

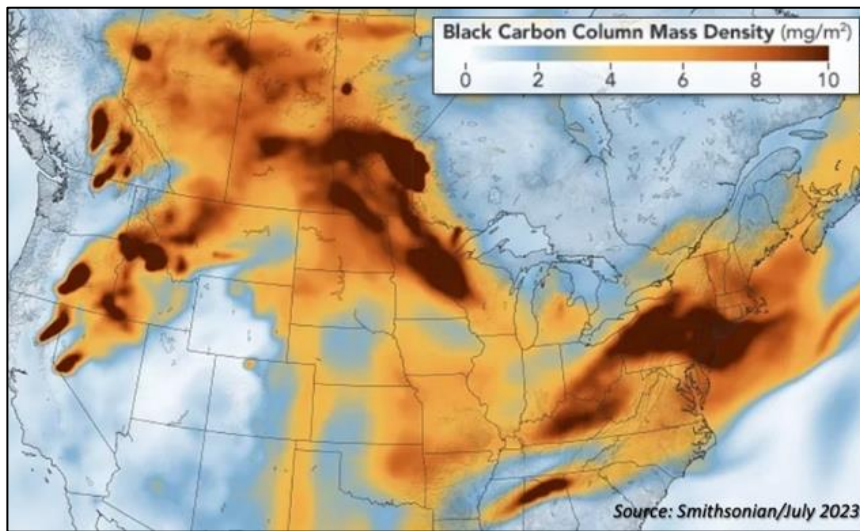
## **Wildfire Smoke Impacts Wildlife and Rehab**

**By Shirley Casey and Allan Casey**

Rehabilitator discussions about wildfires have often focused on caring for wildlife injured by the fires, then admitted with severe burns and smoke inhalation that can result in high mortality. There is growing awareness that smoke from distant wildfires also has more effects – including on wildlife far away from the actual fires. This means that rehabilitators will need to become more aware of recognizing those symptoms. This brief article will highlight just a few of the general short-term and longer-term health impacts; possible action steps rehabilitators may consider taking; and suggest a few related resources to review when time allows (i.e., after rehab busy season).

### **A New Normal?**

Wildfires in the U.S., predominantly in the West, have become much more common in the last decade, having burned a total of 87M acres, which is up 36% from the prior decade. The 2023 fires in Canada have taken this to a new level, having burned 42M acres in the eight months January through August. While wildfires are a normal and historically healthy



process in the natural ecosystem, they have become significantly more destructive with increases in severity, magnitude, and frequency. In addition to the habitat destruction in the immediate area, the resulting smoke is spreading much farther and wider, sometimes thousands of miles away, and lingering much longer. The map at right shows how the US Mid-Atlantic is affected by wildfire smoke plumes originating 2-3K miles away in the western US and Canada.

Many of us in 2023 found air quality severely impacted by the Canadian wildfire smoke, with the associated reduced visibility and health discomforts. Discussion by various public and health professionals

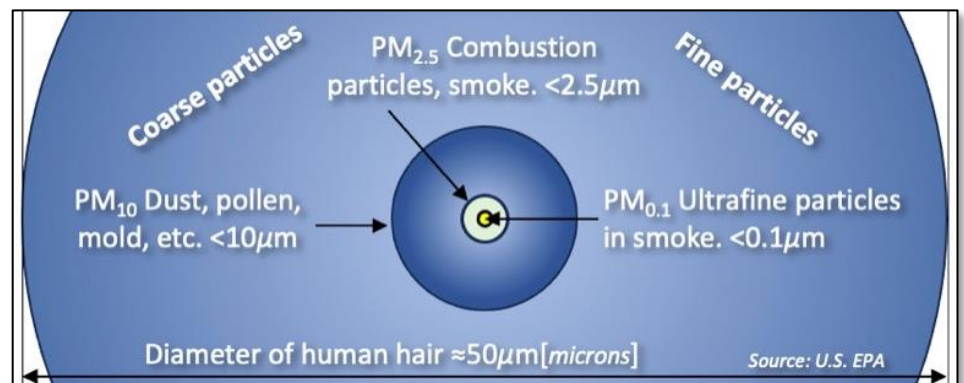
predictably focuses on how heavy wildfire smoke negatively affects people, pets, and domestic livestock. These effects include respiratory distress, eye irritation, reduced physical capability and accelerated exertion/exhaustion. Published research on the impacts of wildfire smoke and numerous air pollutants on people and domestic animals is expanding. While research on the impacts to free-roaming or captive wildlife is growing, it is still limited. Some of the information that is published on people and domestic animals can likely be extrapolated to anticipate and study similar impacts on wildlife health.

### **Is wildfire smoke more harmful than everyday air pollution?**

Considerably. Both are comprised of particulate matter (PM), but the size and composition vary significantly. More common particulate matter originates from various sources, including pollen, dust storms, agriculture, industrial activity and vehicle exhaust. These tend to range in the ‘coarse particle’ range of  $PM_{2.5\mu m}$  to  $PM_{10.0\mu m}$  (microns) in size (see accompanying diagram) and while irritating,

generally move in and out of the respiratory system with little effect for most people. Wildfire smoke, on the other hand, is  $\approx 90\%$  comprised of the ‘fine particle’ range of  $\geq PM_{2.5\mu m}$  in size, which can be lifted very high in the atmosphere and be transported hundreds to thousands of miles in strong jet stream air currents. These particles slowly settle to ground level and can remain in an area for days and weeks. They are also small

enough to deposit in the lungs for some length of time. Wildfire smoke also contains ultrafine particles of  $\geq PM_{0.1\mu m}$  that can



translocate into the circulatory system. Wildfire smoke often contains very different and toxic compounds depending on the source vegetation and items burned.

### **Short-term Health Impacts**

Wildfire smoke directly and indirectly impacts respiratory and cardiovascular health conditions, and mortality of humans – and seems similar for wildlife. Smoke can reduce availability of essential oxygen for tissues and organs. It can increase CO<sub>2</sub> poisoning. It can cause neurological conditions that include confusion and stupor – which can have many consequences. During and after heavy smoke alert periods, more wild animals may be admitted with respiratory and cardiovascular conditions, especially young animals. These young animals exposed to heavy wildfire smoke for days or weeks may appear to be breathing differently, be less active, have less body mass, and generally appear ‘weaker’ and less robust on admission than those admitted to rehab in previous years. In a short time, fluid may build up in the lungs, resulting in rapid and labored breathing and rapid heart rate.

Exposure to wildfire smoke can seriously weaken the immune response, increasing susceptibility as well as incidence of pneumonia, bacterial and viral infections and the ability to overcome them. This can result in both acute and chronic problems. Young animals can be more susceptible to secondary conditions, including other infections. Those developing health problems may be more difficult to treat and resolve – especially in cases of lung and cardiac damage.

If young animals are exposed to heavy and lingering smoke during their first weeks of life, they may be admitted noticeably smaller for their age. Some of these young animals may take longer to grow and develop, remain in rehab longer, and have lower survival rates. This could affect rehab workload, staffing, facility, capacity, resources, and more.

The number of admissions may change from prior years, with the size of litters/clutches smaller than previously observed. In some cases, admissions may drop due to decreased wildlife populations and lower reproductive rates from distressed or impaired parents. In other situations, more wild animals may be found and delivered to rehab when their parents are unable to provide adequate care or have died themselves.

### **Long-term Health Impacts**

Most young animals breathe faster as they grow and develop. In the presence of heavy wildfire smoke, this accelerated respiration can cause the animal to have exposure solely to highly particulated air, which also can impair development of immune systems. Research of newborn primates revealed reduced lung capacity and weaker immune systems in adolescence after exposure to wildfire smoke than those born in years with good air quality. It confirms that damage from smoke can continue to impact years later.

Birth rates, growth, development, and future reproductive success can be impacted by inhaling wildlife smoke. This can mean smaller litters or clutches, as well as slower growth and development. Wildlife population levels certainly can be affected by wildfire smoke – though the scope and level of magnitude of impacts are yet undefined.

Wildlife activity levels and behavior may change when first exposed to smoke, including fear, anxiety, attempts to escape or hide, etc. Animals may reduce activity and be more lethargic when they have less oxygen. Wildlife may sleep more, travel shorter distances, and be slower and less alert. Impaired respiration and cardiac function impact many activities and movements, such as finding and obtaining food, creating shelter, escaping predators – and extending the times for migration.

### **Possible action steps for rehabilitators**

- Keep aware of changes that affect wildlife in the wild and rehab – including wildfire smoke!
- Talk with your veterinarians about wildfire smoke, possible impacts (e.g., lung and cardiac conditions, development), conditions that might be treatable, or not. If treatable, learn about treatment options, duration, and assessment – and likely outcomes.
- Recognize that some treatments that may have been previously considered with young wildlife might *not* be considered appropriate if there is cardiac or pulmonary damage. Antibiotics are unlikely to be considered with substantial organ damage or developmental conditions.
- As always, closely monitor wildlife in care.
- Thoroughly document each animal admission, care and results. The documentation should include notes on air quality patterns, such as heavy wildfire smoke over a period of time prior to admission and daily during care. Include more details on admission, location, dates, general condition, weight, behavior, and specifics! Note observations and trends, as well as

disposition. Details matter. This is especially important and ‘data rich’ when working with young animals since many biologists and researchers tend to focus on adult wildlife.

- Continue to use good practices to help the animal grow, develop, and recover. Pay special attention if/when growth, health and recovery seems different from previous years – for individual animals, species, conditions, etc.
- Consider necropsy if the animal dies or is euthanized for possible impacts by wildfire smoke – especially as patterns appear. Discuss conditions and processes for necropsies may be appropriate and ready before busy season. Know in advance how to arrange necropsy to get timely and helpful results (and not exceed the budget). State agencies and researchers working on these issues may be available to help.
- Consider ways to share/communicate observations, concerns, and results that will help data collection and wildlife in the future!

### **Wildfire smoke is changing rehab activities**

Clearly wildfire smoke is a rapidly growing concern. It is worth more attention and in-depth study – and likely directly impacts many wild creatures, rehabbers and more. Rehabbers have a unique perspective on wildlife health – and likely play a useful role in understanding the impacts of wildfire smoke on wildlife – especially young animals, as they do with reporting on emerging diseases.

### **Authors**

*Shirley and Allan Casey have been licensed wildlife rehabbers since 1986. They are founders of WildAgain Wildlife Rehab in Colorado and [www.Ewildagain.org](http://www.Ewildagain.org). They conduct research and training, and publish on a wide range of rehab topics, including health, nutrition, and training rehabbers.*

### **Resources**

#### **Read this one first:**

Sanderfoot, Olivia. et al. 2022. A Review of Effects of Wildfire Smoke on the Health and Behavior of Wildlife. Environmental Research Letters. <https://iopscience.iop.org/article/10.1088/1748-9326/ac30f6/pdf>

#### **Other helpful articles:**

Cascio, Wayne. 2019. *Wildlife Smoke and Human Health*. Science Total Environment.

Garces and Isabel Pires. 2023. *The Hell of Wildfires: Impact on Wildlife and its Conservation and the Role of the Veterinarian*. Conservation.

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Hirschlag, Allison. 2023. *Smoke from Burning Forests and Peat Can Linger in the Atmosphere for Weeks, Travelling Thousands of Miles and Harming the Health of Populations Living Far Away*. BBC.

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Holm, S. M., Mark Miller, and John Balmes. 2021. *Health Effects of Wildfire Smoke and Public Health Tools*. Journal of Exposure Science and Environmental Epidemiology.

Molteni, Megan. 2023. *As wildfires burn, scientists race to understand the health dangers of prolonged exposure*. Stat. <https://www.statnews.com/2023/07/31/wildfire-smoke-prolonged-exposure-health-risks/>

Reid, Colleen, et al. 2016. *Critical Review of Health Impacts of Wildfire Smoke Exposure*. Environmental Health Perspectives.

Rott, Nathan. 2021. *Study Finds Wildfire Smoke More Harmful to Humans Than Pollution from Cars*. NPR.

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Snow, Megan. 2022. *How Does Wildfire Impact Wildlife and the Forest*. U.S. Fish and Wildlife Service.

U.S. Environmental Protection Agency. 2023. Why Wildfire Smoke is a Health Concern. <https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern>

U.S.G.S. 2021. *Wildfire Smoke Disrupts Bird Migration in the West*.

Yang, Di, et al. 2021. *Unprecedented Migratory Bird Die-Off*. Advancing Earth and Space Science.