

New research proposal to Western National Parks Association (WNPA)

The information supplied should be limited to the space provided and submitted on these forms.
A proposal received in any other format will be returned. Additional attachments are not permitted.

Title of project: Investigating Distribution and Abundance of American Pikas at Bandelier National Monument, to Illuminate How and Why Change is Occurring.	Park(s) in which research is to be conducted: Bandelier National Monument
Name, address, and phone number of principal investigator, (PI)(s): Dr. Erik Beever USGS-NOROCK 2327 University Way, Ste. 2 Bozeman, MT 59715 Office: (406) 994-7670, Fax: (406) 994-6556, Email: EBeever@usgs.gov, Web: usgs.gov/staff-profiles/erik-beever	Payee information - individual name and address or Institution's name and address required: National Park Service Bandelier National Monument 15 Entrance Road Los Alamos, NM 87544
Is this a multiyear project? <input checked="" type="checkbox"/> YES NO Total amount requested: This year \$ <u>6429</u> If multiyear project, estimated amount: 2nd year \$ <u>4800</u> 3rd year \$ <u>4800</u>	Desired start date: <u>May, 2018</u> Note: Not prior to October 1st
Project duration: Project final completion date: <u>September, 2020</u> (see research guidelines)	
Name(s) of research participant(s) who will acquire advanced degree(s) as a result of working on this project, if any:	Product(s) of research (articles, theses, maps, checklists, etc.) in addition to final report to WNPA (see research guidelines): <small>Information from this study will be included with information from other areas across the western USA in numerous peer-reviewed publications. We will also create a glossy project fact sheet (1-2 pgs., in both English and Spanish), a poster to display in the VC, and a web-based summary blog or video (also in English and Spanish).</small>

Abstract to be provided by PI(s). Do not exceed the half-page space provided below.

The American pika (*Ochotona princeps*) has been widely heralded as a model species to address numerous topics at the nexus of basic and applied ecology, to provide insights into species responses that have relevance across the animal kingdom. These include topics such as local-extinction dynamics, movement and persistence of a species across a network of isolated patches (i.e., metapopulation dynamics), and wildlife-climate relationships. Pikas are a highly charismatic mammal (voted 2nd-Cutest Mammal in North America, in an open online vote) that typically inhabits rocky talus slopes and lava flows at high elevations across western N. America. Entities have twice petitioned for pikas to receive state and federal listing under the Endangered Species Act, but lack of trend data and other factors have precluded any such listing. The proposed research complements the PI's research on American pikas since 1994, in areas spanning nine NPS units, 32 National Forests, and numerous BLM-, USFWS-, and state-administered units. This project is part of a broader research effort to better understand the current and recent-past distribution and abundance of pikas across northern NM, and importantly, to identify the climatic and other factors that may be governing any changes (to inform possible climate-adaptation management and conservation actions). Because pikas are diurnal, live in easily defined (rocky talus) habitat, and are easily (usually >90%) detected when they are present, they not only facilitate inexpensive investigation of their status and trends, but also make the incorporation of assistance by park staff and trained volunteers a feasible option. BAND represents an ideal laboratory to assess how species will fare amidst increasing drought and increasing frequency of extreme-weather events, which are both predicted for the southwestern USA, in the coming years.

(1) JUSTIFICATION (to be provided by submitting park): This section should specify the following: 1) Are NPS-appropriated funds available for the project (Yes/No)? 2) Where does this project rank in the submitting park's research priorities for all funding sources? 3) Was this proposal solicited by the park? If not, why is this project important to the park? 4) How will this research enrich visitors' understanding of the park? 5) What are the implications for resource management?

- 1) In 2017 funding was received from the Friends of Bandelier to ensure the study was able to happen. There are no NPS based funding sources for this type of project.
- 2) This project ranks highly for natural-resource projects that are occurring in Bandelier National Monument.
- 3) The park did not request the initial study in 2016. The initial research was funded by other entities for the first year. In 2017, funding was received from Friends of Bandelier to continue the research, at the park's request. The park would like to see the research continue into the future.
- 4) American pikas are globally considered to be an indicator species for the ways in which climate changes can affect mountain species. In Bandelier, American pikas are found in very limited areas known as felsenmeers, another name for rocky talus. We know from the first two years of population studies that pika numbers within the park are very small and the chances of long term survival of pikas here may be very uncertain. We need to continue to monitor pika populations within Bandelier to see if these small rabbit relatives adapt or perish. By interpreting our greater understanding of the pika's survival outcome to the public, everyone may gain a greater understanding of the impacts of climate change worldwide.
- 5) American pikas are just one of many species that could be impacted by climate change, and their ability to adapt or perish may provide insight into how other species will fare in the future. This could greatly impact how resource management deals with at-risk species found within the park.

(2) CONCISE STATEMENT OF RESEARCH OBJECTIVES, DESIGN, AND METHODOLOGY. This section should include the facilities and sites to be used. Note: Limit this section to the two pages provided.

In BAND, in addition to the broader-effort goals across NM, we are seeking to identify 1) whether management actions may help avert the loss of pikas from BAND, and 2) which lessons of pattern and anomaly (for example, fine-scale refuges facilitating persistence at unexpectedly low elevations) can be transferred to other parks that have species at their southern or lower-elevation distributional limit that may be lost due to continuing global change. Using very-high-resolution imagery, in early 2016 we identified 19 areas in BAND that might be physically suitable for pikas (see map at <http://caltopo.com/m/PQM6>). Surveys of all 19 patches in 2016 indicated that 5 patches were unsuitable (rock diameters were far too small or large), and pikas currently occupied 5 of 14 patches (35.7%), and previously occupied another 4 of the remaining 9 patches (28.6% of total). More-thorough investigations in BAND in 2017 found another two patches, and saw current occupancy fall to 25% (4 of 16 patches), and former occupancy increase to 50% (8/16 patches). Although we use probabilistic survey designs such as GRTS or access-constrained approaches in larger parks and more-remote management units, in BAND we can sample all patches comprehensively. The research generally follows methods honed over 23 years (e.g., Beever 1999 through Beever et al. 2016), and adopts methods that are widely used by ecologists. Two surveyors visit each patch 1-3 times, in the first or last 4 hours of daylight. We survey along line transects with paired observers and distance sampling to quantify detectability and minimize the number of pikas that we 'miss', yet also avoid double-counting of pika individuals. Pika sightings, calls, and fresh haypiles denote locations of current pika occurrence, whereas old pika fecal pellets or haypiles denote past pika occupancy. All such locations are recorded with handheld GPS units having accuracy of 3-7 m (WAAS-enabled), and data on vegetation cover, local topography, elevation, and other relevant variables are recorded for each location. We effectively walk elevational contours across each felsenmeer (talus) patch, and use increased density of searches until we find some pika evidence. For patches that are no longer occupied by pikas, we use radiocarbon dating of the old pika fecal (poop) pellets to estimate when pikas last were present in the patch, following methods of Millar et al. (2014). Radiocarbon dating is done by a laboratory collective at Michigan Technological University, which allows for analyses at costs that are less than one-third of the cost, anywhere else (yet having exactly the same precision in results). The ability to be able to simultaneously survey for current and past occupancy of a given mammal species is extremely rare, as is the high detectability (>90% of the time) that American pikas have been shown to exhibit. Identifying which of our competing hypotheses regarding why pika distribution is changing (using information-theoretic approaches) involves using gridded weather-data products (PRISM, Daymet), long-term weather stations, and (to quantify pika-relevant conditions down in talus interstices) compact microclimate sensors (see iButtons in Budget).

For more in-depth details on the field and analytical methods, please see Beever et al. (2010, 2011, 2013, 2016).

Other than the radiocarbon-dating analyses that are performed at MTU (as indicated above), no special facilities are needed. Data entry and QA/QC by the field volunteers can occur either in park offices, or at another (remote) location; they will be reviewed electronically by the PI. Field sites are all mapped, in the context of the broader suite of sites for northern New Mexico, at <http://caltopo.com/m/PQM6>. Purple outline indicates clearly suitable talus for pikas, whereas yellow borders indicate that patches thusly indicated require in-situ verification to ensure that they are physically suitable for pika occupancy (i.e., rock diameters are generally between 0.2 – 1.0 m, to ensure that there are interstices).

REFERENCES CITED:

- Beever, E.A. 1999. Species- and community-level responses to disturbance imposed by feral horse grazing and other management practices. Ph.D. dissertation, University of Nevada, Reno.
- Beever, E.A., C. Ray, P.W. Mote, and J.L. Wilkening. 2010. Testing alternative models of climate-mediated extirpations. *Ecological Applications* 20(1):164-178.
- Beever, E.A., C. Ray, J.L. Wilkening, P.F. Brussard, and P.W. Mote. 2011. Contemporary climate change alters the pace and drivers of extinction. *Global Change Biology* 17(6):2054-2070.
- Beever, E.A., S.Z. Dobrowski, J. Long, A.R. Mynsberge, and N.B. Piekielek. 2013. Understanding relationships among abundance, extirpation, and climate at ecoregion scales. *Ecology* 94(7):1563-1571.
- E.A. Beever, J. Perrine, T. Rickman, M. Flores, C. Waters, S. Weber, B. Yardley, D. Thoma, M. Magnuson, N. Nordensten, and T. Chesley-Preston. 2016. Pika (*Ochotona princeps*) losses from two isolated regions reflect temperature and water balance, but reflect habitat area in a mainland region. *Journal of Mammalogy* 97(6):1495-1511.
- Millar, C.I., K. Heckman, C. Swanson, K. Schmidt, R.D. Westfall, and D.L. Delany. 2014. Radiocarbon dating of American pika fecal pellets provides insights into population extirpations and climate refugia. *Ecological Applications* 24(7):1748-1768.

(3) CONCISE STATEMENT OF HOW YOUR RESEARCH CAN ENHANCE THE INTERPRETIVE MISSION OF THE PARK. Also include one paragraph describing the plan for an interpretation-related product of the research. Use this page only.

The potential extirpation/extinction of species affects many park management decisions. By seeing how the pika deal with being on the brink of extirpation we may gain further knowledge of how/why a species may or may not survive into the future. This knowledge will help to inform a broad range of management decisions into the future. Using interpretation, the park in turn informs the public so they can be aware of what factors affect survivability of a species and the role humans may play in that outcome. At this point we don't know if this will be a story of hope or one of caution. It is amazing that pika have survived in Bandelier to the present considering landscape altering fires and overall warming of the continent and the pika's apparent limited ability to adapt to these changes.

More-specific examples of how research results from this project inform resource management in BAND include: a) the BAND Superintendent offered to consider defending pika-appropriate talus patches from the effects of prescribed fires, using park fire crews; b) explicit incorporation of measuring cover of non-native plant species in our surveys, to inform other BAND efforts; c) testing of the effects of acute-heat stress during summer as a potential mechanism underlying distributional change; among others.

The resulting interpretive product from this research will be a visual display for the visitor center focusing on the life-and-death struggle of these small, very cute and endearing animals. As more data are gathered and the story plays out, the display will be updated. A list of other animals/plants that also are living on the brink within Bandelier, but expanded to include ones that might live in the visitors' backyards, will be incorporated. Also the park will initiate:

- interpretive programming, both formal and informal, personal and non personal, about the pika
- plush pika for sale in WNPA sales outlet to inform public about ongoing research and to allow for visitors to contribute to continuing study efforts if part of the sales is used towards this research.
- public outreach via a citizen science project/programs for both the public to participate in as volunteers and for us to provide information to visitors and surrounding communities.

(4) QUALIFICATIONS OF THE PI(S) CONDUCTING THE RESEARCH. Use this page only. List only those qualifications directly related to this grant request. Include a list of other WNPA-funded research conducted by this PI.

Erik Beever is considered an expert on American Pika in western North America. Erik is a research landscape ecologist with the USGS in Bozeman, MT. He has written 31 professional publications on American pika and mountain environments since 2000. Erik has 24 yrs of experience investigating *Ochotona princeps*, with data taken from all 10 U.S. states and 2 Canadian provinces within the species' geographic range plus 2.5 years of experience observing *O. collaris* (collared pika) in Alaska. Erik was sought as the sole federal scientist (and first choice, among all researchers) to assist the USFWS in informing a judgment on the ESA listing of *Ochotona princeps* (2008-2010), and provided assistance and professional review of the California DFG's documents for considering species listing (2008-2012). Erik is an invited Member of the World Lagomorph Society (since its inception: 2010 – Present), IUCN Species Survival Commission - Lagomorph Specialist Group, Mountain Research Initiative (2009 – Present), Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT; 2009 – Present), and IUCN Protected Areas Specialist Group (2010 – Present). He also delivered 169 (including 83 invited) technical presentations related to pika research, to local and international audiences, 1995-2016.

Erik was invited twice to be a part of the NPS' "Pikas in Peril" research project, but his previous USGS supervisor (different position) would not allow his participation. Erik was invited as the keynote speaker for the inaugural North American Pika Consortium conference (2010). Subsequently, he was selected as the Lead of the Research and [Scientific] Review Subcommittee, for the Consortium.

Erik has worked closely with land managers, conservation practitioners, and diverse interest groups with pikas, contemporary climate change, and other contentious natural-resource issues continuously since 1994 (specifically with pikas: USFWS, USFS, BLM, USDA-NRCS, National Park Service, Fish & Game agencies from several states, numerous conservation NGOs, public-outreach and education groups). Erik has worked with the Associated Press [March 2009, July 2003] and other reporters, columnists, independent writers, outreach staff, and program directors (e.g., of NGOs, institutes, etc.) to describe, interpret, and communicate the results and importance of his research on *Ochotona princeps* in literally thousands of media outlets (2003–Present). Among numerous others, outlets have included journals *Science* (NewsFocus; 2004), *Nature Climate Change* (2011), *Frontiers in Ecology and the Environment* (2011), *BioScience* (2004, 2010), *Conservation Magazine* (2010), newspapers *New York Times*, *Washington Post*, *Los Angeles Times*, *The Daily Telegraph* [London, UK], *The Guardian* [London, UK], *USA Today*, television *BBC*, *ABC News* (Nightly News with Charles Gibson), *Discovery Channel*, *Animal Planet*, and magazines *National Geographic*, *Outside*, *Rock and Ice*, etc.

Erik has not done any WNPA-funded research but he has received 25 grants totaling \$1.86M for research on contemporary climate change, patterns of species vulnerability, and adaptive capacity, 1994 – Present.

Budget for New Research Proposal

Project title and submitting park: Investigating Distribution and Abundance of American Pikas at Bandelier National Monument, to illuminate How and Why Change is Occurring.

Bandelier National Monument

Personnel

PRINCIPAL INVESTIGATOR(S)	Funds requested from WNPA	Cash or in-kind contribution (Please specify which type and source.)
1 Dr. Erik Beever	\$650	\$3250 in kind; USGS
2		
3		

OTHER PERSONNEL (Specify number in brackets. Specify duties to be performed to earn funds on next page.)	Funds requested from WNPA	Cash or in-kind contribution (Please specify which type and source.)
1 VIP's (volunteers (2), selected and trained by EAB)	\$1400	\$1800 in kind; USGS
2 Sally King, BAND	\$0.00	\$3000 in kind; NPS
3 Other BAND staff	\$0.00	\$3000 in kind; NPS
4		
5		

TOTAL PERSONNEL COSTS \$2050 \$11050

EQUIPMENT COSTS (List item and dollar amounts for those items costing more than \$100 each on next page.) \$2479 \$3500 owned by USGS

TRAVEL AND SUBSISTENCE (Itemize on next page.) \$1900 \$0.00

OTHER COSTS

1 Supplies and material		
2 Consulting services		
3 Computer services		\$1800 in kind; NPS, USGS
4 Subcontracts (Itemize on next page.)		

TOTAL PERSONNEL COSTS \$0.00 \$1800

TOTAL PERSONNEL COSTS \$6429 \$16350
 If multiyear project, summarize estimated subsequent year(s) budget(s) on next page.

COSTS (Cont'd). Note: Be sure to explain here the duties that will be performed by any funded individual.

Because USGS-NOROCK provides no operating expenses to Dr. Beever and because he must also cover 10-20% of his salary for the year, we have included a modest amount (i.e., one-sixth of the actual time he will dedicate to the project, each year) for his salary. He will organize all research aspects of the project, and will analyze the data, and write or supervise the writing of all peer-reviewed products for the research. He will also travel to BAND each of the project years (the majority of the "TRAVEL AND SUBSISTENCE" funds will be used to cover his travel to and from BAND. We expect 3-6 days of fieldwork in BAND, depending on the caliber, learning curve, and fitness of the volunteers. Erik, who is fluent in Spanish, will also perform the translation of educational materials into Spanish, a commonly spoken language across New Mexico.

VIPs will assist Dr. Beever in sampling all patches for pika occurrence and abundance, and will enter and double-check all of the field data (templates already exist, to facilitate this). Volunteers will have to prepare for fieldwork by learning the local woody plants and reading several articles about pika biology before-hand, and will be given hands-on training on all the specific field methods, at the start of the field campaign.

Sally King will be the local director of logistics and interpretation for the project, and will facilitate all NPS administration of the project funds. She will also catalyze interest in and distribution of educational materials to a variety of audiences, locally and further afield.

Other BAND staff will help in interpretation of the project results by providing feedback and relevant materials that will be useful throughout the project, and especially when we write up educational interpretive materials and peer-reviewed publications.

EQUIPMENT COSTS:

12 Temperature sensors (Thermochron DS1925L-F5#, by Maxim Integrated), \$82. each	5	\$984.
Temperature + Relative Humidity sensors (Thermochron DS1923-F5#), \$155. Each	One	\$775.
laser rangefinder (Opti-Logic Insight model)		\$325.
Three compasses (Suunto, MC-2 model; \$65. each)		\$195.
Binoculars, (8 x 25 compact; \$50. each)		\$100.
Miscellaneous other equipment (mechanical pencils, data sheet holder/clipboard, etc.)		\$100.
Total		\$2,479.

A special note for researchers and the park superintendent:

WNPA is the funder of this grant on behalf of NPS, and WNPA monitors progress, administers the payment schedule, and determines successful completion or default.

All other decisions regarding the conduct of this research grant (e.g., park access, laws, safety, protocols, etc.) and uses of the research, data, and its products (e.g., release of information, publication, intellectual property, etc.) rest in the hands of NPS and are the responsibility of NPS. Researchers and NPS should clarify any questions or assumptions before accepting the grant.

Due to several factors, ALL WNPA grants are for ONE YEAR ONLY (1 year only); however, we welcome and will carefully consider applications for second or third years following a successful first year.

Best wishes and hopes for a successful project. Thank you from WNPA.

I have read and agree to abide by the research guidelines in effect at the time of this application.

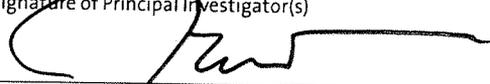
ERIK BEEVER

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DN: cn=ERIK BEEVER, o=Department of the Interior, ou=Geological Survey, email=ERIK.BEEVER@USGS.GOV, c=US

Signature of Principal Investigator(s)

29 August 2017

Date



8/31/17

Signature of Park Superintendent

Date

JOAN BUDZILENI

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Signature of Chief of Interpretation

8.30.17

Date

For WNPA Use Only

WNPA Research Committee Review: Action and Date:

Amount Granted: