

## The Maize Database Project Final Report

### Project Description

The Crow Canyon Archaeological Center and the Hopi Cultural Preservation Office collaboratively developed a project entitled, “Developing a Comprehensive Database of Archaeological Maize for Colorado and the Greater Southwest.” Crow Canyon researchers and educators worked with Stewart Koyiyumptewa, program manager of the Hopi Cultural Preservation Office, to submit a grant proposal for the project to the History Colorado State Historical Fund (SHF) late in 2018. SHF awarded the grant (2019-M2-001) to Crow Canyon and work on the project began in 2019. The project has come to be called “The Maize Database Project,” or MDP for short.

This final report provides a summary of the project, the perspectives of indigenous groups that shaped the project, and a list of future research projects and education initiatives that could be conducted using the databases and other products developed by the project. The MDP team developed this list of future projects during meetings conducted at the beginning and at the end of the project. The MDP team includes the following people:

- Hopi researchers and cultural experts: Stewart Koyiyumptewa, Susan Sekaquaptewa, and Jessica Lomatewama
- Crow Canyon researchers, educators, and volunteers: Mark Varien, Grant Coffey, Paul Ermigiotti, and Read Brugger
- Outside research associates: Kyle Bocinsky, Sarah Oas, and Kelly Swarts.

The team members bring many areas of expertise to the MDP. Most important, Stewart Koyiyumptewa, Susan Sekaquaptewa, and Jessica Lomatewama—the Hopi scholars and cultural experts—provided the team with an understanding of the importance of maize to Hopi people and to other Southwest indigenous groups. Paul Ermigiotti, Grant Coffey, Mark Varien, Kyle Bocinsky, and Read Brugger all worked on Crow Canyon’s long-term Pueblo Farming Project. Read also served as the photographer and videographer for the MDP. Grant and Kyle built the databases for the project. Kyle also served as the first author of the grant that partially funded the project, and he helped to direct the project. Sarah Oas is a prominent ethnobotanist, and Kelley Swarts is a leading expert on the genetics of both archaeological and modern Pueblo maize, and they contributed their extensive knowledge of these topics to the project.

The MDP produced thirteen deliverables. The deliverables included meetings among MDP team members, visits to museums to view maize in their collections, development of educational materials used in making presentations at professional meetings and to the public, and tools for understanding the importance of maize in Greater Southwest, which includes northern Mexico and the southwestern United States.

Four deliverables provide the foundation for this final report. These include 1) museum visits to view maize collections, 2) a database of all available dated maize, 3) an inventory of available Southwest maize in the collections of museums and other repositories, and 4) an annotated bibliography that serves as a tool for those who use the database of maize dates and the database of maize curated in

museums and other repositories. These and other materials from the project can be accessed at <https://maize.crowcanyon.org/>.

## Project History

The MDP grew out of a long-term collaboration (2006–present) between the Hopi Cultural Preservation Office and the Crow Canyon Archaeological Center. The collaboration is known as the Pueblo Farming Project, or PFP. Financial support for the PFP includes grants from the History Colorado State Historical Fund, the National Science Foundation, National Geographic, the Christensen Fund, and ongoing support by the Crow Canyon Archaeological Center.

Pueblo farmers initiated the PFP because of the importance of maize and maize farming in Pueblo culture. It is difficult to overstate the importance of maize to Pueblo people. Pueblo oral histories tie their origins to the adoption of maize agriculture, and archaeologists also view the introduction of maize agriculture as the beginning of Pueblo culture. For Pueblo people maize represents more than food as it permeates almost every aspect of their culture and religion.

Indigenous people domesticated maize in the Rio Balsas drainage of present-day Mexico, a process that began c. 10,000 years ago (Ranere et al. 2009). Archaeological research and genetic studies have played a key role in understanding the domestication and subsequent spread of early maize agriculture (Piperno and Flannery 2001). Maize first entered the Southwest United States about 5,000 years ago (Merrill et al. 2009; Vint 2017; Crow Canyon Southwest maize dates database), and it eventually became adapted to the temperate environment of the upland Southwest (Swartz et al. 2017). This led to the Mesa Verde region of southwestern Colorado becoming a major center of ancestral Pueblo culture.

Maize represents the most important food source for ancestral Pueblo people, providing up to 70% of the calories consumed annually (Matson 2016). Today, maize is central to Pueblo ceremonial and cultural life by being integral to rites that mark childbirth, the naming of babies, initiations from childhood to adulthood, the transition that marks the end of life, communal feasts, religious ceremonies, and more. Many studies link either shortfalls or abundance in maize yields to important events in Pueblo history, including population growth and cultural elaboration (Bocinsky et al. 2016) and the eventual depopulation of the Mesa Verde region (Schwindt et al. 2016).

Given the central role of maize in Pueblo society past and present, understanding how Pueblo people adopted and modified maize is of paramount importance to reconstructing 5,000 years of Pueblo history and for maintaining Pueblo traditions today.

Pueblo farmers from Ohkay Owingeh, Tesuque, Jemez, Zuni, and Hopi created the plan for the PFP during a 2006 meeting at Crow Canyon. The project included the creation of six experimental gardens. The Pueblo farmers wanted to know if their maize varieties and farming techniques would produce yields in the Mesa Verde region of southwestern Colorado, which they consider as part of their ancestral homeland. Among other things, the gardens would measure how yields varied depending on annual changes in precipitation and temperature and, on the soil characteristics of each garden, and on settings of the individual gardens. Five of the gardens were located on the Crow Campus just outside of Cortez, Colorado, with the final garden located on Mike Coffey's farm just outside of Dove Creek, Colorado.

The Pueblo farmers decided that Hopi should take the lead on the project. Hopi continues to practice dry farming, where the only moisture the plants receive is what falls from the sky, and the ancestral

Pueblo people of the Mesa Verde also relied primarily on dry farming. Hopi farmers provided their maize seed varieties, participated in planting and harvesting, and taught the Crow Canyon staff traditional farming techniques for planting, tending, and harvesting the maize.

The PFP-MDP represents one of Crow Canyon's longest-running research and education initiatives, and one of the Center's most important collaborations with American Indian partners (Ermigiotti et al. 2022). The PFP includes as its centerpiece an experimental farming study, but the project also develops and delivers educational curricula, publishes research results, and pursues Hopi interests in maize and maize farming. For example, at the request of the Hopi Cultural Preservation Office (HCPO), the PFP conducted DNA analysis of 16 varieties of modern Hopi maize (Swarts 2017; Varien et al. 2018).

A journal article (Bocinsky and Varien 2017) and two book chapters (Varien et al. 2018; Ermigiotti et al. in press) report PFP research results. An e-book, *The Pueblo Farming Project*, provides the most thorough description of the PFP and updates the results of the experimental farming program each year (Ermigiotti et al. 2022). A documentary film about the PFP, titled *More than Planting a Seed* (Simon 2016), can be accessed through the e-book. The Maize Database Project represents the latest in a series of research initiatives that build on the work of the PFP.

### **The Maize Database Project**

In 2018, the Hopi Cultural Preservation Office (HCPO) hosted a meeting at Kykotsmovi, Arizona where the Pueblo Farming Project team shared the results of the PFP with the Hopi community. After the community meeting, HCPO staff and Crow Canyon staff met for a lengthy discussion about the next step for the PFP. Together, we developed the outline for the Maize Database Project at this meeting.

The Maize Database Project expands the scope of the PFP by conducting the first-ever comprehensive assessment of collections of ancestral and ethnographic maize curated in museums and other repositories. This includes maize from Colorado, the southwestern United States, and northern Mexico. The largest maize database to date is the Ancient Maize Map (Blake et al. 2022); however, this is limited in scope to C14-dated samples, and at the time the MDP began it contained no dated samples from southwestern Colorado.

The MDP fills this gap. It enables studies of how different varieties of maize developed and spread, including the important transition from the first variety of maize—a chapalote-like popcorn—to flour and sweet corn endosperm varieties that were larger and more nutritious. It also enables further study of the development of temperate adaptations in maize, which eventually allowed maize to spread across North America and around the world. The MDP also created a comprehensive database of all available dated maize from the Greater Southwest and includes over 2,100 samples. Finally, we compiled a thorough annotated bibliography to facilitate the use of the curated maize database and the database of maize dates.

The comprehensive database of available curated Southwest maize, the comprehensive database of accessible dated maize, and the annotated bibliography appear on Crow Canyon's website, along with this final report. Public outreach conducted as a part of the MDP includes a Crow Canyon webinar, webinars for other organizations, presentations at professional meetings, and Crow Canyon social media posts. This outreach made awareness of the MDP and its accomplishments widely known. Links to the Crow Canyon webinars on the PFP and MDP and the PFP e-book appear on Crow Canyon's website, and

these provide more background information and videos of Hopi team members speaking about the project.

Our team of Hopi scholars, archaeologists, educators, and maize specialists conducted a series of workshops, meetings, and museum visits. During these collaborations, we assessed connections between ancient maize and modern Pueblo varieties, determined criteria that specimens must meet to be viable for future analyses, and identified a list of research studies and educational initiatives. We list these research and education initiatives below.

The Maize Database team contacted a total of 74 museums and repositories to request an inventory of maize in their collections. This includes museums and repositories from the following locations: 21 from Colorado, 9 from Arizona, 9 from Utah, 9 from New Mexico, 7 from Texas, 5 from Nevada, 15 from other states.

We obtained inventories from 47 of these museums/repositories, including 15 from Colorado, 7 from Arizona, 7 from Utah, 4 from New Mexico, 3 from Nevada, 1 from Texas, and 10 from other states. Table 1 lists the museum/repositories that contributed to the maize database.

Seven museums/repositories responded to our request saying they had no maize in their collections. This includes the following institutions: University of Northern Colorado Anthropology Collections; Great Sand Dunes National Park and Preserve; Colorado Mesa University; Douglass County History Repository; Blackwater Draw Site and Museum; Southern Utah University Garth and Jerri Frehner Museum of Natural History; and the Museum of Texas Tech University.

Seven institutions responded and said they would provide an inventory, but currently we have not received their data.

Three museums responded saying they had maize in their collections but could not or would not provide us with an inventory.

Ten museums/repositories never responded to multiple requests we made asking them to share their inventories.

An accession is the formal act whereby a museum or other repository legally accepts an object or objects into their permanent collection. The 47 inventories provided by museums/repositories include 18,265 accessions of maize. Most of these accessions include more than one object of maize, so the total number of Southwest maize specimens in these collections almost certainly exceeds 100,000 maize objects and probably exceeds 200,000.

The collections include maize from all major regions of the Greater Southwest. For the purpose of the MDP, the Greater Southwest stretches from far West Texas in the east, to southern California in the west, and from northern Mexico in the south, to the northern borders of Colorado and Utah in the north.

The maize in these collections represents about 5,000 years of agriculture. The specimens include the earliest maize in the Southwest, including samples from the Tucson Basin in southern Arizona and samples from other early-agricultural sites in Arizona and New Mexico. Maize samples become more common over time, and the collections contain maize from all major archaeological time periods.

In addition to archaeological maize, the maize accessions also contain ethnographic collections made during the late 1800s and early-to-mid 1900s. This includes collections from almost every Pueblo nation, and from many other indigenous groups from the southwestern United States and northern Mexico. These ethnographic samples provide the best available inventory of indigenous maize varieties present in historic times.

**Table 1.** Museums and Repositories that Provided Inventories

<b>Colorado</b>
1. Canyons of the Ancients Visitor Center and Museum
2. Denver Museum of Nature and Science
3. History Colorado
4. Museum of Natural History, UC, Boulder
5. Colorado Springs Fine Arts Center at Colorado College
6. Museum of Anthropology, University of Denver
7. C.T. Hurst Museum Western Colorado University
8. Fort Collins Museum of Discovery
9. Museums of Western Colorado
10. Luther Bean Museum Adams State University
11. Colorado Springs Pioneer Museum
12. CSU Center for Mountains and Plains Archaeology
13. Trinidad State College Loudon Henritze Archaeology Museum
14. Metropolitan State University of Denver
15. Center for SW Studies/Dept of Anth Ft Lewis College
<b>Arizona</b>
16. Arizona State Museum U of A
17. Museum of Northern Arizona
18. ASU Center for Archaeology and Society and Repository
19. Sharlot Hall Museum
20. Smoki Museum
21. Amerind Foundation
22. Grand Canyon Museum Collections
<b>Utah</b>
23. Edge of the Cedars State Park Museum
24. BYU Museum of Peoples and Cultures
25. U of Utah Museum of Natural History
26. Utah State U Eastern Prehistoric Museum
27. Fremont Indian State Park and Museum
28. Anasazi State Park and Museum
29. Southern Utah University Archaeological Repository
<b>New Mexico</b>
30. Maxwell Museum

31. Laboratory of Anthropology, Museum of Indian Arts and Culture
32. NM State University Museum
33. SMU- Taos Pot Creek Pueblo
<b>Nevada</b>
34. Lake Mead National Recreation Area
35. Las Vegas Natural History Museum
36. Desert Research Institute
<b>Texas</b>
37. Panhandle Plains Historical Museum
<b>Other</b>
38. Museum of Anthropology Washington State University
39. Peabody Museum of Archaeology and Ethnology
40. Harvard University Herbaria
41. American Museum of Natural History
42. Field Museum of Natural History Anthropology/Field Museum Economic Botany Collections
43. National Museum of the American Indian
44. Smithsonian National Museum of Natural History
45. Robert S. Peabody Institute of Archaeology
46. Phoebe A. Hearst Museum of Anthropology
47. Missouri Botanical Garden

Most of the samples in collections are maize cobs, both unburned and burned. There are also many accessions of maize kernels, again both unburned and burned. While fewer in number, there are also many other maize plant parts. In addition, there are many types of maize artifacts. Some of these artifacts include ceremonial objects.

Table 2 presents a summary of the variety of types of maize objects present in collections, the types of maize artifacts present in the collections, the indigenous groups from whom maize was collected, examples of maize foods made by these groups, the range of maize color varieties present in the collections, the terms for maize varieties used by those who collected the maize, and examples of ceremonial use of maize.

**Table 2.** Examples of Objects and Categories of Items Represented in the Maize Database.

**Maize Parts:**

Maize cobs  
 Maize kernels  
 Maize husks  
 Maize tassels  
 Maize shanks  
 Maize stems  
 Maize stalk  
 Maize glume

**Maize Artifacts:**

Cob on a stick  
 Maize quids  
 Maize pot rest  
 String of maize cobs  
 Maize cob stopper  
 Maize cob pottery scraper  
 Maize cob with eagle feather  
 Maize husks cut, tied together, braided, knotted

Maize peduncle  
Maize florets  
Maize roots  
Maize pericarp

**Ethnographic Maize:**

Hopi  
Zuni  
Acoma  
Laguna  
Sandia  
Isleta  
Santa Ana  
San Felipe  
Zia  
Jemez  
Cochiti  
Tesuque  
San Ildefonso  
Nambe  
San Juan/Ohkay Owingeh  
Picuris  
Taos  
Havasupai  
Supai  
Walapai  
Mojave  
Cocopah  
Akimel O'odham  
Tohono O'odham/Papago  
White Mountain Apache  
Mescalero Apache  
Jicarilla Apache  
San Carlos Apache  
Navajo  
Ute  
Tarahumara

**Maize Color Varieties:**

Blue  
White  
Red  
Yellow  
Purple  
Blue gray  
Speckled blue white  
Violet

Maize basket  
Maize husk mat  
Maize meal bag  
Maize tassel pillow  
Maize dart  
Maize figurine  
Maize stalk rattle

**Maize Foods:**

Maize white meal Hopi  
Maize popped  
Maize wafer bread piki bread  
Green corn baked in husks  
Somipiki Hopi  
Boiled corn (Jegos Jyash Me) Hopi  
Meal (Sakwaya Numne) (2 Jars) Hopi  
Corn-bran (Tsi Pu) Hopi  
Corn meal (Horn Gnumne) Hopi  
Dried unripe Corn "Mony" Pima  
Hominy Corn "Kiitsap-Kwivi" (2 Jars) Hopi  
Meal (Dibos Dose) Seed Ground Hopi  
Meal (Pigam Dose) Hopi  
Shikwi Dose - Meal Ground Hopi  
Parched Boiled Whole Corn "Kutuki) Hopi  
Roasted Corn for Coffee (Kaetakti) Hopi  
Sprouts Young Corn (Paoinai) Hopi  
White Meal (Chuku Bike) Hopi  
White Meal (Kwetsa Umne) Hopi

**Terms for Maize Varieties:**

Chapalote  
Flour  
Dent  
Flint  
Maize de Ocho  
Zia mays indurate  
Sweet

Black  
Dark red  
Dark blue  
Purplish black  
Red and white striped  
Blue and white striped  
Yellow and white striped  
Red and yellow striped  
Vermilion  
Salmon  
Dark red brown  
Reddish yellow  
Pink  
Orange  
Black and pink

**Possible Maize Ceremonial Use:**

Maize ears covered in salt mud Zuni Salt Lake  
Ceremonial ear of corn Canyon del Muerto  
Ear of corn charm Shipaulovi  
Corn stalk with dyes  
Sacred hill of corn Hopi  
Ceremonial corn cob  
Corn husks cut and tied for ceremonial use in smoking  
Yellow or white corn meal stained by being saturated by a brown liquid (perhaps yucca juice). Handed out at Olowish dance Zuni  
Kroeber and Parsons early 1900s

**Integrating the Maize Database and Making the Database Public**

A formal request was submitted to each museum or repository by the Crow Canyon Archaeological Center and the Hopi Cultural Preservation Office. A copy of that request is included at the end of this report.

This request specified the format and content of the inventories we hoped to receive from repositories. We quickly learned that most institutions could not provide inventories that followed our guidelines because the museums or repositories have their own system for accessioning collections. This resulted in considerable variation in the format and content of the data provided by the 47 repositories.

Grant Coffey, Database Manager at Crow Canyon, developed the methods to integrate these different inventories into the final inventory of curated maize specimens published on the website. Individual repository lists were integrated into a single master inventory by systematically making them comparable to one another by standardizing the overall data structure. Grant accomplished this standardization and integration in two ways. He retained key fields in the master inventory that were present in most repository datasets. This included fields like Catalog Number, Accession Number, Object, and others. Then he combined data from other unique, repository-specific fields into new descriptive fields that he labeled as the “Comments” and “Notes” fields.

The goal was to retain all key data received from repositories while minimizing the number of fields in the master inventory. Some fields like “Comments” and “Notes” are largely parallel in terms of content, but the information provided in these fields varied by repository, so both fields were retained in the master inventory.

Once the individual repository datasets were standardized by field type and content, they were combined in Microsoft Excel using a Power Query. This process allows multiple datasets to be combined at once while retaining the underlying data structure defined for the master inventory.

Individual datasets were added one at a time to the master inventory. As this was done, Grant assessed descriptive fields for information pertaining to the fields present in the master inventory. For instance,



mention of “burning” or “charring” of a specimen in a descriptive field resulted in specimens being recorded as “Burned” in the master inventory field that records this attribute, even if the original repository inventory did not have a field for this attribute. While Grant attempted to standardize these data, it remains likely that some specimens in the master inventory are burned but are not coded as such in the database (i.e., we believe there is an underestimation of the burned samples as reflected by the burned field).

Despite the large numbers of records contained within the Maize Database, it is of a manageable size. Therefore, we can make the database publicly available, downloadable, and searchable via the Crow Canyon Archaeological Center website. Access to the publicly available version of the dataset can be found by following this link: [https://www.crowcanyon.org/projects/maize\\_database\\_project/](https://www.crowcanyon.org/projects/maize_database_project/)

### **Hopi Perspectives**

As noted by Wall and Masayeva (2004:436), “For traditional Hopis corn is the central bond. Its essence, physically, spiritually, and symbolically, pervades their existence.” Hopi scholars and cultural experts helped to create the PFP and MDP because of this fundamental importance of corn to Hopi people.

When the PFP was initiated, Hopi researchers and farmers were primarily interested in whether their seed and their traditional farming techniques would result in successful harvests in their ancestral homeland of the Mesa Verde region. They did! During the PFP, we measured the effects of environmental variables on maize growth and yields, created educational materials about Pueblo farming and the importance of maize, and documented the genetic diversity of modern Hopi maize. For Hopi members of the team, the PFP further strengthened the connection between contemporary Pueblo people and the Mesa Verde region.

During the March 2018 meeting with the Hopi Cultural Preservation Office (HCPO), Stewart Koyiyumptewa (Program Manager of the HCPO, and Co-PI on MDP) emphasized that the PFP represents an important project for the Hopi people, and they want it to continue. The future projects discussed at that meeting included a call to examine ancient maize in museum collections and to conduct ancient DNA analysis of this maize and compare it to the DNA of modern Hopi maize to strengthen their cultural affiliation and intellectual property claims. The MDP represents a first step towards those goals.

Hopi HCPO members and members of the HCPO Cultural Resource Advisory Task Team also recognized that the PFP had focused on planting, tending, and harvesting maize—activities traditionally undertaken by men. The Hopi farmers who collaborated on the PFP included 15 Hopi men, but these farmers stressed that once the maize was harvested, women took control of the crop. Among other things, women manage the storage, prepare the foods, and select the seed to be planted each year.

At our 2018 meeting, we decided it was critical to have Hopi women be a part of the MDP. Subsequently, Susan Sekaquaptewa and Jessica Lomatewama joined the MDP team. They both belong to clans—the Butterfly and Badger clans respectively—that came to Hopi from the north and possibly from the Mesa Verde region. They joined the team to contribute their knowledge about the importance of maize and to provide their perspectives on the maize held in the collections of museums and repositories.

The Hopi members of the team viewed the MDP as a tool for descendant communities to connect to their deep histories in the Southwest and to the role maize plays in the formation of their cultural identities. They further viewed the project as potentially leading to the identification of items of cultural

patrimony that may be subject to repatriation. Finally, they viewed the MDP as a tool for indigenous communities, who are starting their own collections, to identify candidate materials for curation and loan agreements with repositories.

Perhaps the most profound experience for the MDP team, especially the Hopi members of the team, was the ability to view collections at three repositories: Canyons of the Ancients Visitor Center and Museum, the Mesa Verde Visitor and Research Center, and Edge of the Cedars State Park Museum. Part of our documentation of these museum visits are videos that record observations about the maize samples made by the Hopi members of the team (as well as other team members). As noted by Jessica Lomatewama at our final meeting, “the hands-on experience of viewing the corn was like touching our ancestors. My hope is if we teach our young people with these collections, it will connect them to our culture.” Perhaps more than anything, this illustrates the importance and power of these collections for Hopi and other indigenous people.

### **Ideas for Future Research Projects**

The maize database team identified several topics and questions to pursue through future projects. These ideas for future research came from viewing collections and examining the comprehensive databases of maize dates and maize specimens held in the collections of museums and other repositories. These research topics and questions are listed in the following bullets.

- Identify spatial and temporal gaps in the distribution of maize dates and then search the maize database for maize samples to date and fill these gaps. This dating project would provide a better understanding of the spread of maize throughout the entire Southwest over time.
- Look at associated climatological contexts with dated maize to determine whether/how climate change affected the spread of maize.
- Identify all unburned maize that comes from sites and contexts that likely date to the period when maize first spread throughout the Southwest. Visit museums/repositories to examine and document the characteristics of this early maize. Examination would include developing nondestructive methods for evaluating maize endosperm. The analysis and documentation of these characteristics would address many questions, including but not limited to the following:
  - Systematically evaluating the idea of “landraces” in ancestral and contemporary maize.
  - Systematically evaluating the development and introduction of flour endosperm varieties of maize as part of the Neolithic Demographic Transition in the Southwest.
  - Expand the genetic study of early maize conducted by Swarts et al. 2017 to include maize from more archaeological sites and geographic contexts to comprehensively document the development of new maize genetic characteristics that allowed maize to spread into temperate environments.
- Identify later unburned maize and evaluate the types of endosperm present, including sweet corn. Document how varieties across the Southwest are similar or different and how they varied through time.
- Examine all ethnographic collections of maize to document and describe the variation of indigenous maize present during the late 1800s and early-to-mid 1900s. Compare this variation to the variation in the early maize in the museum/repository collections. Compare this variation to the varieties still present in Southwest Indigenous communities today to assess how maize varieties changed from the earliest maize to maize still in use today.
- Document maize diversity among Southwest indigenous groups. Begin with Hopi maize but extend the study to the other Southwest indigenous groups. Determine where the maize used

by each group came from over time and evaluate the climatological and environmental contexts for the adoption of those varieties by each group.

- Examine the collections to document the diversity of foodways present among Southwest indigenous maize.
- Identify the variation of row numbers in maize and determine how this varies through time and across space.
- Determine how maize was being processed and stored through time, for example, shelled versus unshelled, bound and hung, etc.
- Look at artifacts associated with early maize, including but not limited to tools for processing maize.
- Develop a study of cob-on-stick artifacts to determine their spatial and temporal variation and the variation in how they were made.
- Encourage synthetic research about maize in other regions—for example in the Southeast, Midwest, Northeast—and establish other maize databases (or add to this one).

### **Ideas for Future Education Projects**

Equally important, the MDP can be used to develop educational initiatives. Some of these are listed in the following bullets.

- Create an online lesson about maize and its importance to Southwest indigenous groups.
- Include in that lesson how maize spread to become the world's most important crop today.
- Work with teachers to develop a lesson plan for incorporating this online lesson into a classroom lesson.
- Develop the outreach to make teachers aware of these online and classroom lesson plans. Focus on indigenous schools and teachers at the beginning and then expand to teachers and classrooms across the country.
- Develop partnerships with nearby museums and repositories so these lessons include a field trip to museums. Have curators pull maize objects from the collections before these museum visits so that students could view and learn from these objects. For example, Hopi students at Hopi schools could travel to the Museum of Northern Arizona to view maize specimens in their collections.
- Create a lesson/tool for teaching indigenous stories about maize to indigenous youth.
- Create a lesson/tool for teaching indigenous language via words for different maize varieties and artifacts.

### **Summary**

The MDP includes many important accomplishments. This includes several public presentations about the MDP that were viewed by people from across the U.S. and beyond. For example, a webinar on the MDP was delivered as a part of the Four Corners Lecture series on October 28, 2021. This webinar was viewed by a large audience. A total of 210 people registered for the webinar on zoom, and the webinar reached another 717 people through Crow Canyon's Facebook page. After its live presentation, the webinar was published on Crow Canyon's YouTube page, and an additional 560 users have viewed this archived version of the webinar. Access to the webinar is ongoing and the number of viewers will continue to increase.

In addition, the details of the MDP were presented at two professional conferences: The March 2022 annual meeting of the Society for Applied Anthropology in Salt Lake City and the 18<sup>th</sup> Biennial Southwest Symposium in Santa Fe in January 2023.

Finally, the MDP is featured on the Crow Canyon Archaeological Center website, where it has been read by hundreds of users.

This final report utilized deliverables created by the MDP to create lists of future research and education initiatives. Products that were key to developing these new research and education initiatives include the following: 1) opening and closing MDP meetings attended by the MDP team; 2) visiting three museums/repositories to view their maize collections, 3) compiling a database of all available dated Southwest maize, 4) compiling an inventory of all available Southwest maize in the collections of museums and other repositories, and 5) compiling an extensive annotated bibliography on Southwest maize that facilitates the use of the maize dates database and the curated maize database.

The database of dated maize includes 2,118 dates on samples of maize. The bibliography provides references where most of those dates were first presented, and these references describe the contexts for the dated samples. Publication of this database on Crow Canyon's website makes it accessible to indigenous communities, researchers, educators, and the public. It provides an invaluable resource for future work.

The database of Southwest curated maize includes specimens from 47 museums and repositories. The database includes a total of 18,265 maize accessions and probably over 200,000 individual maize specimens. The Southwest maize contained in this inventory is important in many ways, including understanding how maize expanded from more tropical environments into temperate ones. As such, it is critical to understanding how maize spread to indigenous groups throughout North America and how it became arguably the world's most important crop today. This inventory is the first of its kind, and like the dates database it will be an important tool for future studies of maize and for the development of educational curricula about maize.

The MDP exemplifies the productive work that can be accomplished through partnerships between Native American groups and institutions like the Crow Canyon Archaeological Center that is dedicated to research, education, and collaboration with Indigenous partners. For decades to come, a wide range of users will benefit from the databases and other materials created and made available by the MDP. The many unique and notable achievements of the MDP were made possible through a History Colorado State Historical Fund grant, and we are extremely grateful for that support.

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Repository, Curator, Address:

Dear ,



THE  
RESEARCH INSTITUTE AT  
CROW CANYON



We are writing to ask for your assistance on a new research collaboration between the Crow Canyon Archaeological Center and the Pueblo of Hopi Cultural Preservation Office (CPO), the Maize Database Project. Briefly, we seek your cooperation in providing us with an inventory of all the ancient maize housed in your collections. If there is no maize in your collections, we would appreciate knowing that as well. First, we want to provide some context for our project and then we will address the specifics of our data request.

The Maize Database Project is the next chapter in a long-term CCAC-Hopi CPO project known as the Pueblo Farming Project (PFP). We published an e-book on the PFP, and you can access this book and learn about the PFP at this link: [https://crowcanyon.github.io/pfp\\_ebook/](https://crowcanyon.github.io/pfp_ebook/). The History Colorado State Historical Fund and Crow Canyon are funding the Maize Database Project, which we hope to complete by the end of this year.

The primary objective of the Maize Database Project is to create a database of all archaeological maize from the US Southwest (mainly Colorado, New Mexico, Arizona, and Utah) in the collections of museums and other repositories. We envision a comprehensive database that includes all maize plant parts and both burned and unburned maize, as well as cultural artifacts made from maize parts.

The database will serve many stakeholders, including researchers, descendant communities, and the interested public. The project will have other products as well including educational materials, and we are working to understand women's roles in the use of maize and maize farming. **Our overarching goal is to create a tool that will provide researchers with the information necessary to build coherent research designs concerning ancient maize in the US Southwest, and to be able to communicate effectively and efficiently with curation staff about their needs.** This includes site-level provenience, catalog/accession information, and research request protocols for the museum/repository.

The Maize Database Project team is led by Mark Varien and Stewart Koyiyumptewa, Program Manager of the Hopi Cultural Preservation Office. Other project members include Kyle Bocinsky, Paul Ermigiotti, and Grant Coffey from Crow Canyon, cultural experts Susan Sekaquaptewa and Jessica Lomatewama from Hopi, and two outside scholars: Kelly Swarts, a specialist in ancestral Pueblo maize genetics from the Gregor Mendel Institute at the University of Vienna, and Sarah Oas, an ethnobotanist at Arizona State University.

As a preliminary step in this project, we requested inventories of ancient maize from 10 repositories. Using these as examples, we identified the kinds of information we will include in our maize database. The data fields will include the following categories of information:

- Information on your repository/museum (name, address, website, research request protocols)
- Accession/collection information, including accession/collection numbers and associated project references, if available.
- Catalog number for each specimen—a unique identifier for each specimen that links to records in your repository’s catalog
- Provenience information, including site number or other id number that can be associated with state archaeological site databases by credentialed individuals, and if available more detailed intrasite provenience information
- Fields describing the specimen, including the following:
  - Other object unique identifiers (if different from accession# and catalog#)
  - Culture (if available; e.g., Pueblo)
  - Historic/Cultural Period/Maker (if available; e.g., Pueblo, Basketmaker, etc.)
  - Image/Photo (present/absent, thumbnail if available)
  - Collector/excavator/project identifier (if available)
  - Whether the object is burned/charred
  - Object Description (e.g., corn cob, kernel, husk, etc.)
  - Comments/Notes/Remarks (longer narrative with descriptive information)
  - Analyses conducted (e.g., has the material been dated or otherwise analyzed? Are those data publicly available from your catalog?)

**Our maize database will not contain site-specific location information** (e.g., UTM or Lat.-Long.). If researchers want locational information, the state site number will allow them to request this information using established protocols developed by the State Historic Preservation Officer and/or the appropriate state or federal agency.

Given this information, we request the following from you:

- An excel spreadsheet with a comprehensive inventory of maize in your collections that includes as many of the fields described above that you can provide (no PDFs, please)
- Metadata that describes each of the fields (if necessary)
- The search parameters that produced the inventory (if possible); a list of search terms used (e.g., “maize”, “corn”, “*Zea mays*”, etc.) or a series of SQL statements would be sufficient.
- Protocols that you want to share for how researchers or descendant communities could request to work with these materials

Finally, we plan to do the following with the inventories we receive from repositories:

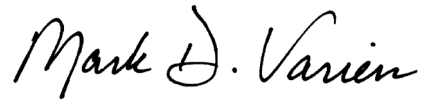
- Integrate the databases we received from each repository into a single maize database
- Make the maize database accessible via a publicly accessible online portal, hosted as part of the Crow Canyon Archaeological Center website ([www.crowcanyon.org](http://www.crowcanyon.org))
- Include a map-based search tool that allows people to search records by county
- Archive the spreadsheets we receive from each repository, including fields you provide that are not integrated into our database (**please do not give us site-specific location information**)



- Submit data for specimens that have been radiocarbon dated to the Ancient Maize Map

Thank you very much for your consideration of our request. We hope to hear from you soon with any questions you may have and look forward to working with you on this exciting project.

Sincerely,



Mark D. Varien  
Executive VP  
Research Institute at Crow Canyon  
Crow Canyon Archaeological Center



Stewart B. Koyiyumptewa  
Program Manager  
Hopi Cultural Preservation Office  
The Hopi Tribe