



Figure 1. Bear Rocks and Allegheny Front Preserve, WV; photo by K. Engelhardt and T. Lookingbill.

## Potential National Natural Landmark Brief

### Name:

Bear Rocks and Allegheny Front Preserve

### Location:

Grant and Tucker Counties, West Virginia

### Description:

The 1,204-acre (487-hectare) site is located between the city of Petersburg (Grant County) and the town of Davis (Tucker County) in West Virginia, just north of the Dolly Sods Wilderness, on the edge of the Allegheny Mountains section of the Appalachian Plateaus Province. The site features illustrative plateau geology, seen in the high elevation (over 4,000 feet above sea level), steep escarpment, flat sedimentary rock, and fluvial dissection. The preserve is representative of the processes that follow continental collision when mountain landforms are transformed into plateau landscapes by millions of years of uplift and erosion. Owing to high elevations and cold temperatures, the plateau ecosystem supports a rich ecological community dominated by red spruce and heath shrubs at higher elevations and by bogs and other wetlands at lower elevations. Bear Rocks provides habitat to more than 190 species of plants, many of which are specially adapted to the harsh conditions on the front. Terrestrial succession with a spruce forest climax is visible in all stages of development.

### Significance:

Bear Rocks and Allegheny Front Preserve is the best example of a plateau within the Appalachian Plateaus Province. The elevated, flat-lying, sandstone-capped rocks of the preserve along the Allegheny Structural Front illustrate how tectonic activity and continental collision form regionally important mountain and plateau landscapes. The high elevation and cool climate of the preserve supports a diverse ecology, containing three G2-ranked communities: High Allegheny Red Spruce Woodland, Cranberry-Beaksedge Peatland, and Central Appalachian Heath Barrens.

### Ownership:

The Nature Conservancy

### Evaluation:

August 2019, Todd R. Lookingbill, University of Richmond, Katharina A. M. Engelhardt, University of Maryland Center for Environmental Science, and David E. Kitchen, University of Richmond.



## General Location:

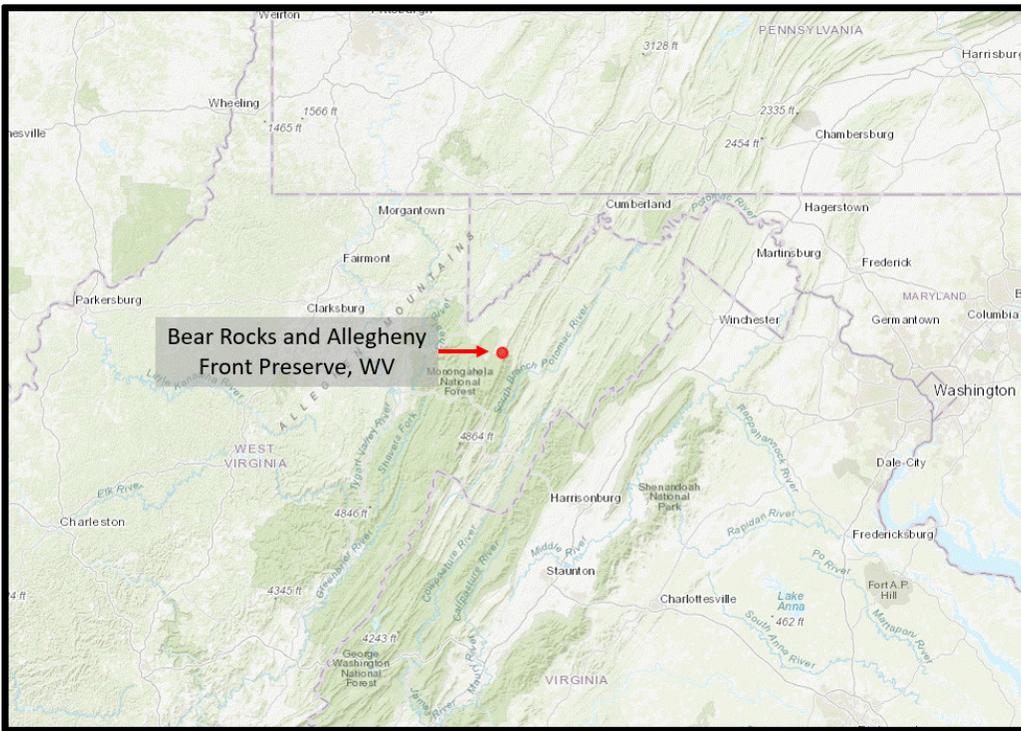


Figure 2. General location of the proposed Bear Rocks and Allegheny Front Preserve NNL in northeast West Virginia.

## Proposed NNL Boundary:

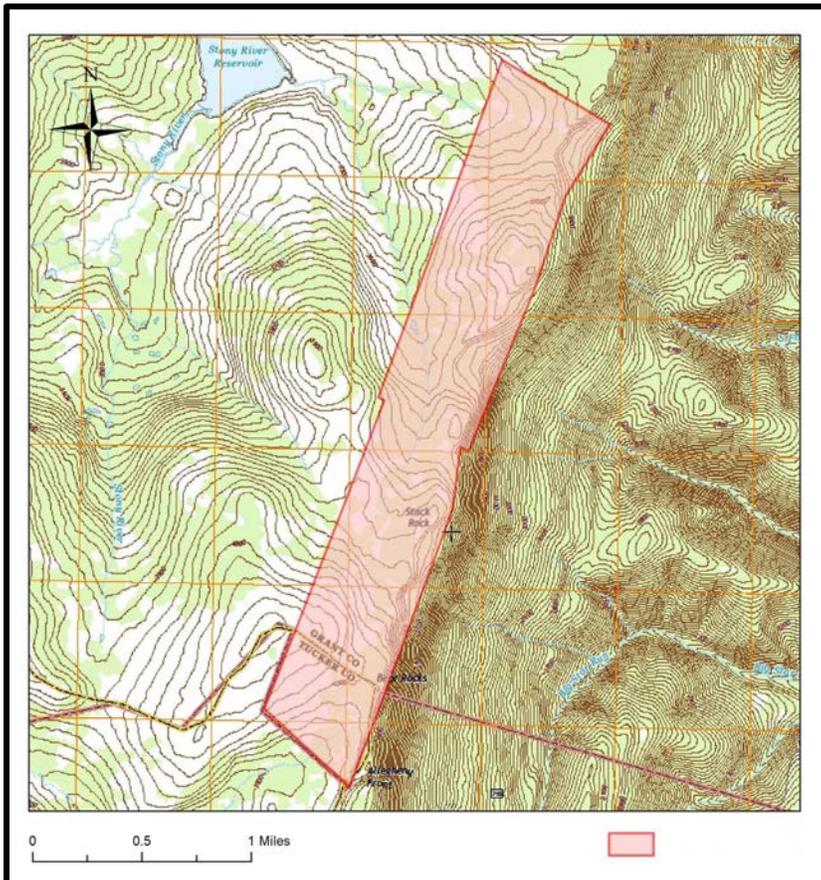


Figure 3. Proposed 1,204-acre NNL boundary for Bear Rocks and Allegheny Front Preserve, West Virginia.



Figure 1. Snottites and blood red worms within Sulphur Cave, Colorado; photos by N. Thomson.

## Potential National Natural Landmark Brief

### Name:

Sulphur Cave and Spring

### Location:

Routt County, Colorado

### Description:

Sulphur Cave and Spring, located on the western side of Steamboat Springs, is an example of an active hypogenic cave. The cave entrance is on top of a travertine deposit that is probably no older than 126,000 years, making Sulphur Cave the youngest solution cave in Colorado. Geothermally heated water issuing from nearby Sulfur Spring contains dissolved hydrogen sulfide (H<sub>2</sub>S) and carbon dioxide (CO<sub>2</sub>), which come out of solution when the spring water enters the cave, filling the cave with a deadly combination of H<sub>2</sub>S and CO<sub>2</sub> gas. Snottites, biologically formed speleothems, uncommon in most caves, hang from the ceiling and contain sulfur-metabolizing bacteria. Water droplets from the snottites contain high concentrations of sulfuric acid, the by-product of bacteria's sulfur metabolism, providing the dissolving agent for the travertine that holds the cave. This process, which initially formed the cave, is the active process still underway today. Relict caves formed in this manner are highly unusual and uncommon, and there are very few known, accessible springs and caves that are actively undergoing sulfuric acid speleogenesis.

Sulphur Cave also includes other natural features and biota that are found either rarely in other caves or are unique to Sulphur Cave. Native sulfur deposits, which are characteristic of this type of speleogenesis, is not present in many caves, but displays prominently in Sulphur Cave. The cave has excellent examples of biovermiculations (created by microbial flora), gypsum crystals and extremophiles, including bacterial mats and the blood-red worm (*Limnodrilus sulphurensis*), living in the stream flowing through the cave, that is globally-unique, found nowhere else in the world.

### Significance:

Sulphur Cave and Spring is a superb example of the process and products of bacterially-mediated sulfuric acid speleogenesis. Caves that are actively undergoing sulfuric acid speleogenesis are extremely rare and Sulphur Cave is the only known example in Colorado, of a cave being dissolved solely by sulfuric acid. The cave contains many uncommon cave features, including biovermiculations, gypsum crystals, native sulfur, snottites (a biologically-formed speleothem), and the recently discovered blood-red worm *Limnodrilus sulphurensis*, which is unique to the cave, found nowhere else in the world.



## Ownership:

The City of Steamboat Springs

## Evaluation:

April 2020, Fredrick Luiszer, University of Colorado, Boulder.

## General Location:

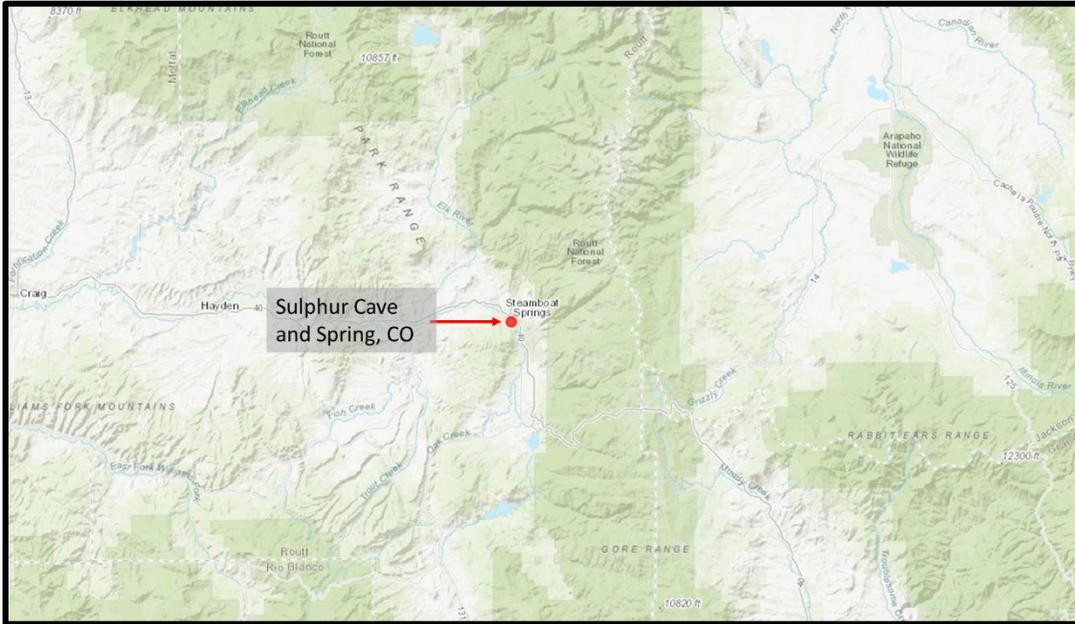


Figure 2. General location of the proposed Sulphur Cave and Spring NNL in northwest Colorado.

## Proposed NNL Boundary:

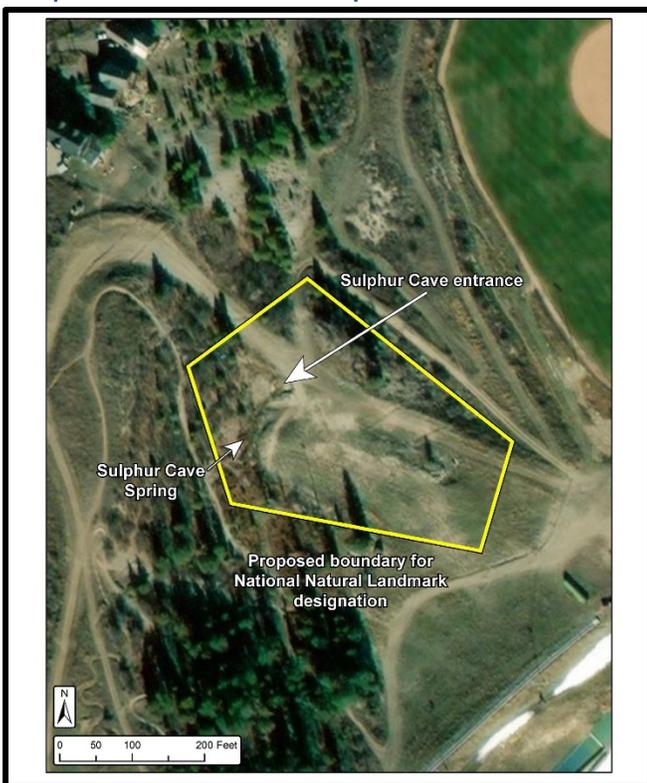


Figure 3. Proposed 2.45-acre NNL boundary for Sulphur Cave and Spring, Colorado.





Figure 1. Lanphere and Ma-le'l Dunes, California; photo by A. Pickart.

## Potential National Natural Landmark Brief

### Name:

Lanphere and Ma-le'l Dunes

### Location:

Humboldt County, California

### Description:

Lanphere and Ma-le'l Dunes, located three miles west of Arcata in Humboldt County, California, is a remarkably undisturbed, yet easily accessible site with an outstanding variety of dune habitats and associated wetlands. These habitats, which are in excellent condition, contain virtually all the species of vascular plants typical of dune systems in northern California and southern Oregon, plus a number of rare species. Lanphere and Ma-le'l Dunes is part of the system of dunes associated with Humboldt Bay in northern California, which is situated within the largest system of dunes between Point Reyes National Seashore and the Oregon Dunes National Recreation Area. The site contains particularly good examples of dune plant communities and related dune landforms. Many of these features are now very rare, because dunes within this range have been extensively transformed by human activity and the spread of introduced plants. In addition to the characteristic dune vegetation and open sand, Lanphere and Ma-le'l Dunes supports a number of threatened plants and animals and affords a special opportunity to study the natural relationships among dune organisms and physical processes.

### Significance:

Lanphere and Ma-le'l Dunes represents one of the most diverse and highest quality remnants of coastal dunes habitat in the North Pacific Border physiographic province. This site includes a diverse array of natural, native vegetation, in contrast to most of the other dune systems north of central California. The site also is known for rare flora, including one of the best remaining populations of the endangered Menzies wallflower (*Erysimum menziesii*) and beach tidy-tips (*Layia carnosa*). The site is very scenic and affords the public an inspiring view of a natural coastal ecosystem that was once common along the western coast and is now nearly lost.

### Ownership:

The Bureau of Land Management and U.S. Fish and Wildlife Service

### Evaluation:

May 2019, Peter Alpert, University of Massachusetts – Amherst, and James S. Kagan, Portland State University.



## General Location:



Figure 2. General location of the proposed Lanphere and Ma-le'l Dunes NNL in northwestern California.

## Proposed NNL Boundary:

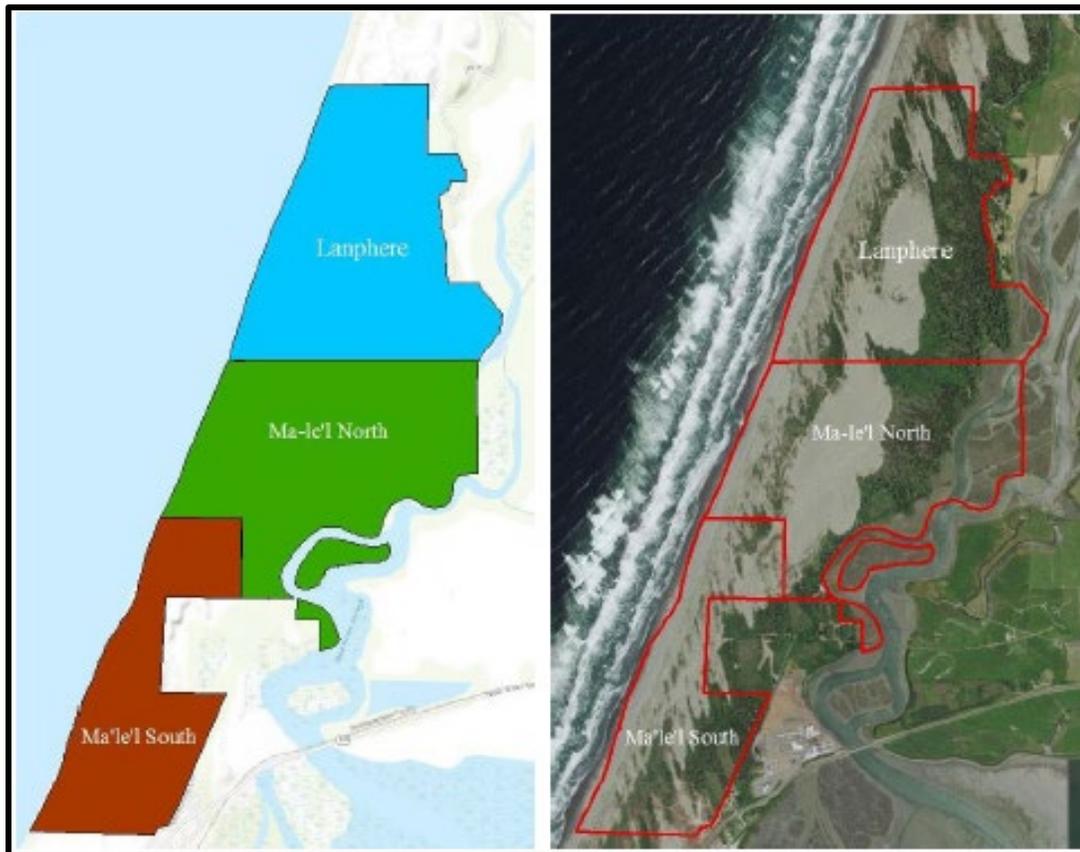


Figure 3. Proposed 834-acre NNL boundary for Lanphere and Ma-le'l Dunes, California.

