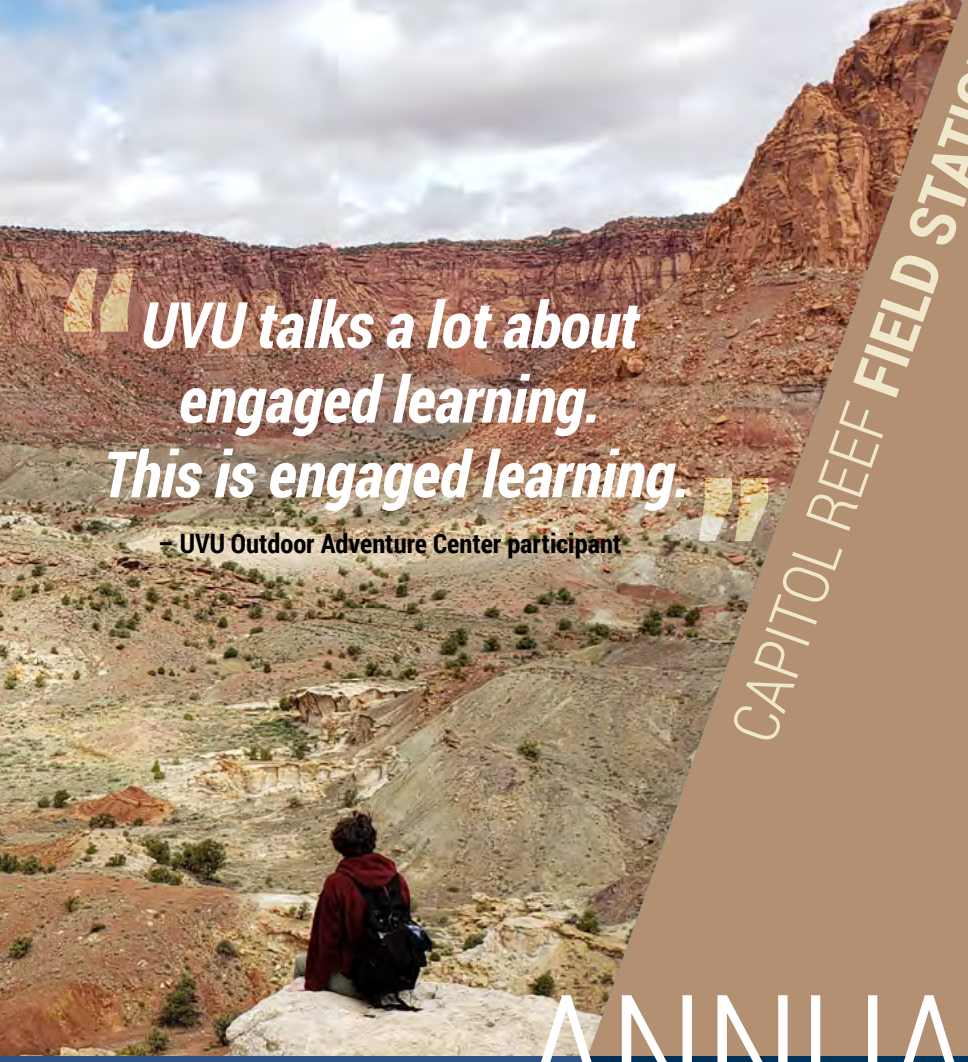

"UVU talks a lot about engaged learning. This is engaged learning."

– UVU Outdoor Adventure Center participant

CAPITOL REEF **FIELD STATION**

ANNUAL **REPORT**

2018-2019

> ***"I think the setting really makes you realize how much the environment matters."***
>
> – Brigham Young University Astronomy Club participant

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Joseph Ceradini
Research Associate, Biology

ASSISTANT SITE MANAGER
James Robinson

This year, we celebrated the 10th anniversary of Capitol Reef Field Station (CRFS), so a "Top Ten Things about CRFS List" is in order —David Letterman style.

#10. CRFS is located in a stunning valley in the middle of Capitol Reef National Park where Pleasant Creek flows year-round and dramatic sandstone cliffs frame the peaks of the Henry Mountains.

#9. With Capitol Reef National Park as the classroom, CRFS exemplifies engaged learning.

#8. As a well-designed, sustainable facility, CRFS models environmental ethics by showcasing solar technology, water conservation, and waste reduction.

DIRECTOR'S INTRO

#7. CRFS fosters research and creative work linked to the Colorado Plateau with its own grant program, and its staff has received National Science Foundation funding to study its cohort of university-operated field stations located in U.S. national parks.

#6. CRFS is an excellent conduit for outreach and community engagement with events and service projects such as star shows, BioBlitzes, and the removal of graffiti and invasive species.

#5. CRFS has a strong working relationship with the National Park Service.

#4. CRFS is relevant to a wide range of disciplines and has an interdisciplinary advisory board.

#3. CRFS has been able to expand its facility and teaching capacity with a new classroom building through the generosity of our private donors, especially the Bill and Margaret Pope family.

#2. CRFS supports an internship program that enables UVU students to work with National Park Service biologists, ecologists, and interpretive staff.

#1. CRFS is visited by around 500 undergraduates each year, which puts it in the top 15% of field stations nationwide.

Here's to another ten years with our recently-renewed 10-year agreement with Capitol Reef National Park to continue to allow UVU to cultivate the growth of CRFS.

Michael T. Stevens, Ph.D.
Director, Capitol Reef Field Station
Utah Valley University

10th ANNIVERSARY

In November 2018, we hosted a celebration of the 10th anniversary of the field station. The three-day event occurred over a beautiful fall weekend and was attended by 63 guests, including both field-station veterans and first-time visitors. Our keynote speaker was Rosemary Sucec, a Cultural Anthropologist with the National Park Service, who led guests on an interpretive hike. Kaitlin Gray, a Music Performance major at UVU, provided a cello performance including *"A Sky Full of Stars,"* inspired by Capitol Reef's incredible night skies. Park Superintendent Sue Fritzke, UVU President Dr. Astrid Tuminez, and CRFS Director Dr. Michael Stevens all shared remarks to highlight the enduring and effective partnership between the park and UVU. Everyone enjoyed wood-fired pizza and salad provided by a local caterer, Beth Peisner. Guests fortunate enough to spend the night participated in star shows lead by Site Manager Joe Ceradini and UVU astronomer Dr. Karl Haish. The planning for the anniversary event was done by UVU students as an engaged learning project in Kim Hanson's Public Relations Campaigns class (COMM 4850).

PHOTOS BY AUGUST MILLER, UVU MARKETING & COMMUNICATIONS

KAITLIN GRAY

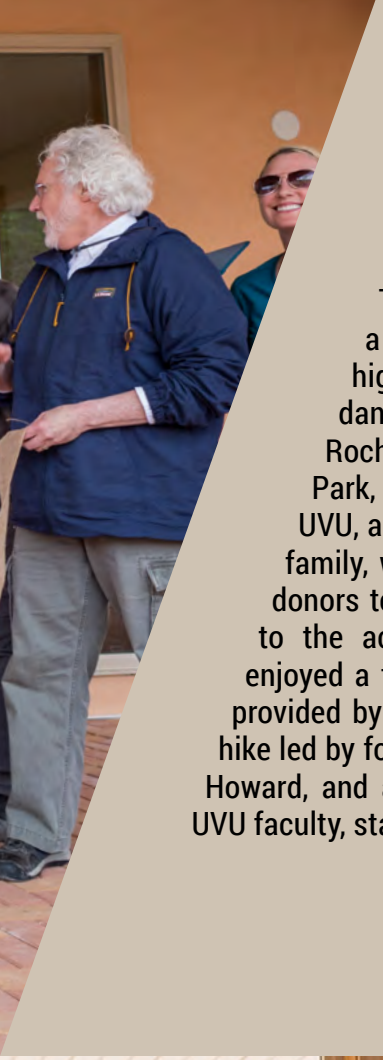
ROSEMARY SUCEC & GUESTS

SUPERINTENDENT FRITZKE AND PRESIDENT TUMINEZ

RIBBON **CUTTING**

PHOTOS BY TRAVIS LOVELL, UVU DEPT. OF ART & DESIGN

CULTURAL ENVOY



In April 2019, we hosted a ribbon-cutting ceremony for our new classroom building. The ceremony featured Cultural Envoy, a UVU student leadership program that highlights Native American student dancers, followed by remarks from Dr. Jim Roche representing Capitol Reef National Park, Dr. Cheryl Hanewicz representing UVU, and Louis Pope representing the Pope family, who have been incredibly generous donors to CRFS over the years. In addition to the actual ribbon-cutting, our guests enjoyed a two-day event including a lunch provided by a local caterer, an interpretive hike led by former Park Archaeologist Julie Howard, and a mini BioBlitz organized by UVU faculty, staff, and students.

LOUIS & RUTH POPE

"A simple and purposeful location that is in tune with its mission and its audience."

– UVU Nature to the Classroom participant

Our **MISSION**

Capitol Reef Field Station, in partnership with Capitol Reef National Park, promotes and supports engaged learning, environmental ethics, and research and creative work through the exploration of the Colorado Plateau.

ABOUT CRFS

Our **HISTORY**

From CRFS, visitors can see hundreds of millions of years into the past. The rocky landscapes tell stories of shallow seas, tidal flats, swamps, and sand deserts. Over time, Pleasant Creek has carved its way through the canyon walls to create the oasis that has attracted life for millennia including Paleo-Indian, Desert Archaic, Fremont, and Numic-speaking (Ute and Paiute) people.

More recently, Mormon pioneers began to set the scene that we see today. In 1882, Ephraim Hanks established his ranch in Pleasant Creek Valley, building the first permanent home in what would become Capitol Reef National Park. This same ranch changed hands many times over the years, and had been converted into a tourist destination called Sleeping Rainbow Ranch when the national park was created in 1971. The ranch's owner, Lurt Knee, deeded the ranch to the national park in a transaction that included life tenancy. The land was handed over to the park in 1995. A few years passed before UVU approached the park with the idea of converting the unoccupied site into a field station. It was agreed that a field station would support the missions of each organization, and after years of close collaboration on the project, the idea became a reality. CRFS opened its doors in October 2008.

Our **VISION**

Our vision is that our visitors leave the field station having learned more than the content of their coursework. Far away from many of life's daily distractions, visitors are able to immerse themselves in educational experiences that are enriched by the natural world that surrounds them. Practicing conservation encourages all visitors to think about their role in the environment and deepen their understanding of environmental ethics. We hope that every visitor connects to the landscape and develops an appreciation for the natural and cultural legacies of the Colorado Plateau.

Our **PLACE**

Beyond the paved roads, our buildings sit atop a mesa in the Pleasant Creek Valley in the heart of Capitol Reef National Park. The field station is surrounded by stunning views of canyon country. The sun rises over the last mountain range in the continental United States to be mapped, the Henry Mountains, and sets over Boulder Mountain, which was an active volcano tens of millions of years ago and supported small glaciers during the last ice age. At night, casual stargazers and serious astronomers alike can see the Milky Way and abundant constellations against a sky so dark that it's recognized by the International Dark-Sky Association. Only 3.5 hours from UVU and the Wasatch Front, our incredible location provides an unparalleled opportunity for place-based learning.

Our **PARTNERSHIP**

The success of CRFS is made possible through the partnership between UVU and Capitol Reef National Park. There are only ten other university-operated field stations located inside U.S. national parks. Our uncommon partnership allows CRFS to provide its visitors with educational experiences that are as remarkable as the landscape in which they occur. CRFS is property of the National Park Service and is operated by UVU in accordance with our 10-year general agreement with Capitol Reef National Park.

UTAH VALLEY UNIVERSITY

NATIONAL PARK SERVICE

CAPITOL REEF FIELD STATION
UTAH VALLEY UNIVERSITY

FIG. 1 **The number of user days at CRFS have increased over the years.**

VISITATION SUMMARY

Visitation to CRFS has steadily increased since opening in 2008, and this year was no exception. User days, calculated by multiplying the number of visitors by the number of calendar days they spent at the station, totaled 2,651 (**FIG. 1**). Our current use is nearly four times greater than our first complete fiscal year with visitors (2009-10). We credit this substantial increase to our relevance to a variety of disciplines and the excellent venue for engaged learning that we provide. The table on page 12 shows a complete list of all of our visiting groups.

Seventy-two percent of our user days were associated with UVU this year. The University of Kansas and University of Utah were other leading sources of user days. Groups from Utah State University, Summit High School, Southern Utah University, University of the Sunshine Coast, and the U.S. Fish and Wildlife Service visited CRFS for the first time this year (**FIG. 2**).

Visitors from UVU represented all eight of UVU's colleges and schools (**FIG. 3**). This is excellent evidence that a field-station experience is applicable to many areas of interest. Our top two sources of visitation were the College of Science and the School of the Arts.

During the 2018-19 fiscal year, 730 people (including 448 undergraduates) visited CRFS in 43 groups. The average group size was 17 and the average stay per group was 4 days. Females and males comprised 51% and 49% of visitors, respectively.

FIG. 2 **Percentages of CRFS user days from various institutions.**

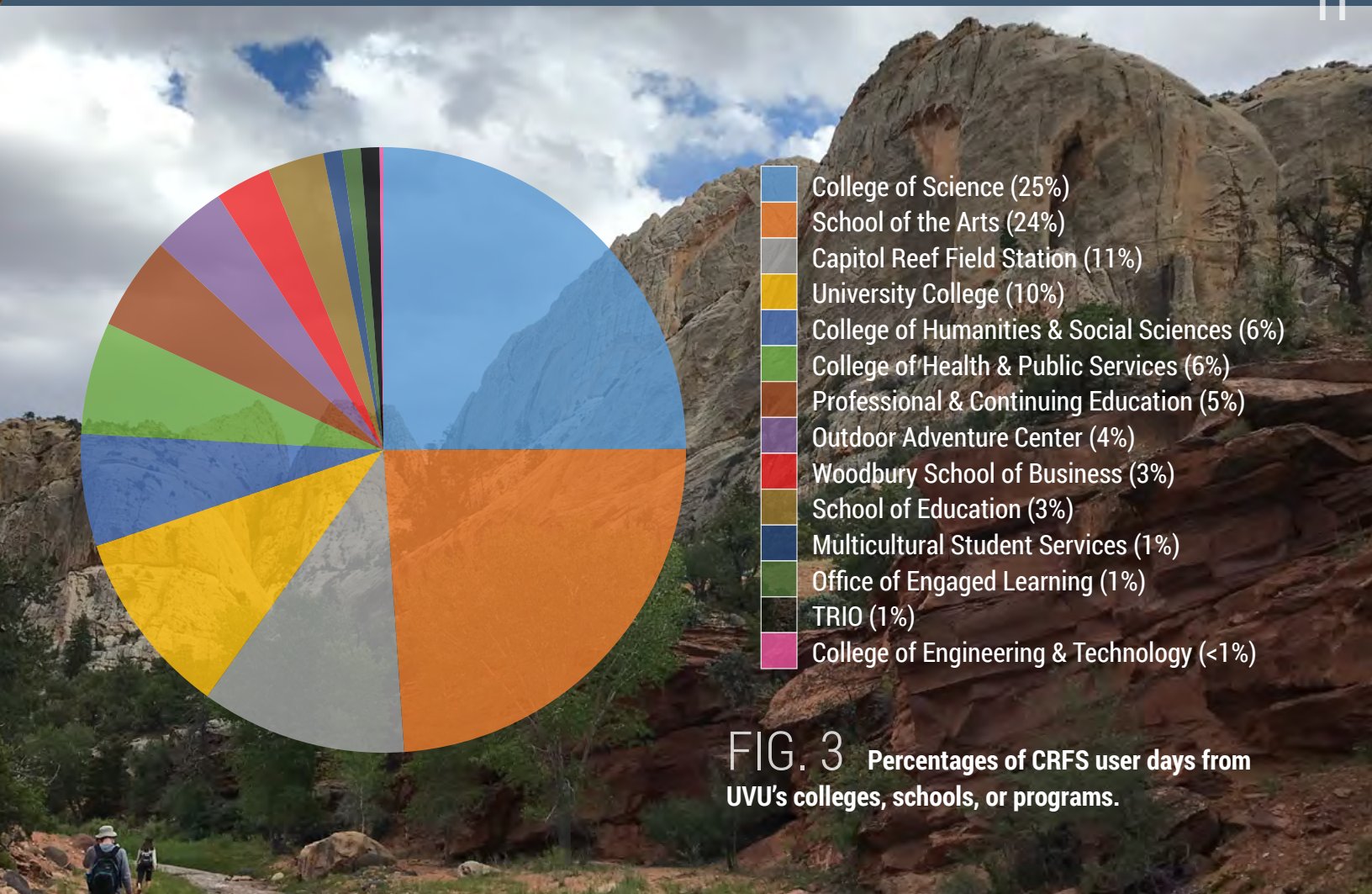


FIG. 3 **Percentages of CRFS user days from UVU's colleges, schools, or programs.**

UVU CLASSES WHO VISITED CRFS

COLLEGE	COURSE	TITLE
College of Engineering & Technology	DGM 4410	Senior Capstone II: iBeacon Project
College of Health & Public Services	DENT 3045	Dental Hygiene IV Clinical
	NURS 490R	Wilderness Nursing
	NURS 499R	Wilderness Nursing
College of Humanities & Social Sciences	COMM 350R	Environmental Communication
	POLS 3030	Civic Innovation Workshop
	SPAN 3030	Spanish Conversation and Composition
College of Science	BOT 4050/4055	Plant Ecology
	GEO 202R	Science Excursion
	GEOG 1600	Geography of Utah
	PHYS 425R	Physics for Teachers
	REC 4400	Park Management
School of the Arts	ART 300R	Special Topics in Photography
	ART 371R	Photography: Alternative Processes
University College	ELL 2110-2140	English Language Learning
	ELL 2110-2140	English Language Learning
	ESL 1320	English Language Learning

UVU AFFILIATED GROUPS WHO VISITED CRFS

SPONSORING ORGANIZATION	GROUP
Capitol Reef Field Station	10th Anniversary Event
	Ribbon-cutting Event
College of Humanities & Social Sciences	Philosophy of Art
College of Science	Astronomy Club
	BioBlitz
	Nature to the Classroom
	Physics Japan Workshop
Multicultural Student Services	Leadership Training
Outdoor Adventure Center	Trip Leader Training
Office of Engaged Learning	Directors' Meeting
Professional & Continuing Education	Writers' Workshop
	Writers' Workshop
School of Education	CREATE Lab Training
TRIO	Leadership Training
Woodbury School of Business	Financial Literacy Summer Camp

CLASSES FROM OTHER UNIVERSITIES WHO VISITED CRFS

UNIVERSITY	CLASS
Brigham Young University (Provo, UT)	Astronomy Club
Southern Utah University (Cedar City, UT)	SPARC
University of Kansas (Lawrence, KS)	Geology Field Methods
University of Utah (Salt Lake City, UT)	Parks, Recreation, & Tourism
Utah State University (Logan, UT)	Utah Conservation Corps
Weber State University (Ogden, UT)	Bears Ears & Beyond
Westminster College (Salt Lake City, UT)	Westminster Expedition

RESEARCH GROUPS WHO VISITED CRFS

SPONSOR	PRINCIPAL INVESTIGATOR
University of the Sunshine Coast (Sippy Downs, QLD, Australia)	K. Robertson
U.S. Fish & Wildlife Service (West Valley City, UT)	J. Lewinsohn & L. Lee
Utah Valley University (Orem, UT)	E. Sproat

OTHER GROUPS WHO VISITED CRFS

SCHOOL	EVENT
Summit High School (Orem, UT)	Teacher Development Workshop

This year, the operating funds at CRFS came from three sources: institutional support from UVU ($208,860.49); funds generated by user fees and product sales ($27,038.50); and private donations ($19,074.41) (**FIG. 4**). This funding supported the salaries and benefits of the staff ($160,498.66), operations and maintenance ($29,162.87), student internships ($17,178.25), marketing and outreach ($13,388.23), and research ($704.57) (**FIG.5**). While UVU generously supports the station, CRFS relies on private donations to pay for new building projects and important programs such as student internships and research. This year, we're seeking donations to remodel the existing site manager's quarters to allow for an artist-in-residence or scientist-in-residence to stay at the field station long term. If you value our mission, please make a donation at: **uvu.edu/crfs/support.html**. Contact Jim Murphy at **jmurphy@uvu.edu** or **(801) 863-5511** with questions about making a donation.

FINANCIAL REPORT

FIG. 4 **Funding for CRFS by source.**

Institutional Support (82%)
User Fees & Product Sales (11%)
Private Donations (7%)

FIG. 5 **CRFS outlays by category.**

Salaries & Benefits (73%)
Operations & Maintenance (13%)
Student Internships (8%)
Marketing & Outreach (6%)
Research & Creative Work (<1%)

FIG. 6 **Ninety-eight percent of our visitors strongly agreed (89%) or agreed (9%) that their educational experience was enhanced by their field-station visit (n = 402).**

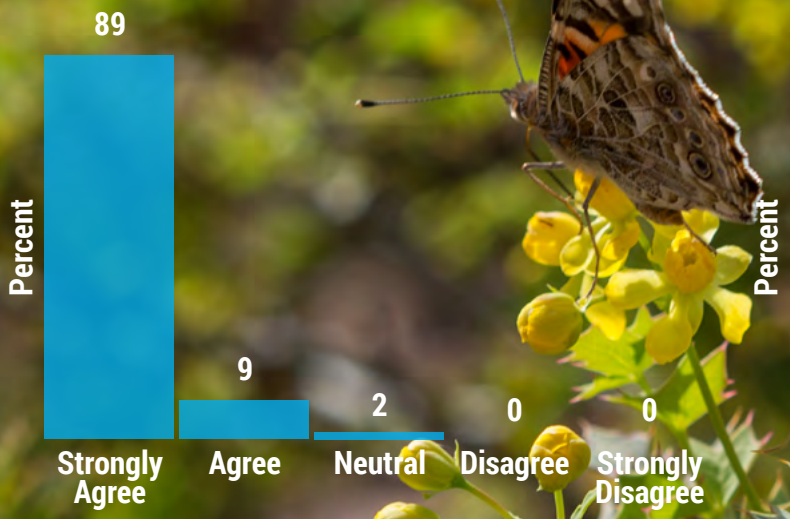


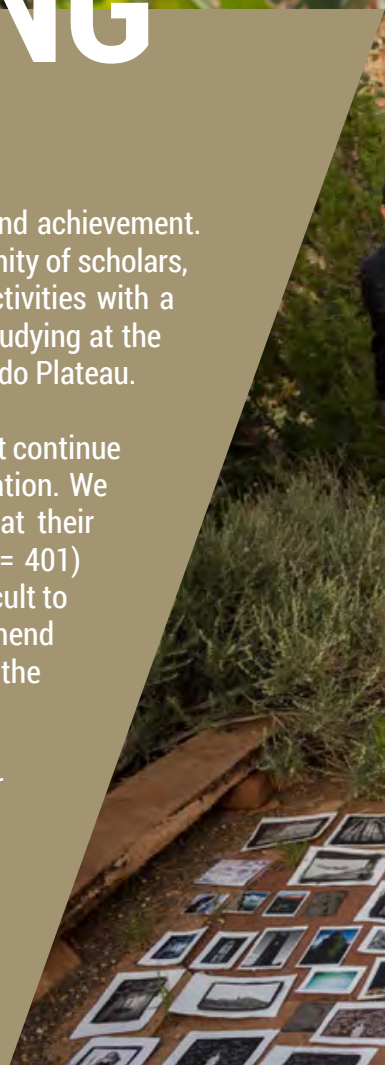
FIG. 7 **Ninety-six percent of our visitors strongly agreed (88%) or agreed (8%) that the learning environment at the field station is difficult to replicate on campus (n = 401).**

ENGAGED **LEARNING**

Engaged learning is vital to UVU's mission, which also includes student success, inclusion, and achievement. As a valuable university resource, the field station is actively committed to fostering a community of scholars, creators, and practitioners. The field station facilitates a wide range of engaged-learning activities with a careful eye given to student success, professional development, and stewardship of place. Studying at the field station is more than just hands-on learning; it is a full immersion experience in the Colorado Plateau.

We are very proud of the array of disciplines across UVU, from philosophy to plant ecology, that continue to find innovative and exciting ways to pursue engaged-learning experiences at the field station. We regularly survey our visitors, and 98% (n = 402) strongly agreed (89%) or agreed (9%) that their educational experience was enhanced by their field station visit (**FIG. 6**). Similarly, 96% (n = 401) strongly agreed (88%) or agreed (8%) that the learning environment at the field station is difficult to replicate on campus (**FIG. 7**). We also found that our students would enthusiastically recommend the field station to others with over 99% (n = 405) encouraging other students who have the opportunity to visit the field station.

While we have too many groups to highlight in any one report, please read about some of our visitors this year and the unique ways in which they studied and learned at the field station.



UVU

HISTORIC PHOTOGRAPHIC PROCESSES AND DIGITAL ALTERNATIVE PHOTOGRAPHIC PROCESSES

July 9-21, 2018

UVU photography professors Travis Lovell and Reid Elem led a group of UVU students who were enrolled in two different photography courses—Historic Photographic Processes (which included methods used in the late 18th century) and Digital Alternative Photographic Processes (which included printing photographs on a range of nontraditional materials). In line with the field station's environmental ethics mission, all materials used in these processes were sustainably sourced. Travis Lovell further details their activities:

"We draw inspiration from the history and beauty of the national park while taking day hikes and drives and return to the field station to interpret what we saw into printed photographs. Students learned principles of chemistry and physics as they made their own photo paper by coating the sheets of paper with iron, silver, and/or palladium in ways that made the paper light-sensitive. Exposures were made using the ultraviolet light produced by the sun and then treated in additional chemicals for development and to make them archival. Digitally we were able to print on a variety of materials as diverse as climbing equipment, glass, metal, maps, trash, wood, bottles, computers, and custom-treated papers. Both of these classes allowed students to discuss artistically and conceptually how the visual image relates directly to the idea that they are trying to communicate. All the materials used in these processes were sustainably sourced outside of the park and brought to the field station for use in these photographic methods."

ENGAGED **LEARNING**

UNIVERSITY OF UTAH
PARKS, RECREATION, & TOURISM
March 25-29, 2019

The University of Utah's Parks, Recreation, and Tourism program uses the field station to offer a unique opportunity for students specializing in Outdoor Recreation Studies (ORS). Ph.D. candidate Qwynne Lackey summarized their trip this way:

"Students were able to apply skills learned in the class when planning and leading several outdoor recreation experiences that met the needs and interests of the entire group, and each student was able to lead their own on-site interpretive talk related to Capitol Reef National Park. Furthermore, an important activity that the students complete is a hypothetical land management role-playing scenario situated in Capitol Reef National Park. In previous years, this activity has been completed in the classroom prior to coming to CRFS. However, during the last two years, this activity has been completed on-site, which we feel enhances student learning by increasing context and student engagement in the activity. Overall, instructor observations and student evaluations suggest that the 2019 ORS field trip to CRFS was a critical component of the semester-long ORS block course that greatly enhanced student learning. Many of the experiences—such as the many on-site recreation planning and leadership opportunities, interpretive talks, national park staff interviews, and role-playing activities—would be difficult or impossible to re-create without the opportunity to stay at the CRFS and the help of the CRFS staff."

UVU

OUTDOOR ADVENTURE CENTER

August 31-September 3, 2018

Kim Reynolds of UVU's Outdoor Adventure Center brought a group of 17 UVU students to the field station for leadership training exercises. She relates:

"Using the field station for leadership training has been an incredible opportunity. It gives the students a chance to get to know one another, practice experiential education, and ask questions about the Outdoor Adventure Center mission and how they fit in at Utah Valley University. The fall training we offer is required for all trip leaders and we cover a lot of information about trip planning, group dynamics, risk management, leadership styles, and goals. We also take time to visit the park participating in hiking and canyoneering, giving the trip leaders a chance to lead the group working on technical skills and group management."

"Thought-provoking environment that encouraged me to think about my place in the environment and my resource-use."

– University of Utah Parks, Recreation, & Tourism participant

ENGAGED **LEARNING**

UNIVERSITY OF KANSAS
FIELD GEOLOGY
May 25-June 3, 2019

June 2019 marked the sixth time that geology students from the University of Kansas stayed at the field station as part of a geology field course, where students were taught to understand and map rock exposures. The group was led by Dr. Diane Kamola, who lauded the field station's sustainable practices and asserted, *"I can't think of a better place to stay while teaching."* Dr. Kamola further describes their experience:

"Our stay at the UVU field station enhanced our educational objectives for this course. Our students spent their days analyzing and mapping classic geologic features within Capitol Reef National Park. Students mapped a well-exposed normal fault at Chimney Rock, and then mapped the more complicated Waterpocket Fold along the Notom Road. The abundant exposures in the park allowed us to reach our course objectives, which include studying the principles of field geology and the application of field methods to solving geological problems. The serenity of the field station was a welcoming retreat at the end of each long field day."

UVU
WILDERNESS NURSING
May 8-10, 2019

Dr. Gary Measom led a group of UVU Nursing students in activities focused on practical medical concerns while in wilderness settings. In Dr. Measom's words, some of their activities included:

"We had a class on primary and secondary assessment in the wilderness, and collecting a pertinent history. We also talked about giving report to a secondary provider. … All the students enjoyed [a hike to Cassidy Arch]. During the hike, three of the students acted out their injury scenarios and the other students had to treat those who were acting as if they were injured. We did get a lot of strange looks from the other hikers on the trail."

"I can't think of a better place to stay while teaching."

– Dr. Diane Kamola, University of Kansas

FIG. 8 **Ninety-seven percent of our visitors strongly agreed (84%) or agreed (13%) that staying at CRFS made them more aware of their personal environmental impact (n = 403).**

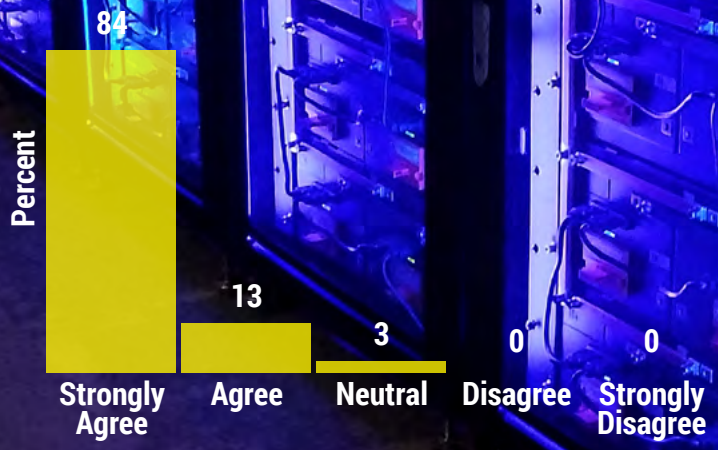
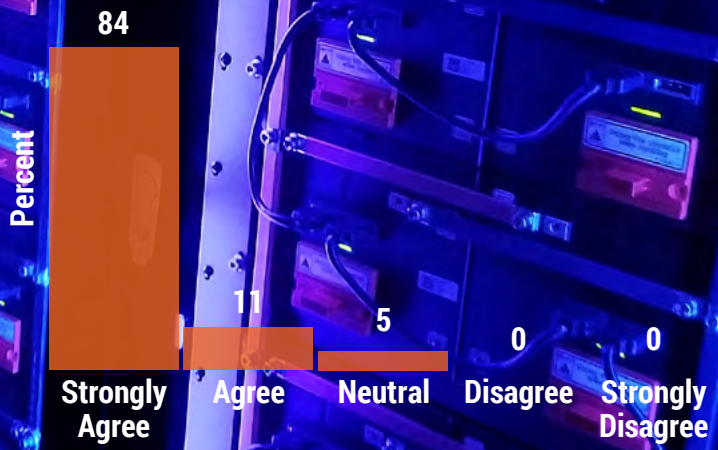


FIG. 9 **Ninety-five percent of our visitors strongly agreed (84%) or agreed (11%) that they place more value on protected public lands such as Capitol Reef National Park because of their stay at CRFS (n = 404).**



ENVIRONMENTAL ETHICS

We endeavor to foster a more developed sense of stewardship of place among all of our visitors. We continue to teach every visiting group about sustainable practices as we measure water usage and non-recyclable trash for each group. We hope that everyone who visits the field station is able to gain an increased appreciation for how their in-the-moment activities are situated in the time and scale of environmental processes, which range from observing the geological grandeur of the surrounding cliffs to preserving the tiny biological soil crust on the desert soil. This sort of awareness is often a by-product for visitors who gain knowledge in their individual disciplines as well as in environmental ethics.

We teach our visitors about conservation, and 90% (n = 385) reported learning new ways to conserve. In addition, 97% of visitors (n = 403) strongly agreed (84%) or agreed (13%) that staying at CRFS made them more aware of their personal environmental impact (**FIG. 8**). Our visitors also leave with a greater appreciation for public lands with 95% (n = 404) strongly agreeing (84%) or agreeing (11%) that they place more value on protected lands such as Capitol Reef National Park because of their stay at CRFS (**FIG. 9**).

BIOBLITZ

In June 2019, CRFS, UVU's Department of Biology, and Capitol Reef National Park hosted a BioBlitz. UVU Biology students played a key role in planning and implementing the event. In a BioBlitz, citizen scientists and biologists work together to find, photograph, and identify as many living organisms as possible in a specified area. BioBlitzes foster engagement among the public, universities, and land management agencies. These activities contribute important baseline data to the broader scientific community in open-access databases, such as iNaturalist. We spent one day focused on the Pleasant Creek and Oak Creek areas and a second day on the Cathedral Valley area of the park. The event was attended by fifty-five volunteers who added 2,572 observations to iNaturalist representing 282 different species. (**FIG. 10**).

To view all of the Capitol Reef BioBlitz observations see:
www.inaturalist.org/projects/capitol-reef-national-park-bioblitz-2019

"I took a second look at Capitol Reef's iNaturalist observations this week, and I couldn't be more impressed. Through your efforts at the BioBlitz, the park has increased its iNaturalist observation count from about 700 observations at the beginning of the year to almost 4,000, an almost sixfold improvement. I hope it's been rewarding to engage both students and the public while collecting important information on park resources. It's also exciting to see that the park has received continued engagement since the event's end, as both more observations from the event have trickled in and additional visitors have contributed their own observations."
- Parker A. Hopkins, Natural Resources Specialist, National Park Service, Ft. Collins, CO

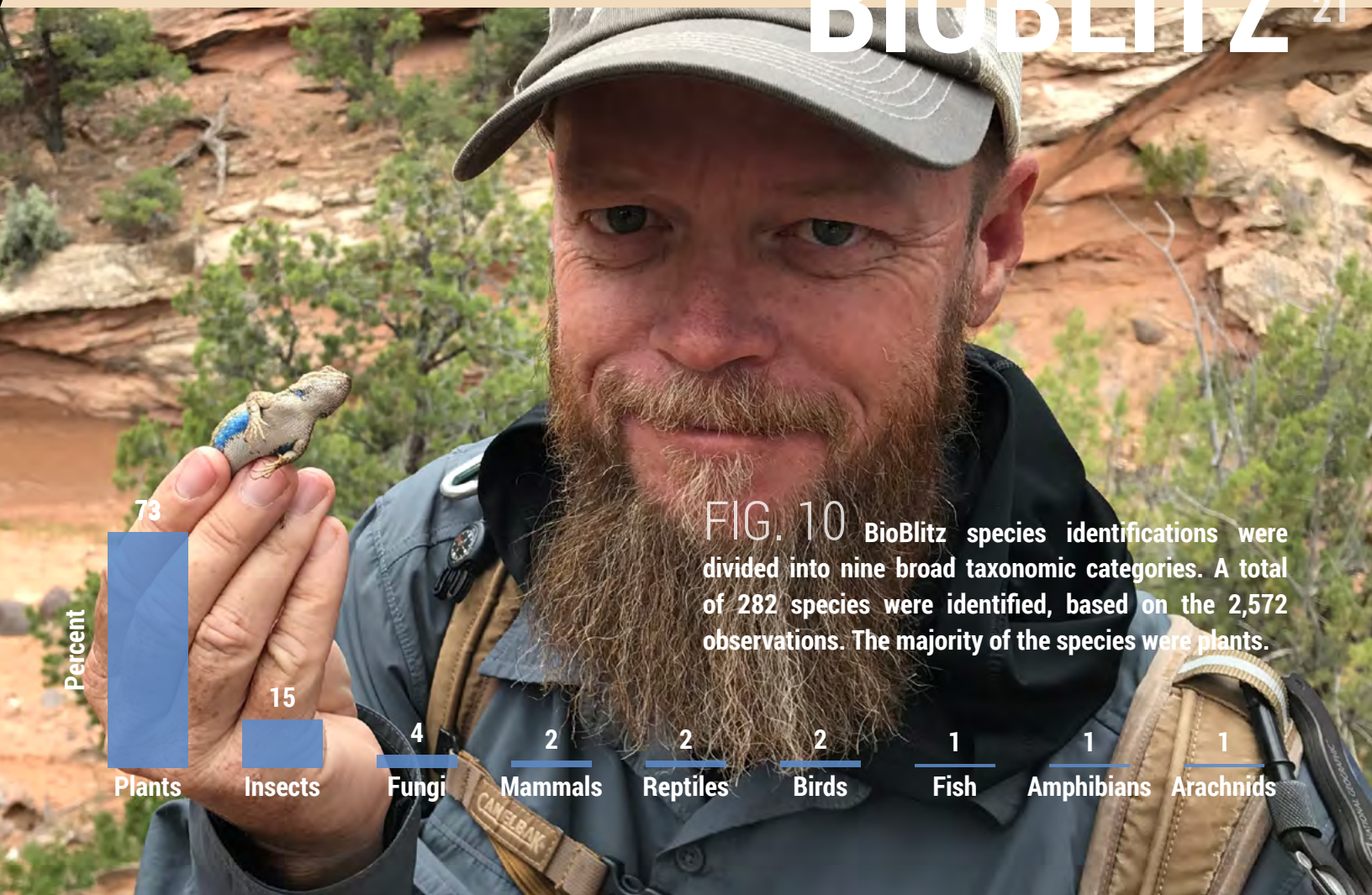


FIG. 10 **BioBlitz species identifications were divided into nine broad taxonomic categories. A total of 282 species were identified, based on the 2,572 observations. The majority of the species were plants.**

RESEARCH & CREATIVE WORK

CRFS supports and conducts research and creative work that improves our understanding and appreciation of the Colorado Plateau. This year, we highlight three projects focused on different aspects of the ecology of Capitol Reef National Park, including service-learning research on small mammal species diversity and two studies utilizing different approaches to improve cactus conservation.

SMALL MAMMAL ECOLOGY AND SERVICE LEARNING

Joe Ceradini, CRFS site manager and research associate in UVU's Biology Department, writes about his service-learning research project on small mammal ecology in Capitol Reef National Park.

"Capitol Reef Field Station and Capitol Reef National Park create the ideal context to provide students with service-learning experiences while simultaneously addressing research and management needs of the national park. We are live-trapping small mammals in order to better understand species diversity and population dynamics of these understudied species in the park. Small mammals influence multiple trophic levels and can serve as easy-to-monitor indicator species, making them an important component of many ecosystems. For example, small mammals help regulate plant communities through seed dispersal and seed predation, and are critical prey species for many predators, including reptiles, mammals, and birds. Small mammals in the park, primarily woodrat species, are the primary prey source for the federally threatened Mexican spotted owl (Strix occidentalis lucida)*, which is a park management priority species. Finally, small mammals may serve as indicators that reflect broader ecosystem changes due to factors such as climate change and invasive species.*

"We conducted a pilot study this year to identify locations for trapping that are both easy to access from the field station (in order to maximize student involvement) and provide valuable small mammal biodiversity data. We have trapped small mammals in a variety of habitats in Pleasant Creek Valley, such as grassland, sagebrush, pinyon-juniper, and riparian. So far, we have set traps for a total of 217 trap-nights (number of nights x number of traps) and captured, tagged, and released eight small mammals, including deer mice, canyon mice, and woodrats. Feedback has been extremely positive from UVU students and professors that have participated. Participants learn first-hand about ecological research, small mammal ecology, and national park management. Trapping will be ongoing, creating many more service-learning opportunities, including opportunities for student independent studies."

> ***"The ideal context to provide students with service-learning experiences while simultaneously addressing research and management needs of the national park."***
>
> – Joseph Ceradini, Capitol Reef Field Station

> ***"It provided an opportunity to not only learn, but put my learning and experience into action."***
>
> – Brigham Young University Astronomy Club participant

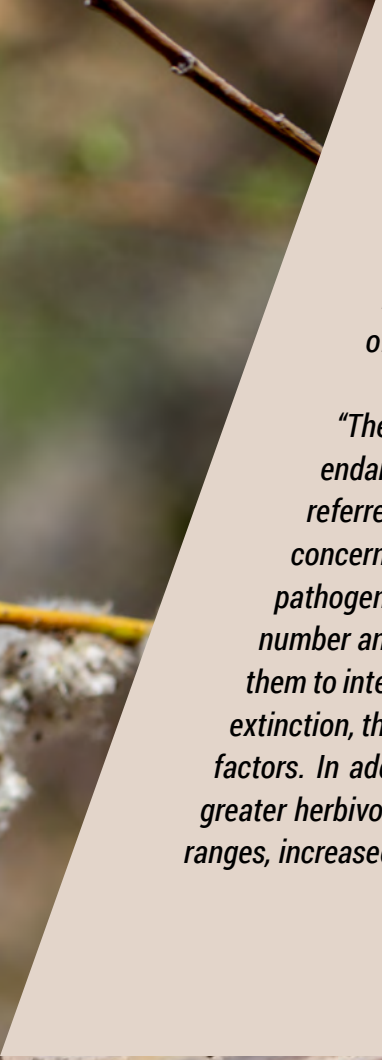
RESEARCH & CREATIVE WORK

INVESTIGATION OF GENETIC AND ENVIRONMENTAL PREDICTORS OF SUSCEPTIBILITY TO HERBIVORY

Matt Wang, M.S. candidate at Northwestern University and Chicago Botanical Garden, writes about his graduate research on an endangered cactus species in the Capitol Reef region.

"The purpose of this research is to examine environmental factors and cactus genetics to determine if there are any traits that make Sclerocactus wrightiae *populations more or less susceptible to herbivory, and to assess potential extinction risk for the species.*

*"*Sclerocactus wrightiae *is an endangered cactus endemic to southeastern Utah. In 2015, biologists at Capitol Reef National Park discovered cacti that were infested with larvae from an unknown insect. Larvae were collected and reared and it is believed to be a species that is entirely new to science; a moth in the genus* Rhagea*. This new herbivore's presence caused a large decline in numbers within the park as well as the surrounding land managed by the Bureau of Land Management. The losses continued throughout 2016, but there have been no sightings since. In the years since its discovery, there have been no observations of herbivory on any other genera or species despite widespread presence of other cactus species. This unusual species-specific herbivory*



may indicate that the herbivore has always been present, but some unidentified factor has caused a reproductive boom or release from pressures that previously kept population numbers in check. Alternatively, it may be a novel introduction due to expanded range caused by a number of potential factors such as climate change or other vectors like cattle or humans.

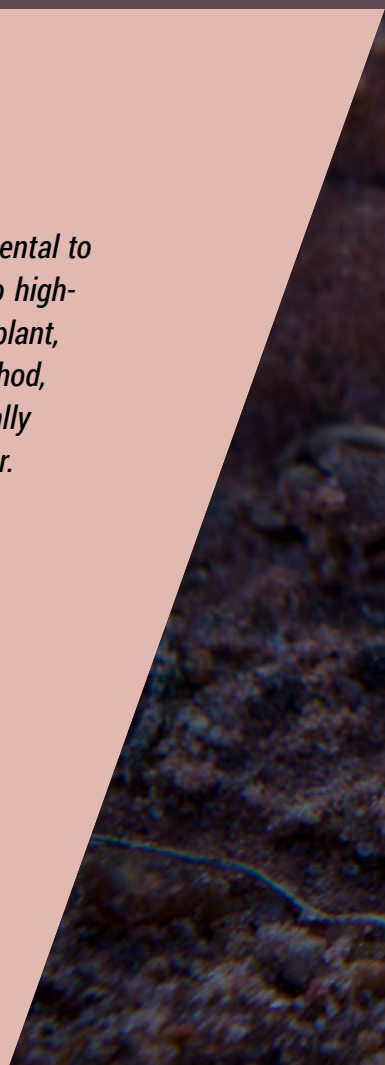
"The potential for pathogens and herbivory to contribute to extinction of a species is higher for endangered species. This is due to multiple interacting factors contributing to what is commonly referred to as the extinction vortex. These other factors include restricted population sizes, genetic concerns, and higher levels of external stress predisposing them to greater impact from herbivores or pathogens. The rising numbers of novel introductions and looming threat of climate change can affect the number and severity of diseases and insect herbivory and alter the range of diseases and insects, allowing them to interact with new host species. Hence, although herbivory and disease will rarely be the sole cause of extinction, they can reduce numbers to levels where there is an increased risk due to genetic and other random factors. In addition, the predicted effects of climate change can increase the impact through higher stress, greater herbivore consumption, reduced ability to respond, and changes in insect phenology resulting in larger ranges, increased population sizes, and longer growing periods."

CACTUS MICROBIOMES AND CONSERVATION

Dr. Geoff Zahn, assistant professor in the Biology Department, writes about his CRFS-funded research on modifying plant microbial communities to improve conservation of an endangered cactus species in Capitol Reef National Park.

"Plants aren't just plants. They are complex communities that include a plant host, and dozens or hundreds of microbes that make up what we sometimes call the 'holobiont.' In fact, many 'plant' traits that people have been measuring for decades turn out to be microbial traits in disguise. Recent research has shown that we can help plants adapt to climate change, resist disease or drought, or even increase reproductivity by simply changing the microbial communities that associate with plants' leaves or roots. One candidate for microbiome engineering is the endangered cactus, Sclerocactus wrightiae*. It is possible that once we understand what microbes are part of this plant, we can use this knowledge to improve conservation efforts.*

"The first step in this project was to determine if a common sampling method would be detrimental to the plants. Typically, we have to remove a small piece of tissue from a plant and subject it to high-throughput DNA sequencing to determine what microbes are present. But with an endangered plant, there is a risk that cutting into it to remove tissue could do more harm than good. To test the method, we performed tissue sampling on a closely related cactus, S. parviflorus*, which is not federally listed as endangered. Each cactus was photographed and monitored over the course of a year. Cacti that received incisions were compared to those in the control group that did not. So far, it looks like this sampling strategy had no adverse effects on the plants, so the hope is that soon we can begin to discover the microbial members of* S. wrightiae *and to look for ways to improve cactus health."*



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*Denotes a UVU student

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"My experience at Capitol Reef Field Station changed my life!"

– UVU Nature to the Classroom participant

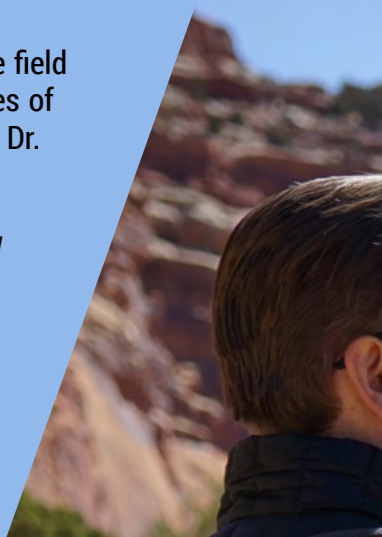
OUTREACH & **SERVICE**

The presence of the field station in Wayne County facilitates connections among UVU students, the local community, and the National Park Service. CRFS serves as an important destination not only for university faculty and students but also for visitors from the local community. Additionally, seven different groups this year engaged in service projects for a total of over 1,035 service hours. These projects included species identification and documentation, graffiti removal, and invasive species removal.

UVU
GEOGRAPHY OF UTAH
September 28-30, 2018

In the fall of 2018, students from Dr. Hilary Hungerford's Geography of Utah class visited the field station to complete a landscape sketch that would help them learn about geologic processes of the Colorado Plateau, and to participate in service learning by removing graffiti in the park. Dr. Hungerford relates how this was accomplished:

"Most of the students in the group are future teachers, and through their time in Capitol Reef gained important skills in reading and explaining landscapes and also understanding the vulnerability that some of our park spaces encounter."



UVU
NATURE TO THE CLASSROOM
March 15-17, 2019

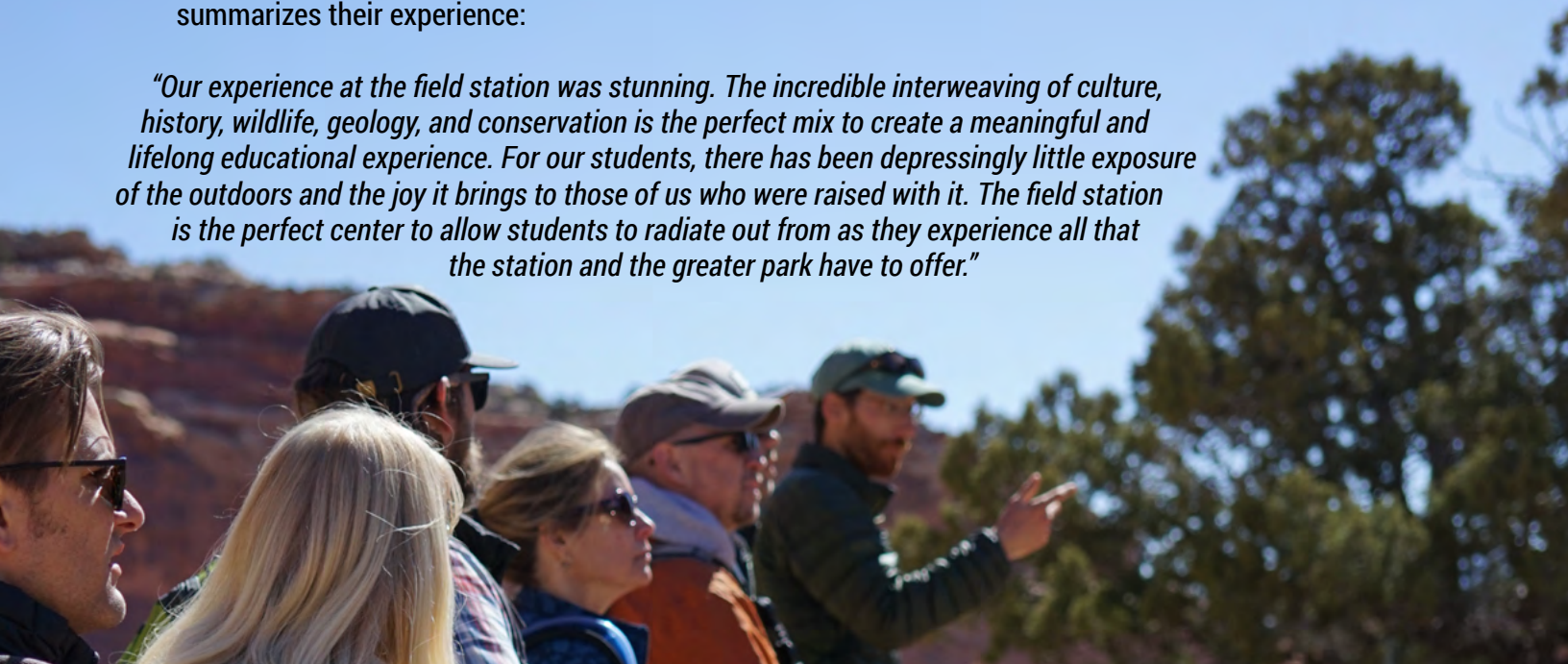
Nature to the Classroom is a project conceived by UVU students and faculty to reach out to local elementary schools and collaboratively create opportunities to incorporate nature into the classroom. The program attempts to train a dedicated and growing body of educators to recognize the importance of getting children outside to engage with their environment in active learning and play. In all these activities, the program focuses on using nature as a tool to enhance the existing curriculum. Scott Williams, associate professor in the Department of Exercise Science and Outdoor Recreation at UVU, and Cinimin Kofford of the National Park Service, worked in collaboration with a team of elementary school teachers and four UVU students to conduct this year's conference. In all, sixteen public school teachers from throughout the Wasatch Front participated. Conference sessions included presentations on experiential education, Leave No Trace outdoor ethics, sustainability, public lands, and ecology. One trip participant shares their experience:

"From the first night seeing a true dark sky through a telescope to the incredibly useful information I received throughout the conference, the experience was fantastic. Being able to be in the park and stay at such a beautiful facility with such wonderful people is an experience I'll never forget. Even though it was a change of pace for me to be so conscious of water use and sustainability, I loved it and was inspired to take those practices home with me. Thank you Nature to the Classroom and UVU. My experience at Capitol Reef Field Station changed my life!"

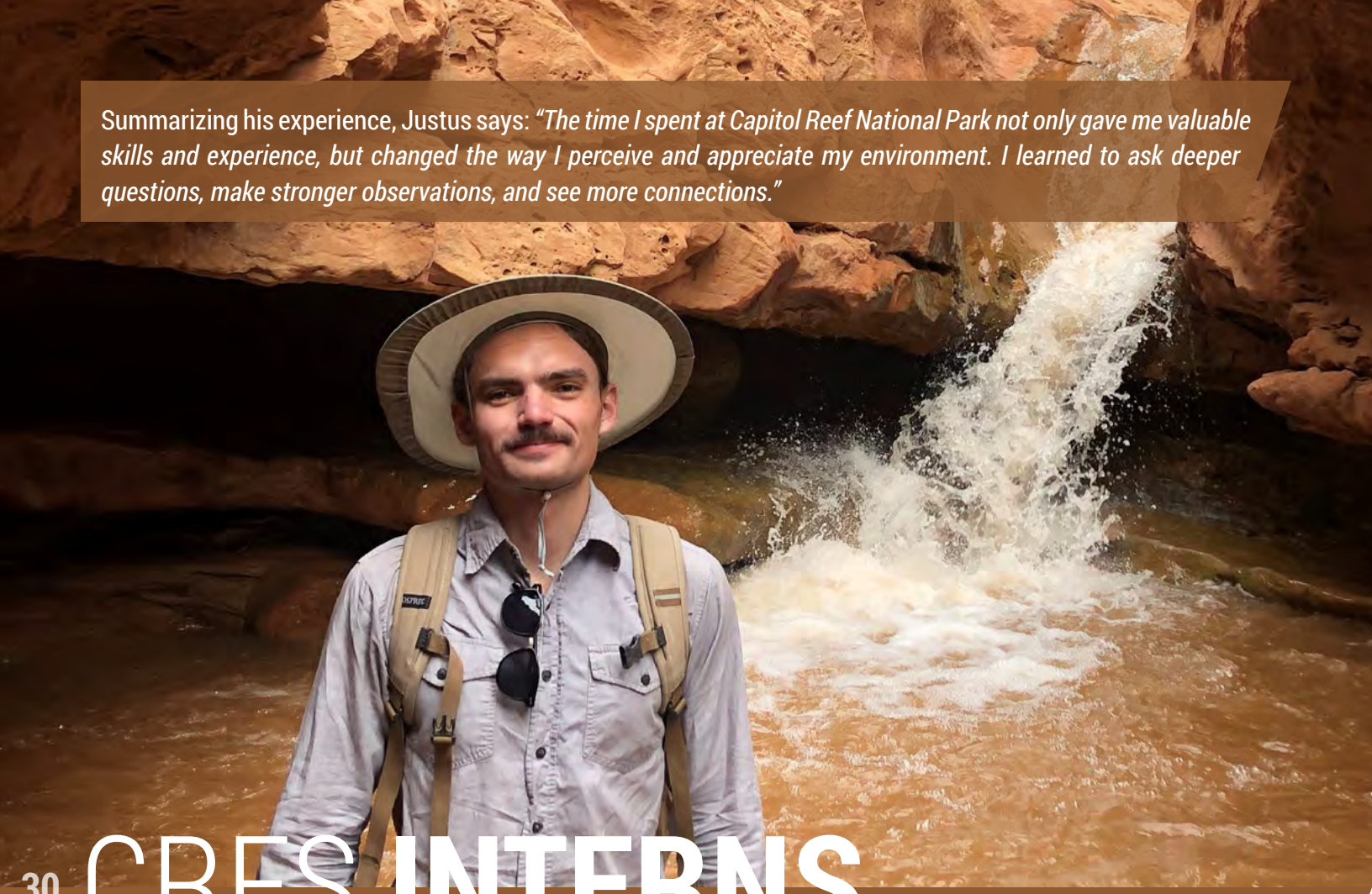
SUMMIT HIGH SCHOOL
CAPITOL REEF TEACHER DEVELOPMENT WORKSHOP
April 12-14, 2019

Summit High School, a local school for at-risk youth, brought a group of educators to the field station to create cross-curriculum lesson plans. Summit High School plans on bringing small groups of students to the field station to immerse them in an outdoor ethics and conservation mindset. Trip leader Marshall Kay summarizes their experience:

"Our experience at the field station was stunning. The incredible interweaving of culture, history, wildlife, geology, and conservation is the perfect mix to create a meaningful and lifelong educational experience. For our students, there has been depressingly little exposure of the outdoors and the joy it brings to those of us who were raised with it. The field station is the perfect center to allow students to radiate out from as they experience all that the station and the greater park have to offer."



Summarizing his experience, Justus says: *"The time I spent at Capitol Reef National Park not only gave me valuable skills and experience, but changed the way I perceive and appreciate my environment. I learned to ask deeper questions, make stronger observations, and see more connections."*

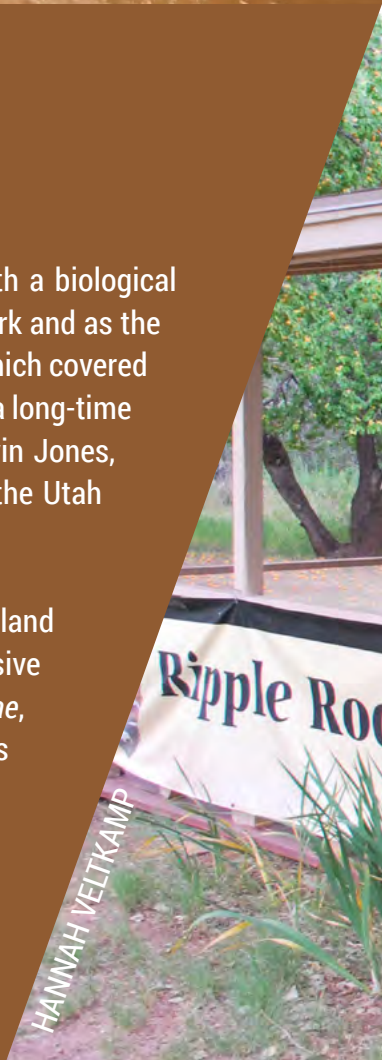


CRFS **INTERNS**

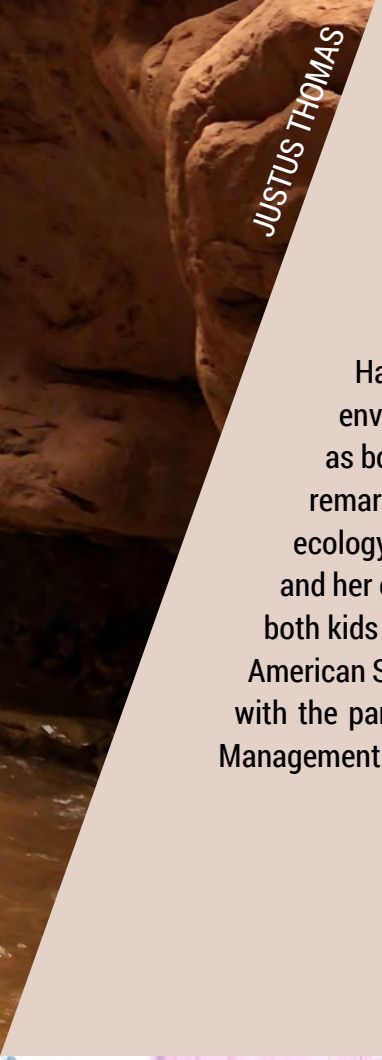
NATURAL RESOURCES INTERN
Justus Thomas

Justus Thomas, an Environmental Science and Management major at UVU, worked as both a biological technician with the Resource Management and Science Division of Capitol Reef National Park and as the assistant site manager for CRFS. He was also the recipient of the Cordell Roy Scholarship, which covered his tuition as he earned college credit for his internship. The scholarship honors Cordell Roy, a long-time employee of the National Park Service. It is funded by a generous endowment from G. Kevin Jones, who is an attorney in the Office of the Solicitor, U.S. Department of Interior, representing the Utah units of the National Park Service. Cordell Roy also contributed to the endowment.

Justus gained experience with ecological field data collection as an essential step in the land management process. He participated in a variety field surveys in the park, including extensive surveys for two endemic cactus species, *Pediocactus winkleri* and *Sclerocactus wrightiae*, which are both listed under the Endangered Species Act. In addition to cactus surveys, Justus learned plant identification, collected native plant seeds to facilitate restoration projects, monitored a peregrine falcon nest, conducted riparian surveys, managed motion-triggered wildlife cameras, and assisted with data entry and management in the office. In addition to ecological field work, Justus helped facilitate groups visiting the field station.



HANNAH VELTKAMP



JUSTUS THOMAS

RIPPLE ROCK NATURE CENTER INTERN
Hannah Veltkamp

Hannah Veltkamp, a Botany major at UVU, managed the Ripple Rock Nature Center, which is an environmental education center oriented towards children. Hannah was able to use her background as both an educator and botany major to help kids and adults understand and appreciate the many remarkable resources within Capitol Reef National Park. Hannah conducted daily programs on the ecology and geology of Capitol Reef, including a Junior Ranger program. Her programs were interactive, and her excitement and passion for the material was evident, which helped her to successfully engage both kids and adults. Hannah was also able to use her sign language skills to interact with and educate American Sign Language speakers visiting the park. In addition to managing Ripple Rock, Hannah worked with the park interpretation staff in the visitor center and with other park divisions, such as Resource Management and Science, which exposed her to different career opportunities in the national park.

Reflecting on her internship, Hannah says: *"Internships investigate a specific field and expand into learning about how different subjects work together to function as a whole. During my time at Capitol Reef National Park, I went deep into the investigation process of interpretation. I conducted Junior Ranger focused programs, worked at the visitor center for the general public, and eventually worked with other divisions in the park to see the role they have in helping Capitol Reef National Park."*

STRATEGIC **PLAN**

CRFS staff utilize strategic planning to guide our operations. We have five objectives that direct our decision-making. A summary of our past and future activities related to these objectives follows:

1. Promote CRFS as a venue for engaged learning utilized by a variety of disciplines and multiple institutions.
This year we promoted CRFS at three major events: our 10th anniversary celebration, a ribbon-cutting ceremony for our new classroom building, and a BioBlitz. Each of these events was attended by many first-time visitors. Interest in utilizing the field station as a venue for engaged learning has grown over the years and this was our busiest year ever. We hosted visitors from twelve different institutions, from as far away as Australia. For the second year in a row, our visitors represented a wide array of disciplines—from all eight of UVU's colleges and schools.

2. Develop environmental awareness and engage visitors in sustainable practices to be applied at home.
At the field station, we teach our visitors about conserving water and reducing waste by involving them in an engaged-learning project focused on their own water use and trash production. At the end of each visit, our site manager calculates the gallons of water used and pounds of trash produced by each group. We're happy to report that our engaged-learning project is working and that our visitors are stellar examples of sustainability! This year our visitors used just 13.8 gallons of water per person per day, which is less than half of what an average American uses. In terms of trash, our visitors produced just 0.3 pounds per person per

day. The typical American generates 15 times as much trash! Many visitors report that their field-station experience had a lasting effect on their environmental awareness and that they still use some of the strategies for water conservation and waste reduction that they learned at CRFS.

3. Foster research and creative work that utilize CRFS as a venue from which to explore the Colorado Plateau.

Research activities this year focused on park priorities involving small mammals and cacti. Site Manager Joe Ceradini is involving UVU undergraduates in live-trapping small mammals to study the diversity and dynamics of their populations. UVU alumnus, Matt Wang, who is currently a graduate student at Northwestern University, is examining genetic and environmental factors that influence the susceptibility of *Sclerocactus wrightiae* to herbivory. Dr. Geoff Zahn is testing a method for studying the microbiome of *S. parviflorus* that he plans to apply to the endangered cactus, *S. wrightiae*.

4. Continue to collaborate with our National Park Service field-station partners and build relationships with other relevant organizations.

Since 2008, UVU has operated CRFS through a five-year General Agreement with Capitol Reef National Park. This year, the park extended the duration of our renewable agreement to ten years—through 2029! We're grateful for the trust park leadership has in us to continue to effectively manage the field station. We look forward to our ongoing collaborations with the park through our field-station partnership.

5. Ensure that CRFS facilities, staffing, and services meet visitor needs.

We were so excited to open our new classroom building this year! The 1,400 ft^2 building is on the south side of the mesa top between the solar panels and the existing CRFS campus. It includes a classroom with sinks, cabinets, and ample work surfaces that opens onto a covered patio that offers additional teaching space outside in the shade. The classroom has an abundance of windows with spectacular views of nearby sandstone cliffs and the Henry Mountains in the distance. The building also has a telescope storage room with an adjacent observation patio, a space for research instruments, and two restrooms accessible from the outside. The new building will enhance the field-station experience for all visitors and increase CRFS's ability to support the missions of both the park and UVU. If you haven't already, come and see the new building!

"We really can't do what we do here, anywhere else."

– University of Utah Parks, Recreation, & Tourism participant

Capitol Reef Field Station makes a difference—so can you!

Because of the support of our donors, we've completed the construction of our new classroom building! Our next phase is to construct a residence facility for our site manager and remodel the existing site manager's quarters to serve as housing for an artist-in-residence or scientist-in-residence. These planned expansions will enhance the field-station experience for all visitors and increase the field station's ability to fulfill its mission of engaged learning, environmental ethics, and research and creative work in the context of the Colorado Plateau.

Please visit **uvu.edu/crfs/support.html** to contribute. Donations are tax-deductible to the extent allowed by law and we will honor your contribution by listing your name in our annual report. Contact Jim Murphy at **jmurphy@uvu.edu** or **(801) 863-5511** with questions about making a donation.

A big thank-you to our donors!

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"Being immersed in the experience —total and complete focus and integrated learning."

– UVU Environmental Communication participant

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Thank you to Paul Fenske, UVU Printing Services, for layout and design.

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CAPITOL REEF **FIELD STATION**

ANNUAL REPORT **2018-2019**

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