Smoke in the Ozark Highlands

Slideshow Script

Slide 1 - *Please use the* Click *prompts that are embedded in the slideshow script to coordinate the narration with corresponding images.*

In this lesson we will learn about some of the environmental hazards associated with “Smoke in the Ozark Highlands” and learn about ways that such hazards can be managed. Click

Slide 2 - Smoke is made up of a complex mixture of gases and fine particles produced when trees, grasses, and other organic fuels burn. Smoke presents many challenges for both fire practitioners and officials trying to minimize health impacts on populations. To understand smoke production, we must be familiar with the stages of combustion. Click

Slide 3 - *Read the slide*. During this stage, steam is a major component of smoke giving it a white appearance. *Be sure to give students enough time to take notes.* Click

Slide 4 - The second stage of combustion is flaming. During flaming… *Read the slide*. *Be sure to give students enough time to take notes.* Click

Slide 5 - The third stage is smoldering. During this stage… *Read the slide*. *Be sure to give students enough time to take notes.* Click

Slide 6 - And the final stage is glowing. *Read the slide*. *Be sure to give students enough time to take notes.* Click

Slide 7 - As an environmental hazard, smoke presents a variety of impacts that must be managed in order to reduce associated risks. Some people may enjoy the smell of smoke from a campfire, but smoke is not healthy.

Click Click Exposure to the pollutants in smoke causes immediate responses in people, such as burning eyes, a runny nose, coughing, phlegm, wheezing and difficulty breathing. Click Click The younger and older segments of populations are usually affected the most by smoke exposure, especially those with asthma, heart disease, or lung disease. Smoke intensifies symptoms. Click Click Smoke also reduces visibility which can cause accidents. Click Traffic accidents are one of the most common causes of mortality related to smoke. Click DON'T DRIVE INTO SMOKE! Prescribed fire planners eliminate or reduce smoke effects by burning only when the wind is from specified directions and when weather conditions allow for smoke to readily disperse. Click

Slide 8 - It is important to remember that not all impacts related to smoke are negative. Smoke components, many of which are categorized as pollutants, are part of biogeochemical cycles. Click Click Sulfur dioxide, for example, is part of the sulfur cycle. Click Sulfur dioxide, a gas, allows sulfur to move rapidly in the environment. Click Click The smell of smoke triggers an instinctive "flight" response to flee or seek shelter in many species that have never been exposed to fire previously. Smoke also attracts species to fires, Click such as this Swainson's hawk, since prey species may have lost concealing shelter or may have been disoriented, injured, or killed. Click

Slide 9 - The Clean Air Act is the primary law regulating smoke. As part of its mission to protect public health and welfare, the Clean Air Act developed the National Ambient Air Quality Standards [NAAQS] for 6 criteria pollutants. These 6 pollutants, monitored by the Environmental Protection Agency [EPA], are Click particulate matter, Click ozone, Click carbon monoxide, Click nitrogen dioxide, Click sulfur dioxide, Click and lead. Click "Criteria" (the plural of criterion) indicates that these pollutants are used as standards for air quality decision making. Click Except for lead, these pollutants are present in smoke from vegetative fires. Click

Slide 10 - Ozone and particulate matter are the two most problematic pollutants in smoke. Since the ozone from smoke is ground-level or tropospheric, it's reactivity can result in human health issues as well as affecting other living things and nonliving materials. $PM_{2.5}$ particles are of special concern because such particles are smaller than 2.5 microns (micrometers) in diameter. It would take at least 20 $PM_{2.5}$ particles placed side by side to equal the diameter of a human hair. Due to their small size, $PM_{2.5}$ particles can penetrate deeply into the lungs and can even enter the circulatory system and impact organs such as the brain. Click

Slide 11 - Here are some of the health effects of $PM_{2.5}$ particles and tropospheric ozone. *Give students time to take notes.* Click

If students ask, ***COPD*** *(**chronic obstructive pulmonary disease**) is a chronic inflammatory lung disease that causes obstructed lung airflow*.

Slide 12 - The EPA's AirNow program reports air quality using the official "Air Quality Index" [AQI] which is a color-coded index designed to communicate whether air quality is healthy or unhealthy. Click To calculate the value for AQI, a location's concentrations of criteria pollutants are used (lead is not included). Click All 5 of these pollutants are components of smoke, so the AQI approach is a useful tool for judging the impact of smoke on human health. Click

Slide 13 - The color-coded categories used in AirNow's AQI provide statements that describe air quality in an area, which groups of people may be affected, and steps that can be taken to reduce exposure to air pollution and related health impacts. The GIS model used in this activity incorporates this color-coded system. Click

Slide 14 - Risk analysis can help reduce or eliminate the environmental hazards associated with smoke. Risk analysis involves Click identifying environmental hazards. For this activity, pollutant exposure and reduced visibility are the hazards. Click Click The next step in risk analysis is determining the acceptable level of risk. Click Click Finally, any acceptable risk must be managed. Click For this activity, no reduced visibility is acceptable, Click and air pollution should be managed so that exposure is limited to the yellow AQI category. Click

Slide 15 - Let's work through a case study to better understand smoke management. We'll use "case study" information from JenksFERST, a long-term study site where small-scale prescribed burns are often conducted. Click It is apparent that there are some "points of concern" around the study site that must be taken into consideration when planning prescribed burns. Click

Slide 16 - Here is a table with fire and weather parameters for a growing season prescribed burn at JenksFERST Click and an image showing the VSmoke-Web default webpage. Click Case study information is organized to correspond with the Click "Fire & Weather Info" on the VSmoke-Web simulator. Click Numbers used on the case study table Click match the numbering on the VSmoke-Web simulator. VSmoke-Web default values that are not listed on the case study table should not be changed. Do not copy down the information for this case study, you will have an opportunity to choose a case study, and a table of information for that case study will be provided. Click

Slide 17 - From the case study information provided, the VSmoke-Web simulator projects the probable air quality concerns associated with a burn's smoke plume. Notice that the smoke impact projection consists of ellipses with colors corresponding to the AQI table seen earlier. Click With the simulator's satellite view, Click "points of concern" near the burn site are easier to distinguish. Can you identify any "points of concern" near this burn? *Give students an opportunity to respond.* Which "points of concern" are forecasted to be impacted by this burn? *Give students an opportunity to respond.* Here are a few examples: Click 1) a residential area [RA]; Click 2) soccer fields [SF]; Click 3) a golf course [GC]; Click 4) and an airport. Click The air quality impacts of the areas delineated by the colored ellipses can be determined using the AQI table. If this simulated burn were to take place, decisions would have to be made regarding postponing or delaying soccer games and flights to and from the airport. Healthy individuals playing golf could probably continue with no adverse effects, but at risk individuals should go indoors at the golf course club house until the smoke clears. Individuals in the affected residential area could go inside with closed doors and windows until the smoke clears. Click

Slide 18 - Smoke impacts should be avoided as much as possible. Prescribed burns at JenksFERST reduce or mitigate smoke impacts by being smaller and by being conducted when the wind is in "prescribed" directions. Click Conducting a prescribed burn of only 0.1 acres instead of 1.0 acre while the wind is from the west produces a different smoke projection with minimal impacts to the surrounding area. Click The two simplest ways to manage smoke impacts are: 1) to reduce the size of the burn; and 2) to pay attention to wind direction in relation to “points of concern.” Click

Slide 19 - Choosing a case study will be done using an online map. After selecting a case study, be sure to follow the prompts on the student worksheet that assist with organization of case study parameters and with the identification of “points of concern.” Click

Slide 20 - These are examples of “points of concern” that have a greater risk of suffering smoke impacts. Does anyone have any other examples that should be considered? *Give students an opportunity to respond. Students may identify animal related areas or activities, such as farms, ecologically sensitive areas, etc.* It is now time for you to begin the VSmoke-Web simulation. Follow the instructions on the student worksheet….

Leave this slide up so students can refer to it if necessary.

The End