

**To:** Cynthia Staszak[cstaszak@blm.gov]  
**Cc:** Matthew Betenson[mbetenso@blm.gov]  
**From:** Backer, Dana  
**Sent:** 2017-02-15T13:07:26-05:00  
**Importance:** Normal  
**Subject:** NLCS proposals - 2 for GSENM  
**Received:** 2017-02-15T13:07:35-05:00  
[PennState GSENM NLCS2018.pdf](#)  
[NHMU-USU GSENM NLCS2018.pdf](#)

Hi Cindy

I am part of the evaluation committee for the NLCS proposals headed by Allison Ginn. There were 8 proposals for UT (2 for GSENM, 5 for BENM, and one statewide). The GSENM proposals are attached and summarized below. They are both for on-going work on the Monument.

One is with Jabe Beal to continue the work with Penn State (Dr. Taff) on the recreation/social science. The proposal title is "Inventory and Monitoring Research for Ecological and Social Conditions in BLM's GSENM WSA's" They proposal to monitor backcountry recreational use in North Escalante Canyon Gulch, Phipps Death Hollow, and Scorpion during the summer of 2017. I have spoken with Jabe. He is going to provide comments on Penn State's past performance and his capacity to collaborate with Dr. Taff.

The second proposal is continuing paleontological work with University of Utah (Dr. Irmis). They propose to test the hypothesis that latitudinal differences in climate controlled the evolution of life on land during this time. Field work will be focused on inventory, monitoring, and scientific collection of the Late Cretaceous bedrock exposures in GSENM. Areas of field work include Wahweap Headwaters, Blue Wash headwaters, north and east of Nipple Spring, between Wahweap Wash and Blue Wash in the northeast portion of the Butler Valley Quad, northern Horse Mountain, Four Mile Bench Flats, and north of Death Ridge totaling approximately 3000 acres. Dr. Titus has already prepared a brief statement.

Allison requested a statement of support from the monument managers. I'd be happy to draft this letter. I can also meet with you to discuss the proposals in more depth. Allison needs to submit ranked proposals and evaluations to the state director by 2/22.

Thanks.

Dana Backer  
Science Program Administrator  
Grand Staircase Escalante National Monument  
Kanab, UT 84741  
435-644-1257

[Attachment B]

**BUREAU OF LAND MANAGEMENT**  
Financial Assistance (Cooperative Agreements)



## PROJECT PROPOSAL

(Suggested Format)

**Instructions:** A Project Proposal must be submitted with the Standard Form (SF) 424 Application for Federal Assistance for all BLM Assistance Agreements. Complete each section below. Use additional sheets as needed.  
\*\*If this is a continuation of existing BLM cooperative agreement identify the current BLM agreement number and project title below.

Person Submitting Proposal: Randall Irmis, PhD Date: 01/23/2017

Organization Name: Natural History Museum of Utah, University of Utah

\*\*Agreement or Announcement No.: L17AS00001 / L12AC20378

\*\* Agreement or Announcement BLM FY2017 Bureau-wide National Conservation Lands  
Title: Scientific Studies Support Program

Estimated Period of Performance: 05/01/2017 to 04/30/2018

BLM POC: \_\_\_\_\_  
Proposed Project Location: Grand Staircase-Escalante National Monument

This work will occur on: ☒ Public Lands ☐ Both Public & Private Lands

### MISSION AND OBJECTIVE:

The founding presidential proclamation for Grand Staircase-Escalante National Monument (GSENM) highlighted this area as a scientific frontier for geology and paleontology, emphasizing that its establishment preserved “...one of the best and most continuous records of Late Cretaceous terrestrial life in the world (Clinton, 1996).” These words could not have been more prophetic; the decade and a half of paleontological survey and scientific research on the Kaiparowits Plateau in GSENM have elucidated spectacular ancient ecosystems from 95-75 million years ago that teemed with a vast array previously un-recognized species of amphibians, turtles, lizards, crocodylians, dinosaurs, early mammals, birds, and many other organisms. These discoveries are a direct result of a fifteen-year-long collaborative inventory, collection, and research effort between the Natural History Museum of Utah (NHMU) and GSENM that is just now beginning to paint a much more lucid picture of the significance of the Kaiparowits Plateau’s fossil resources.

This GSENM-NHMU collaboration is guided by Monument Management Plan Decisions SCI-1, SCI-2, and PAL-1, which directs that critical fossil resources deserve inventory and protection (collection). Not only has this project revealed the presence of giant dinosaur-eating alligators, unique new species of horned, duck-billed, and tyrant dinosaurs, as well as fossil dinosaur skeletons covered in skin impressions, but it has surveyed nearly 100,000 acres of fossiliferous Late Cretaceous bedrock exposures, discovering over a thousand significant paleontological sites, and saving thousands of rare fossils from destruction by erosion and/or human impact.

The paleontological survey and research also provides a positive public face for natural science at GSENM and on BLM-managed lands in general, as it is a gateway towards a better public understanding of scientific resources on federal lands. Results from the GSENM-NHMU collaboration reach *millions* of people statewide, nationally, and internationally, through BLM

**Project Proposal**

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visitor centers, NHMU museum visitation, statewide NHMU education and outreach, and national and international media coverage of GSENM-NHMU scientific research.

By conducting paleontological inventory of the nearly one million acres of Late Cretaceous bedrock exposures at GSENM, this collaborative project not only identifies and protects the fossil resources for which the monument was founded, but also opens a critical window onto the unique ancient ecosystems that are preserved nowhere else on earth. Our work over the past 14 years has discovered nearly three thousand fossil specimens of species of dinosaurs, crocodylians, turtles, lizards, mammals, and other organisms that are only found in the 95-75 million-year-old rocks at GSENM; at least twenty of the dinosaur species alone are completely new to science. These ecosystems represent the height of dinosaur diversity, just 10 million years before they went extinct.

Even more important than the discovery of numerous new species is that these data demonstrate that each local region of western North America during the Late Cretaceous greenhouse world had its own unique ecosystems. We thus look to test the hypothesis that latitudinal differences in climate controlled the evolution of life on land during this time. Furthermore, can we determine if these regional differences were controlled by repeated rise and fall of sea level through the Late Cretaceous? Such research questions are directly relevant for understanding the biotic effects of *current anthropogenically-forced global climate change, which is leading to a warming high-CO<sub>2</sub> world not unlike the Late Cretaceous.*

**RESEARCH THEME AND TECHNICAL APPROACH:**

Please identify which themes apply to your projects (please check boxes that apply by placing cursor in front of the box and clicking twice):

- ☒ ***Research Identified in Unit Science Plans (for National Monuments, National Conservation Areas, and Similar Designations)***
- ☐ *Effectiveness Research*
- ☒ ***Standardized Inventory and Monitoring***
- ☐ *Research Syntheses*
- ☐ *Citizen Science*
- ☐ *Other Management-Driven Research* All themes and goals apply

**Fieldwork** - We propose to continue the inventory, monitoring, and scientific collection of Late Cretaceous bedrock exposures in GSENM, starting with Wahweap Headwaters area and east towards the Blue Wash headwaters area (Kaiparowits Fm) that was not previously accessible (SE portion of Canaan Peak Quad), areas north and east of Nipple Spring (Wahweap and Straight Cliffs fms), the area between Wahweap Wash and Blue Wash in the northeast portion of the Butler Valley Quad, northern Horse Mountain area (NW quadrant), the Four Mile Bench Flats, and north of Death Ridge (all Kaiparowits Formation), for a joint BLM-NHMU total of 3,000 acres. In particular, a very rare associated tyrannosaurid skeleton requires excavation in the NE Butler Valley Quad, and this area requires extensive inventory. Nearby exposures to the north and west have not been systematically surveyed and inventoried in ten years. The paleontological resources of the Straight Cliffs and Wahweap formations are poorly known; we will also focus on surveying these formations given our success in discovering significant sites the past five years, including an extremely rare 80-million-year old proto-duck-billed dinosaur, an 80 million-year-old giant crocodylian, and the first diagnostic carnivorous dinosaur and turtle remains from these formations.

During inventory the crews will walk in teams of two to three abreast over exposed bedrock,

recording in detail via GPS, notebooks, standardized forms, and photographs the location of any significant fossil resource encountered. Late summer would be spent conducting additional inventory, and collection/stabilization of significant specimens that can be collected on surface authority or have prior authorization. Collection techniques consist of photo documenting the site and re-acquiring GPS data prior to collection, along with the recording of the rock context and associated fossils. Sites yielding more than one element are mapped using meter grids. Site maps are subsequently digitized for archival purposes.

**Research** - In addition to initiating investigation of any important new fossil specimens collected during the 2017 inventory, we will focus our scientific research and publication efforts on a number of already-collected specimens. In particular, a manuscript on a new species of ankylosaurid (armored) dinosaur from the Kaiparowits Formation, which was part of a recent M.S. thesis by Jelle Wiersma under the direction of PI Randall Irmis, is currently in revision for the open access journal *PeerJ*, and we expect that a paper on a second new ankylosaur from the same thesis will be submitted to *Journal of Vertebrate Paleontology* during the first half of 2017. Irmis is about to submit a manuscript with Dr. Alan Titus (GSENM) on the giant alligator *Deinosuchus*. Irmis also has in preparation two manuscripts with Dr. Joseph Sertich (Denver Museum of Nature & Science) that will be submitted for publication in 2017: one on a new species that is the oldest caiman-relative yet discovered, and a second on important new material of a large crocodilian called *Denazinosuchus*. NHMU preparator Tylor Birthisel continues to work on his M.S. thesis on skull growth and variation of the crested duck-billed dinosaur *Parasaurolophus* (started in Fall 2016), based on nearly a dozen skulls collected by NHMU & BLM crews from GSENM during this partnership. *By placing these new discoveries in an evolutionary and geologic context, we can start testing our research questions about latitudinal zonation and effects of sea level change.* Finally, undergraduate student Nathan Ong is using bone histology to study ontogenetic change in soft-shelled turtles (trionychoids) from the Kaiparowits Formation; he presented this work at the 2016 Society of Vertebrate Paleontology Annual Meeting, and is currently writing it up for publication in a peer-reviewed journal.

**Data Management** - All information related to the survey will be archived digitally. Specimen and site records will be input into NHMU's new collections database that uses the EMu software platform. This system also allows us to archive associated records (field notes, photos, accession records, preparation and conservation records, publications, etc) through its digital asset management system. We can also generate custom reports at the BLM's request. Site and specimen information will be provided to the BLM in multiple formats, including as spreadsheets (Excel or CSV) and GIS-compatible files.

**Public Dissemination, Education, and Outreach** - New fossil discoveries and research findings are integrated into all aspects of NHMU's public and school programs. Fossil casts and new research will be added to our on-site programs such as *Scientist in the Spotlight*, *Junior Science Academy*, and teacher workshops, as well as off-site programs such as *Museum on the Move* and *Teaching Toolboxes*. Work on new fossil specimens from GSENM is publically visible daily, as our fossil preparation lab has large windows through which students and visitors can observe fossils being extracted from their rocky matrix. Collections work is also featured annually in NHMU's 2-day *Behind the Scenes* event, an open house for the public to see specimens in the collections that are not otherwise on display. In 2017, two new skeletal mounts of GSENM fossils will go on display; in early 2017 the new armored dinosaur species mentioned above will be exhibited coincident with publication, and later in the year it will be joined by a juvenile of the horned dinosaur species *Utahceratops*. Coinciding with the paper's publication, we also plan to put on display the original fossil of the new caiman-relative mentioned above. Our new digital database EMu has a web-based public portal so that the public can search our collections and see photos of specimens not on display (all sensitive information such as site coordinates are redacted). Finally, we publish scientific results published in a variety of technical

**Project Proposal**

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journals (with Open Access options where possible), and we will issue press releases and related material that publicize an accessible summary of the exciting new discoveries and research coming from the GSENM-NHMU partnership.

**Mitigation of Resource Degradation** - To prevent the degradation or destruction of newly discovered fossil resources, we will prioritize the collection of significant fossil specimens deemed to be at risk. This work will be done in consultation with GSENM paleontologist Alan Titus. All newly located paleontological sites will be evaluated for risk to resources, and these management recommendations will be forwarded to GSENM as part of our annual report. We will specifically note any sites that appear to be at risk to vandalism or degradation from visitor traffic. Finally, we continually re-visit previously-located sites to monitor the condition of existing paleontological resources.

**Project Evaluation** - The project will be fully successful if NHMU & GSENM jointly monitor 50 sites and inventory 3,000 acres. Also, fieldwork at the four to six sites estimated to need collection will be finished by November 2017. In addition, the submittal of the two manuscripts and final report with GIS data must be made by March of 2018 and the skeletal mounts will also be installed by that time. A moderately successful outcome would be if only 75-80% of the targets for monitoring, collection, and inventory were met and only one exhibit and one paper finished, however this is at full funding levels (\$20K). Not successful would see 60% or less of each target accomplished and neither a paper nor exhibit submitted.

NHMU work will be monitored by the GSENM paleontologist. This person will monitor our fieldwork progress and ensure that we are meeting our goals with respect to the timeline and objectives outlined above. In the past, we have been in contact with the GSENM paleontologist on a weekly to monthly basis.

<b>Milestone / Task / Activity</b>	<b>Start Date</b>	<b>Completion Date</b>
Background research, planning, and coordination with BLM field office and GSENM	March 2017	May 2017
Fieldwork in GSENM to inventory fossil resources. Tasks include systematic prospecting to identify new fossil sites, evaluation of these sites, and excavation of those sites under risk. This will be undertaken by crews of trained staff and volunteers from the NHMU	May 2017	October 2017
Preparation and curation begun at the NHMU of specimens collected in 2017	August 2017	December 2017
Preparation and submission of final report to BLM	November 2017	March 2018

**PUBLIC BENEFIT:**

By collaborating with GSENM staff to survey, inventory, collect, and research Cretaceous paleontological resources within the monument, we are providing strong value to the general public in a number of ways. At a fundamental level, this work provides a baseline understanding for the fossil resources within the monument, so that these resources can be effectively managed and preserved – one of the main goals of designating a particular area of federal land as a national monument. Thus, this helps keep these fossils in the public trust, enriches the visitor experience, and deepens the public's understanding of science and natural history. In the specific case of GSENM, our discoveries have shown that not only is this a fossil-rich monument, but the Late Cretaceous ecosystems preserved within its boundaries are unique among those known worldwide, with species of plants and animals (including dinosaurs) not found anywhere else on earth. As these discoveries are disseminated to the public through

exhibits, public (interpretive) programs, educational programs, and the news media, it fosters a greater appreciation and respect for GSENM and public lands in general, particularly for non-renewable scientific resources such as fossils that can be easily damaged.

As outlined in the 'Past Performance' section below, the results of our collaborative project with GSENM are broadly disseminated to the public in many different ways. Statewide, our education programs reach over 100,000 K-12 students each year, and exhibits at GSENM and NHMU reach well over 300,000 nationwide and international visitors per year. We also reach a worldwide audience, with over 100,000 people reading our open-access publication of scientific journal articles, and *millions* of people reading about these discoveries in the news media. This ability to interface with the public on a local, statewide, national, and international levels makes our GSENM-NHMU partnership a singular project in educating the public about the value of paleontology, science, and public lands. Paleontology provides an intuitive and accessible gateway to natural science and conservation for all ages, and increases the wonder and excitement that visitors feel when visiting a national monument. Our work at GSENM brings to the forefront these long-vanished environments and organisms from millions of years ago and provides to the public a tangible connection to understand change through time, the history of life on earth, and the value of science on public lands.

#### **QUALIFICATIONS, PAST PERFORMANCE, ACTIVE BLM COOPERATIVE AGREEMENTS:**

Our previous collaborative GSENM-NHMU paleontological survey, inventory, monitoring, and research work in Grand Staircase-Escalante National Monument has been conducted under a succession of assistance agreements: JSA015003, JSA071004, and L12AC20378. A summary of the accomplishments and work done under these agreement is presented below.

**Resource & Scientific Significance** - NHMU teams have logged a total of 950 days of fieldwork, amounting to 6,255 person days, for a grand total of about 56,875 person hours of fieldwork alone. During this time, the area surveyed in both the Wahweap and Kaiparowits formations has totaled ~48,340 acres. Over 964 vertebrate localities have been discovered, and over 3,200 vertebrate fossils saved from erosion, including over 95 partial to complete skeletons. Scientific discoveries include four new species of giant herbivorous horned dinosaurs (Kirkland & DeBlieux, 2010; Sampson et al., 2010, 2013; Lund et al. 2016a,b), a new species of giant duck-billed dinosaur (Gates & Sampson, 2007), two new species of giant carnivorous tyrannosaurs (Carr et al., 2011; Loewen et al., 2013), a sickle-clawed "raptor" dinosaur (Zanno et al., 2011), six different species of crocodylians including the giant dinosaur-eating alligator *Deinosuchus* (Irmis et al., 2013), and over a dozen species of turtles, including a new pig-nosed species (Lively, 2015, 2016; Hutchison et al., 2013).

**Public Value** - The results of this collaborative GSENM-NHMU project have literally reached millions of people statewide, nationwide, and internationally. Research products include over twenty peer-reviewed scientific articles, dozens of presentations at scientific meetings, two internationally-attended symposia, a 634 page multi-authored scientific volume (Titus & Loewen, 2013), and four professional society field trips. We have committed to publishing this work in open-access venues so that all U.S. citizens can read the results; the last six open-access papers (Sampson et al., 2010, 2013; Zanno et al., 2011; Boyd et al., 2013; Loewen et al., 2013; Lund et al., 2016b) have been read by a combined total of over 136,000 people, and shared via social media by over 20,000 people, a remarkable feat given these are technical scientific articles. These discoveries have been broadcast by thousands of media outlets nationally and internationally. For example, the recent announcement of the new pig-nosed turtle species *Arvinachelys* caught public imagination and was covered by 613 media outlets; the recent new

tyrannosaur *Lythronax* was covered by nearly 1100 outlets. The *Arvinachelys* press release (October 2015) resulted in positive media exposure for the BLM and GSENM equivalent to \$7.74 million in advertising. More recently, in May 2016, the announcement of the new horned dinosaur *Machairoceratops* was covered by nearly 100 media outlets worldwide. We expect that our early 2017 publication of a new species of armored dinosaur, which is also set to be in an open-access journal (*PeerJ*), will garner similar positive coverage for GSENM. Additionally, the cooperative GSENM-NHMU project was the focus of a feature article in the May 2014 issue of *National Geographic Magazine*, and was promoted in a July 2015 *New York Times* feature article (<http://tinyurl.com/oj5bdg9>). Finally, research, specimens, and scientists from the GSENM-NHMU partnership have been featured in a new richly-illustrated popular science book by Christa Sadler entitled '*Where Dinosaurs Roamed: Lost Worlds of Utah's Grand Staircase*', published by Glen Canyon Natural History Association in November 2016.

Even more important is how these scientific discoveries can directly reach the public and transform their understanding of the history of life on earth, and the importance of scientific resources from federally-managed lands. These discoveries, including hundreds of original fossils from GSENM, are featured in the 90,000 square-foot *Utah's Past Worlds* Gallery at the Natural History Museum of Utah. Since opening the new building at NHMU in late 2011, the exhibits have been visited by over 1.53 million people, with 266,316 visitors in calendar year 2016 alone. In early November 2013 we opened a special exhibit focusing on the new GSENM tyrannosaur *Lythronax*, and have had over 950,000 visitors to date. GSENM fossils were also featured in our *Behind the Scenes* event in November 2016, which allows visitors to see collections not normally on display; we received over 3,000 visitors in this two-day event. *Lythronax* and GSENM fossils in our exhibits and preparation lab were part of the 2016 NHMU legislative evening, attended by over 670 Utah state and county legislators and their families; we expect similar attendance at this year's event. GSENM fossils are also featured in a 3-year exhibit at the Utah State Capitol entitled 'A Paleontologist's Paradise', **where they are seen by state legislators, staffers, and over 150,000 members of the public each year.**

Educational benefits from this work are equally critical. In addition to the many University of Utah students that visit NHMU exhibits (including 150-200 per semester from the World of Dinosaurs course), we have made it a priority to integrate K-12 education with our work. During the 2015-2016 school year, 57,000 K-12 students and teachers visited NHMU on class field trips. We also strive to reach classrooms statewide by bringing programs to schools themselves. Our outreach programs such as *Museum on the Move* focus on core curriculum objectives, and feature replicas (casts) of GSENM fossils; these programs reached over 25,700 elementary students and teachers in the 2015-16 school year. Finally, we loan teaching toolkits that also feature GSENM fossil casts to K-12 teachers throughout the state, and this program reached an additional 41,700 students and teachers this past school year.

A separate project awarded through funding opportunity L16AS00092 in FY2016 was a collaborative project between NHMU and the BLM Utah Moab Field Office to produce a series of short web videos about dinosaur tracksites in and around Moab that A) encouraged the public to visit the sites while also promoting the new **Respect and Protect** initiative; and B) give an informative introduction to the paleontology of each site. Planning for this project occurred in Spring and early Summer 2016, and filming occurred over a one-week period in late August 2016. Editing and post-production occurred during Fall 2016, and preliminary versions of the videos were presented at the 76<sup>th</sup> Society of Vertebrate Paleontology Annual Meeting in Salt Lake City, UT (Hunt-Foster et al., 2016). The videos have now been finalized, and we are working to develop contextual web content to go along with them; all content should be publically available by March 2017, and promoted through both NHMU and BLM social media.

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**Project Proposal**

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[Attachment A]

**BUREAU OF LAND MANAGEMENT**

Utah State Office

Grants &amp; Cooperative Agreements

**PROJECT PROPOSAL**

**Instructions:** A Project Proposal must be submitted with the Standard Form (SF) 424 Application for Federal Assistance for all BLM Assistance Agreements. Complete each section below. Use additional sheets as needed.

**\*\*If this is a continuation of existing BLM cooperative agreement, identify the current BLM agreement number and project title below.**

Person Submitting Proposal: B. Derrick Taff Date: 1/31/2017

Organization Name: The Pennsylvania State University

**\*\*Agreement or Announcement No.:** L17AS00001

**\*\* Agreement or Announcement Title:** BLM FY2017 Bureau-wide National Conservation Lands Scientific Studies Support Program (Formerly known as National Landscape Conservation System Research Support Program)

Estimated Period of Performance: April 1, 2017 – December 31, 2018

BLM POC: Jabe Beal and Allison Ginn

Proposed Project Location: Grand Staircase-Escalante National Monument

This work will occur on: ☒ Public Lands ☐ Both Public & Private Lands

**MISSION:**

Our mission is to execute rigorous scientific examinations, that aid in informing strategies to properly inventory, monitor, and adaptively manage ecological and experiential resources and conditions in parks and protected areas.

**Project Title:** Inventory and Monitoring Research for Ecological and Social Conditions in BLM's GSENM WSA's.

Protected areas within the National Conservation Lands System (NCLS), such as Grand Staircase-Escalante National Monument (GSENM), and specifically the Monument's Wilderness Study Areas (WSAs), are under mandate to apply scientific examinations of the resources therein, to inform appropriate inventorying, monitoring, and adaptive management that ensures conservation of these special places for future generations. This proposed research will address this need.

**OBJECTIVE:**

In accordance with the mandates requiring that the Bureau of Land Management (BLM) properly maintain and enhance the conservation values on properties within the NCLS, this proposed research facilitates this policy, meeting suggested research within national and state-wide plans and strategies, specifically improving and standardizing inventorying and monitoring, gaining understanding of experiential factors from visitors, and synthesizing findings in a manner that informs adaptive management of these special places. The proposed research would occur in Utah National Conservation Lands (NCLs), within GSENM, specifically examining three WSA's, and adjacent zones within the Monument, that are experiencing high volumes of visitor use and associated resource and experiential impacts.

Specifically, the objectives of this research are to monitor and record backcountry recreational use impacts in the high-use WSAs in GSENM including the North Escalante Canyon Gulch, Phipps Death Hollow, and Scorpion, and utilize the data collected to identify critical issues and adapt monitoring protocols to aid the Bureau of Land Management (BLM) and GSENM in future planning and management decisions. Specifically, we intend to develop data collection techniques that utilize electronic

[Attachment A]

forms and GPS-based data dictionaries for streamlined and transferable collection, analysis and data entry protocols. Additionally, we intend to interview  $n \approx 25$  diverse user-groups including backcountry overnight, and day-users regarding the WSAs and surrounding zones, to examine how current social and resource conditions are aligning, or misaligning with visitor expectations. Finally, we will synthesize these data to develop proposed indicators that can be replicated, re-measured and monitored over time; direct and indirect management strategies stemming from these findings will also be developed, to aid with adaptive management strategies of these NLCS WSAs and adjacent lands in the future.

Methods will utilize robust strategies including ratio scale continuous metric measures, which will allow statistical comparisons over time, through repeatable, digital data collection measures. Aligning visitor interviews will feature semi-structured questions regarding experiential conditions, which will be recorded, and analyzed so that themes, and potential indicators of quality can be created and assessed in the future. Collaboration between the expert team, including recreation ecologists, social scientists, and BLM Memorandum of Understanding (MOU) partners at the Leave No Trace Center for Outdoor Ethics (with an established and ongoing BLM MOU with the Center for >20 years), and staff at GSENM and BLM state offices will ensure that this project and associated outreach from these results, informs state and national management of WSAs.

#### **RESEARCH THEME AND TECHNICAL APPROACH:**

- ☒ ***Research Identified in Unit Science Plans (for National Monuments, National Conservation Areas, and Similar Designations)***
- ☒ ***Effectiveness Research***
- ☒ ***Standardized Inventory and Monitoring***
- ☒ ***Research Syntheses***
- ☐ ***Citizen Science***
- ☒ ***Other Management-Driven Research***
- ☐ ***All themes and goals apply***

#### ***Background***

GSENM is a NLCS that contains ~1.9 million acres managed by the BLM – the largest national monument in the contiguous U.S., the first managed by the BLM, and the last place in the continental U.S. to be mapped. The area contains stunning landscapes, unique topography and ecosystems containing natural, cultural, and paleontological resources, which facilitate varied recreational and commercial opportunities. GSENM is situated within an area surrounded by protected areas, managed by other federal entities such as the U.S. Forest Service and National Park Service. The area contains numerous designated wilderness areas, and within GSENM specifically, the BLM manages sixteen WSAs which require that management retain the wilderness character of the areas, such as maintaining naturalness and outstanding opportunities for recreation (GSENM Management Plan, 2000; Section 202 FLPMA). Recreational opportunities in GSENM include activities such as camping and backpacking, climbing and canyoneering, off-highway vehicle (OHV) use, hunting, fishing, and stock use, as education and interpretation. Commercial entities are also allowed under permit, including livestock grazing and outfitter and guide operations.

#### ***Need***

As in many protected areas where managing recreation opportunities while trying to conserve the unique ecosystems sought by recreationists, the managers at GSENM must strike a balance between use and preservation of the resources (Grumbine, 1994). This is particularly challenging in an area like GSENM and southern Utah generally, where visitors may be local, or international, participating in a variety of activities, and possibly recreating in numerous types of protected areas with varying levels of direct and indirect management. This challenge is confounded by increased use within the state of Utah, thought to be contributed to recent marketing strategies by the state (e.g., “The Mighty Five”, “Utah – Life Elevated”). Inevitably, recreational use, (and in particular increases in use and types of uses), leads to resource impacts (Hammit, Cole, & Monz, 2015). Specific to the Monument, the limited social science that has been conducted, suggests that visitors to GSENM seek naturalness and tranquility in the remote

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and rugged landscape, which promotes self-reliance and discovery (Casey, 2014). However, these characteristics are in jeopardy due to the increased use of the area, and the associated impacts to the resources such as vandalism, trash, human waste, and crowding (Casey, 2014).

### ***Mandates and Planning Strategies***

At a national and state level, the BLM has developed strategic plans to inform management approaches that mitigate ecological and social impacts on NCLs such as GSENM (The BLM NLCS Science Strategy, 2007; (NLCS 15-year Strategy (2010-2025): The Geography of Hope, 2011; NCL BLM Utah 5-Year Strategy for 2014-2019). Thus, GSENM is charged with providing “sustainable recreation” opportunities, or those that “provide for environmental sustainability while fulfilling the social and economic needs of present and future generations” (NLCS 15-year Strategy (2010-2025): The Geography of Hope, 2011). The 15-year strategy, as prescribed in the BLM’s “Geography of Hope” suggests that the agency must use science to aid in managing conservation that provides for compatible uses that protect the resources and values of GSENM; manage the area collaboratively, considering other agencies, and land owners that influence the larger ecosystem in which the Monument is situated; and increase the public’s awareness and understanding in a manner that promotes current and long-term stewardship (2011). Specifically, the plan suggests that GSENM “develop measures and conduct management reviews” (Theme 1; Goal 1a) to evaluated effectiveness, by generating and maintaining “baseline inventory and geo-referenced data of NLCS values” (Theme 1; Goal 1b). Furthermore, GSENM must “identify research needs and incorporate physical, biological, and social science” to inform adaptive management, interpretation and outreach (Theme 1; Goal 1c). This strategy specifically suggests that the agency “conduct periodic visitor surveys” to examine the experiential qualities of their needs (Theme 2; Goal 2d), and through the application of science to inform interpretive strategies, continue to support programs such as “Leave No Trace to foster outdoor ethics and stewardship” (Theme 3; Goal 3d).

GSENM contains 16 WSAs, requiring special management, which has also been outlined in strategies such as the NCL BLM Utah 5-Year Strategy for 2014-2019. Specifically, WSAs contain wilderness characteristics, that include: “roadless areas of at least 5,000 acres” or “of manageable size;” appears to contain “naturalness” “affected primarily by the forces of natures;” and “provides for outstanding opportunities for solitude or primitive and unconfined types of recreation” (NCL BLM Utah 5-Year Strategy for 2014-2019). The North Escalante Canyon Gulch, Phipps Death Hollow, and Scorpion WSAs are situated in the areas of GSENM that receive the most visitation. Furthermore, the types of high visitation occurring within these WSAs – both day-use and overnight – have the potential to cause resource and experiential impacts. Furthermore, the NCL BLM Utah 5-Year Strategy for 2014-2019 suggests that state and field-level staff must prioritize WSAs, and specifically develop monitoring strategies for these unique places (Theme 1; Goal 1b). Specific to GSENM, the NCL BLM Utah 5-Year Strategy for 2014-2019 indicates that the Monument must implement plans for developing a comprehensive digital data and management structure based on scientifically-sound strategies (Theme 1; Goal 1c). Finally, the NCL BLM Utah 5-Year Strategy suggests that GSENM must expand public engagement and stewardship efforts, through indirect management such as education and interpretation (Theme 3; Goal 3d).

Leave No Trace-based strategies are the most prominent form of indirect management in protected areas (Marion, 2014). The program has its origins in wilderness settings, such as the WSAs of focus in this proposed research. However, there is currently limited adoption of Leave No Trace communication and education strategies in GSENM. Yet, the BLM has an existing MOU with the Leave No Trace Center, and the collaborative researchers proposing this research, have extensive experience researching Leave No Trace from both ecological and social aspects (see Lawhon et al., 2013; Marion 2014; Taff et al., 2014). Furthermore, the proposed research will not only provide applicable information for adaptive management and planning, these studies will also expand the science behind Leave No Trace-based research, and incorporate the Center for Outdoor Ethics in these efforts through the development of outreach tools.

### ***Research Addressing Mandates, Needs, and Strategies***

This proposed research meets all of these needs, strategies, and mandates discussed above, thus

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improving the management of this NCL, in a manner that could also be informative for other protected areas. First, this research will develop a digital data dictionary that can be used to monitor and record ecological impacts associated with recreation in high-use in GSENM's North Escalante Canyon Gulch, Phipps Death Hollow, and Scorpion WSAs. Second, the collaborative team of researchers and practitioners will employ the digital dictionary to geo-spatially reference and monitor these areas, evaluating impacts. This research will identify critical issues that can be monitored over time, and inform adaptive management strategies that can mitigate impacts. Third, this research would employ semi-structured qualitative interviews with approximately 25 user-groups – both day-users and overnight – regarding these high-use WSAs, to further understand experiential components of the visitor experience as it relates to ecological and social conditions in these areas. Fourth, our collaborative team of researchers will synthesize these data to develop proposed indicators that can be replicated, re-measured and monitored over time. Finally, based on these robust methods and resulting findings, our research team will suggest direct and indirect management strategies, to aid with adaptive management approaches for these NLC WSAs and adjacent lands in the future.

Therefore, applying inventorying and monitoring strategies of both ecological and social data, will provide foundational knowledge, filling gaps and understanding for this NCL while adhering to policies and strategies prescribed by the national and state level of the BLM. Furthermore, this paired ecological and social approach, and the results stemming from this methodology, will inform management strategies for the surrounding protected areas managed by the BLM and other agencies, thus further meeting strategic partnership plans outlined through themes within the state-level NCL BLM Utah 5-Year Strategy and national BLM documents such as the "Geography of Hope" and the BLM NLCS Science Strategy.

#### **METHODOLOGICAL/TECHNICAL APPROACHES:**

As researchers we have complementary, but diverse skillsets that marry the recreational ecology and social science approaches. Dr. Marion has extensive experience researching visitor impacts and informing sustainable recreation management, while Dr. Wimpey's expertise focuses on geospatial information analysis, and Dr. Taff's area of expertise is in human dimensions of natural resources, focused on influencing protected areas visitor behaviors (based within Leave No Trace approaches) to align with management objectives. All three researchers have vast experience applying rigorous and defensible research to inform visitor use management in remote backcountry settings of parks and protected areas such as GSENM. Together, these researchers will collaboratively apply the following technical approach to this project:

- Convert existing paper-based data collection to spatially explicit digital data collection linked to digital imagery that permits a range of statistical and GIS analyses and summarization;
- Provide quantitative, spatially explicit (i.e., all data will be recorded with GPS coordinates), data collection of existing visitor (day and overnight-users) impacts within GSENM's North Escalante Canyon Gulch, Phipps Death Hollow, and Scorpion WSAs through a digital data dictionary
  - Characterize the type, extent, and severity of visitation-related resource impacts to vegetation and soils;
  - Obtain Monument research permit;
- Conduct semi-structured qualitative interviews with approximately 25 user-groups – both day-users and overnight – regarding these high-use WSAs, to further understand experiential components of the visitor experience as it relates to ecological and social conditions in these areas
  - Interviews will be recorded and transcribed for analysis;
  - In addition to the Monument research permit, also obtain Office of Management and Budget approval for social science examination on federal lands, as well as Institutional Review Board approval through Penn State University;
- Analyze and synthesize these data (both ecological and social described in above as 2 and 3) to develop proposed indicators that can be replicated, re-measured and monitored over time
  - Specifically suggest and inform direct and indirect management strategies, to aid with adaptive management approaches for these NLC WSAs and adjacent lands in the future (findings could also apply to other WSAs with similar ecosystems and visitor uses)

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- Identify critical issues with the ecological impact results, that can be monitored over time, to inform adaptive management strategies that can mitigate impacts;
- Facilitate incorporation of monitoring data into interagency Visitor Use Management (VUM) planning frameworks and to integrate monitoring data into ongoing adaptive management decision-making;
- Consult with GSENM staff in applying monitoring data and recreation ecology knowledge to resolve visitor impact management problems through improved site management and visitor management regulations;
- Partner with the Leave No Trace Center for Outdoor Ethics, to pair ecological findings with the qualitative experiential themes (i.e., possible experiential indicators that can be monitored over time) to established indirect management approaches through applying Leave No Trace-based messaging/outreach specific to GSENM's WSA environment and visitor demographic.

### ***Goals, Milestones, and Measurements***

1. Project Initiation
  - a. E-Meeting held to initiate project
  - b. Further refine methodologies
  - c. Identify key personnel, existing data and schedule/logistics
  - d. Obtain GSENM research permit
2. Develop Data Dictionary and Inventory Protocol
  - a. Work within team and with BLM key staff to draft and refine digital forms and tools for WSA-based data collection
  - b. Finalization through field testing with team and BLM staff during September/October field work in GSENM
3. Develop semi-structured interview script for qualitative interviews with a range of user-groups focused upon the key WSAs
  - a. Obtain Office of Management and Budget approval of interview instrument
4. 2017 Field Data Collection September/October
  - a. Recreation ecology data collection
  - b. Qualitative interview data collection
  - c. Wrap up meeting with BLM staff at conclusion of field work
5. Data analysis, synthesis and reporting
  - a. Draft and review of a report for GSENM including:
    - i. Documentation of method(s) development
    - ii. Methodological manuals for field data collection
    - iii. Summary of results of ecological and social/experiential inventory
    - iv. Overview of recommendations for management practices including specific recommendations/outreach tools developed collaboratively with the Leave No Trace Center for Outdoor Ethics

### ***Summary Project Schedule***

<b>Milestone / Task / Activity</b>	<b>Start Date</b>	<b>Completion Date</b>
Project initiation	April 2017	April 2017
Develop data dictionary and inventory protocol	May 2017	May 2017
Develop semi-structured interview script and submit for OMB approval	May 2017	June 2017
2017 Field data collection	September 2017	October 2017
Data analysis, synthesis and draft reporting	October 2017	May 2018
Revised final report draft to GSENM, state offices and national BLM NCL officials	June 2018	September 2018
Work with GSENM, state offices and national BLM NCL and the Leave No Trace Center to	October 2018	December 2018

[Attachment A]

implement synthesized results/outreach tools		
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**PUBLIC BENEFIT:**

There are numerous benefits to the public associated with this proposed research. The ecological and experiential conditions (i.e., sustained health of resources and conditions) of GSENM, and specifically its WSAs, are vital to sustain the mission and ensure continued quality recreation opportunities. This research will continue the development of indicators and monitoring associated with recreation-related impacts and experiential conditions, in a time when use and demands on the resource are increasing. The analyses generated from this project will be applied to improve the sustainability of the resources, by informing direct and indirect management strategies that can influence visitor behaviors in a manner that aligns with GSENM WSA management objectives. Thus, this project will provide the vital information needed to ensure monitoring that can inform and enable management to sustain ecological health, which is fundamental for quality recreational experiences.

**QUALIFICATIONS, PAST PERFORMANCE, ACTIVE BLM COOPERATIVE AGREEMENT:**

Drs. Taff, Wimpey, and Marion, described below, currently have an ongoing project with the BLM, titled “*Collaborative research to monitor and record backcountry use impacts at Grand Staircase Escalante National Monument, 2016-2021*” – Agreement # L16AS00032), which aligns with this proposed research, but does not specifically represent WSAs, nor contain a social science, experiential component or outreach element with the Leave No Trace Center. The proposed research would benefit from the existing project, because the researchers will be able to reduce costs as a result of already being onsite and working with GSENM.

*Principle Investigator*

Derrick Taff, Ph.D.

Assistant Professor, Recreation, Park and Tourism Management, Pennsylvania State University

[Bdt3@psu.edu](mailto:Bdt3@psu.edu)

814-867-1756

Dr. Taff’s responsibilities will include overseeing administration of the project and facilitating the development of all associated products. Dr. Taff will facilitate consultation with GSENM staff regarding visitor management, assisting with all protocol development, training of field staff, data analysis and synthesis, and implications that will result in outreach materials.

Dr. Taff holds a Ph.D. in Human Dimensions of Natural Resources, and he has conducted social science research in numerous protected areas, including BLM’s GSENM, to help inform management efforts based on rigorous scientific approaches. His research focuses upon communication as it pertains to visitor-use management, visitor behaviors, and social and ecological wellbeing in parks and protected areas. Much of his research takes place in wilderness backcountry settings, consisting of resources similar to those found in GSENM. He has conducted federally funded social science research across a span of protected areas including Grand Teton National Park, Sequoia National Park, Rocky Mountain National Park, Mount Rainier National Park, Bandelier National Monument and Denali National Park and Preserve. He has also conducted research in City of Boulder Colorado Open Space and Mountain Parks, Wyoming State Parks, and Pennsylvania State Forests. He has published over 30 research reports, journal articles, and book chapters, aimed at aiding protected areas managers’ influence of visitor behaviors to align with management objectives. A full list of these publications can be found at:

<http://www.hhdev.psu.edu/rptm/directory/Bio.aspx?id=www.hhdev.psu.edu/rptm>. Dr. Taff is an avid hiker and backpacker, a Leave No Trace Master Educator, a board member for the Society for Wilderness Stewardship, and a Wilderness Mentor for the Eppley Institute for Parks and Public Lands.

Pennsylvania State University’s Recreation, Park and Tourism Management Department, which will oversee and facilitate this research, has the expertise, facilities, and equipment to administer ongoing support for the duration of this project.

*Professional Services*

[Attachment A]

Jeremy Wimpey, Ph.D.  
 Applied Trails Research and Adjunct Faculty, Recreation, Park and Tourism Management, Pennsylvania State University  
[Jeremyw@appliedtrailsresearch.com](mailto:Jeremyw@appliedtrailsresearch.com)  
 443-629-2630

Dr. Wimpey's responsibilities include logistical and administrative support to the project and development of geo-spatially bound and digitally referenced protocols with Drs. Marion and Taff. Dr. Wimpey will provide GIS and GPS technology support for integration of digital field data collection methods to the team and will collect field data with the team for the duration of the project. Jeremy Wimpey, PhD. is the sole proprietor of Applied Trails Research, LLC. Dr. Wimpey is one of the country's leading recreation ecology practitioners. His applied field investigations help public lands managers understand the phenomena and mechanisms associated with visitor-use-related-impacts to wildlife, water, vegetation, and soils as and impacts to other recreationists (degradation or enhancement of users' experience) in outdoor settings. His experience focuses on estimation of recreation demand, wildland recreation classification/resource inventory, public involvement methodologies, social impact analysis, state comprehensive planning, site design, land acquisition, use measurement, impact assessment, and facility operation/maintenance. His unique background—academic, outdoor enthusiast, entrepreneur—help bring an innovative and holistic approach to providing solutions for recreation management challenges. Dr. Wimpey has collaborated with the National Park Service and US Forest Service, supported the work of research institutions, and published numerous trail impact and trail management works in academic journals and popular sources.

Jeff Marion, Ph.D.  
 Field Station Leader/Adjunct Professor  
 Virginia Tech University  
[jmarion@vt.edu](mailto:jmarion@vt.edu)  
 540-231-6603

Dr. Marion will work with Drs. Taff and Wimpey and the Leave No Trace Center as well as GSENM staff to develop recreation ecology protocols, train and assist field staff, and consult with Monument staff on visitor impact management problems.

Dr. Marion is an avid canyoneering enthusiast who has visited Grand Staircase-Escalante National Monument three times for canyoneering in the last five years. He is enthusiastic about returning to meet and work with Monument staff in developing visitor impact inventory and monitoring protocols and consulting on alternative visitor impact management strategies and actions.

Dr. Marion conducts research on visitor impacts and sustainable recreation management for the National Park Service and other protected natural areas. He has expertise in carrying capacity planning, decision-making, and management, including LAC, VERP and the new Visitor Use Management (VUM) framework (see attached paper). He has authored more than 150 scientific publications and routinely consults with park and recreation managers to develop campsite and trail monitoring protocols and to improve the sustainability of recreation visitation to avoid or minimize resource and social impacts. A founding member of the national Leave No Trace program's board of directors, he chaired its Educational Review Committee for a decade, helping to develop and refine a diverse array of low impact principles and practices. In 2014 he authored the official comprehensive book of Leave No Trace practices for the U.S. Leave No Trace program.

Dr. Marion has developed extensive expertise from his research involving the development and application of campsite and/or trail inventory and monitoring programs at the following protected natural areas:

Delaware Water Gap National Recreation Area, New River Gorge National River, Upper Delaware Scenic & Recreational River, Shenandoah National Park, Great Smoky Mountains National Park, Big Bend National Park, Everglades National Park, Acadia National Park, C&O Canal National Historical Park, Big Cypress National Preserve, George Washington Memorial Parkway, Isle Royale National Park, Zion National Park, Haleakala National Park, Appalachian National Scenic Trail, Huascarán National Park (Peru), Torres del Paine National Park (Chile), Big South Fork National River and Recreational



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Area, Denali National Park, Arctic National Wildlife Refuge, Boundary Waters Canoe Area Wilderness, Daniel Boone National Forest, and 11 Wilderness areas of the Jefferson National Forest.

Dr. Jeff Marion has conducted numerous research projects and published associated guidance on the development of campsite and trail impact monitoring and management practices. For a complete listing visit: [https://profile.usgs.gov/jeff\\_marion](https://profile.usgs.gov/jeff_marion)

Ben Lawhon  
Education Director,  
Leave No Trace Center for Outdoor Ethics  
[Ben@LNT.org](mailto:Ben@LNT.org)  
303-442-8222

Ben and the Leave No Trace Center will aid the lead researchers in developing outreach materials for implementation at GSENM and similar NLCs, based on the synthesized results of this project. Ben holds an MS in Human Dimensions of Natural Resources, and has been working with the Leave No Trace Center for Outdoor Ethics for more than 15 years. As their Education Director, he oversees the development of outreach materials for parks and protected areas globally. He has extensive experience developing education and communication strategies through the Center, based on rigorous ecological and social science.

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