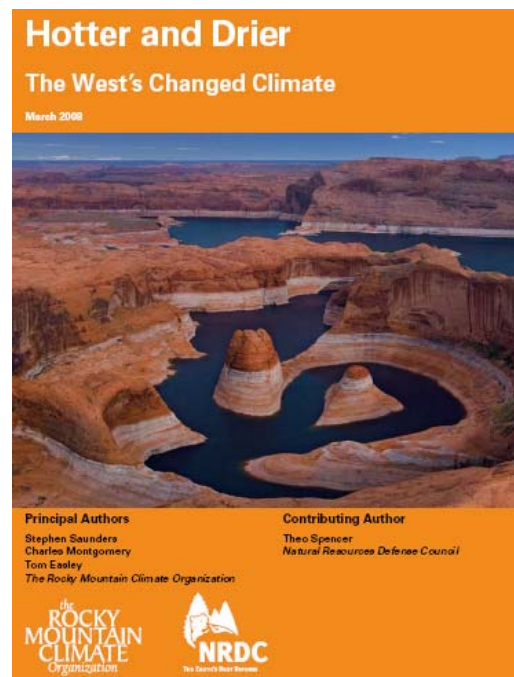
## Rocky Mountain Climate Organization

*Hotter and Drier: The West's Changed Climate* is a report issued in the Spring of 2008. The Rocky Mountain Climate Organization; a group of 17 government agencies, 17 business representatives, and 11 non-profit organizations sponsored the report. The report studied recent state of the art research into climate change in the Rockies.

The results of the study showed that since 1970, the average temperature in the west has increased 2.5 degrees Fahrenheit, far greater than the Earth's average and second in the US only to Alaska. These are some of the findings of this mega-study:

- Snow pack has been less than average 60% to 90% of the time since 1950.
- Rain is falling 75% more of the time instead of snow.
- Since 1948 peak snowmelt has been arriving 30 days earlier in many cases.
- Since 1950 stream flow in the west has been decreasing by 2% per decade. That adds up to about a 10% total reduction.
- The most recent drought in the west that peaked in 2005 affected nearly 90% of the west and was one of the longest droughts in 105 years.

*The study found that measured increases in temperatures, decreases in snow pack, and earlier peak stream flows from 1950 to 1999 are more than 99 percent likely to be outside what could be expected through natural climate variations.*



## Beetles are Rewriting the Textbooks



This outbreak is rewriting the textbooks. Young trees are being attacked and even spruce trees are falling victim. The Mountain pine beetle is a pine bark beetle. Pine bark beetles just don't eat spruce trees. There are so many bugs that their favorite food – the older, less healthy pines - are no longer enough. It remains to be seen whether or not the beetles will continue to prey on these traditionally non-targeted trees.

There are so many beetles now that they are attacking young and healthy trees successfully. The trees cannot produce enough sap to push all of the beetles out of their boreholes: there are just too many beetles.

Beetle infestations are occurring further north and at higher elevations than have ever been seen before. Northern British Columbia has seen its first outbreak ever of mountain pine beetle in the last few years.

Longer growing seasons, because of a warming climate, are allowing beetles to complete their life cycle in one year instead of two or more as is common in areas of the northern Rockies. This has caused a proportional increase in the number of beetles involved in the current outbreak.

Beetles have now been found in Canada on the western side of the Rockies. Because of the high altitude and low temperatures high in the Rockies, mountain pine

beetles have been unknown west of the Rockies until recent warming has allowed the beetles to survive winters at high altitude and naturally spread to the west slope.



Climate computer models do not take tree death from beetle infestation into consideration. These forests are an important sink for carbon dioxide only if they are alive. Once dead, they not only stop absorbing carbon dioxide, but the decay of the dead trees releases tremendous amount of carbon dioxide back into the atmosphere. This is a climate surprise that has not even been considered by



scientists in the bigger picture of climate change. Their super computer climate forecasts do not yet take this into consideration.

## Misinformation Critically Affects the Public

Inappropriate reporting of the “natural nature” of insect infestations across the west is playing a crucial role in the public perception of the impacts of climate change. The size of these outbreaks and the sheer volume of evidence showing extended drought and warmer temperatures as a cause are ample evidence to prove the close association with climate change.



Some agencies, including the US National Park Services, maintain that natural cycles and fire suppression are to blame and ignore manmade climate change. But the overwhelming evidence that climate change has significantly affected temperature and precipitation across the west makes this an illogical assumption.

The Intergovernmental Panel on Climate Change (IPCC) warned in their 2007 fourth Assessment report that it is “very likely” that global warming will increase pest and disease outbreaks in forests.

The findings of the Rocky Mountain Climate Organization that the current outbreak has significantly affected by climate take into consideration 50 scientific studies and data from 125 other scientific sources. The study finds that when compared to the twentieth century average, the West has warmed 70 percent more than the world as a whole.

This is a real threat to efforts to convince the public of the seriousness of this outbreak and of climate change in general. Normal outbreaks don’t continue on until nearly all of the trees are dead in areas as large as British Columbia and northern Colorado. Scientists have been warning us of massive insect infestations because of climate change for decades. The perpetration of the assumption that this outbreak is natural, leads the people to believe that this is normal, that we could expect this to happen even if we had not significantly changed our atmosphere by releasing unfathomable amounts of stored fossil carbon energy into our atmosphere over the last 150 years.



This pandemic is rapidly approaching continental scale. The effects from the widespread regional forest destruction are large enough to impact our Earth's climate by themselves. As this pandemic grows, the effects to our climate will grow too and increase the effects of warming like an avalanche. The forests will no longer be able to absorb carbon dioxide, which will warm the planet. Then the forests will begin to decay and start to emit carbon dioxide at rates equaling the production of carbon in large developed nations at first, if we are lucky. To continue to portray this pandemic as natural is a grave threat to the planet.

## The Future

In 2007, some areas saw an infestation rate increase of the mountain pine beetle that was 100 times greater than it had been in 2006.

The winter of 2007 / 2008 was the 49<sup>th</sup> (out of 127) coldest recorded in North America. This was not a really cold year, but a colder than normal. Globally, the year was the 31<sup>st</sup> warmest out of 127, much warmer than average. Three years ago, North Central Colorado experienced a cold spell where low temperatures were significantly below -20 for a few weeks. These temps were similar to what happened last winter and the outbreak is worse this year than ever before. Last year's cold winter may not have slowed the outbreak..



The Canadian Forest Service says that in British Columbia alone, another 22 million acres of trees will die in the next decade. Up to 44 million acres of trees could be killed in British Columbia by 2015.

The National Forest Service Incident Commander for the mountain pine beetle program estimates that every acre killed by the beetle contains 500 trees. By the time this attack has run its course in Colorado, two million acres, or one billion trees will be dead. By the time it ends in British Columbia 21 billion trees will be dead. The outbreaks in Colorado and BC will likely only end when all of the susceptible trees are dead, one billion or more trees per year.

The mountain pine beetle is the biggest threat to our planet's forests today, because right now, this insect is the most aggressive of them all given the current conditions in our forests. There are however, many other insects and diseases that are showing unprecedented outbreaks as well. The California pine beetle outbreak has killed nearly a million acres. The New Mexico and Four Corners Region outbreak of the pinyon bark beetle has killed nearly three million acres of the high altitude "desert

forests” in the southwest. The Alaskan spruce beetle outbreak has killed another three million acres on the Kenai Peninsula. All of these outbreaks are at unprecedented levels.

The Alaskan outbreak is spreading to the interior of the state. Far to the south, the southern pine beetle has been a long time problem with southern yellow pine monocultures from Texas to South Carolina. The beetle is resurging in numbers today because of extreme drought in some areas and there are concerns of its northward migration following the northward extension of its range because of general warming.

There is a new outbreak that is rapidly changing the greater Yellowstone ecosystem. This beetle attacks white bark pine. Tremendous impacts have been seen in the last few years. These white bark pine forests make up the predominant ecosystems in the greater Yellowstone area and they have peculiar tendencies that may make this outbreak one of the most severe of them all. They white bark pines are the keystone of this very significant environment, meaning their demise could radically alter the area, and reproduction of these forests after a beetle attack is also more difficult than in other forests for a number of different reasons.

Other important players that are considered real threats to forest stability not yet mentioned include the Jeffrey pine beetle, fir engraver, Douglas fir beetle, western balsam beetle, western spruce bud worm, red turpentine beetle, sub-alpine fir decline, aspen leaf miner and Douglas fir tussock moth. Sudden Aspen Decline (SAD), a malady of aspen trees that causes progressive aspen forest die-off, more than doubled in Colorado from 2006 to 2007, from 139,000 to 334,000 acres.



A 2006 report from the National Academy of Sciences predicts up to a 9 degree F increase in temperature in the American West by the end of the century. By 2050 the water levels in Lake Mead and Powell will likely fall lower than the bottom of the outlet pipes at the dams.

- River flows could be reduced by 8 to 11 percent by the end of the century, enough to trigger water curtailments under the Colorado River Compact every fourth year.
- By the end of the century, Dust Bowl conditions will be the new climate norm of the Southwest.
- As soon as 2030, the average flow of the river could be reduced to only half of the level on which the Colorado River Compact is based.

The USDA report Climate and Forest Diseases of Western North America: A Literature Review says of their analysis of over 230 different sources:



“Climate change may cause a crossing of an environmental threshold, resulting in irreversible changes to ecosystems...”

The 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report, surveying worldwide climate change research since the third IPCC report in 2001, utilizing 500 primary scientists and 2,000 expert reviewers from more than 100 participating nations, has determined, with “very high confidence” that “insect outbreaks are increasing and are likely to intensify in a warmer future with drier soils and longer growing seasons.”



The boreal forests that extends across the sub Arctic and Arctic regions to the Arctic Ocean contain approximately 3.7 trillion acres of forest, or 1.8 quadrillion trees - most of which are susceptible to bark beetles. Right now, these trees are beginning to be affected by bark beetle attacks. These forests are among the most easily impacted on Earth. They do not function well in a warmer climate. This is why they are found at the ends of the Earth. The area of these great northern forests at risk is simply astonishing. They cover fifteen percent of the Earth’s entire land surface.

The implications arising from a significant tree kill in these forests from this continuing outbreak are quite literally unimaginable. To illustrate the great risk, the 22 million acres of dead trees in British Columbia today represent one-one hundredth of one-one hundredth of one percent of the trees in the boreal forests. That is for every tree killed so far in British Columbia, there are 100,000 trees in the great northern forests.

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