Statement for the Record

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Society of Vertebrate Paleontology

U.S. House Committee on Natural Resources

Forgotten Voices: The Inadequate Review and Improper Alteration of Our National Monuments

March 13, 2019

Chairman Grijalva, Ranking Member Bishop, and Members of the Committee, thank you for the opportunity to submit testimony into the record regarding the impacts on science caused by the proposed reduction of Grand Staircase-Escalante and Bears Ears National Monuments.

About the Society of Vertebrate Paleontology

I am a paleontologist and professor of Earth and Atmospheric Sciences at Indiana University. I represent the Society of Vertebrate Paleontology (SVP), as its Immediate Past President. SVP is the largest professional organization of paleontologists in the world and has over 2,200 members. Our mission is to advance the science of vertebrate paleontology; to support and encourage the discovery, conservation, and protection of vertebrate fossils and fossil sites; and to foster an appreciation and understanding of vertebrate fossils and fossil sites by the general public.

SVP works with regulators and legislators around the world to keep scientifically important vertebrate fossils in the public trust because they provide the primary evidence for the history of vertebrate animals on our planet. We have a long, fruitful history of collaboration with the State of Utah, the Department of Interior, the US Forest Service, and the US Congress regarding protection of vertebrate fossils on state and federal public lands. We have worked especially closely with our federal partners on what is now known as the Paleontological Resources Preservation Act (PRPA) of 2009.

SVP and its members were engaged in the processes that led to the establishment of Grand Staircase-Escalante and Bears Ears National Monuments and we have been concerned about the negative impact that reductions to their size will have, both in the short and long terms. I estimate that at least 10% of SVP's members have visited the Monument and I reckon that upwards of 50% have used data from research there.

Paleontology at Grand Staircase-Escalante NM (original boundaries)

Grand Staircase has made a profound impact on science. In the late 80s, paleontologists Rich Cifelli and Jeff Eaton, then both of Oklahoma University, discovered fossil mammals from an interval of the Cretaceous period that had never produced mammals before. By 1996, important fossils had been identified in 20 out of the 24 geological units that were to be incorporated into the Monument.

Since the Monument was established, more than 3,500 fossil localities have been documented. Research at GSENM by the Natural History Museum of Utah alone has registered 964 paleontological localities and over 2,000 vertebrate fossil specimens, including about 100 associated skeletons of extinct vertebrates. BLM and Denver Museum of Nature & Science have discovered many other vertebrate sites not included in this count. This is nothing to say of work by researchers at the Museum of Northern Arizona, University of North Florida, Marshall University (in West Virginia), and the BLM on the rich invertebrate and vertebrate fossil assemblages from the marine Tropic Shale. Additionally, Researchers from Denver Museum of Nature & Science and Idaho State University have conducted field research on additional paleobotanical and invertebrate sites.

Our understanding of the Mesozoic—the "Age of Reptiles"—has been profoundly changed by the research that continues to be done at Grand Staircase. Paleontological resources there all three periods of the Mesozoic the Triassic, Jurassic, and Cretaceous periods. The monument also contains a little of the pre-Mesozoic Permian period.

The western part of the monument has yielded spectacular trackways, including unusual forms like *Brasilichnium*, which is likely to have been produced by Mesozoic synapsids. Extensive collections of fossils have been recovered from the Chinle, Moenave, Kayenta, and Navajo formations, many of them still under study, including fish and petrified forest. The oldest fossils in the Monument, from the Permian period that immediately preceded the Earth's greatest extinction (called the Permian-Triassic extinction after the geological periods that bracket it) when up to 95% of species became extinct, are also found in this western area. The type area of the Permian-aged Kaibab Limestone lies in the southwestern part of the monument. A type area has special scientific importance because it is where the rock unit is defined. The Kaibab Limestone is found in many places across the southwest, but it is recognized there by principles of correlation based on characteristics observed in its type area. Type areas of several younger geological units are also found elsewhere at Grand Staircase (e.g., Tropic Shale, Straight Cliffs Fm., Wahweap Fm., Kaiparowits Fm.).

The Kaiparowits Plateau provides one of the most complete records of the Late Cretaceous time anywhere in the world and only about 20% of it has been inventoried. Many new species have been described from this area, including mammals, dinosaurs, lizards and snakes, turtles, crocodyliforms, elasmobranchs, bony fish, invertebrates, and plants. Just in terms of dinosaurs, 13 new species have been discovered, like *Diabloceratops*, a devilish-looking horned dinosaur, and *Lythronax*, the "King of Gore". The spectacular dinosaur discoveries made in the Kaiparowits have been so notable that they were display at SVP's Salt Lake City meeting in 2016 (https://www.youtube.com/watch?v=5Av0PNt3ZaI). New fossil mammals, birds, lizards, snakes, plesiosaurs, fish, plants, and insects have also been found there.

The east-central part of the Monument is dominantly Jurassic in age, including important fossil vertebrate trackways and Morrison Formation paleobotanical and dinosaurian sites. The far eastern section, the Circle Cliffs, contains Permian and Triassic rocks, which have yielded scientifically important fossils including the largest Triassic age petrified forest outside of Petrified Forest National Monument. This region has also produced the most complete skeleton of the bipedal stem-crocodilian *Poposaurus* ever found, an animal that is important for understanding the early split between crocodilians and dinosaurs.

Work at the monument taught us how the Earth recovered from its largest extinction, about the effect of oxygen depletion on Cretaceous oceans, and, especially, about how Earth's ecosystems became "modern" because of the rise of flowering plants in a process now known as the Cretaceous Terrestrial Revolution. Statistical analysis indicates that we are still in the initial discovery phase, with many more yet to come.

More information about the paleontology of Grand Staircase can be found in the following online sources:

- 1997 synopsis by Utah Geological Survey (Gillette and Hayden, 1997) http://archive.li.suu.edu/docs/ms130/AR/gillette.pdf
- 2001 synopsis by Utah Geological Survey and BLM (Foster *et al.* 2001) https://ugspub.nr.utah.gov/publications/special_studies/ss-99.pdf
- 2018 Map of Cultural and Paleontological sites at GSENM from BLM scoping documents (**Appendix 1**), also available at https://eplanning.blm.gov/epl-front-office/projects/lup/94706/140146/172250/Cultural_and_Paleo_Resources_Poster.pdf

Paleontology at Bears Ears NM (original boundaries)

Paleontology at Bears Ears is at the same formative stage today as Grand Staircase was in 1996. As stated in the 2016 proclamation, the paleontological resources there "are among the richest and most significant in the United States, and protection of this area will provide important opportunities for further archaeological and paleontological study." Just as Grand Staircase has transformed our understanding of change during the Mesozoic that led to the rise and fall of the dinosaurs, so too does Bears Ears promise to transform our understanding of the earlier biological and ecological events that led up to the Permian-Triassic extinction, which occurred 251 million years ago before dinosaurs had appeared, and the steps in life's subsequent recovery.

Today it awaits the scientific momentum conferred to it by Monument status, momentum that may now never come.

Bears Ears National Monument's scientific potential has been proven by on paleontological work at Valley of the Gods, Cedar Mesa, Honaker Trail, Red Canyon, Arch Canyon, Comb Ridge, and Indian Creek. All of the areas, which are scattered across the entire monument, contain extraordinary paleontological resources, and thus justify the existing boundaries. The bulk of Bears Ears paleontology belongs to the Paleozoic Era, the first great phase of life on Earth, with the rest being from the subsequent Mesozoic Era, making Bears Ears the "prequel" to Grand Staircase.

The central areas of the Monument—Bears Ears Buttes, Dark Canyon, and Cedar Mesa—have yielded unusually complete Pennsylvanian and Permian fossil communities. The species at this time were quite different from the familiar dinosaurs, pterosaurs, and crocodilians of the Mesozoic, they were dominantly large amphibians, synapsids, the distant relatives of today's mammals, and the earliest reptiles. Unusually complete synapsid remains have been found there, along with the strange burrows that they inhabited.

The Valley of the Gods in the south-central part of the Monument, is a place to study some of the earliest land-dwelling vertebrates in North America. It has also produced exquisitely preserved leaves and trunks of ancient vegetation. Southern Utah at that time was on the western coast of North America, and fossils exposed at Honaker Trail provide evidence that this arid landscape was for a time during the Pennsylvanian period a thriving coral reef.

The Indian Creek region in the north documents the ecology of large carnivorous temnospondyl amphibians in the Moenkopi Formation, and the geologically younger Chinle Formation has produced abundant fossil plants, crayfish and burrows, as well as extinct amphibians and reptiles, such as metoposaurs, phytosaurs, crocodylomorphs, and dinosaurs. Fossil sites in this area were looted before the Monument was established.

The eastern edge of the Monument has a unique record of Jurassic and Cretaceous vertebrate life. Examples include many new dinosaur taxa like the prosauropod *Seitaad*, whose remains are unique to this area. This region has also produced important vertebrate and plant fossils from the Quaternary that help us understand the climatic and environmental processes that have shaped the history of life in western North America over the last 2.5 million years of Earth's history.

The western side hosts one of the best records of the Late Triassic and Early Jurassic periods in the world, a time when the early phase of recovering from the massive Permian-Triassic extinction was ending and a new phase of Mesozoic life was beginning. Early Permian sites in this region have produced well-preserved fossils of the giant amphibian *Eryops*, and many individuals of the sail-backed early mammal relative *Sphenacodon*.

Also on the western side is Red Canyon, which was not included in the original monument as a compromise with mining interests. Red Canyon lies in the v-shaped gap that cuts across the western end of Bears Ears. It preserves what may be one of the richest records of the Triassic-Jurassic transition anywhere in the world, providing crucial information for paleontologists seeking to understand how dinosaurs came to dominate terrestrial ecosystems during the Mesozoic Era. This area has only just begun to be prospected and it has already produced an incredible range of vertebrate diversity, including enigmatic animals like the armored *Doswellia*. Despite its paleontological importance, it was not incorporated into the 2016 monument boundaries of its potential for extractive mining, especially uranium.

More information about the paleontology of Bears Ears is available from the following resources:

- Synopsis by Uglesich *et al*, which is currently in press in Geology of the Intermountain West, due out later in 2019 (link to preprint version is included here) https://peerj.com/preprints/3442/

Broader impacts

The scientific impacts of these two monuments have resonated across the nation. Literally thousands of videos can be found on *YouTube* of *Lythronax* alone, ranging from science shorts to computerized reconstructions of the King of Gore battling its cousin *Tyrannosaurus rex*. One Grand Staircase researcher, Dr. Scott Sampson, is known to nearly everyone under the age of 20 as the paleontologist from *Dinosaur Train*. And even former Secretary Ryan Zinke chose a Grand Staircase dinosaur to exhibit in his office

Outreach efforts from collaborative research have reached hundreds of thousands of people. Hundreds of peer-reviewed scientific articles, dozens of conference presentations, a 634-page scientific volume titled *At the Top of the Grand Staircase: the Late Cretaceous of Southern Utah* (2013), a richly illustrated popular book titled *Where Dinosaurs Roamed* by Christa Sadler (2016), and maybe a dozen professional society field trips have focused on their paleontological advances. Many of the scientists working on monument material have committed to publishing their research papers in open-access journals so that everyone can read the results. Usage statistics show that hese papers have been read at least 200,000 times and shared via social media by over 1,400 people (**Table 1**).

Table 1. *Readership of example open-access papers about paleontological research at Grand Staircase-Escalante National Monument as of March 9, 2019.*

Citation	Title	Online reads	Downloads	Shares
Sampson et al., 2010	New horned dinosaurs from Utah	45,054	4,494	52
Sampson et al. 2013	A remarkable short-snouted horned dinosaur		107	118
Zanno et al., 2011	A new troodontid theropod, *Talos sampsoni*	15,488	1,771	26
Boyd et al., 2013	Crocodyliform feeding traces on juvenile ornithischian dinosaurs	10,532	933	35
Loewen et al., 2013	Tyrant dinosaur evolution	48,186	4,089	147
Lund et al., 2016	A new centrosaurine ceratopsid, *Machairoceratops cronusi*	19,653	1,295	549
Tapanila and Roberts, 2012	The earliest evidence of holometabolan insect pupation	5,856	724	0
Farke et al, 2013	Ontogeny in the tube-crested dinosaur *Parasaurolophus*	43,340	2,910	5
Atterholt et al., 2018	The most complete enantiornithine from North America	4,869	1,208	127
Wiersma and Irmis, 2018	A new southern Laramidian ankylosaurid, *Akainacephalus johnsoni*	14,996	1,522	399
	Totals:	**207,974**	**19,053**	**1,458**

Monument fossils have garnered considerable media attention. A joint project between Utah Natural History Museum and GSENM was featured in a 2014 issue of National Geographic. More than 600 media outlets covered the discovery of a "pig-nosed" turtle from GSENM, *Arvinachelys*, more than 100 covered the discovery of the new horned dinosaur *Machairoceratops*, and nearly 1,100 covered the new tyrannosaur, *Lythronax*, as one might expect given the public fascination with these carnivorous dinosaurs.

What was cut

At Grand Staircase, President Trump excluded more than 1,100 known scientifically important paleontological sites, approximately 31% of those that have been discovered so far, and an unknown number awaiting discovery when the un-inventoried areas are surveyed. Many of the resources named in the 1996 proclamation were excluded in whole or in part (**Table 2**).

All of the oldest geological units were cut, as were the oldest strata from the Monument's famed Late Cretaceous sequence (**Appendix 2**). Not only have most of the Permian and Triassic sites from Circle Cliffs and virtually all of the marine sites from the Tropic shale been excluded, but so too have the extraordinary mammal sites of the early Cretaceous that led to the establishment of the monument in the first place. The type areas of the Kaibab Limestone, Tropic Shale, and Straight Cliffs Fm. (including its four members, Tibbet Canyon, Smoky Hollow, John Henry, and Drip Tank) were excluded. The map (**Appendix 3**) is derived from BLM's scoping data to highlight the excluded sites and two show examples of the scientific papers based on them (BLM's original map is included here as **Appendix 1**). Because the cuts affect whole sections of the geological time represented at the Monument, the effect is like ripping chapters from a book—much of the plot is lost.

Table 2. *Paleontological resources named in the 1996 Grand Staircase-Escalanate Proclamation that Mr. Trump has excluded in whole or in part.*

Named 1996 resource
Circle Cliffs sites
Kaiparowits Plateau stratigraphy (oldest half)
Dakota Sandstone sites (now known as Naturita Fm.)
Tropic Shale sites (including type area)
Wahweap Fm. sites
Tibbet Canyon member sites (including type area)
Smoky Hollow member sites (including type area)
John Henry member sites (including type area)
Straight Cliffs Fm. sites (including type area)
Cenomanian through Santonian age mammal sites

At Bears Ears, hundreds of sites were excluded. Virtually all of the Paleozoic section of the monument was excluded, including most of the important Permian-Triassic boundary (the point of Earth's largest mass extinction), which are the paleontological features that most justify monument status (**Appendix 4**). All of the Valley of the Gods and Fry Canyon sites were excluded, as were most of those at Indian Creek. All but a sliver of the Morrison Fm., famous for its Jurassic dinosaurs, was cut. In fact, almost all of the paleontological resources named in the 2016 proclamation was removed in whole or in part (**Table 3**). The primary exceptions are those at Arch Canyon and Comb Ridge.

Table 3. *Paleontological resources named in the 2016 Bears Ears Proclamation that Mr. Trump has excluded in whole or in part.*

Named 2016 resource
300 million year old coral reefs
Mammal-like reptile burrows from the Permian period at Cedar Mesa
Late Triassic river systems
Bears Ears (sensu stricto) sites related to transition from reptiles to mammals
Ray-finned fish sites from Permian period
Paleozoic giant amphibians, synapsids, and plants
Clams, crayfish, fish, and aquatic reptiles from Indian Creek's Chinle Formation
Fossilized trackways at Valley of the Gods
Fossilized trackways at Indian Creek
Triassic-Jurassic transition in Chinle, Wingate, Kayenta, and Navajo Formations
Pleistocene sites

I do not have counts of numbers of sites at Bears Ears that are as precise as for Grand Staircase. BLM did not release maps of sites or paleontological sensitivity classifications for the excluded areas of Bears Ears. Furthermore, less synthetic information about Bears Ears is available in the scientific literature because the scientific benefits of monument status had not yet kicked in when Mr. Trump made his cuts.

Why monument status matters for paleontological science

National monuments don't just protect fossil sites, they *conserve* them. Protection is important, of course, but basic protection is now provided on all public lands by the Paleontological Resources Preservation Act (PRPA). Monument status confers funding through the National Conservation Lands System to restore, maintain and develop designated national heritage resources on federal land. At Grand Staircase, these funds help pay for paleontological field crews, for helicopter lifts of excavated specimens from inaccessible areas and for conservation of those specimens back in the lab. Just as Fort McHenry National Monument in Maryland would not realize its value as a historic site if its buildings were not maintained, so too would these two monuments fail to live up to their scientific potential if their fossils were not studied. Monuments actively enhance the value of their scientific resources to make the most of them for the American people.

The original management plan for Grand Staircase placed priority on paleontological research. It established the position of monument paleontologist, currently held by Dr. Alan Titus. Titus conducts surveys for new fossil resources and assesses their vulnerability. He establishes research priorities for the funding that comes from the National Conservation Lands system and BLM. He deploys that funding so that the best specialists from around the world can study the fossils, trackways, and sediments of the Monument. He promotes multidisciplinary synthesis activities that actively encourage research specialists, each working on their own projects, to put their results together into a larger whole. One example is the 634-page volume on Grand Staircase paleontology that contains 28 peer-reviewed papers by more than 40 authors from around the world (Titus and Loewen, 2013, cited above). And Titus ensures that the fossils are placed in the public trust, available both to the scientific community and to the nation.

Paleontology, like any science, rests on the principle of verifiability. Science is a process in which scientists revisit old data time and time again to verify earlier findings, to ask new questions and to apply new technology. The scientific process means that paleontologists routinely return to sites where major discoveries were made in the past. For example, when *Tyrannosaurus rex* was discovered in 1902, scientists had no way of precisely dating the rocks in which it was found nor did they have any inkling that it was one of the last dinosaurs standing before a massive asteroid crashed into the Earth. Only by applying radiometric dating and rare earth element analysis at those classic sites more than 100 years later have we come to understand the demise of dinosaurs.

Paleontologists work at Grand Staircase and Bears Ears because of their extraordinary fossil records, of course, but also because they know the sites will remain intact. Verifiability has become increasingly important; every paleontologist has faced a situation where they cannot answer a pressing question because a key fossil has been misplaced or a critical site has been destroyed. Because of this, SVP's standards for professional ethics dictate that we curate scientifically important specimens in accessible public repositories like museums and do our best to preserve the sites they come from. Places like national monuments and national parks that prioritize protection of fossil sites are therefore prime research areas.

Rebutting claims made in Mr. Trump's proclamations

Mr. Trump asserted in his 2017 proclamations that the Paleontological Resources Preservation Act of 2009 (PRPA) provides care for paleontological resources as does monument status. PRPA does no such thing. PRPA simply makes it illegal to collect vertebrate fossils without a scientific permit, it does not prioritize them over mineral extraction, grazing, recreation, conservation, or other multiple use demands.

PRPA does not prioritize scientific research, nor does it facilitate it in the way that a monument does. The added value provided by having paleontologists on staff whose job it is to conduct inventories, collaborate with researchers, prioritize funding, and encourage synthesis is what has made Grand Staircase so productive for the nation. Furthermore, monument status conveys funding from the National Conservation Land system. Thus the level of management provided under PRPA is thus a big step down from monument status.

And while PRPA imposes penalties for illegal collection, it does not prevent sites from being destroyed by other approved activities. For example, if mining in the uranium-bearing Morrison Formation were to be approved, the impact assessment required under FLPMA might result in mitigation consisting of excavating fossils from the site and recording information about their context. But these actions would not keep the site itself from being destroyed. The best science requires that sites will remain intact in five, ten, or 100 years so that they can be reinvestigated with new eyes and new technologies. Monument status ensures that sites will be preserved intact into the indefinite future, which is why scientists often choose to work within the boundaries of a monument instead of on ordinary multiple-use land when equivalent fossils are available in both places.

Finally, I will note that PRPA's effectiveness is currently compromised because Department of Interior has yet to publish regulations published regulations almost a decade after the Act was passed.

Mr. Trump also argued in his proclamations that some of the resources protected by the monuments are not "unique". His logic would better support expanding the monument boundaries to encompass such resources in their entirety than it does reducing the boundaries to exclude them completely. Regardless, some resources are indeed expansive and it is impractical to protect them everywhere they occur. But when those resources are scientifically important it is crucial to reserve some part of them in such a way that their scientific value is given priority. Placing scientifically important parts of the Kaibab Limestone (such as its type area), the Chinle Fm., and the Wingate Sandstone into Grand Staircase balances the need for scientific protection against other uses, such as mineral extraction. The latter can be carried out in exposures of these formations that lie outside the Monument.

Finally, Mr. Trump listed in his 2017 proclamation the paleontological resources that would continue to be protected inside his reduced monument boundaries. Perplexingly, several of those were, in fact, excluded in whole or in part (**Table 4**).

Table 4. *Paleontological resources named in Mr. Trump's own 2017 proclamation as being protected inside the reduced monuments that were, in fact, excluded in whole or in part.*

Named 2017 resources
Triassic sites at Vermillion Cliffs
Type areas of some of the 16 [sic] species that have been "found nowhere else"
Vertebrate fauna sites from the Cenomanian through Santonian ages
Older half of the "most continuous record" of Late Cretaceous life in the world
Dakota Sandstone mammal and reptile sites (now known as Naturita Fm.)
Tropic Shale sites (including type area)
Type localities of 5 plesiosaurs and sites of oldest mosasaurs in Tropic Shale
Wahweap Fm. sites

Impacts of the cuts on paleontological science

The cuts have already had some short term impacts on science and will have even more consequential long term ones. One researcher, Rob Gay, has had an application for funding for research in the excluded areas of Bears Ears declined because the non-profit granting agency felt the future of the area was too uncertain. At the time of Mr. Trump's proclamation geochemists Celina Suarez of University of Arkansas and Marina Suarez of University of Kansas were awaiting decision on a grant application they made to the National Science Foundation for work with paleontologists Peter Makovicky of the Field Museum in Chicago, Lindsay Zanno of the North Carolina Museum of Natural Sciences, and Rich Cifelli and Rick Lupia of University of Oklahoma for research in excluded areas of both monuments. Paleontologist Robin O'Keefe of Marshall University in West Virginia had a half completed excavation of a marine reptile in the excluded part of Grand Staircase. Would they need new permits? Would the collaborative services of the monument paleontologist be available? Would field work funding through the Monument continue? The short term impacts are the uncertainties that have been introduced into existing projects like these.

The long term impacts are the loss of priority for paleontological resources and NCLS funding for research in the excluded areas, as well as the loss the synthetic work of the Monument paleontologist. Much of the scientific potential of these two uniquely important areas will remain unrealized if these cuts are implemented.

SVP's attempts to inform the Department of Interior about these issues

SVP engaged fully with the monument review process after Mr. Trump set it in motion early in 2017.

In May, 2017 we wrote to Secretary Zinke in advance of his visit to Bears Ears National Monument at the outset of his review. We described the paleontological resources that are found in the Monument and encouraged him to see them for himself. We also offered to provide additional information about them, including consultations with paleontologists who conduct research there.

In July, 2017 we submitted 38 pages in response to Mr. Trump's initial review of BLM monuments established in 1996 or later. We provided a detailed evaluation of the paleontological resources of the 21 terrestrial monuments that were subject to review. While all of those monuments protect paleontological resources of some kind, Grand Staircase and Bears Ears were identified as the two most valuable monuments in terms of their scientific potential. Our document raised most of the points that I have included in this testimony. The document we submitted is available here:

http://vertpaleo.org/GlobalPDFS/SVP-Repsonse-to-National-Monument-Review-July-2017.aspx

In March, 2018 we submitted a another 28 pages of comments on the draft management plans for Mr. Trump's reduced monuments. Our comments are available here:

http://vertpaleo.org/GlobalPDFS/SVP-Response-Letter-(BENM)-Final.aspx

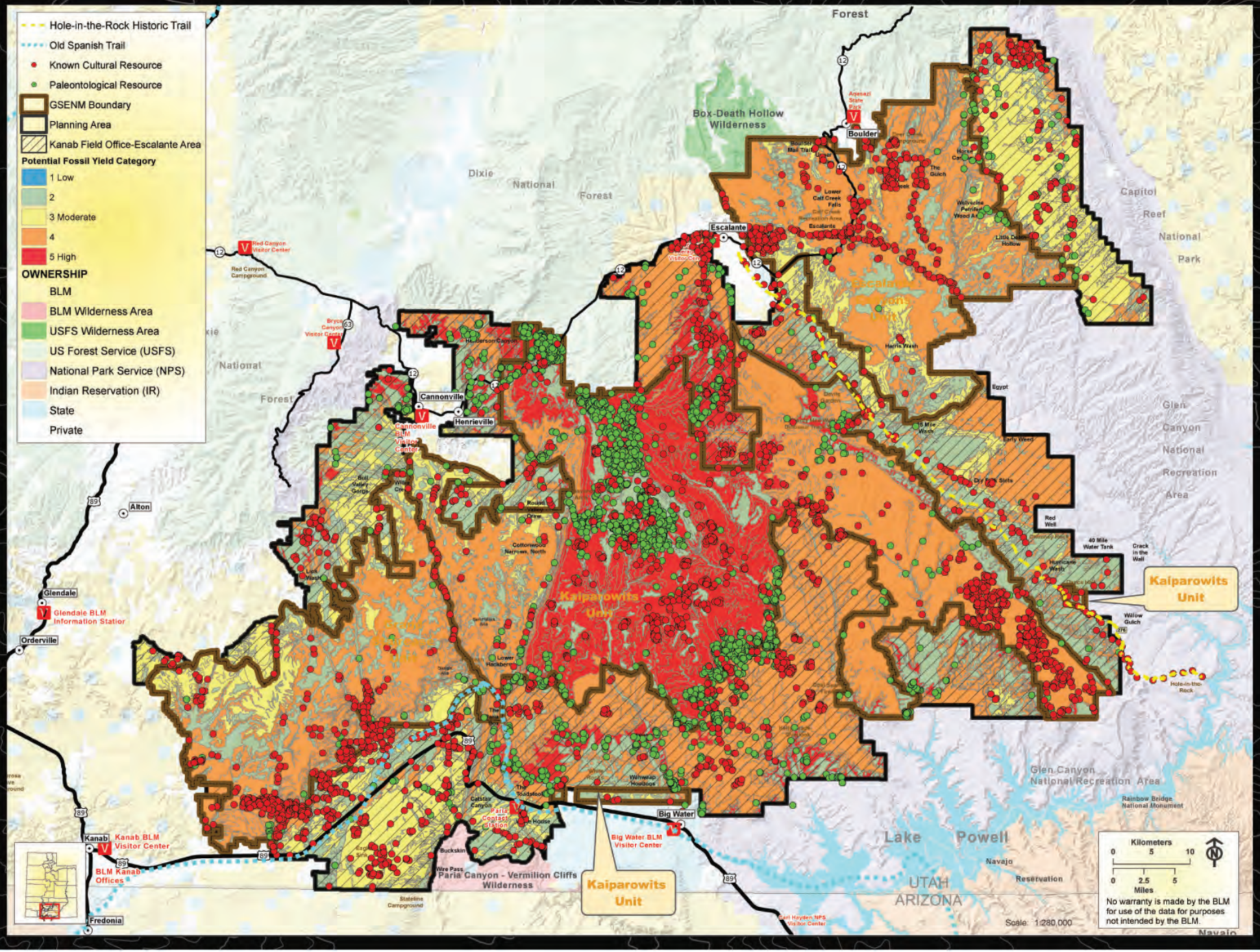
http://vertpaleo.org/GlobalPDFS/SVP-Response-Letter-(GSENM)-Final.aspx

We received no direct response to our letter or our comments. Normally BLM has responded to use directly when we have commented on paleontological resources or when we have written to the Secretary of the Interior about paleontological issues.

And compared to standard Interior planning processes, the process to cut these monuments has been unreasonably accelerated. For comparison, less than a year elapsed between the first announcement that monuments would be reviewed and the close of the consultation process on the new management plans. But the process for approving regulations under PRPA have already taken nearly 10 years.

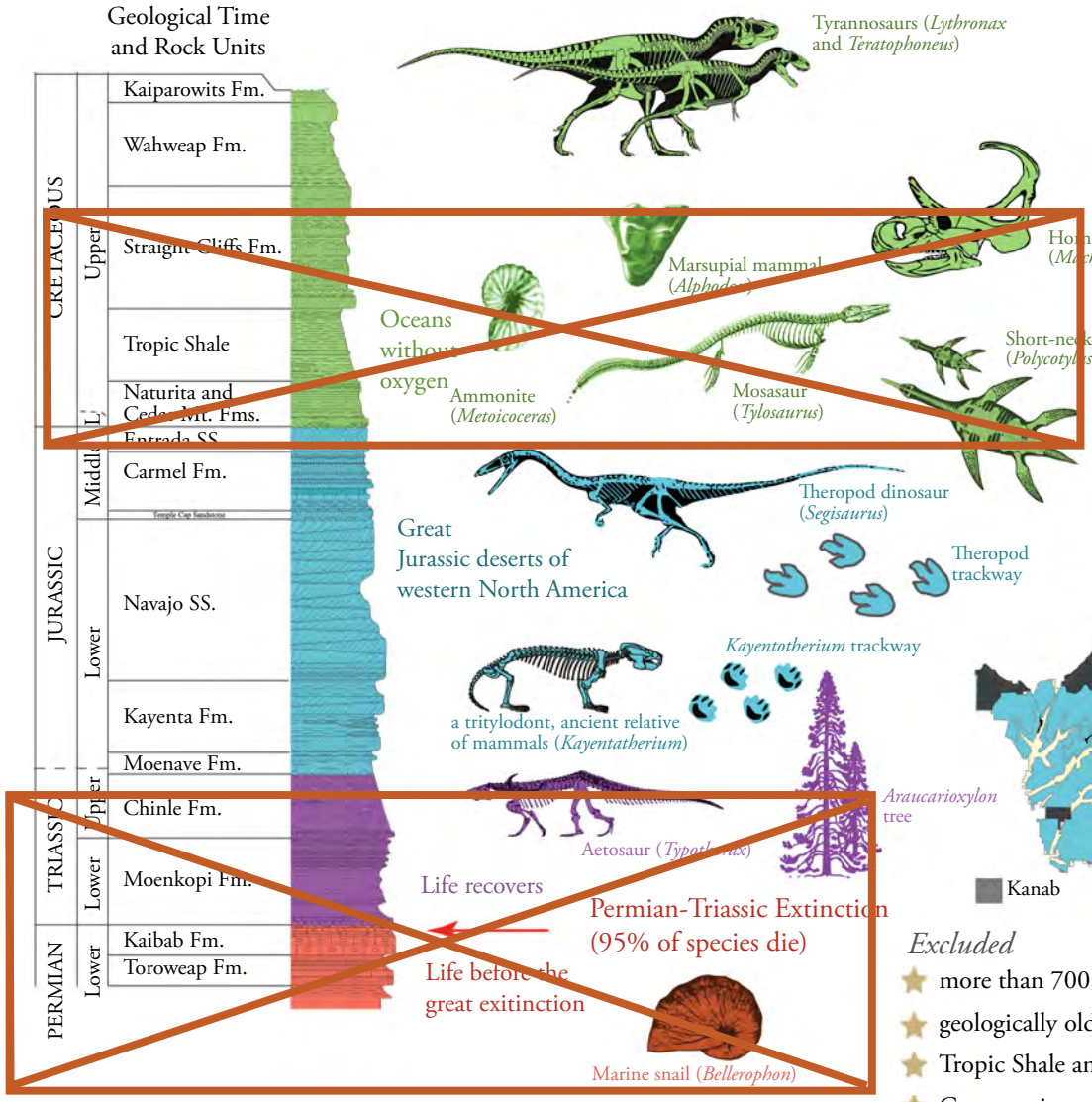
Thank you, Mr. Chairman and members of the Committee, for the opportunity to share this testimony.

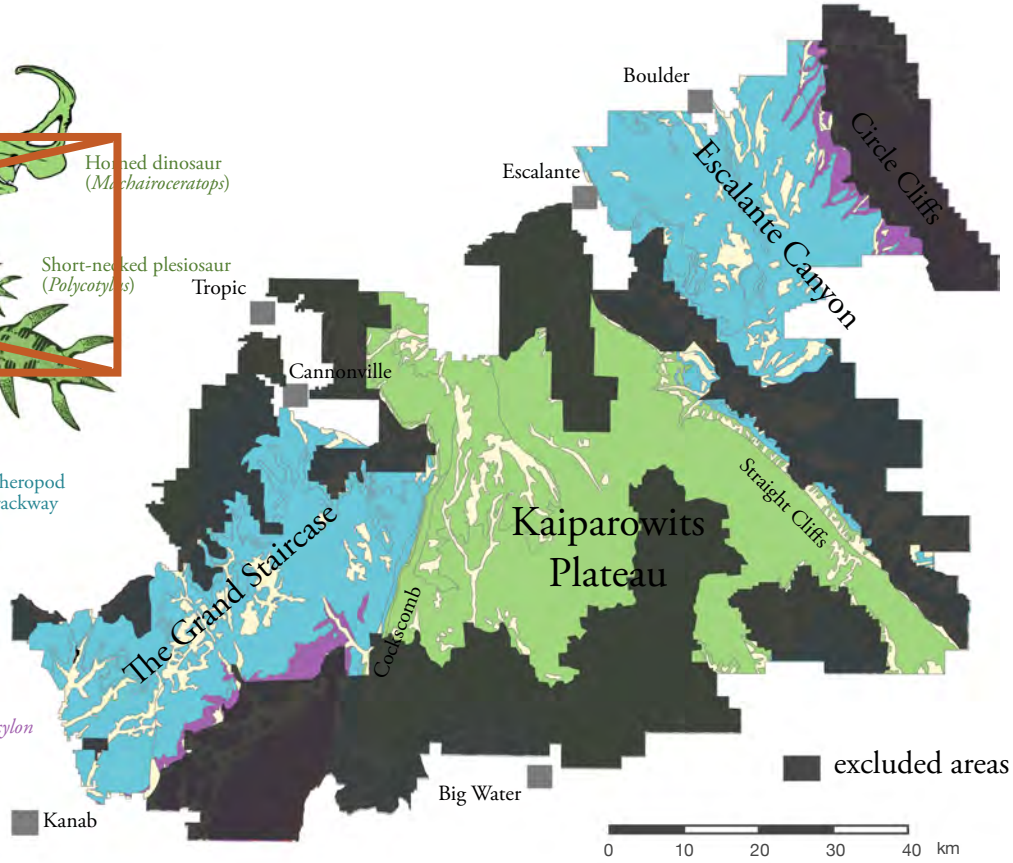
Grand Staircase-Escalante National Monument & Kanab-Escalante Area
Resource Management Plans Scoping | Cultural and Paleontological Resources



Paleontological and Geological Resources

Excluded from Grand Staircase-Escalante National Monument

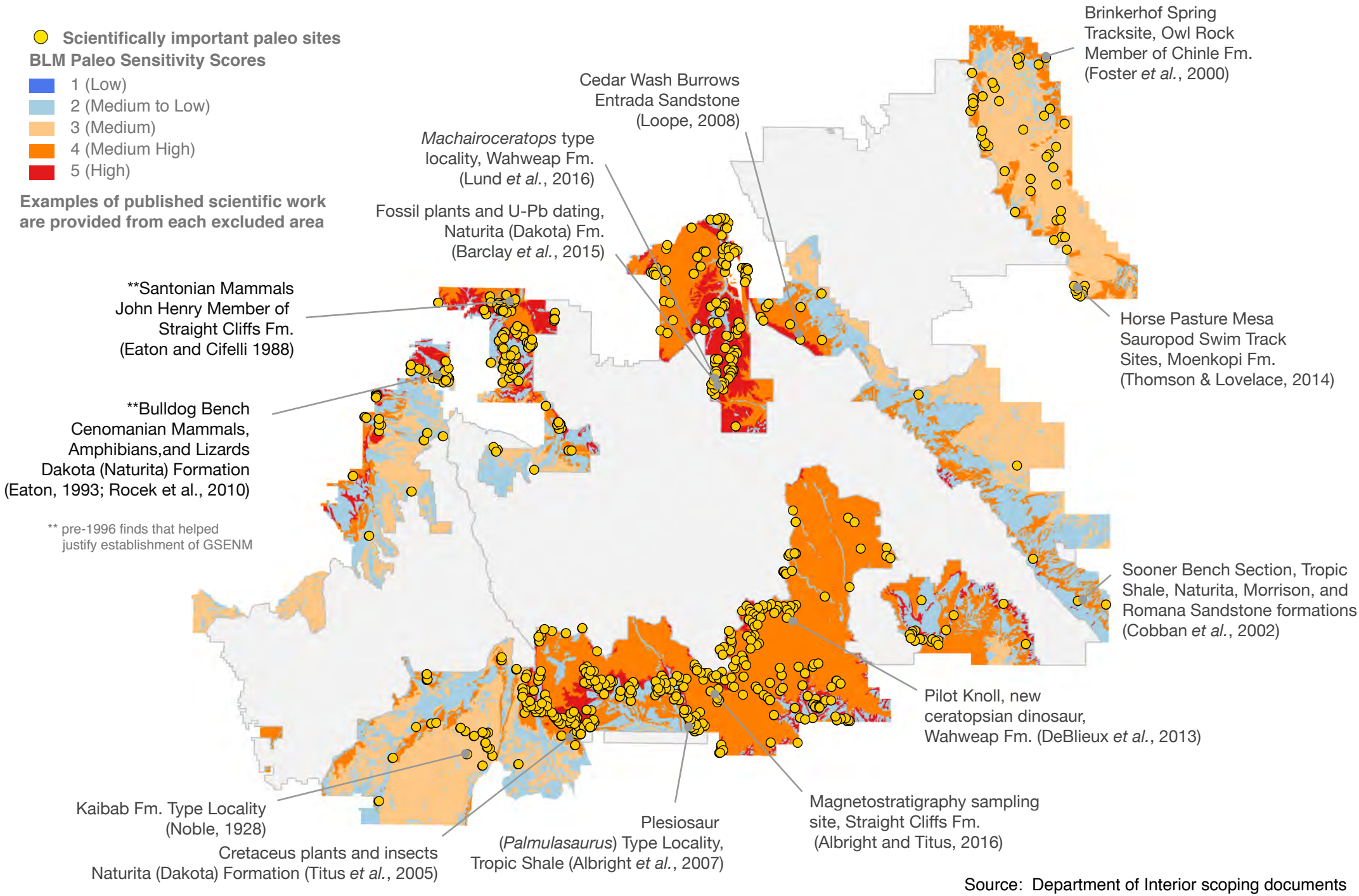




Excluded

- more than 700 scientifically important fossil localities
- geologically older sections of the world's most completely preserved Cretaceous ecosystems
- Tropic Shale and marine reptiles and the Cenomanian-Turonian extinction
- Cenomanian and Santonian aged mammal fossil sites for which Monument was established
- Most of the Permian and Triassic periods
- Chinle Formation, with its record of post-extinction vertebrate and plant life
- scientific type area of Permian-aged Kaibab Formation

Scientifically important paleontological sites excluded from Grand Staircase-Escalante National Monument



Source: Department of Interior scoping documents

Paleontological and Geological resources
Excluded from Bears Ears National Monument

- Hundreds of scientifically important paleontological sites have been excised from the Monument
- Valley of the Gods, which has yielded some of the first vertebrates to ever walk on land, has been excluded
- Sites in the Cathedral Butte area with rare burrows of ancient Triassic animals have been excluded
- Cutler Group documents life in the Permian period with sail-backed *Dimetrodon* lived before the Earth's largest mass extinction

  Red Canyon and Indian Creek, which contain two of the most important fossil sequences in the Monument, have been excluded
- Utah's only published Triassic aged dinosaur site has been excluded