Hi, my name is John Miller, I’m a senior at Penn State Brandywine and I will be your host of this podcast. Today’s topic is the impacts on water related to wildfire. For those of you who aren’t familiar, wildfire is another term for forest fire. Wildfire can have significant effects on water quality, from sediment loads to chemical reactions. In today’s podcast, we will explore these impacts in detail.

Erosion rates dynamically increase as a result of wildfire. Due to the increased erosion, high sediment loads and turbidity can be observed. [1] Sediment loads, in large amounts increase processing costs of water treatment facilities. In severe cases, such as Colorado’s Buffalo Creek wildfire, sediment can even shut the facilities down entirely. [1] Sediment containing phosphorus also promotes plant growth when found in high concentrations. This can reduce the amount of dissolved oxygen in the watershed, impacting the local wildlife. [2]

Turbidity refers to the level of clarity or how clear the water is. Turbidity promotes algae blooms which, like phosphorus, can also reduce oxygen levels in the water. [3] Turbidity is measured in nephelometric turbidity units (NTU) and an acceptable level for entering a water treatment facility is anything under 20 NTU. [4] Aside from being aesthetically unappealing, turbidity not removed from drinking water can promote growth of pathogens increasing the risk of waterborne disease. [5]

Wildfire affects water chemistry in various ways. PH measures the acidity or alkalinity of the water. A normal PH for tap water and freshwater aquariums is a value of 7.0. PH spikes can be observed as a result of an overload of sediment into the watershed. PH tends to spike initially after a wildfire and heavy storms, then stabilizes over time. [6] Ash deposited by runoff can increase the alkalinity in the watershed [7], while metal minerals can act as “Lewis acids” [6] increasing the water’s acidity.

Another chemical imbalance caused by wildfire is increased levels of nitrogen. Nitrogen comes in several forms and the primary forms deposited into watersheds following a burn are ammonium and dissolved organic carbon. [7] Dissolved organic carbon and nitrates are removed from the water only by means of microbial activity; also, known as beneficial bacteria. [3] Nitrites and nitrates are a byproduct of the microbial activity consuming ammonium. [3] The ammonium is the result of nitrogen volatizing. A study on watersheds in Southern California showed nitrate levels increasing by as much as 550% under post wildfire conditions. [7] To put this into perspective, many of you may own an aquarium or know someone that does. Nitrate levels for a healthy aquarium should never exceed 40ppm. An increase of 550% would show levels as high as 220ppm and would certainly result in the loss of your aquatic friends.

Phosphorus is another chemical effect that can be observed following a wildfire. Phosphorus levels increase primarily due to ash deposited into the surface water following a wildfire. [3] Phosphorus tends to bind to soil and, therefore, increases levels in the watershed as runoff occurs. Phosphorus also promotes algae blooms, which can have a leaching effect on the dissolved oxygen in the water. [3] Additionally, phosphorus based fire retardants can have adverse effects on the watershed when used to extinguish wildfire. [2] Aside from algae blooms, phosphorus can pose health threats to humans when found in drinking water. The leaching effect of oxygen can lower oxygen levels in the blood stream. Due to trace amounts of iron that come along with phosphorus, it is possible to corrode copper piping in our water delivery systems. [8]

Furthermore, burning soil produces amino acids which lead to elevated levels of ammonia immediately following a wildfire. [5] Wildfire can cause the top-level soil to become hydrophobic, preventing water from permeating. [2] Due to a lack of infiltration, runoff levels may increase by as much as 2,350%! [1] High-intensity fire can also increase the erosion rate of soil, which in turn increases the sediment load delivered to the watershed. [6] Runoff depositing ash into the watershed, raising PH values, facilitates dispersion of the soil’s aggregates. [9]

Prescribed burns are fires that are intentional and controlled. These controlled burns can reduce the risk of extreme wildfire. [10] Proper burn plans must be in place prior to a prescribed burn. Characteristics of a proper plan include considerations of temperature, wind, moisture and humidity and smoke dispersion. [10] Watershed impacts may still be observed in terms of chemical and sedimentation, however, to much less a degree than wildfire impacts.

In conclusion, we can see there is a direct relation between wildfire and water quality. By administering prescribed burns, we can effectively reduce the risk of forest fire and its damage to the environment. For more information on wildfire and its impacts on water quality see the additional references and links provided in the transcript. Thank you all for listening and may your passion for Earth science burn intensely.

*(This audio file was recorded by John Miller on November 11, 2016)*

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