Ute STEM Project

A Study in the Integration of Western Knowledge and Native American Knowledge Bases

ABOUT THE PROJECT AND LESSONS LEARNED (2016–2022)

History Colorado/Gen9 Productions

by Liz Cook, Sheila Goff, Kate Livingston, Shannon Voirol

History Colorado

National Science Foundation
WHERE DISCOVERIES BEGIN

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Foreword

We acknowledge that the land currently known as Colorado has been the traditional homelands of Indigenous peoples since time immemorial. We are grateful to work in partnership with the 48 sovereign nations who continue to call this land home. Together, we plan exhibits; collect, preserve, and interpret artifacts; do archaeological work; and create educational programs to share the history of Colorado. We especially recognize our relationships with the Southern Ute Indian Tribe, the Ute Indian Tribe of the Uintah and Ouray Reservation, and the Ute Mountain Ute Tribe that are at the core of the Ute STEM Project.

The Ute STEM Project is a beautiful bridge-building project that spans across time and connects living cultures and embodied knowledge. It is important to note that the work is only possible because of those who have preserved knowledge within the Ute Tribes over many generations—even against extreme and violent systems of erasure, assimilation, and colonization. We are immensely grateful, too, for the generosity of our tribal partners who shared the knowledge that is foundational to this work. Ute STEM is generational work from the ancestral knowledge embedded in the project to the youth and future descendants who will benefit from it. Its impact is wide and will be long.

When I think about the core vision of the Ute STEM Project, I am reminded of a favorite quotation that comes from Chicana poet and professor Norma E. Cantú, PhD:

"I have often said that the next revolution after the industrial and technical will be the spiritual revolution which will happen when science catches up to ancient knowledge and traditions. Our ancestors communicated with and established connections to what we in our mechanized and scientific world cannot fathom. Science will one day discover there are nonwestern ways of knowing and being and we will once again regain the ability to communicate with ourselves and at all levels."

These words perfectly articulate the spirit of this work, and it is a reminder of what the study and preservation of history really means. For too long, we have been trained to think that history, science, and other disciplines are the domain of formally educated experts, museums, scholarly books, and official archives. We cannot be trapped by such limited perspectives. History and science belong to all of us. It is living and breathing in our bodies, our families, our communities. It is our inheritance, our obligation, and it also forms our destinies.

The Ute STEM Project recognizes that there are many ways of knowing and building knowledge. An inclusive history must do more than add content related to intentionally marginalized communities and erased histories and ways of knowing. It must also expand beyond the confines of Enlightenment–era European epistemologies.

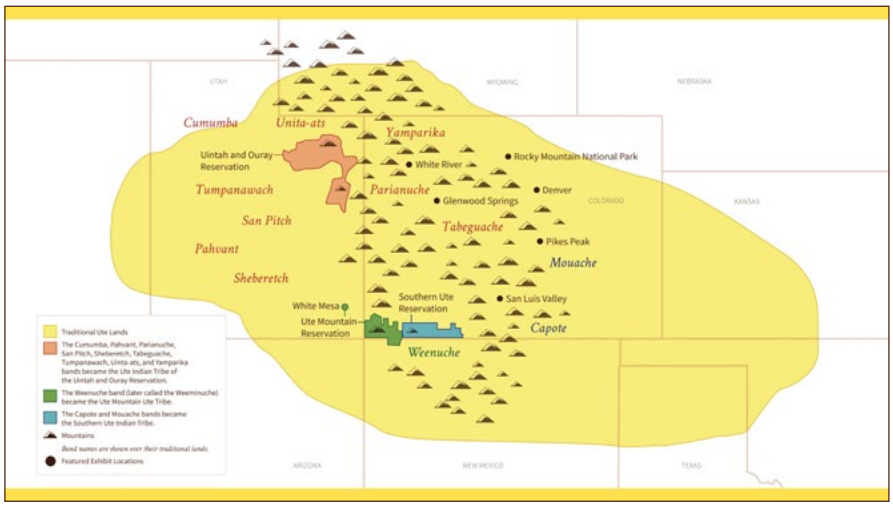
We are excited to share the results of the Ute STEM Project with our partners and our communities, and look forward to the new knowledge that will build on this work.

— Dawn DiPrince
Executive Director & State Historic Preservation Officer
History Colorado


Lu Anne Tyrell

About the Ute people
AND THEIR HISTORY IN COLORADO

This project was primarily focused on exploring the connection between Ute traditional knowledge as it relates to STEM, and sharing a broader background on the Ute people and their local history was also important to provide context. As we began to engage with the public through exhibit and educational materials development, it became apparent that Coloradans were highly interested in learning more about Ute history and knowledge. This was also supported through project evaluation. As such, background on the Ute people is provided here to offer context for this report. These images and text come directly from the exhibitions created during this project, told in first person just as they are in the exhibitions.



"Our history is written on the land."

—Regina Lopez-Whiteskunk, Ute Mountain Ute Indian Tribe

For generations we lived in bands, consisting of family groups, with distinct territories. All the bands were Ute and shared one language and culture. Today we are three Ute Tribes. Many of us still retain our band identities.

- **Southern Ute Indian Tribe**, headquartered in Ignacio, Colorado (Capote and Mouache)
- **Ute Mountain Ute Tribe**, headquartered in Towaoc, Colorado and White Mesa, Utah
- **Ute Indian Tribe of the Uintah and Ouray Reservation**, headquartered in Fort Duchesne, Utah

We call ourselves Nuuchuu or Nuu'ciu, "the people." Our American Indian neighbors called us by different names. Spanish explorers used a version of those names and called us Yutas, Uticas, or Utacas.

Ute people speak different versions, or dialects, of the same language. Our ancestors spoke this language, but it wasn't written down. In modern times, spellings of the same word vary depending on the dialect that is being recorded.

According to Ute oral traditions, we have lived in the Rocky Mountains and surrounding basins and plains since time immemorial. Archaeological evidence supports our presence here for generations. Some studies indicate that Utes descended from ancient Fremont peoples living in the deserts of Colorado 2,000 years ago. Other research indicates that Utes migrated to Colorado 800 years ago as Puebloan people moved away from villages in the Mesa Verde region.

The Utes created a dense network of trails linking every part of our territory. We created routes over high mountain passes, across deserts, and deep into sheltered valleys. We followed the same paths every year on our seasonal rounds.

Many of today's highways follow former Ute trails. Interstate 70 through Glenwood Canyon and US 285 from Denver to South Park over Kenosha Pass both follow Ute routes.

UTE HISTORY

13,000–7,000 years ago
Earliest archaeological records show people living in Ute homelands.

1000–1500
Utes follow seasonal rounds; trade and raid.

1500–1800
Utes capture horses from Spanish explorers and traders.

1800–1900
US moves into Ute territory; Utes lose most of land through treaties and move to reservations.

1900–1950
Ute children forced to attend boarding schools.

1950 on
Utes form sovereign governments. Utes persevere.

Ute STEM:

A MULTI–GENERATIONAL, MULTI–DISCIPLINARY COLLABORATION PROJECT

Over the course of six years (2016–2022), History Colorado, three Ute Tribes, and archaeology and ethnobotany partners undertook an ambitious, highly collaborative project, called Ute STEM, to explore new ways of looking at the field of Science, Technology, Engineering, and Math (STEM) learning.

Project Objective and Goals

As the oldest continuous residents of Colorado and Utah, the Ute people have long used science, technology, engineering, and math in the form of traditional ecological knowledge (TEK) to survive and thrive in the Rocky Mountains. The project team's objective was to highlight Ute peoples' systematic knowledge of plant use, engineering of wood shelters, mathematical patterns in beadwork, and weaving technology to demonstrate this.

To achieve the project objective, we set out with three primary goals:

1. Advance the understanding of traditional Ute STEM knowledge and elevate the role of today's Ute people as STEM learners and practitioners.
2. Increase lifelong STEM learning across Colorado.
3. Share a replicable model of collaboration between tribes, history museums, and scientists.

We approached the first goal through several years of collaborative archaeology and ethnobotany field work which helped preserve and generate a deeper understanding of Ute traditions, ecology, shelter, and the STEM foundations of Ute art. All field work activities took place in traditional Ute territory in Colorado. The knowledge generated became the foundation of an extensive collection of museum exhibits and educational programming. (Learn more about the field work on pages 10-17.)

To increase STEM learning (goal two), we created a series of ten short films, museum exhibitions at two museums, a statewide, hands-on K–12 education program, online learning, educator trainings, traveling exhibits, and more. (Learn more about the exhibits and programs on pages 20-27.)

The final goal, to share a replicable model, is still underway, and we expect it to continue for some time. Thus far we have done extensive sharing both in person and virtually, with groups and one-on-one, with the public and private entities. Our sharing has taken many forms, including articles, papers, presentations, tip sheets, training materials, online resources, and more. (Learn more about these efforts on pages 34-41.)

"There were Ute scientists before there were scientists. And Ute astronomers before there was astronomy."

—Garrett Briggs, Ute cultural expert, Southern Ute Indian Tribe

2015
- May 2015—Initial grant application not awarded but encouraged to apply again

2016
- October 2016—National Science Foundation grant award, project and evaluation begins

2017
- June 2017—New building and exhibitions at Ute Indian Museum open
- July 2017—Collaborative field work in Montrose, Colorado

2018
- June 2018—Collaborative field work in San Luis Valley, Colorado
- December 2018—Exhibition at History Colorado Center opens
- December 2018—Field work films complete

2019
- July 2019—Collaborative field work in Montrose, Colorado
- Summer 2019—Ethnobotany Garden work at Ute Indian Museum in Montrose begins
- October 2019—K–12 Education Outreach Program launches

Goal 1: Understanding and connecting Ute Indian traditional knowledge and Western science

The goal of the Ute STEM Project was to bring together two knowledge systems. Once viewed as opposites, they are now seen as complementary and valuable approaches to science literacy[1]:

- **Traditional ecological knowledge (TEK)**—Knowledge, innovations, and practices of Indigenous peoples, developed from experience gained over the centuries and adapted to the local culture and environment.[2] TEK is passed down orally from generation to generation and is relied upon for survival. As the project name implies, Ute STEM focused specifically on TEK from Ute Tribes.
- **Western STEM**—An approach to teaching and learning that integrates the subjects of science, technology, engineering, and math (rather than teaching them separately), and focuses on developing higher level thinking skills by connecting classroom learning to the real world.

The project team's overarching objective was to demonstrate the connection between Ute TEK and contemporary STEM practices, and to leverage that connection to develop compelling and exciting ways to engage people of all ages and backgrounds in informal STEM learning. The project builds on other recent efforts to explore these connections.

Goal 2: Encouraging informal STEM learning

People of all ages learn science in an increasingly wide variety of ways, and formal schooling is only one part of a larger ecosystem of STEM learning that also occurs throughout one's lifetime.[3] Studies have shown that people are most likely to engage with STEM learning in an informal setting, and those informal settings are critical to building scientific capacity.

As a result, organizations such as the National Science Foundation (NSF) are working to help advance informal STEM learning by funding related research, innovation, and engagement programs. Ute STEM is one such program and was supported by a $2.2 million National Science Foundation Advancing Informal STEM Learning (AISL) grant over six years. The Ute STEM Project centered informal science learning in a variety of settings: archaeological field sites, history museums, nature centers, and parks.

National Science Foundation

NATIONAL SCIENCE FOUNDATION ADVANCING INFORMAL STEM LEARNING (AISL) PROGRAM

The Advancing Informal STEM Learning (AISL) program seeks to: advance new approaches to and evidence-based understanding of the design and development of STEM learning opportunities for the public in informal environments; provide multiple pathways for broadening access to and engagement in STEM learning experiences; advance innovative research on and assessment of STEM learning in informal environments; and engage the public of all ages in learning STEM in informal environments.[4]

2020

- March 2020—Education Outreach Program goes virtual due to Covid pandemic
- Summer 2020—Ethnobotany Garden work at Ute Indian Museum in Montrose continues
- School year 2020–21—Virtual delivery of Education Outreach Program continues

2021

- May 2021—1-year grant extension granted; Ethnobotany Garden opening and celebration in Montrose
- September 2021—Traveling exhibit completed
- October 2021—Traveling exhibit opens at first venues

2022

- March 2022—K–12 Education Outreach Program re-launch with pilot partners
- June 2022—Celebration at History Colorado
- June–August 2022—K–12 Education Outreach Expansion to 60+ partners across Colorado
- September 2022—Legacy report, evaluation, and films complete

Goal 3: Bringing disciplines and generations of people together

While this project was not the first to explore the intersection of STEM and traditional ecological knowledge, it stood out for its unique mix of participants and partners. Not only did Ute STEM bring together tribes, scientists, archaeologists, museums, and educators, but it also connected generations of tribal youth and elders. Extensive collaboration among all the partners was a highlight of this project and an aspect that was necessary for successful implementation. Partners brought tremendous enthusiasm, respect, grace, curiosity, and passion to this project, and many cited how transformational the experience was. The core partners included:

The Ute Tribes

Today there are three Ute Tribes (Southern Ute Indian Tribe, Ute Indian Tribe of the Uintah and Ouray Reservation, and Ute Mountain Ute Tribe), and their involvement in this project was essential. An important priority was that the Ute people are the experts to explore, observe, investigate, and document their traditional knowledge. Representatives from the three tribes provided invaluable leadership as to how to best preserve traditional Ute STEM knowledge and share it beyond Ute audiences.

This was a highly collaborative project. Representatives, cultural experts, education departments, and elders from each of the three tribes were intimately involved throughout the project, from initial tribal consultation meetings, through field work and guiding of final exhibits and materials. Long-standing relationships and previous successful collaborations between the tribes, History Colorado, and other partners all helped to foster a successful partnership. (Read more about each of the tribes on pages 48-53.)

Dominguez Archaeological Research Group, Inc. (DARG)

Dominguez Archaeological Research Group (DARG) also played an essential role in the project. In fact, the idea for Ute STEM was borne from a collaborative meeting between tribal representatives and DARG in 2014. DARG brought tremendous archaeological expertise and a long history of successful collaboration with the Ute Tribes. Their staff helped plan and lead interactive field work activities and shared extensive knowledge throughout the field work period.

Dr. Kelly Kindscher

Dr. Kelly Kindscher, senior scientist/professor at the University of Kansas, served as the project ethnobotanist and led field work activities to explore and document traditional plants and their uses. He also worked closely with the Ute Indian Museum in Montrose to plan a new ethnobotany garden as part of this project.

History Colorado

History Colorado served as the project lead and staffed a variety of roles, including tribal liaison, field work coordination, exhibit and educational programming development, and grant management.

(Read more about all the partners, as well as the hundreds of hosts, creative teams, volunteers, and other participants involved, on pages 46-59.)

A history museum leading a STEM project

While a history museum may not be an obvious steward for a STEM learning program, History Colorado was in a unique position to make this project possible for several reasons.

First, research has shown that local history museums are well positioned to provide relevant informal STEM

Southern Ute Indian Tribe

Ute Indian Tribe of the Uintah and Ouray Reservation

Ute Mountain Ute Tribe

DARG Dominguez Archaeological Research Group

History Colorado

learning for their communities. Learners in rural and smaller communities, including Native American reservations, often have limited access to engaging informal STEM learning experiences. Museums and their programs can provide those experiences by allowing people to pursue and develop STEM interests, engage in scientific inquiry, and reflect upon their experiences.[5] In fact, just one visit to a museum may result in increased understanding of scientific concepts, arguments, explanations, models, or facts.[6]

Additionally, History Colorado has a track record of developing innovative informal STEM exhibits and programs, such as *Living West*, a core exhibit at the History Colorado Center in Denver, Colorado, which explores the state's environmental history and science through hands-on STEM exhibits about water use, agriculture, and wildfire. History Colorado's El Pueblo History Museum in Pueblo, Colorado also implemented a successful STEM collaboration exploring traditional Hispanic adobe construction and weaving techniques.

Most importantly, this project was based on long-standing relationships and successful collaborations with the project partners. For example, over the past 20 years, History Colorado and the three Ute Tribes have built strong partnerships in the implementation of the Native American Graves Protection and Repatriation Act (NAGPRA). This work has forged deep and enduring bonds between our staff and tribal partners and now serves as a national model for collaboration between tribes and museums. For more information on the synergies between History Colorado's NAGPRA work and exhibition development, listen to our *Lost Highways* podcast at shorturl.at/ejtxB.

The importance of evaluation

The topic of evaluation as it relates to museums might be new to some, while others reading this report may be familiar with it. Simply put, museum evaluation equates to visitor (and potential visitor) studies. Because museums are public facing, it's important to include the voices of the communities and populations we serve in both creating and continually improving the exhibits, programs, and services we provide.

At History Colorado, and especially with longer-duration projects such as Ute STEM, our evaluation efforts are focused on continuous improvement. We're interested in measuring not simply whether a project, program, or exhibition was a success or not, but more so in understanding ways in which it may have shifted awareness, expanded knowledge, and changed behavior.

History Colorado does not employ in-house evaluation staff. However, the size, complexity, and importance of this project necessitated evaluation activities; not to mention, the National Science Foundation grant required involvement of an external Institutional Review Board (IRB) to oversee the evaluation process. To accomplish our goals and requirements for evaluation and external review, we partnered with ExposeYourMuseum LLC, who led evaluation throughout the project and engaged with a trusted IRB.

As lead external evaluator, ExposeYourMuseum LLC's Kate Livingston provided audience evaluation and consultation, including process, front-end, formative, and summative evaluation. They conducted four distinct types of evaluation:

1. Process (evaluation of the project team's processes and ongoing learning)
2. Field work
3. Museum exhibitions (with emphasis on Ute STEM interactive exhibits, including traveling exhibits)
4. Public programs and education outreach (including the History Take-Out program)

Throughout the project, Livingston worked alongside the project partners to ensure evaluative thinking and practices were embedded and provided ongoing consultation to ensure all elements of the evaluation remained reflective, responsive, and culturally informed.

Evaluation efforts centered around four primary audiences, with different measurable learning outcomes for each:

- **Ute youth and adults**, who are underrepresented in STEM learning and professions, who participated in the Ute STEM Project as STEM learners, educators, and practitioners as well as cultural experts.
- **Family and adult learners** who were served by exhibits, public programs, and education outreach.
- **K–12 learners and educators** who were engaged through programs focused on STEM and developing 21st-century skills.
- **Tribal educators and consultants, museum staff, scientists, and informal STEM educators** who engaged with the Ute STEM partner team through various sharing opportunities.

Learn more about different aspects of the evaluation process under the Measuring Results headings throughout this report.

History Colorado/Gen9 Productions

"I don't know all the answers, but I do know some of the things I've been told about my elders about some of these areas. That's why we work together to exchange ideas, exchange information."

—Alden Naranjo, Ute cultural expert, Southern Ute Indian Tribe

Collaborative field work

leads to new knowledge, deep sharing, and transformational experiences

Goal 1: Advance understanding of traditional Ute STEM knowledge and elevate the role of Ute people as STEM learners and practitioners

The first major element and critical underpinning of this project was a more than two-year period of collaborative field work that brought together tribal cultural experts from three Ute Tribes, Ute youth, scientists, and History Colorado staff. Most of the field work was completed in the summers of 2017 and 2018.

The core project team designed these field work activities to support the first of three major goals for this project: *"To advance understanding of traditional Ute STEM knowledge and elevate the role of Ute people as STEM learners and practitioners."* The knowledge shared and gained, participants' experiences, program evaluation, and extensive video footage from the field work ultimately became the foundation of new exhibits and educational programs developed and delivered later in the project.

A multi-generational, multi-disciplinary team collaborates

Each field work session involved about 30–40 people, including Ute youth, Ute elders, scientists, land managers, History Colorado staff, a film crew, and the project's external evaluator.

Central to the field work approach was visiting cultural sites together so that Ute elders could share traditional knowledge with the scientists, History Colorado, and most importantly the next generation of youth. For many of the youth, this was the first time visiting places where their ancestors had lived, and it was a unique opportunity to learn about traditional ecological knowledge from their elders.

By including scientists such as archaeologists and ethnobotanists in the field work, participants were also able to learn about and engage in hands-on scientific research. This exposure to both traditional and scientific fields of study simultaneously allowed the youth to develop their own conclusions and connections between the skills and knowledge of their ancestors and modern-day STEM concepts.

Connecting to ancestral places

The field work took place on the ground in traditional Ute territory, around the areas of Montrose in western Colorado and the San Luis Valley in southern Colorado. Together, the field work team visited numerous historical Ute sites, many of which are now on US Forest Service and Bureau of Land Management lands.

At these sites the Ute youth, Ute elders, and scientists worked together to document evidence of Ute use of the landscape such as trails, traditional shelters (called wickiups), culturally modified trees, edible and medicinal plants, and artifacts in the Ute homeland. Throughout the activities, we explored the correlation between Ute traditional ecological knowledge and STEM (for example, how traditional shelter building required an understanding of engineering concepts).

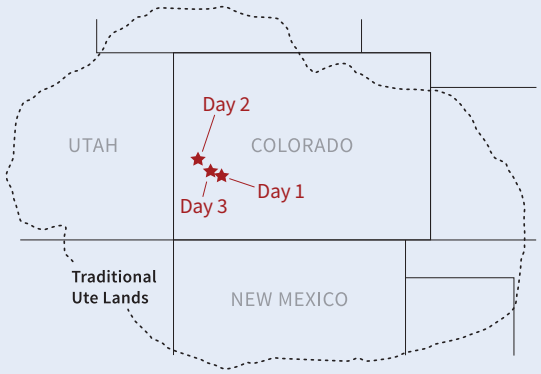
An important experience for all

The project evaluation demonstrated that field work was inspiring for everyone involved. Tribal youth expressed interest in and enthusiasm for their experiences, especially since most had never visited an archaeological site where their ancestors lived. Tribal cultural experts appreciated the opportunity to impart traditional knowledge to Ute youth. And, archaeologists acquired new insights into areas they had previously studied.

Year 1: Archaeology field work in Montrose, summer 2017

When: July 26–28, 2017

Where: Montrose, Colorado



Day 1—Ute Indian Museum, Montrose, Colorado
Day 2—Decker Big Tank Wickiup Village, Uncompahgre Plateau, Rio Blanco County, Colorado
Day 3—Shavano Valley Rock Art Site, Montrose, Colorado

Who:

- 12 Ute youth
- 11 Ute adults and elders
- 4 History Colorado staff
- 7 Dominguez Archaeological Research Group (DARG) archaeologists and researchers
- 3 Bureau of Land Management (BLM) staff
- 3 Ute Indian Museum/ Shavano Rock Art Site volunteers
- 2 film crew members
- 1 external evaluator

In the summer of 2017, our group comprised of Ute elders, Ute youth, and archaeologists met near Montrose, Colorado to visit historic Ute Indian cultural sites. They explored and documented traditional Ute structures, rock art, culturally significant trees, and remnants of historic campsites. Knowledge shared informed interactive exhibits and short films which were completed later in the project.

An introduction to traditional Ute territory and culture at the Ute Indian Museum

A visit to the Ute Indian Museum in Montrose, Colorado kicked off the project's 2017 field work activities. The museum, one of History Colorado's 11 museums and sites, was originally built in 1956 near the ranch of Uncompahgre leader Chief Ouray and his wife Chipeta. Youth were eager to learn about Ute culture and history from their elders and were inspired by the use of drones for archaeological research, among other methods and tools. The activities provided an excellent foundation for more in-depth field work to follow.

Exploring traditional Ute structures at the Decker Big Tank Wickiup site

Our field work team hiked their way to the top of the Uncompahgre Plateau to their next site, the Decker Big Tank Wickiup site, to learn about and document Ute lodges, triangle-shaped stick structures, historically used for shelter and storage, and sometimes called "wickiups." The site is one of the earlier Ute campsites recorded to date and the

group explored numerous standing wickiups, some dating back to the 1790s.

Ute cultural expert Terry Knight Sr. of the Ute Mountain Ute Indian Tribe explained how the Ute people would have used such a site: *"That's where they stayed. Because we lived outside. The Ute people lived outside. Only when it got bad would they seek shelter."*

The youth responded with interest. *"I thought we lived in tipi shade houses…but then looking at this, I didn't notice we were mountain men before the reservation,"* shared Odis Chapoose, of the Ute Indian Tribe of the Uintah and Ouray Reservation. *"It just makes me feel like our ancestors were smarter,"* said Kalynn Weaver, of the Southern Ute Indian Tribe.

A discussion about how to visit ancestral sites with respect also left lasting impressions on the youth. Ute cultural expert Cassandra Naranjo Atencio of the Southern Ute Indian Tribe explained *"The poles themselves, some of them are lying on the ground, so be careful where you walk and pay attention. Don't cross over them. You walk around them. Those are homes and shelters that our people put up a long time ago. So, you have respect for them."*

Archaeologist Curtis Martin with the Dominguez Archaeological Research Group (DARG) rounded out the conversation with an archaeology perspective. He explained how the village was first recorded in 1978, and shared observations he and DARG have made since then. *"It was the dead part of this tree that we took a tree ring date out of and got our date of 1795. Seven years ago, this pole was still standing, and that's what's happening to them. Once they're on the ground…they deteriorate real fast,"* he shared.

Participants learned about various methods and tools archaeologists use to record sites, including making maps and drawing artifacts, and then leveraged that knowledge to document changes to the site since its last recordings seven years ago.

Understanding the importance of rock art in the Shavano Valley

Field work also took the team to an extensive Ute rock art site in the Shavano Valley, just west of Montrose in the ancestral homeland of the Uncompahgre Ute. It contains one of the most important concentrations of rock art in western Colorado, with 37 panels dating back more than a thousand years.

This site was an opportunity to gain a deeper understanding of the importance of respecting and preserving rock art. Ute cultural expert Terry Knight Sr. of the Ute Mountain Ute Tribe explained that ancestors would make *"…a certain mark that says something about that individual, that family, and the environment they're in…"*

Participants witnessed a wide variety of subjects depicted by the art, including human figures carrying bundles or tools, bears leaning against trees, and maps of the Uncompahgre Plateau including hunting or traveling trails marked with dotted lines. Betsy Chapoose, of the Ute Indian Tribe of Uintah and Ouray Reservation, explained how the depictions might be difficult to understand, *"…because they're from different time periods and different things were happening in those time periods. But because they're all here, this was a very important place."*

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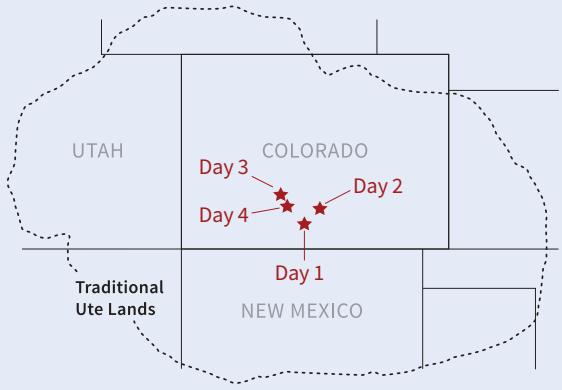
Year 2: Ethnobotany field work in the San Luis Valley, summer 2018

When: June 11–14, 2018

Where: San Luis Valley, Colorado



Day 1—Adams State University, Alamosa, Colorado
Day 2—Great Sand Dunes National Park and Fort Garland, Colorado
Day 3—Carnero Canyon, Rio Grande National Forest, San Luis Valley, Colorado
Day 4—La Ventana Arch, Rio Grande National Forest, San Luis Valley, Colorado

Who:

- 5 Ute youth from Southern Ute Indian Tribe*
- 4 Ute adults and elders
- 3 tribal staff/tribal family members
- 5 History Colorado staff
- 2 ethnobotany staff
- 4 Dominguez Archaeological Research Group (DARG) staff
- 3 National Park Service and US Forest Service staff
- 2 film crew members
- 1 external evaluator

*Last-minute extenuating circumstances prevented Ute Mountain Ute Tribe and Ute Indian Tribe of the Uintah and Ouray Reservation from sending youth participants

2018 field work activities took place in the San Luis Valley in southcentral Colorado, another traditional Ute territory, to focus primarily on ethnobotany. A group of Ute elders, scientists, and Ute youth visited several sites to discuss and record how Ute people traditionally used different grasses, plants, and trees. Ethnobotany field work findings informed a new ethnobotany garden at the Ute Museum in Montrose as well as interactive exhibits and short films which were completed later in the project.

Exploring culturally modified trees in the Great Sand Dunes National Park

One site visited was Indian Grove, located within the boundaries of the Great Sand Dunes National Park and Preserve. It's a stand of about 200 ponderosa pine trees, of which 72 trees have been culturally modified, meaning altered by people. This was a traditional hunting and gathering site of the Ute people and they learned to peel the outer bark of ponderosa pine to reach the soft inner bark which could be eaten or used for weaving. Evidence suggests that these trees were primarily peeled between 1815 and 1846.[7]

Ute cultural expert Alden Naranjo of the Southern Ute Indian Tribe explained that *"A lot of our people did this, a lot of the Ute bands peeled trees…And women were the ones that did this. They knew how to take all that bark off and use it. Because when you're coming out of eating dried fruit, dried meat all winter long, this helps your digestive system. So that's why they would do the peeled trees in the spring."*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US Forest Service archaeologist Angie Krall explained the agency's commitment to protecting the trees: *"These are nice, still living trees…They're pretty special...When we do prescribed burns or get a fire start in this country, we acknowledge that these are the last of these trees…I call them an organic cultural resource. So, we have a protocol… that we protect these...They really are the last and I still want to show you guys these trees as long as we can."*

Learning traditional basket-making with pine needles and yucca

After collecting pine needles from the Great Sand Dunes site, Ute cultural expert Cassandra Naranjo Atencio of the Southern Ute Indian Tribe instructed participants in making pine needle baskets: *"They used to take some of these brown ones or green ones and soak them, and they would process that yucca plant and make string out of it. You process the leaves of that yucca plant, scrape it all down, put it in water."*

Ute Indian Museum director and carekeeper CJ Brafford expanded on the lesson: *"…he'd go with his grandmother and they would get sap from the tree. She'd take the sap and she'd heat it and they'd take dirt clods and put it in there. It was like making a glue. When they'd make the water jugs, that's what they would coat the inside with. Once they used the willow to make the structure of the vessel, they would take the sap, his grandmother would pour it in there with the dirt clods and some rocks. They would shake it back and forth and it would coat the inside and then they would do the outside."*

Understanding times of conflict at Fort Garland

A visit to the Fort Garland Museum and Cultural Center brought to light a time of great conflict between the Utes and settlers during American expansion into the West.

Ute cultural expert Alden Naranjo of the Southern Ute Indian Tribe noted that the stated US decision to build the fort was *"To keep the marauding, savage, bloodthirsty Utes at bay...to keep the Capute band from raiding the Mexican settlers...from stealing the livestock."* Mr. Naranjo provided the Ute perspective: *"The reason they stole horses, cows, and livestock is because settlers had killed most of the natural game."* He explained that Fort Garland was intended to be a distribution point for supplies such as food, blankets, and livestock that were promised to the Capute (one of the bands that make up the Utes) via treaties. However, *"All the material things the government had promised them were never distributed. The agents in the Army here sold the livestock that was supposed to be for the Capute band…and made profit on that,"* he explained.

While at the Fort, Ute cultural expert and archaeologist Garrett Briggs of the Southern Ute Indian Tribe led a stone tool-making activity with the youth. This was an important lesson in preparation for the following day's visit to an archaeological site. Project ethnobotanist Kelly Kindscher led the youth in an activity to preserve plant samples for later study.

Exploring Ute campsites in Carnero and Penitente Canyons

Field work activities also took the group to historic Ute encampments in Carnero and Penitente Canyons in the Rio Grande National Forest, which offered numerous opportunities to observe and discuss Ute usage of the area, including plants, trees, stones, and rock art.

Ute cultural expert Alden Naranjo of the Southern Ute Indian Tribe explained the importance of making offerings when taking plants from the land: *"…if we were going to come up here and pick this pinyon, we made offerings to say thank you for we're going to take some of this here to nourish ourselves, our families, our elders, and little children. That's why I made this offering for each of us so we could see this and remember our people."*

Ethnobotanist Kelly Kindscher reiterated the importance of learning about traditional plants: *"I think not only plants are interesting, but they're an important part of whoever lives here. We're all connected to place. And learning what they are, how to use them, how to protect them, how to manage them, I think connects all the people to where we're at."*

Understanding La Ventana Arch's importance

The group's final site visit was to La Ventana Natural Arch in the Rio Grande National Forest, a site considered sacred to the Ute. The US Forest Service presently manages it as a traditional cultural property[8] because of significance to Indigenous peoples.

Ute elders explained the arch's significance in cultural ceremonies and as a rendezvous location. The site also provided an important background for discussions about the juniper tree, also called a cedar, which was another important resource for the Ute people in addition to the ponderosa pine. Ute cultural expert Terry Knight Sr. explained common uses for the bark: *"They used to use it to weave, like for your sandals. They wrapped it in buckskin and put it in the cradleboard to give it that good cedar aroma. They also used the bark for the saddles. They put that bark between deer hides maybe a couple inches thick. That was their saddle pad,"* he explained.

Our group heard from the US Forest Service about efforts to interpret and protect the site, and everyone helped with land restoration in a damaged area.

History Colorado

Jazmin's story: *You can totally feel our ancestors there*


History Colorado/Gen9 Productions

"Really emotional… amazing," are a few ways that 17-year-old Jazmin Carmenoros described her experience participating in field work activities. She was one of five youth from the Southern Ute Indian Tribe on the 2018 field work team in Colorado's San Luis Valley.

After hiking to a historic Ute encampment in Carnero Canyon, Jazmin found herself getting emotional. *"You can totally feel our ancestors there and you can feel it in how much they loved that spot. It felt amazing…you felt them. It made me feel stronger about the Ute woman I am,"* she shared.

Jazmin found learning about her culture to be both fun and inspiring. *"The peeled tree was definitely one of the newest things I've seen because I've never seen one of those until this trip,"* she shared. Both the Ute elders and US Forest Service staff had unique information to share about the Utes' practice of peeling the ponderosa pine tree and their various uses for it. Jazmin learned from elders that peeling the bark *"was a women's chore."* And from US Forest Service archaeologist Angie Krall she learned that a handful of the inner bark, called cambium, *"has 9 glasses of milk worth of calcium in it."*

Interactions like these, with elders and scientists alike, while on ancestral land, made an impression on Jazmin. *"Just knowing that Ute women did it was pretty cool too. And, why they did it…to get some sweetness or calcium to make their bones healthier,"* she shared.

"With two different sides you hear two different stories."

It also helped her see and appreciate the connection between traditional knowledge and Western science. *"With two different sides you hear two different stories. Our elders have been taught this way and they know this way. Then the scientists are really smart and book people. Putting those two together equals a really strong story and facts,"* she shared.

FROM THE EXHIBIT FLOOR:

Ute structures and engineering

Ute structures, called wickiups, are one example of Ute traditional knowledge the collaborative field work sought to explore, document, and connect to STEM learning. During site visits, elders shared their knowledge and archaeologists shared their history studying the areas. Video footage of the visits along with many one-on-one interviews were used to inform, design, and develop numerous project deliverables, including a short film, an interactive activity exhibit, and teaching materials for educators. From a STEM perspective, each of these is intended to help people make the connection that the Ute people utilized engineering concepts to build their structures. Here are a few examples of the resulting exhibits and materials.

In this brief film, Ute cultural experts explain the importance of wickiups to the Ute people. The film is one of ten developed and is on display in the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado, the Ute Indian Museum in Montrose, Colorado, traveling exhibits, and on the internet for use by educators across the state. See this and all the films developed at **h-co.org/utestemplaylist** or **h-co.org/stemvideos**.

History Colorado/Gen9 Productions

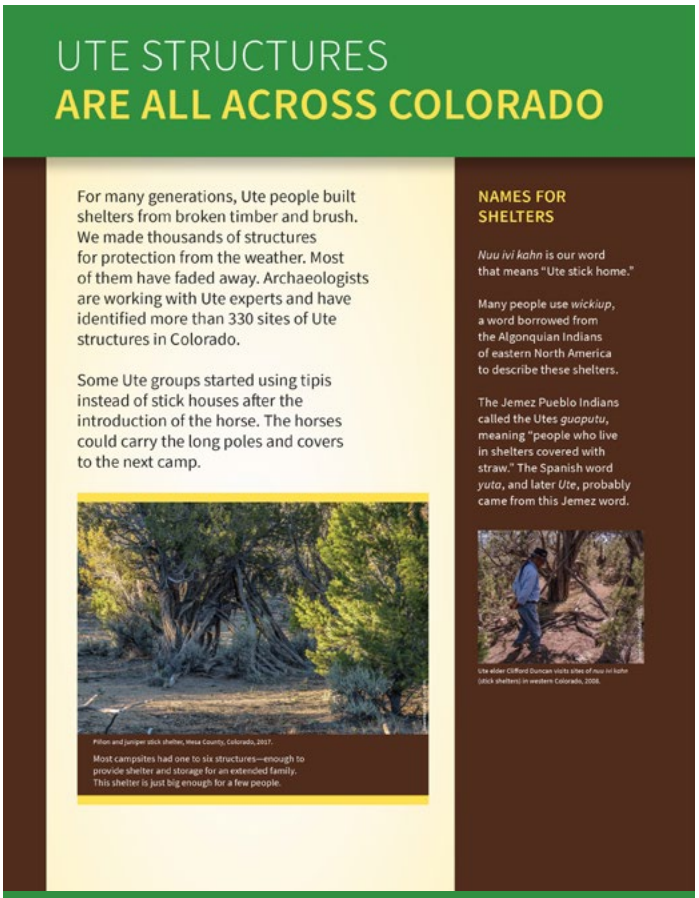
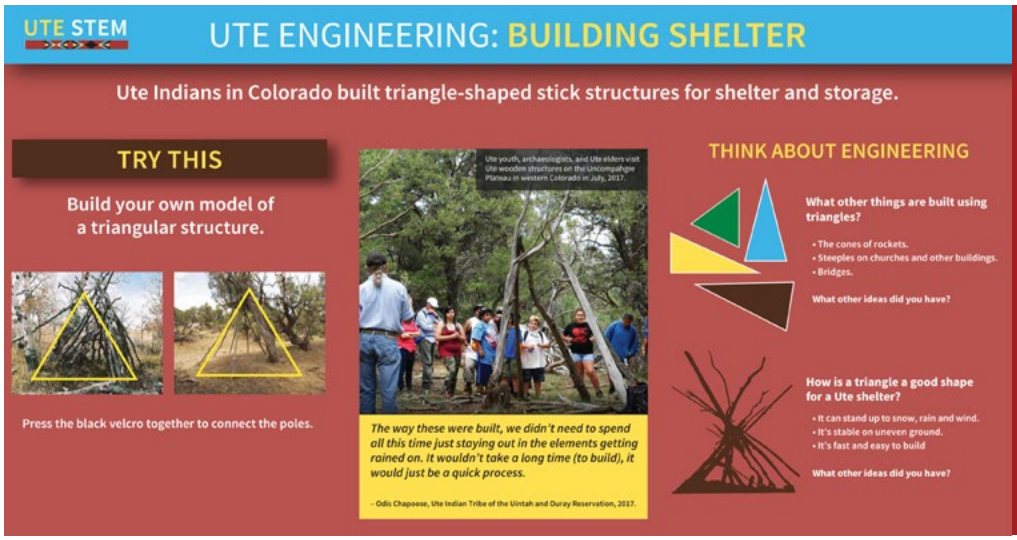


Exhibit graphics highlight how Ute traditional knowledge and Western archaeology work together to build knowledge about Ute structures (wickiups). These graphics are part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado as well as the Ute Indian Museum in Montrose, Colorado.

History Colorado



Instructions for an interactive Ute STEM activity on shelters. This interactive activity is part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado. It is also included in a traveling exhibit, and in Ute STEM History Take-Out kits used by educators and partners across Colorado.

History Colorado

BEHIND THE SCENES Q & A:

Making collaborative field work happen


History Colorado/Gen9 Productions

History Colorado project organizers Liz Cook, Shannon Voirol, and Sheila Goff share insights into what it took to coordinate the collaborative field work part of the project.

Q. How was tribal consultation part of the field work planning process?

A: History Colorado is a state agency, therefore we have a formal government-to-government relationship with each tribe. Prior to this project we had conducted other work via this relationship such as NAGPRA compliance, and we continued to use the same formal consultation approach. That involves contacting tribal leadership and asking who you should work with. Tribal leadership then designates tribal representatives who participate and speak on behalf of the tribe. We took this approach with each of the three Ute Tribes and representatives from each were designated to work on this project. We were also connected with the education departments for each tribe.

Along with the process of formal consultation was making sure to go through formal channels (for example, formal invitation letters to tribal chairmen) to invite attendees to any of the events—consultation, field work, exhibit openings, and celebration days—that included tribal partners. This was important in acknowledging tribal sovereignty and our government-to-government relationship.

Q. How were the field work sites and experts selected?

A: This was a highly collaborative process involving all the project partners. Every partner had some prior experience with each of the sites that were eventually selected. Several sites were recommended by Dominguez Archaeological Research Group (DARG) and the US Forest Service, while others were recommended by the tribes. The museums visited were a natural fit given their connection to History Colorado. In the end, every decision regarding where to go involved speaking with tribal representatives from the three Ute Tribes.

Q. Is there anything you wish you knew before embarking on the process?

A: Having relationships with the site hosts (caretakers of the lands) is one of the most important elements to have in place. Visits to the sites where one or more of the partners had existing relationships were the most productive and rewarding.

Q. Were there any unexpected challenges during field work and how were they overcome?

A: The ratio of adults to youth was opposite of what we expected. We originally planned to engage many more youth, however recruiting large numbers proved to be challenging. In the end it worked out just fine, if not for the better because of the deep experiences had by the youth (and everyone) due to smaller groups and more intimate interactions with tribal elders and scientists.

Q. Did you have any "aha" moments?

A: Let the tribal elder speak first and the scientist second. We learned this the very first site visit and everyone agreed that elders should be the experts talking to the youth about what they know, and then the scientists fill in.

Q. How was the field work transformational?

A: It was so incredibly powerful to see the youth engaging with tribal elders and scientists. Likewise, seeing scientists working alongside tribal elders, both learning and listening. The very open, collaborative nature of the interactions was truly impressive. Additionally, to physically be present on ancestral lands was so important to the youth and their elders. The youth walked away with that sense of "this is our place, we were here."

MEASURING RESULTS:

Field work takeaways

Evidence of specific outcomes were measured throughout the project by Denver-based external evaluator Kate Livingston (ExposeYourMuseum LLC). Field work evaluation consisted of observation, interviews conducted and filmed during field work to capture immediate feedback, and follow-up phone interviews four to six weeks after field work. A few highlights from field work evaluation findings included:

- Participants appreciated seeing and sharing new perspectives, gaining in-person connections to sites and people, and ideas for new approaches or methods. Youth often valued information they had learned or memories of seeing wickiups or petroglyphs.
- After field work, several scientists checked facts they had shared or sought more input on information shared by Ute tribal members. Youth and adults were interested in learning more about history and culture, and some were inspired to seek similar experiences (such as finding wickiups on other property).
- Participants reflected on how each group brought unique contributions. Ute tribal members were thought to offer lived experience, direct ties to the past, authenticity, respect, nuance, and detail. Scientists were considered contributors of research, scientific rigor, mastery of methodologies or techniques, depth, and detail. Museums and museum staff were perceived as having the ability to connect with a broader audience. History Colorado was seen as a platform for sharing information about Ute culture and history with the public.
- Discussions were seen as a positive method of gaining a fuller picture. Likewise, the project offered methods for overcoming barriers between separate tribes, and separation between Indigenous people and scientists. Some felt the project helped to legitimize archaeology as a pursuit for youth, whether in academia or future careers.

"Participants reflected on how each group brought unique contributions."

- At times Ute and non-Ute adults alike felt uncomfortable during moments where scientists were questioned, or power and authority conventions were challenged. That said, they typically felt these moments were important for growth and progress as well as to the partnership and collaboration between Ute tribal members, scientists, and museum staff. Some considered ways to better support tribal members or allow greater space for discussion.

"I want to learn about more of my culture. Like how my culture goes back to the first Native Americans…"

—Ute youth, 2017 field work

"If we look at the past—of how [others] viewed Indigenous peoples as relics of the past or as simply specimens to be analyzed. And I think that nowadays with the collaboration between archaeologists, scientists, academics, elders, and youth, it's very important because it provides an opportunity for groundwork to be laid to correct the mistakes of the past but also to open up the doors of the future looking at different types of research questions, [how oral tradition can] help advance the knowledge about the Utes."

—Ute archaeologist, 2017 field work

"It's the transference of knowledge from elder to younger but also, to me, land manager. I relish those very rare opportunities, and I feel like I gained more than I gave out there… Just that ability to transfer such deep and substantive knowledge of land and landscape and culture on that same land. It's pretty unforgettable."

—Forest Service land manager participant, 2018 field work

History Colorado

"Making a tipi is engineering. [Beadwork] patterns are math."

—History Colorado museum visitors, 2019

Videos, exhibits, and programs

elicit new ways of thinking about STEM

Goal 2: Increase lifelong STEM learning across Colorado

The second major piece of this project was to develop the learning resources—exhibitions, videos, school programs, and even a garden—that would help the project team achieve the goal of **"Increasing lifelong STEM learning across Colorado."** That meant taking all the field work, video footage, interviews, conversations, and more, and translating them into engaging and educational experiences and resources. All these resources needed to share Ute traditional knowledge effectively and culturally, as well as Western STEM and the ways the two are connected, with a broader, public audience.

Captivating videos provide personal connections to Ute lands and knowledge

Videographers recorded more than 40 hours of interviews and activities throughout the 2017 and 2018 field work activities. The edited footage became ten short videos that provide viewers with an incredible first-hand experience to see and hear Ute youth, Ute elders, and scientists share knowledge, thoughts, and emotions from their visits to Ute lands around Colorado. We incorporated these videos into the museum exhibits and made them available to the public and educators via several online resources. The videos are grouped into topical areas, including:

- Ute Knowledge & Science—Three videos in which Ute elders and scientists discuss and share knowledge of historic Ute sites in western Colorado, filmed summer 2017.
- Ute Ethnobotany in the San Luis Valley—Three videos highlight Ute Indian traditional knowledge and use of plants, filmed in the San Luis Valley of southern Colorado in summer 2018.
- Ute Youth Voices on Traditional Knowledge & Science—Three videos in which Ute youth talk about the integration of traditional Ute knowledge and STEM practice, and the importance of preserving historic sites, filmed summer 2017 and summer 2018.
- Ute Ethnobotany Garden—This video tells how the Ute Indian Museum's garden was replanted with native plants important to the Ute people, and includes interviews with Ute tribal members, master gardeners, and museum staff.

View these videos at h-co.org/utestemplaylist or h-co.org/stemvideos.

Additionally, field work footage was later used for a Rocky Mountain PBS program, *"The Wickiup Investigation,"* on the collaboration between project partner, Dominguez Archaeological Research Group, Inc. (DARG), and the three Ute Tribes.

Exhibits tell the Ute story and explore STEM connections

Ute Indian Museum *Written on the Land: Ute Voices, Ute History* Exhibition

The first resource finalized was an expansion of and completely new exhibits at the Ute Indian Museum in Montrose, Colorado, an effort that was underway before Ute STEM field work began. The 2,200 square foot permanent exhibit opened in 2017 and focuses on the relationship between Ute people and the Rocky Mountains. It is broken into nine thematic sections highlighting the Ute history of different locations in Colorado and Utah. The exhibit introduces the concept of "cultural landscapes" that is explored through 60 graphic panels, 30 artifact cases, and four video mini-theaters.


History Colorado

Written on the Land: Ute Voices, Ute History is purposefully told from the perspectives and in the voices of today's Ute people to help reinforce the message that the Ute are still here today.

We implemented the exhibits in two phases: the core exhibits about Ute history opened in 2017, and Ute STEM elements opened in 2021. Several of the initial core exhibits formed the foundation for the future Ute STEM-specific exhibits, including:

- Interpretation and artifacts related to cultural landscapes, TEK (traditional ecological knowledge), and ethnobotany to speak to future ethnobotany exhibits.
- Baskets used for storing water, gathering berries, and preparing seeds to speak to the technology of baskets.
- Cases of beaded artifacts to speak to the mathematics of beading.

In May 2021, we added Ute STEM exhibit elements, including videos of the 2017 and 2018 field work, interpretive panels, and interactive elements on ethnobotany, basketry, wickiup engineering, and beading.

Learn more about the Ute Indian Museum in Montrose, Colorado at h-co.org/ute-indian.

History Colorado Center *Written on the Land: Ute Voices, Ute History* Exhibition

Using much of the same content from the Ute Indian Museum, we developed a long-term exhibition, *Written on the Land: Ute Voices, Ute History*, which opened at Denver's History Colorado Center in December 2018. Similarly, the Denver exhibition shares extensive information about the Ute people and their relationship to the Rocky Mountains.

Like its sister exhibition in Montrose, *Written on the Land: Ute Voices, Ute History* features a Ute STEM section with videos highlighting the 2017 and 2018 field work and four interactive exhibit stations. We specifically designed this section to look distinct from the rest of the exhibition and visitors are greeted by a STEM-specific welcome panel as they enter the space.

History Colorado

A guiding quote for the videos and interactives came from Ute cultural expert and archaeologist Garrett Briggs of the Southern Ute Indian Tribe: *"There were Ute scientists before there were scientists. And Ute astronomers before there was astronomy."* This quote provided a framework for always leading with STEM principles, followed by Ute traditional knowledge, in exhibit text and interactive activities. Additionally, Ute representatives agreed that the materials in the interactives should be scientific models of Ute STEM concepts, rather than exact replicas of Ute work. They felt this approach could help expand non-Ute and Ute visitors' ideas of STEM to include Ute knowledge.

The resulting interactive exhibits represent each letter of STEM: science, technology, engineering, and math, and have the same basic construction and general organization:

- Ute Science: Plant Uses and Biology—visitors can turn triangular blocks with pictures of plants from different land elevations such as Yampa and rice grass, to uncover "science notes" and "Ute uses."
- Ute Technology: Weaving Solutions—visitors can explore different weave structures using vessel models constructed from plastic tubes, mesh, and plastic pebbles.
- Ute Engineering: Building Shelter—visitors can build a model of a Ute structure using tent stakes for the poles and Velcro for the string.
- Ute Mathematics: Patterns and Beadwork—visitors can count out and assemble paperboard rows of patterns to make designs similar to those used in Ute beadwork.

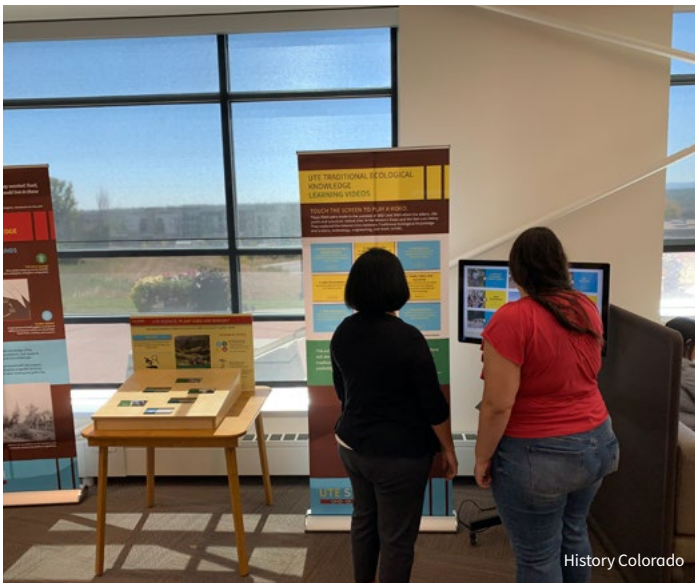
Learn more about the Denver exhibition at h-co.org/written-land.

Ute Knowledge Portable Exhibits extend learning to tribes and Colorado communities

To extend this unique learning opportunity to as many people as possible, especially in rural parts of Colorado, we developed a portable exhibit. We specifically designed it to be easy to transport, lightweight, and simply packaged. Using repurposed graphics, the portable version includes much of what is found at the stationary museum exhibits, and includes:

- 6 pop-up banners with information on Ute lands, seasons, traditional knowledge, and about the Ute STEM Project
- Touch screen monitor with all 10 exhibit videos on it
- 4 hands-on interactive stations with the same activities as the museums (science of plants, technology of weavings, engineering of wickiups, and math of beadwork)

The portable exhibit components are easily boxed or folded up, and everything fits comfortably in a small SUV. The entire exhibit is easy to set up.



History Colorado

We created six copies of the portable exhibit which can be rented or borrowed, and they reside with and are managed by the following groups around Colorado:

- Southern Ute Indian Tribe (Southern Ute Museum)
- Ute Mountain Ute Tribe (Education Department)
- Ute Indian Tribe of the Uintah and Ouray Reservation
- History Colorado Community Museums (El Pueblo History Museum, Fort Garland, Trinidad)
- Ute Indian Museum
- History Colorado Center

Several locations have already hosted one of the portable exhibits, and several more are scheduled, including:

- Red Rocks Community College Arvada and Lakewood Campuses, October–November 2021
- CSU Spur (free educational destination in Denver) opening events, January 2022
- Rocky Mountain Biological Laboratory in Crested Butte, June–August 2022
- Summit Historical Society in Dillon, June–August 2022

Learn more about the Ute Knowledge Portable Exhibits at h-co.org/uteknowledge.

UTE INDIAN MUSEUM WRITTEN ON THE LAND: UTE VOICES, UTE HISTORY EXHIBITION:

More than
77,000 visitors
since 2017

HISTORY COLORADO WRITTEN ON THE LAND: UTE VOICES, UTE HISTORY EXHIBITION:

More than
124,000 visitors
since 2018

TRAVELING EXHIBITS:

More than
29,000 visitors
reached since 2021 at seven host museums, colleges, and visitor centers

Ute Ethnobotany Garden brings Ute plant knowledge to life

Based on findings and knowledge shared during ethnobotany field work, we took the opportunity to restore an original 1990s garden at the Ute Indian Museum. Funding for the effort came from this Ute STEM Project as well as other contributors, and a volunteer task team led the project. The Ute Indian Museum's team of volunteers and staff were able to build on the garden's existing layout, including gravel paths, areas of shade and sun, a seating area encircling a peace pole, and a foot bridge spanning a space between a very small pond and its outflow leading to the nearby Uncompahgre River.

All the non-native plants were removed and replaced. The team spent many hours researching plants used by the Utes in western Colorado. They studied native plant resources, consulted with subject matter experts, including project ethnobotanist Dr. Kelly Kindscher and interviewed members of the Ute Tribes. The resulting list of plants included only those species native to Montrose County where the museum is located and where the Utes traveled when following the seasonal plant blooms. A team of more than 40 volunteers helped with plant removal and installation.

Finally, we added interpretive signage to highlight the Ute STEM Project and explore Ute plant uses for food, medicine, textiles, dyes, and soap. The Ute Ethnobotany Garden at the Ute Indian Museum opened in May 2021 with a celebration with community members and Ute Tribe representatives. Complementary public programming and K–12 field trip curriculum are currently being developed.

Learn more about the Ute Ethnobotany Garden and its evolution at h-co.org/ute-garden.

K–12 education programs bring interactive Ute STEM learning into the classroom

To reach K–12 learners across the state, we added a module to an already successful History Colorado K–12 program called History Take-Out.

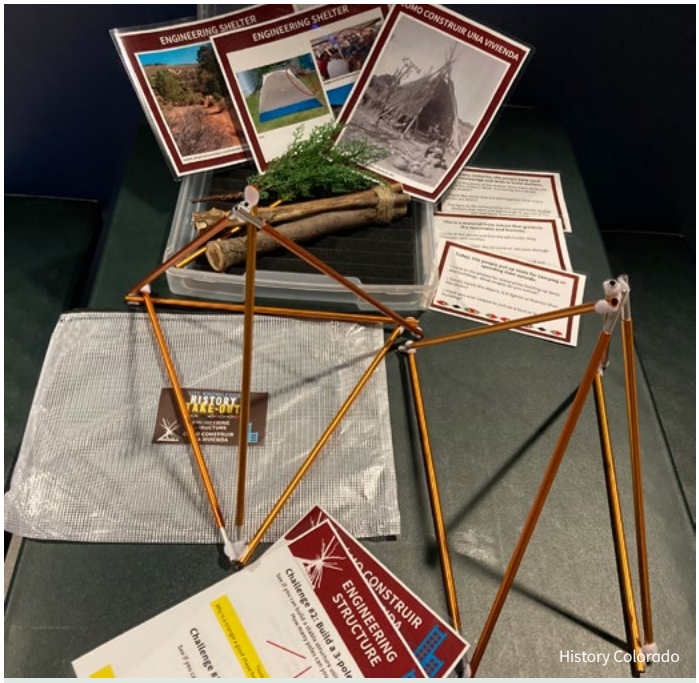
Underneath the History Take-Out umbrella, we launched a new Ute STEM Take-Out program and "kit," Ute Knowledge: Colorado's Original Scientists History Take-Out program, in fall 2019 with several pilot partners. Educators from History Colorado museums and dozens of partners deliver a one-hour hands-on program about Ute STEM on-site at schools, museums, and libraries across the state.

UTE ETHNOBOTANY GARDEN:

More than **20,000 visitors** since 2021

Mary Menz

The program meets 4th Grade history, math, and science standards (see h-co.org/utestem-standards). The kits are highly portable, and all components fit into a single rectangular carrying tote. Inside are numerous interactive activities, all modeled after the Ute STEM exhibit interactive stations, which students use to investigate how the Ute Indians used science, technology, engineering, and math to live and thrive in the Rocky Mountains.



History Colorado

29,000+ learners
reached in-person pre-Covid

3,100+ learners
reached via virtual field trips during Covid

15,000+ learners
reached in-person Sept 2021–Sept 2022

110 Ute Knowledge History Take-Out kits given to:

- Southern Ute Indian Tribe, Ute Indian Tribe, and Ute Mountain Ute Tribe education partners
- Title VI—Indian, Native Hawaiian, and Alaska Native Education programs across Colorado
- 90+ tribal, museum, library, school, and park partners
- 44 (of 64) Colorado counties and 2 kits to Utah

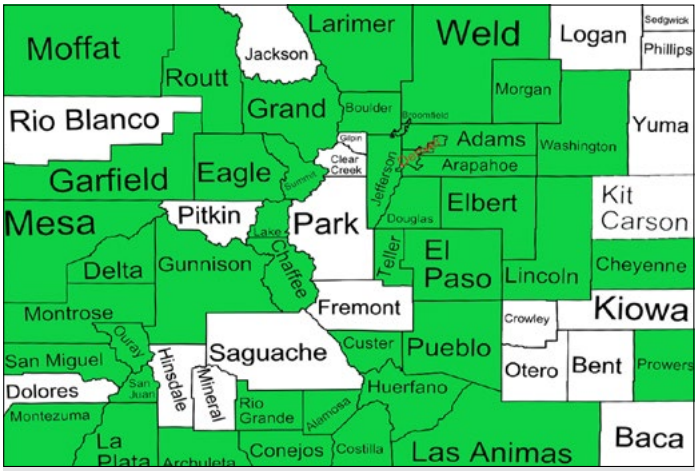
The **History Take-Out network** is anticipated to serve at least **16,000 learners** per year

Each kit contains materials for 1–4 hours of learning opportunities. During the lesson, students first gather around an interactive canvas floor map of Ute territories. They explore the different regions, seasons, tribes, and Ute terms using large, laminated cards while considering how Ute people solved problems using traditional STEM knowledge. Then students explore six matching and challenge activities on plant science, basket and clothing technology, shelter engineering, and beading and travel math. Each activity comes in both Spanish and English.

The educators have received virtual training that walks through each activity, as well as numerous other resources such as the Colorado Department of Education's Nuu-ciu Strong 4th Grade Resource Guide. Our goal is to put kits in the hands of more than 100 partners with at least one kit in every Colorado county by the end of 2022.

Learn more about Ute Knowledge: Colorado's Original Scientists History Take-Out at h-co.org/stemprograms.


Colorado Parks and Wildlife Schools and Outdoor Learning Environments (SOLE) Program



Ute Knowledge History Take-Out partners are in green counties.

A fourth grade classroom's story:
A different perspective on science and technology

History Colorado

For fourth grade teacher Lauren Hollington, and 17 students from St. Rose of Lima Catholic Academy in Denver, learning about Ute STEM was an eye-opening experience.

Lauren, who had done other History Colorado Take-Out programs in the past, signed her classroom up for the new Ute Knowledge: Colorado's Original Scientists module to kick off an Expedition on the Ute Native American Tribe lesson. *"It seemed like the perfect tie-in,"* she explained.

To guide their Ute STEM lesson, Lauren and her students decided to consider two main questions: Why did the Ute people move throughout their history, and how did they rely on the land?

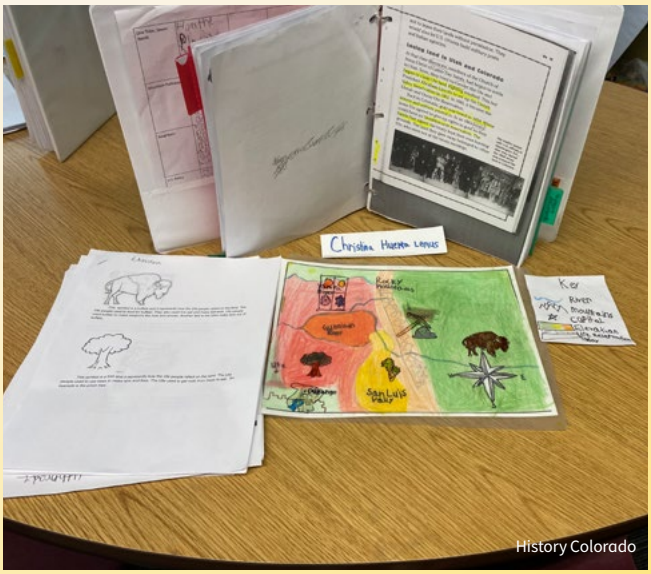
"They were able to see how the Utes engineered many different things using the land and surroundings."

The class took advantage of pre- and post-visit activities provided with the Take-Out program and were excited to welcome a History Colorado educator into their classroom to facilitate interactive challenges on plant science, basket and clothing technology, shelter engineering, and beading and travel math.

"…it helped us see science and technology in a different way," shared Lauren. *"Students are so used to technology being only computer or devices related, whereas they were able to see how the Utes engineered many different things using the land and surroundings."*

In addition to STEM concepts, Lauren also wove geography into the program: *"Tying in geography as a science also opened their eyes because it was not what their ideas of science were."* The class made physical maps of Colorado to further explore their guiding questions, creating symbols to depict Ute use of the land and movement around Colorado.

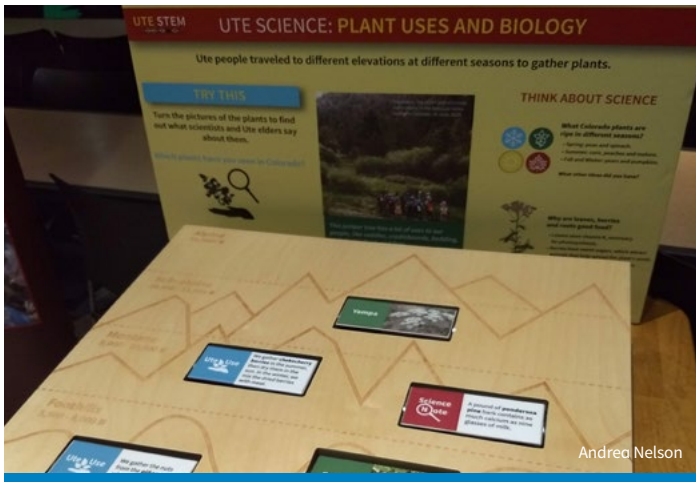
Overall, the program provided important and memorable lessons for Lauren and her students. *"I think the most impactful thing it had was when the students realized how much the Ute people were affected by the migration of new settlers. I think it really gave them a different perspective than what they had learned or known about, and our discussions were very meaningful,"* she shared.


History Colorado

FROM THE EXHIBIT FLOOR:

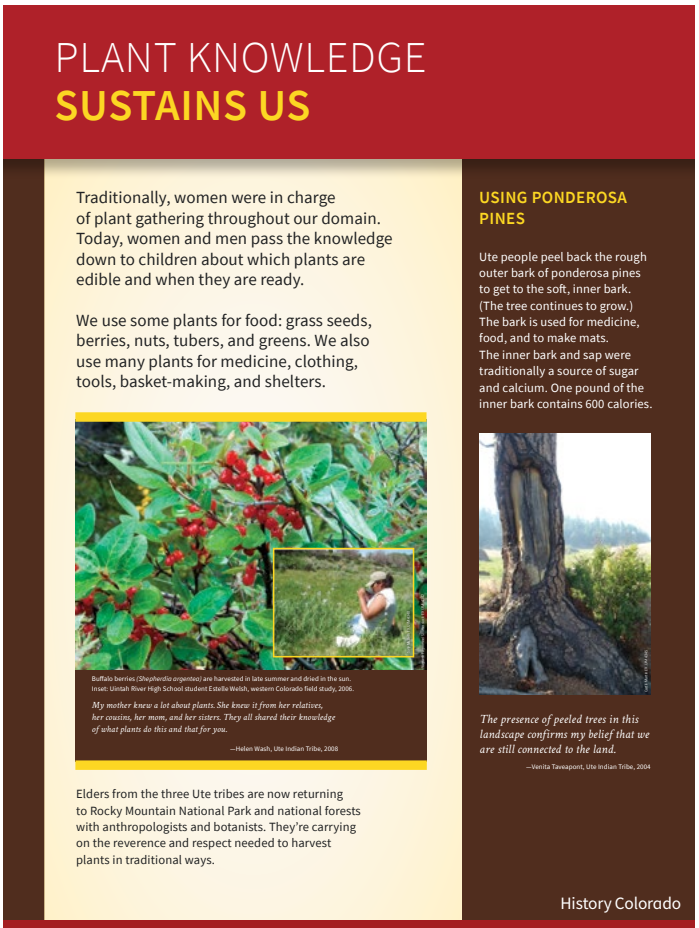
Ute science—plant uses and biology

During field work, Ute elders, archaeologists, and ethnobotanists discussed plant uses from their own, distinct, expert perspectives. The knowledge shared is captured in museum exhibits, several short videos, an interactive activity exhibit, teaching materials for educators, and an ethnobotany garden. From a STEM perspective, these demonstrate the connection between Ute traditional knowledge about plants and modern botany and biology studies. Here are a few examples of the resulting exhibits and information.



Andrea Nelson

An interactive Ute STEM activity on plant uses and biology. This interactive activity is part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado. It is also included in a traveling exhibit, and in Ute STEM History Take-Out kits used by educators and partners across Colorado.



History Colorado

Exhibit graphics highlight Ute traditional knowledge about plants. These graphics are part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado as well as the Ute Indian Museum in Montrose, Colorado.

Mary Menz

An example of interpretive signage installed in the Ute Ethnobotany Garden at the Ute Indian Museum in Montrose, Colorado.

BEHIND THE SCENES Q & A:

From knowledge gathering to public exhibits

History Colorado project organizers Liz Cook, Shannon Voirol, and Sheila Goff share insights into how results and findings from field work were transformed into exhibits and programs.

Q. How did the field work inform the exhibits and programs?

A. There is a direct relationship between what happened in the field and what happens in the exhibits. Every Ute STEM interactive exhibit is accompanied by video footage and photos taken out in the field, providing the opportunity to directly see and hear the interactions and experiences among the Ute elders, scientists, and youth. The Technology of Weaving exhibit is one example. The accompanying video shows the group among the trees in Great Sand Dunes National Park observing Ute cultural expert Cassandra Naranjo Atencio as she demonstrates how to use pine needles to weave baskets. A close-up photo taken in the field depicts that process as well. Exploratory moments like these directly informed the concepts used in the interactive exhibits themselves as well.

Q. How were the tribes involved in the exhibit and program development process?

A. Consultations with the tribes were critical to the process. We consulted with the tribes when planning the overall approach for the interactive exhibits. We also used consultation meetings to review exhibit prototypes, text, and videos. Throughout the process, it was important to show every deliverable in a respectful way to the tribes and then be willing to change it when something didn't work.

Q. What other inputs did you consider as you were developing the exhibits and programs?

A. Talking to other museums about what they did was important. The National Museum of the American Indian in New York shared background on their TEK exhibit, particularly about deciding to use recycled newspaper bags instead of plant fiber for a rope making activity. This influenced our decision to use "hi tech" materials to make models of things.

Q. What steps did you take to go from ideas to final products?

A. Our prototyping approach made a big difference, especially for getting tribal feedback. We essentially created a full-scale exhibit out of cardboard boxes to show where the exhibit cases would be, with printed pictures on them to show the proposed content. We also printed out copies of the proposed text panels, on which edits and comments could be written. It was a lot of work, but it was well worth it. It brought the project to life, and we made many decisions coming out of the process.

Q. Were there any unexpected challenges along the way?

A. Like many organizations, the Covid-19 pandemic required us to shift our school programming approach to virtual. We challenged ourselves to reimagine the History Take-Out program from in-person, in-school delivery to something different. That's when the idea for the Take-Out kits came about. We adapted the interactive activities into self-contained kits that could be provided to schools and other partners. And, instead of in-person training for partners, we developed simple online training videos for anyone interested in hosting the program. In the end, this enabled us to significantly increase student reach as the kits will eventually be housed in all 64 Colorado counties.

History Colorado

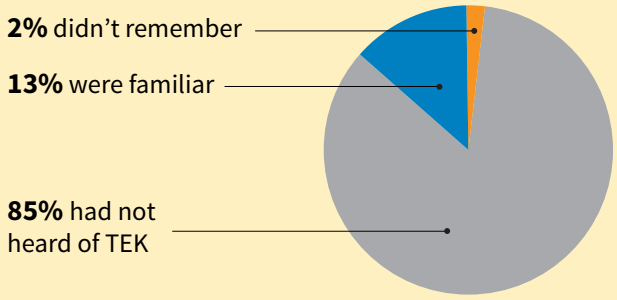
MEASURING RESULTS:

The journey from topic testing to final exhibits

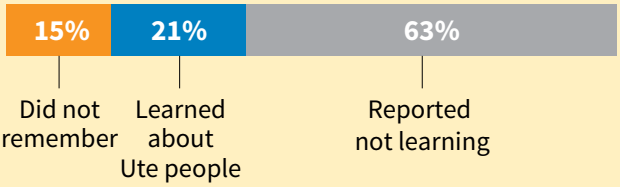
External evaluator Kate Livingston (ExposeYourMuseum LLC) conducted numerous phases of evaluation throughout the project to assess, inform, and guide the development of each programmatic element, centering the voices and perspectives of Ute people, museum visitors, students and educators, and the general public. Highlights from these efforts include:

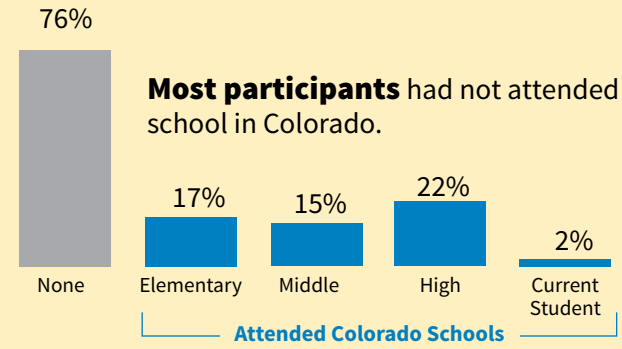
Assessing awareness and interest through front-end evaluation

87% of participants were unfamiliar with the term *Traditional Ecological Knowledge*



Most participants reported not learning about Ute people in school, though some had or did not remember.





Most participants had not attended school in Colorado.

The first step was to assess awareness of and interest in traditional ecological knowledge (TEK) and the culture and history of the Ute people. This was done at the History Colorado Center via interviews and by sharing example film clips with 114 museum visitors. A few highlighted findings include:

- Participating visitors were asked to consider what information Ute people may have about their environment. Many felt agriculture and growing food, animals, and climate and weather would be well-understood topics. Less common, but also discussed were geology and terrain, water, social and historical knowledge, building materials and tools, and conservation.
- While most participants were unfamiliar with the term TEK, most were able to define the term in one or more of the following ways: a use of natural resources; a way to learn about surroundings; a method of living in harmony with the environment; sharing values and passing on information; and environmental sustainability.
- Compared with how science is typically taught in school, visitors expressed that TEK offered a more direct connection to science and nature, used more flexible, less formal methodologies, engaged cultural and verbal traditions, and addressed purposeful, specific information. Visitors noted that both TEK and school-based science used hypothesis-testing, trial and error, and experimentation to identify information; shared many of the same concepts (for example, findings, foundational ideas about gathering information); generated communal, shared knowledge; and addressed ecological topics.
- Reflecting on video shown about Native scientists, participants felt they were exposed to a new or different way to think about science, were surprised to realize limited representation of voices and perspectives in science, had ideas about the video content or the speaker, and were curious or interested in learning more.
- Before leaving, many indicated they were interested in visiting the exhibit or believed the topic and information were valuable to share with the public.

Using hands-on experimentation to develop interactive exhibits

Because History Colorado was designing the exhibits and school programming to feature interactive stations and activities, an in-person, hands-on approach was used to test ideas and inform final decisions. The process involved observing more than 200 museum visitors of all ages interacting with prototypes across two testing sessions. The first session tested beading (math) and wickiup (engineering) interactive activities, and the second tested plants (science) and baskets (technology).

***Did you notice** examples of how Ute people use STEM (science, technology, engineering, and math)?*

***85% of visitors** to the Ute STEM area correctly provided an example of Ute people using STEM*

EXHIBIT SWEEP RATE

- *Exhibits with lower sweep rates* are considered more thoroughly used (300 is the average Sweep Rate Index, or SRI, typically cited in visitor research)*
- *Ute STEM exhibit = **43.75** SRI (visitors engage longer than average, when compared to other exhibits)*

*Sweep Rate Index (SRI), developed by Beverly Serrell, measures visitor engagement in exhibitions of different sizes. To calculate SRI, divide the square footage of the exhibition by the average time a sample of visitors spent in the exhibition. The higher the number, the faster people are moving through the space and (according to the premise Serrell outlines) the less engaged they are. Lower SRIs indicate more engagement.

Evaluating visitor experiences with museum exhibits

A summative evaluation of the *Written on the Land: Ute Voices, Ute History* exhibition was conducted at the History Colorado Center, with particular attention given to the Ute STEM interactive area. The evaluation was designed to assess the overall visitor experience, as well as if and how project goals and learning outcomes were achieved through the STEM interactives. The evaluation involved observing 66 visitors to the exhibition and interviews with 60 of those visitors in March and April 2019. A few highlighted findings include:

- Visitors made the connection between TEK and STEM. When asked to describe the Ute STEM interactive area of the exhibit, one visitor said, *"Integration of Native knowledge and modern science."*
- Visitors were able to articulate a variety of examples of Ute knowledge and skills. A visitor stated, *"Making a tipi is engineering. [Beadwork] patterns are math."*
- Visitors appreciated the long history of Ute people in what's now Colorado. One visitor realized, *"The scale of their territory in the beginning to now, being on the reservations. The Utes have lost a lot of land through history."* Another commented, *"History of Colorado that most people don't know."*
- Visitors grasped that Ute people continue to live and thrive today. When asked about Colorado specifically, a visitor said, *"We were looking at the maps, how it's charged with violence. The oral history. People are still here, working on in Denver. An active, living culture."*
- Visitors expressed that the content of *Written on the Land* should be shared widely. When asked to describe the exhibit to a friend or family member, visitors said, *"It's necessary to know this if you live in Colorado"* and *"Important for people to know and feel empathy."*
- Visitors appreciated the variety of opportunities available to them to engage and learn within the exhibition.


Ryan Erickson

MEASURING RESULTS:

History Take-Out takeaways

To assess the project outcomes related to K–12 education programs, Ute Knowledge: Colorado's Original Scientists History Take-Out Program was evaluated by Denver-based external evaluator Kate Livingston (ExposeYourMuseum LLC). Evaluation consisted of:

1. Observing five lessons facilitated by History Colorado Center museum educators at Denver-area schools and two at the museum (including observing more than 120 students, 7 teachers, and several chaperones).
2. Online surveys completed by seven teachers whose classrooms had the History Take-Out program at their schools (facilitated by History Colorado Center museum educators).
3. Online surveys and/or one-on-one interviews with 19 teachers who had completed the virtual training and facilitated the lessons themselves with students around Colorado.

A few highlights from the K–12 education program evaluation included:

- Students made connections directly related to Ute STEM desired outcomes during the program, as observed by their engagement, behavior, comments, and questions. For example, one student asked the question, *"Does this mean we're in Ute territory?"* when seeing the map depicting where Ute people once resided and currently reside today.
- Teachers appreciated the direct links between the program and the standards and curricula they were teaching students about Colorado. Related, teachers recognized that History Take-Out extended and expanded what youth might usually be exposed to about Indigenous peoples. One teacher commented, *"I appreciated the respect towards the Utes. This program modeled for the students how to respect the knowledge and wisdom of the Utes and their innovative approach to life even before we had STEM as a class."*
- Teachers indicated that the program influenced how they might approach teaching about the Ute people and other Native people in the future. It also encouraged teachers to include more participatory and interactive teaching

techniques. As one teacher commented, *"I will try to make my teaching more interactive and not so general."*

- Teachers appreciated the History Colorado Center's museum educators and applauded their facilitation of the program. For example, one teacher shared, *"It is such a delight to have a well-informed, patient, and kind facilitator here on campus talking about the Ute people. I am so thankful for this program and the materials were used in a really age-appropriate way. Thank you!!"*
- More than 85 percent of teachers reported that their students continued to talk about the program afterward. For example, one teacher shared, *"The students loved the huge map and the hands-on materials. They felt successful because they were able to answer many of the questions."*
- All teachers reported either some or a substantial increase in their students' and their own interest in Ute people.
- Teachers who engaged in the virtual training program to facilitate the program themselves were motivated to incorporate the program in their classrooms to provide their students with a more accurate and nuanced understanding of Colorado history, as well as to grow their own and their students' knowledge about the Ute people. One teacher explained, *"I'm motivated by my desire to help accurately teach American history because my own education in elementary and high school was very white-washed and didn't tell the whole story."*

"I recognize the value of understanding the Native American way of connecting with nature. Learning their culture and traditions is a gateway to understanding how we too can live in balance with the natural world."

—Virtual training participant/educator

"I really appreciated the teaching of the Utes as a contemporary people and not just a historical perspective."

—Teacher hosting History Take-Out at their school

History Colorado

MEASURING RESULTS:

Traveling exhibition takeaways

After the Ute STEM traveling exhibition was created, it was installed at the Red Rocks Community College Arvada campus from October 1–31, 2021 and then at the Lakewood (main) campus from November 1–December 15, 2021. External evaluator Kate Livingston (ExposeYourMuseum LLC) relied on self-report from community college educators and administrators to inform the evaluation. They shared approximate attendance numbers, photos of students and visitors interacting with the exhibition, visitor comments, and student reviews/write-ups of their experiences. About 400 visitors experienced the traveling version of Ute STEM between the two campuses. Student comments included:

- *"The interactive activities like the beadwork patterns and the weaving solutions were fun to see how the Ute people did their daily rituals. The questions on the board [accompanying labels] of these activities made it more active, so we get to use our brains. It was very satisfying seeing the connections of science to the ones of the environment. I hope we can do something like this every year."*
- *"As a student, the Ute STEM exhibit is very important to me. It gave me a perspective of Indigenous life I did not get in public schools or my adult life. I hope more students get the opportunity to interact with the Ute STEM exhibit like I did."*
- *"I often think of the Ute STEM exhibit when I am in my Honors class, talking about climate change. I have a hunch that Indigenous knowledge may end up saving our planet. Thanks for the opportunity to see this information in a way that honors Indigenous origins and current knowledge and applications."*

Two Red Rocks Community College staff members completed an online survey about their experiences hosting the traveling exhibition. Survey responses included:

- *"I loved this exhibit and was so happy to add to our campus experience with this wonderful exhibit. The process was straightforward and simple, the people that we worked with at History Colorado were awesome in making this available to our students. Visually, it was very engaging. The hands-on tables helped with the examples of the STEM skills involved in the daily life of the Ute peoples. LOVED the quote that said, 'We were astronomers before there was astronomy.' So impactful."*
- *"Faculty and Staff members are still mentioning how interesting and engaging the exhibit was. A colleague from a neighboring school contacted me, sad that she had 'missed' the exhibit. I was happy to tell her that she could still see this in the 'Written on the Land' exhibit at the History Colorado museum."*
- *"It is an exemplary opportunity to point out the significant knowledge base that Indigenous communities bring to the table. The exhibit impacted my understanding about the depth of Ute knowledge. I have increased appreciation for this contribution."*

"The opportunity to hear, touch and manipulate the items was great because what I watched on the videos I then got to 'try out' and that made it fun."

—Educator hosting the traveling exhibition

"I've always been curious about the science that was lost during colonization, and it was really interesting to learn not just about that but about the differences in the ways knowledge of the world around them was shared from generation to generation for the Ute people. I loved the exhibit, and I would love to see more like it in the future!"

—Community college student who visited the traveling exhibition

Colorado Parks and Wildlife Schools and Outdoor Learning Environments (SOLE) Program

"The field is changing. If we're going to talk about Native people, we need to have Native voices and they need to take priority."

—Sheila Goff, History Colorado, Ute STEM Project tribal liaison

Informing and inspiring others through sharing

Goal 3: Share a replicable model of collaboration between tribes, history museums, and scientists.

The final component of this six-year project was to document and share lessons learned, best practices for collaboration, and replicable approaches with broader audiences who may want to use this information to inspire and inform their own work. Such audiences may include national networks of tribes, other history and science museums, archaeologists, and other scientists, to name a few.

Four big takeaways

As we continue to work with our partners to capture and share lessons learned and best practices from the Ute STEM Project, a few key topics of interest have emerged:

1. Recognizing the importance of place
2. Embracing the unexpected and exploring alternatives
3. Using best practices for tribal-museum collaboration
4. Budgeting for a collaborative project involving tribes

Highlights from each of these topics are shared here, and more detailed information can be found in the "Interested in learning more?" section on pages 44-45.

TAKEAWAY ONE: Recognizing the importance of place

The Ute people were removed to reservations and lost most of their homeland as the US moved into Ute territory during the 19th century. Today, the majority of Ute people live on three different reservations which are far from many of those original territories. For this project, that meant that many of our Ute participants, especially the youth, had never visited places where their ancestors once lived.

One of the most fundamental takeaways from this project has been to recognize how important it was to physically visit and spend time at Ute ancestral sites together during the field work stage. These in-person, hands-on visits were incredibly meaningful for everyone involved.

For the Ute youth, it established tangible and direct connections to their own people and culture. As youth Mo'Av Berry of the Southern Ute Indian Tribe explained, *"When I come to these sites, I feel at home because I know that my people walked this land, and I'm walking the same trail that they're walking in some way. I'm finding where they used to be and where they lived. In some ways it pushes me to go more forward to see more of this world because there's a lot more to explore about my tribe."* Odis Chapoose of the Ute Indian Tribe of the Uintah and Ouray Reservation said *"...I didn't notice we were mountain men before the reservation."*

For the Ute elders, it brought generations of family together and provided an opportunity to pass down knowledge while standing in the very places many earlier generations had called home. Ute cultural expert Alden Naranjo of the Southern Ute Indian Tribe encouraged the youth to be mindful of those connections: *"You're the descendants of these people…of the elders that were around at one time. So, this is part of who we were at one time, living in these mountains, living in areas like this. So remember that, remember who you are."*

"I see this also as a repatriation of place..."

For the scientists and History Colorado, it made us think about repatriation in different ways beyond the repatriation of ancestors from museum collections. Project ethnobotanist Dr. Kelly Kindscher put it aptly: *"I'm just repeatedly moved by the larger sadness of the situation of Native folks being so far removed from where they were living, in this case with physical evidence present, that we're actually taking them for the first time…to their own places. I really think a lot about repatriation these days. I see this also as a repatriation of place, giving them access to these places, and finally being recognized."*

Richard Ott, with Dominguez Archaeological Research Group (DARG), echoed the sentiment: *"My personal aim in all of this is the reconnection of Ute people with the land in Colorado…it's the land that actually informs all of us…"*

For everyone, it demonstrated how important it is to keep these historical landscapes alive and keep the Ute people connected to them. *"We have probably many places that can be utilized as outdoor classrooms for Ute youth, tribal youth, because they exhibit or contain the Ute signature,"* explained Angie Krall, archaeologist with the Rio Grande National Forest. *"We have culturally modified trees. We have recently found our one and only wickiup so far that we've ever found in the [Rio Grande National] forest, Ute pottery, Ute projectile points. It's really alive; it's so visual. Especially culturally modified trees are just such a strong presence on the landscape of Ute presence, and still living and thriving, which I like to think of as Ute tradition and culture still growing and thriving. And the more young ones who can come out and look at the breadth of what their landscape is, not just was, is."*

TAKEAWAY TWO: Embracing the unexpected and exploring alternatives

Remaining open and adaptable was another important lesson learned from this project. We initially came into it with plenty of structure, rigorous agendas, and carefully scripted activities, but it didn't take long before we realized we needed to let things unfold organically. Every time we did that, it paid off immensely. A few examples include:

Trust that good things will happen and avoid over-structuring—During the first year of field work, we filled every hour with a planned activity or presentation, which we realized after evaluation interviews with participants, was too much. The second year we allowed for free time hanging out at the sites and casual sharing about topics. This led to many wonderful, unplanned interactions that naturally happened and were deeply appreciated by participants.

Approach culturally responsive exhibit and program development with options—We heard from tribal representatives in very clear terms, don't "play or pretend at BEING Ute." They encouraged us away from using exact replicas of Ute work or natural materials to be more respectful of materials and practices. Our challenge was how to encourage hands-on interaction and a connection to Ute culture while at the same time demonstrating respect. Based on work that we had seen in the imagiNATIONS Activity Center at the National Museum of the American Indian in New York, we focused on using alternative materials that are more reflective of engineering, scientific, and technical models. For example, instead of using real wood sticks to demonstrate wickiup construction, we used tent poles and Velcro. Instead of natural plant fibers to demonstrate weaving, we used contemporary and recycled woven materials. In consultation, the tribes agreed this was an appropriate approach.

Remain flexible and adaptable in the face of uncontrollable influences—The Covid-19 pandemic landed in the middle of this project and has continued to affect our work throughout the remainder of it. That has meant canceled field work activities, no traveling to conferences to share about the project, halted classroom visits, locked-down reservations, and more. Luckily, we completed two years of invaluable field work before everything shut down, and thankfully, we were able to adapt to new virtual and restricted environments. Conference sharing became one-on-one conversations. In-person visits to elementary classrooms became virtual visits, and later became self-contained activity kits with self-directed online training for teachers. Video conferencing became a comfortable way to informally share with our tribal partners. In the end, many of these adaptations have led to more impactful approaches, and we continue to apply those lessons to other areas of our organization.

It didn't take long before we realized we needed to let things unfold organically.

TAKEAWAY THREE:
Using best practices for tribal-museum collaboration

For those with project ideas that involve Native American tribes, consulting with the relevant tribes should be the very first thing on the agenda. History Colorado staff (Shannon Voirol and Sheila Goff) and Betsy Chapoose (Director, Cultural Rights and Protection, Ute Indian Tribe of the Uintah and Ouray Reservation) presented the following "Seven Steps for Tribal Consultation" at the Mountain-Plains Museums Association (MPMA) conference in 2017. We continue to share it with interested museums, scientists, tribes, and others across the country, both at conferences and in many one-on-one conversations. While these recommendations were developed with museum relationships in mind, they are applicable across other disciplines as well.

1. Before Consultation: Get to know the community—research, read, visit, and listen.
    - Read tribal websites.
    - Follow the tribe's main Facebook and other social media.
    - Follow the tribal education department's Facebook and social media.
    - Visit the reservation.
2. Before Consultation: Find the appropriate tribal person(s) to work with.
    - Write tribal leadership and request a designated tribal representative to participate in your project.
    - As needed, follow up with additional communication.
    - Check tribal website for tribal culture department staff.
    - Get contact suggestions from local museums with ongoing NAGPRA work.
    - Contact your state's Council on Indian Affairs for contact suggestions.
    - Don't assume that hearing nothing means that the project has tribal approval.
3. Before Consultation: Plan enough time and funding.
    - Assume it will take weeks or months to find tribal person(s) with enough time to collaborate with your museum.
    - Include funds to pay tribal honorariums, and reimburse for lodging, per diems, mileage.
4. During Consultation: Meet in person and explore informal opportunities.
    - If your state or local government has a guide on consultation, use that as a starting point. We used the Colorado Commission of Indian Affairs Consultation Guide for protocol help (see following section for link).
    - Make sure your museum leadership is actively present and participating.
    - Provide meals and/or refreshments.
    - Encourage tribal members to choose meeting locations, restaurants, etc.
5. During Consultation: Have a broad idea of what your museum would like to do and be very flexible.
    - Start by saying something like "We'd like to discuss ideas for a museum program or exhibit about the culture and history of your tribe."
    - Listen.
    - Listen.
    - Change the idea to fit what you hear.
6. During Consultation: Provide documents and ideas for reactions.
    - Ensure there is time for reading at meetings.
    - Plan for open-ended discussions.
    - Listen more than you speak; this is an opportunity to learn. This includes limiting questions.
    - Capture extensive notes; ask for clarification while note-taking, as needed.
    - Glean tribal direction from your notes afterwards.
7. After Consultation: Celebrate and sustain.
    - Express gratitude (for example, thank you notes, culturally appropriate gifts, etc.).
    - Plan for celebration events with travel, food, and time for honoring and being together (for example, we had opening celebrations for the exhibits in Montrose and Denver, the garden in Montrose, and the end of the project in Denver).
    - Budget for ongoing meetings and collaborations.
    - Be open to and encourage ongoing changes, edits, and ideas from tribal members as the project progresses.
    - Be sure you are respecting intellectual property.

TAKEAWAY FOUR: Budgeting for a collaborative project involving tribes

This is a snapshot of some of the project costs that may help others planning similar projects. Numbers reflect costs during the 2016–2022 project timeline.

Tribal Consultation

Consultation with designated tribal representatives, elders, and youth was key to the success of the project. As the lead partner, History Colorado was responsible for travel logistics and travel arrangements for tribal partners.

- For our larger "opening" or culmination event, we budgeted for multiple additional participants, which included elders, youth royalty, veterans color guard, and a drum group.
- While grant rules prohibited gifts, this is an important cultural practice. We were able to find other funding sources to share gifts with tribal partners and participants.
- It was important to be clear about when participants would be reimbursed for mileage or other travel expenses: prior to trip, during trip, if afterwards give a sense of 15 days or 30 days.

Daily honorarium for their time and expertise	$250–350
Lodging/food/per diem (for field work, youth shared hotel rooms or dorm rooms at a local university)	current local rates
Mileage or flights	current local rates
Tribal flags for any events	$200 each

Exhibits

The grant directly supported the interpretive graphics, videos, and interactives directly related to the project, as well as a percentage of the overall exhibit interpretive graphics, artifact cases, and environmental treatments related to Ute traditional ecological knowledge.

- Exhibits were budgeted at $450 per square foot.

Ute Indian Museum exhibition	about 30% of 2,280 square feet total
Written on the Land exhibition at the History Colorado Center, Denver	about 25% of 3,300 square feet total

Portable Exhibits

Graphic design	$1,500
Six interpretive pop-up banners	$600
Video touchscreen	$1,500
Four interactive stations and graphics	$1,700
Shipping/packing materials	$200
EACH	**$5,500**

Ute Ethnobotany Garden

Native plants	$2,000
Labor for preparation and planting	$9,000
Interpretive signage	$12,000
Other landscaping hard costs	$1,000
TOTAL COST	**$24,000**

Films

Filming onsite during field work and at the Ute Indian Museum, depending on the number of videographers, travel etc., with 10–14 days of filming over the project's 6 years	$1,000–2,000 per day
Logging and editing videos, and post-production to produce 10 short films (included color correcting, captioning, and video and audio formatting/outputting)	$20,000

Education Kits—Costs to produce 100+ kits, included:

Graphic design for kit materials	$1,500
Materials for kits and manuals	$800 per kit
Training videos production and editing	$2,000
Employees to develop, train, and distribute over 2.5 years	Two full-time

History Colorado

How information has been shared with different audiences

Sharing with museums

- Colorado-Wyoming Association of Museums Annual Conference, *Museum-Tribal Collaboration*, 2017
- Mountain-Plains Museums Association Annual Conference, *Museum-Tribal Collaboration*, 2017
- Innumerable conversations and teachings to other project teams within History Colorado

Sharing with educators and students

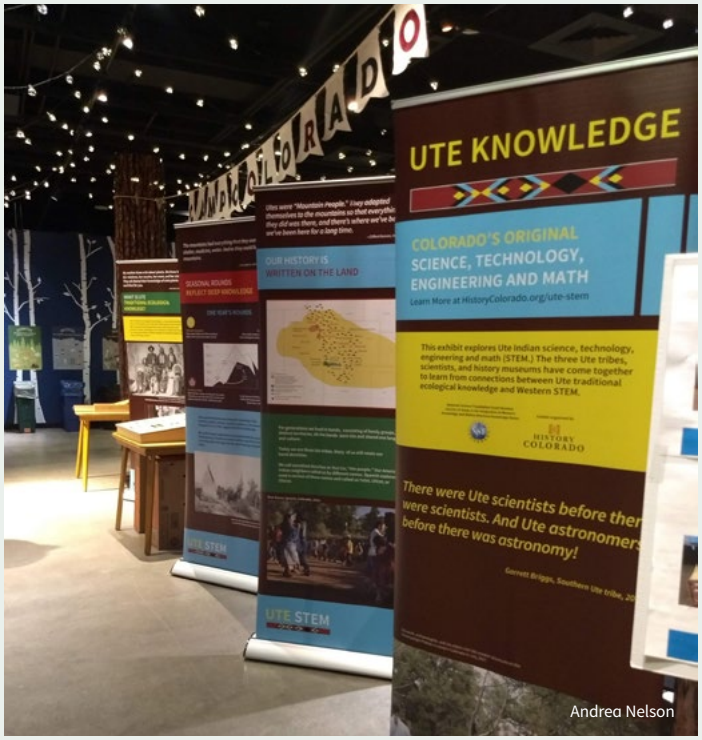
- National History Day in Colorado teacher training, *Using Native American History*, 2018
- National Science Foundation, AISL Principal Investigator Conference, 2019
- Colorado Science Conference, *Using Ute STEM Hands-on Classroom Activities*, 2019
- National Association for Interpretation Conference, 2019
- Colorado Alliance for Environmental Education virtual meeting, *Using Ute STEM Hands-on Classroom Activities*, 2020
- University of Denver, museum studies/anthropology class, 2021
- Red Rocks Community College, interpretation course with Colorado Parks and Wildlife, 2022
- *Ute Knowledge* History Take-Out kit trainings for 80+ partner organizations, 2022

Sharing with scientists

- Society of American Archaeology, *Ancient Heritage, Living Connections, Tribal and Hispanic Partnerships in Archaeology and Education*, 2019
- Colorado Council of Professional Archaeologists Annual Meeting, project overview, 2020

Sharing with land managers and nonprofit organizations

- Yampatika Environmental Education and Stewardship, Steamboat Springs, interpretive signage, January–February 2022
- Bureau of Land Management Grand Junction, Eagle Rock Shelter, interpretive signage and tribal consultation, May 2022
- Friends of Lake County, re-interpretation, June 2022
- Friends of Cedar Mesa-Utah, collaborative field work with youth, March 2022
- Douglas County Open Space, Hidden Mesa Open Space Ethnobotany Garden, tribal consultation, April 2022



Andrea Nelson

Sharing with the public

- Ute Indian Museum, Ute Trails Project presentation by Dominguez Archaeological Research Group (DARG), 2017
- Ute Indian Museum, opening celebration, 2017
- Ute Indian Museum, project overview, 2018
- History Colorado Center, opening celebration for *Written on the Land: Ute Voices, Ute History* exhibition, 2018
- STEM For All Video Showcase, 2019
- Ute Indian Museum, wickiup film, 2018
- Ute Indian Museum, presentation on Ute Rock Art by DARG, 2019
- Tesoro Indian Market and Powwow festivals, 2019–2022
- Ute Indian Museum, opening celebration for Ethnobotany Garden and Ute STEM Exhibits, 2021
- Ute Indian Museum, Ethnobotany Garden Tour and Talk, 2022

Mary and CJ's story: *Reviving a Ute landscape*

Mary Menz and CJ Brafford

"…the landscape plays such an important role to our Native people," explained CJ Brafford, Ute Indian Museum director and carekeeper.

CJ, along with a team of dedicated volunteers, set out in 2019 to transform a decades-old museum garden into a new Ute Ethnobotany Garden as a component of the Ute STEM Project.

As Oglala Lakota herself, CJ understands the deep connection that tribes like the Ute have with the land and is passionate about re-connecting them with the landscape that was once theirs. *"[The garden is] bringing full circle to the Ute people that this is where they come from; this is where they'll always be. They came from the mountains and the landscape that is here is the landscape that protected and cared for them."*

After several summers of researching, removing, and replacing plants, the new Ute Ethnobotany Garden is now a tranquil, spiritual place that welcomes both Ute and non-Ute visitors. The garden features plants traditionally used by the Ute, and interpretive signage allows visitors to explore how the plants were, and still are, used for medicine, food, and other activities. *"Plants like the Yampa root,"* shared CJ. "*You can eat that. It sustained [the Utes] in so many different ways."*

"When we do have Ute people come through…it's just the pride that they have of what the ancestors, the creator, have given them. To see the garden there and know that at one time how all these plants were used... When the young kids are over there, it's the asking questions, 'Did they use this?', 'Why did they use it?' Storytelling develops from over there," shared CJ.

Since opening to the public in May 2021, the garden has seen thousands of visitors, from Ute cultural experts like Terry Knight who continue to harvest bee balm flowers for medicine, to families and school groups who want to learn more about Ute history.

Volunteer and Colorado Native Plant Master, Mary Menz, who helped spearhead the garden transformation, is passionate about encouraging visitors to the garden: *"… it's important for people, whether they have children or not, whether they are interested or not, that they recognize that this is a valuable part of our history. That it's valuable to retain and document this information because the Ute people have knowledge that we don't even know. I just hope it inspires more Ute people to share what they know; more people of any culture to share their experiences and their traditions, oral or otherwise, with younger generations so that they're not lost."*

Mary, CJ, and team are also excited about what's to come. *"Now we're looking at how kindergarten through grade 12 can come here and experience the garden,"* said Mary. *"Or to encourage the Utes who still come here to harvest the bee balm that they used in cultural and ceremonial purposes. And to have more science around the garden such as creating herbarium samples, having students actually collect the plants, record the data…so that the museum has a record of these for as long as the museum is here."*

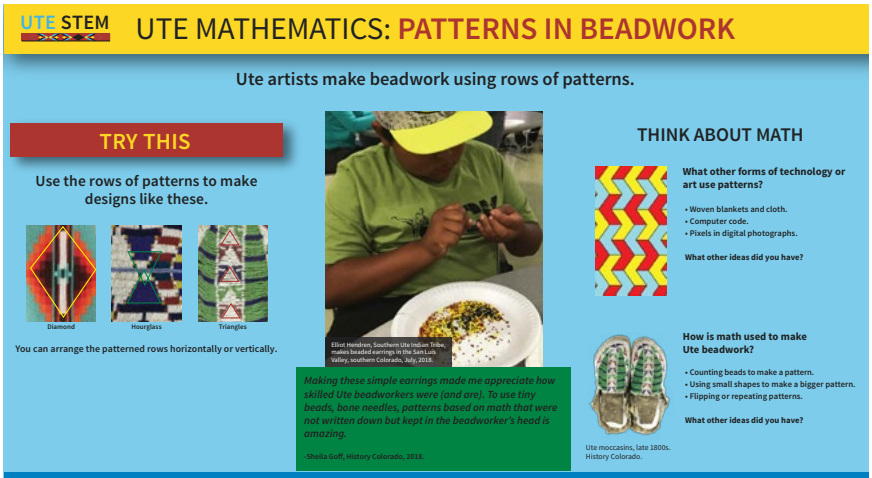
FROM THE EXHIBIT FLOOR:

Ute math and technology with beads and baskets

Field work exploration and hands-on activities during this project exposed participants to Ute traditional knowledge of making beadwork and baskets. Ute elders shared the types of natural materials and led the group in beadwork and basket-making exercises, all while exploring the connection to STEM concepts of math and technology. This knowledge has been captured and translated into museum exhibits, several short videos, interactive activity exhibits, and teaching materials for educators. Here are a few examples of the resulting exhibits and materials.

An interactive Ute STEM activity on technology concepts used by Utes in weaving and baskets. This interactive activity is part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado. It is also included in a traveling exhibit, and in Ute STEM History Take-Out Kits used by educators and partners across Colorado.

History Colorado



An interactive Ute STEM activity on math concepts used by Utes in making beadwork. This interactive activity is part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado. It is also included in a traveling exhibit, and in Ute STEM History Take-Out Kits used by educators and partners across Colorado.

History Colorado

Ute royalty wear beaded crowns in the Walking Together for Healthier Communities event, near Four Corners Monument, Colorado, 2015.

Beadwork should be touched. Beadwork should be worn. Beadwork should be alive.

—Mariah Cuch, Ute Indian Tribe, 2013

NEW TRADE CHANGES
ART OF BEADING

Ute women have been beading for generations. Before contact with Europeans, we made beads from seeds, shells, and elk teeth. We also used dyes and paints from plants and animals for decoration.

Colorful glass beads from Italy and the Czech Republic traveled over new trades routes in the 1700s. The new beads inspired an artistic transformation. We worked with beads in geometric and floral patterns and applied these to shirts, dresses, and moccasins.

Chief Ouray in studio portrait, 1850–70.

Chief Ouray wearing a combination of traditional styles and new materials. The beaded shell necklace and fur hair ties are traditional. The shirt is made of new wool trade cloth.

Exhibit graphics highlight Ute traditional use of beads. These graphics are part of the exhibition, *Written on the Land: Ute Voices, Ute History*, at the History Colorado Center in Denver, Colorado as well as the Ute Indian Museum in Montrose, Colorado.

History Colorado

BEHIND THE SCENES Q & A:

Sharing a replicable model

History Colorado project organizers Liz Cook, Shannon Voirol, and Sheila Goff discuss the importance of sharing about the project with others.

Q. Why was it important to be able to share a replicable model of collaboration between tribes, history museums, and scientists as part of this project?

A. The field is changing. If we're going to talk about Native people, we need to have Native voices and they need to take priority. We want to show others what can be learned through a collaborative project like this and that tribes are good partners.

Q. How have your plans to accomplish this goal evolved over the course of the project?

A. The Covid-19 pandemic definitely affected our approach. For example, instead of traveling around the country speaking at large conferences as we anticipated, we've transitioned to more of a coaching role with many one-on-one conversations. While we may eventually speak at conferences sometime in the future, for now we're thankful for this evolved model of sharing because it feels more impactful. We've already been able to help several local groups successfully engage with tribes for terrific projects right here in Colorado.

Q. As you continue to share about the project with others, have you received any interesting feedback?

A. In considering other exhibits about Indigenous people, what strikes everyone is how unique the STEM component is. That just hasn't been addressed as much. It sounds simple, but it's not, and we're finding that it's being seen as very special.

Q. Has anything surprised you as you continue to share and disseminate information from the project?

A. It's been both surprising and inspiring to see how this project has affected everyone involved, from the exhibit makers to the film crew, and everyone in between. The interest in, and excitement about this project has been infectious, and each of the project's hundreds of contributors has become a disseminator of information in their own way.

History Colorado

MEASURING RESULTS:

Dynamic, culturally informed evaluation

For the Ute STEM Project, the involvement of tribes, youth, and myriad partners created unique dynamics that required a very thoughtful and dynamic approach to evaluation. We appreciate external evaluator ExposeYourMuseum LLC's philosophy and methodology which emphasizes equity, ethics, transparency, and an iterative cycle of learning. A few noteworthy aspects of the overall evaluation process include:

Culturally informed approach—The evaluation for Ute STEM prioritized being aware of and informed by all who participated in and were affected by this project and its results. This was especially important due to the legacy of white-led research and evaluation efforts marginalizing Indigenous peoples and communities. In particular, centering our Ute partners in all aspects of the evaluation was essential. That meant following the lead of the three tribes, consulting with them on methodology and instruments, and honoring the unique dynamics created by the collaborative nature of the project.

Working within the tribal consultation process—We were fortunate to already have strong relationships and a tribal consultation process in place when we started this project. We also had an existing relationship with our external evaluator. That provided us with the opportunity to involve the evaluator early and often to work in collaboration with the tribes, ensuring transparency throughout the project. All evaluation processes were shared through the project—from ideas, to questions that might be asked, to methodologies that might be used.

In particular, centering our Ute partners in all aspects of the evaluation was essential.

Never was this a presentation on how we would conduct evaluation, but rather a collaborative conversation to make decisions together. An example of this can be seen in the evaluation of the field work. Our original idea was to have the evaluator conduct video interviews during field work, leveraging the skills and availability of the videographer who was documenting field work. Tribal leaders suggested directly involving youth participants in the process as an opportunity for them to learn evaluation, videography, and interviewing skills firsthand. That led to a meaningful shift in the evaluation methodology and processes, whereby several youth ran the video camera and interviewed their elders themselves, with coaching from the evaluator and videographer.

Working with tribal educators—Due to involvement of so many youth in this project—both as field work participants and through educational outreach, we decided to work with tribal education partners. Each tribe connected us with someone from their tribal education office who was able to review evaluation materials to be used with students and educators, from survey and interview questions, to prototypes of interactive activities. This proved to be very helpful and supported project inclusion and transparency.

Ongoing process evaluation—In addition to evaluating the field work, exhibits, and programs, it was important to us to also have ongoing evaluation of how the project was progressing internally. ExposeYourMuseum LLC conducted online surveys and interviews throughout the project to assess to what extent project leadership and key stakeholders felt they were on track, meeting project goals and milestones, and achieving desired outcomes. This "pulse check" helped us to make course corrections as needed to our processes and procedures throughout the project.

Ensuring ethical evaluation with an institutional review board (IRB)—IRBs are not often utilized for history museum projects, but Ute STEM was not a typical project. Due to the nature of the National Science Foundation grant, we were required to engage an external IRB for this project. Their role was to ensure that participants in Ute STEM were treated in an ethical way during all evaluation activities. This required a significant amount of work and ongoing communications, led by our evaluation partner, ExposeYourMuseum LLC. It was critical for us to have a project partner who understood the importance of and how to prepare for an IRB process.

Interested in learning more?

Many, many resources have come out of this project—too many to cover all within the pages of this report. Whether you are a museum representative, tribal member, scientist, educator, evaluator, or an individual curious to learn more, this is a list of resources used by our team and partners to plan the project, as well as resources created by our team and partners to share knowledge and expanded learning.

Of course, we're also always happy to connect directly with anyone interested in learning more as well. The best place to start is on the Ute STEM Project website at h-co.org/ute-stem, including project reports at h-co.org/utestem-reports.

Tribal relations	
Colorado Commission of Indian Affairs Ccia.colorado.gov Ccia.colorado.gov/resources/state-tribal-consultations	Serves as the official liaison between the State of Colorado and the Southern Ute Indian Tribe and the Ute Mountain Ute Tribe. The Colorado State-Tribal Consultation Guide offers helpful guidance.
"Collaborating Beyond Collections: Engaging Tribes in Museum Exhibits." Advances in Archaeological Practice, Volume 7, Special Issue 3, August 2019 bit.ly/collabcoll	Article authored by tribal cultural expert Betsy Chapoose and History Colorado staff.

Teaching Ute history and Ute STEM	
Nuu-ciu Strong, A Colorado Fourth Grade Resource Guide Lessons about the Ute People of Colorado h-co.org/nuuciu-strong	A resource for fourth grade educators to use to support teaching the history, culture, and present lives of the Ute people.
Ute Tribal Paths Digital Exhibit exhibits.historycolorado.org	Digital interactive exhibits to bring history to life for elementary students. Rich in multimedia, primary sources, and historical photographs, the online exhibits are aligned to Colorado Academic Standards.
Ute Knowledge History Take-Out Kit h-co.org/stemprograms	A facilitated hands-on program at your school in which students investigate how the Ute Indians used science, technology, engineering, and math to survive and thrive in the Rocky Mountains. By testing materials, they'll see how Ute people solved problems in the past and still do today.

Exploring Ute history and Ute STEM	
Ute Indian Museum, Montrose, Colorado h-co.org/ute-indian	Connects the past with contemporary Ute life and culture. Exhibits focus on the Ute peoples' history of adaptation and persistence, and unfold around a central theme of geography, highlighting significant locations in Ute history. Through exhibitions, visitors explore topics of Ute cultural survival, political determination, economic opportunity, and the celebration of the Bear Dance.

Rocky Mountain PBS "Colorado Experience: The Original Coloradans" video.rmpbs.org/video/colorado-experience-original-coloradans	30-minute program that explores the history of the state's original inhabitants: the Utes.
Ute STEM field work videos h-co.org/utestemplaylist or h-co.org/stemvideos	Ten-part video series featuring field work by a team of Ute elders, Ute youth, and scientists as they visited sites in the Western Slope and the San Luis Valley in Colorado, to explore the intersections between Traditional Ute Ecological Knowledge and science, technology, engineering, and math (STEM).

From the Ute Indian Tribes

Southern Ute Indian Tribe	Website: SouthernUte-nsn.gov Tribal Newspaper: The Southern Ute Drum SuDrum.com
Ute Mountain Ute Tribe	Website: UteMountainUteTribe.com Tribal Newspaper: Weenuche Smoke Signals Facebook.com/WeenucheSmokeSignals
Ute Indian Tribe of the Uintah and Ouray Reservation	Website: UteTribe.com Tribal Newspaper: Ute Bulletin (available on the main website)

Research from our archaeology and ethnobotany partners

Dominguez Archaeological Research Group	The Ute Trails Project: Dargnet.org/trails.html The Colorado Wickiup Project: Dargnet.org/wickiup_project.html Both were the foundational work with Ute tribal representatives that identified many of the sites visited during Ute STEM field work.
Kelly Kindscher, University of Kansas	University of Kansas Native Medicinal Plant Program: NativePlants.ku.edu/ethnobotany-research-2/native-american-ethnobotany/ute-ethnobotany-project

Culturally responsive evaluation

The Center for Advancement of Informal Science Education (CAISE)	Informalscience.org/news-views/culturally-responsive-evaluation-informal-stem-environments-and-settings
LEAD Projects (Learning through Evaluation, Adaptation, and Dissemination)	Lead.wceruw.org/resources.html
University of Illinois Urbana-Champaign College of Education, Center for Culturally Responsive Evaluation and Assessment	Crea.education.illinois.edu/media/publications

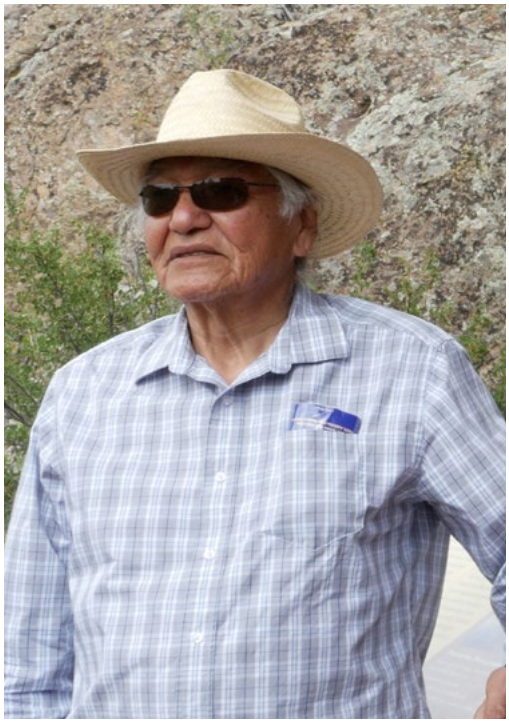
2017 field work participants

Acknowledgments

"We didn't get wiped out; we didn't move away. We're still here and we will still be here."

—Ute cultural expert Terry Knight Sr. of the Ute Mountain Ute Indian Tribe

2018 field work participants



Honoring Alden Burch Naranjo Jr.

"Be proud of who you are, because you are part of this land. You are part of the surroundings. You are one of the creations the Creator made."
—Alden Naranjo, Ute cultural expert, Southern Ute Indian Tribe

We honor the contributions of Alden Burch Naranjo, Jr. (1941–2020), who served for 20 years as the Southern Ute Indian Tribe's Native American Graves Protection and Repatriation Act (NAGPRA) Coordinator. His knowledge and expertise made a significant, immeasurable impact on preservation, archaeology, exhibits, and programs at History Colorado and to countless other individuals and organizations across the State of Colorado. The Ute STEM Project is just one of his many legacies.

On June 11, 2022, the project partners, representatives of History Colorado, the Southern Ute Tribe, and members of the Naranjo family gathered at History Colorado to celebrate the work of Mr. Naranjo, and to reflect on the impact of the Ute STEM Project.

Read his obituary at Sudrum.com/voices/2020/05/08/obituary-alden-burch-naranjo-jr.

The Southern Ute Indian Tribe

Role in the Ute STEM Project:
Tribal partner, Ute cultural experts

Location:
Ignacio, Colorado

About:
The Southern Ute Indian Reservation is to the south and east of Durango, Colorado. The tribal reservation is a checkerboard reservation with tribal member allotments as well as tribally owned land dating back into the early 19th century. The tribe has 307,838 tribally owned acres.

- More than 1,400 enrolled members who reside both on and off the reservation are descendants of the historic Mouache and Capote Ute bands.

- The Southern Ute Tribal Council has seven members including the Chairman.
- The tribe owns the Growth Fund (Tierra-Real Estate and Construction Companies; Red Willow Oil and Gas Production Company, and Red Cedar Oil and Gas Gathering Company) and Sky Ute Casino Resort. The estimated value of the Growth Fund is more than $4 billion. The tribe recently finished construction of a multi-purpose facility and chapel. Its Cultural Museum construction will be completed shortly. The tribe is a strong player in the federal legislative energy arena.
- The Southern Ute Indian Tribe programs include Economic Development, Judiciary, Department of Natural Resources, Health Clinic, Social Services, and Elder Center. The Southern Ute Montessori Academy serves students in Head Start through elementary.
- The Southern Ute Bear Dance is held on Memorial Day weekend in May. The first Southern Ute Tribal Fair was held in 1920. The Southern Ute Fair Powwow is a three-day event held annually on the second weekend in September at the Sky Ute Fairgrounds

Contact Information:

Tribal Chairman and Tribal Council
Leonard C. Burch Building
P. O. Box 737
356 Ouray Drive
Ignacio, CO 81137
970-563-0100
SouthernUte-nsn.gov

Leadership and Consultation (2013–2022):

Chairman Melvin J. Baker

Chairman Christine Sage

Chairman Clement Frost

Councilwoman Dr. Stacey Oberly

Councilwoman Linda Baker

Councilwoman Amy Barry

Councilman Tyson Thompson

Southern Ute Tribal Council members (2013–2022)

Alden Naranjo, Native American Graves Protection and Repatriation Act Representative

Cassandra Naranjo Atencio, Native American Graves Protection and Repatriation Act Coordinator

Elise Redd, Culture Director

Edward Box III, Culture Department Director

Garrett Briggs, Native American Graves Protection and Repatriation Act Coordinator

Hanley Frost Sr., Culture Education Coordinator

Susan Cimburek, Director, Southern Ute Cultural Center and Museum

Sunshine Whyte, Executive Assistant, Council Affairs

Latitia Taylor, Director, Southern Ute Education

Ute STEM Field Work Participants:

Mo'Av AJ Berry

Jace Carmenoros

Jazmin Carmenoros

Elliot Hendren

Nate Hendren

Jeremiah Najar

Cyrus Naranjo

Sarajane Washington

Kalynn Weaver

Alden B. Naranjo

Cassandra Naranjo Atencio

Garrett Briggs

Deb Pace, Education Department

Jacob H. Atencio, Assistance

Southern Ute Education Department Youth Interns:

Sergio Howe

Bella Howe

Special thanks to the Southern Ute Indian Tribe Veterans Honor Guard, Tribal Royalty, and all Southern Ute Indian Tribe members who assisted in the Ute STEM Project, exhibits, gardens, and events in Montrose and Denver.

The Ute Indian Tribe of the Uintah and Ouray Reservation

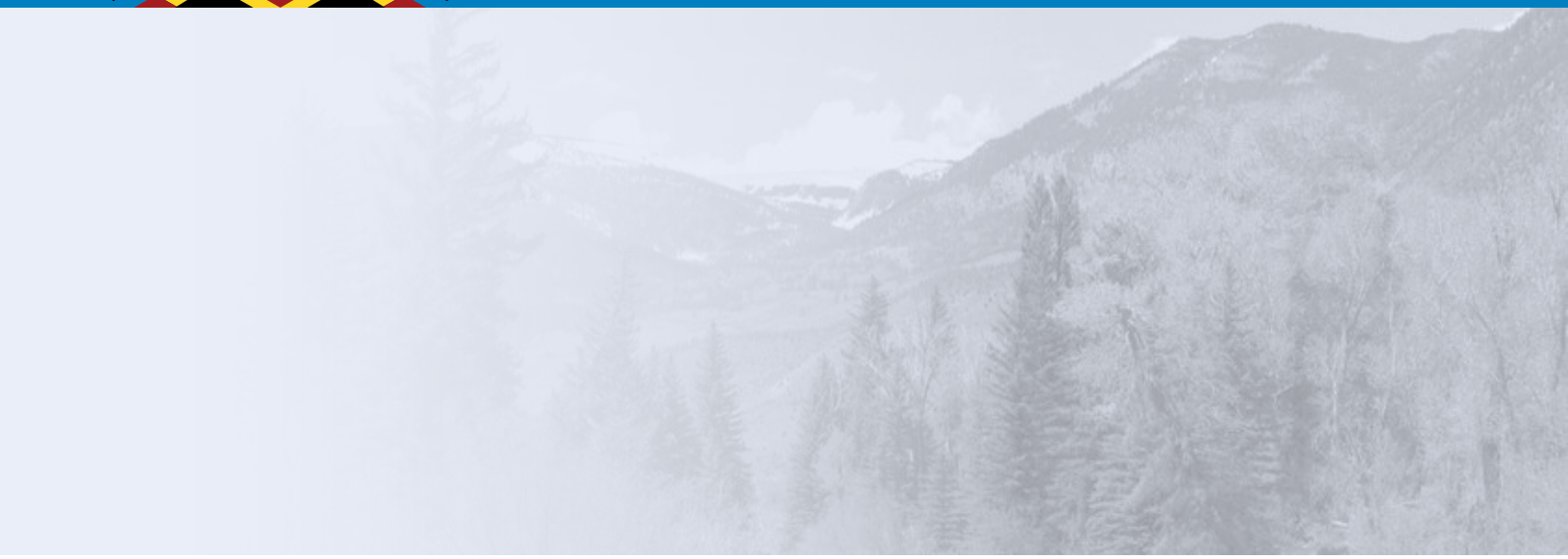
Role in the Ute STEM Project:
Tribal partner, Ute cultural experts

Location:
Fort Duchesne, Utah

About:

The Uintah and Ouray Reservation is in northeastern Utah (Fort Duchesne), approximately 150 miles east of Salt Lake City, Utah on US Highway 40. The reservation is located within a three-county area known as the "Uintah Basin." It is the second largest Indian reservation in the United States and covers over 4.5 million acres.

- The tribe is now three bands: Uintah, Uncompahgre, and White River. The bands are comprised of historical bands, including: Cumumba, Parianuche, Pahvant, San Pitch, Sheberetch, Tabeguache, Tumpanawach, Uinta-ats, and Yamparika. Today, tribal membership is 3,022, over half of whom live on the reservation.
- The elected six-member Ute Business Committee is led by the tribal chairperson and runs the government and commerce.
- The tribe oversees approximately 1.3 million acres of trust land. The education department includes language programs and the Uintah River High School. The tribal business enterprise also operates a supermarket, gas stations, bowling alley, bison ranch, and other businesses.
- The Bear Dance is held in May in the communities of Randlett, Fort Duchesne, and White Rock.



Contact Information:

Uintah & Ouray Tribal Business Committee
P.O. Box 190
Fort Duchesne, UT 84026
435-725-4824
Utetribe.com

Leadership and Consultation (2013–2022):

Chairman Luke Duncan

Chairman Shawn Chapoose

Councilman Tony Small

Ute Indian Tribe Business Council members (2013–2022)

Betsy Chapoose, Director, Cultural Rights and Protection

Valentina Sireech, Ute Tribal Enterprises, LLC

Ute STEM Field Work Participants:

Lanie Chapoose

Odis Chapoose

Spencer Chapoose

Vlad Longhair

Betsy Chapoose

MaryLee Longhair

Brock Chapoose

Rainee Chapoose

Brad Longhair

Brooks Perank

Special thanks to the Ute Indian Tribe Veterans Honor Guard, Tribal Royalty, and all Ute Indian Tribe members who assisted in the Ute STEM Project, exhibits, gardens, and events in Montrose and Denver.

The Ute Mountain Ute Tribe

Role in the Ute STEM Project:
Tribal partner, Ute cultural experts

Location:
Towaoc, Colorado and White Mesa, Utah

About:
The Ute Mountain Ute Tribe's reservation lies in southwest Colorado, southeast Utah, and northern New Mexico. There are two communities on the Ute Reservation: the tribal headquarters in Towaoc, Colorado and the small community at White Mesa, Utah.

- The Ute Mountain Ute Tribe are the descendants of the historic Weeminuche (or Weenuche) band. Today there are more than 2,000 enrolled members who reside both on and off the reservation.
- The Ute Mountain Tribal Council functions both as the legislative and executive branch of government, with a separate tribal court. The tribe has an elected seven-member council, with a chairman. Terms are three years. The tribal administration is in the community of Towaoc, Colorado and the White Mesa community is in Blanding, Utah.
- The tribe owns the Ute Mountain Casino and Hotel, the Weeminuche Construction Company, a Farm & Ranch Enterprise, and the Ute Mountain Tribal Park.
- The tribal programs include Economic Development, Department of Natural Resources and Environmental Protection Agency Offices, a Health Clinic, Social Services Department, Head Start Program (56 students), a Child Care facility, Community Center, a Cultural Office, Career Center, and Tribal Police. The Kwayigut Community Academy, a public school guided by Nuuciu culture and language, opened in 2021.
- The Ute Mountain Ute Bear Dance is held in Towoac the first weekend in June, and also includes a feast, powwow, hand games, and a 5K and 10K run. The community of White Mesa holds a Bear Dance in early September.

Contact Information:

Tribal Chairman and Tribal Council
125 W. Mike Wash Road Tribal Complex
P. O. Drawer JJ
Towaoc, CO 81334
970-565-3751
UteMountainUteTribe.com

Leadership and Consultation (2013–2022):

Chairman Manuel Heart

Chairman Harold Cuthair

Vice Chairwoman Juanita PlentyHoles

Councilwoman Regina Lopez-Whiteskunk

Councilwoman Marissa Box

Ute Mountain Ute Tribal Council members (2013–2022)

Terry Knight Sr., Tribal Historic Preservation Officer

Lynn Hartman, Contract Administrator

Nikki Shurack, Cultural Resources Contract Administrator

Michela Alire, Executive Secretary

Tanya Amrine, Education Division Director

Tina King-Washington, Kwayigut Community Academy

Sophia Box, Tribal Member

Ute STEM Field Work Participants:

Kateri Bancroft

Leander Collins

Kasity Porambo

Terry Knight Sr.

Nikki Shurack

Afrem Wall

Special thanks to the Ute Mountain Ute Tribe Veterans Honor Guard, Tribal Royalty, and all Ute Mountain Ute members who assisted in the Ute STEM Project, exhibits, gardens, and events in Montrose and Denver.

Dominguez Archaeological Research Group, Inc. (DARG)

Role in the Ute STEM Project:
Archaeologists and researchers

Location:
Grand Junction, Colorado

About:
DARG is a 501(c)(3) non-profit corporation established in 2003 to serve as a catalyst for innovative and collaborative archaeological and anthropological research, preservation, and education in the northern Colorado Plateau region. Functioning as a consortium of research associates and technical advisors, DARG's operational focus is to coordinate research, raise and administer funding, and manage projects that advance its mission.

DARG has worked collaboratively with the three Ute Tribes for many years on numerous archaeological, ethnohistorical, and applied anthropological projects:

- The Colorado Wickiup Project (CWP) has documented more than 446 aboriginal wooden features at 90 sites throughout the state, revealing new insights into the history of the Colorado Utes. The project was awarded History Colorado's 2014 Governor's Award for Historic Preservation.
- In 2008 DARG coordinated a Ute Ethnohistory Project conducted by three western Colorado Bureau of Land Management (BLM) field offices in collaboration with the three Ute Tribes. The project brought together BLM field office cultural resource staff and managers with tribal cultural representatives to visit Ute heritage sites and locales in the study areas.
- In 2010 DARG collaborated with the Northern Ute Tribe and the BLM Grand Junction Field Office to host a two-day field visit that brought together a group of young adult tribal members, Ute cultural advisors, and DARG and BLM archaeologists and seasonals.
- Building on the success of the Colorado Wickiup Project and other collaborative Ute projects, DARG is now conducting a long-range, multi-disciplinary study of aboriginal Ute trails and cultural landscapes in western Colorado. The goals of the program include the development of practical ways to integrate Ute cultural perspectives and traditional ecological knowledge with the scientific and technological perspectives of contemporary archaeology and anthropology. Several phases of the project are currently underway in collaboration with the Ute Tribes.

Contact information:

P.O. Box 3543
Grand Junction, CO, 81502
970-245-7868
darg.colorado@gmail.com
Dargnet.org

Ute STEM Field Work Participants:

Carl Conner

Masha Conner

Sally Crum

Kristin Kayaani

Curtis Martin

Richard Ott

Nicky Pham

Sonny Shelton

Jessica Yaquinto

DARG
Dominguez Archaeological Research Group

University of Kansas | Dr. Kelly Kindscher

Role in the Ute STEM Project:
Ethnobotanist

Location:
Lawrence, Kansas

About:
Kelly Kindscher is best known as a passionate advocate for native plants, native landscapes, and wild places. His research is focused on native prairies, prairie plants, and plant communities. He is a conservationist, teacher, mentor, and environmental problem solver, and the author of books on edible and medicinal plants.

College took him to the University of Kansas (KU), which has become his professional home. He graduated with honors in the Environmental Studies Program and earned the PhD in Systematics and Ecology in 1991. His master's thesis became the basis for his first book, *Edible Wild Plants of the Prairie*, and his dissertation research examined the groupings and importance of plant guilds in tallgrass prairie ecosystems.

He took a position at KU, and his work has evolved over the years. Today, his primary responsibilities are as a plant ecologist for the Kansas Biological Survey, where he conducts research on plant communities throughout Kansas, the Midwest, and the Great Plains and Rocky Mountain states; and in the Environmental Studies Program, where he furthers his research agenda, mentors students, and has taught a variety of classes, including Ethnobotany and the program's Capstone course, formerly known as Environmental Impact Assessment.

Contact information:

Phone: 785-864-1529
kindscher@ku.edu
Kindscher.ku.edu

Mailing address

Kansas Biological Survey
2101 Constant Avenue
University of Kansas
Lawrence, KS 66047-3729

Field work host sites

Alamosa National Wildlife Refuge: Fws.gov/refuge/alamosa

The Archaeological Conservancy, Shavano Valley Rock Art Site: Archaeologicalconservancy.org;
Thanks to: Carol Patterson and Shavano Valley Site volunteers

Bureau of Land Management, Grand Junction Field Office: Blm.gov/office/grand-junction-field-office

Great Sand Dunes National Park and Preserve: Nps.gov/grsa
Thanks to: Fred Bunch, Chief of Resource Management

Rio Grande National Forest: Fs.usda.gov/riogrande
Thanks to: Angie Krall, Heritage Program Manager and Kent Smith

History Colorado

Role in the Ute STEM Project:
Project lead

Location:
Denver, Colorado

About:
Established in 1879, History Colorado is a 501(c)(3) charitable organization and an agency of the State of Colorado under the Department of Higher Education.

The organization offers access to Colorado's history through cultural and heritage resources like its museums and historic sites statewide, programs for families and adults, stewardship of Colorado's historic treasures, and resources for students and teachers making a positive impact on preschoolers, students in grades K–12, and those in higher education. The organization provides programs and services related to historic preservation and archaeology as well as access to a vast collection of archives, artifacts, and historical photography.

The History Colorado Center, opened in 2012 in Denver, houses core exhibits along with traveling exhibitions through its Smithsonian Affiliation. It offers public programs, events, and educational programs that foster cultural understanding through authentic perspectives. The History Colorado Center is also home to the Office of Archaeology and Historic Preservation, State Historical Fund, and Stephen H. Hart Research Center.

History Colorado's museums and historic sites include the Center for Colorado Women's History, El Pueblo History Museum, the Fort Garland Museum & Cultural Center, Fort Vasquez, the Georgetown Loop Historic Mining & Railroad Park®, the Healy House Museum and Dexter Cabin, the Trinidad History Museum, and the Ute Indian Museum.

As part of History Colorado, the State Historical Fund's historic preservation grants program has awarded more than 4,500 grants in all 64 counties across Colorado, resulting in a total impact of more than $1.07 billion on Colorado's economy since the program's inception in 1993.

As the State Historic Preservation Office, the Office of Archaeology and Historic Preservation assists with archaeological permitting, nominations to the National and State Registers, certification of county and municipal preservation programs, approval of federal and state preservation tax credits, and review of the effects of federal projects on historic resources. The office also maintains a database of archaeological and historical resources throughout Colorado.

Contact information:

1200 Broadway
Denver, CO 80203
303-447-8679
HistoryColorado.org

History Colorado Leadership:

Dawn Di Prince, Executive Director and State Historic Preservation Officer

History Colorado Board of Directors

Past leadership: Steve Turner, Ed Nichols, Kathryn Hill, Bill Convery, JJ Rutherford

Project Leadership:

Liz Cook, Exhibit Developer, Principal Investigator

Sheila Goff, Curator of Ethnology and NAGPRA Coordinator (retired)

Shannon Voirol, Manager of Exhibit Planning

CJ Brafford, Director, Ute Indian Museum

Lori Bailey, Project Coordinator

Carly Jones, Ute STEM K–12 Education Coordinator

Ute Indian Museum:

CJ Brafford

Chris Cooper

Carly Jones

Regina Lopez-Whiteskunk

Mary Mentz

Amerson Woodie

Ute Indian Museum Volunteers

Ute STEM Field Work Participants:

Lori Bailey

CJ Brafford, Oglala Lakota

Liz Cook

Sheila Goff

Shannon Voirol

Amerson Woodie, Oglala Lakota and Navajo

Kelley Ivers

Anita McDaniel

Kirby Stokes

Exhibit Planning, Development, Design, and Production:

Ken Benson

Jason Hanson

Shaun Fausett

Celia Helfrich

Bill King

Abby Krause

Shannon Voirol

History Colorado Curatorial and Collections:

Melissa DeBie

Sheila Goff

Kimberly Kronwell

James Peterson

Stephen H. Hart Research Center

History Colorado Education Programs:

Becca Chickadel

Josie Chang-Order

Liz Cook

Laura Douglas

April Legg

Carly Jones

Sherry Meschko

Sarah Pettis

Caite Plunkett

JJ Rutherford

Brittny Saldaña

Angel Vigil

History Colorado Staff Support:

Michael Carrara

Kelly Williams

Gail Young

Office of Archaeology and Historic Preservation

History Colorado Center Security and Mailroom Staff

History Colorado Community Museum Staff

With heartfelt thanks to our project volunteers:

Emily Dobish, Director of Volunteer Engagement

Volunteers of History Colorado

Juanita Hurtado, Denver Public Schools Student Intern

Luke Poirier, Denver Public Schools Student Intern

Credit Union of Colorado Volunteers

Joshua School Student Volunteers

WorldDenver Volunteers

ExposeYourMuseum LLC | Kate Livingston

Role in the Ute STEM Project:
External evaluator

Location:
Denver, Colorado

About:
Kate Livingston (pronouns: they/she) supports museums, arts, and cultural organizations to better understand their internal climates and cultures, current and prospective audiences, and roles and potential in their communities. Kate has 15+ years of experience designing, developing, and executing research and evaluation and 10+ years designing strategic, master, and interpretive plans. Additionally, they are a Professional Certified Coach (PCC), focusing on executive, leadership, and career coaching. Kate has been the principal investigator on NSF and IMLS grants and coordinated evaluation on NSF, IMLS, NASA, NEH, and NIH funded projects. They are a former board member of the Visitor Studies Association. From 2007-2013, Kate led the department of Audience Insights at the Denver Museum of Nature & Science.

Contact information:

kate@exposeyourmuseum.com
303-885-6750
Exposeyourmuseum.com

Creative contractors

EDX Seattle
(exhibit design and planning, Edxseattle.com)
- Charles Davis
- Sherry Smith
- Kate Rosendale
- Ryan Seago

Gen9 Productions
(videography and editing, Gen9productions.net)
- Mara Ferris
- Robbie Prechtl

JoMotion Creative
(film editing and multimedia programming, Jomotion.com)
- Jody Monson

Erin McPike
(graphic design for portable exhibit and History Take-Out Kit)

ASAP Signs
(garden signage, Asapsignsmontrose.net)
- Julie Holzmeister

Exhibit Interactives
- Ginni Baker (interactive design)
- Janelle Vigil (interactive design and fabrication)
- Holtz Custom Wood & Metal (interactive fabrication)

Legacy Report
- Emphasis Marketing, LLC (Emphasismarcom.com)
- Mittera Colorado (Mittera.com)
- ZR Designs, LLC (ZRDesigns.com)

Special thanks

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Maggie Riggs (science assistant)
Lisa Tshuchiya (field work)

Field work support:
Adams State University
Fort Garland Museum & Cultural Center
Ute Indian Museum and the community of Montrose, Colorado

Ute Knowledge portable exhibit hosts:
Red Rocks Community College, Arvada and Lakewood, Colorado
Rocky Mountain Biological Laboratory, Crested Butte, Colorado
Summit Historical Society, Dillon, Colorado
Southern Ute Cultural Center and Museum, Ignacio, Colorado
Kwayigut Community Academy, Towaoc, Colorado
El Pueblo History Museum and Fort Garland History Museum

Ute Knowledge History Take-Out network partners

And many, many more!

NOTES

[1] Migus 2001

[2] Ser.org

[3] Informalscience.org/what-informal-stem-learning

[4] NSF.gov

[5] Friedman 2008; Bell et al. 2009

[6] Guichard 1995

[7] Nps.gov/articles/000/the-indian-grove-within-great-sand-dunes-national-park-and-preserve.htm

[8] A property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. (NPS.gov)

History Colorado