

Best management practices for livestock and equine during wildfire smoke events

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Wildfire can be an important tool in maintaining diverse and healthy ecosystems. However, wildfires can also increase greenhouse gas emissions, devastate ecosystems, and decimate animal populations and their habitats, along with homes and other structures, creating hazardous health impacts on humans and animals (UC Davis: Science and Climate, n.d.). The intent of this article is to provide recommendations for best management practices for livestock and equine owners during wildfire smoke events. Some of these recommendations may not be applicable to owners of large quantities of livestock and/or equine.

The duration and intensity of a wildfire smoke event is dynamic and can change rapidly from fire to fire. It is important to understand that the U.S. Air Quality Index (AQI) is the Environmental Protection Agency's (EPA) index for reporting air quality. The AQI is measured from zero to 500. The higher the AQI, the greater the level of air pollution and the greater the health concern. The AQI is divided into six categories, each of which has a different color, making it easy for people to determine unhealthy levels (AirNow, n.d.). Generally, if the air quality falls into the unhealthy, or red range (150+), people with compromised health should avoid prolonged outdoor work or activity. Everyone else should limit the time they spend outdoors. To determine which AQI range is safe for you, consult with your physician. If you feel the effects of wildfire smoke, animals probably do too.

Figure 1: Air Quality Index (AQI) basics for ozone and particle pollution chart

Daily AQI	Levels of Concern	Values of Index	Description of Quality
Green	Good	0-50	Air quality is satisfactory, and air pollution poses little to no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are usually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: Everyone is likely to be affected.

Wildfire smoke is made up of carbon dioxide, carbon monoxide, particulate matter, soot, hydrocarbons, and other organic materials including nitrogen oxides and trace minerals. The composition of smoke depends on what was burned – wood, vegetation, plastics, housing materials and other combustibles all produce different compounds. Particulate Matter (PM) is a term used for a mixture of solid particles and liquid droplets found in the air. Fine Particulate Matter (PM_{2.5}) is generally the major pollutant of concern in the smoke of wildfires, as particulates from smoke tend to be very small in size. The PM_{2.5} is microscopic (less than 2.5 microns in diameter) and can reach the deepest airways in the lungs (Madigan, Wilson, & Stull, 2008). Toxic gases, which may be inhaled by animals with immediate and close exposure to fires, may impair oxygen delivery, leading to death (Bond, Osborne, & Leguillette, 2019).

During wildfire smoke events, animals, like humans, can be harmed by continuous inhalation of smoke. Since it is unrealistic to think all livestock and equine animals can be kept indoors, the following guidelines are best management practices for livestock and equine owners, with the understanding that this document is not meant for evacuation considerations, but rather for day-to-day activity during wildfire smoke events. The EPA (2019) recommends that if smoke persists or becomes too dense, livestock or equine may need to be evacuated or moved to less smoky areas. To view the AQI levels in your region, visit [AirNow.gov](https://www.airnow.gov).

Movement

If livestock and/or equine must be moved or exercised during a wildfire smoke event, they should be moved slowly, or at a walk. Animals that are asked to jog/trot or run will inhale more smoke and particulates, thus potentially causing more irritation to their respiratory systems. Additionally, try to limit additional exposure to dust, which can contribute to the increase in pollutants in the air.

Nasal breathing increases filtration of air and particulates, removing most particles larger than 5µm (micrometers). Smoke irritation, stress, activity and exercise all increase the frequency of mouth breathing. Mouth breathing bypasses nasal filtration, permitting the inhalation of both large and

small particles, in turn increasing the risk of smoke inhalation injury (Lalonde, et al., 1994). Taking special care with your animals to reduce instances that trigger mouth breathing (panting) can reduce the risk of smoke inhalation injury.

Equine events that are strenuous, such as trail riding, outdoor horse shows, or cutting/sorting events, should be avoided during long-term smoke events. During an extreme wildfire smoke event, University of Calgary studied the impact of poor air quality on exercise performance on polo horses that were at a maintenance level of fitness at the end of the competition season. Every horse involved in the study exhibited coughing when at rest and during exercise, and owners complained of decreased performance. Additionally, a lung wash was performed on the horses to retrieve cells and particulate matter. Every horse in the study showed inflammation of the respiratory tract. Large amounts of debris and pollen were also found in the cells, which are diagnostics of asthma in horses, and were also seen by veterinarians working in the affected area (Bond, Osborne, & Leguillette, 2019).

Figure 2: Air Quality Index (AQI) guidelines for working horses

Daily AQI	Levels of Concern	Values of Index	Description of Quality
Green	Good	0-50	Regular work.
Yellow	Moderate	51 to 100	Ok to work, but lighter work for horses with respiratory issues.
Orange	Unhealthy	101 to 150	Light work. Less for horses with respiratory issues.
Red	Unhealthy	151 to 200	Unhealthy for all horses. Slow walk or no work.
Purple	Very Unhealthy	201 to 250	No work.
Maroon	Hazardous	251 +	No work.

(Kelley, 2020)

Plan to give livestock and equine four to six weeks to recuperate from airway damage caused by wildfire smoke after the air quality returns to normal. Attempting to handle, move or transport livestock may aggravate the condition, delay healing, and compromise animal performance for weeks or months to come (American Veterinary Medical Association, n.d.; Madigan, Wilson, & Stull, 2008).

Water

All livestock and equine should always have access to fresh, clean water, but this is especially true during a wildfire smoke event. Water allows for animals to keep their airways moist and to stay hydrated. The consumption of water also assists with the clearance of inhaled particulate matter by allowing the windpipe (trachea), large airways (bronchi) and small airways (bronchioles) to remove inhaled particulate material in smoke. Dry airways allow particulate matter to remain in the lung and air passages (Madigan, Wilson, & Stull, 2008). If water is in a tank or trough, it should be cleaned regularly, as ash and other particles may contaminate it, thus making it undesirable to drink. Water should also be provided near the feed source (U.S. EPA, 2019). Horses will drink the most water within two hours of eating hay, so having clean water near the feed increases water consumption (Young, 2020).

Feed

Try to limit dust exposure by feeding low-dust or dust-free feeds. Hay may also be soaked before feeding to horses to limit dust exposure (Young, 2020). Sprinkling or spraying a dirt pen/lot or a stall with water will also help decrease particulates, which may contain mold, fungi, pollens and bacteria (Madigan, Wilson, & Stull, 2008). If livestock feed is ground or mixed, keep in mind this will also be creating additional particulates that may further cause irritation to animals and people.

Health Concerns

Animals, like humans, may exhibit signs and experience symptoms that indicate smoke irritation and stress has/is occurring. These symptoms may include:

- Watery, red or burning eyes
- Nasal discharge
- Difficulty breathing
- Sneezing
- Coughing or gagging
- Wheezing
- Shortness of breath
- Aggravated heart and lung diseases
- Open mouth breathing
- Increased breathing rate
- Increased pulse rate
- Fatigue or weakness
- Disorientation or stumbling
- Reduced appetite and/or thirst

(American Veterinary Medical Association, n.d.; Pinkerton, 2017).

Particulates can also alter the immune system and reduce the ability of the lungs to remove foreign materials, such as pollen and bacteria, which livestock and equine are normally exposed to (Madigan, Wilson, & Stull, 2008). Additionally, smoke inhalation can cause irritation, causing the airway to swell and become blocked (Bond, Osborne, & Leguillette, 2019). If these symptoms worsen, contact your veterinarian to determine a treatment plan. In severe cases, the animal may get bronchitis or pneumonia, and could potentially die. Veterinarians can prescribe specific treatments, such as intravenous fluids, bronchodilator drugs, systemic antibiotics or other treatments, which will facilitate hydration and health of the airway passages. Blood tests or other tests may be recommended to determine whether a secondary bacterial infection has occurred and may be contributing to the current respiratory problem (Madigan, Wilson, & Stull, 2008).

Market-ready, obese, older or pregnant animals, as well as those with cardiovascular or respiratory diseases, may experience more challenges during wildfire smoke events. Additionally, lactating animals may have a decline in milk production (Skibiell, 2021).

Wildlife

Wildlife may also be impacted during a wildfire event. Wildlife will generally flee or hide until the danger has passed, and some just move around within active fire spaces. Wildlife may struggle after a wildfire due to lack of habitat, shelter and food sources lost in the fire (Wallace, n.d.; Gleason & Gillette, 2009). Wildlife that may be seen after a wildfire may include, but are not limited to, bears, deer, elk, antelope, coyotes, fox, bobcats, racoons, skunks, badgers, mountain lions/cougars, raptors and other birds, and wolves.

The animals that flee may inadvertently end up in the same spaces as your livestock or equine. It is important to remain vigilant as a livestock or equine owner to ensure safety of your animals. Wildlife-proof fencing may need to be erected to ensure livestock are safe from unwanted wildlife (predators). Additionally, wildlife will be seeking water and feed, and will travel via waterways. Wildlife will be scared or nervous, as they are out of their natural habitat. All precautions should be

taken around them, as they may be dangerous. Keep animal and human feed locked up and in a space that cannot easily be accessed by wildlife. Unless the wildlife become dangerous or threatening to animal or human life, leaving them alone may be the best course of action.

Susceptibility

Not all livestock and equine are alike, so knowing your animal(s) normal behavior and susceptibility to smoke irritation and smoke inhalation injury is very important. During and after the 2019-2020 Australian bush fires, cattle were reported to be minimally impacted by the extended smoke exposure, with little evidence of severe effects (Eid, Beggs, & Mansel, 2021). Whereas, controlled studies of sheep, rabbits and guinea pigs indicated lung injuries similar to humans (Lalonde et al., 1994; Thorning et al., 1982; Ramos et al., 2013). Like humans, equine can suffer from asthma in mild to severe forms that can be triggered by inhalation of mold, dust and pollen (Tessier et al., 2017). Special care in reducing these triggers is important during smoke events because they are also vulnerable to smoke-induced asthma (Bond et al., 2019).

Insurance

Purchasing insurance for livestock and equine is always a good option and can cover numerous possible loss (death) scenarios. Animals can be insured as an individual animal, as a blanket policy, as a herd policy or as broad peril. The cost of the insurance policy will depend on what is included and the number of animals insured. If it is believed wildfire smoke inhalation was the cause of death, a veterinarian should be contacted for a necropsy to determine cause of death. For more details and quotes, contact your insurance agency.

It may also be helpful to have photographs of the smoke and visibility, as well as record the AQI when photos are taken. This information may be helpful should you need to pursue an insurance claim.

Conclusion

Living in the Western region of the U.S. means there is a chance of living with wildfire smoke, which can take a physical toll on humans and animals. There are several things that can be done as a livestock or equine owner to limit the negative impacts, which may include limiting animals movement, providing plenty of access to clean water, feeding dust-free feeds, creating dust-free environments, and watching for signs of distress. Ensuring a good relationship with your veterinarian and having insurance on livestock and equine animals is advisable as well.

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