The politics of palaeontology: the creation, reduction, and restoration of Grand Staircase-Escalante and Bears Ears national monuments

Grand Staircase-Escalante and Bears Ears are tracts of U.S. public lands in Utah that were designated as national monuments in 1996 and 2016 respectively in part for the importance of their geological and paleontological resources. In the 25 years since it was established, Grand Staircase-Escalante became known as the “science monument” for its strong emphasis on palaeontological science, including coordinating activities of its palaeontological manager. Synthesis of the hundreds of scientific papers based on research there transformed our understanding of the evolution of Mesozoic ecosystems. Even before a management plan could be implemented at Bears Ears National Monument, President Donald Trump revoked the boundaries of both monuments and retained less than half their total areas. His action was arguably the first major rollback of palaeontological resources in the United States, underscoring the position of science in the political debate about public lands. Palaeontologists joined Native American tribes, conservation groups, and businesses in a joint effort to re-establish the monuments, an effort that was partially realized when President Joseph Biden restored their boundaries in 2021. The palaeontological significance of these national monuments intersects with many other perspectives on the value and use of these lands, including indigenous and religious groups who faced oppression, imperatives for the conservation of wilderness, the desire for economic and industrial expansion, and political struggle between state and federal and executive and legislative. This article explores the scientific and political significance of the palaeontology of these two monuments.

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Introduction

On 4 December 2017 in the Utah state capitol building, U.S. President Donald J. Trump signed proclamations 9681 and 9682, which reduced the size of Bears Ears and Grand Staircase–Escalante national monuments by more than fifty percent. In doing so, he began the process of rescinding the special conservation priority that palaeontological resources had or would benefit from in these two regions of the Colorado Plateau. His action was a notable reversal in the history of improving legal protection of fossils in the United States, but it also illustrated how palaeontological science intersects with public policy, law, economic interests, cultural diversity, and political discourse. President Trump’s polarizing populist politics galvanized the world’s attention onto these two national monuments, and in doing so focused attention on palaeontology and the political and social connections between science and society. This paper briefly describes the spectacular palaeontology of these two parcels of land, the histories of their status as national monuments, and the consequences of these political decisions on research and fossil preservation. It also delves deeper into what federal lands are in the United States, how they are managed, and why they are increasingly important to palaeontological science. Finally, it explores how the complex values of indigenous people, religious groups, local communities, ranchers, outdoor enthusiasts, hunters, extractive industries, and national identity overlap with the interests of palaeontologists on federal lands.

The palaeontology of Grand Staircase–Escalante and Bears Ears National Monuments

Grand Staircase–Escalante and Bears Ears national monuments enclose parts of the northwest quadrant of the Colorado Plateau in southern Utah (Figure 1). The first published scientific work from the area was recorded by John Wesley Powell’s survey of the Colorado River basin (Powell 1875) and the basic stratigraphy (and some of the palaeontology) was worked out in the early 20th century by Gregory and Moore (1931). A most inaccessible region, southern Utah was one of the last areas of the United States to be systematically mapped or surveyed for palaeontological resources (Titus 2013). The descriptions in this section are consistent with the monuments’ original and restored boundaries.
Collectively the two monuments encompass palaeontological resources from the Late Carboniferous (starting about 315 Ma) through the Late Cretaceous (ending about 74 Ma) and thus document the history of North American vertebrates from just after they became important members of terrestrial ecosystems until not long before the Cretaceous-Palaeogene extinction event. Both monuments also contain fossiliferous Quaternary deposits. What is now southern Utah was positioned near the western edge of North America at the beginning of that interval, inundated by epicontinental seas at high stands, but increasingly terrestrial and arid, with eolian dunes common by the latest Carboniferous and early Permian (Soreghan 1994; Doelling et al. 2000; Blakey 2009). As Pangea broke apart in the Mesozoic, mountain building along the continental margin created mountain barriers that left the region arid and landlocked (Blakey et al. 1983). The spread of interior seaways in the Jurassic and Cretaceous again put southern Utah on coastal margins. The Mesozoic stratigraphic sequence contains marine units inter-
leaved with coastal plain and eolian environments (Doelling et al. 2000).

A comprehensive overview of the palaeontology and geology of the Bears Ears region was recently provided by Gay et al. (2020). A Triassic phytosaur was the first vertebrate fossil to be described from what is now Bears Ears (Lucas 1898), but Charles Camp was the first palaeontologist to purposely survey for vertebrate localities when he visited in the late 1920s to study the faunas of the Chinle Formation (Fm.; Camp 1930). The Chinle Fm., which represents a complex package of fluvial and lacustrine deposits (Blakey and Gubitosa 1983) is also one of the most productive sources of uranium in North America (Dubiel 1983) and a mine has been opened in the area surrounding at least one of Camp’s sites. The Bears Ears region has only been partly surveyed for vertebrate fossils because of its remoteness. Its geologically oldest fossils are from the late Carboniferous Hermosa Group, especially the marine Honaker Trail Fm. which has a fauna of brachiopods, corals, bryozoans, and conodonts (Melton 1972; Ritter et al. 2002). The overlying Cutler Group spans the latest Carboniferous to the late Permian, and has rich floras and faunas in the southern Valley of the Gods area that document ecosystems in which amniotes originated and diversified (Sumida et al. 1999; DiMichele et al. 2014; Huttenlocker et al. 2018). The Permian aged Cedar Mesa Sandstone contains floras, trackways, burrows, and bone beds, including a spectacular association of permineralized tree trunks and vertebrate fossils from the Indian Creek area in the north part of the monument (Stanesco and Campbell 1989; Gay et al. 2020). The Permian-Triassic boundary is lost in a hiatus of about 20 million years before the record picks up again with the Moenkopi and Chinle formations. Plants, fish, temnospondyls, and trackways, including archosaur swim tracks, have been recovered from the Moenkopi Fm. in Bears Ears, but the unit has not been extensively surveyed (McKee 1954; Welles 1967; Thompson and Lovelace 2014). The Chinle Fm. makes Bears Ears spectacular from a palaeontological perspective. Hundreds of fossiliferous localities are known with associations of plants, invertebrates and vertebrates, the latter including fish, temnospondyls, phytosaurs, and aetosaurs (e.g., Parrish 1999; Martz et al. 2014; Hunt-Foster et al. 2016). Bears Ears has fewer Jurassic and Cretaceous outcrops than Grand Staircase–Escalante, but the exposures are nevertheless palaeontologically important. Jurassic geologic units include the Moenave Fm., the Navajo, Kayenta, and Wingate Sandstones, and Morrison Fm. Cretaceous units include the Burro Canyon Fm., a lateral equivalent of the Cedar Mountain Fm. of Grand Staircase–Escalante. One of the only dinosaur skeletons recovered from the Navajo Sandstone is the sauropodomorph Seitaad ruessi from Bears Ears at Comb Ridge (Sertich and Loewen 2010). The Morrison Fm., which is exposed only in a narrow belt on the east side of Bears Ears, has yielded many important floras and faunas (e.g., Gillette 1996; Turner and Peterson 1999; Foster 2005). Petrified wood, footprints, and some leaf fossils have been described from the Burro Canyon Fm. (Milàn et al. 2015; Gay et al. 2020).

More than 4,000 scientifically important sites have been identified at Grand Staircase–Escalante National Monument in the 25 years since the monument was established, and to date only a fraction of the area has been surveyed (Bureau of Land Management 2018). Scientific reviews of its palaeontology have been published by Foster and colleagues (2001) and Titus and Lowen (2013). A popular synthesis of the discoveries at Grand Staircase was written by Sadler (2016), and excellent summaries are provided by Clinton (1996) and Biden (2021c). Doelling and colleagues (2000) reviewed the geology of the monument. The monument can be divided into four physiographic sections, which from east to west are identified as Circle Cliffs, Escalante Canyons, Kaiparowits Plateau, and the Grand Staircase. Most of the bedrock geology is Mesozoic in age, but there are Permian aged outcrops in the Circle Cliffs area and at the southern foot of the Grand Staircase. Important among these outcrops is the type area of the Kaibab Fm., a geologic unit scientifically defined based on the exposures in Kaibab Gulch, also known as Buckskin Gulch (Noble 1928; Gregory and Moore 1931). A hiatus exists at the Permian-Triassic boundary, and the sedimentary record resumes with the Triassic aged Moenkopi and Chinle formations as at Bears Ears. Triassic units in the monument have been the focus of dozens of important studies. The Wolverine Petrified Forest in the Petrified Forest Member of the Chinle Fm. is the second largest Triassic-aged forest in North America. The Circle Cliffs area has yielded the earliest evidence of holometabolan insects and conifer wood, an association that continues to the present time (Ash 2003; Tapanila and Roberts 2012). The Brinkerhof Spring track site, preserved in the Owl Creek Member of the Chinle Fm. in the Circle Cliffs area, includes dozens of reptilian trackways, including Rhynchosaurioids, Gwynedichnium, and Apatopus, the latter likely to have been produced by phytosaurs (Foster et al. 2000). This same area preserves swim tracks in the Moenkopi Fm. (Thompson and Lovelace 2014). A nearly complete Popsaurus skeleton is another notable find from the Circle Cliffs Triassic (Gauthier et al. 2011; Schachner et al. 2011, 2020). Jurassic geologic units include the Moenave, Kayenta, Navajo, Carmel, and Entrada Sandstone formations, and preserve many important trackway sites. The Kayenta Fm. has several kinds of dinosaur track, as well as trackways of a cat-sized therapsid, Brasilichnium (Hamblin and Foster 2000). The sauropod trackway from the Twentymile Wash track site in the Entrada Sandstone is the most ancient of its kind in the United States and is the only sauropod trackway that reveals a distinct tail trace (Foster et al. 2000). The Entrada also preserves an
extensive aeolian dune system containing unusual burrows likely attributable to insects and arachnids (Loope 2008). A depositional hiatus occurs between the Middle Jurassic Entrada dune field and the early Cretaceous Cedar Mountain Fm. This Cretaceous rock sequence, which starts with the Cedar Mountain Fm. and continues upward through the Naturita, Tropic Shale, Straight Cliffs, Wahweap, and Kaiparowits formations, is literally the centrepiece of Grand Staircase–Escalante, making up the Kaiparowits Plateau and the areas to its south (Doelling et al. 2000). The Tropic Shale, a dark organic-rich shale, records a diverse marine community of foraminifera, ammonites, sharks, bony fish, plesiosaurs, and ichthyosaurs. The Tropic Shale records a palaeofauna affected by Oceanic Anoxic Event II, a large-scale change in oceanic conditions that depleted the waters of oxygen and caused pulses of extinction in advance of the end-Cretaceous event (Albright et al. 2007a, b, 2013). The Tropic Shale of Grand Staircase also contains rare terrestrial remains, such as the therizinosaurid dinosaur Nothronychus graf-fami (Zanno et al. 2009). As the Western Interior Seaway regressed after Turonian stage, the Grand Staircase region was blanketed in the terrestrial sediments that make up the Straight Cliffs, Wahweap, and Kaiparowits formations. The faunae and florae of these units are arguably the most important documentation in the world of the ecological succession that was recently designated as the Cretaceous Terrestrial Revolution, the transition to an angiosperm-dominated world of pollinating insects and lissamphibian, squamate, and mammal insectivores (Lloyd et al. 2008). In fact, the mammals discovered by Rich Cifelli and Jeff Eaton in Turonian- and Santonian-aged units of the Straight Cliffs Fm., an important interval for which fossiliferous rocks are globally rare, brought serious attention to the palaeontology of the Kaiparowits Plateau and catalysed the establishment of the monument (Eaton and Cifelli 1988; Cifelli 1990; Eaton 1995; Eaton et al. 1999). The Straight Cliffs Fm. also has extensive nearshore deposits, including coals, that preserve plant and animal remains. Literally thousands of sites are now known from these units, and they document a flora and fauna that differ from more northerly Late Cretaceous ecosystems in Montana, the Dakotas, and Alberta. This ecosystem went through major turnovers in taxonomic and functional composition despite the dominance of dinosaurian taxa. Dozens of new dinosaur, mammal, bird, turtle, lizard, lissamphibian, and other taxa have been recovered, including new theropods Lythronax and Teratophoneus, a remarkable diversity of ceratopsian herbivores, including Diabloceratops, Nasutoceratops, and Kosmoceratops, the entantiornithe bird Mirarce eatoni, and the unusual turtle Arvinachelys goldeni with double narial openings (Kirkland and DeBlieux 2010; Titus et al. 2005; Roček et al. 2010; Sampson et al. 2010; Carr et al. 2011; Farke and Patel 2012; Loewen et al. 2013; Lively 2015; Lund et al. 2016; Atterholt et al. 2018).

How and why the national monuments were established

Grand Staircase and Bears Ears are both National Monuments on U.S. federal lands that are managed by the Bureau of Land Management (BLM). Grand Staircase–Escalante National Monument was established by U.S. President Bill Clinton in 1996 under Proclamation 6920 (Clinton 1996) and Bears Ears National Monument was established by President Barak Obama in 2016 under Proclamation 9558 (Obama 2016).

The term “public land” is often used interchangeably for federal land in the U.S., but it has both wider and more restrictive definitions. In broad parlance, public lands are those owned by a state or municipality and are managed for a collective purpose, such as many Crown lands in British Commonwealth countries or conservation units in Brazil. In the U.S., the legal term “public land” was narrowly defined in FLPMA as lands managed by the BLM (43 U.S.C. § 1702(e)), but elsewhere in U.S. law it is defined as lands administered either by BLM or the U.S. Forest Service (16 U.S.C. § 1332) and as lands administered as part of the national park system, national wildlife refuge system, the national forest system, lands on the outer continental shelf, and lands administered by the Smithsonian Institution (16 U.S.C. § 470bb(3)) (Lehski et al. 2022). In this paper, public land is used in the general sense rather than the stricter senses of U.S. law.

As used here, “federal land” refers to land owned by the U.S. Federal Government, most of which is managed by the U.S. Department of the Interior, including the BLM (987,000 km²), the Fish and Wildlife Service (360,000 km²), the National Parks Service (320,000 km²), and the Bureau of Reclamation (28,000 km²), or by the U.S. Department of Agriculture, including the USDA Forest Service (777,000 km²). In total, about 2.5 million km² are held by the U.S. government, much of it in western states where it was acquired by treaty, purchase, or warfare with other nation states or indigenous peoples (Vincent et al. 2017; Evans 2020). Today’s federal lands were either retained by the U.S. government (most federal land was distributed to private owners through the Homestead Act or was deeded to new states as they were created) or because they were subsequently acquired by trade or purchase. Some federal land is withdrawn for military use, some protected as National Parks, some for management of forest resources, and some forms Native American tribal homes held in trust by the Bureau of Indian Affairs, and much of it is managed by the BLM under the “multiple use” mandate established by the Federal Land Policy and Management Act of 1976 (FLPMA; 43 U.S.C. § 1701) that requires a balance between uses such as grazing, mining, oil and gas extraction, ecological conservation, science, and recreation, or by
the U.S. Forest Service under a multiple use mandate for "outdoor recreation, range, timber, watershed, and wildlife and fish purposes" established by the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. § 583). Multiple use is therefore the default for BLM and Forest Service lands unless a parcel is specially reserved for a particular purpose.

National Monuments are a type of reserved land that may be designated by a U.S. president under the authority of the Antiquities Act of 1906. The ultimate authority over federal land resides with the U.S. Congress. National Parks, such as Yellowstone National Park can only be established by congressional act. Congressional action typically moves slower than do potential or active adverse effects to resources, thus Congress enacted the Antiquities Act, to delegate authority to the president to "declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments" and to reserve parcels of land for their protection and management (Public Law 59-209, 16 USC 431-433). The president, as head of the executive branch of government, is responsible for the managing of public land via the agencies mentioned above. The Antiquities Act gives the president what can be viewed as special power to protect historic, archaeologic, and scientific resources that might be endangered by the many activities that occur on public lands. By naming objects or resources, an Antiquities Act proclamation establishes the value of preservation over other uses within the boundaries of the monument. Soon after the Antiquities Act was adopted, Theodore Roosevelt invoked it to create Devils Tower National Monument in Wyoming, long revered by several Native American tribes as Bear's House or Bear's Lodge, because of its scientific importance as evidence of the geological process of erosion (Roosevelt 1906). Use of the land inside that monument is limited to activities that protect and conserve the hexagonal columns of basalt that formed when subterranean magma cooled 40.5 million years ago. In 1908 President Roosevelt set the precedent for using the Antiquities Act as a way to take protective action in the face of a stalled congress by setting aside Grand Canyon National Monument, an area of more than 3,300 km², after the failure of many legislative bills in the Senate since 1882 (Roosevelt 1908). Eleven years later, Congress elevated the monument designation to Grand Canyon National Park in 1919 (Ruple 2019). Since then, presidents have used the authority of the Antiquities Act to establish 156 national monuments, including several where palaeontological resources were motivating factors (Santucci 2006, 2017; Ruple 2019).

In 1996, President Bill Clinton used the power of the Antiquities Act to protect Grand Staircase–Escalante National Monument, a region of about 6,800 km², to conserve the scientific and historic resources of the Kaiparowits Plateau, Grand Staircase, Escalante Canyons, and Circle Cliffs. While noting many archaeologic and ecological resources, the proclamation highlighted geological and palaeontological resources. Even though very little palaeontological research had been done in 1996, the enormous potential was realised. The proclamation noted everything described above, including explicit naming of Late Cretaceous geologic formations. The Circle Cliffs area was specifically noted for the importance of palaeontology, the Grand Staircase, Paria Canyon, and Escalante Canyons because of their geology, and early mammal finds of Cretaceous Santonian age were also specifically noted (Clinton 1996).

President Clinton’s protective action was an immediate response to proposals by the Dutch-owned Andalex Resources (now UtahAmerican Energy, a subsidiary of Murray Energy Corporation) to mine up to 2.5 million tonnes of coal per year from the Straight Cliffs Fm. on the Kaiparowits Plateau, which would have made permanent changes to the landscape, including road building on a major scale (Rait 1996; Allison 1997). The creation of the monument stoked political passions at local, state, and national levels. Fifty black balloons were released at an anti-monument demonstration in Kanab, Utah, and effigies of Bill Clinton and Secretary of the Interior Bruce Babbitt were hung in Escalante (Brooke 1997; Taylor 2016). Members of the palaeontological community were supportive and actively corresponded with the Department of Interior about protecting palaeontological resources (see comments by Jeff Eaton in Sadler 2016).

Despite the controversy, planning for Grand Staircase–Escalante management went forward. Congress adjusted and ratified the monument's boundaries in Utah Schools and Lands Exchange Act of 1998 (Public Law 105-335, 16 USC 431 note), which traded other federal land for Utah's land and mineral holdings within the new monument's boundaries and paid the state an additional US $50 million. A formal management plan for the monument was adopted in 2000 (Bureau of Land Management 2000). Finalizing the management plan involved a rigorous public notice and comment period as mandated by the FLPMA and the National Environmental Policy Act (NEPA) of 1969. More than 6,800 comment letters were received, and 15 scoping workshops were conducted. Important from the perspective of palaeontology, a science symposium was explicitly part of the planning process and included 60 scientific presentations attended by more than 200 people (Hill 1997; Williams 2001). In keeping with the purpose outlined in the proclamation, the management plan prioritized science by establishing a formal advisory committee that was composed of eight scientists (archaeology, palaeontology, geology, botany,
A new model of palaeontological resource management at Grand Staircase

Grand Staircase–Escalante National Monument was unique because for the first time in U. S. history a monument would be managed by the BLM. Before 1996, monuments had been managed by the National Park Service. The National Park Service Organic Act (16 U.S.C. § 1) was enacted by Congress in 1916 to promote and regulate national parks and monuments “to conserve the scenery and natural and historic objects and the wildlife therein and to provide for the enjoyment of the same.” Previous national monument proclamations had been transferred by executive action to the Park Service, but President Clinton’s proclamation stipulated that Grand Staircase would be managed by the BLM (Clinton 1996; Williams 2001). The BLM was created in 1946 by President Truman who consolidated the U. S. General Land Office, which managed the disposal of federal lands and the Grazing Service (Pierson 1997). By 1996 the BLM’s mission had evolved from disposing of federal lands and managing grazing rights to multiple-use management guided by FLPMA. BLM broad mission since this time is to balance competing interests such as mining, grazing, recreation, and scientific inquiry among American stakeholders. The establishment of Grand Staircase–Escalante National Monument in 1996 apparently caught officials in Utah and Washington by surprise because it marked an expansion of BLM’s mission (Williams 2001).

Grand Staircase was also unique in being explicitly staffed with a full-time palaeontological manager. The management plan of 2000 obliged monument managers to inventory for palaeontological resources, to mitigate damage to palaeontological resources that might be caused by other projects, and to develop collaborative partnerships with universities to document and interpret sites. To fulfill those obligations, BLM hired Alan Titus in 2001 as the monument palaeontologist. That role added tremendous scientific value to the monument. Proactive inventory and preservation efforts have identified thousands of new palaeontological localities throughout the monument, made possible by coordination with university and museum researchers. Funding through BLM, including the National Landscape Conservation System (NLCS), provided resources for work in remote areas, including helicopter lifts, and resources for fossil preparation, curation, and study. Importantly, the monument management plan’s explicit missive to coordinate “multi-scale and interdisciplinary” research and to foster a “comprehensive and integrated” science program resulted in deliberate scientific syntheses between palaeontologists, palaeobotanists, ichnologists, geochemists, sedimentologists, and stratigraphers (e.g., Foster et al., 2001; Titus and Loewen 2013; Jones et al. 2021; Titus et al. 2021; Yamamura et al. 2021). The added value from scientific management and preservation activities is what makes Grand Staircase’s status as a national monument exceptional. In contrast, palaeontological resources on unreserved federal lands (and many reserved parcels) receive basic protection under the Palaeontological Resources Preservation Act of 2009 (PRPA) but are not proactively prioritised for research or conservation (16 U.S.C. § 470aaa).

In December 2016, President Barak Obama established Bears Ears National Monument (BENM) by Proclamation 9558 to protect the landscapes and structures that are part of the active lives of native tribes in the four corners region, the historical artifacts from early European settlement of the area, the geological structures, the palaeontological resources, and the wildlife and ecosystems of 1.35 million acres of BLM and Forest Service lands in south-eastern Utah (Obama 2016). Like the original monument designation of the Grand Canyon, the Obama administration’s proclamation came after competing proposals to protect this land repeatedly stalled in congressional politics. For more than seven years, tribes in the Bears Ears area had engaged with local and national politicians to protect the cultural resources in the area as a national monument. In 2010 a proposal from the Diné (Navajo) was submitted to Utah Senator Robert Bennett’s land planning initiative for San Juan County, followed by a more comprehensive plan to Utah Senator Rob Bishop’s Public Land Initiative in 2013 (Bears Ears Coalition 2019). A coalition of five tribes (Diné, Hopi, Zuni, Ute Mountain Ute, Uinta and Ouray Ute) presented a well-developed proposal directly to the White House in 2015 to protect 1.9 million acres of federal land in southwest Utah as BENM (Bears Ears Coalition 2015). In 2016 Senator Bishop introduced a competing plan in the U.S. Senate that would have protected 1.39 million acres but did not include tribal governance and largely ignored tribal input. Bishop’s bill failed to come to a vote. President Obama’s proclamation took many of the principles from the Bears Ears Coalition proposal into account, including integration of tribal decision-making into the monument’s management process. The final proclamation encompassed a smaller area than either of the previous proposals, omitting land in the southwest near the confluence of the San Juan and Colorado Rivers, as well as lands in the Red Canyon that, while rich in cultural places and vertebrate fossils, also have active uranium mines.
President Trump's 2017 proclamations and their impact

In December 2017 President Trump redefined the boundaries of Bears Ears and Grand Staircase–Escalante National Monuments, reducing both substantially (Trump 2017b, c). GSENM was split into three smaller units (Grand Staircase, Kaiparowits, and Escalante Canyons) that collectively retained only 53% of President Clinton's now Congressionally ratified monument (4,062 km² out of 7,610 km²). BENM was split into two units (Shash Jáa and Indian Creek) that represented only 15% of President Obama's original designation (817 km² out of 5,463 km²) (Fig. 1). In so doing, President Trump excluded thousands of scientifically important palaeontological localities from the monuments, thus effectively reducing the priority placed on multi-disciplinary and integrated research and conservation enjoyed under the GSENM management plan (and largely stalled implementation of rigorous palaeontological inventory efforts and research at BENM).

Changing the management status of U.S. federal land is not a trivial matter, even for a determined president. President Trump's downsizing required a several stage process. He first directed Secretary of the Interior, Ryan Zinke, to conduct a review of all national monuments established by presidential proclamation since 1 January 1996 that were larger than 405 km². This effort culminated in a report on whether each monument designation was made with adequate public outreach and stakeholder input, whether each parcel of land was, as stated in the Antiquities Act, "the smallest area compatible with the proper care and management of the objects to be protected", and whether the objects in the designations were "historic landmarks and prehistoric structures, or other objects of historic or scientific interest" (Trump 2017a). President Trump directed Secretary of Interior Zinke to deliver this report in 120 days, a charge encompassing data from 27 national monuments, including Grand Staircase–Escalante and Bears Ears. Not coincidentally, GSENM was established shortly after 1 January 1996 that were larger than 405 km². This effort culminated in a report on whether each monument designation was made with adequate public outreach and stakeholder input, whether each parcel of land was, as stated in the Antiquities Act, "the smallest area compatible with the proper care and management of the objects to be protected", and whether the objects in the designations were "historic landmarks and prehistoric structures, or other objects of historic or scientific interest" (Trump 2017a). President Trump directed Secretary of Interior Zinke to deliver this report in 120 days, a charge encompassing data from 27 national monuments, including Grand Staircase–Escalante and Bears Ears. Not coincidentally, GSENM was established shortly after 1 January 1996. The Department of Interior's review included a public invitation for comments. The Society of Vertebrate Palaeontology (SVP) responded to that invitation by reviewing the palaeontological resources on the 21 non-marine national monuments under consideration, and all were documented to have scientifically important palaeontological resources within their boundaries or geologic units with high potential for such resources, and SVP recommended that all boundaries be maintained. Zinke's report stated that the comments received were "overwhelmingly in favour of maintaining existing monuments," but nevertheless recommended that the boundaries of Bears Ears, Cascade-Siskiyou, Gold Butte, Grand Staircase–Escalante, Katahdin, Northeast Canyons and Seamounts, Organ Mountains–Desert Peaks, Pacific Remote Islands, Rio Grande Del Norte, and Rose Atoll monuments be adjusted (Zinke 2017). The report also recommended that three new national monuments be created, including the Badger-Two Mountain sacred areas in Montana, an area including civil rights martyr Medgar Evan's home in Mississippi, and the Civil War era Camp Nelson in Kentucky. Three months later, President Trump issued two proclamations downsizing GSENM and BENM (Trump 2017b, c), but took no action on the other recommendations. Congress later designated Medgar Evan's home and Camp Nelson as national monuments and revised the designation of land adjacent to Organ Mountains–Desert Peaks in New Mexico as part of the John D. Dingell Jr. Conservation, Management, and Recreation Act of 2019.

The immediate impact of the reduced monument boundaries was most apparent at GSENM because of its 21-year history as a centre of palaeontological research. Even though only a fraction of the monument had been systematically surveyed for palaeontological resources, at least 1,700 sites were documented as scientifically important (Bureau of Land Management 2018). Of those, at least 730 (42%) were removed from the monument boundaries by downsizing (Figure 2), including: Santonian and Cenomanian sites discovered by Cifelli and Eaton that helped justify the original establishment of the monument in 1996 (Eaton and Cifelli 1988; Eaton 1993); large parts of the Wahweap and Straight Cliffs formations, including the Tibbet Springs Quarry bonebed (DeBlieux et al. 2013); all of the main Tropic Shale localities where the anoxic event and turnover in marine reptile faunas have been studied including the USGS Smokey Hollow drill site (Fortiz 2017; Jones et al. 2019, 2021); most of the fossil rich exposures for the Naturita Fm. (e.g., Barclay et al. 2015); virtually all of the Triassic units; and all of the Permian units including the type area of the Kaibab Fm. (Noble 1928). Importantly, several of these exclusions are explicitly named in the 1996 proclamation as objects for protection, including the mammal sites of Cenomanian through Santonian age, the Circle Cliffs Triassic Forest and its structural setting the Waterpocket Fold, and the units that make up the Kaiparowits Plateau including the Tropic Shale, Wahweap, Naturita (then known as Dakota) and Straight Cliffs formations. Awkwardly, several of the palaeontological objects that President Trump singled out for protection in his 2017 proclamation were actually excluded under the reduced monument boundaries, including the early mammal localities in the Cenomanian and Santonian and the numerous holotype marine reptile localities in the Tropic Shale. The palaeontological value of the excluded areas is apparent from BLM's own Potential Fossil Yield Classification (PFYC) system, which ranges from 1 (very low potential) to 5 (very high potential) (Bureau of Land Management 2016). PFYC is a predictive potential model for geologic units to assess likelihood for occurrence of palaeontological resources. The PFYC model is often utilized in areas undergoing environmental assessment for potential ground disturbing activities. None of the excluded areas, nor any of the monument for that matter, falls into the "very low" category,
whereas 47% of the excluded area is designated PFYC 4 or 5 (high or very high potential for palaeontological resource occurrence). At the time monument boundaries were reduced, at least 28 palaeontological researchers were working in areas formerly part of GSENM (based on an unpublished survey of SVP membership in 2017). Removing these areas from the national monument effectively removed them from the BLM’s National Conservation Lands System (NCLS). NCLS provides funding for conservation of resources, including scientific research, and monument reduction effectively removed lands from the monument’s palaeontological management strategy that had proven effective for more than twenty years.

The scientific impact of the BENM reductions was less direct because the monument had only been established in 2016 and a management plan had not yet been adopted. Nevertheless, the potential for palaeontological advances at BENM appears to be equal to that of GSENM (Gay et al. 2020). At the time BENM boundaries were adjusted, at least 22 researchers were working on palaeontological projects inside the monument boundaries based on a survey of SVP members in 2017. It was expected that palaeontological resources at BENM would be managed using the same model as GSENM, by appointing a monument palaeontologist with the mandate to initiate and coordinate inventory and research efforts. Instead, most of the monument was removed from the NCLS, and the bulk of the area remains un-surveyed.

The legal logic used to authorise a reduction in monuments hinged on a clause in the Antiquities Act that treats the president to declare monuments that are “confined to the smallest area compatible with the proper care and management of the objects to be protected”. Having directed the Department of Interior to report on the appropriateness of the boundaries, President Trump’s proclamation stated that the boundaries of both Grand Stair-

Figure 2. Map showing the approximate locations of scientifically important palaeontological localities that were excluded from Grand Staircase–Escalante National Monument by Proclamation 9682. The parts of the original monument that were retained are shown in light grey. Colours in the excluded areas indicate BLM’s potential fossil yield classification. Call-outs reference exemplar sites and publications (site locations from Bureau of Land Management 2018).
case and Bears Ears were “greater than the smallest area” and so would be reduced so they “are no larger than necessary” (Trump 2017b, c). As discussed below, President Trump’s view that a president has the power to downsize a national monument is at odds with both the wording of the Antiquities Act and the priorities established by the proclamations of previous administrations. In the case of BENM and GSEN, the text of Trump’s proclamations errs in excluding many objects that had been established as valuable parts of the country’s heritage in previous proclamations. Indeed, his own proclamation reaffirmed the value of those objects and thus can be viewed as substantiating that monument boundaries should not be reduced. Despite his emphasis on the importance of the monuments’ resources, President Trump dismissed some as either not unique to the monuments, like the palaeontological resources in the Chinle or Morrison formations, or as being protected in some way by other laws like the Palaeontological Resources Preservation Act and therefore not in need of national monument designation. Other palaeontological resources were listed as though they were protected in the downsized monuments when, in fact, they had been excluded, including the type localities for marine reptiles from the Tropic Shale. President Trump’s proclamation also included the unquantified assertion that “research conducted since the [original] designation” had shown some areas to be devoid of scientifically important objects. This statement is not applicable to palaeontological resources, as shown in Figure 2. In summary, President Trump’s proclamation included contradictory information, including specific mention of objects designated for protection while at the same time excluding those same objects from adjusted monument boundaries.

**Palaeontologists take legal action to reverse President Trump’s proclamations**

On the day that President Trump issued his proclamations 9681 and 9682, SVP joined other plaintiffs in filing lawsuits to reverse this action. I was president of the Society at the time. At least 42 members, or about 2% of the membership, had active field projects in parts of the monuments that were being excluded according to a survey conducted by the Society. An estimated 250 members had been active in the field or co-authored papers about new discoveries from the monuments. And likely the majority of members routinely used data from palaeontological discoveries there. SVP’s mission is to “support and encourage the discovery, conservation, and protection of vertebrate fossils and fossil sites”.

From nearly the time of its founding, SVP had been involved in non-partisan advocacy for fossil preservation in the United States and elsewhere. In 1945, for example, a committee made up of Bertrand Schultz, Lewis Gazin, Claude Hibbard, and James Bump drafted legislation to mitigate palaeontological resources in Nebraska and elsewhere in advance of reservoir construction, an effort that resulted in the “Act to Provide for Cooperation by the Smithsonian Institution with State, Educational, and Scientific Organizations in the United States for Continuing Palaeontological Investigations in Areas which Will Be Flooded by the Construction of Government Dams of 1949”, 20 U.S. Code § 78, ch. 427, § 1, 63 Stat. 606 (Schultz 1949). More recently, SVP advocated many years for legislation to protect fossils on federal lands, eventually resulting in passage of PRPA. The recension of preservation status large parts of GSEN and BEN marked the first substantial rollback of preservation status for palaeontological resources on federal lands in the United States. This resulted in protections weaker than in many other countries, specific to an area of critically important and active centre of scientific research. Thus, SVP’s Executive Committee decided to take action to maintain and enhance the conservation status at the GSEN and Bears Ears.

Mounting a legal challenge to a federal land management action, especially one driven by the White House, was beyond the expertise and capacity of a society like SVP, so the Society partnered with several organizations with parallel interest in conservation and with greater legal experience to challenge the constitutionality of the proclamations as co-plaintiffs. SVP joined Grand Staircase–Escalante Partners and Conservation Lands Foundation, both non-profit organizations with missions for promoting science, conservation, and education at GSEN and other national conservation lands. The law firm Covington & Burling, located in Washington, D.C., provided pro bono legal support for the Grand Staircase effort. For Bears Ears, SVP joined co-plaintiffs Utah Diné Bikéyah, a Native American-led non-profit that works with the five tribes of the Bears Ears region (Navajo or Diné, Hopi, Zuni, Ute Mountain Ute, and Uinta Ouray Ute), Friends of Cedar Mesa, a local conservation-focused non-profit, Patagonia Works, a provisioning company, the Access Fund, a climbers advocacy group, the National Trust for Historic Preservation, a non-profit historic preservation organization, Archaeology Southwest, and Conservation Lands Foundation. Legal support for Bears Ears comes from the Hogan Lovells law firm. The legal teams provide advice, host discussion meetings with the plaintiffs, and craft depositions for the courts. They also coordinate strategy with several other plaintiff groups who filed lawsuits against the Trump administration over the downsizing of the monuments.

The legal argument underpinning both complaints is that a U.S. president lacks the authority to rescind a previous president’s designation of a national monument. The Antiquities Act delegates Congressional power to the president to “declare” a monument and to “reserve parcels of land”; but it does not grant the power to rescind or reduce them. The power to rescind monument status, we argued, lies solely with the U.S. Congress, making Trump’s action ultra vires, or outside of his legal authority. The argument
was secondarily scientific in demonstrating that palaeontologically important objects, including those explicitly named in the original monument proclamations, were excluded when the monument boundaries were reduced. Proclamations 9681 and 9682 did little to circumvent the basic constitutional argument, instead arguing that they were simply redrawing the boundaries so that they encompassed the “smallest area compatible with the proper care and management” of the objects of interest within the monuments (language borrowed from the Antiquities Act). Interestingly, the text of proclamation 9682 states that palaeontological localities that had been named in the original Clinton monument designation (proclamation 6920) were being excluded, but simultaneously asserts that the Palaeontological Resources Preservation Act of 2009 (PRPA) now protects them and thus negates the need for national monument status. The assertion is effectively incorrect. The PRPA guides land management agencies to inventory and monitor palaeontological resources, provides specific permitting authority for collection of palaeontological resources, and outlines prohibitions and penalties that provide “passive” protections. However, the PRPA explicitly does not mandate active mitigation actions, it does not prioritise palaeontological resources over other resources or activities, and it does not mandate research or conservation.

The lawsuits were filed on 4 December (GSENM) and 6 December (BENM) 2017 in the United States District Court for the District of Columbia (Cases 1:17-cv-02591-TSC and 1:17-cv-02605-TSC). The D.C. District Court is one of 94 in the United States, and typically hears cases that have national significance. The cases were assigned to Judge Tanya Chutkan, who consolidated them based on their legal commonalities. Several groups intervened in favour of President Trump’s proclamations, including the state of Utah, the Utah counties of Garfield, Kane, and San Juan (where the monuments are located), and both the American and Utah Farm Bureau Federations. Intervenors may make depositions to the court on points raised by plaintiffs or defendants. Other groups—including Conservatives for Responsible Stewardship, a group of state attorney generals, a large group of U.S. Representatives, a group of law professors, and three archaeological organizations—filed amicus curiae or “friend of the court” statements against President Trump’s proclamations. Judge Chutkan denied a motion by the Department of Justice (which represents the President and Federal agencies in court) to transfer the cases to the Utah District Court and denied a motion by the plaintiffs for a quick summary judgement. Additionally, Judge Chutkan ordered the BLM and US Forest Service to provide the plaintiffs notification of any “notice-level” activities planned for the excluded areas of the monuments, such as authorising mining activity, road building, or resource management planning. Despite the passing of almost two years, Chutkan did not rule on the cases, and at the time of this writing the legal challenges are currently on stay and settlement discussions are underway between the plaintiffs and the U.S. Department of Justice.

President Biden’s 2021 monument boundary restoration and its context

In November 2020, President Trump lost his re-election bid to President Biden. On 20 January 2021, the same afternoon that he took office, President Biden issued executive order 13990 instructing the Department of Interior to re-examine the appropriateness of the originally proclaimed boundaries for GSENM and BENM (Biden 2021a). Department of the Interior Secretary Deb Haaland, who President Biden appointed as the first Native American to hold the post, visited the monuments and stakeholders in Utah. In June 2021 Secretary Haaland submitted an unpublished recommendation to the White House that the original boundaries were appropriate and should be restored. On 8 October 2021, President Biden signed proclamations 10285 and 10286 restoring the boundaries of BENM and GSENM, respectively. The restoration of Bears Ears included a small addition that President Trump’s Proclamation 9681 made on the eastern boundary of the Indian Creek unit of the latter monument (Biden 2021b, c). Biden’s proclamations identify many palaeontological resources by name and by geological unit, including well-known holotype dinosaurs including *Nasutoceratops*, *Diabloceratops*, *Akainacephalus*, *Teratophoneus*, and *Lythronax*, the phytosaur *Crosbysaurus*, and the Flag Point and Twentymile Wash trackway and formations like the Kaiparowits, Wahweap, Tropic Shale, Cedar Mesa, Moenkopi, and Chinle.

This victory for monument preservation is incomplete because the District Court has not resolved the constitutional issue of whether a president has the power to rescind or reduce a national monument. Without resolution of this question, there is nothing that will prevent future presidents from modifying monuments again. President Trump’s novel interpretation of the Antiquities Act would, in the words of the amicus brief from Conservatives for Responsible Stewardship, “make national monument boundaries expand and contract like an accordion depending on the political agenda of the incumbent president” (Conservatives 2018). Strong legal reasoning exists to argue that President Trump’s actions were ultra vires (beyond his authority). Of the 157 national monuments established by U.S. presidents since 1906 under the authority of the Antiquities Act, 20 minor modifications (reductions) have been enacted. However, historical monument modifications have only been made to correct minor errors in the original proclamations or maps, accidental inclusion of private or state land, or to aid war aims under the authority of other acts of Congress (Squillace et al. 2017; Ruple 2019). Never has there been monument reduction on the scale of GSENM or BENM, or one that explicitly excluded objects that had been designated for protection. Prior to President Trump’s action it had been more than fifty years since a U.S. President had reduced
the size of a national monument. In the intervening time, FLMPA introduced language that explicitly forbids the Secretary of the Interior, and implicitly a U.S. president, from revoking land withdrawals or reducing national monuments, reserving those powers to Congress itself (Ruple 2019). Even when national monuments have been decommissioned because the protected resources were literally gone, as was the case with Fossil Cycad National Monument where the fossil plant remains for which it was created were completely depleted by overcollection, it has been done by act of Congress (Santucci and Hughes 1998; Santucci 2017).

Biden’s proclamations discourage future downsizing by carefully enumerating objects and resources across the entirety of each monument, summarising the acts of Congress from the 1990s that ratified GSENM’s boundaries, emphasizing that the objects need protection beyond laws like PRPA, and questioning the validity of reduction by a president (Biden 2021b, c). PRPA makes it illegal to collect palaeontological resources except for limited amounts of casual collecting of non-vertebrate fossils without a scientific rationale and permit, but it does not prioritise them over other resources or activities, it does not mandate the same level of inventorying and coordinated research as GSENM’s 2000 management plan, nor does it provide the same increased levels of staffing or funding for management of palaeontological resources.

Competing interests in southern Utah
Palaeontologists are not the only group with interests in the lands of southern Utah. Scientific research requires access, excavation, and removal of fossils from the landscape, activities that must coexist with wilderness, landscape, and cultural conservation practices. That these activities are not always mutually compatible is illustrated by observations from researchers that the original monument designation had negatively affected palaeontological research because vehicular traffic had been restricted to help preserve the wilderness landscape. This section briefly reviews how the land and resources in these monuments are important to Native American tribes and descendants of Mormon settlers and to the extraction of resources such as minerals and petroleum.

Native American tribes have an important stake in lands across North America and specific interests in southern Utah. As described above, a coalition of five tribes was the first to propose what is now Bears Ears National Monument as an effort to preserve cultural spaces, present and past. Native Americans, including ancestors of the five tribes, lived in the area prior to European settlement (Iversen 2002; Kelley and Francis 2019). The Spanish empire began encroaching in the 1500s, succeeded by the government of Mexico after independence in the 1820s, and the United States claimed governance following the Treaty of Guadalupe Hidalgo that ended the Mexican–American War in 1848. By the 1860s the U.S. Army was taking military action against the region’s tribes, destroying crops, poisoning water sources, and incurring thousands of people on what would later become reservations (Thompson 1976; Franz 2021). From the U.S. legal perspective, southern Utah became federal land in 1848, eventually to be managed by the Department of Interior for multiple uses. Nevertheless, the peoples who were evicted continue to use these lands and consider them to be sacred. The Intertribal Coalition proposed strong language for collaborative management of Bears Ears by the five tribes and Department of Interior (Bears Ears Coalition 2015; Franz 2021). President Obama’s proclamation failed to adopt that language, instead proposing a different form of shared governance in the form of a tribal commission composed of an elected officer from each of the five tribes (Obama 2016). President Trump’s revision of Bears Ears restricted the Commission’s authority to a much smaller Shash Jáa unit and weakened the tribal voice by adding an elected officer from San Juan County (Trump 2017b). President Biden’s proclamation (10285) restored the original Commission structure along with the monument boundaries (Biden 2021b). This shared management arrangement is a major step in tribal co-governance of federal land outside formal reservation boundaries. This principle was constitutionally broached by the 1994 Tribal Self-Governance Act (Public Law 103-413, 25 USC 46), and the formalities are only starting to be explored (King 2007; Franz 2021).

The national monument reductions offered an opportunity for palaeontologists to work with tribes toward a common goal of reinstating original boundaries. However, the interests of palaeontological science and tribes are not always aligned. An example of ongoing conflict involves the Stearns Quarry in New Mexico, a rich Eocene site in the Galisteo Fm. (Stearns 1943; Lucas 1982). The quarry is on land managed by BLM as the Ball Ranch Area of Critical Environmental Concern (ACEC) and is therefore worked by palaeontologists under the authority of scientific permits. The ACEC is an inholding of land surrounded by the deeded lands of the Pueblo San Felipe, who objected to salvage excavation at the locality in 2015 (Bureau of Land Management 2017). The tribe argued that the fossils at that site were items of cultural patrimony and therefore protected under the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990. In support of the Pueblo’s position, the National Congress of American Indians passed a resolution asserting that fossilized remains are in general objects of cultural patrimony when they occur on tribal or ancestral tribal lands and therefore should be managed under NAGPRA rather than PRPA (National Congress of American Indians 2015). In 2016 the Pueblo appealed BLM’s decision to issue a palaeontological excavation permit to the Interior Board of Land Appeals. SVP submitted an amicus curiae that did not take a position with regard to Stearn’s Quarry,
but argued that unexcavated fossils should not be considered objects of cultural patrimony because they predate tribal occupation of the land and therefore constitute a broader human patrimony. The IBLA ruled against Pueblo San Felipe’s appeal (Bureau of Land Management 2017), but the matter is still contested. In 2019 New Mexico state representative Deb Haaland, who now serves as Secretary of the Interior, introduced a bill (H.R. 2717) that would convey the Ball Ranch property to the Pueblo of San Felipe (Haaland 2019). More details about this ongoing matter are related in another paper in this volume.

Some Utahns, including some elected state and county officials, feel that establishment of these monuments was a “land grab” that was intended to weaken local access to the land and its resources. The state of Utah and the Church of Jesus Christ of Latter-day Saints have had complex history with the U.S. federal government, the legacy of which has left some state residents with a profoundly suspicious view of its motives. Mormon settlers arrived in southern Utah before it was annexed into the United States, albeit long after the tribes. Mormonism began during the religious revival of the 1820s in upstate New York centred around Joseph Smith, Jr., who was later considered a prophet of the Church of Jesus Christ of the Latter-Day Saints (Arrington and Bitton 1992). Members of Smith’s new movement settled in Ohio and Missouri in the early 1830s. In Missouri they received cruel and often violent treatment and were expelled forcibly from county to county culminating in 1838 in the so-called “Mormon War” in which the state governor ordered Mormons to be completely expelled from the state or exterminated (Bushman 1960). Several thousand Mormon refugees fled eastward across the Mississippi River, whereupon church leader Joseph Smith appealed to President Van Buren and Congress to redress the rights, property, and land they had lost, to which Van Buren replied, “I can do nothing for you – if I do anything, I shall come in contact with the whole state of Missouri” (McBride 2016). To escape continuing persecution in the Midwest, Brigham Young led the group into the Nebraska Territory making their way to what is now Utah by 1847. Only a year later, the United States claimed the area as part of the Treaty of Guadalupe-Hidalgo. In 1849 Mormon settlers petitioned to be admitted to the Union as the state of Deseret which was to have encompassed most of the Great Basin, but the proposal was rejected largely based on anti-Mormon sentiment and the politics of representation of slave states, and instead Congress established it in 1850 as a territory named after the Ute peoples, who were themselves being persecuted by Mormon settlers (Turner, 2017). Soon after, President James Buchanan sent a secret military expedition to Utah to “quell disloyalty” and to remove church leader and governor Brigham Young from power. The effort failed, but increased tensions between the territory and the federal government. Little federal control was exerted over residents afterward until 1869 when a federal land office was established in Salt Lake City to apply the strictures of the Homestead Act of 1862 to settlement on what was now considered to be U.S. public land. By this time the Mormon families had established farms and small towns across the region under the church-centered land laws of the territorial governorship of Brigham Young (Sauder 1996). Through the latter 19th and early 20th centuries, pressure from non-Mormon Americans increased, first from claims made under the General Mining Act of 1872, then from suppression of polygamy during the process of statehood in 1896, then from regulations imposed under the Taylor Grazing Act of 1934, and finally from the emergence of modern federal land management with the establishment of BLM in 1946 and enactment of 1976. This long history has left many 21st century Mormons and other Utahns with the view that the federal government has been a consistent enemy of their religion and way of life. Grazing rights have been a political flashpoint in Utah associated with the two large national monuments in southern Utah, which are nearly unique in allowing some grazing to continue within the boundaries to allow fifth and sixth generation ranchers to continue the practice (Clinton, 1996; Heaton and Miller, 2015). Political sentiments were so high in places that President Clinton and his Secretary of Interior Bruce Babbitt were hanged in effigy along the streets of Escalante, Utah (Babbitt, 2005). In recent decades, those same sentiments have resonated with other broader anti-federal movements in the United States. LaVoy Finicum, who died while evading Federal law enforcement when the Citizens for Constitutional Freedom organized by Ammon Bundy occupied the Malheur National Wildlife Refuge with the aim of re-establishing grazing rights on federal land, was from Kanab, Utah, where Grand Staircase-Escalante National Monument headquarters is located (Brosseau, 2016).

The movement for grazing access has a complex relationship with the interests of palaeontologists. On the one hand, vegetation treatments to improve forage for livestock can destroy fossils at the surface because it often involves removing natural piñon pine and juniper forest cover by “chaining”, in which tractors or other heavy equipment pull heavy chains between them to uproot trees and other vegetation (Bureau of Land Management 2008). This process can destroy soils and other soft substrates, as well as the objects in them (Redmond et al. 2013). But access for grazing makes for easier access for palaeontological inventory and collection than do wilderness conservation areas where vehicular access is prohibited. Local interests can also be at odds with scientific norms such as placing fossils in public trust repositories. In testifying to the US House of Representatives in favour of President Trump’s reduction of GSENM, Garfield County Commissioner Leland Pollack asserted that the monument management plan had allowed universities and museums from around the world to “extract and raid our world-class archaeological and palaeontological artifacts and take them out of the County with no remuner-
A broad range of stakeholders have potential interest in the mineral, oil, and gas resources in southern Utah, but these resources are surprisingly unimportant given the amount of political rhetoric that was focused on them as a reason for downsizing the monuments. The Naturita and Straight Cliffs formations in Grand Staircase contain substantial deposits of what is estimated to be more than 62 billion tons of high-grade coal, of which 11 to 16 billion tons are estimated to be recoverable (Hettinger et al. 1996; Allison 1997; Vanden Berg et al. 2018, 2021). As mentioned above, an underground mining operation was being planned in the Straight Cliffs beds and was one of the threats that prompted presidential action to withdraw the land. Little mining occurred, and the economic viability is nearly absent today because of a decreased global demand for coal coupled with the high cost of extraction and transportation to what are largely international markets (Vanden Berg et al. 2018). Some oil and gas resources exist, but those that are economically viable are outside the boundaries of both monuments (Allison 1997; Vanden Berg et al. 2018, 2021). 255 oil and gas wells were drilled in what is now Bears Ears National Monument, but only nine produced anything, and they were abandoned by the early 1990s (Vanden Berg et al. 2021). Uranium has been recovered from the Chinle deposits in both monuments and from the Morrison Fm. at Bears Ears, but those too became economically unviable before the monuments were established (Vanden Berg et al. 2018, 2021). Tar sands are present in the Circle Cliffs region of Grand Staircase, and there are some titanium, zirconium, and manganese deposits, but as with other resources these are not viable for economic development in the near future (Allison 1997; Vanden Berg et al. 2021). Small alabaster deposits have been worked at Grand Staircase, including some that were reopened in the excluded lands. Both monuments have sand and gravel resources (Vanden Berg et al. 2018, 2021). Aggregates have not been important in the past, but with increased demand there could be increasing reason to develop these resources in accessible areas near roads. Resource extraction also has a complex relationship to scientific investigation, much like grazing rights. Resource extraction requires roads, which can facilitate access by scientists both for traveling to sites and by literally exposing buried fossiliferous layers, but it also has the potential to destroy palaeontological resources.

Conclusion
The conflict over the boundaries of Grand Staircase–Escalante and Bears Ears National Monuments may have been a watershed moment for palaeontological resource management in southern Utah, with implications for all federal lands. The management plan that had been in place at Grand Staircase before 2016 placed an emphasis on science, specifically palaeontology. Employing a full-time monument palaeontologist with a small staff charged with inventorying palaeontological resources and coordinating research at the monument created a strong collaborative scientific network that recovered thousands of significant fossils and has produced geological surveys of stratigraphic and sedimentological settings providing correlative benefits to adjacent lands. Palaeontological management at GSENM has produced hundreds of scientific publications, including cross-disciplinary syntheses that make the monument one of the most important Mesozoic research areas in the world. Where relevant, this plan should have been a model for all U.S. national monuments, where significant palaeontological resources exist, such as Bears Ears. The replacement management plan at GSENM has little emphasis on science, and Trump-era changes to BLM administrative hierarchies diluted local capacity for managing palaeontological resources. There is no guarantee the next management plan will recapture the same scientific priority as the original. Indeed, the political, cultural, scientific, and social landscapes have changed so much since the original plan was adopted that there may be less societal will to prioritise science than there was in the late 1990s. These trends are not unique to southern Utah; rather they are international in scale. Palaeontologists should be aware of these trends, sensitive to interests beyond science, and attentive to the politics of land management. Moving forward, palaeontological sciences will navigate a rapidly shifting political landscape requiring collaborative engagement with a diverse set of stakeholders who espouse a diverse set of values.

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