Combustible Bedrock Fires: Urgent Need for Major Expansion in Geologic Hazard Program Support to Prescribed Burn and Wildfire Programs on National Forests System Lands

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Combustible bedrock fires, such as coal seam fires, are burning on many National Forest System (NFS) lands across the U.S. and are igniting wildfires. The combustible bedrock fires are not contained and not controlled, and there is no prospect of containing or controlling most of these underground fires. Underground fires typically become technically or economically unfeasible to stop unless extinguished shortly after first ignition. Combustible bedrock fires can burn underground for decades and centuries and thus are a never-ending, unstoppable ignition source for wildfires.

Existing combustible bedrock fires on or near NFS lands continue to enlarge the area of potential ignition sources for wildfires. The existing combustible bedrock fires and potential cumulative impacts are significant. But now two responses to the wildfire crisis have the potential to make a bad situation even worse…order of magnitude(s) worse.

Increase in Prescribed Burns

First, the Forest Service is embarking on a fast-track major increase in prescribed burns on millions of acres. Prescribed burns are potential ignition sources for combustible bedrock fires. This geologic hazard is far greater than just coal mines, and extends across vast landscapes where coal seams or other combustible bedrock (such as natural gas or oil bearing formations, oil shale, gilsonite, tar sands, pyritic rock) are at or near the ground surface. There is an urgent need for a major expansion in Geologic Hazard Program support to the Prescribed Burn Program. Without a major expansion in geologic support, there is a high probability that prescribed burns will ignite catastrophic combustible bedrock fires that were avoidable but instead will burn for decades and centuries.

Increase in Wildfires

Every year the Forest Service responds to increasing wildfires on millions of acres. Wildfire suppression strategies are used to decide which wildfires (or parts of wildfires) to suppress and

which are allowed to play a natural role. Wildfires are ignition sources for combustible bedrock fires. There is an urgent need for a major expansion in Geologic Hazard Program support to the Wildfire Program, such as by providing geologists as Resource Advisors to Incident Management Teams Planning and Operations Sections. Without a major expansion in geologic support , there is a high probability that wildfire suppression strategies will miss opportunities to suppress fire in areas with this geologic hazard and to prevent catastrophic combustible bedrock fires that will burn for decades and centuries.

Wayne National Forest - Ohio

The New Straitsville mine coal seam fire has been burning ever since 1884 (historical marker) It is estimated that more than 200 square miles of coal has burned.

The Wayne National Forest purchased thousands of acres of abandoned mine lands in this area from the 1930s and now owns a significant portion of the underground fire.To this day, snow melts on the ground above where the fire burns and holes open and spew steam and smoke sometimes quite high in the air.

Little Missouri National Grasslands - North Dakota

COAL OUTCROP FIRE SUPPRESSION IN THE NORTH DAKOTA BADLANDS


Typical badlands topography associated with the coal outcrop fires (left photo).
The plume of steam and smoke from this coal seam fire was visible for miles (right photo).

The Abandoned Mine Lands Division of the North Dakota Public Service Commission conducted its first coal outcrop fire suppression project during the winter of 2003. The objective was to extinguish coal seam outcrop fires actively burning on U.S. Forest Service lands in the badlands of southwestern North Dakota. An estimated 30 coal seam outcrop fires were ignited as a result of a 1999 grass fire that burned about 70,000 acres of grasslands in North Dakota, near the Montana border.

A primary concern was the possibility of additional grass fires igniting as a result of the burning coal seams. Since the 1999 fire, at least four subsequent grass fires have already been attributed to the burning coal seams. Left alone, underground lignite coal fires have been documented to burn for decades in North Dakota.

“They were concerned about it way, way back then, but it just — lost the funding.”

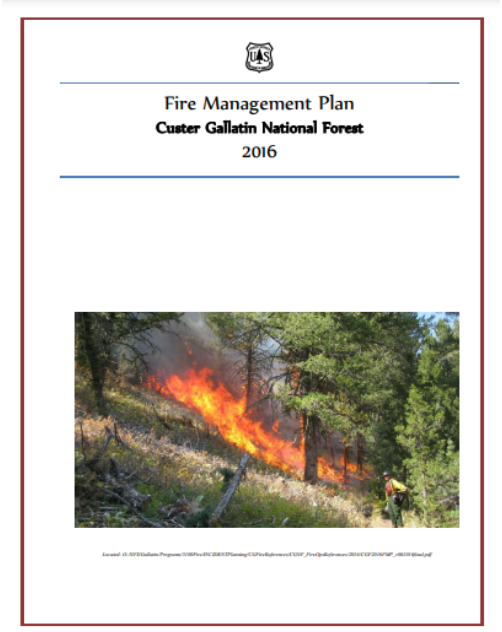
Funding is now even patchier. After the Bureau of Mines dissolved in 1996, the Abandoned Mine Lands Division of the North Dakota Public Service Commission used almost $170,000 in federal

funding to suppress 60 naturally occurring coal-crop fires between 2003 and 2012 on state and federal land underlain by lignite coal.

The costs were authorized by a special grant, part of a cooperative agreement between the U.S. Forest Service and the Interior Department's Office of Surface Mining. But the program ended in 2012, and Joan Breiner, assistant director of North Dakota's Abandoned Mine Lands Division, said the agency was no longer allowed to extinguish these fires and had stopped tracking them altogether.

Across the West, the number of agencies tracking coal seam fires, their funding methods for dealing with such fires, and their strategies for mitigation, if they exist, are complicated and hard to track, often isolated within bureaucratic silos.

Custer Gallatin National Forest - Montana and South Dakota


Fire Management Plan
Custer Gallatin National Forest
2016

Coal Seams. Coal is naturally occurring and located in rock strata in layers or veins called coal beds or coal seams. Exposed coal seams are abundant through southeast and central Montana as well as western North Dakota and South Dakota. Coal seam fires pose a serious problem that can be a hazard to firefighter's health and safety. Coal seam

fires can emit toxic gases, including carbon monoxide, sulfur dioxide, and other potentially hazardous gases.

Firefighters are typically not equipped or trained for coal seam fires and should not attempt to extinguish such fires with hand tools and engines. Putting water on coal seam fires is normally useless. Mitigation crews will need to excavate the burning coal seam and mix the hot material with soil and water to cool. The area can be reclaimed by backfilling the seam and re-vegetating the disturbed area.

Notify all incoming incident command teams and firefighting resources of known locations of exposed coal seams, coal mines, or abandoned coal mines adjacent to ongoing incidents and the risks and precautions to take when working around coal seam fires.

Some naturally occurring coal-seams in South Dakota, North Dakota and Montana, contain elevated levels of radioactive materials as well as other constituents of concern (arsenic, molybdenum, thorium, etc.). In some cases, historic uranium mining within these coal seams has further distributed and exposed these hazards. These areas include, but are not limited to, US Forest Service administered lands in Harding County South Dakota in the following areas: North Cave Hills, South Cave Hills and the Slim Buttes.

Los Padres National Forest - California

On private property just outside Los Padres National Forest, wisps of smoke escape through cracks in scorched ground high in the hills above Fillmore, Ventura County. The blaze has smoldered and flared since 2008 through landslide cracks and fissures in the ground.

Gas emissions appear to be from oil and gas bedrock formation, geologists have said. A leading theory is that the Ranch Fire in 2007 ignited those gases and caused the blaze.

It’s not the only fire burning beneath Ventura County. In 2004, firefighters put out flames in Los Padres National Forest. But it turned out the burning had started underground. The spot was in a remote location north of Ojai in the

Dick Smith Wilderness.

Source: VC Star March 8, 2018

San Juan National Forest - Colorado

Fire crews excavate a coal seam fire on San Juan NF north of Dolores, Colorado.

This Is the One Colorado Fire That Snow Can't Extinguish: Westword 2019 Dec 30

> Winter weather has been doing its part to mitigate wildfires in Colorado… But there's one big exception to this rule: the Coal Seam fire, in southwestern Colorado.
>
> Why? The fire is actually underground rather than on the surface of the **San Juan National Forest**, located not far from Durango. Firefighters believe that it had been burning for more than a year when it was discovered earlier this month, and trace its source to another flare-up, the **Plateau fire**, which was largely extinguished back in August 2018. And there's no telling how long it might take for the Coal Seam fire to exhaust itself.

"It could burn for years," acknowledges Patrick Seekins, fire management officer for the **Dolores Ranger District**, the local agency assigned to deal with the matter. "I've heard about coal seam fires across the nation that have gone on for that long. It's pretty crazy. And there are a lot of unknowns."

If the Coal Seam fire bursts through the earth and sets plants and the like ablaze, as it's already done once so far, will firefighters be able to battle it safely? Or might they accidentally fall through the top layer of soil onto the ultra-hot coal, potentially causing severe injuries and leaving other crews without a way to know where they can situate themselves without risking the same fate?

Underground Fire Burning in Coal Seam on Dolores Ranger District: Forest Service 2019 Oct 18

The fire has been burning underground since summer 2018 when the Plateau Fire occurred. The seam is extremely hot and will continue to burn for an indefinite period of time producing minimal amounts of smoke and a strong odor of creosote that will be noticeable. The ground in and around the coal seam is extremely unstable and the area should be avoided.

Coal seam fire near Dolores extinguished; second one discovered: The Durango Herald 2020 July 24

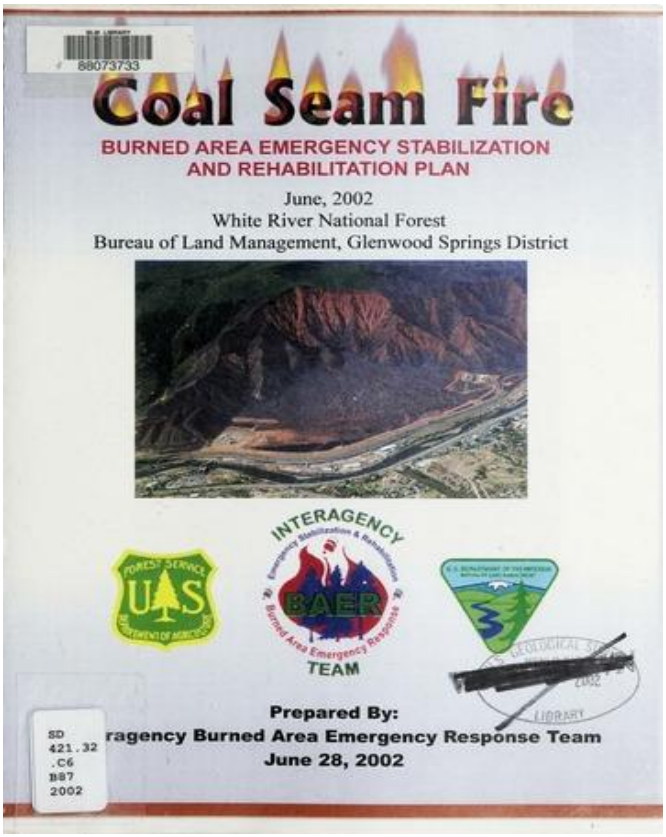
A coal seam fire discovered in October north of Dolores has been extinguished, but another one along a steep ledge was discovered a few miles west, according to the San Juan National Forest. The newest fire is being monitored but is much less accessible, said Dolores District Ranger Derek Padilla.

To extinguish the first fire, crews excavated the area with heavy equipment for several days in late May, then added water and a foam fire retardant, Padilla said. When there was no more smoke, the excavated coal seam was filled back in with soil, and the area was brought back to the natural grade.

Coal seam fires on San Juan NF and other lands in southwest Colorado

White River National Forest - Colorado

Coal Seam Fire memories still burning a decade later: 2012 June 8 PostIndependent



2002 coal seam fire burned in Glenwood Springs and the White River NF

GLENWOOD SPRINGS, Colorado – Ten years ago today, a wildfire sparked by a burning underground coal seam and pushed by hot, dry gusting winds blew up into a roaring conflagration of epic size that swept through West Glenwood.

The Coal Seam Fire burned 29 homes and more than 12,000 acres of land. Thousands of residents in West Glenwood and Four Mile were evacuated for days. Firefighters were camped at Two Rivers Park for weeks fighting the blaze as it lurched northward on the Flat Tops.

Remarkably, no one was killed or seriously injured, a point of pride for fire officials who had absorbed the painful lessons of the Storm King Fire eight years earlier, which killed 14 federal firefighters.

In August 2002, the burnt slopes gave way under heavy thunderstorms to send devastating mudslides down into Mitchell Creek and onto I-70.

Today, officials are marking the anniversary by issuing a strict regional fire ban covering private and public lands. With fire conditions this year as severe as those of 2002, there is widespread fear that an errant spark on a windy "red flag" day will lead to another disastrous wildfire.

"Today, the conditions are just as bad as they were then," said Bill Kight, public information officer for the White River National Forest. He spoke from Eagle on Thursday, buffeted by high winds on yet another of this season's red flag warning days.

Colorado gets $10 million to fight coal seam fires like those burning at Marshall Mesa and Glenwood Springs: The Colorado Sun 2022Feb9

Coal seam fires have burned for more than 100 years at old Colorado coal mines, including in South Canyon near Glenwood Springs, where smoke and steam are constantly visible just off a trail. New federal infrastructure money is coming to help Colorado finally extinguish some ancient embers. (Colorado Department of Natural Resources file photo)

Colorado will get $10 million in new federal infrastructure money to combat decades-old coal seam fires like those on Marshall Mesa and in Glenwood Springs that periodically flare up and wreak havoc, state officials said Tuesday.

The new funding more than triples Colorado's existing federal budget for all coal mine cleanup efforts, and will be largely focused on combating the seam fires dating before 1977, the Department of Natural Resources said. State officials called the massive increase a "game changer" in their fight, saying it will protect threatened communities and support mining-related jobs in a declining industry.

Front Range fire officials have said they are investigating coal fires from old mines long burning along Marshall Mesa as a potential cause of the late December Marshall fire, which burned nearly 1,100 homes and was the most destructive wildfire in Colorado history. Marshall Mesa coal was the culprit in grass fires in previous years, officials have said.

Smoldering coal deposits were identified as the cause of the 2002 Coal Seam fire outside Glenwood Springs, which burned 29 homes across 12,000 acres. The ongoing coal fires continue to vent smoke and steam near the city landfill in the South Canyon area, and new flare-ups are a constant worry for town residents and officials, said Mayor Jonathan Godes.

The old seams are a "ticking time bomb," Godes said, and previous levels of spending haven't been enough to slow down the fires.

The new federal reclamation money will be enough to make serious efforts on some of the most troublesome fires in the state, Graves said, including Marshall Mesa and Glenwood Springs.

Of 38 monitored fires, some burning for more than 100 years, he said, only one was called "extinguished," and department officials hedge their bets even on that one, he added.

The new funding could add $10 million a year for up to 15 years for Colorado, Graves said.

The Marshall fire is renewing focus on underground coal blazes across Colorado and the U.S.: 2022 Jan 30 The Colorado Sun

The estimated future cost to control the 200 known abandoned mine blazes across the U.S. is almost $900 million, according to the Office of Surface Mining database

A fire raging in an underground Colorado coal field in 1883 sent so much smoke pouring from cracks in the ground that the scene was likened to burning volcanoes and the state's first mining inspector deemed the blaze "impossible to extinguish."

Nearly 140 years later two fires still smolder in the now-abandoned coal field near Boulder — the same area where a wildfire last month destroyed more than 1,000 homes and buildings and killed at least one person.

Could smoldering coal have started such a fire? History shows the answer is yes, with at least two Colorado blazes in the past 20 years blamed on mine fires that spread to the surface. And in Montana this past summer slow-burning coal reserves fanned by winds sparked a pair of blazes that burned a combined 267 square miles (691 square kilometers) on and around the Northern Cheyenne Indian Reservation.

Across the U.S. at least 259 underground mine fires burned in more than a dozen states as of last September, according to federal Office of Surface Mining data. There are hundreds and possibly thousands more undocumented blazes burning in coal seams that have never been mined, researchers and government officials say.

As climate change leads to drought across larges swaths of a U.S. West already seeing longer and more destructive fire seasons, experts say smoldering coal fires will pose a continuing threat.

Such fires can be ignited by lightning, humans and even spontaneously at temperatures as low as 86 degrees Fahrenheit (30 degrees Celsius), said Jurgen Brune a Colorado School of Mines engineering professor. Many are impossible to put out, slowly burning underground as the combustion feeds off a small amount of oxygen present in the coal, he said.

“Covering it up and trying to take away the oxygen from the fire puts out most fires. Not for coal fires,” Brune said.

Underground coal seams burn unpredictably and can break through to the surface without warning long after a fire starts, he said.

“It’s like trying to predict an earthquake,” Brune said. “With all the technology we have today they are not coming any closer to predicting them. The same goes for a coal fire.”

The fires emit toxic mercury and the greenhouse gas carbon dioxide, and cause sinkholes when the ground’s surface collapses into burned cavities below. In Centralia, Pennsylvania, the fumes and subsidence from a coal fire that started beneath the town in 1962 got so bad that more than 1,000 people eventually relocated at a cost of $42 million.

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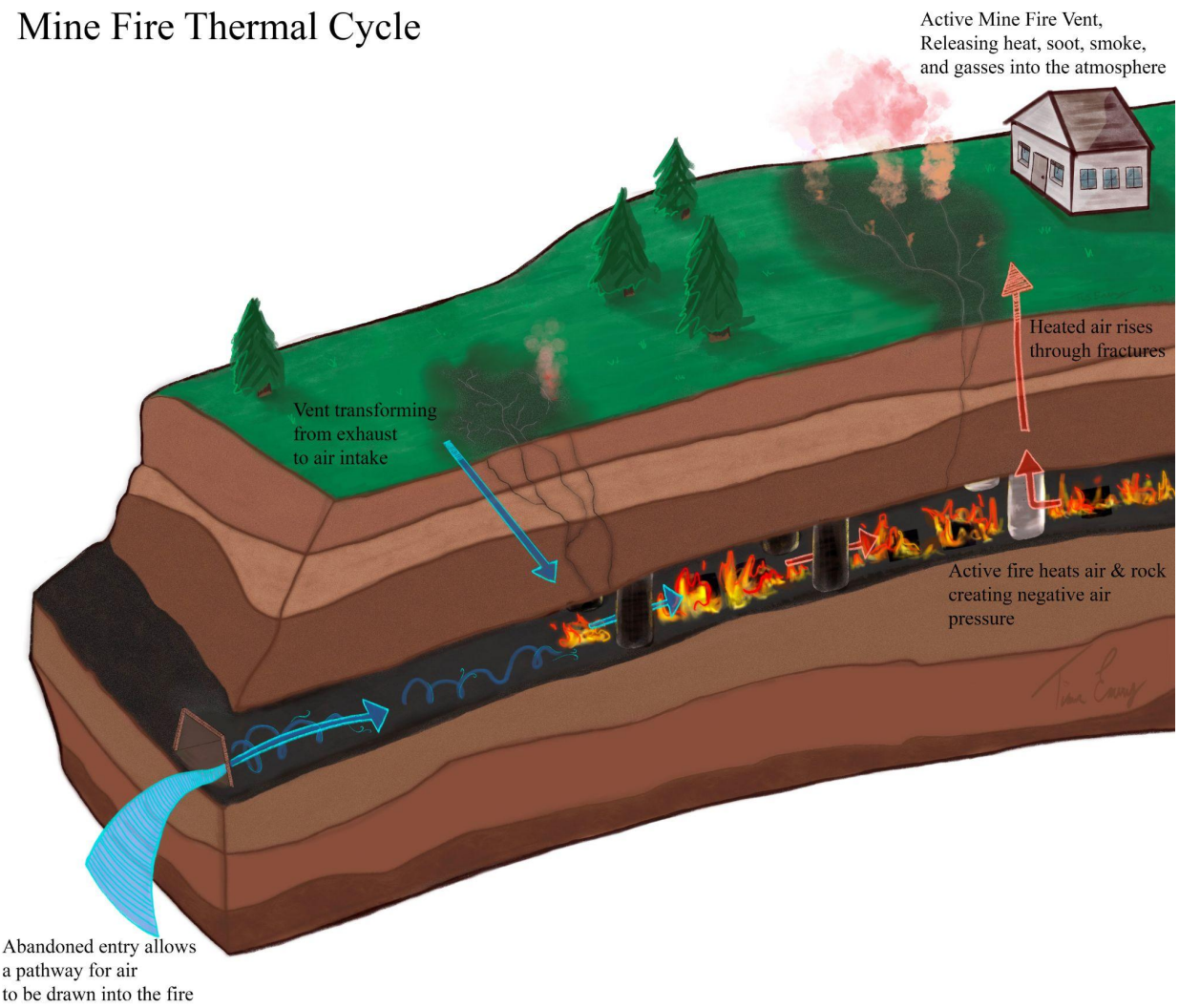
In the wake of last summer's fires, local officials in Montana plan to map out burning seams across the state's southeast in coming months using a federal grant. Controlling them will be difficult and could cost a minimum of $300,000 per site, said Bobbi Vannattan with the Rosebud Conservation District, which is helping to coordinate the mapping.

San Juan National Forest - Colorado

Natural ignition sources include natural wildfires, lightning, bedrock exposure to oxidation e.g. landslides, resulting in spontaneous combustion. Human-caused ignition sources include accidental or intentional wildfires, prescribed burns, trash and landfill fires, bedrock exposure to oxidation by dozer lines or excavation for roads, log landings, etc.).

The underground fires consume the bedrock and undermine the overlying ground leading to fractures, cracks and collapse holes in the ground surface. These vents release smoke, toxic deadly gases, and greenhouse gases. Surface and groundwater are polluted.



[Underground Mine Fire Thermal Cycle: Office of Surface Mining Reclamation and Enforcement (OSMRE), U.S. Department of Interior]

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In turn, once established, combustible bedrock fires become decades-and-centuries long ignition sources of wildfires and structural fires.