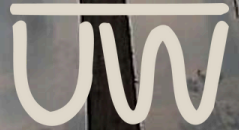




UNIVERSITY
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Extension Beef Team



BEEF BRIEF

A Burning Issue: Wildfire Smoke Exposure in Cattle

With an average 7.2 million acres burned in the U.S. annually, concerns of wildfire smoke inhalation in cattle has become a hot topic in animal research. Across Wyoming in 2024, 728 fires burned over 620,000 acres. The smoke from these fires has the potential to impact health and production of the nearly 1.26 million head of cattle that call Wyoming home.

Smoke Composition

Wildfire smoke is made up of 2 main components: gases and particulate matter. Particulate matter is further broken down into coarse and fine categories. The fine particulate matter (PM_{2.5}), only 2.5 micrometers or less in diameter, tends to be the center of health concerns in both humans and animals because it is smaller than a single red blood cell and has the potential to pass into the blood stream via the lungs, carrying pathogens and harmful materials such as heavy metals and carcinogens with it.

Cattle & Respiratory Diseases

Cattle respiratory tract anatomy and physiology make them more susceptible to respiratory diseases, commonly referred to as the bovine respiratory disease complex (BRDC). Anatomically, cattle have

large bronchi and bronchioles (the main branches of the lungs) and comparatively small alveoli, where gas exchange occurs. This means that a large quantity of air is taken in with each breath, but the efficiency of gas exchange is low, making it easy for environmental contaminants to get trapped within the respiratory tract. Additionally, cattle have 7 lung lobes with limited collateral ventilation and macrophage activity, which combined makes it more challenging to clear pathogens and foreign materials from the lungs. With this in mind, it makes sense that BRDC is one of the most common culprits of health-related losses in the cattle industry and that it would be related to environmental conditions (ex: poor ventilation, high humidity, increased air particulates). Therefore, many wildfire smoke studies have focused on the respiratory impacts of smoke inhalation.

Smoke Impacts on Cows

Dairy cattle have been the primary focus of wildfire smoke research, primarily due to their accessibility for sampling and monitoring. Thus, due to their similar anatomy and physiology, the summary image featured below includes results from both dairy and beef cattle research. However, it's important to note that management of beef cattle differs drastically from their dairy counterparts, so their exposure and response to wildfire smoke exposure may vary.

Research on feedlot and range beef cattle has shown that wildfire smoke inhalation impacts cattle directly through increased mortality, skin burns, and changes in eating/drinking behaviors. Additionally, an indirect increase in pneumonia and respiratory cases with a decrease in carcass weight and quality have been observed. Specifically, a multi-year study looked at post harvest carcass quality after major wildfire events in Australia and found that as distance from fires increased, so did hot carcass weights and backfat. This same study found that if smoke exposure exceeded 30 days, hot carcass weight and back fat decreased, meat color scores increased (indicating more dark cutters), and the odds of pneumonia increased by 25 times. Even 6 months after exposure, carcass pneumonia odds were still 15 times higher in cattle that had experienced 30+ days of smoke. This study demonstrates that distance and duration of exposure to wildfires makes a difference when it comes to impacts on cattle, and that the effects may be long lasting.

Studies focused on live animal sample collections have shown that feedlot cattle exposed to PM2.5 decreased their feed and water intakes and consequently had a reduction in average daily gain and body weights. Blood samples have captured changes in metabolic and immune pathways, indicating that both the inflammatory and immune systems are activated during smoke exposure events.

In dairy cattle, decreases in milk production and increases in mastitis cases have also been observed. While not the primary focus of beef production, the decline in milk could become a concern for range cattle with pre-weaned calves exposed to wildfire smoke.

Smoke Impacts on Calves

Beef calf data is even more limited than mature cattle. However, a beef x dairy calf study out of Oregon found that blood cortisol increased during smoke events, indicating a stress response throughout the body. Holstein dairy calf research has observed increased coughing, eye discharge, heart rates, and respiratory rates due to wildfire smoke exposure. Additionally, blood samples indicate an increase in fat metabolism and an activation of the inflammatory and immune systems, similar to what has been observed in mature cattle. Lung ultrasound scores also increased in the days and weeks following exposure, showing signs of consolidation. While not a diagnosis of clinical pneumonia, this consolidation could be a sign of underlying respiratory damage or disease.

Action Steps, Recommendations and Resources Available

Wildfires are unpredictable, and it can be challenging to know when/if one may come through your area. However, proper preparations could make all the difference. Consider taking some of the following steps to ensure you’re prepared for wildfire season:

- Maintaining a relationship with your veterinarian. When it comes to health and treatment of animals post-wildfire exposure, this relationship can make all the difference.
- Ensure records are accurate and up to date. This includes making sure animals are ID’d (ear tags, brands, EID’s, etc.) and keeping accurate numbers and locations of animals. Not only will this help you identify any missing animals, but it can be incredibly helpful when applying for relief funding to know how a disaster impacted your operation compared to previous years.
- Have an evacuation plan and kit. Identify where you would’d move animals to and how to get them there. Consider having things like extra feed, water troughs, an emergency first aid kit (both human and animal), and basic tools (flashlights, gloves, knife, wire cutters, shovel) in one location that can be easily accessed.
- Be prepared if evacuation isn’t an option. It may be necessary to open gates, cut fences, and allow your livestock to fend for themselves. It’s important to try and to provide access to water and a route to flee from burning or particularly smoky areas.

In the case of wildfire smoke exposure, be sure to follow proper supportive management practices such as low stress handling, providing a balanced ration, and monitoring animals for any signs of illness in the weeks and months following exposure. Signs and symptoms of smoke and/or wildfire exposure can include:

Watery, Red or Burning Eyes	Aggravated Heart & Lung Disease
Nasal Discharge	Open-mouth Breathing
Sneezing	Increased Heart & Respiratory Rates
Coughing or Gagging	Fatigue or Weakness
Wheezing	Disorientation or Stumbling
Shortness of Breath	Reduced Appetite

Smoke Impacts on Cows

Treatment options for animals that have been exposed to extreme smoke exposure are limited. If symptoms develop or worsen, animals may develop pneumonia or bronchitis and be at risk of death. A veterinarian may need to use or prescribe intravenous fluids, bronchodilator drugs, systemic antibiotics, or other treatments to help with hydration and maintaining airway passages. For animals that don't need immediate veterinary care, the American Veterinary Medicine Association (AVMA) has listed some recommendations for general livestock care during wildfire smoke events, including:

- Limiting exercise that might increase smoke inhalation
- Providing fresh, clean water
- Allowing 4-6 weeks for recovery before resuming strenuous movements
- Limiting dust exposure by feeding low-dust feed or watering down holding areas
- Protect yourself – consider wearing a mask while taking care of animals

A more comprehensive list of AVMA recommendations can be found at: [Wildfire Smoke Fact Sheet - Protect Your Livestock](#).

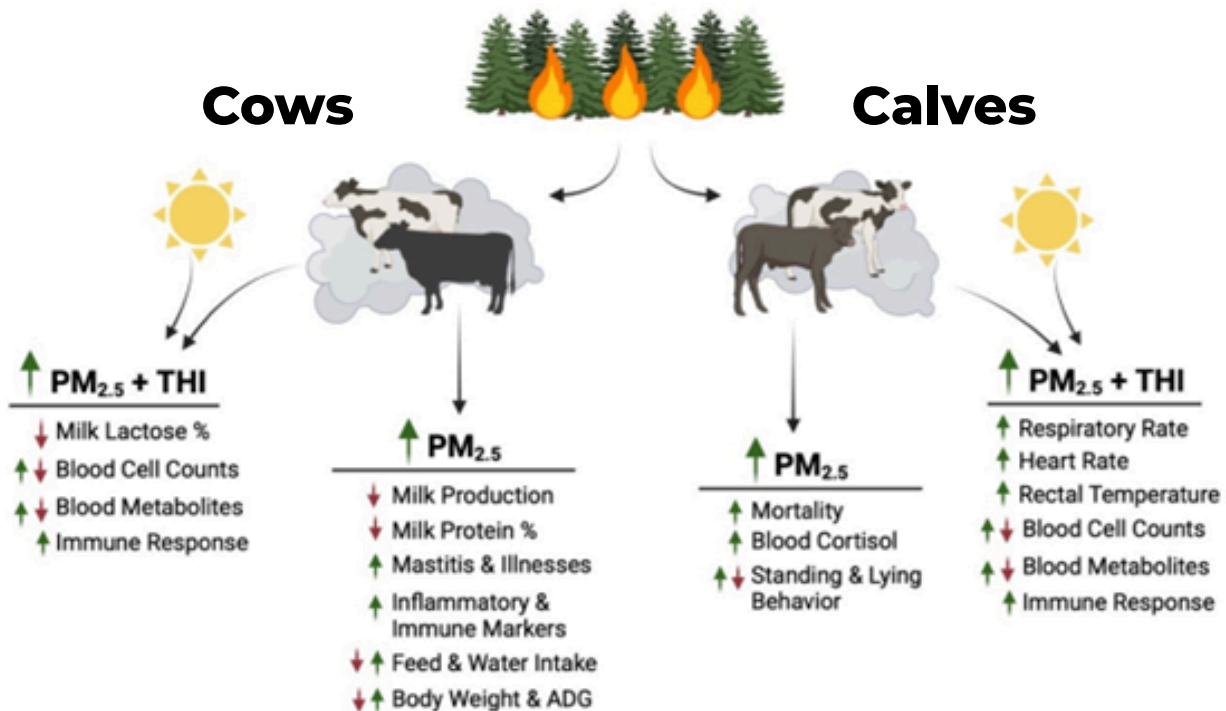
For farmers and ranchers impacted by wildfires, University of Wyoming Extension has developed resources to assist with disaster education ([EDEN](#)) and locating emergency hay supplies ([Wyoming Extension | Wyoming Emergency Hay Assistance - Hot Springs County](#)).

Additionally, the USDA has launched several programs to help with financial relief for those who have been impacted by natural disasters. Details of their programs and eligibility can be found on this fact sheet: [Emergency Assistance for Wildfire](#). The Wyoming Livestock Roundup featured an article on October 10th, 2025 that highlights wildfire recovery resources: [GMO webinar outlines wildfire recovery resources - Wyoming Livestock Roundup](#)

Closing Thoughts

Wildfire research is still novel, with beef focused studies being limited by accessibility challenges. The dairy industry has begun to provide insight as to what physiological changes may be occurring in bovine exposed to wildfire smoke; however, beef cattle, particularly those on rangeland that's actively burning, have unique risks and exposures that need to be looked at further. In the meantime, respiratory diseases, carcass quality, and mortality rates have been established as burning issues when it comes to cattle health and production concerns post-smoke exposure.

Summary of fine particulate matter ($PM_{2.5}$) from wildfires and Temperature Humidity Index (THI) effects on mature cattle (left) and calves (right). THI is a known environmental factor that causes metabolic and physiological changes in cattle and is commonly included in wildfire smoke studies.



This brief was created by UWyo Extension Beef Team, 2025-6

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