Teacher's Guide: Background Information

Hayman Fire

It is extremely hard to separate the human hardships from the ecological damage of the Hayman Fire. The Coalition for the Upper South Platte (CUSP), as a watershed protection group, feels it is impossible to consider one and not the other. Perhaps CUSP recognizes the connection because our immediate concern after the Hayman Fire was for the victims – the private property owners. People cried on our shoulders, vented their frustrations, and gave us their utmost trust. It was a very humbling experience. It is one thing to watch a disaster on TV, far removed from the devastation, it is quite another to step into a disaster area and become one of the rocks the victims depend upon. Our souls have forever been changed. We raked and seeded, sand bagged, built erosion control barriers, planted trees, shoveled mud, and organized thousands of volunteers. It is not over. The restoration will take many decades.

Preventing another catastrophic fire is possible, though it will take a very long time. My goal is to impress upon you that fire is a part of the natural cycle. The service learning project your students are participating in provides a snapshot into one type of forest ecosystem. I have found through the years the idea of a healthy forest in people's minds relates to the forest they visit or to the forest where a house is, but rarely to both. The science presented here represents a quick and easily understandable investigation into ponderosa pine dominated forest stands.

Some Tree Basics

Before we take a trek into the ponderosa dominant forest, let's first talk about some of the other types of forest in the Rockies:

<u>Lodgepole pine</u>: This tree species gets a lot of press because of the catastrophic loss due to a natural cycle - the mountain pine beetle infestation. Lodgepole pines have serotinous cones. A serotinous cone is one that requires heat, like from a forest fire, to open up and release the seeds. These seeds then grow into new lodgepole pine trees. I tell students that lodgepole pines are like the mythical phoenix bird of legend - they need fire to start a new life. Most children know the phoenix as Fawkes in the Harry Potter books. Yellowstone offers a great example of the re-growth in lodgepole pines after a fire.

Lodgepole stands historically have a mosaic of varying ages across a broad landscape. One hillside could have been established in 1850 and another in 1905 and so on (meaning they had stand replacing fires a year or two prior to their establishment). Lodgepole pines live 150 to 180 years, and mountain pine beetles prefer trees 80 years or older. Because fire has been suppressed in Colorado since 1876, and in the nation since 1910, almost all of the lodgepole in Colorado are old. Colorado's lodgepole pines are thus very susceptible to infection by the mountain pine beetle. As in the situation of a forest fire, lodgepole pine stands are being killed by mountain pine beetles. Unlike a forest fire, there is no heat to open the pinecones and establish new trees.

Another analogy involves thinking of the forest as a checker board. Imagine all the red squares represent areas burned within the last 50 to 100 years (meaning young trees dominate that area) and the black squares represent the old tree stands (susceptible to pine beetle). By suppressing fire, all the red squares were erased and the board becomes almost black. Rather than taking decades to spread through forests, the pine beetles become extremely successful in moving across the wide open field.

I highly recommend the booklet 'A Year in the Life of a Mountain Pine Beetle,' by Buford the Mountain Pine Beetle (with help from the Colorado State Forest Service). You can print a copy of the book (http://csfs.colostate.edu/pdfs/Buford_MPB_Book.pdf) and a copy of the coloring book (http://csfs.colostate.edu/pdfs/BufordColoringBookFINAL.pdf), which is useful for young students. www.csfs.colostate.edu has great information if you want to learn more. The links to these documents are provided in the links and references section of this module.

Aspen is another tree species common in Colorado. These trees lives to be 80 to 100 years old, and the roots have been dated to be thousands of years old. Aspen are the largest growing organism in the world and they are also the oldest. This species depends upon disturbances to sprout new trees. Fire is the most common natural disturbance. We have seen aspen sprouting new trees 14 days post-fire! Western states, including Colorado, have experienced a huge decline of aspen stands. Evergreen trees have invaded the root systems and are choking them out. Additionally, there are several diseases and insects that are actively infecting the trees. Suppressing wildfire is another possible reason for the decline in aspen stands.

You have seen that each dominant tree species has unique ways of regenerating. They also have unique root structures that play a role in forest management practices. Lodgepole roots intertwine and support one another like woven fabric. This makes patch cuts a practical method for lodgepole thinning. Ponderosa pine roots run deep and are loyal to that one tree, thus giving the trees more space and freeing up nearby soil nutrients for the roots to take in. Aspen share the same root system and thrive when their stands are thinned with no other tree species in their patch.

Urban Forest

Urban trees have the same basic needs as wildland trees.

Benefits of Trees In Urban Areas

Thank you to Kathleen Alexander for composing and compiling this information.

“Trees are major capital assets in cities across the United States. Just as streets, sidewalks, public buildings and recreational facilities are a part of a community's infrastructure, so are publicly owned trees. Trees - and, collectively, the urban forest - are important assets that require care and maintenance the same as other public property. Trees are on the job 24 hours every day working for all of us to improve our environment and quality of life.

Colorado’s urban forest provides many environmental benefits to our community. Aside from the obvious aesthetic benefits, trees within our urban forest improve our air, protect our water, save energy, and improve economic sustainability.

Unlike urban areas in the eastern U.S., canopy cover in Colorado decreases along an urban to rural gradient. In other words, since most trees have been planted, much of the tree cover is in urban areas as opposed to “natural lands”. Therefore, estimated pollutant uptake rates are higher for residential compared to natural or unmanaged lands. Possible management implications of these estimates are that air pollutant uptake benefits from tree planting may be optimized by planting in areas where air pollutant concentrations are elevated and where relatively high planting densities can be achieved, thereby enhancing the health of urban dwellers.” This information has been gathered from the following website: http://www.coloradotrees.org/why.php

As stated above, Colorado’s urban forests are not only pleasing to the eye, they provide a valuable service. Cities in turn provide the basic needs of a tree. They can fertilize, water, and protect trees. A quick online search shows that counties around the world are looking to urban forests—trees in cities—to solve carbon issues as well as improve air quality. Several researchers have concluded that if every homeowner planted one tree, and nourished it, the carbon in the atmosphere would decrease 50%. On the flip side- what is the timeline for the 50% decrease? Fast growing trees have short life spans. Will non-native trees be introduced in the flurry to plant more trees while causing other species harm? Will financial budgets cause a trend in monocultures of trees to be planted with the potential of being wiped out by one disease or one bug (i.e. Dutch elm)?

Many municipalities are implementing ordinances pertaining to trees, such as contractor responsibilities when repairing streets and sidewalks, trees that cannot be planted (invasive species like Russian Olives), tree trimming, health regulations (sick trees must be removed), etc.

Carbon Sequestration

Trees remove (sequester) carbon dioxide (CO_2) from the atmosphere during photosynthesis to form carbohydrates that are used in plant structure/function and return oxygen back to the atmosphere as a byproduct.

Terrestrial carbon sequestration is the process through which carbon dioxide (CO_2) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils.

Forests and soils have a significant influence on atmospheric levels of carbon dioxide (CO_2). Tropical deforestation is responsible for about 20% of the world's annual CO_2 emissions. Carbon sequestration rates vary by tree species, soil type, regional climate, topography and management practice. In the U.S., fairly well-established values for carbon sequestration rates are available for most tree species.

Carbon accumulation in forests and soils eventually reaches a saturation point, beyond which additional sequestration is not possible. This happens, for example, when trees reach maturity, or when the organic matter in soils builds back up to original levels before losses occurred. Even after saturation, the trees or agricultural practices would need to be sustained to maintain the accumulated carbon and prevent subsequent losses of carbon back to the atmosphere.