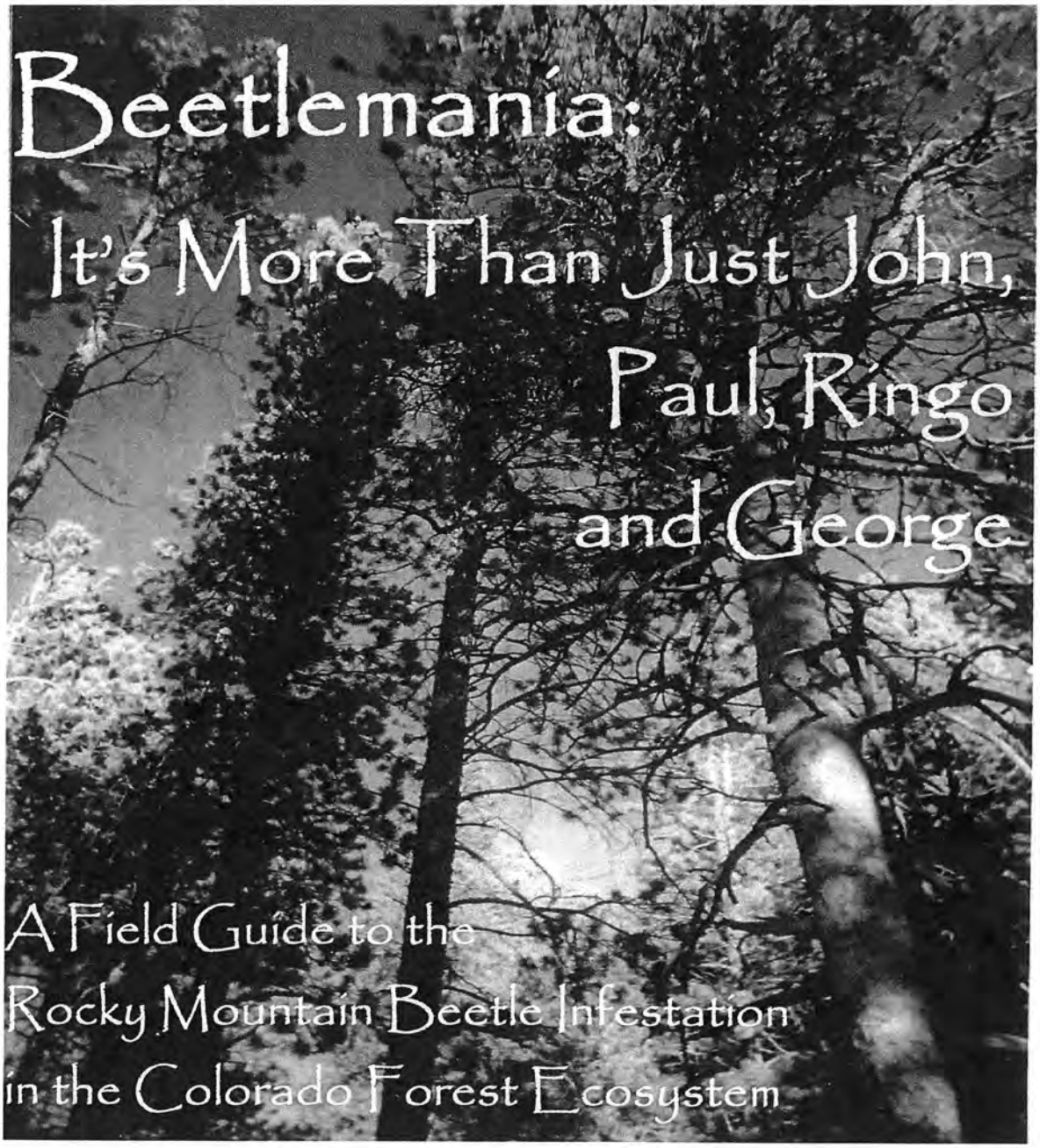


Written and Illustrated by the students in
Mrs. Forbes's 6th Grade Crew
at Explore Elementary

Ponderosa Pine Tree
By: Juan

The ponderosa pine tree is home to its worst enemy. This little enemy is the Mountain Pine Beetle. The Mountain Pine Beetle is destroying Ponderosa and Lodge Pole Pine trees through out Colorado's forests. Experts predict that all lodge pole pine trees will be devastated, and the ponderosa pines will be significantly impacted.

The ponderosa pine tree can grow up to 227 ft. in height. Their pine cone is 5-11 cm long. The pine cone needs heat to open up and release the seed. They are usually found in the Colorado forests.

The beetle bores in to the Ponderosa's bark. Once it enters the bark, it leaves blue stain fungus inside the tree. The blue stain is what kills the tree. It spreads as it infects the tree phloem.

The future of the ponderosa pine is looking bad. It is happening because of the ponderosa's worst enemy THE MOUNTAIN PINE BEETLE.

Photo by Michael

The ponderosa pine cone is 5-11 cm long. The pine cone needs heat to open up and release the seed.

Artwork by Juan

Lodge Pole Pine Tree
By: Julie

Forests are very precious. The forests make oxygen and help us breathe. It gives us wood and provides homes for animals and wildlife. If you explore the Colorado forests right now, you will find the Lodge Pole Pine Tree because the mountain pine beetle epidemic is killing our pine trees.

The Lodge Pole Pine is green and brown in color. Its bark is thin and kind of scaly. The tree grows to 90-120 feet tall. It can live up to 150 years old. In order for a new Lodge Pole Pine Tree to grow, the cone from another tree needs to fall off then be heated by a fire or direct sunlight. With heat or fire the pine cone opens to release the seeds. Then the wind blows and the seed is planted somewhere. After the seed begins to grow, the seed begins a new tree.

MPB or Mountain Pine Beetle is al natural part of our forest and it loves the Lodge Pole Pine. The beetle eats through the bark and lays their eggs in thee under the bark. When they do that they release the blue stain fungus. It spreads around the tree and kills it by not letting water get to the tree.

The Lodge Pole Pine Tree is going to die out of our Colorado forests. New trees will take its place. Our forests will look very different in the future than they do right now. Hopefully, the Lodge Pole Pine Tree will come back in 80-100 years from now.

The Lodge Pole
Pine Tree by Julie

Photography by:
Darron & Mya

The Mountain Pine Beetles and Their Predators
By: Kaiya

Oh no, our forests look horrible! Mountain pine beetles have always been here and always will be --no matter what we do. The last time experts counted, they have destroyed two million acres of trees. The infestation peaked from 2007-2008 since when it first started in 1996. If the temperature doesn't get 40 degrees below zero and stay that way for a few days, then the mountain pine beetle epidemic doesn't stay in balance and more trees will die. The mountain pine beetle has natural predators that play a very important part to keep our forest in balance.

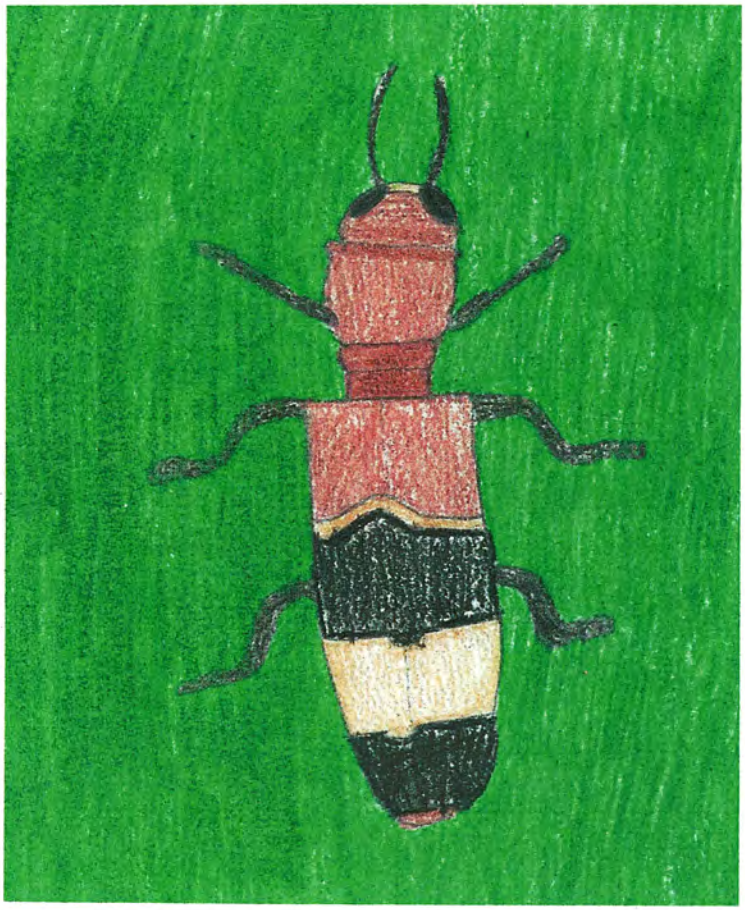
One down, about 300,000 left to go! One of the categories of predators is birds which include the three toed woodpeckers and the pygmy nuthatches. The pygmy nuthatch is mainly seen in ponderosa pine forests. They only eat insects like your all time favorite, the mountain pine beetle, and vegetables (pine seeds). The wood pecker is the other one; they eat fruit, mountain pine beetles, and sap, plus some other insects. They are mainly seen in western Canada, Alaska, and the Midwestern United States.

Acts of cannibalism happen in the insect world. There are insects that prey on the mountain pine beetle including the checkered beetle. This beetle's body is covered in tiny hairs just like humans, and of course your all time favorite the mountain pine beetle. Plus they hunt the larvae of termites, bees, and wasps. If they had to pick their favorite prey they would pick the mountain pine beetle. They have been seen in Australia, the Middle East, the Americas, Africa, and Europe. Weather can also affect checkered beetle just like the mountain pine beetle. For example, the heat can speed their life cycle speed up, while the cold climate slows it down. Both hot and cold temperatures can kill the mountain pine beetle. Female checkered beetles need to eat so that way they can have enough energy to lay 28-42 eggs at a time which they do 36-72 hours after eating. They lay their eggs in between the bark of a wood borer infested tree or under a rock (in the soil). When these eggs hatch the larvae are red or yellow. The larvae eat the eggs of wood boring beetles while the adults eat the adult mountain pine beetle. The checkered beetle is the primary insect predator. But there are others: the wasp, the Dichopodid fly, and the round headed wood borer.

The final kind of natural predator for the mountain pine beetle is a parasite called a nematode or an internal, parasitic worm. This worm is very special because they don't go through the pupa stage in their life cycle. When they become adults the female is larger than the male. Their bodies are long, slender, and thinner on both tips. They live in fresh water, marine, and terrestrial environment, but they have been seen in Antarctica, and oceanic trenches. They eat fungi, and protozoans, but some are occasionally filter feeders. The nematodes can prevent female mountain pine beetles from making or laying eggs.

Usually when the mountain pine beetle population is in balance, their natural predators help to keep them that way. Unfortunately, in this case that isn't happening. Too many things are causing the beetle population to be out of balance and the natural predators can't keep up. Experts predict that we will have all new forests in 1-5 years because the beetle epidemic will wipe out all the pine trees from the Colorado forests.

Photography by: Alysa



The checkered beetle is one of the natural predators of the mountain pine beetle. Artwork by Kaiya

The Natural Cycle of the Forest
By: Mariah

Everything in nature has a natural cycle--a usual way that things are born, live and then die. A forest, a group of trees, has a cycle too. Trees grow into maturity from a seed, and then die a natural death of old age or sometimes die from fire, extreme weather or bugs and pests. Trees are usually different ages in a forest and of different kinds. The Mountain Pine Beetle is one factor that has altered the natural cycle of the forests in the Rocky Mountain ecosystem.

Even though the Mountain Pine Beetle is mostly despised by Coloradoans and Canadians alike, the little bugs (the size of a grain of rice) have an imperative role to play in our forests. They help our forests when they invade old and dying trees, leaving behind *blue stain fungus*. In about a year, the old tree dies and a new tree takes its place starting another generation. There are so many beetles (for many reasons) that the trees can't defend themselves from thousands of attacks in one season from these little pesky insects. Since the Mountain Pine Beetles are so out of hand, all of the trees are dying – young and old -- one by one.

Humans have affected the cycle of the forest in a few ways too. One is our management of the forest and its resources. We have stopped letting nature run it's course – as in forest fires that help to destroy old trees and allow new trees to come in. Another is global warming which is changing the climate and stressing the trees out, making them an easy target for the beetles. There are so many stressed trees in the forest, the beetles have a feast, an all you can eat buffet!

Once a natural cycle has been interrupted or altered, everything else in the ecosystem changes too. Millions of pine trees have died in the Rocky Mountains so far. That means animals, insects, reptiles, amphibians and bird species will be impacted. Their habitats and food sources changed or even disappear completely. Some animals will be destitute without tall, mature pine trees. During the current cycle, the pine beetle is out of control which throws off the natural cycle of the forest. Hopefully in the future, the forest cycle will be more in balance and be allowed to run its natural course without humans interrupting it.

The life cycle of a pine tree, from sapling through maturity and finally, death.
Artwork by Mariah

Photograph by Darron

Concerns

Photograph by Caleb

A Homeowner's Perspective on MPB, by Alysa

Beetlemania:

It's more than just John, Paul, Ringo and George

A Field Guide to the Rocky Mountain Beetle Infestation in the Colorado Forest Ecosystem

Written and Illustrated by the students in
Mrs. Forbes's 6th Grade Crew
at Explore Elementary

Multiple Perspectives
by: Alysa

How could something so small actually be so big? The Rocky Mountain Pine Beetle is one of these so small but so big examples -- this beetle is only as big as a grain of rice but it's devastating the Colorado forests. How does something so small do so much damage? Three groups of people are impacted by this epidemic: property owners, tourists, and Coloradoans in general.

In case you haven't read anything about this problem it's important to know how the beetle kills the trees. The beetle carries a fungus called blue stain fungus. When the beetles eat their way into the tree, the fungus spreads to the phloem. The blue stain kills the tree by cutting off the water circulation. Then the female beetle makes a J-shaped gallery that she lays her eggs in. When they hatch, they eat their way around the tree (called girdling) and then they eat their way out of the bark and fly to a new tree. This is the life cycle of a Rocky Mountain Pine Beetle.

As the trees die, they change colors from green to gray to red. Finally, they drop all their pine needles and aren't very aesthetically pleasing. If you own property in the mountains your property values can go down because your land isn't as pretty as it used to be. Even though new trees will take the place of dead trees, it might take 20 years for this to happen. Many people buy property or move to the mountains because it's so beautiful and now it won't be.

People come to Colorado for it's beautiful trees, forests and resorts. Every time you see a picture of Colorado there are mountains with trees on them. When you think Colorado-- you think pine trees. If the pine trees die and the forest is not as pretty as it used to be, will people still want to come here? The people that make money from tourists coming to Colorado may not make as much money or go out of business completely because of the pine beetle devastation.

People literally love trees. Humans have developed a relationship with trees. Trees are loved for their wisdom, beauty and the fact that they provide oxygen for people. People have written songs and poetry in honor of trees and forests, they are respected and celebrated in artwork and paintings. As the trees die, people are sad. People are feeling the loss of trees and forests emotionally. Even though it's a natural part of the forest cycle (trees dying), people don't have to like it.

There are several ways to look at the Rocky Mountain Pine Beetle's impact on Colorado and its people. The fact is that it's a natural part of the forest cycle, but we don't have to like it. At this point it is an epidemic problem. In the short term property owners, Coloradoans and tourists will be impacted. In approximately twenty years or so, our forest will look different but majestic again, as new trees take the place of dead pines.

So many trees are dead in our forests, that falling trees are a serious safety issue for people enjoying the outdoors. The parks service has posted signs and posters warning people to be aware of falling trees while in the forest.

Artwork by Lino

Photography by Connor

For Our Own Safety

By: Lino

"Watch out !" Dead trees are a safety issue in Colorado. Pine trees are infected with blue stain fungus from Mountain Pine beetles. Trees are dying all over from this disease that Mountain Pine Beetles inject into trees . A dead tree can stand in the forest for up to ten years.

Unfortunately the dead trees are falling on people and killing them. That's why trees are rapidly becoming a safety issue. Some people are at risk like boy scouts, families on hikes, bikers that bike in the mountains. We cannot spray the tree because the chemicals will kill the beetle but also the tree.

Our solution is to remove the wood from the forest and use it purposely. The use for dead wood is fire wood and if we don't get the dead wood out of the forest. Many people could get injuries or even die in the forest. We should listen to suggestions that other people have to help the safety issues that were dealing with. Another solution would be just chopping down old dead wood so no one could get hurt. The ways that trees die are from Mountain Pine Beetles they inject blue stain fungus into the phloem which prevents the tree from getting water. We need to be safe around the forest because some of the dead wood could fall on us and may even kill us. After many years our forest will change but it's not the end of the world for us.

Artwork by Jared

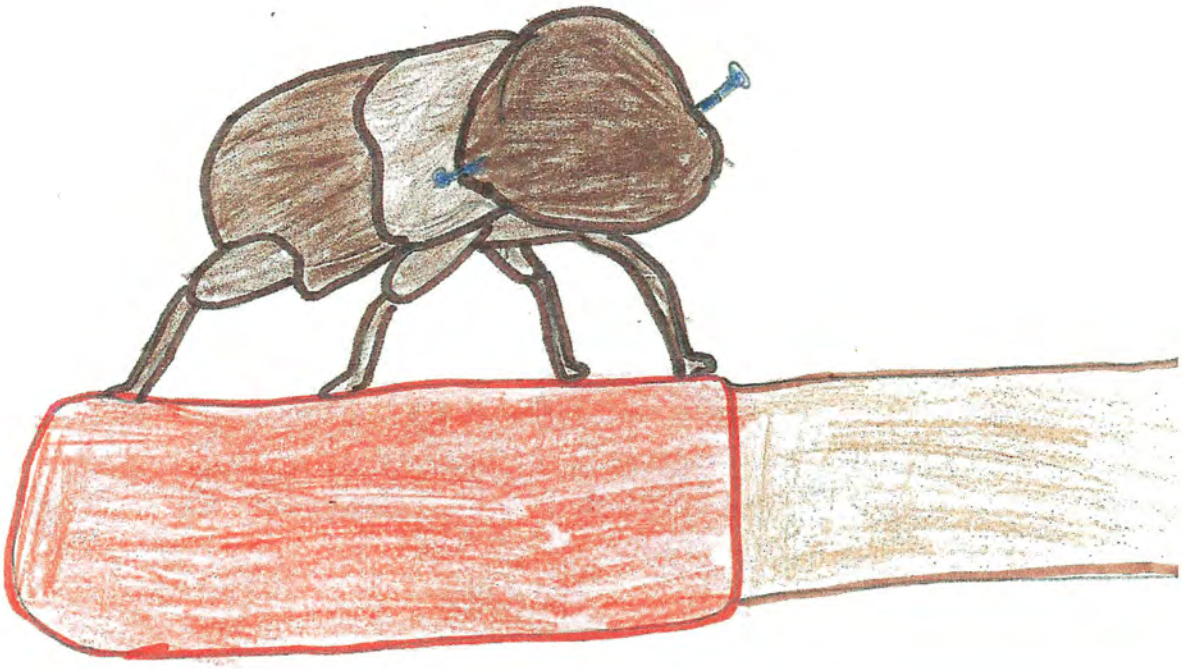
Photograph by Bonifacio

Wild Fire
By: Jared Louis

Wildfire is a huge risk for astronomical fires. Wildfires are a current concern because our forests are dieing in Colorado due to the blue stain fungus. The blue stain fungus comes from the mountain pine beetle, hundreds of thousands of pine beetles are feasting on our trees.

Is wildfire a danger to our forest? Yes, yes because our forests are in danger because of all the dying trees, they are a fire hazard. If a wildfire breaks out it is more likely to become out of control and could destroy houses and properties. Pine beetles can leave behind 45 million to 60 million tons of dead wood which increases fire risk.

What can we do with 45 million to 60 million tons of dead wood? I'll tell you what we can do, we can remove the dead wood but it'll take years to do; we can use the dead woo d for logging. Also we can use it for fire wood. We can prevent wildfires from occurring by getting rid of dead trees and trying to slow down the spread of mountain pine beetles.



A mountain pine beetle is the size of a match head.
Artwork by Michael

Photography by Kaiya

Beetles In Your Backyard

By: Michael

The Mountain Pine Beetle has killed over two million trees in our Colorado forests. But what about our town of Thornton and the surrounding towns Northglenn and Brighton? Will it destroy all there pine trees. Has the mountain pine beetle left the forest and hit the pine trees in the city?

Experts predict that the ponderosa pine trees will be seriously impacted and the lodge pole pine trees will be completely wiped out in the Colorado Mountains. Many towns and cities that are not in the mountains have these same trees in their yards and parks. The city of Brighton recently published an article for homeowners suggesting ways to prevent your trees from damage and how to tell if they have been attacked. The article suggests looking for pitch tubes, saw dust at the base and boring holes in the bark. It recommends using chemicals to protect your tree or artificial pheromone spray to communicate that the tree is full (preventing other pine beetles from stopping there).

There are lawn services and tree care companies that are advertising to come to your house and check your trees. And if needed, they can help you protect them, get rid of infected trees, and give you advice on how to prevent future damage.

It seems that the Rocky Mountain Pine Beetle is coming out of the mountains and into the cities. Will it completely wipe them out like it is predicted to do in the mountains? Only time will tell.

Colorado's ecosystem includes 18 species of amphibians, 48 reptiles, 123 mammals, and 408 birds - quite diverse. This tail-less lizard was found at Chautauqua Park in Boulder.
Photograph by Darron

Artwork by Jenna

Diversity of Plant and Animal Life
By: Jenna

You know when you want to change your clothes, you just get into your closet and you just get a complete new outfit? Well our forests are headed for a big change, soon. Mountain Pine Beetles are killing our forests' trees.

When one little thing changes in an ecosystem everything changes. Dead trees cover about 52,000 acres of the state forests. Lodge pole pine is the most common, covering about 60%. Blue Spruce and Fir trees make up 23%. The remaining 17% of trees are Aspen forests. One example is idea is the idea that when the Lodge Pole Pine and most of the Ponderosa Pine die; the forests will get more sunshine. New plants that like sunshine will come in. The plants living on the forest floor will then have more sun- light to grow. Some plants will like this, some won't. With the new plants coming in, that means new trees like Aspen and Blue Spruce will be the primary trees in our future forest.

As the pine trees die out, animals like the Pine Squirrels, Goshawk, Three Toed Wood Pecker, Boreal Owl, and the Boreal Toad will leave. Then we will have new species including amphibians, reptiles, mammals, and birds. This Colorado ecosystem has includes a diverse 18 species of amphibians, 48 reptiles, 123 mammals, and 408 birds - quite diverse. After the RMPB infestation changes our ecosystem, we can expect 70% of them stay for a while, while others just move to other ecosystems. New species will come into the new forest since it will have increasing moisture and warmth.

Change is natural. Destructive--but healthy. When the climate changes, plants that don't like a lot of sunshine die then plants that love lots of sunshine come in. Same thing with animals, certain types of animals like cold temperatures and others don't, they like warm temperatures. When the tall trees fall and die it is destructive but it is making more sunlight for all the plants that were already there and for new plants coming in. Still, changing is natural. Destructive, but healthy.

Woodpecker activity is often a sign of MPB activity within a tree. The Three Toed Woodpecker is a natural predator of the MPB.

Photo By: Connor

Three Toed Woodpecker

Original Artwork by Austin

Dedication Page:

This book is dedicated to future generations of students and children. It is our deepest desire that Colorado's forest ecosystem and the animals that live here will still be here for future generations – including the mountain pine beetle. We hope that decisions are thoughtfully and purposely made regarding forest management and human activity that impacts climate change, so that the natural system stays in balance for our children and their children.

This book is also dedicated to the forestry department and the forest rangers that currently protect and manage our regal Colorado forests and natural resources.

Finally, we'd like to honor our parents for their support and guidance. We appreciate the numerous ways you have helped: giving us ideas, computer support, emailing our work to Mrs. Forbes, taking us to the library, listening to our drafts (over and over and over again), developing our film and signing "stuff" for school. We would not be who we are, without YOU!

Written and illustrated from September to December 2009
Mapleton Public Schools
Explore Elementary
9100 Poze Blvd.
Thornton, CO 80229

Impacted Species:
Three Toed Woodpecker

Story by Austin

The Three Toed Woodpecker is going to leave our Colorado forests because there's becoming less and less lodge pole and ponderosa pine trees. Without any of the tall, old pine trees that the three toed woodpecker likes, they would not have any place to live or lay their eggs. The lodge pole pine and ponderosa pine trees are dying because of the mountain pine beetles. If there are no lodge poles or ponderosa pines, there are no mountain pine beetles. If there's no mountain pine beetles--the three toed woodpeckers would have nothing to eat—they LOVE those little beetles.

The three toed woodpeckers have an unusual ability to grip on to the trunk of the tree instead of the branch. They actually got their name from the three toes they have on each foot. These wondrous critters have colors --forest colors like brown, gray, white and black. The three toed woodpecker doesn't migrate; they gather or aggregate, in the winter, in areas where food is plentiful. They stay close to the same summer eating and breeding grounds. If the lodge pole and ponderosa pines disappear from the Colorado forests due to RMPB, there will be a food shortage, a habitat loss and the woodpecker will leave the forest for a long time. It's possible that in 80-200 years, our forest will have the pine trees that the woodpecker prefers again and three toed woodpecker will return – only time will tell.

The goshawk is both, territorial and aggressive. They will defend their territory ferociously from everything, even humans.

Artwork by Jessica

Photograph by Jared

Photograph by Juan

The Mountain Pine Squirrel by Melissa

Two Squirrels in Action, Photographers: Kayla & Alysa

Pine Squirrel

By: Melissa

The Mountain Pine Beetle is making a huge change in our forests' ecosystem which is threatening the pine squirrel. The mountain pine beetle is killing many pine trees in the forest. This is affecting the rest of our wildlife. Remember, that when something changes in an ecosystem everything changes.

Pine squirrels (Tamiasciurus hudsonicus), sometimes referred to as a red squirrel or chickaree, have a huge distribution in North America that is extending all the way to Canada and Alaska; it's even found throughout the Rocky Mountains all the way to New Mexico. The pine squirrel loves the old and mature forest which is going to be rare in Colorado's future because of the mountain pine beetle. In addition, the pine squirrel is a really important prey for the Northern Goshawk, and without it we might even lose the Northern Goshawk from our forests.

Scientists believe that from one to five years from now, the forest stands will still be dominated by mature lodge pole pine trees. This means that during the immediate future the pine squirrel population isn't going to change much. After the attack when all trees over 6 inches in diameter have died out, that will cause the pine squirrel population to decrease rapidly as their food stores are disappearing. Squirrels will become extremely vulnerable to bird predators as the tall trees die out. The time that it's going to take between the trees dying and the squirrels population decreasing will be three years or less. In addition, trees that survive the bark beetle epidemic will be very unlikely to make many seeds that the squirrels would eat. For squirrels to survive and stay in the Rocky Mountain stands of live trees, they will have to be at least twenty acres long.

Scientists predict that after six years of forest death, pine squirrels will have stopped using areas that are supported by pure lodge pole forests. There are two reasons the squirrel will be leaving: there will be a very small amount of winter food and the cover from aerial predators will be limited. This means that pine squirrels will be living in other kinds of forests, but no longer in the Rocky Mountain pine forests.

There are thousands of pine squirrels in our forests currently, but just because of the mountain pine beetle they will leave our Rocky Mountain forests. Remember as one thing changes in the ecosystem, it could be big or small, it will change everything.

Photograph by Jeffery

The Boreal Toad is the only toad to live in the Colorado Mountains. Artwork by Derik

The Boreal Toad

By Derik

Pine beetles are becoming a devastating problem. The Boreal Toads are losing their homes and food sources. It is having a difficult time with the forest ecosystem changing due to the Mountain Pine Beetle devastation. Experts predict that the lodge pole and ponderosa pine trees will leave our forests, in that case, the boreal toad will leave too.

The boreal toad is the only toad to live in the Colorado mountains. Females grow larger than males. Both females and males appear warty and have a light colored stripe down their backs. They eat flies, grasshoppers, mosquitoes, beetles and moths. The mating process happens in lakes, beaver ponds, flooded meadows, and glacial kettle holes. They are picky about mating. They only mate when it's cold enough. Global warming is part of the problem it's not cold enough. The female lays between 3,000 and 8,000 eggs. The male doesn't have a loud call just a quiet chirp.

Wildlife experts predict that from three to five years after the pine beetle infestation the boreal toad will leave our forests. The pine needles will fall off the trees and their will be less shade. The forest ground will be dryer and the toad won't have the wet and cold habitat it likes. In six to twenty years, the ecosystem will be shadier and wetter again so the toad may return to the ecosystem.

The mountain pine beetle although really small has a huge affect. It's like a domino effect – if one thing happens it effects the whole forest ecosystem. Like the boreal toad, it might come back to the forest, but it will take some time – perhaps as many as twenty years.

Future Forests

The Quaking Aspen Tree
By: Darron

Thanks to the mountain pine beetles, all the Lodge Pole pines are predicted to die in the Rocky Mountain pine forests. The Ponderosa pines are expected to be seriously impacted. There are two trees that will grow in the place of the Lodge Pole and Ponderosa pines. One is the Aspen, or the Quaking Aspen, and the other is the Blue Spruce.

An Aspen is a white barked tree. An aspen tree can usually grow 10 feet in height. Sometimes an aspen can grow 20 feet high. Aspens have a good life span. They can live up to 20 years. Aspen trees are also very flammable which means they can catch on fire fast. On the Aspen bark it has some type of sun block to resist the sun.

The reason the aspen will take over is that when all the pine trees are dying and falling in the forest, the aspen seeds will have more light to grow. Another thing to know is that the aspen trees grow very fast and will fill up the new empty space in the forest after the pines die. The aspen will change the forest in that they are more flammable than pines so it's possible there will be more forest fires in the new forest. Currently, there are a lot of aspen trees in the mountains. In the future there will be even more.

The aspen tree does have natural threats just like the pine trees have in the mountain pine beetle. In fact, it has four that we know of. One is called the poplar borer. This wood boring beetle is an infection to the aspen; its larva spreads and when it hatches it kills the tree bark. The second is trunk rot which is also an infection. The way this happens is a fungus goes through any broken branch tips and starts to grow stumps out of any part of the trees. The third is called marssonina blight with is a fungus that changes the leaf color but doesn't really damage the tree. The last natural threat is called black canker and rarely kills the tree but slows its growth.

Experts predict that the future forest in the Rocky Mountains will look very different. In the very near future it may look plain since the pines will be dying and the aspen won't be very big yet. But eventually the aspens will be full size and spreading across the mountainside, changing colors every fall.

Photograph by Caleb

The Quaking Aspen Tree
by Darron

Blue Spruce

By: Bonifacio

The Colorado Blue Spruce tree, Picea pungens, will make its appearance in a Colorado forest near you in the very near future. A blue spruce tree looks like a pine tree, except that each needle is attached to the branch one at a time. A pine tree has a bundle of needles attached to the branch. The needles on the blue spruce are sort of a bluish color. The tip of each needle is viciously sharp. The pine cones on the blue spruce are thinner than the ones on a pine tree. Blue spruces are a medium sized tree that can grow 25-30 yards tall. A really tall one would be 46 yards tall or a half of a football tree. The bark of the blue spruce is very thin.

Where does the blue spruce grow?

The Blue spruce grows in Western Wyoming, Eastern Idaho, south to Utah, Northern and Eastern Arizona, South New Mexico, and to the central Colorado Mountains. The blue spruce can grow in these places because the Rocky Mountains pass though those places. It's rare to find a forest made up of only blue spruce trees. Usually they are mixed in with aspens and other trees. Blue spruces like to live from 6,000 to 8,500 feet in elevation. They can survive up to 10,000 feet in elevation.

Why will the future forest include the blue spruce?

The Rocky Mountain pine beetle is threatening all the pine trees in our Colorado forests. Experts predict that the ponderosa pine and lodge pole pine trees will be mostly wiped out of our forests. Eventually new trees and wildlife will take the place of the current pine trees. Blue spruce will be one of those new trees. Even though we have blue spruce trees right now in our forest, we'll soon have a lot more. The spruce trees grow very fast so they'll replace the dead or dying trees in the forest. The new spruce could live up to 600 years, but chances are a fire would burn them out. The blue spruce is not threatened by the mountain pine beetle. There are spruce beetles that are like the pine beetles, but at this time they are not in the red zone.

Table of Contents:

The needles on the blue spruce are sort of a bluish color. The tip of each needle is viciously sharp. The pine cones on the blue spruce are thinner than the ones on a pine tree.

Artwork by Bonifacio

A blue spruce tree on the Explore Elementary School Campus

Photography by Juan

Future Infestations – Future Forests

By: Connor

Do you know how big a Mountain Pine Beetle is? It's as big as a match head or 5 mm. Currently mountain pine beetles are causing big problems in the ecosystem because they are so out of balance. As we ride out this "perfect storm", we are thinking about what the forest will look like after the current infestation has run it's course and how we can prevent it from happening like this again.

The Mountain Pine Beetle is killing the trees in our forests. It's actually always killed trees in our forest, just not in this rapidly. The way this little bug is killing them, is a disease called blue stain fungus. Right when the Mountain Pine Beetle goes into the tree, the blue stain fungus spreads into the phloem. The tree has a hard time getting water and nutrients to all its parts. The tree will eventually die in about one year. A tree can possibly stand for 10 years before it falls, but at the rate the trees are dying, there are massive amounts of deadfall in our current forest. The deadfall in the forest has negative impacts for both people and wildlife. Humans have safety risks (like wildfire and falling trees) and since the ecosystem is changing, many animals are relocating (including the woodpecker, pine squirrel and boreal owl). What do you think our forests will look like with out ponderosa and lodge pole pine trees?

The future forests will have more aspen and blue spruce trees. Forest rangers are predicting that very few lodge pole and some ponderosa pines will make it thru the current infestation and be scattered here and there. But the most popular tree in Colorado is going to be, the aspen, because they grow so fast and will like all the light that they'll have.

At this point there is no stopping the little bug, just slowing it down and saving some trees. There are a few ways to do this. We can put wood in a big pile and spray them with love pheromones and when the mountain pine beetles are in the wood, we burn it. We can spray uninfected trees with insecticides that prevent the beetle from boring into that tree. You can tell if the tree is infected or not by looking for certain signs. Signs of infection: brown/reddish pine quills, flakey bark, pitch tubes (no holes in it) and little holes in the bark of the trees. Signs that a tree has not been infected: green pine quills, non flakey bark, no pitch tubes. If there is a pitch tube with the mountain pine beetle stuck in it – it may or may not be healthy because that means the fought off one attack, but may have not been successful with others.

Our forest would not be in this out of balance situation if we had let the forest fires burn which is a natural step in the life cycle of a forest. To prevent future infestations, we need to change our forest fire fighting policies. In addition we need to address issues of global warming and climate change. And finally, we need to manage the forest by having trees of different kinds and ages.

Artwork by Connor

Photograph by Meghan

Photograph by Alysa

Balancing the Risks

Current treatment options include spraying your trees with chemicals that repel the MPB. This option is most commonly used by property owners with only one or two trees to protect.

Artwork by Mariya

Infected trees are marked for removal.
Photography by Connor

Current Treatment Options

By: Mariya

In our Colorado forests there is an epidemic proportion of mountain pine beetles (MPB). Mountain pine beetles are out of control. In a couple of years, the pine trees in our forests might be gone. Nothing can stop the mountain pine beetles from killing the trees, but actually we can slow them down and protect certain trees. There are options of treatment for both the short term and long term.

Short term treatment is faster and applies for the trees in the most immediate danger--the trees that are right now threatened by MPB. The first strategy of short term treatment is spraying trees with chemicals called carbaryl, permethrin, and bifenthrin. Those sprays are telling to mountain pine beetles that the tree is full and there is no more space for anymore beetles to come in. There are risks involved in using the chemicals, though. These chemicals are dangerous for other creatures in the ecosystem. There is also a second strategy of short term treatment called solar treatment. Solar treatment is done with plastic. The plastic needs to completely wrap the tree from the base to the crown. In order for the solar treatment to be successful the bark temperature should reach 110 degrees Fahrenheit. After it reaches 110 degrees under the bark, any pupae, larvae and/or adult beetles die from the heat.

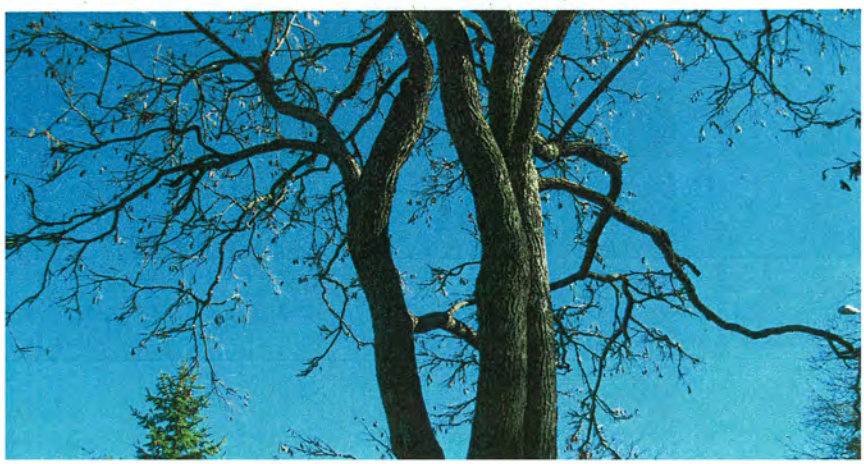
Long term treatment is protecting trees in the future from unnatural MPB infestation. MPB has and will always be a part of the Rocky Mountain ecosystem, but it doesn't have to be as out of balance as it is now. The first strategy of long term treatment is cutting down the trees. This process called clear cutting. Cutting down the trees will help manage the forest so that it isn't so dense. For option to work, about one mile of completely cut trees, even healthy trees, should be cut. After a while, new and healthy trees will grow. A healthy forest has trees of different ages which helps to keep the MPB in balance. There is another kind of forest management which includes thinning, logging, and prescribed fire. Thinning is used to remove some trees from the dense forest. Logging is used to remove trees and use it for different wood furniture and other products that are made out of wood. Prescribed fire is used to burn old and stressed trees and to open the pine seeds so that new and healthy pine trees will have a chance to grow.

At this point in the MPB infestation, treatment will only protect a few trees. The goal of treatment is not to completely get rid of the beetle, but instead keep it in balance and work towards that goal with the future forests.

Photography
by Cruz

Artwork by
Meghan

Photography
by Jenna



Wood products

By: Meghan

Mountain Pine Beetles are at epidemic proportions. They are killing the trees, and will kill lots more. When they attack the tree, there's a fungi in their mouths called blue stained fungus. As they bore though the wood the fungus contaminates the tree, and blocks the tree from getting the water, and nutrients that it needs. Eventually the tree dies. What to do with the hundreds of acres of dead wood in Colorado forests?

Wood chips are one thing you can do with dead blue stained wood. Wood chips are used for heating and power. Wood chips are mostly used in buildings and campuses. To create heat for a building or for hot water, they burn the wood. To get power they burn the wood and use the heat to spin the turbines that generate electricity. Using dead wood can also be good for our environment. We can save other types of fuel sources, especially non renewable resources.

Blue stained wood can also be used for lumber and furniture. Some people may think that blue stained wood would not work as well as normal clean wood, but it does. It's exactly the same except its blue color. Lumber can be used to build or repair houses, also buildings. Blue stained furniture is becoming more popular in things like wooden chairs and tables.

Wood pellets are another way to use blue stained wood. Wood pellets are used in some home heating in pellet stoves. Another use is cord wood. These types of heating are used in small places, like a home or an apartment. Cord wood Can also be used for fires or bon fires.

Using mountain pine beetle killed wood is good for the environment. Claiming it from the forest and using it can stop or reduce the risk of forest fires. People can stop using new clean wood and use beetle-killed wood instead. Using beetle killed wood helps to give a bad situation a good ending.

There are over 6 billion people living on Earth now. Scientists predict that number will be 9 billion by 2050. More humans are interacting with nature now than ever before.

Artwork by Jeffery

Photography by Julienn

The Good, the Bad, and Human Choices

By: Jeffery

In 2007 and 2008, nine hundred thousand acres of forest were demolished by the mountain pine beetle. Humans interact with nature no matter what we do. By just being here humans interact with nature. Humans interact with nature everyday and we have good decisions and bad decisions on how to take care of the Colorado forests.

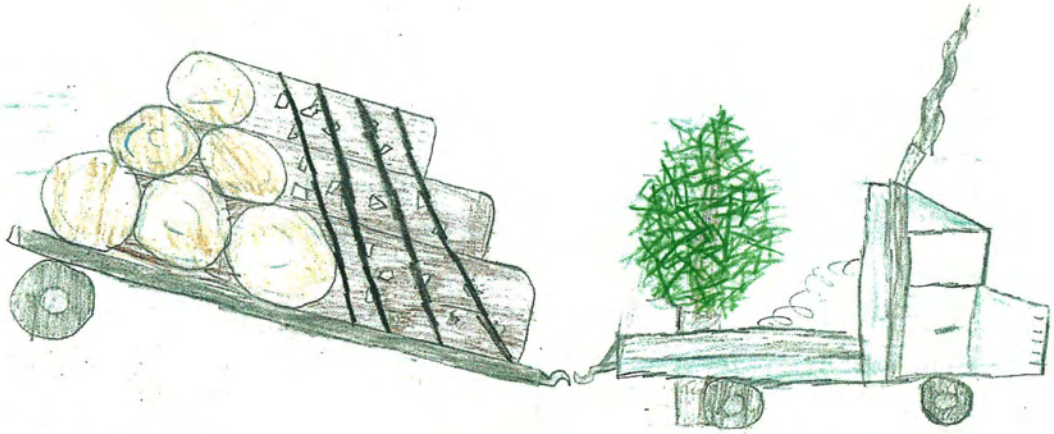
One of those decisions is fire mitigation. We have stopped wildfires from burning for over a hundred years. Fire is an important process in the forest cycle; it gets rid of the old, dyeing or dead trees. One way we can fix this is having firefighters start a controlled wildfire. But Colorado's forests are in such bad shape, the firefighters will not be able to cease the wildfire, because the fire would be too big. Since we have stopped wildfire from burning, Colorado's forests are unhealthy.

Another one of those decisions is forest management. In the 1960's and 1970's environmentalists chained themselves to trees, so forest managers couldn't cut down old trees. If the environmentalists didn't chain themselves to the trees, Colorado's forests would be healthier. Colorado has too many old trees so the young trees don't get sunlight and the young trees don't grow. The forest soil is covered by pounds and pounds of debris from too many trees in the forest. Also the trees can't get water, and the trees are stressed. So the forest's soil makes it an unhealthy forest. Logging is what the forest needs to get healthy again. Since the environmentalists chained themselves to trees the forest management people couldn't take out old trees so young trees can't get sunlight. Since in 1849, about fifteen thousand people came to Colorado, for the gold rush all the pine forest was cut down for houses. So then all the pines came back at the same time. So Colorado's forest is the same age which makes a very stressed and unhealthy forest. So logging is really needed for Colorado's forest.

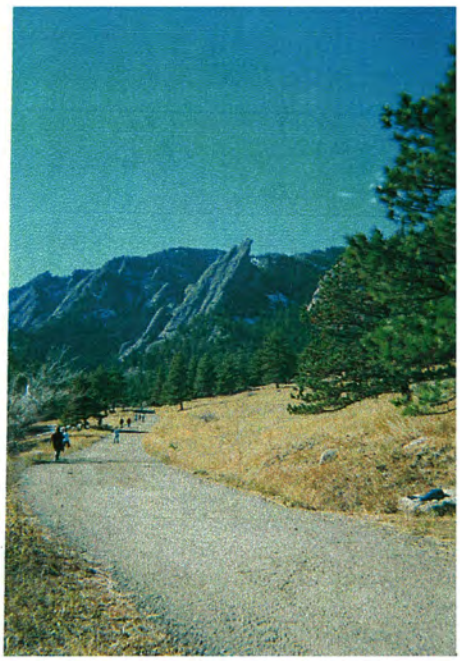
The last decisions that we made is climate change. Since humans use fossil fuels like oil, coal, and natural gas we are releasing carbon in to the air. Since Colorado's Climate used to be cold, the use of fossil fuels has been making it hotter. So temperatures have been rising. The change in temperatures has allowed the mountain pine beetle to become an epidemic case.

The human choices that have affected our forests are what we can fix to make our forest better for future generations. Even though our forests are in bad shape we can still fix the forest for the future generations. We can learn from our mistakes and do better for the next forest.

The Perfect Storm



Artwork by Caleb



"The Path", by Mariah

Logging

By Caleb

Logging is very important to the human lifestyle. Humans have used the resources found in the forest since the beginning of civilization. Logging provides us with houses and furniture. There wouldn't be pencils, paper, tables, or even simple huts without the logging industry. The question is, how is logging related to the mountain pine beetle epidemic happening in Colorado?

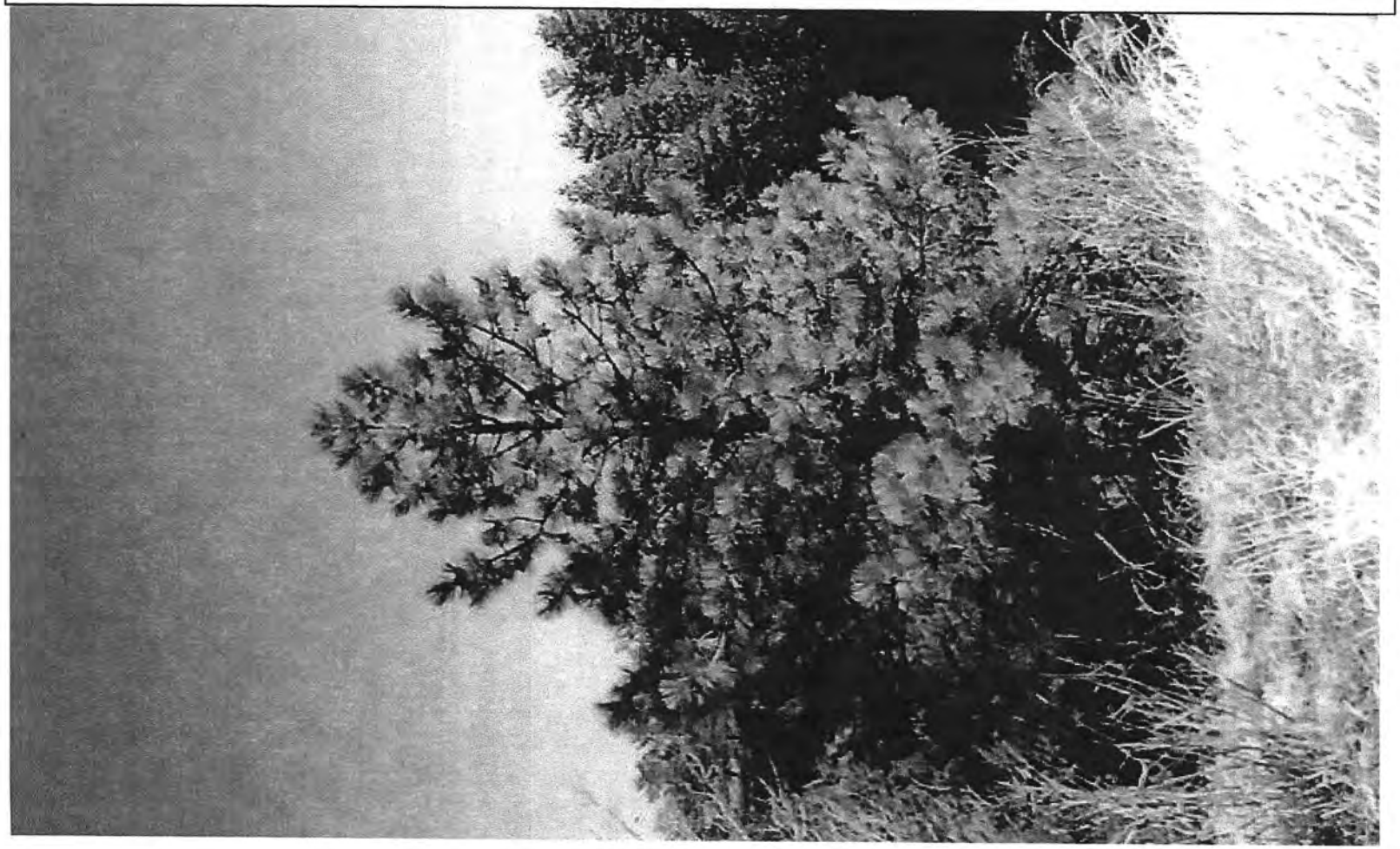
There are lots of logs but not enough loggers in Colorado. Many mills can't afford to pay a decent salary for loggers, so the industry is hurting for skilled workers. Unemployment rates at some mills are about 20 %. It doesn't help that people disagree with logging because it kills trees. Even though healthy forest management includes thinning trees, people don't like to kill them. In doesn't matter that most of these trees will die because of the mountain pine beetle epidemic.

Mountain pine beetles are devastating the forests. All the lodge pole pine trees are predicted to be dead before most children will have children of their own. Experts predict that the ponderosa pine tree will be seriously impacted. If these forests die then many of the animals will leave their natural habitat in Colorado and find new homes. These beetles are NOT helping logging either. They leave blue stain fungus in the trees that they kill. Although the blue stain fungus doesn't change the way wood works, it changes the way it looks and has yet to become popular for building uses.

Logging could be a solution to the acres and acres of dead wood in the Rocky Mountain forests. Both money and people are needed to harvest the dead trees —both of which the logging industry is running low on. Blue stained wood needs to be acceptable for any wood product, regardless of how it looks. Logging also addresses the serious risk of wildfire right now, since the forest is loaded with fuel.

All in all logging gets rid of fire fuel, finds artistic wood for building resources, employs people and still some people don't accept it. People have a hard time accepting the fact that logging is healthy for our forest. People have a relationship with trees and forests that makes it hard for them to cut down trees – even when it's good for the tree, the forest and for the community.

The Perfect Storm



Fire Mitigation and Suppression
by Cruz

Zzz Timber! We are going to have to make a controlled fire. Why? So we can put things back in order. Fire mitigation is a big picture of the safety of people and property, and controlled burning to minimize wildfire damage. This will give you vital facts about the mountain pine beetle infestation and the role of fire mitigation and suppression.

People think that wild fires are bad but actually they do help us. They help us by getting rid of old and dead trees. If there was a wild fire it would get rid of all the dead wood in the forest. And it would get rid of all the old trees so the little trees can get sun light. The fire will get rid of all the rubble and wood on the forest floor. Fire is a natural part of the forest life cycle.

What can we do to keep fires going or allow them to burn in a safe way? We can either start slimming the forest or start a controlled fire. Slimming the forest is when we go in and take out all the old and dead trees. A controlled fire is when we start a fire on purpose to burn off all the dead trees.

Several years ago, people stopped letting natural forest fires burn. This is called fire suppression. When they don't let the fires burn, the trees get overcrowded and stressed. People were worried they would get out of control and burn down structures, injure people or destroy the forest and its resources. Fire suppression is part of the reason that the mountain pine beetle infestation is so bad right now - the trees are overcrowded and stressed.

In order to have a healthy forest we need to start some controlled fires to get rid of the acres and acres of dead wood that have been killed by the MPB. We also need to allow fires that are started naturally, by lightning for example, to burn. Then the forest won't get to this point again where it's overcrowded and stressed out.

Photograph by Melissa

Fire is a natural part of the forest life cycle.

Artwork by Cruz

Stressed Out Trees

By: Briana

Did you know that trees get stressed? Colorado's pine trees are currently in danger of disappearing because of the Rocky Mountain Pine Beetle. Although the pine beetle has always been in the forest, there are too many to keep it in balance. One reason the infestation is so out of balance is that the trees in our forest are very stressed. Stressed trees are less strong and more of a target for the pine beetle.

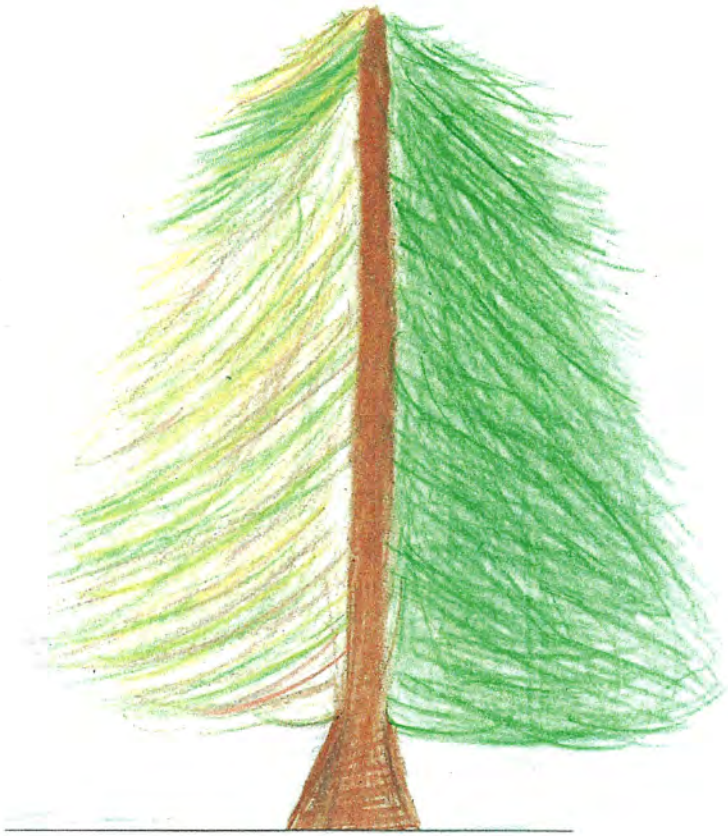
One reason the trees are stressed is that they are not getting enough nutrition in the forest from the soil. The soil is too thin and too many trees are depending on it to provide them with nutrients. It would be like a whole class of students sharing a peanut butter and jelly sandwich – only one sandwich for 30 students. You would be pretty hungry. The forest is overcrowded with trees and the soil doesn't have enough nutrients to make the trees healthy and strong.

Another reason the trees are stressed is the draught conditions that Colorado has right now. A draught is when an area doesn't get as much water as it usually does through rain or snowfall. Colorado's climate has been changing due to global warming so we haven't had as much snow and rain as usual. The trees in our forests aren't as full and healthy as they could be with their usual amount of water. They are dry and brittle.

In conclusion, the pine beetle has a feast of trees in the Colorado forests right now – old, mature, and stressed. By managing our forests better in the future, we can help relieve the trees from being stressed.

The right side of the tree is healthy. The left side shows evidence of stress. Trees get stressed from drought, overcrowding and poor soil nutrition.

Artwork by Briana



Photography by Jessica

The Age of the Forest

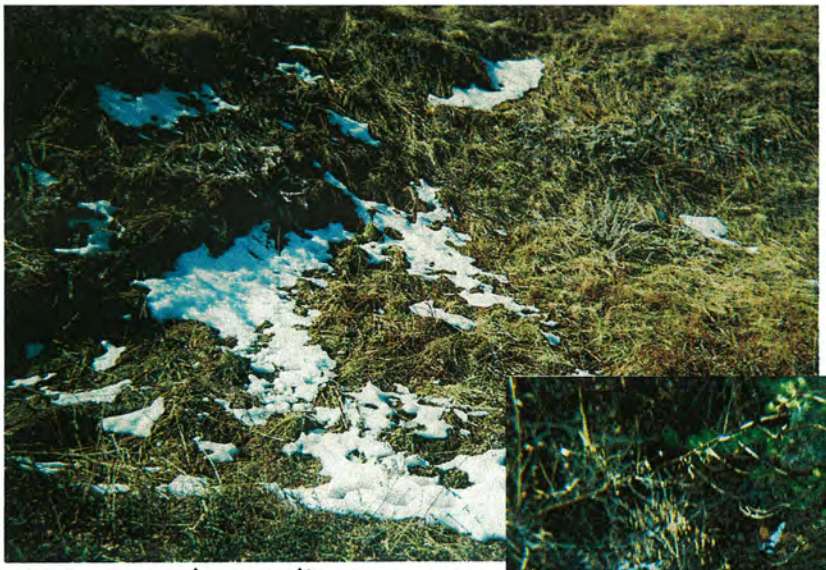
By: Kayla

The mountain pine beetle is not just killing old and stressed out trees but the beetles are also killing young trees too. There are two types of trees the beetles like: lodge pole pine and ponderosa pine. All the conditions are right in the forest now for a" perfect storm" of pine beetles. One major condition is that all the trees in the forest are the same age.

In 1849 the gold rush happened in Colorado. Thousands of people came to Colorado in search of gold. When everyone came to Colorado, they cut down all the trees in golden gate canyon state park and the surrounding areas. They used the trees to build houses, stores and mines and to support the mass of people coming for the gold. At that time, the forest regenerated and new trees came in. this meant that all the trees were" born" at the same time and would be the same age.

Another reason the forest is the same age is the managing of the forest that humans have done. Humans decided to stop all fires from burning the forest. This fire suppression is stopping a natural destructive process. Although forest fires see bad, they are actually good for a forest because they burn down old trees so that new trees can grow in and they open up pine cones for pine seed to get planted.

A healthy forest has trees that are all different ages- some old, some new and some in between. There are different ages of trees. A healthy forest is a balanced ecosystem. Hopefully, in the future humans will make more informed choices and mountain pine beetle attacks will be less serious.



Photograpy by Derik

Artwork by Kayla

Global warming

By: Mrs. Forbes' Crew

You may be wondering what global warming, or climate change, has to do with the mountain pine beetle, sometimes known as" M.P.B." To answer your question, it has everything to do with the little beetles. Humans have done many things to increase CO_2 levels and with CO_2 comes heat, which in return causes the climate to change and makes our winters warmer. That is a problem because without cold winters we cannot kill the mountain pine beetle's larvae. And that is one of the only natural things that helps to keep the mountain pine beetle in balance.

You might be wondering what else climate change impacts or influences. You might have heard about the polar bears being in danger. The ice caps and glaciers are melting, that is causing the polar bears to have nowhere to go, so eventually, they starve or drown. The glaciers melting is not a good situation because when they all melt sea levels will eventually rise. If the glaciers melt too much (which scientists say probably will,) the sea levels will rise and MILLIONS of people around the world will need to be relocated to other places. This means many more people will have to be relocated to America (Considering the economy right now), that won't make it any easier for our country to right itself. There is a catch in this global warming chapter where we tell everybody's view of "global warming". We are not saying you should or shouldn't believe them; we are just letting you know what they are thinking about the

Dear Reader,

The 5th and 6th grade students of Explore Elementary have successfully created the school's first ever field guide books. The journey – from field work and brainstorming to research and publication – lasted 12 weeks, culminating with a public book release celebration. Students independently researched various topics connected with the Mountain Pine Beetle infestation in Colorado's forest ecosystem. Students illustrated their own work, as well as captured the beauty and diversity of our forests through photography.

All student work went through many rounds of drafting, critique and revision. However, as student authors, the information in this book may contain slight errors – both in scientific content and grammatical composition. To fact check any author or learn more about MPB, please visit the following websites.

http://csfs.colostate.edu/pages/mountain-pine-beetle.html

http://www.summitpinebeetle.org/

situation. Some people challenge scientist's evidence about global warming. Some people say that global warming is no big deal and it is another one of earth's many climate changes.

As climates change, ecosystems change – as in the MPB. Invasive species all over the world are moving to new habitats that can't protect themselves from the new plants and animals that are moving in. One change in an ecosystem (such as climate) is bound to change everything else. Scientists are seeing species become endangered or completely leave an area based on climate change.

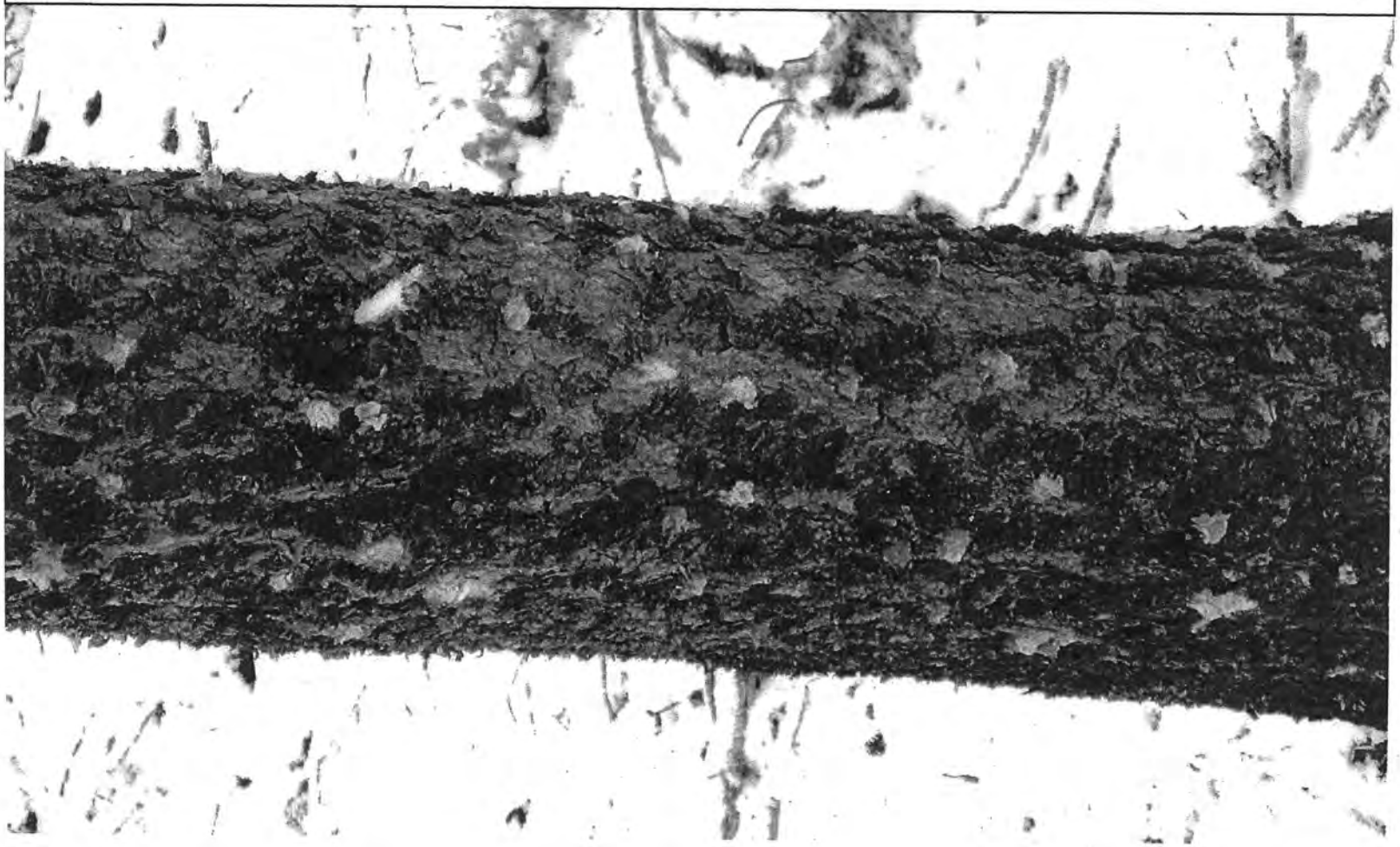
Every time we burn fossil fuels we are releasing carbon into the atmosphere. Therefore, reducing our use of electricity and seeking alternative energy sources such as solar and wind energy will help to reverse the damages of global warming. And if not reverse, at least slow down the rate of change.

Our crew is in complete agreement that climate changes are happening across the globe based on evidence we have examined. Ninety-Six percent of our crew believes human activity has <u>significantly</u> impacted carbon emissions, thus amplifying climate changes into a more serious situation than previous climate changes (again based on evidence). The remaining four percent of our crew believes human activity has <u>not significantly</u> impacted carbon emissions, thus having no to little impact on climate changes that are occurring.

- Meet the Authors.....

- Briana — bilingual, family oriented, creative, and honest
- Kaiya — smart, talented, considerate, and indigestive
- Lino — a football lover, a comedy king, a good brother, and a loyal friend
- Caleb — competitive in chess, great in math, bets a lot, is a gamer
- Austin — artistic, witty, comedian, strong reader, good friend
- Michael — a sk8 boarder, comedian, compassionate and Oscar-the-grouch-like
- Jeffery — sports addict, math whiz, chess master, and wise beyond his years
- Mariah — good big sister, Twilight fan, likes basket ball, and a good friend
- Jared — jokester, excellent flame artist, happy, and chess master
- Melissa — is bashful, intelligent, nice and a good friend
- Mariya — mathematician, a good friend, multi-lingual, and a queen of origami
- Kayla — a loving, careful sister, a loyal friend, and good in school
- Jessica — smart, creative, a good cook, and a huge fan of the Twilight saga
- Darron — funny, witty, collector and a geologist
- Juan — smart, courageous, and loving
- Alysa — strong minded, creative, intelligent and spiritual
- Mya — spiritual, hippy- like, open-minded, and creative
- Derik — funny, loves the Twilight saga, loves basketball, and creator
- Bonifacio —Dallas Cowboys lover, football addict, and athletic,
- Julienn — generous, creative, sweet, kind and a "hugger"
- Meghan — animal lover, creative, sweet-hearted, and a very loving daughter
- Jenna — faithful, fun big sister, affectionate, loyal friend and all about the family mily
- Cruz — confident, funny, a handy man, and a quick learner
- Connor — smart, comedian, loyal friend, athletic, and competitive
- Sharon — mom, daughter, passionate teacher, hippy-esque, and creative

Mountain Pine Beetle (MPB): What is it?



Mountain Pine Beetle

By: Mariah

Who knew that such little bugs could cause such huge problems? The Rocky Mountain Pine Beetle, or *Dendroctonus ponderosae*, are only about the size of a piece of rice. Although so small, this little beetle leaves its imprint on the pine trees in the Colorado forests – you can tell where it's been by the dying pine trees it leaves behind.

Mountain pine beetles are one of the most significant insects of the Western pine forests in Colorado. Mountain pine beetles primarily attack Ponderosa pine and lodge pole pine. In the late summer or early fall the female pine beetle finds a tree she likes. She burrows in through the bark and makes a J-shaped gallery to lay her eggs. Female beetles release pheromones to attract males. The beetles hatch as white larvae and dig into the tree's bark where they spend the winter. The larvae have a natural kind of antifreeze which protects them from freezing in the winter. As long as it doesn't get too cold or stay cold for too long, in the spring the pupae eats more of the inner bark before it burrows out of the tree as an adult. The life span of the beetle is about one year.

Mountain pine beetles have predators just like other animals do. Here are three of their predators: a woodpecker, a predatorial wasp, and other species of beetles. Just because pine beetles live under the bark, that doesn't mean predators can't hear them. In fact, woodpecker activity on the tree is one sign that the tree is infected.

Mountain pine beetles have little grooves on their bodies called mycangium. These grooves carry the blue stain fungus. As they enter a tree, the fungus spreads to the phloem of the tree with carries the water through out the tree. Once infected, the tree can't transport the water and nutrients that it needs and so it dies within one year of being attacked. Mountain pine beetles play a very important role in our forests. They infest and kill older and larger stressed trees. Mountain pine beetles are native to our forest ecosystem.

The beetles hatch as white larvae and dig into the tree's bark where they spend the winter. The larvae have a natural kind of antifreeze which protects them from freezing in the winter.

Artwork by Mariah

A tree tries to defend itself against the attacking beetles by releasing sap at the boring site. These pitch tubes are a sign of MPB attack in a forest stand.