# ROOTS OF WISDOM:
## NATIVE KNOWLEDGE. SHARED SCIENCE.

*Staff & Educator's Guide*

OMSI

# Roots of Wisdom

Native Knowledge. Shared Science.


*About the logo and exhibition design:*

*The graphic icon in the* Roots of Wisdom *logo expresses interconnection, a theme that is emphasized throughout the project in the content of the exhibition and activity guides, as well as the way the Roots of Wisdom Project Team (OMSI and project partners and advisors) worked together. The four colors represent the four cultures featured in the project and are used throughout the exhibition and the website. As a jumping off point, we listed a few evocative words—interconnection, reciprocity, kinship, collaboration—and selected several of the visual elements used in the exhibition graphics—circles, the four colors, and dashed lines. The designer explored a number of options, and we did a quick test with visitors to determine what they thought.*

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Everyday Encounters with Science

**ROOTS OF WISDOM: NATIVE KNOWLEDGE. SHARED SCIENCE.** was developed by the Oregon Museum of Science and Industry (OMSI) in collaboration with the Indigenous Education Institute (IEI), the National Museum of the American Indian (NMAI), native community elders, educators, and youth. The exhibit was produced and is toured by the Oregon Museum of Science and Industry. The exhibit was made possible with funds provided by the National Science Foundation, Grant No. DRL-1010559. Any opinions, findings, and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the Foundation.

# Contents

# Forward

The *Roots of Wisdom* exhibition is rooted in indigenous knowledge and ways of life lived for countless generations. Much of this Traditional Ecological Knowledge (TEK) has been passed down for generations. Today, as never before, this knowledge is of vital importance as it speaks strongly to the significance of balance to create a healthy environment. The exhibition also provides a contemporary scientific perspective, along with the traditional knowledge perspective, illuminating the complementary aspects of both ways of knowing and a greater sense of understanding that would not be possible with one perspective alone.

The exhibition was created through a working partnership between a large science center (Oregon Museum of Science and Industry, OMSI), a Native, non-profit indigenous organization (Indigenous Education Institute, IEI), and four Native communities: Native Hawaiian members of the Pacific American Foundation and Waikalua Loko Fishpond Preservation Society, Tulalip Tribes, Confederated Tribes of the Umatilla Indian Reservation, and Eastern Band of Cherokee Indians. The partnerships were unique in that they were created at the very beginning of the project to engage Native voices as co-creators of the exhibition. This type of collaboration provided a unique organization and process of creating the exhibition collaboratively with mutual consensus. This work was indeed a learning process for the participants and resulted in an exhibition that reflected the voices of the communities and respected the ways that the communities wanted their stories told. At the same time, the process acknowledged the rigor and discipline of the scientific establishment.

*Roots of Wisdom* supported four distinct Native communities in sharing their stories of revitalization and restoration using their traditional knowledge in a contemporary perspective. The result is a synthesis of TEK and Western scientific knowledge in a way that each one complements the other.

There are many commonalities between the two worldviews, but there are also many distinct differences even among and within tribes. In this project, the communities were able to speak for themselves, and the collaborative process allowed for unique and authentic voices to be heard rather than a collective generalized, simplistic approach.

To our eyes, the importance of understanding ecology from a Native perspective may be the most significant aspect of the exhibition. The interconnections of all things and the interdependencies of all relationships need to be understood within this comprehensive context of restoration built on traditional knowledge and practices.

Restoration in this case implies an understanding of environmental balance created by nature. Conservation in terms of the environment can enable a community to achieve wellness and freedom from toxicity. In Native communities, balance is of primary importance. Understanding the concept of balance is a facet of living in accordance with the natural cycle. This concept permeates every aspect of life, from the skies of the universe to every part of the land and oceans.

This collaborative project has provided a place for authentic Native voices in a major science center. Bringing together two lenses and two perspectives of Native and Western science results in a synthesis of restoration and conservation, thus engaging Native communities as well as the scientific community to the benefit of the general public.

The *Roots of Wisdom* exhibition is unique and, to the best of our knowledge, an exhibition like this one has seldom been created before. We are grateful to OMSI and the National Science Foundation, as well as to all the partners, for funding and bringing this project to fruition, in a spirit of collaboration, as well as respecting traditional cultural protocol and professionalism.

There are many Native communities in the United States, and we have only focused on four communities (Native Hawaiian, Confederated Tribes of the Umatilla Indian Reservation, Tulalip Tribes, and Eastern Band of Cherokee Indians) for this exhibition. Almost every tribe across the county is involved in one way or another in these kinds of restoration projects. Wherever *Roots of Wisdom* is exhibited, local tribes may well have restoration projects underway. These projects can also be showcased as an addition to the exhibition and for public outreach in order to provide relevance and be useful to local communities.

Each Native community has established sustainable ecological relationships with the local environment. Many places have been historically altered, but there is great potential to restore the land and waters to a healthy environment. In this age, human health and community wellbeing are connected to the land. A healthy environment can ensure a healthy population via the establishment of a balanced ecological network. A reciprocal relationship of land and water resources should be of vital interest to every person and every community. After all, we share this planet together.

David H. Begay, Ph.D.
Nancy C. Maryboy, Ph.D.
Indigenous Education Institute

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Thank you very much to the following partners, advisors, and contributors for participating in the *Roots of Wisdom* project and the development of this guide.
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# Introduction to *Roots of Wisdom* for Museum Staff

This Staff Guide has been written for the staff working and volunteering in the *Roots of Wisdom* exhibition and the people training them. The guide includes cultural sensitivity information, exhibit descriptions, demonstration ideas, maintenance and safety tips, and the Active Learning Log—an open-ended worksheet for students to fill out while exploring the exhibition.

As museum staff hosting the *Roots of Wisdom* exhibition, it is important to understand some of the critical history, misconceptions, and current realities of U.S. Native communities and peoples. Few people in North America know much about Native communities and cultures, leading them to stereotype Native peoples in disrespectful and misguided ways. Similarly, many non-Native people believe that "Indians are all gone," "ancient relics," or "something from the past" and talk about Native people, communities, and cultures in the past tense. However, as museums and visitors will see in this exhibition (and hopefully elsewhere), Native people have overcome many challenges and are very much alive.

In fact, it is an exciting time in Indian Country. Native peoples today are working on thriving and cultural revitalization. Many communities are also focused on restoring their local environments because environmental health and cultural preservation depend on one another. The National Science Foundation and Ecological Association of America are also looking to Native people to help restore environments. *Roots of Wisdom* demonstrates how four Native communities in the United States are using Traditional Ecological Knowledge along with Western science to restore their local environments.

*Roots of Wisdom* is a cross-cultural collaboration among the Oregon Museum of Science and Industry (OMSI), the Indigenous Education Institute (IEI), the National Museum of the American Indian (NMAI), and the four Native partner communities highlighted in the exhibition including the Confederated Tribes of the Umatilla Indian Reservation, Eastern Band of Cherokee Indians, Pacific American Foundation and Waikalua Loko Fishpond Preservation Society, and the Tulalip Tribes.

Abundant thanks go to all of the project partners, advisors, community leaders, and youth advisory board members who worked together to create this project. Their willingness to share their insights, time, stories, and hopes for the future is the heart of this project and will touch visitors around the country.

If you have any questions about the content of the staff guide, exhibition, or related materials, please contact the OMSI Exhibition Tour Manager at 503.797.4659 so that we can help connect you with the right people to answer your questions.

# Guidelines for Respecting Cultural Knowledge

The topics included here were identified and written in collaboration with Deana Dartt, Ph.D. (*Chumash*), project advisors, and project partners.

This section is meant to be a general introduction for museum staff on how to better respect and present cultural knowledge and issues pertaining to Native peoples in the United States. By no means does the following section encompass all of the ongoing and multifaceted matters related to the varied and diverse cultures of the indigenous peoples of North America and Hawai'i. Instead, the content is intended to address some of the most important questions and issues that museum staff might come across or be asked about. We strongly encourage museum staff to learn more by accessing the resources listed at the end of the guide and by looking for educational resources created by Native communities in their areas.

**Respecting Native cultures**

Valuing and respecting diverse cultures is critical for museums of all types and particularly important when hosting the *Roots of Wisdom* exhibition. Staff should be considerate of cultural differences and similarities that exist without equating value (right or wrong, good or bad) to these differences. Respecting people and cultures means recognizing that all individuals are unique and that the way they interact with their community and the larger world is affected by their language, beliefs, values, and personal experiences. Respecting cultures in this way also allows us to communicate and collaborate more effectively with diverse communities, such as in the *Roots of Wisdom* exhibition.

When hosting the *Roots of Wisdom* exhibition or conducting any project with Native communities, it is critical to develop a basic understanding of the key issues impacting Native communities today and historically. This understanding is particularly important because of the long history of human rights abuses Native communities have been subjected to and the lack of information most people have about contemporary Native peoples. Below, we highlight historical notes and discussions of some of these key issues that project partners and advisors wanted staff at host museums to be aware of.

> *"Native people often feel the term 'wild' is a pejorative term. From a Native perspective, it is thinking more about a natural order. There is no such thing as a wild river, it has an order, nature's order. The beauty has an order." —David Begay, Ph.D. (Diné [Navajo]), Vice President, IEI*

**North America was not "wild" or "undiscovered" before Europeans arrived**

In many Native American languages, there is no word for wild. Instead, nature is often understood as an interconnected, organic system of which the indigenous people are a part. However, because European explorers and settlers did not understand these interconnections or natural systems, they called the environments that they encountered in the Americas "wilderness." Therefore, for many Native people, using the word "wild" diminishes the value of nature's order and the long-term relationships indigenous communities have had with their homelands.

> *"European settlers who first arrived in the 'New World' wanted to believe it was just that: new not only to them but to all human kind. With their diseases preceding them, diminishing complex Native civilizations, Europeans readily assumed that the Americas were, and always have been, a barely populated wilderness. This view, which justified hundreds of years of European land theft and mistreatment of Indians, has been slow to die." —Stephanie Batencourt, NMAI (quotation from the NMAI book* Do All Indians Live in Tipis?*)*

Similarly, it is crucial to understand that the ancestors of contemporary Native American people were the original discoverers and inhabitants of North America and that they lived on this continent for thousands of years before Europeans arrived. Contact with Europeans first occurred with the arrival of Western explorers and settlers in the fifteenth century who brought with them devastating diseases that Native peoples had no immunity to, cultural conflict, and displacement on a mass scale. These disturbances changed the life-ways and futures of millions of people, and Native communities today are still recovering from the near obliteration of their populations and cultures.

> *"When talking about a name for the exhibit 'wild' was a word that rubbed people the wrong way. Native people know about managing resources from living in the same place for so long. Before Europeans showed up, they assumed things were 'wild.' They didn't know how to take care of it." —Randall Melton (CTUIR), Collection Curator, Tamástslikt Cultural Institute]*

Although Europeans perceived North America as empty space when they arrived, it was in fact populated by tens of millions of people (Batencourt 27) from an enormous diversity of Native American communities. The continent was a mosaic of sophisticated cultures with varying political systems, spiritual beliefs, languages, and forms of art. These cultures included rich knowledge of their local ecosystems and how to sustain their communities in that environment. Many tribes also had working systems of agriculture and aquaculture that dated back hundreds or thousands of years.

**Refer to Native communities with the appropriate names**

It is best is to refer to the specific, official tribal or National name whenever possible. Many Native people feel honored and recognized when their tribe, Nation, or community is referenced accurately. Many tribes are commonly known by names that they do not use for themselves and are sometimes offensive. Therefore, it is best to either ask a tribal member or go to an official resource (e.g. the tribe's government website) to make sure that you are using the appropriate name.

If you do need to use a generic term, *American Indian* and *Native American* are both used in the United States. The terms *Native* and *indigenous* are also acceptable. In Canada, the appropriate terms are *First People, First Nations*, and *aboriginal*. When talking about Hawai'i, use *Native Hawaiians* and, for Alaska, use *Alaska Natives*.

**Native America is incredibly diverse**

Native Americans do not belong to a single homogenous group—instead Native people in the United States belong to hundreds of different nations, tribes, bands, villages, Rancherias, and pueblos. As of September 2014, there are 566 federally recognized American Indian tribes and Alaska Native villages in the United States (http://www.bia.gov/WhoWeAre/index.htm). Many other tribes and Native communities are not federally recognized, but are recognized by states or are seeking federal recognition. For more information on this topic, visit NMAI's website for the *Nation to Nation* exhibition (http://heritageforward.com/nation-to-nation).

**Identifying "Who is Native?" is a very complex issue**

Identity establishment is a complex issue in many Native American communities**.** Overall, there is no single Native American experience, and each community or tribe establishes its membership in different ways. It is especially important to know that *it is inappropriate to ask someone "how Indian" they are or make assumptions about their Native ancestry based on their appearance as it can be offensive or embarrassing for that person.*

Blood quantum is one system that is used in the United States to identify Native Americans, but it is not the only mechanism that individuals or communities use to define their cultural identities. The Oneida Trust and Enrollment Committee explains, "In the United States, 'blood quantum' is the degree to which an individual can prove a certain amount of Indian blood. This amount is used to determine the individual's tribal belonging and legal rights. Blood quantum is a measure of the amount of Indian blood, expressed as a fraction such as one-half or one-fourth."

For many people and some tribes, though, clan relationships and lineage are more important than blood quantum. For example, the Cowlitz Indian Tribe in Southwest Washington have eliminated the need for blood quantum to establish cultural identify and instead require that newborns be lineal descendants in order to be enrolled in the tribe.

In general, the work of determining membership and establishing cultural identity is a complicated, ongoing issue. To learn more, please see the resources listed at the end of this guide.

> *"Each tribe establishes its membership in a different way. Tribes have the right--because they are governments--to decide who is and who is not a tribal member. As a result, a lot of Native people today may not 'look Indian' or fit a stereotypical image of an Indian." —Liz Hill, National Museum of the American Indian (quotation from the NMAI book* Do All Indians Live in Tipis?)

**Federally recognized tribes are "sovereign nations" with certain rights**

Tribes that are federally recognized by the U.S. government are called "sovereign nations" and are supposed to be protected by federal law differently than other entities. This sovereign nation status is meant to require the U.S. government to engage with the tribe in a "nation-to-nation" relationship. Sovereignty also allows for the nation's independent authority and the right to govern itself.

The sovereignty of federally recognized nations extends to the traditional cultural practices of these communities, including the rights to use land and resources associated with cultural traditions. The following quote from the US Bureau of Indian Affairs addresses the special rights that American Indians are entitled to:

Therefore, some Native communities have the right to hunt, fish, gather, or perform other activities in places where non-Native people are not allowed to because of these treaty agreements.

It is also important to note that sovereignty and treaty rights are a very complicated and contentious issue. Many treaties have not been upheld by the U.S. government, and access to land and resources outlined in treaties is often denied by government or private entities. To learn more about these issues, please refer to the references at the end of this guide.

**Native languages are critical for maintaining Native cultures and knowledge**

Language maintains the strength of a person's cultural identity. Indigenous languages also contain a rich place-based knowledge. Traditionally in Native American societies, language and knowledge have been passed down orally. In recent history, many Native Americans were persecuted for using their language. Many indigenous languages are in danger of disappearing.

> *"Do American Indians and Alaska Natives have special rights different from other citizens? Any 'special' rights held by federally recognized tribes and their members are generally based on treaties or other agreements between the tribes and the United States. The heavy price American Indians and Alaska Natives paid to retain certain rights of self-government was to relinquish much of their land and resources to the United States. U.S. law protects the inherent rights they did not relinquish. Among those may be hunting and fishing rights and access to sacred sites." —U.S. Bureau of Indian Affairs, http://www.bia.gov/FAQs/*

> *"A great deal of the knowledge of a people—cultural, spiritual, medicinal, and cosmological—is carried in the language. With the loss of language comes the loss of an immense cultural knowledge, history and beliefs." —Liz Hill and Arwen Nuttall, National Museum of the American Indian (quotation from the NMAI book* Do All Indians Live in Tipis?)

When an indigenous language is lost, much of the cultural knowledge contained within it is also lost. Therefore, the loss of a language is also a loss of history and a culture. Now, many communities are actively working to preserve and restore their languages and therefore to preserve the traditional knowledge that is contained within them. Throughout the *Roots of Wisdom* exhibition, Native languages and words are prominently featured because of language's importance in sharing and passing along culture and knowledge.

*"Indigenous languages are very important—if you kill the language, you kill the culture. Raising kids to be multilingual is really important to the survival of all nations! 500 years of Hawaiian chants end up being detailed geological record. Native science describes inquiry through poetic story." —VerlieAnn Malina-Wright [Hawaiian],*

**Traditional Ecological Knowledge**

The term Traditional Ecological Knowledge (TEK) is not explicitly used in the exhibition, but the concept is used by several academics and government agencies, and the project team based the exhibition's main messages around TEK.

What is TEK? "Traditional Ecological Knowledge is the term used to describe the knowledge and beliefs that Indigenous peoples hold of their environments that is handed down through the generations…Drawing upon on the previous several decades of TEK-related research, the following attributes can be said to typically describe the central definition of TEK: cumulative and long-term, dynamic, historical, local, holistic, embedded, and moral and spiritual." (Menzies and Butler, 2006). Other people may refer to this type of knowledge as indigenous knowledge or Native science. The project team chose to use the term "traditional knowledge" in the exhibition to avoid academic jargon and to keep concepts accessible to a wide range of audiences.

Why is TEK so important to all people? TEK offers society the opportunity to strengthen its capacity to manage environmental disturbances and local environments sustainably. Because TEK is a long-term body of accumulated locally based knowledge, it can provide both a more intimate and holistic view of the natural world. A growing number of people, including many non-Native scientists, are beginning to see how traditional knowledge and Western science can be consider two 'ways of knowing' that can be complementary rather than contradictory, especially when considering understanding ecological systems. *Roots of Wisdom* focuses on this idea of "Shared Science" using TEK and Western science to enhance our knowledge and stewardship of the natural world.

*"The survival of TEK—a living library residing in the hearts and minds of Native peoples—is tied directly to the survival of indigenous cultures. TEK is entirely dependent on the continuance or restoration of traditional land based cultural practices." —Dennis Martinez (O'odham/Chicano), Co-Director, Takelma Intertribal Project (TIP) and Chair, Indigenous Peoples' Restoration Network (IPRN), from http://www.ser.org/iprn/iprn-home/welcome*

*"For over 10,000 years, American Indians from diverse tribes have lived in the United States. Natural resource management is not a modern invention; Indians have practiced the roots of this applied discipline for millennia. Our North American landscapes, a reflection of historical processes, both natural and cultural, bear the indelible imprint of a harvested and tended the wilds for millennia." —Traditional Ecological Knowledge: An Important Facet of Natural Resource Conservation. U.S. Department of Agriculture Natural Resource Conservation Service. n.d. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1045244.pdf)*

*"The Three Sisters [gardens of corn, beans, and squash] offer us a new metaphor for an emerging relationship between indigenous knowledge and Western science, both of which are rooted in the earth. I think of the corn as Traditional Ecological Knowledge, the physical and spiritual framework that can guide the curious been of science, which twines like a double helix. The squash creates the ethical habitat for coexistence and mutual flourishing. In envision a time when the intellectual monoculture of science will be replaced with a polyculture of complementary knowledges. And so all may be fed." —Robin Wall Kimmerer (2013) in* Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants

## Speaking With and About Native People in the Museum

An important part of our roles as museum educators is to respectfully share the content of our exhibitions with diverse audiences. The following section contains suggestions for how to be culturally sensitive in these interactions recognizing that many non-Native museum staff, especially in science centers, will not have had a lot of experience working with Native curators, partners, and visitors. This information is provided because it is also important for staff to be accurately and respectfully presenting the material to all audiences to reinforce the messages of the exhibition and dispel misinformation.

*"People are going to ask you questions, and you think that they are questions, but they are really lightning bolts of fear… People have an investment in **not** knowing in a settler nation state. This is a different kind of ignorance. This requires different levels of patience and understanding." —Darren Ranco (Penobscot), University of Maine, Coordinator of Native American Research & Associate Professor of Anthropology*

**Assume that there are Native people in your audience**
With this idea in mind, always be polite and respectful when talking about someone else's culture and recognize that you might make mistakes.

**If you do not know the answer to a question, do not answer it**
It is okay to say, "I don't know, but I will try to find out." There are several resources listed at the end of this guide to help answer common questions. The book written by the Smithsonian Institution's NMAI titled *Do All Indians Live in Tipis?* is especially helpful for many common questions. You are also welcome to contact OMSI or IEI (http://indigenousedu.org/), and we can reach out to project advisors and partners to answer questions.

*" It doesn't make sense to say…'I read all about you guys before I got here,' before coming to a tribal museum. You can't really know in that way. Instead, I answer, 'this is what I've been told or taught,' to explain how I know the things that I am sharing." — Randall Melton (CTUIR), Collection Curator, Tamástslikt Cultural Institute*

**Learn about what names to use**
As explained previously, it is best is to refer to the specific, official tribal or national name whenever possible. Many Native people feel honored and recognized when their tribe, nation, or community is referenced accurately. Many tribes are commonly known by names that they do not use for themselves and are sometimes offensive. Try to learn how the Native communities describe themselves before identifying them. It is best to either ask a tribal member or go to an official resource (e.g. the tribe's government website) to make sure that you are using the appropriate name.

If you do need to use a generic term, *American Indian* and *Native American* are both used in the United States. The terms *Native* and *indigenous* are also acceptable. In Canada, the appropriate terms are *First*

*"Well-meaning people assume traditional knowledge is like a legend or myth. Actually, it is a form of real empirical knowledge that can be used. It is real knowledge based on doing something over and over again." —Charles Menzies (Tlingit/Gitxaała), Professor, Department of Anthropology, University of British Columbia*

*People, First Nations*, and *aboriginal*. When talking about Hawai'i, use *Native Hawaiians* and, for Alaska, use *Alaska Natives*.

**Recognize that "Native America" actually represents an enormous diversity of nations, people, cultures, and communities**

*"It has been reported that at the end of the 15th century, over 300 American Indian and Alaska Native languages were spoken." —U.S. Bureau of Indian Affairs, http://www.bia.gov/FAQs/*

Native American cultures are commonly lumped together, and many people assume that all American Indians are the same. This idea is not true. Native Americans come from thousands of different communities with a multitude of diverse cultures, separate histories, and unique languages. No general characteristics apply to all Native American people, tribes, or communities. Although some tribes may share similarities in their stories, language, or cultural practices, all North American tribes are unique in and of themselves.

**Avoid using the past tense to talk about Native peoples, cultures, knowledge, and life-ways**

*"When you say, 'This is how they used to do it,' you are teaching students that we are dead." —Wenix Red Elk (CTUIR), Public Outreach and Education Specialist, Department of Natural Resources, CTUIR*

Non-Native people often assume that if current Native people do not live traditionally, then they do not exist. This idea is not true. There are many Native communities that are actively working to protect and restore their cultural traditions in a modern context.

To acknowledge the continuing existence of Native peoples and cultures, it is more respectful and accurate to use the terms "art" or "object" instead of "artifact" when referencing an object from a Native culture. Similarly, use "pre-contact" instead of "prehistory" when talking about Native cultures before Europeans arrived. Change has always been happening in North America, before and after contact with European and other cultures, and Native communities have a variety of ways of tracking and recording these changes over time.

**Be respectful of Native worldviews and knowledge**

Origin stories and traditional knowledge are not "myths" or "legends." Instead, they are a critical part of many people's worldviews. Traditional stories and knowledge are also rooted in a deep understanding of the local environment and history of the places where indigenous people have lived for generations.

**Avoid "exoticizing" or "romanticizing" Native people and cultures**

Exoticizing means to portray Native people and cultures as exotic or unusual. Romanticizing means to glamorize or idealize Native cultures or people. It is particularly common for non-Native people to exoticize or romanticize Native cultures or people in regards to their spiritual or environmental practices. Therefore, it is important to recognize that there are many Native people with strong connections with the environment or spirituality, but not everyone and not all in the same way.

**Avoid reinforcing negative stereotypes**

Here are some common examples:

- *Not all Native people live on reservations.* Just like most U.S. populations, the largest Native communities are found in urban areas. According to the 2010 U.S. Census, 78% of people who identified as Native American lived outside of American Indian or Alaska Native areas. Many Native people live in urban centers because of relocation policies.
- *Not all Native people are "traditional" or "spiritual," but that does not mean that they are not still Native people.* Like any diverse category of people, each person and community has their own spiritual and religious understanding and identity.
- *Do not assume that Native people look a certain way* (e.g. high cheekbones, dark straight hair, and other physical characteristics). Individuals have their own unique and diverse ancestry, set of physical attributes, and personal preferences that influence how they look, but this physical appearance does not confirm or negate their identity as a Native person.
- *Not all Native people live in teepees, nor did their ancestors.* There are thousands of different Native communities throughout what is now the United States with a wide variety of housing used to best fit their cultures, environments, and climates. Such housing can include teepees, pueblos, longhouses, or high-rise apartments.
- *Not all Native communities have casinos that pay for schooling and other community needs.* Many Native communities do not have casinos or other tribal enterprises that provide payments to individuals or fund community needs. Other Native individuals are not enrolled members of a federally recognized tribe or nation, therefore making it impossible for them benefit from tribal enterprises. People in this situation are also denied services reserved for tribal members under federal law. Therefore, it is not appropriate to assume that all Native American and Alaska Native people have special financial or support services available to them.

# Important Considerations for Science Museums

**Respecting intellectual property**

Museums and similar institutions must respect the intellectual property rights of Native knowledge holders, which means respectfully working with the knowledge holders to identify what information should be shared, how it should be shared, and how it should be credited. Just like any expert in their field, the knowledge holders should also be compensated appropriately for their time and expertise. Unlike with many other types of scientific or historical knowledge, it is rarely appropriate to simply reprint or share Native knowledge without the explicit permission of the knowledge holder. For example, it would be inappropriate to retell a cultural story or share photos of a cultural ceremony without first consulting with the knowledge holders who maintain and understand those traditions. It is also important to know that one individual does not speak or represent his or her tribal nation or community. If you are looking for this type of credit or authority on an area, then you must approach the tribal council, and they will lead you to the appropriate individuals.

To learn more about how to respectfully work with Native knowledge holders and include cultural information in educational environments, please refer the references at the end of this guide including the documents created by the Alaska Native Knowledge Network.

**Human remains in the building**

Being near human remains and/or having remains on display can be uncomfortable or offensive to some Native people for a variety of reasons. For some people, human remains are seen as potentially harmful. For others, it reminds them of how remains of Native people have been removed from their traditional and appropriate burial grounds to be put in museums and other non-Native institutions, which is extremely offensive and painful. Other individuals and communities may prefer not to view or be close to human remains such as skeletons and fetuses. Therefore, if your museum has human remains in its collections or exhibitions, it is important to warn visitors about this situation and allow them to make an informed decision about visiting the museum or certain exhibit areas.

> *"The reason for telling people that there are human remains in the building is to protect the visitor. Many Native people feel that there is a negative attachment to the bones, and visitors could be harmed by the negative energy." — Nancy Maryboy (Cherokee/Diné [Navajo]), President and founder of IEI*

[Note: it is now illegal in the United States for museums to keep remains of Native people or funerary objects. The Native American Graves Protection and Repatriation Act (NAGPRA) requires that these items be returned to the Native communities that they were removed from.]

*"When I talked to our Native advisors about why it would be offensive to see human remains in a museum, especially those of their ancestors, I started thinking about how I would feel if someone removed my grandfather from where we buried him in our nearby veteran's cemetery. I would be horribly sad and offended. It would be even worse if they put his remains on display without permission." —Kyrie Thompson Kellett, OMSI*

Advisors for the *Roots of Wisdom* exhibition brought this issue to OMSI's attention before the exhibition opened allowing the team to reach out to local advisors and partners working in Native-serving organizations and tribes for guidance about where to locate the exhibition and how to alert visitors to the presence of human remains in the building.

The following recommendation to include signs/copy in critical areas came from advisors and partners as well as OMSI's experience while hosting the exhibition.

**Include signage/copy in the following places:**

- At all point of sale stations, membership window, and membership check in
- Near any exhibitions with human remains
- On any materials/advertising promoting the *Roots of Wisdom* exhibition
- On web pages promoting the *Roots of Wisdom* exhibition

**Suggested copy for signage:** Out of respect for cultural and personal beliefs, OMSI would like to make you aware that there are **human specimens in the museum.** If you have any questions, please contact a staff member.

## Exhibition Overview

*"Aloha 'āina—to love the land, to plant the seed. I am hoping youth will see that and ask the question: 'how do you love the land?' When people come away with knowing that all knowledge is valuable, then that seed will spring forth to help solve the world's problems. I hope the exhibit inspires questions like, 'Uncle,* how *do you aloha 'āina? How do you love the land?' It goes with the Hawaiian saying 'all knowledge is not learned in one school.'"—Herb Lee, Jr. (Hawaiian), Executive Director for Pacific American Foundation and Vice President of Waikalua Loko Preservation Society*

*"What I want people to walk away with is that that they see these are three different tribal nations and Hawaiians, which are all different. We are not all the same people; we don't live in teepees, etc. These four stories represent even larger historical and cultural contexts and ecosystems, and we aren't all the same as Native Americans. Everyone has specific needs and projects despite overarching themes."—Wenix Red Elk (CTUIR), Public Outreach & Education Specialist, Department of Natural Resources of the CTUIR*

*"There are some protocols in indigenous communities about what types of knowledge you can share, so one of the key concepts that emerged for this project was reciprocal collaboration. Mutual exchange, shared science—it's collaborative. I hope people take away that we are all connected and interrelated and responsible for things on this earth."—VerlieAnn Malina-Wright, Ed.D. (Hawaiian), Chairman, Pacific American Foundation*

*"There are more things that are shared than are different. Don't be confused by the tag traditional. It's not staid, past, static. It's dynamic, shifting, and moving. Just like Western science changes, so does Native knowledge. We can get lost in the cultural differences, but there's a universal mode of inquiry framed through cultural traditions."—Charles Menzies, Ph.D.* (Tlingit/Gitxaała)*, Professor, Department of Anthropology, University of British Columbia*

In *Roots of Wisdom*, students and families will learn the ways in which traditional knowledge of indigenous peoples and cutting-edge science are being applied to improve our world. The exhibition tells the stories of four communities, giving visitors real-life examples of how traditional knowledge and Western science provide complementary solutions to ecological and health challenges. Through the voices of elders and youth, hands-on interactives, and clever video games, visitors will gather resources, examine data, and take part in the growing movement toward sustainability and reclamation of age-old practices. The exhibition is specially designed for students ages 11–14 and has English audio, video, text and language samplings from several different indigenous communities.

## *Goals of the* Roots of Wisdom *Exhibition*

*Roots of Wisdom*'s primary educational goal is the concept that TEK and Western science are valuable and relevant to society, and that they offer complementary ways of understanding the natural world. Because general audiences are likely to be more familiar with Western science and relatively unfamiliar with indigenous ways of knowing, much of the exhibition content was developed to introduce TEK as a worldview/way of knowing. The main messages ingrained within these goals are as follows:

1. TEK and Western science have many commonalities, but they are also unique in many ways because they both depend on a cultural context.
2. TEK is long-term and place-based.
3. Indigenous peoples have been here for thousands of years and are still here today, engaging in both traditional and modern practices.
4. Native knowledge holders use TEK in a dynamic way, adapting their practices based on continuing observations of the environment.
5. TEK is cyclical and considers the connections between all things.

In addition, collaborative efforts are at the core of *Roots of Wisdom*'s goals and messages. This exhibition is the result of collaborations among OMSI, IEI, Smithsonian Institution Traveling Exhibition Service (SITES), and the Smithsonian Institution NMAI with four Native community partners that have graciously shared their restoration stories and their voices. As such, *Roots of Wisdom* aims to:

1. Leave visitors with knowledge that the exhibition is a collaboration among its partners.
2. Communicate the concept that reciprocal collaboration between TEK and Western science is valuable.
3. Foster further collaborations as the exhibition travels.
4. Encourage both Native and non-Native visitors to examine their personal connections to place, culture, and the stories being presented.

## *Exhibit Descriptions and Visitor Facilitation Tips*

*The exhibit components are grouped into five thematic areas:*

1. Introducing and Understanding Traditional Knowledge and Western Science
2. Re-establishing a Native Plant (Eastern Band of Cherokee Indians)
3. Restoring Fish Ponds (Native Hawaiians)
4. Rediscovering Traditional Foods (Tulalip Tribes)
5. Saving Streams and Wildlife (Confederated Tribes of the Umatilla Indian Reservation)


The descriptions below include brief introductions to the themes explored in each thematic area as well as the title, description, and image of each exhibit component. If there are specific notes for facilitating or maintaining a specific exhibit component, they will be noted as *facilitation tips.*

**THEMATIC AREA: Introducing and Understanding Traditional Knowledge and Western Science**
Native discoveries and innovations have been used and adapted over time and now touch our lives every day: many foods we eat and products we use came to us through knowledge passed down by Native Americans and Hawaiians. However, sometimes this adaptation comes at a price for Native communities. In cases of biopiracy, traditional knowledge and natural resources are taken from Native people without permission or compensation.

**Native Origins**
Who knew that many of the foods and common household items we use today actually came to us from indigenous peoples? Visitors explore this display and realize that from our first aid kits to our crispers, Native knowledge impacts our lives every day.



**Biopiracy**
Visitors learn about the darker side of *Native Origins*. In many cases, knowledge has been taken from indigenous people without their permission and without compensation, an act called biopiracy. Visitors are asked to compare biopiracy with bioprospecting, the term for research of useful organic compounds that is not necessarily considered unfair to people or environments.

**Story Area and Comment Board**
Stories are an important means of passing down TEK. Listen closely to the stories of Native Americans and Hawaiians, and you will find a wealth of information about the natural world and traditions associated with it. At the story area, visitors are invited to listen to and read stories from Native communities and consider the wisdom they communicate.

What is your personal connection to the environment, culture, and tradition? At the Comment Board, visitors are asked to share their own stories. Facilitators can choose between a variety of prompts (or write their own—sample questions and additional discussion of this component are included in the *Maintaining the Comment Board* section of this guide), and visitors are provided with paper and pen with which to write their responses.

**THEMATIC AREA: Re-establishing a Native Plant (Eastern Band of Cherokee Indians)**

River cane, a North American bamboo, is important for river ecosystems in the southeastern United States and is used for many traditional practices by the Eastern Band of Cherokee Indians. Although it was once plentiful across southeastern landscapes, less than 2% of its historical range remains. Today, the tribe is working with scientists and regional groups to restore river cane. They are also revitalizing cultural traditions that use the cane, such as basket making.


**River Cane Ecology**

River cane is important to water conservation because canebrakes (thickets of cane) filter sediment and excess runoff from farms and towns. In this exhibit, visitors turn cranks to work a model that simulates runoff flowing across two hills: one with a canebrake and one with grass. Which will allow more sediment to flow into the river?

*Facilitation tips:*

- *Periodically check to make sure that the balls roll into the conveyor troughs properly. If balls are straying inside the mechanism, call the Traveling Exhibits Technical Manager at 503.797.4660 for assistance.*

**Passing a Tradition**

River cane is used for many traditional practices including basket making. In this exhibit, visitors will learn about basket making and the ways that the Eastern Band of Cherokee Indians is keeping the tradition alive. Visitors are invited to watch a short video on the project and even try their hand at weaving.

*Facilitation tips:*

- *Periodically make sure that the two weaving boards and the four accompanying challenge cards are on the table.*
- *Feel free to leave the patterns made by visitors on the weaving boards. They are often interesting and inviting to other visitors.*

**THEMATIC AREA: Restoring Fish Ponds (Native Hawaiians)**

Everything that happens to the mountains above affects the land and water below. Because of this connection, Native Hawaiians traditionally lived in small land divisions called *ahupua'a* —land sections extending from mountain to ocean and including varied resources like taro fields and fish ponds. Native Hawaiians are today using traditional knowledge and science to restore parts of the *ahupua'a*. Although

fish pond restoration is challenging, the work is significant for Hawaiian culture and is potentially important for future sustainable food sources.

**Aloha ʻĀina: Love of the Land**


Through the flow of water, anything that happens at the top of a mountain affects what is below. In this exhibit, visitors place blocks to build a Hawaiian *ahupuaʻa* based on traditional knowledge. Hints on each block help visitors place plants and animals where they grow best and help the system thrive.

*Facilitation tips:*

- *Check periodically to make sure all blocks are accounted for, and place them back in the storage bin if they have been left in the slots on the "mountain" part of the exhibit.*
- *Check the lights in this component periodically. If the thunder sound effect or any lights stop working, call the Traveling Exhibitions Technical Manager at 503.797.4660 for assistance.*

**Hawaiian Fish Ponds**

For hundreds of years, Native Hawaiians built fish ponds to produce food for their communities. Today, many groups are restoring ponds that have been out of use for at least 100 years. In this exhibit, visitors restore a traditional Hawaiian *loko iʻa* (fish pond) on a touch screen by removing invasive species, rebuilding walls, and stopping pollution. It is hard work!

**THEMATIC AREA: Rediscovering Traditional Foods (Tulalip Tribes)**

The Tulalip Tribes have historically gathered and tended a rich variety of natural resources, but over time, tribal members' health suffered as they lost access to traditional foods. Tribal members today are gardening organic foods and, in the process, reconnecting to native food and traditional medicine plants. In doing so, they combine traditional knowledge and Western science for a more culturally appropriate approach to health care.

**Connected to the Land**

Limited land access and environmental problems like pollution can make it difficult for the Tulalip Tribes to access native foods. However, the tribes continue to protect and carry traditional knowledge about the care and use of native plants. In this exhibit, visitors use a touch screen to explore the Tulalip lands to gather and learn about traditional foods available in different seasons.

**Food: Medicine of the Land**


Plants have a lot to teach us. In this exhibit, visitors learn about wild harvesting and gardening of important plants through an audio interactive. Visitors touch a watering can to garden plants or a bee to wild native plants to hear what the plants have to share with us. Visitors learn how eating local, traditionally harvested food and community-grown produce is beneficial to human health.

*Facilitation tips:*

- *Check periodically to make sure that the watering wand is not dangling toward the ground, which strains the hose.*

**THEMATIC AREA: Saving Streams and Wildlife (Confederated Tribes of the Umatilla Indian Reservation)**

Throughout their long history in the Pacific Northwest, the Cayuse, Umatilla, and Walla Walla tribes have learned about and relied upon streams for water, transportation, cultural practices, and sacred foods. In recent years, the streams and wildlife have faced problems, but the tribes are using their resources to restore waterways.

**Protecting an Ancient Fish**

This fish looks positively prehistoric! And it is. The lamprey is over 450 million years old. It is also a sacred food for the Confederated Tribes of the Umatilla Indian Reservation and an important part of local river ecosystems. Unfortunately, lampreys are facing extinction in the Columbia River basin. In this exhibit, visitors "catch" and scan lampreys to learn how tribal members are using traditional knowledge and Western science to help ensure a future for lampreys.

*Facilitation tips:*

- *Count lampreys periodically as they are sometimes stolen or missing. Eight or so seems to be the ideal number to keep in the bin, although it is best to stay below this number rather than over. Too many lampreys in the exhibit at one time seems to encourage theft, perhaps because visitors figure that one will not be missed.*
- *Check each day to make sure all lampreys are working. Sometimes the chips move away from the head, which makes them not register on the scanner. If this problem occurs, call the Traveling Exhibitions Technical Manager at 503.797.4660 for assistance.*

**Healthy Streams, Returning Salmon**


Construction, farming, and dams have blocked streams and removed water, which makes it difficult for salmon to swim upstream to spawning grounds on tribal lands. In this exhibit, visitors learn how the tribes are engaging in river restoration to make them healthier habitats for returning fish. Visitors use blocks to build a stream and score points for including features that the tribes are using to restore their waterways.

*Facilitation tips:*

- *It is okay to leave pieces on the board -- the partially completed activity draws the attention of other visitors.*

# Correlation with Educational Standards

## Next Generation Science Standards

**Practices**

- Asking questions and defining problems
- Developing and using models
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

| | Disciplinary Core Idea | MS |
|---|---|---|
| LIFE SCIENCE | | |
| LS1 | From molecules to organisms: Structures and processes | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | ✓ |
| LS3 | Heredity: Inheritance and Variation of Traits | |
| LS4 | Biological Evolution: Unity and Diversity | |
| EARTH & SPACE SCIENCE | | |
| ESS1 | Earth's Place in the Universe | |
| ESS2 | Earth's Systems | ✓ |
| ESS3 | Earth and Human Activity | ✓ |
| ENGINEERING, TECHNOLOGY, AND APPLICATIONS OF SCIENCE | | |
| ETS1 | Engineering Design | ✓ |

## Topics

| | |
|---|---|
| *MSLS2.A* | *Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)* |
| *MSLS2.A* | *Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)* |
| *MSLS2.A* | *Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)* |
| *MSLS2.C* | *Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)* |
| *MSLS2.D* | *Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.(secondary to MS-LS2-5)* |
| *MSETS1.B* | *There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)* |
| *MSESS2.A* | *All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)* |
| *MSESS2.C* | *Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)* |
| *MSESS3.A* | *Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)* |
| *MSESS3.C* | *Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)* |
| *MSETS1.B* | *Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)* |

## Performance Expectation

MS-LS2-1 *Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.*

MS-LS2-2. *Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.*

MS-LS2-4. *Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.*

MS-LS2-5.

MS-ESS2-1 *Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*

MS-ESS2-4 *Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.*

MS-ESS3-1 *Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.*

MS-ESS3-3 *Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.*

MS-ETS1-3 *Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

*Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.*

## National Standards for Arts Education

*NA-VA.5-8.4* ***Understanding the Visual Arts in Relation to History and Cultures***

- *Students know and compare the characteristics of artworks in various eras and cultures*
- *Students describe and place a variety of art objects in historical and cultural contexts*
- *Students analyze, describe, and demonstrate how factors of time and place (such as climate, resources, ideas, and technology) influence visual characteristics that give meaning and value to a work of art*

*NA-VA.5-8.6* ***Making Connections Between Visual Arts and Other Disciplines***

- *Students describe ways in which the principles and subject matter of other disciplines taught in the school are interrelated with the visual arts*

# Lesson Plans for Formal, Informal, and Museum Education

The *Roots of Wisdom* activity guides (in the Appendix) support both formal and informal educators in communicating the value of traditional knowledge and Western science to youth and their families. The guides offer options for facilitating fun, interactive activities while also acting as a tool for connecting audiences to local indigenous communities.

## CLASSROOM PROGRAMS

**Restoration Project Poster Boards**
Students work in small groups to research a restoration project and create a poster board collage on how science and traditional knowledge are being used for environmental and cultural restoration. Students make a short presentation on their collage, which is put on display in a classroom or museum hosting the *Roots of Wisdom* exhibition.

**Voices from Our Community**
Students interview a Native American elder and a Native or non-Native scientist to gather different perspectives about the natural world.

## AFTER-SCHOOL PROGRAMS

**Weaving**
Learn traditional knowledge through the craft of weaving. Participants will explore how the process of weaving can inform us about different cultures.

**Exploring Natural Dyes**
Learn traditional knowledge and environmental science through the craft of creating and using natural dyes. Participants will explore how to create dyes using natural and organic materials, how they behave on different types of fabrics, and how a range of colors can be created with just a few ingredients from the yard or kitchen.

## MUSEUM EDUCATION

**Natural Dyes Demonstration**
Participants are invited to use organic materials from the local environment or the kitchen to make beautiful natural dyes. If time and materials permit, visitors can use dyes to create a bookmark to take home.

**Native Origins Match Card Game**
Participants are challenged to match images of items traditionally used by indigenous people with images of modern day counterpart items in use today. The activity can be facilitated by an educator or group leader, or self-facilitated by the user. After completing the matching challenge, participants can discuss other examples of indigenous knowledge.

# Active Learning Log

Name_____

**Native Origins**

Many things we use or eat on a daily basis have come to us from indigenous people of the Americas. Explore the display of products with native origins.

Did any of the foods with native origins surprise you? Which ones? Why?

**Re-establishing a Native Plant**

- **River Cane Ecology**

  River cane is an important plant culturally and ecologically to the people of the Eastern Band of Cherokee Indians. Turn the cranks on the river cane ecosystem model to simulate how runoff flows down two separate hills.

  Which hill allowed more sediment (the white balls) to flow into the river: the hill with the river cane or the hill without the river cane? Why? Which environment is healthier?

- **Passing a Tradition**

  Watch the video. Sarah Thompson describes how Cherokee weavers prepare the river cane for basket making. What plants do they use to dye their baskets?

**Restoring Fish Ponds**

- **Aloha ʻĀina: Love of the Land**
  Place the blocks to build a Hawaiian *ahupuaʻa* based on traditional knowledge.

  Draw the flow of water from the top of the mountain to the fish pond. What plants and animals did the water encounter along the way?

- **Hawaiian Fish Ponds**

  Play the video game.

  How did you improve the environment in the fish pond?

  What plants and animals are the Native Hawaiians removing in order to restore the fish ponds?

**Rediscovering Traditional Foods**

- **Connected to the Land**

  Play the video game. What plants and animals did you harvest for your community?

  What happens if you harvest too much?

- **Food: Medicine of the Land**

  Use the bee and garden wand to touch the wild and garden plants. Listen to the recordings.

  How do the Tulalip people traditionally use Nodding Onion?

  Which plant do they grow that helps lower their rate of heart disease?

**Saving Streams and Wildlife**

- **Protecting an Ancient Fish**

  Grab a lamprey and scan it. Where was your lamprey last found?

  How do the people of the Confederated Tribes of the Umatilla Indian Reservation traditionally use lampreys?

- **Healthy Streams:**

  Build a stream. Draw your stream below and include the features you added to make the stream healthier.

# Active Learning Log Answer Key

Name_____

**Native Origins**

Many things we use or eat on a daily basis have come to us from indigenous people of the Americas. Explore the display of products with native origins.

Did any of the foods with native origins surprise you? Which ones? Why? Bubblegum, chocolate, vanilla, pumpkin, sunflower, corn, bean, squash, popcorn.

**Re-establishing a Native Plant**

- **River Cane Ecology**

  River cane is an important plant culturally and ecologically to the people of the Eastern Band of Cherokee Indians. Turn the cranks on the river cane ecosystem model to simulate how runoff flows down two separate hills.

  Which hill allowed more sediment (the white balls) to flow into the river: the hill with the river cane or the hill without the river cane? Why? Which environment is healthier?

  The hill with the river cane grove is healthier because it had less runoff. There was less runoff because the river cane helped slow down the water so it could soak into the ground before getting to the river.

- **Passing a Tradition**

  Watch the video. Sarah Thompson describes how Cherokee weavers prepare the river cane for basket making. What plants do they use to dye the baskets? Walnut, butternut, and bloodroot.

**Restoring Fish Ponds**

- **Aloha ʻĀina: Love of the Land**
  Place the blocks to build a Hawaiian *ahupuaʻa* based on traditional knowledge.

  Draw the flow of water from the top of the mountain to the fish pond. What plants and animals did the water encounter along the way?


- **Hawaiian Fish Ponds**

  Play the video game.

  How did you improve the environment in the fish pond? By removing invasive and non-native plants.

  What plants and animals are the Native Hawaiians removing in order to restore the fish ponds? Barracuda, mangrove, and non-native seaweed.

**Rediscovering Traditional Foods**

- **Connected to the Land**

  Play the video game. What plants and animals did you harvest for your community? Salmon, blackberries, and clams.

  What happens if you harvest too much? You have to give it away to your neighbors who need it.

- **Food: Medicine of the Land**

  Use the bee and garden wand to touch the wild and garden plants. Listen to the recordings.

How do the Tulalip people traditionally use Nodding Onion? They eat it with Sockeye Salmon and season food with it.

Which plant do they grow that helps lower their rate of heart disease? Blueberries.

**Saving Streams and Wildlife**

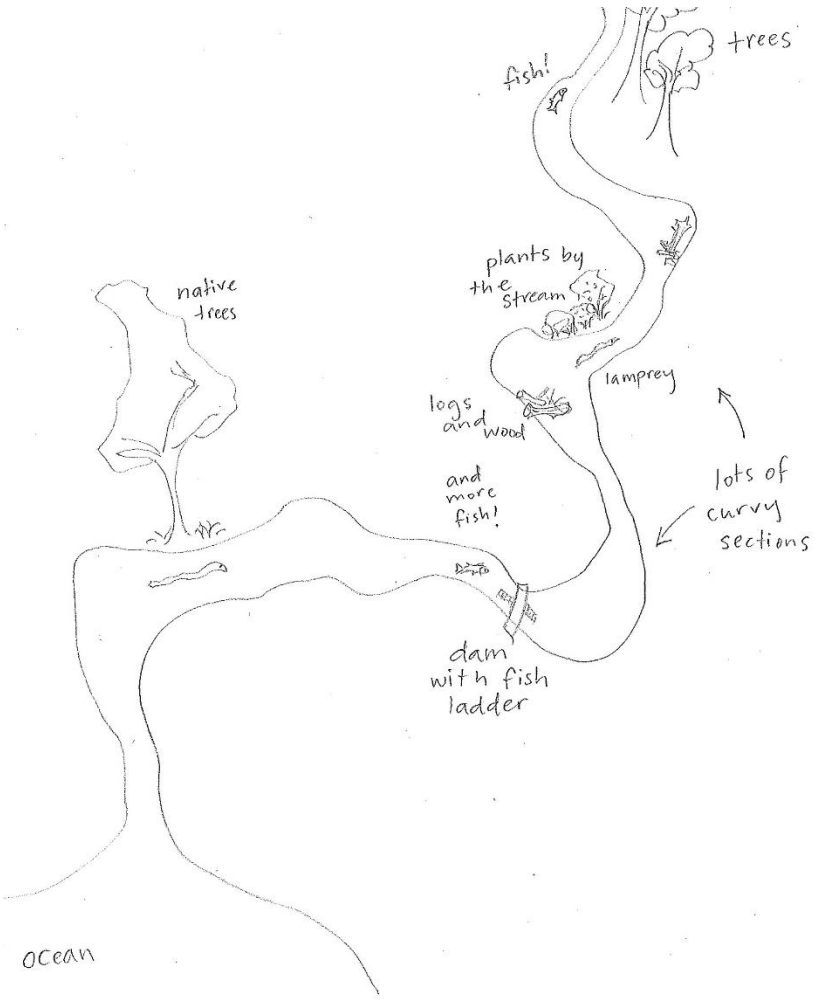
- **Protecting an Ancient Fish**

  Grab a lamprey and scan it. Where was your lamprey last found? On the _____ River near _____.

  How do the people of the Confederated Tribes of the Umatilla Indian Reservation traditionally use lampreys? As a food source and medicine.

- **Healthy Streams**

  Build a stream. Draw your stream below and include the features you added to make the stream healthier.



# Procedures and Daily Maintenance

**Opening**

- Make sure all touch screens and computer-based activities (*Connected to the Land*, *Protecting an Ancient Fish*, *Restoring Fish Ponds*) are turned on and working properly.
- Make sure all video activities (four intro videos, *Passing a Tradition*) are working properly.
- Make sure the Comment Board is freshly stocked with paper and the pen is functional. Sort through the visitor-submitted sheets and post the interesting, relevant responses on the Comment Board. Update the question if need be. (Sample questions and more information about maintaining this component are included in the *Maintaining the Comment Board* section on page 38).
- Make sure all exhibit surfaces and the exhibition area are clean.
- Make sure there are 6–8 lampreys in the *Protecting an Ancient Fish* exhibit.
- Make sure that two weaving boards and four accompanying challenge cards are on the table.
- Make sure all blocks in the *Aloha ʻĀina: Love of the Land* component are accounted for and placed in the storage bin.
- Check the lights in the *Aloha ʻĀina: Love of the Land* component are working. If the thunder sound effect or any lights stop working, call the Traveling Exhibitions Technical Manager at 503.797.4660 for assistance.
- Make sure that all of the lampreys are working. Sometimes the chips move away from the head, which makes them not register on the scanner. If they are not working, consult the Technical Manual or contact the Traveling Exhibitions Technical Manager at 503.797.4660.
- Make sure the balls in *River Cane Ecology* roll into the conveyor troughs properly. If balls are straying inside the mechanism, call the Traveling Exhibits Technical Manager at 503.797.4660 for assistance.

**Throughout the Day**

- Throughout the day, make sure to clean tabletops, especially near the Comment Board, of stray pen marks. Use a soft, lint-free, non-abrasive cloth dampened with Simple Green© to clean the plastic laminate. Dry the surface immediately with a soft, lint-free, non-abrasive cloth.
- Make sure the Comment Board is always stocked with paper and the pen is functioning. Keep the tabletop neat to encourage appropriate activity.

**Closing**

- Make sure all computer-based activities and videos are turned off.
- Make sure that the watering wand in *Food: Medicine of the Land* is stored properly so that it is not dangling by its hose.
- Check to make sure that the stuffed lampreys have not disappeared. If so, look for where they might have been placed in other exhibit components or areas of the exhibition hall.

**General Cleaning**

Please see the *Cleaning* section of the Technical Manual for general cleaning instructions.

# Maintaining the Comment Board

The Comment Board is an element of the *Story Area* where visitors are asked to contribute their thoughts to the exhibition. Questions are chosen by the host organization and serve to encourage visitors to consider the big idea of the exhibition within the context of their own lives (see suggested questions and creating questions below). Visitors answer the question and then drop their responses into a slot, where museum staff will later gather, curate, and post the responses.

In providing a framework for visitor dialogue, the Comment Board helps to foster a sense of community and discussion. By having the opportunity to contribute their thoughts and experiences, visitors are able to personalize the exhibit and have a more meaningful experience. The answers posted on the Comment Board also help to expose visitors to each other's thoughts and ideas, enhancing the exhibit by including a diversity of community voices. [*Get creative! Visitors are more likely to respond to comment boards if the paper is special in some way, such as color or interesting shapes and designs.]*

**Creating Questions**

The aim of each question is to get the visitor to consider the main themes of the exhibition, pause to think about his or her own experiences, and share. Ecological knowledge, tradition, environmental sustainability, cultural heritage, place, shared knowledge, and personal connection to the land and environment are some topics that might be addressed in questions should the hosting organization decide to create its own.

The best questions are simple, specific, and personally relevant. The questions should give visitors set parameters, yet be short enough for them to be able to answer in a reasonable amount of time. It's important to be respectful of a participant's time and abilities while still offering a meaningful means of contributing to the project. Keeping the questions open-ended allows visitors to interpret them through their own personal lens and provide responses.

**Questions Used at OMSI**

These questions were created by the OMSI *Roots of Wisdom* team and tested while the exhibition was on the museum floor:

- *What have you learned about your natural environment from living in one place for a long time?*
- *What is a food that is a part of a tradition in your family? What is the tradition?*

The second question about food elicited more responses overall (169 vs. 29), suggesting that questions about shared experiences such as food or family may be easier to relate to for more people and therefore evoke more participation.

In both cases, though, about two-thirds of the responses were relevant and appropriate for posting. This fraction is relatively high, suggesting that both questions were good at eliciting thoughtful responses. Having a portion of the responses be inappropriate or irrelevant is very common, so do not worry if this situation is the case at your institution as well.

We also used the following four questions for a much more limited time, and found they also worked well. [Some of the prompts tested on the OMSI floor are printed on sheets, ready to post. They are stored in the Comment Board.]

- *Is there a place that is special to you? What about that place makes you feel connected to it?*
- *Do you have a story or a memory about something that is special in your local environment?*
- *Is there a place that matters to you that you would like to see environmentally protected or restored?*
- *What is an important tradition in your family or community? What have you learned by being part of it?*

**Other Suggested Questions**

The following questions are ones that the OMSI *Roots of Wisdom* team saw as having potential. A great deal of thought was put into creating them, although there was not an opportunity to test them all while the exhibition was on the floor. We tried out the first four (starred below), which worked out well.

- Do you have a story about a plant or animal native to the place you live? Why is it important to protect that plant or animal?
- Do you live where your ancestors lived? Is there anything you wish you could learn about that place?
- What is special about your local environment? How many generations of your family have lived there?
- Is there something that comes from nature that is part of your family heritage?
- How long have you lived in your hometown? What do you find unique about the environment in your area?
- Is there a special place important in your family history? What is special about that place?
- Do you have a story of when you grew, harvested, fished, or hunted for your own food?
- What if you lived off the land? What would you eat? What would you need to know about?
- Do you have any stories about an experience you had in nature? Were you inspired to do or create anything as a result?

**Curating the Comment Board**

Curating the answers for posting on the Comment Board is an important task for the overall benefit of complementing the *Roots of Wisdom* exhibition. When sorting and choosing answers for the board, pick answers that can model to other visitors how best to contribute. A diverse range of specific, thoughtful, and meaningful answers not only enriches the experience of those reading them, but models how to consider the question to other participants. Modeling great answers is also encourages participation and sets the tone of future responses.

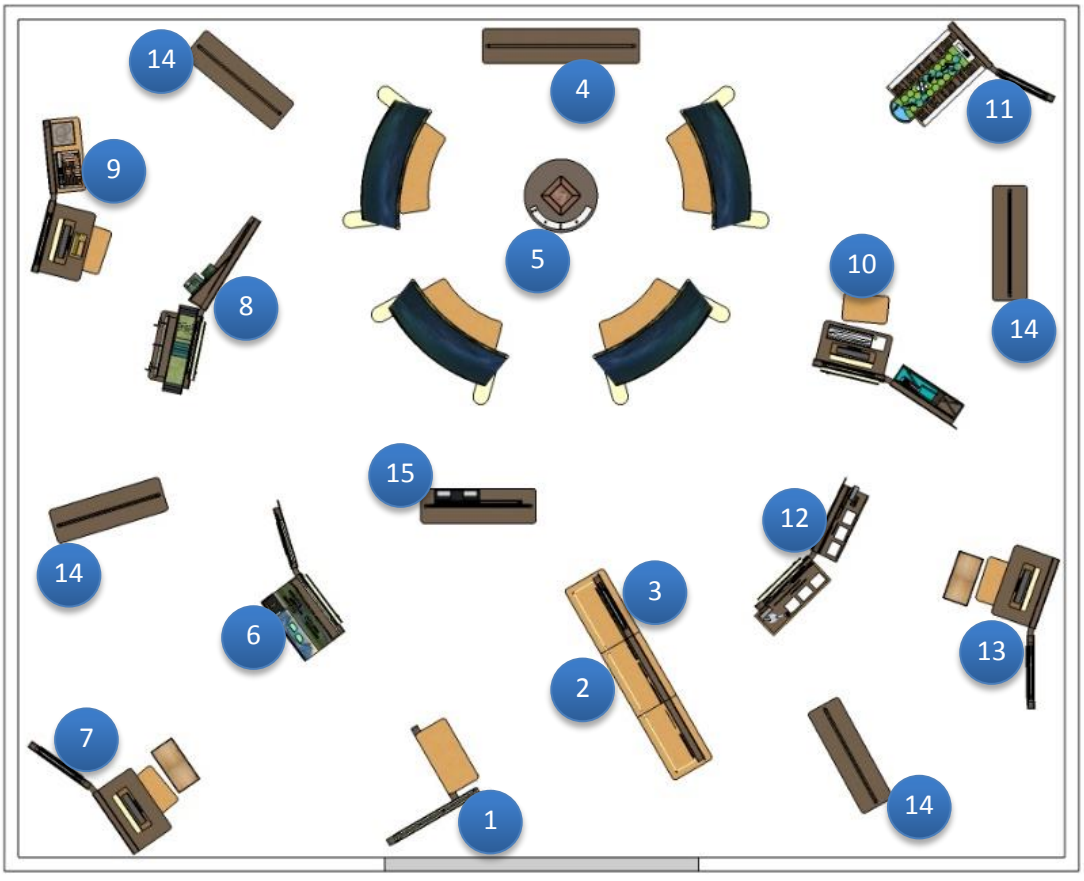
Also, be sure to include answers given from people of varying ages and backgrounds. Doing so makes the content more accessible and serves to communicate to visitors of all ages and backgrounds that their contributions are relevant and appreciated. Host organizations can set the tone for future answers by answering the question themselves first and posting the answers for visitors to see.

**Local Content**

On the back of the Comment Board is an area that offers the host organization and its staff a chance to personalize the exhibit, interpret it through their own lens, and make the exhibit locally relevant. We encourage hosting organizations to fill this space with local articles and stories that reflect the big ideas of the exhibition. This opportunity can be used to spotlight local restoration or research projects, recognize exceptional individuals, or simply highlight interesting and relevant topics. However, the space can also be used for displaying more Comment Board responses should the host organization choose to do so.

## Sample Floor Plan

1. Introductory Panel and Collaboration Story
2. Native Origins
3. Biopiracy
4. Comment Board
5. Story Area
6. Hawai‘i Video / Aloha ‘Āina: Love of the Land
7. Hawaiian Fish Ponds
8. Cherokee Video / River Cane Ecology
9. Passing a Tradition
10. CTUIR Video / Protecting an Ancient Fish
11. Healthy Streams, Returning Salmon
12. Tulalip Video / Food: Medicine of the Land
13. Connected to the Land
14. Environmental context panels (4)
15. Taking care of Homelands and Culture (map)



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# Appendix: Activity Guides

# Restoration Project Poster Boards

| | |
|---|---|
| ***Program Type:*** Classroom, afterschool, or community center program | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length***: 1–2 hours | ***Class Size:*** Up to 30 students |

**Description:** Students work in small groups to research a restoration project and create a poster board collage on how science and traditional knowledge* are being used for environmental and cultural restoration. Students make a short presentation on their collage, which is put on display in a classroom or museum hosting the *Roots of Wisdom* exhibition.

**Traditional knowledge refers to information, skills, and practices that are developed, sustained, and passed on from generation to generation within a community.*

**Topics**: Traditional Knowledge, History, Environmental Science, Generational Learning, Careers in Science

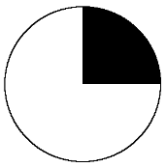
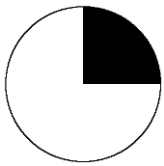
**Process Skills Focus**: Critical thinking, research, reading, writing

## LEARNING OBJECTIVES

*For Next Generation Science Standards alignment, see end of outline.*

- Students will understand that there are many cultural and environmental restoration projects happening around the country
- Students will research a specific restoration project related to a Native community
- Students will learn about contributions of traditional knowledge and Western science to restoration projects

## TIME REQUIRED

| Advance Prep | Set Up | Activity | Wrap-Up |
|---|---|---|---|
|  |  |  |  |
| **60 minutes** | **15 minutes** | **60+ minutes** | **15 minutes** |

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Introduction | Instructor-led discussion | 10 min |
| Videos | Instructor-led discussion | 5–10 min |
| Creating Poster Boards | Participant-led group activity | 30–40 min |
| Group Presentations | Participant-led group discussion | 10–20 min |

## SITE REQUIREMENTS

- Access to tables or floor space large enough for groups of 2–3 students to create poster board collages with arts and craft supplies
- Access to a chalk or dry erase board
- Access to a computer and projector for screening introduction videos
- Access to computers or iPads (1 per 2–3 students) **or** printed materials for researching restoration projects *(see Advance Preparation for more details)*

## SUPPLIES

| Supplies | Amount | Notes |
|---|---|---|
| Chalk board or dry erase board | 1 | Large enough for students to come up and write notes |
| Computer (preferable) | 1 | For watching intro videos |
| Projector (preferable) | 1 | For watching intro videos |
| Computers or iPads (optional) | 1 per group of 2–3 students | For researching information. Printed materials can be used as an alternative. |
| Printer (optional; color printer preferred) | 1 | For printing information and graphics for poster boards |
| Tables or group of desks | 1 per group | For assembling poster boards (students can work on the floor as an alternative) |
| Poster boards (around 64 cm × 64 cm or 24” × 24”) | 1 per group | Cardboard or foam core could also be used |
| Markers | 5 per group | A variety of colors |
| Scissors | 1 per student | |
| Glue stick | 1 per group | |
| Pencils | 1 per student | For taking notes / making a draft |

## ADVANCE PREPARATION

- Instructor should find one local restoration project for each group of students to research. Making contact with local tribal offices such as the Department of Natural Resources is a good place to start. As an alternative, students can research one of the several projects highlighted on either the Roots of Wisdom[1] or American Indian Responses to Environmental Challenges[2] websites if local stories are difficult to find.
- Instructor can select a limited amount of information on each restoration project to print for each group instead of having students use computers or iPads. Printing extra-large font works well for students to read over as a group and for cutting and pasting onto poster boards.
- Each group should have at least 3–5 images printed out to cut and paste onto poster boards. Students can draw pictures as an alternative.

[1] http://omsi.edu/exhibits/row/
[2] http://www.nmai.si.edu/environment/

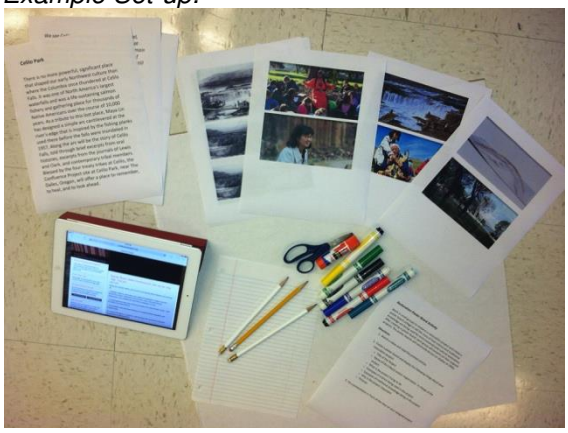
- Select 2–3 students who can work well together for each group.
- If students are a different ages and have varying reading abilities, adjust the amount of research information assigned to the groups.

## SET UP

15 minutes

- Set-up computer and projector (if available) to display introduction videos.
- Give each group of students all materials needed to research a restoration project and create a poster board:
  - Poster board
  - Computer or iPad and printer **or** pre-printed information and graphics
  - Markers
  - Scissors
  - Glue
  - Pencils

*Example Set-up:*



## INTRODUCTION

10 minutes

*Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.*

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics.* Feel free to improvise as needed.

To begin the activity, draw a vertical line down the middle of the board and write "science" on one side and "traditional knowledge" on the other.

**Introduction**

Today we are going to learn about environmental restoration projects, why they are important and how people can use information shared by scientists and Native Americans to care for the Earth.

Environmental restoration can happen in a variety of situations. Restoration projects are sometimes very involved, like removing a parking lot to plant Native plants or re-directing the flow of a river to restore salmon habitats. These projects rely on heavy equipment like cranes and bulldozers. Often projects are much smaller, like digging out invasive species from a backyard using common gardening tools like rakes and shovels. Sometime these projects need to be informed by professionals like scientists and engineers and sometimes they can be led by whoever feels passionate about caring for the Earth. **Let's think about projects happening around our local area. Can anyone name an example?** *My mom removed blackberry bushes in our backyard, people planted trees along our road, I saw people working on the river to help fish, etc.* Those are all good examples. **Can you now tell me why these projects are important?**

Building on projects happening in the local area and those that students may have named as examples, discuss why environmental projects are important to heal and protect the Earth.

Let's now think about useful information for carrying out an environmental restoration project. For example, it might be important to know what the place looked like before it was impacted by people, what plants and animals used to live there, etc.

**What else can you think of that's important to know about a restoration project?**

Let's now focus on how science and knowledge shared from Native Americans, often called traditional knowledge, can help restore the environment.

**What comes to mind when you think of science and the environment?**

Science can be very broad, so think big!

*A person studying water, learning about the weather, animals, plants, test tubes, experiments, etc.*

Have students brainstorm what science is in the broadest sense and have them write comments on the board to create a list to reflect upon during the activity.

That's a great list. Let's now think about what comes to mind when we think about information shared by Native Americans, which we call traditional knowledge. I'll give you some background information. People often refer to traditional knowledge as information passed down from one generation to another. Think about facts you have learned from people older than you. Raise your hand if you know people who are at least two generations older than you. These people could either be your grandparents or other people in your community of the same generation or older.

Provide the students with a real-life example. Tell a personal story of something you learned from a person of an older generation or make up a story that students can relate to.

Example story:
*My grandfather loved to fish. He knew how to identify many different species of fish and which tasted the best. He taught me to be patient when catching fish, since he knew that the fish wouldn't always be easy to find and trap. He never got frustrated when he didn't catch fish and he was confident that he would come back another day to fish and be successful then.*

**Optional Enrichment**
If students identify as Native American or indigenous of another culture, ask if anyone in the class has an example to share of something they learned about their people and culture from someone who is older than them, like a grandparent or tribal elder.

Traditional knowledge can be expressed in many ways through storytelling, rituals, songs, crafts, or gathering food. Traditional knowledge can be another way of learning or knowing and can be just as a valuable as learning facts in a more scientific way. **Now that you have a little background, what comes to mind when you think of traditional knowledge?** Possible answers: *cultural traditions, storytelling, dancing, woodworking, harvesting food, animals, hunting, where to find food, plants, medicine, witnessing climate change, etc.*

See the Resources section below for reading more on traditional knowledge (often referred to as Traditional Ecological Knowledge).

We are now going to watch a couple of videos about environmental and cultural restoration projects using both science and traditional knowledge to help restore the environment and Native culture. After the videos, I'll assign you to groups of 2–3 students and you'll create a poster board about a restoration project that is either happening around our local community or is highlighted on a museum website.

**Optional Enrichment**
If students have the chance to visit the *Roots of Wisdom* exhibition, review the content in the exhibition and relate it to the conversation. See optional extensions section for more information.

**INSTRUCTOR-LED DISCUSSION**

## Videos

5 – 10 minutes

Both the Roots of Wisdom[3] and American Indian Responses to Environmental Challenges[4] websites have videos telling stories of environmental and cultural restoration projects happening in Native communities around North America. The *Roots of Wisdom* website has four short 2–3 minute videos that focus more on traditional knowledge. The American Indian Responses to Environmental Challenges website has several longer videos on four other restoration projects. These videos are good to show if there is more time to complete this activity. Instructors are encouraged to start with the video referenced below and explore both websites to get an idea of how science and traditional knowledge are being used in a variety of situations.

The first film we are going to watch is about restoring a native bamboo plant in North Carolina called Re-establishing a Native Plant[5]. It was filmed for an exhibition created by the Oregon Museum of Science and Industry (OMSI) in Portland, Oregon. This film is about how the Eastern Band Cherokee are working to restore habitat for river cane, a type of bamboo. The film also discusses the cultural traditions that the plant is used for.

After the film, ask students what they saw in the film that relates to science and traditional knowledge.

[3] http://omsi.edu/exhibits/row/
[4] http://www.nmai.si.edu/environment/
[5] http://omsi.edu/exhibits/row/meet-the-communities/cherokee

**GROUP ACTIVITY**

## Creating Poster Boards

30 – 40 minutes

Now that you have seen an example of how a museum highlighted a restoration project that uses both science and traditional knowledge, it's your turn to create a poster board to tell the story of a different project.

Assign the students to groups of 2–3 students and hand out all of the materials needed to complete the project.

You should have all the materials needed to complete the project. Here is a handout with your directions.

Provide each group with a handout of directions.

The poster boards can go on display in either the classroom, somewhere else in a school or ideally in a museum hosting the *Roots of Wisdom* exhibition. Museums can use the poster boards to supplement the exhibit and highlight restoration projects happening in their local community.

## *Handout*

*(Available for download as a Microsoft Word document at: http://omsi.edu/exhibits/row/education-resources/)*

## Restoration Poster Board Activity

Work in small groups to research a restoration project and create a poster board collage to tell the story of how traditional knowledge and science are used for environmental and cultural restoration. After creating the poster boards, each group will present their board and talk about their project.

**Directions**

Create a poster board highlighting the following information:

1. Name of the project
2. Name of the Native community working on the project *(There may be more than one)*
3. What the project is about
4. Examples of how science is being used
5. Examples of how traditional knowledge is being used
6. Why this project is important
7. Pictures of the restoration project (at least 3-4)

**PARTICIPANT-LED GROUP**

## Group Presentations

10 – 20 minutes

Ask each group of students to make a short presentation of their poster board. Students can use their direction sheet as a guide for their presentation. Have each group share the following:

1. Name of the project
2. Name of the tribe or Native community working on the project
3. What the project is about
4. Examples of how science is used
5. Examples of how traditional knowledge is used
6. Why the project is important

**OPTIONAL EXTENSIONS**

- Take a field trip to a museum hosting the *Roots of Wisdom* exhibition and challenge students to find examples of science and traditional knowledge as they move through the exhibit components. Lead a group discussion near the exhibit afterward and have students share what they learned about science and traditional knowledge.
- Talk with museum staff about displaying the poster boards in the museum to highlight restoration projects happening in the local community.
- Educators could involve students in an actual restoration project and create a poster board about that project.

## RESOURCES

Links to videos:

- Roots of Wisdom[6]
- American Indian Responses to Environmental Challenges[7]

Links and resources for cultural guides:

- Alaska Native Knowledge Network[8]
- Guide to Implementing the Alaska Cultural Standards for Educators[9]
- Indian Education for All - Montana Office of Public Instruction[10]
- Navajo Culture[11]

## GLOSSARY

| Vocabulary | Definition |
|---|---|
| **Elder** | A person who has gathered knowledge and wisdom about his or her culture; not all elderly people are elders |
| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

[6] http://omsi.edu/exhibits/row/
[7] http://www.nmai.si.edu/environment/
[8] http://ankn.uaf.edu/Publications/Knowledge.html
[9] https://education.alaska.gov/standards/pdf/cultural_standards.pdf
[10] http://opi.mt.gov/programs/indianed/IEFA.html
[11] http://serc.carleton.edu/research_education/nativelands/navajo/culture.html

## NEXT GENERATION SCIENCE STANDARDS

**Practices**

- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Structure and function
- Stability and change

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | ✓ | ✓ |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | | n/a | n/a | | | | | |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | | |

# Voices from our Community

| | |
|---|---|
| ***Program Type:*** Classroom, afterschool or community center program | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length:*** 1–2 Hours | ***Class Size:*** Up to 30 students |

**Description:** Students interview a Native American elder and a Native or non-Native scientist to gather different perspectives about the natural world.

**Topics**: Traditional knowledge, history, environmental science, generational learning, careers in science

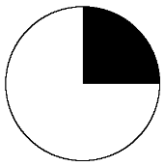
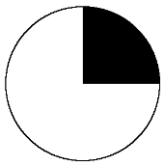
**Process Skills Focus**: Critical thinking, listening, inquiry, writing, observing

## LEARNING OBJECTIVES

*For Next Generation Science Standards alignment, see end of outline.*

- Students will learn about traditional knowledge and careers in science from Native American elders and a Native or non-Native scientist in their local community
- Students will experience how cultural identity can impact career choices and knowledge about the environment
- Students will learn basic interviewing skills

## TIME REQUIRED

| Advance Prep | Set Up | Activity | Wrap-Up |
|---|---|---|---|
|  |  |  |  |
| **60 minutes** | **15 minutes** | **60+ minutes** | **15 minutes** |

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Introduction | Instructor-led Activity | 30 min |
| Native Elder Interview | Participant-led Activity | 30–60 min |
| Native or non-Native Scientist Interview | Participant-led Activity | 30 min |
| Wrap-up | Instructor-led Activity | 5 min |

## SITE REQUIREMENTS

Most any space can work for this activity as long as people can hear each other and the space is comfortable for guest speakers (e.g., a chair).

## SUPPLIES

| Supplies | Amount |
|---|---|
| 8.5”×11” paper | 1 per student |
| Pen or pencil | 1 per student |

## ADVANCE PREPARATION

- Locate a Native American elder and a Native or non-Native scientist who are interested in being interviewed by a group of youth.

    - Suggestions for where to find a Native American elder:
        - Tribal government center
        - Powwows
        - Community college
        - University with Native American Studies Department
        - American Indian Science and Engineering Society (AISES)
        - Society for Advancement of Chicanos/Hispanics and Native Americans in Science (Sacnas)
        - Urban native coalition
        - Indian walk-in center
        - Tribal museum
        - Tribal or cultural center
        - Family members of youth
        - Retirement or assisted living center
        - Local Native-owned companies and businesses

    - Suggestions for where to find a Native or non-Native scientist:
        - Family members of youth
        - Natural resources department
        - Medical facilities
        - A local Native American department or association of a college or university such as the American Indian Science and Engineering Society[1]
        - Local companies that employ scientists

- Cultural sensitivity should be taken into consideration when reaching out to an elder and asking for an interview. The facilitator is encouraged to speak with people in the Native community and learn protocol for asking an elder to present. This protocol may vary among different communities.
- An honorarium is often appropriate to offer in return for someone sharing cultural knowledge.
- **Always** have a gift to present a guest from the Native community. This gift can be flowers, food, a card signed by the students, or even a gift made by the students.
- Provide the interviewees with information about the type of questions students will be asking and ask them if they feel comfortable answering the questions.

[1] http://www.aises.org/

## SET UP

An interview can take place in a variety of settings. Students sitting in a semi-circle with an elder or scientist in front can work well. Facilitators are encouraged to create an informal atmosphere and not have students sit in their desk in a traditional classroom layout. Non-traditional learning environments like sitting in a circle outside or in a communal space can foster more conversation and create a more comfortable atmosphere for guest speakers and students.

## INTRODUCTION

# Interview Process

30 minutes

Suggested script is shaded. Important points or questions are in **bold**. Feel free to improvise as needed.

**Introduction**
The facilitator introduces students to the interview activity and leads a conversation about how different experiences can shape people's perceptions about science and the environment. Although conversations can vary, an example dialog is provided below.

Today we will be interviewing a Native elder and a scientist from our local area to learn about their lives and what they think of nature, science and the environment. Interviewing different types of people can create different types of experiences and our interview with an elder may be different than our interview with a scientist. For example, elders might like to share information by telling stories about their life while a scientist might like to answer a list of questions about their work.

Our first interview will be with _____ (name). An elder is a person of an older generation who has a great deal of knowledge, lived experience and information about their family, community, culture and local environment. Elders are traditionally very well respected in Native communities. How many of you know elders in your family or community? Do you look up to them and treat them with a great deal of respect? I hope so.

Give students some basic information about the person they will be interviewing and how they should act during the interviews and in the presence of a Native elder. Students should:

- Be polite and attentive
- Not speak out of turn or without raising a hand first
- Be patient in waiting for the speaker to answer a question
- Speak loudly and clearly when asking a question
- Be mindful of not asking questions that are too personal

Before we meet with each of our presenters, we need to create a list of questions that you as a class will ask these presenters during the interviews. To get an idea of what type of questions we want to ask, let's think about what these people might want to share with us. **Many of you have grandparents and know other people of the same generation as _____ (guest speaker). What do you think _____ (guest speaker) might like to share with us?**

Since we are focusing on learning about science and the environment, let's also think about how older generations may have interacted with nature and the environment when they were your age. **What experiences might they have had that could be different from your own? For example, would the way their family acquired food have been different? Would they have spent more time playing outside without modern technologies? Who can think of a question they would like to ask?**

Have students take 3–5 minutes to work on their own or with the person next to them to come up with 2–3 questions each. Suggest that students also have the option of asking an elder to tell a story related to their topic of interest rather than just a straightforward question. Interacting with an elder can be a way to explore cultural protocols and allow an elder time to reflect and share information in his or her own way.

Go around the room and ask each student/group what they came up with and make a list of questions on the board for students to ask during the interview. See the list below for examples of good interview questions.

Now that we have a list of questions for our Native elder, let's think about what we want to ask our scientist.

Our next interview will be with _____ (name). He/she is a _____ scientist and works for _____. Let's now come up with a list of mostly new interview questions.

Give students enough time to repeat the process of either working alone or in pairs to come up with a list of new questions. Try to encourage the students to come up with questions related to being a scientist, what type of education scientists need for their jobs, and how working with the Native community has influenced scientists' perceptions of science and the natural world (if applicable). See the list of example questions below.

Teachers can ask students to take notes on each question asked during the interviews or take a moment after each interview to write down 3–5 facts they learned about each interviewee.

Educators are encouraged to draw specific attention to the skills of interviewing as a social science, such as defining a research question, interviewing people, listening and observing, and analyzing the responses as part of the scientific process.

**GROUP ACTIVITY**

## Native Elder Interview

30–60 minutes

**Example questions for a Native elder:**

1. Could you share some information about your family with us?
2. What was life like when you were between 11 and 14 years old?
3. From your perspective as a Native elder, what do you think is important for youth to know about the environment and why?
4. How can I best take care of myself, my community, and the Earth?
5. What inspired you as a child? What continues to inspire you now?
6. What are your concerns with respect to our community?
7. What are your concerns with respect to our Earth?
8. What advice do you have for us?

## GROUP ACTIVITY — Native or non-Native Scientist Interview

30 minutes

**Example questions *for a Native or non-Native scientist*:**

1. What are your hobbies?
2. Where are you from?
3. What is your current job/position?
4. What education and/or experience did you need to get your job?
5. As a child, did you have any hobbies, interests, or experiences that helped prepare you for success in _____ (interviewee's field)?
6. When did you realize that you wanted to be a _____ (interviewee's profession)?
7. Did you have a mentor or teacher who inspired your interest in your current career or expertise?
8. What do you think was the most important thing you learned growing up?
9. What is your dream? What do you most hope to accomplish in your life?
10. Did you have to overcome any obstacles on your path to becoming an expert in your field?
11. Who do you look up to as heroes in your field? In your community?
12. Do you have any advice for students who are interested in pursuing a career in_____ (interviewee's field)?
13. What projects are you working on now?
14. How does the research / work you do affect people's lives?
15. How does the research / work you do affect us here in our community?
16. What do you like most about your work?
17. What inspired you as a child? What continues to inspire you now?

## WRAP-UP

5 minutes

- **It's very important to present a gift to any guest speaker from the Native American community.** Have a student or two present a gift to the interviewees at the end of the interviews and thank them for visiting.

- After both guest speakers have left the classroom, engage students in a conversation around how the interviews were different and what they learned about how each speaker engages with nature and science. Talking about how differences in age, careers, culture, etc. can encourage students to think about how different people experience science and nature in different ways.
- Ask students to turn in their notes or 3–5 facts they learned about each interviewee to get credit for participating.
- Either have the class make one large thank-you card or have students each make individual thank-you cards to send to the guest speakers.

## OPTIONAL EXTENSIONS

- Students can conduct a one-on-one interview with a community or family member. A brief summary of the interview and answers to their interview questions can then be shared with their class and/or turned into their teacher. This activity could be completed to earn extra credit.

## BACKGROUND INFORMATION

Guidelines[2] for interviewing a Native elder:

1. Cordial greeting of the elders. Inquire if they had a good sleep. Inquire if they have anything of importance to communicate right then.
2. Give reason(s) for meeting.
3. Consider presenting a release form for the elder to sign.
4. Try to approach the subject from all angles. Remember that most students don't know much about Native stuff, but they love it.
5. Take breaks at appropriate times.

Tips[3] for students for conducting interviews:

**STEP 1: Research, research, research**. Then research some more. The only way to come up with good questions is to know everything there is to know about your subject.
**STEP 2: Contact the person you wish to interview**. Ask when a good time would be to do the interview. Be polite! Say "please" and "thank you." Try to set up the interview in person. If this isn't possible, then set up a phone interview.
**STEP 3: Read over your research and brainstorm a list of 15 questions**. The more specific your questions are, the better! And never ask questions that can be answered with a simple yes or no.

**STEP 4: Come prepared with:**
A pencil
A notebook
A list of good questions
A recording device (always ask permission before recording an interview)
**STEP 5: Be on time!** Arrive at your interview with plenty of time to spare. If you've never been to the place where your interview is taking place, go early and scout it out. There is nothing more unprofessional than a reporter who is late.
**STEP 6**: Conduct your interview in an organized, timely manner**.**
**STEP 7**: Even if you are recording an interview, take notes**. Don't try to write every word said. It will slow down the interview. Just take down the highlights.**
**STEP 8**: Review your research and your interview notes**. Circle or highlight quotations that you think will be good for your article. Now you're ready to begin writing!**

[2] http://ankn.uaf.edu/NPE/CulturalAtlases/interview.html
[3] http://www.scholastic.com/teachers/lesson-plan/how-conduct-interview

## RESOURCES

Links and resources for cultural guides:

Alaska Native Knowledge Network[4]
Guide to Implementing the Alaska Cultural Standards for Educators[5]
Indian Education for All - Montana Office of Public Instruction[6]
Navajo Culture[7]

## GLOSSARY

| Vocabulary | Definition |
|---|---|
| **Elder** | A person who has gathered knowledge and wisdom about his or her culture; not all elderly people are elders |
| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

[4] http://ankn.uaf.edu/Publications/Knowledge.html
[5] https://education.alaska.gov/standards/pdf/cultural_standards.pdf
[6] http://opi.mt.gov/programs/indianed/IEFA.html
[7] http://serc.carleton.edu/research_education/nativelands/navajo/culture.html

## NEXT GENERATION SCIENCE STANDARDS

**Practices**

- Planning and carrying out investigations
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | ✓ | |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | | n/a | n/a | | | ✓ | | |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | | |

# Weaving

| | |
|---|---|
| ***Program Type:*** After-school, community center, classroom, museum education activity | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length***: 1–2 Hours | ***Class Size:*** Up to 36 students |

***Description****:*
Learn traditional knowledge* through the craft of weaving. Participants will explore how the process of weaving can inform us about different cultures.

**Traditional knowledge refers to information, skills, and practices that are developed, sustained, and passed on from generation to generation within a community.*

***Topics***: weaving, craft revival, natural resources, traditional knowledge

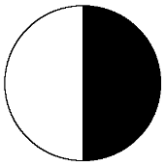
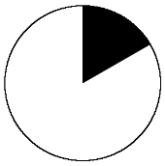
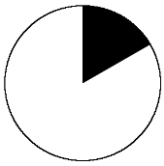
***Process Skills Focus***: observing, measuring

## LEARNING OBJECTIVES

*For Next Generation Science Standards, see end of outline.*

- Traditional knowledge of weaving is important to many indigenous communities.
- Learning how to weave and gathering the resources necessary for weaving can contribute to an understanding about the environment and Native culture.
- Weaving can be very complex and involves math and pattern skills.

## TIME REQUIRED

| Advance Prep | Set Up | Activity | Wrap-Up |
|---|---|---|---|
|  |  |  |  |
| **30 minutes** | **10+ minutes** | **60+ minutes** | **10 minutes** |

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Introduction | Facilitator-led Activity | 10 min |
| Guest Speaker (optional) | Group Activity | 30–60 min |
| Weaving a Loom | Individual Activity | 60 min |

## SITE REQUIREMENTS

- Tables or desks to accommodate students
- A quiet and comfortable setting with chair(s) for optional guest speaker(s)
- A computer, projector, and speakers with internet access is optional to show instructional videos prior to the activity.

## SUPPLIES

| Permanent Supplies | Amount |
|---|---|
| Scissors | 1 per student |
| Rulers | 1 per student |
| Colored pencils or markers* | 3–5 per student |
| Computer with internet access and projector (optional) | 1 (total) |
| Weaving examples from a local Native community (if available) | 1–3 (total) |

| Major Consumables | Amount |
|---|---|
| Written directions (see “Background Information”) | 1 per student |
| Masking tape | 5” per student |
| Cardboard, approx. 18 cm × 13 cm (7” × 5”) | 1 per student |
| Yarn, 5–10 colors* | 1.2 m (4 ft) x 5 colors per student |
| White string (thick floss or kite string) | 3m (10 ft) per student |
| Popsicle sticks | 1 per student |

## ADVANCE PREPARATION

- Print one copy of the written directions (see "Background Information") for each student.
- Cut the cardboard into 18 cm × 13 cm (7" × 5") pieces (one for each student).
- Cut the yarn into 1.2 m (4 ft.) lengths
- Practice completing the activity and, if internet access is available, review the videos listed in the Introduction and Individual Activity sections before working with participants.
- See the Resources section for learning and sharing information on traditional practices and environmental science around weaving.
- If your location is close to a *Roots of Wisdom* exhibition (www.omsi.edu/exhibits/row), participants can first visit the exhibit and learn about Cherokee weaving and river cane restoration.
- Reach out to the local Native community and invite a guest speaker to share information on traditional weaving in the local area.
- If a guest speaker is not available, educators are encouraged to find local stories or weaving traditions to share.
- If possible, provide examples of weavings (from local Native cultures if possible) that students can touch and feel.

## SET UP

- Lay out all the supplies at the front of the room.
- If available, turn on computer, speakers and projector and navigate to the following videos
  - http://vimeo.com/99194466
  - https://www.youtube.com/watch?v=-ByYj5G4-Hc
- If time is constrained or if the students are particularly young, the cardboard looms can be pre-made:
- Using a ruler, draw eight 0.6 cm (¼ inch) long lines along the top and bottom of the loom. The lines should be around 0.6 cm (¼ inch) apart and should line up with one another from top to bottom. Use a pair of scissors to cut along the 0.6 cm (¼ inch) long lines on both the top and bottom of the loom – you're only making short cuts 0.6 cm (¼ inch) long!

- Tape the string down on the left side of the loom. This will be the back side of the loom. Wind the string through the slots, creating vertical warp strings. Tape the end of the string to the back of the loom (see Image 1). You can add more tape if you'd like to secure all of the strings. Be sure to save about 1 inch of tape for later (see Image 1).

**Image 1**

## INTRODUCTION

10 minutes

*Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.*

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics.* Feel free to improvise as needed.

Today we are going to learn about the ancient practice of weaving and what it can tell us about different cultures. People from all over the world have been making baskets for thousands of years. Although baskets are quite common, it can be extremely difficult to gather the materials needed to make a basket and learn how to weave different patterns and designs.

**Recommended Introduction to Weaving**

Before we make weavings of our own, we're going to hear from a local Native Elder about the current and historical practices of weaving in our region. I'd like to introduce _____ (name), an Elder from the _____ tribe/ community.

Facilitator is encouraged to reference the *Voices from our Community* activity guide for information and protocol on interviewing a Native Elder. The guide is available on the *Roots of Wisdom* website at: http://www.omsi.edu/exhibitions/row/education-resources/.

**What did you learn from _____ (name) about how basket weaving is important in this area?**

**Alternative Introduction to Weaving**

Before we make weavings of our own, we're going to watch a video talking about how important basket weaving is to the Eastern Band Cherokee in North Carolina. After the video, I am going to ask you what you learned that makes this craft so important to the Cherokee people.

Show video: http://vimeo.com/99194466 [2:19]

**What did you learn in the video that makes basket weaving important to the Eastern Band Cherokee?**

- *It's a family tradition*
- *It's been happening for a long time*
- *It's important for people not to forget traditions*
- *To learn about the plants used to make baskets*
- *To teach people information about their culture*

The facilitator can use resources referenced below and/or information from his or her local Native community to discuss why basket weaving is important and its history in the local area. Educators are also encouraged to emphasize patterns and pattern structures and provide examples of complex weaving patterns that students can touch and feel.

**INDIVIDUAL ACTIVITY**

## Weaving a Loom

60 minutes

You can weave all kinds of materials together to make things. Can anyone name a few materials used for weaving?

Today, we're going to be using yarn to weave fabric.

Hold up a completed weaving, on a loom, as an example. Point out each part in of the weaving in turn.

You can see that there are many different parts to this weaving. The weaving is done on a loom – we'll use a cardboard frame for our looms. There are also the strings that provide structure for the weaving – those are called warp strings. And then there's the colorful thread that we use to make our design – those are called weft strings. We're now going to watch a video showing how to assemble one of these looms and how to use it.

Directional video: https://www.youtube.com/watch?v=-ByYj5G4-Hc [3:05]

If internet access is not available, simply read the directions below to the class. (Even if you do show the video, it's also helpful to read these directions to your class.) Use your completed loom as an example so the students can see what they'll be designing.
Hand out a piece of cardboard, the string, ruler, tape, and scissors to each student. Also, hand out the page of written directions, in case students learn better by reading.

I'm handing out a page of written directions. I'll also explain what we're going to do, so you can follow my example, if you wish.

Pick up your piece of cardboard. That's your loom. We're now going to put the warp strings on. Using a ruler, draw eight 0.6 cm (¼ inch) long lines along the top and bottom of the loom. The lines should be around 0.6 cm (¼ inch) apart and should line up with one another from top to bottom. Use a pair of scissors to cut notches along the 0.6 cm (¼ inch) long lines on both the top and bottom of the loom – you're only making short cuts 0.6 cm (¼ inch) long!

Pick up your piece of string. We're now going to make the warp strings. Tape the string down on the left side of the loom. This will be the back side of the loom. Wind the string through the slots, creating vertical warp strings. Tape the end of the string to the back of the loom (see **Image 1**). You can add more tape if you'd like to secure all of the strings. Be sure to save about 1 inch of tape, which we'll use later.

**Image 1**

It's now time to design your pattern. What would you like to create? Remember that horizontal lines of color will be the easiest to weave.

Hand out the graph paper and the colored pencils (or markers) to each student.

Pick up your piece of graph paper. Draw a pattern on a piece of graph paper that is the same size as the loom. Use 3–5 colored pencils to represent the colors of yarn that will be used in the weave. The pattern will serve as your guide for when you weave your pattern.

Hand out the yarn and the popsicle sticks.

Choose which color of yarn you will begin with. Tape the popsicle stick to one end of the yarn (see **Image 2**). Moving from left to right, place the popsicle stick over one string and under the next string. Repeat this over/under pattern until you cross all strings. Then wrap the yarn around the last string and move back in the opposite direction (right to left) using the same over/under pattern. Repeat for as many lines as you would like with that color of yarn.

**Image 2**

When you want to switch to a different color of yarn, finish an entire row and then switch to new piece of yarn. Do not tie a knot at the end of the yarn to start a new color. Each piece can be simply left hanging off to the side.

Complete your weaving by following the pattern you drew on the graph paper. Weave until the loom is completely full.

When you're finished with your weaving, cut the warp threads on the back of the loom and lift your weaving off of the loom. You have a wall hanging to display!

**RECOMMENDED ACTIVITY**

If a Native Elder was not available to speak with the students, read the following optional story to the students as they weave. This story features baskets as a part of Native American folklore.

## *Basket Woman, Mother of the Stars*

**Tribe: Skidi Pawnee**

**Back in the beginning of time, when all things were being created, First Man lived in a forest of tall pine trees. One day while on a hunting trip, he discovered a small lodge. Next to the lodge was a tiny cornfield. "I wonder who lives here," he thought.**

**The next day, First Man brought his wife, First Woman, through the forest to see the lodge. As they came near, a little old woman came out to greet them. "I am basket woman, or Moon, the mother of the stars. I lured you here." Then she invited her visitors inside. Around a small fire sat four old men: Wind, Cloud, Lightning and Thunder.**

**The lodge was filled with Moon's daughters. Soon the girls began to sing and dance. Moon's daughters told First Man to watch and listen very carefully so he could teach the sacred songs and dances to others. After the singing and dancing, Basket Woman's Daughters taught First Man and First Woman ceremonies and games.**

**Evening Star danced in the west and held a basket representing the moon. The basket was made of willow reeds held together with mud, for the earth is filled with trees. Four daughters of Black Star were also there: they danced and moved toward the west and each placed what she carried in Evening Star's basket two swan necks and two fawn skins. These represented the four gods in the west.**

**The basket woman's daughters taught First Man and First Woman a game. They gave them the Moon basket, plum seeds which represented the stars, and twelve sticks which are the circle of chiefs in the sky. They used the sticks as counters.**

**When First Man and First Woman had learned all they should, their neighbors from the lodge jumped into their basket and flew away up to the sky to return to their places.**

What is some of the symbolism present in this story? What kind of science can you identify in this story? What does the basket woman represent? What do the twelve sticks represent?

*The twelve sticks may represent the twelve constellations of the zodiac (i.e., the constellations that the Sun appears to pass through over the course of a year.)*

## CLEAN UP

10 minutes

- Throw out any yarn scraps and collect the supplies into a box.
- If students have not finished their weavings, allow them to take home yarn with the directions handout.

## OPTIONAL EXTENSIONS

This program can be used in conjunction with the traditional dyes activity also found on the Roots of Wisdom website located at www.omsi.edu/exhibits/row. The dyes made from natural materials could be used to dye yarn for weaving opposed to the fabric referenced in the activity guide.

## BACKGROUND INFORMATION

There are a variety of videos that can be helpful for facilitating and completing this activity.

- Primary Weaving[1]
- Weaving on a Cardboard Loom[2]
- Beginning Basic Weave[3]
- Restarting Basic Weave[4]

This activity is referenced in a website entitled *Craft Revival: Shaping Western North Carolina Past and Present* and has a wealth of information on the history and culture of the Cherokee Nation and references for books and other activities.

- Craft Revival: Shaping Western North Carolina Past and Present[5]
- Referenced Weaving Activity[6]
- Additional Cherokee-themed K-12 Lesson Plans[7]

1 http://www.youtube.com/watch?v=-ByYj5G4-Hc

2 http://www.youtube.com/watch?v=LbtKnvc_9No&app=desktop

3 http://www.youtube.com/watch?v=nkZQtmrIKBM

4 http://www.youtube.com/watch?v=PZgxyWR1Aq8

5 http://www.wcu.edu/library/DigitalCollections/CraftRevival/index.htm

6 http://www.wcu.edu/library/DigitalCollections/CraftRevival/k12/Elem_weavingdraft.html

7 http://www.wcu.edu/library/DigitalCollections/CraftRevival/k12/index.htm

# Weaving Activity Directions

- Create a small handmade loom by cutting a piece of cardboard into a small rectangle (about 5 inches wide by 7 inches long is a good size for starters).
- Using a ruler, draw six to eight ¼ inch long lines along the top and bottom of the loom. The lines should be around ¼ inch apart and should line up with one another from top to bottom.
- Use a pair of scissors to cut along the ¼ inch long lines on both the top and bottom of the loom (See Image 1).
- Cut a long section of white string (about 16 times the length of your loom). Tape the string down on the left side of the loom. This will be the back side of the loom. Using Image 1 as a guide, pull the string up through slot one, down through slot two, up and over slot 3, down through slot 4, etc. Follow this pattern until the string has crossed through all slots. Tape the end of the string to the back of the loom.
- Draw a pattern on a piece of graph paper that is the same size as the loom. Use three to five colored pencils to represent the colors of yarn that will be used in the weave. The pattern will serve as a guide for weaving.
- Choose a color of yarn to begin with. Moving from left to right, place the yarn over one string and under the next string. Repeat this over/under pattern until you cross all strings. Then wrap the yarn around the last string and move back in the opposite direction (right to left) using the same over/under pattern. Repeat for as many lines as you would like with that color of yarn.
- When changing the color of the yarn, finish an entire row and then switch to a different color. Do not tie a knot at the end of the yarn to start a new color. Each piece can be simply left hanging off to the side.
- Complete the weave by following the pattern drawn out on the graph paper. Weave until the loom is completely full.
- Either cut the weave off the loom to make a wall hanging or frame the weave on the loom by making a cardboard frame.

## RESOURCES

Links and resources for cultural guides:

Alaska Native Knowledge Network[8]
Guide to Implementing the Alaska Cultural Standards for Educators[9]
Indian Education for All - Montana Office of Public Instruction[10]
Navajo Culture[11]

## GLOSSARY

| Vocabulary | Definition |
|---|---|
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| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

## NEXT GENERATION SCIENCE STANDARDS

[8] http://ankn.uaf.edu/Publications/Knowledge.html
[9] https://education.alaska.gov/standards/pdf/cultural_standards.pdf
[10] http://opi.mt.gov/programs/indianed/IEFA.html
[11] http://serc.carleton.edu/research_education/nativelands/navajo/culture.html

**Practices**
- Planning and carrying out investigations
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**
- Patterns
- Cause and effect

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | | |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | | n/a | n/a | | | | | |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | | |

# Weaving Activity Directions

- Create a small handmade loom by cutting a piece of cardboard into a small rectangle (about 5 inches wide by 7 inches long is a good size for starters).

- Using a ruler, draw six to eight ¼ inch long lines along the top and bottom of the loom. The lines should be around ¼ inch apart and should line up with one another from top to bottom.

- Use a pair of scissors to cut along the ¼ inch long lines on both the top and bottom of the loom (See Image 1).

- Cut a long section of white string (about 16 times the length of your loom). Tape the string down on the left side of the loom. This will be the back side of the loom. Using Image 1 as a guide, pull the string up through slot one, down through slot two, up and over slot 3, down through slot 4, etc. Follow this pattern until the string has crossed through all slots. Tape the end of the string to the back of the loom.

- Draw a pattern on a piece of graph paper that is the same size as the loom. Use three to five colored pencils to represent the colors of yarn that will be used in the weave. The pattern will serve as a guide for weaving.

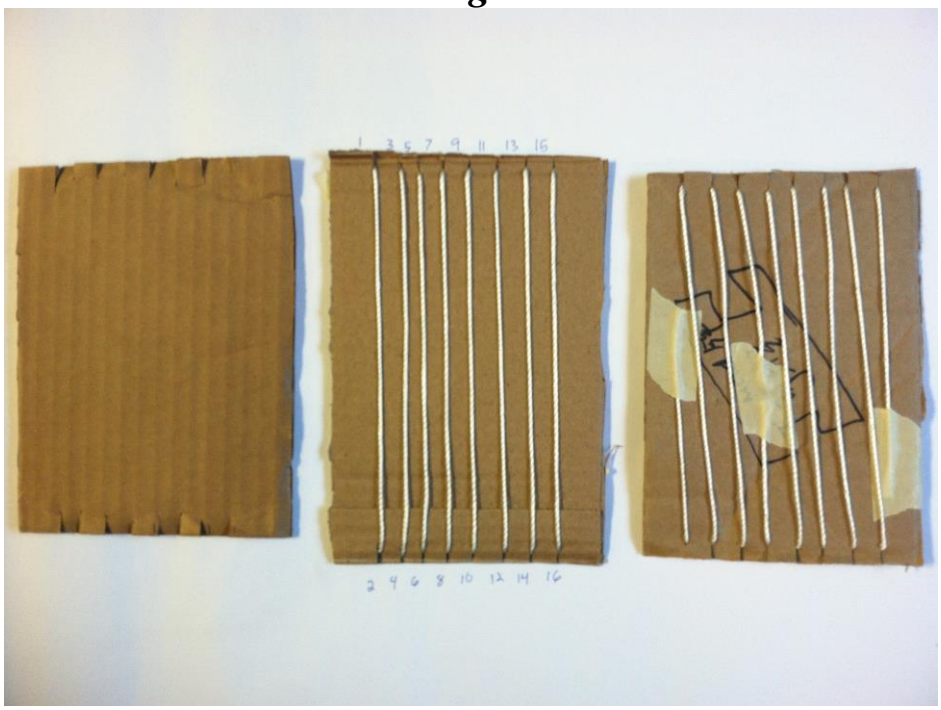
- Choose a color of yarn to begin with. Moving from left to right, place the yarn over one string and under the next string. Repeat this over/under pattern until you cross all strings. Then wrap the yarn around the last string and move back in the opposite direction (right to left) using the same over/under pattern. Repeat for as many lines as you would like with that color of yarn.

- When changing the color of the yarn, finish an entire row and then switch to a different color. Do not tie a knot at the end of the yarn to start a new color. Each piece can be simply left hanging off to the side.

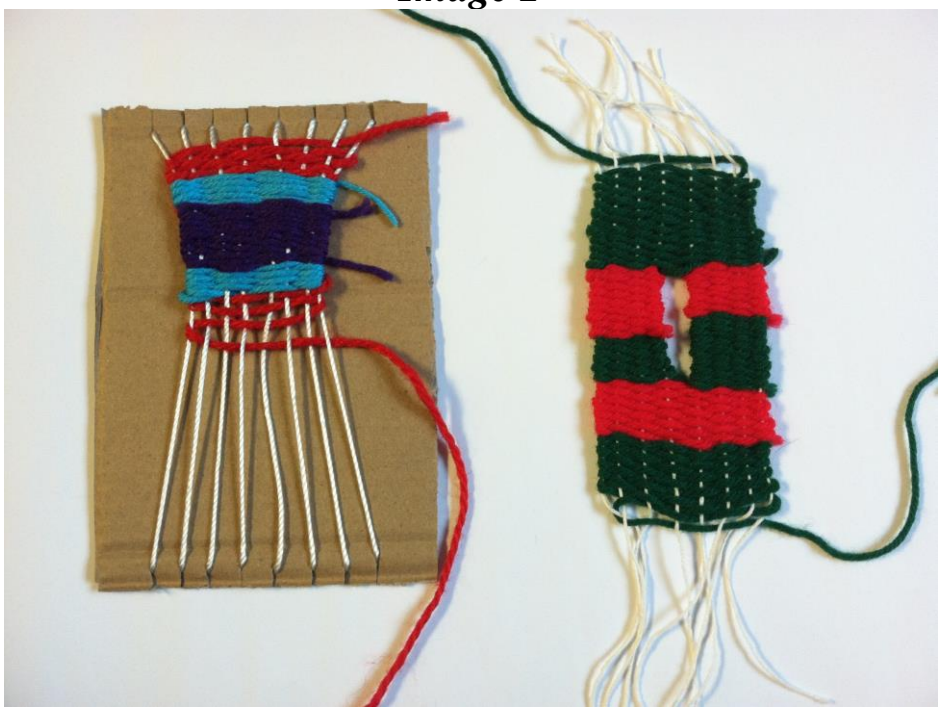
- Complete the weave by following the pattern drawn out on the graph paper. Weave until the loom is completely full.

- Either cut the weave off the loom to make a wall hanging or frame the weave on the loom by making a cardboard frame.

## *Image 1*



## *Image 2*



# Exploring Natural Dyes Activity

| | |
|---|---|
| ***Program Type:*** After-school, community center, classroom, museum education activity | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length***: 1–2 hours | ***Class Size:*** Up to 36 students |

***Description****:*
Learn traditional* knowledge and environmental science through the craft of creating and using natural dyes. Participants will explore how to create dyes using natural and organic materials, how they behave on different types of fabrics, and how a range of colors can be created with just a few ingredients from the yard or kitchen.

**Traditional knowledge refers to information, skills, and practices that are developed, sustained, and passed on from generation to generation within a community.*

***Topics***: Dyes, patterns, natural resources, environmental science, traditional knowledge

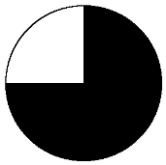
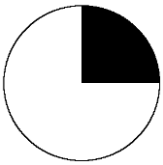
***Process Skills Focus***: Observing, predicting, inquiry, critical thinking, controlling variables, experimenting

## LEARNING OBJECTIVES

*For Next Generation Science Standards, see end of outline.*

- Indigenous peoples from around the world create dyes from locally available materials.
- Natural dyes can be made from organic materials such as plants, fungi, invertebrates, or minerals.
- Passing down knowledge through generations is a valuable way to gain skills and learn about the environment.

## TIME REQUIRED

| Advance Prep | Set Up | Activity | Clean Up |
|---|---|---|---|
|  |  |  |  |
| **60+ minutes** | **45 minutes** | **60+ minutes** | **15 minutes** |

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Introduction | Facilitator-led/partner discussion | 10 min |
| Guest Speaker (optional) | Group Activity | 30–60 min |
| Exploring Natural Dyes | Individual Activity | 20–30 min |
| Wrap-Up | Guided Discussion | 5 min |

## SITE REQUIREMENTS

- Classroom or community space large enough for class size
- Tables with chairs grouped into fours (each table shares supplies)
- Access to water source
- 1–2 adults per 20 students

## SUPPLIES

| Permanent Supplies | Amount |
|---|---|
| Paintbrushes, fine point | 1 per student |
| Containers for dye (clear cups are preferable) | 1 for each dye, per table |
| Container for rinse water | 1 per student |
| | |
| Plastic tablecloths | 1 per table |
| Drying rack | 1 |
| Rulers | 1 per student |
| Pencils | 1 per student |

| Major Consumables | Amount |
|---|---|
| Plant-based fabric (cotton, linen), laundered, cut into 7–10 cm (3–4”) squares | 1 square per student |
| Animal-based fabric (silk, wool), laundered, cut into 7–10 cm (3–4”) squares | 1 square per student |
| Silk fabric, laundered, cut into 7–10 cm (3–4”) squares | 1 square per student |
| Tea, beets, spinach, turmeric, dried black beans | as needed |
| Alum (potassium aluminum sulfate) | 4 oz. per lb fabric |
| Cream of tartar | 1 oz. per lb. fabric |
| Iron (ferrous sulfate/scrap iron) | ½ oz. per lb. fabric |
| Additional source materials for extracting dye (e.g., vegetables, fruits) | as desired |
| Paper towels | 1 roll per table |
| Paper cups (option for permanent dye containers) | as needed |
| Paper (blank, unlined for creating observation chart) | 1 per student |
| Drying rack or drying area | 1 |
| Observation chart (see the Resources section) | 1 per student |

## ADVANCE PREPARATION

- Reach out to members of the local Native community and ask if they are willing to share information about what in the local environment was historically used to create natural dyes.
  - Suggestions for where to find a Native community member:
    - Family members of youth
    - Tribal or cultural center
    - Retirement or assisted living center
    - Local Native-owned companies and businesses
- Facilitators are also encouraged to ask for examples of color significance from members of locally based indigenous cultures.
- Cultural sensitivity should be taken into consideration when reaching out to an elder and asking for an interview. The facilitator is encouraged to speak with people in the Native community and learn protocol for asking an elder to present. This protocol may vary among different communities.
- An honorarium is often appropriate to offer in return for someone sharing cultural knowledge.
- **Always** have a gift to present a guest from the Native community. This gift can be flowers, food, a card signed by the students, or even a gift made by the students.
- Create 2–3 dyes from materials in the local environment (see Native Plant Dyes[1]) and 2–3 from products purchased from a grocery store.
  - In general, chop up the source material and simmer in water (1 part source material to 4 parts water) for an extended period of time, allowing it to cool and sit overnight, before straining.
  - The following colors can be made from common grocery store items:
    Brown: Black tea, brewed strong
    Red: Beet, fresh (heat slowly and do not boil) or canned
    Blue: Blueberry, fresh or canned
    Green: Spinach, fresh or frozen
    Yellow: Turmeric, powdered
    Orange: Yellow onion skins, boiled
    Purple/Black: Black beans, dried
- Optional time savers:
  - Steep materials for less time or use juice from fruits or vegetables. Many vegetable and fruit juices such as carrot, pomegranate, and grape need no special preparation other than pouring into a container. Dried herbs and spices may also be steeped in water for a simple dye preparation. *Caution – the resulting shade of color will be lighter and more prone to fading using either of these methods.*
- Take 1–2 of the dyes and pour a portion of each into a separate container with the alum or cream of tartar, which act as a *mordant* to fix the color onto

[1] http://www.fs.fed.us/wildflowers/ethnobotany/dyes.shtml

the materials. Choose either silk or wool as an animal-based fabric to be saturated with an iron mordant by soaking fabric for an hour in a solution of water that has been boiled with ferrous sulfate, old iron nails, a cast iron pan, or even scrap iron. Cut all fabric into 7–10 cm (3–4") squares (one square per student).

- Optional (if time allows): Launder all fabric *without using fabric softener* to open up fibers to allow the dye to be more readily absorbed.
- Print the observation charts (see the Resources section), one per student.

**CAUTION: Do not use fabric softener when laundering the fabrics.**

## SET UP

Set out supplies at each table of 4 students with the following items on each table:

- Plastic tablecloth to cover tabletop
- 1 roll of paper towels/clean rags to blot brushes and wipe up spills
- 1 container of each type of prepared dye (2–3 from store-bought materials and 2–3 collected from the local environment)
- 1 container of water to clean brushes when changing colors
- 1 square of each type per student:
    1. plant-based fabric (cotton or linen)
    2. animal-based fabric (silk or wool)
    3. a second piece of the same type of animal-based fabric, treated with an iron mordant
    4. synthetic fabric (examples: polyester, rayon, or spandex)
- 1 paintbrush per student
- 1 ruler, pencil, and sheet of blank, unlined paper per person

## INTRODUCTION

30 minutes

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics.*

*Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.*

**Recommended Introduction with Guest Speaker**

Today we are going to learn about the ancient practice of creating and using natural dyes. People from all over the world have been using materials they find in nature to create dyes for thousands of years. Before we explore different dyes on our own, I've asked a Native Elder from our local community to join us today and talk about the current and historical practices of creating and using dyes amongst our local Native American community.

Refer to the *Voices from our Community* activity guide for information and protocol on interviewing a Native Elder. The guide is also available on the *Roots of Wisdom* website at www.omsi.edu/exhibits/row.

**Alternative Introduction with Guided Discussion (if a guest speaker is not available)**

Today we are going to learn about the ancient practice of creating and using natural dyes. People from all over the world have been using materials found in local environment to create dyes for thousands of years. Plants, fungi, invertebrates, and minerals are all sources for creating dye.

Today, dye is still a huge part of our culture and daily life.
For example:

- It is really hot outside, so I am wearing white to stay cool.
- I am wearing our school's logo because we have a game tonight.
- I am wearing my favorite color because it makes me happy!

Now partner up with your neighbor and take 30 seconds each to tell each other about why you choose to wear certain articles of clothing today. You can discuss things like colors, patterns, and designs. Ready, set, go!

If time allows, have a few students share what they discussed with their partner.

We all have deeper reasons for choosing our clothes each day than just covering ourselves and staying warm. Our day's activities, personal needs, social identity, and the roles we play (like being a teacher or a student) all contribute to the choices we make. The way we make ourselves look tell us a lot about each

other. Colors, as well as the patterns and designs we make with them, often have deeper, symbolic meanings. Team uniforms are a common example. However, what is true for us today and our culture didn't always hold true in past times and other cultures.

Let's think about some of the deeper, more symbolic meanings of colors and patterns in our society today. For example, *red can mean stop, or signify anger. Yellow can be cheerful or cowardly. White can indicate cleanliness and purity. Black is often associated with grief, formalwear, and even punk rockers!*

If time allows, ask students to come up with more examples of what colors symbolize in our society.

Now let's compare how some of our views to those of one particular Native American community. Red, yellow, black and white are four sacred colors to the Cheyenne people, a plains tribe from the Upper Midwest on the United States. To the Cheyenne people, red traditionally symbolized life, yellow the sun's power, black victory, and white dawn.

Native American cultures used dye for making patterns and designs with color for many reasons such as to identify different groups of people, indicate a family's status, and portray tribal values. Traditional knowledge was handed down for generations on how to collect natural materials and create dyes for making particular colors and designs. Archeologists can sometimes learn a lot about past cultures and how they changed over time by studying the colors and designs of objects found in a particular place.

While natural dyes have been around for thousands of years, industrially made dyes have only been around for a few hundred years. Since then, the synthetic textile and dye industry has become a huge part of modern society and also one of the largest sources of industrial water pollution on earth.

Natural dyes are better for the environment because they don't create toxic chemicals like formaldehyde, chlorine, lead, and mercury. Natural dyes are less toxic to the environment and the people who work with them and wear them.

INDIVIDUAL ACTIVITY

# Exploring Natural Dyes

20–30 minutes

Now that we have a little background information about dyes, let's talk about how we are going to explore the ones on our tables.

**Can anybody guess why some stains are easy to wash out and others aren't?** *Some plants stick better than others. Some colors are brighter than others. Chemicals in some plants stick to fabric better than others.*

Those are good guesses. Different types of materials are made up of different types of threads, called fibers. These fibers play an important role in determining how dyes and fabrics respond to one another. Animal fibers are considered easier to dye because they are mainly composed of proteins. Plant fibers can be more difficult because they a have thicker and smoother surface, making it difficult for dyes to bond.

**Who can name an example of a fabric made from plants?** *Cotton from the cotton plant, linen from flax*

**Who can name an example of a material made from animals?** *Leather from cows, silk from silk worms, wool from sheep*

Natural dyes can often fade less and last longer if a substance to fix the color onto a material – a mordant – is applied to the material before or after the dye. For example, fabric dyed with berries will fade quickly and wash out, if not treated with a mordant. Mordants work by binding with the dye to create an insoluble compound. They create more of an affinity between the dye and the fabric. The metal ions in the mordants form strong bonds between the dye and the fiber. Mordants like salt, vinegar, and baking soda are good for plant-based fabrics. Metallic mordants like alum, iron, and copper are better for animal-based fabrics, such as wool and silk. Some mordants have been used for centuries, such as wood ash and even stale urine! Urine is most effective when "aged" at least 2 weeks before using. Whew! What an odor!

Some dyes don't need any type of added mordant to work well. These dyes often contain tannin, which is a naturally occurring mordant in black walnut, safflower, and lichen.

Over time, Native communities learned which dyes affixed well to which materials. This knowledge was passed down through generations, becoming traditional knowledge. Careful observations of the natural world result in learned knowledge, which is also how scientists conduct their studies. Traditional knowledge and science both try to explain the world we live in.

Divide the class into groups of 2–4 students so they can share supplies and have conversations around the activity.

1. Provide each student with an observation chart (see the Resources section) and instruct the students to fill out their charts as they use different fabrics and dyes.

2. Have students use a paintbrush to apply the dyes to the fabric and create a pattern. Ensure that the students record their observations.

*Instruct the students to rinse their brushes in the rinse water when changing to a different dye color.*

3. Tell the students that they can take home their fabric samples and observation chart.

## WRAP-UP

5 minutes

*Lead a discussion with the students, prompted by the following questions.*

**Which dye on which fabric was your favorite color?**

**How did the colors vary using fabrics or dyes that had been treated with mordants? Were the colors brighter or dimmer when mordants were used?**

**Why do you think dyes react differently on different fabrics?**

**What kind of pattern did you create?**

**Why did you choose it?**

**Does it have any personal or social meaning for you or for your culture?**

## CLEAN UP

- Place the dyed fabric squares onto the drying rack or drying area and instruct students to clean up their tables by discarding trash and wiping up spills.
- Students should place all unused materials into center of tables for reuse.
- **Remind students to take home their observation charts and continue to observe the effects of mordants on dyes.**
- Save leftover dyes in a refrigerator to extend their shelf life for another class.
- Clean all the paintbrushes and containers.

## OPTIONAL EXTENSIONS

- Involve students in collecting materials to create the dyes and ask the students to make predictions about what colors the materials will create.
- Create sample pieces of fabric dyed naturally with and without the use of mordants. Expose some of them to sunlight for an extended time, creating a visual aid that would show how the effects of light contribute to colors fading over time, and how mordants and fixatives prevent color loss.
- Locate local Native items that have been made with natural dyes to show students. If these items not readily available, a slideshow or some other kind of visual aid can be created.
- At-Home Extension: Test the fabric samples for colorfastness by rinsing the samples with clean, cold water. If the dyes rinse out easily, you can always make a new design on the same fabric with dyes you create at home for yourself.

## RESOURCES

*Colors from Nature: Growing, Collecting, and Using Natural Dyes*. Bobbi A. McRae. Timber Press, 1993.
A good beginner's guide to dyeing.

*Dyes from American Native Plants: A Practical Guide*. Lynne Richards and Ronald J. Tyrl. Timber Press, 2005.
An excellent guide to North American dye plants and their effects.

Resource and dye plant guide[2] from the USDA Forest Service. Provides a useful "color guide" to Native North American plants.

Database[3] of Native plants and their known uses by Native American communities.

Resource[4] with very detailed information on culturally significant plants.

Listing[5] of regional dyeing organizations and dyeing resources.

[2] http://www.fs.fed.us/wildflowers/ethnobotany/dyes.shtml
[3] http://herb.umd.umich.edu/
[4] http://plants.usda.gov/java/factSheet?cultural=yes
[5] http://www.naturaldyes.org/organizations.htm

# Observation chart

Name: _____

**Example:**
*Light pink in color, really pretty.*

Fabric: *Silk* Mordant: *No*
Dye: *Beet juice*

Fabric: Mordant:
Dye:

Fabric: Mordant:
Dye:

Fabric: Mordant:
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Fabric: Mordant:
Dye:

## GLOSSARY

| Vocabulary | Definition |
|---|---|
| **Dye** | Substance (natural or synthetic) that changes the color of something.<br>Adjective dye: A dye that requires a mordant to bond the dye to the fabric.<br>Substantive dye: A dye that readily bonds to fabric without the use of added mordants. |
| **Dyebath** | Mixture of water and dye that the object is soaked in. |
| **Fiber** | A thread that forms a material.<br>Synthetic fiber: Manmade fiber.<br>Plant-based fiber: Fiber derived from plant sources, like cotton and linen.<br>Animal-based fiber: Fiber derived from animal sources, like silk and wool. |
| **Mordant** | A fixative, typically a metallic salt solution, which helps to permanently bond the dye to the fiber. |
| **Elder** | A person who has gathered knowledge and wisdom about his or her culture; not all elderly people are elders |
| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

## NEXT GENERATION SCIENCE STANDARDS

**Practices**

- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect
- Energy and matter
- Structure and function
- Stability and change

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | ✓ | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | ✓ | |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | | n/a | n/a | | | | ✓ | |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | ✓ | |

# Exploring Natural Dyes Demo

| | |
|---|---|
| ***Program Type:*** Demonstration | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length***: 15 Minutes | ***Class Size:*** 1–5 Participants |

**Description***:* Natural materials from the local environment or fruit and vegetables from your kitchen can be used to make beautiful natural dyes. If time and materials permit, use dyes to create a bookmark that you can take home.

**Topics**: Dyes, patterns, natural resources, environmental science

**Process Skills Focus**: Observing, predicting, experimenting

## LEARNING OBJECTIVES

*For Next Generation Science Standards, see end of outline.*

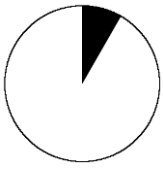
- Natural dyes can be made from organic materials such as plants, fungi, invertebrates, or minerals.
- Native peoples worldwide have used natural dyes for generations.
- Passing down knowledge through generations is a valuable way to gain skills and learn about the environment.

## TIME REQUIRED

**Advance Prep**

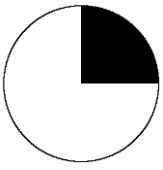
**60+ minutes**

**Set Up**



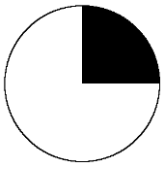
**5 minutes**

**Activity**



**15 minutes**

**Clean Up**



**15 minutes**

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Introduction | Instructor-led Activity | 1–2 min |
| Natural Dye Activity | Individual Activity | 10 min |
| Wrap-up | Instructor-led Activity | 1–2 min |

## SITE REQUIREMENTS

- One table (8’ × 4’ or so) with four chairs
- Access to water source (for advance preparation and clean up) and stove (for advance preparation)

## SUPPLIES

| Permanent Supplies | Amount |
|---|---|
| Paintbrushes, fine point | 5 |
| Cheesecloth | 1 ft × 1ft |
| Pint-sized glass jars with lids | 1 per dye |
| Table (8’ × 4’ or so) | 1 |
| Plastic tablecloth | 1 |
| Chairs | 5 |
| Teaspoon measure | 1 |

| Major Consumables | Amount |
|---|---|
| White cotton, silk, wool, or linen cloth | Square yard, approximately |
| Tea, beets, turmeric, dried black beans, blueberries | as needed; see Advance Preparation |
| Cream of tartar | 4 teaspoons |
| Alum (potassium aluminum sulfate) | ½ cup |
| Paper towels | 1 roll per table |
| Jumbo index cards (5” × 8”) | 20 |

## ADVANCE PREPARATION

- Collect 3 types of plants from the natural environment that can be used to make dyes (see Native Plant Dyes[1]) and 2 products from a grocery store than can be used to make dyes (see Native Plant Dyes). Create the dyes by chopping up the source material and simmering it in water (1 part source material to 4 parts water) for up to several hours, allowing it to cool and sit overnight, before straining each dye with cheesecloth into a glass jar or other clear container.
    - The following colors can be made from common items:
      Brown: Black tea, brewed strong
      Red: Beet, fresh (heat slowly and do not boil) or canned
      Blue: Blueberry, fresh or canned
      Yellow: Turmeric, powdered
      Orange: Yellow onion skins, boiled
      Purple/Black: Black beans, dried
- Optional time savers:
    - Steep materials for less time or use juice from fruits or vegetables.
    - Many vegetable and fruit juices such as carrot, pomegranate, and grape need no special preparation other than pouring into a container.
    - Dried herbs and spices may also be steeped in water for a simple dye preparation. *Caution – the resulting shade of color will be lighter and more prone to fading using either of these methods.*
- Add 2 teaspoons of the alum and ¼ teaspoon of cream of tartar to each cup of dye and mix well; the alum and the cream of tartar act as a *mordant* to fix the dye onto the cloth.
- Cut the cloth into bookmark-sized pieces (suggested size: 2” × 8”).
- Facilitators are encouraged to ask for examples of color significance from members of locally based indigenous cultures.

## SET UP

- Place the plastic tablecloth over the table.
- Put the five clear containers of prepared dyes on the table, along with the paintbrushes, roll of paper towels, index cards, and pre-cut pieces of cloth.

[1] http://www.fs.fed.us/wildflowers/ethnobotany/dyes.shtml

## introduction

1 – 2 minutes

*Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.*

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics.*

Welcome! Would you like to learn about using natural materials to create different colored dyes? **People from all over the world have been using locally sourced materials to create dyes for thousands of years.** I've created some dyes here out of things collected in the local environment as well as a few things from the grocery store.

Indigenous cultures from around the world have used dye for making patterns and designs for many reasons. Just as any country's flag's colors and patterns are powerful symbols today, objects decorated with natural dyes can be used to identify different indigenous groups of people, indicate a family's status, and portray tribal values.

Let's think about some of the deeper, more symbolic meanings of colors and patterns in our society today. For example, *red can mean stop, or signify anger. Yellow can be cheerful or can describe someone acting cowardly. White often indicates cleanliness and purity. Black is often associated with grief, formalwear, and even punk rockers!*

## NATURAL-DYE ACTIVITY

10 minutes

Here at this table, you can experiment with using natural dyes on a piece of fabric, similar to what indigenous cultures have done for generations.

Ask participants to sit or stand around the table. Hand each person a piece of cloth on top of an index card for creating a take-home bookmark or have them work on a large piece of cloth while at the table.

Here are the natural dyes that you can use. I made these using [explain the materials]. You can use the paintbrush next to each dye to paint on your fabric.

If materials are available for creating a bookmark, let participants know that they can carry their bookmark on top of an index card while it dries.

Ask participants inquiry-based questions while they are completing the activity. For example: **How do you use colors to represent certain ideas or meanings? Can you think of examples of colors that have significant meaning in your culture?**

**Optional Additional Talking Points**

Natural dyes are better for the environment because they don't use toxic chemicals like formaldehyde, chlorine, lead, and mercury. Natural dyes are less toxic to the environment and the people who work with them.

Native American cultures used dye for making patterns and designs with color for many reasons such as to identify different groups of people, indicate a family's status, and portray tribal values. Red, yellow, black and white are four sacred colors to the Cheyenne people, a plains tribe from the Upper Midwest of the United States. To the Cheyenne people, red traditionally symbolized life, yellow the sun's power, black victory, and white dawn.

## WRAP-UP

1 – 2 minutes

Traditional knowledge about natural dyes has been handed down for generations. People share information about how to collect natural materials and create dyes for making particular colors and designs. Archeologists can sometimes learn a lot about past cultures and how they changed over time by studying the colors and designs of objects found in a particular place.

## CLEAN UP

- Clean up any dye spills on the table using the paper towels.
- Put the lids back on the glass jars and wash the paintbrushes in water.
- Save leftover dyes in a refrigerator to extend their shelf life for another demonstration.

## RESOURCES

*Colors from Nature: Growing, Collecting, and Using Natural Dyes*. Bobbi A. McRae. Timber Press, 1993.
A good beginner's guide to dyeing.

*Dyes from American Native Plants: A Practical Guide*. Lynne Richards and Ronald J. Tyrl. Timber Press, 2005.
An excellent guide to North American dye plants and their effects.

Resource and dye plant guide[2] from the USDA Forest Service. Provides a useful "color guide" to Native North American plants.

Database[3] of Native plants and their known uses by Native American communities.

Resource[4] with very detailed information on culturally significant plants.

Listing[5] of regional dyeing organizations and dyeing resources.

[2] http://www.fs.fed.us/wildflowers/ethnobotany/dyes.shtml
[3] http://herb.umd.umich.edu/
[4] http://plants.usda.gov/java/factSheet?cultural=yes
[5] http://www.naturaldyes.org/organizations.htm

## GLOSSARY

| Vocabulary | Definition |
|---|---|
| **Dye** | Substance (natural or synthetic) that changes the color of something.<br>Adjective dye: A dye that requires a mordant to bond the dye to the fabric.<br>Substantive dye: A dye that readily bonds to fabric without the use of added mordants. |
| **Dyebath** | Mixture of water and dye that the object is soaked in. |
| **Fiber** | A thread that forms a material.<br>Synthetic fiber: Manmade fiber.<br>Plant-based fiber: Fiber derived from plant sources, like cotton and linen.<br>Animal-based fiber: Fiber derived from animal sources, like silk and wool. |
| **Mordant** | A fixative, typically a metallic salt solution, which helps to permanently bond the dye to the fiber. |
| **Elder** | A person who has gathered knowledge and wisdom about his or her culture; not all elderly people are elders |
| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

## NEXT GENERATION SCIENCE STANDARDS

**Practices**

- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect
- Energy and matter
- Structure and function
- Stability and change

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | ✓ | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | ✓ | |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | | n/a | n/a | | | | ✓ | |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | ✓ | |

# Native Origins Match Game

| | |
|---|---|
| ***Program Type:*** Classroom, afterschool or community center program | ***Audience Type:*** Grades 6–8, ages 11–14 (emphasis on Native youth) |
| ***Program Length***: 30 Minutes | ***Class Size:*** 1–5 Participants |

**Description:** Participants are challenged to match images of items traditionally used by Indigenous people with images of modern day counterpart items in use today. The activity can be facilitated by an educator or group leader, or self-facilitated by the user. After completing the matching challenge, participants can discuss other examples of Indigenous knowledge.

This activity is ideal for a classroom, after-school program or museum. If done in conjunction with the exhibition, the activity can be set up near and complement the *Native Origins* exhibit component within the *Roots of Wisdom* exhibition.

**Marketing Description:** Did you know many of the foods we eat, medications we take, and products we use were first recognized and used by Indigenous people? Join _____ *(museum name, afterschool program, etc.)* for a hands-on activity that will broaden your perspective on how Native peoples have contributed to the way we live.

**Topics**: Traditional knowledge, history, environmental science, generational learning, botany, horticulture

**Process Skills Focus**: Critical thinking, reading, inquiry, observing, predicting

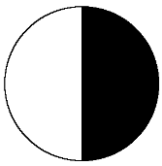
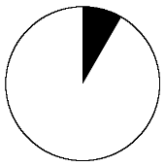
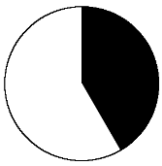
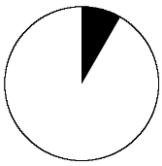
## LEARNING OBJECTIVES

*For Next Generation Science Standards, see end of outline.*

- Many of the common foods we eat, medications we take, and products we use were first recognized and used effectively by Indigenous people.
- Traditional knowledge and Western science are different ways of knowing but have many commonalities.

- Indigenous peoples have been here for thousands of years and are still here today, engaging in both traditional and modern practices.

## TIME REQUIRED

| Advance Prep | Set Up | Activity | Wrap-Up |
|---|---|---|---|
|  |  |  |  |
| **30 minutes** | **5 minutes** | **15-20 minutes** | **5 minutes** |

## PROGRAM FORMAT

| Segment | Format | Time |
|---|---|---|
| Native Origins Match Game | Instructor-led Activity or Individual Activity | 5–20 min |
| Wrap-Up | Individual Activity | 2–5 min |

## SITE REQUIREMENTS

- Space for a table
- A quiet area that will allow for group conversations
- Optional: the activity is ideal to facilitate adjacent to the *Native Origins* exhibit component in the *Roots of Wisdom* exhibition.

## SUPPLIES

| Permanent Supplies | Amount |
|---|---|
| Set of printed matching cards: 18 green cards and 18 blue cards | 1 set |
| 4–6 ft. table for displaying cards | 1 |
| Self-facilitated direction sheet (optional) | 1 |
| 8.5” × 11” sign holder (optional) | 1 |

## ADVANCE PREPARATION

- Print the downloadable file of the cards double sided so that the green cards end up blank on the back and the blue cards end up with text on the back.
- If activity will be self-facilitated, print self-facilitated direction sheet and place it in the sign holder.
- Facilitator should be familiar with the content on the cards and the correct matches before facilitating the activity.
- This program can be enriched by making connections with local Native communities and creating additional cards highlighting objects from the local area and their historical uses among Native communities. A Microsoft Word template document is available for download to create additional match cards.
- It is helpful to review any state or local resources that may be available to assist in delivering culturally competent programs for Native youth (see the Resources section).

## SET UP

- Select just some (e.g., 5–10) of the blue and corresponding green cards to display at a time. Choose which cards to display according to the age group participating in the activity (see “Tips for facilitation” below).
- Spread the blue cards out evenly across the table picture-side up.
- Stack the green cards picture-side up into one pile adjacent to the blue cards.
- If self-facilitated, display the one-page, self-facilitated direction sheet upright on the table.

## NATIVE ORIGINS MATCH GAME

5 – 20 minutes

*Let participants speculate before offering answers to any questions. The answers given in this outline are provided primarily for the instructor's benefit.*

Suggested script is shaded. Important points or questions are in **bold**.

**Introduction**

Hello, my name is _____. Thanks for being here today. Would you like to play a quick game?

**Facilitation**

Here on this table we have a stack of green cards highlighting images of items that were first put into use by Indigenous people of the Americas. Adjacent to the green cards are several blue cards highlighting images of items that have in some way evolved from the items shown on the green cards. Your challenge is to match the items on the green cards with their counterparts on the blue cards. As an example, we can do the first one together. Let's look at the item on this green card and read the text below the picture *(choose whichever card is on top)*.

For example: Here we have a picture of a willow bush. It reads *Native American and other Indigenous cultures used parts of the willow plant for pain relief*. Looking over the blue cards, what do you think could be a match to this description? Think about pain relief as a big clue.

*Participant selects the card highlighting the aspirin pills*.

That seems like a logical choice. Turn the card over and see what it says. The first sentence reads *Aspirin contains acetylsalicylic acid, extracted from willow and other salicylate-rich plants*.

You're correct! By reading the back of each card, you'll know if you select the correct match. You can also know if you are correct by looking for a corresponding number on the back of each card. Now that you have the hang of it, try matching the rest of the cards on your own or with a partner.

**Conclusion**

**Great job! Now that all (or most) of the cards have been matched, can you think of anything not shown on the table that you use or eat that could have originated from Indigenous communities? Examples can be from all around the world, not just the Americas.**

**Even more specifically, can you think of anything that would have originated from tribal communities in our local area?**

Facilitators are encouraged to reach out to their local Native community and learn examples to share with participants.

If this activity is done in a museum with the *Roots of Wisdom* exhibit, present the activity near the *Native Origins* exhibit component and direct visitors there to learn more about this topic after the activity.

**Tips for facilitation:**

- Create an engaging experience by inviting participants to work together to match the cards. Suggest participants take turns reading the definitions.
- Only display a selection of cards. Having all the cards on display at the same time can be overwhelming.
- Use a select number of cards with a difficulty level appropriate for each specific audience (see table below). For example, only use the lower numbered cards when working with younger audiences.

**Easier ……Card Difficulty……Harder**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** |

**SELF-FACILITATED ACTIVITY**

5 – 20 minutes

Participant(s) approach a table displaying the match game and read the directional sign sitting upright in a sign holder on the table.

**Content on Sign** (available at: www.omsi.edu/exhibits/row)**:**

Many of the common foods we eat, medications we take, and products we use were first recognized and used by Indigenous people.

Match the images of items traditionally used by Indigenous people with images of items in use today.

***Directions:***

1. Spread the blue cards out picture-side up.
2. Stack the green cards into one pile picture-side up.
3. Pick up and read the first green card.
4. Look over the blue cards and place the green card next to the card that you think is the correct match.
5. Repeat these steps until all of the green cards have been matched with a blue card.

6. For each match, turn over the blue card and read the description on the back to reveal if the match is correct. Each match will have a corresponding number to confirm the correct answer.
7. Discuss your findings with a neighbor.

## WRAP-UP

2 – 5 minutes

**Can you think of other important contributions discovered by Indigenous communities?**

## OPTIONAL EXTENSIONS

- For longer afterschool or classroom extension, a Microsoft Word template document is available for download for students to create additional match cards on Native origins – ideally from the local region. The file is available for download on the *Roots of Wisdom* website at: www.omsi.edu/exhibits/row.

## RESOURCES

**For learning more about Native origins of the Americas:**
"Do All Indians Live in Tipis?: Questions and Answers from the National Museum of the American Indian" (book)

Links and resources for cultural guides:

Alaska Native Knowledge Network[1]
Guide to Implementing the Alaska Cultural Standards for Educators[2]
Indian Education for All - Montana Office of Public Instruction[3]
Navajo Culture[4]

## GLOSSARY

| Vocabulary | Definition |
|---|---|
| **Elder** | A person who has gathered knowledge and wisdom about his or her culture; not all elderly people are elders |
| **Indigenous/Native** | An individual who has an ancestral claim to a particular environment or region |
| **Traditional knowledge** | Wisdom held by elders that is passed down to younger generations |
| **Ways of knowing** | Information gained by patient observations, life wisdom, and accumulated knowledge |
| **Western science** | A system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us |

[1] http://ankn.uaf.edu/Publications/Knowledge.html
[2] https://education.alaska.gov/standards/pdf/cultural_standards.pdf
[3] http://opi.mt.gov/programs/indianed/IEFA.html
[4] http://serc.carleton.edu/research_education/nativelands/navajo/culture.html

## NEXT GENERATION SCIENCE STANDARDS

**Practices**

- Asking questions and defining problems
- Analyzing and interpreting data
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

- Patterns
- Cause and effect

| | Disciplinary Core Idea | K | 1 | 2 | 3 | 4 | 5 | MS | HS |
|---|---|---|---|---|---|---|---|---|---|
| Physical Science | | | | | | | | | |
| PS1 | Matter and Its Interaction | n/a | n/a | | n/a | n/a | | | |
| PS2 | Motion and Stability: Forces and Interactions | | n/a | n/a | | n/a | | | |
| PS3 | Energy | | n/a | n/a | n/a | | | | |
| PS4 | Waves and Their Applications in Technologies for Information Transfer | n/a | | n/a | n/a | | n/a | | |
| Life Science | | | | | | | | | |
| LS1 | From molecules to organisms: Structures and processes | | | n/a | | | | | |
| LS2 | Ecosystems: Interactions, Energy, and Dynamics | n/a | n/a | | | n/a | | | |
| LS3 | Heredity: Inheritance and Variation of Traits | n/a | | n/a | | n/a | n/a | | |
| LS4 | Biological Evolution: Unity and Diversity | n/a | n/a | | | n/a | n/a | | |
| Earth & Space Science | | | | | | | | | |
| ESS1 | Earth's Place in the Universe | n/a | | | n/a | | | | |
| ESS2 | Earth's Systems | | n/a | | | | | | |
| ESS3 | Earth and Human Activity | ✓ | n/a | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Engineering, Technology, and Applications of Science | | | | | | | | | |
| ETS1 | Engineering Design | | | | | | | | |

Roots of Wisdom
Native Knowledge. Shared Science

# *Native Origins*
## Match Game

Many of the common foods we eat, medications we take, and products we use were first recognized and used by indigenous people.

Match items traditionally used by indigenous people with images of items in use today.

***Directions:***

1. Spread the blue cards out picture-side up.

2. Stack the green cards into one pile picture side-up.

3. Pick-up and read the first green card.

4. Look over the blue cards and place the green card next to the card you think is the correct match.

5. Repeat these steps until all green cards have been matched with a blue card.

6. Turn over the blue cards and read the descriptions on the back to reveal if the matches are correct. Each match will have a corresponding number to confirm the correct choice.

7. Discuss your findings with a neighbor.

**Can you think of other important contributions discovered by indigenous communities?**

Eastern Woodland Indians living in the northeastern United States were the first known people to have used the sap of maple trees.

1

Maple syrup is made from the xylem sap of maple trees and is now a common food all around the country.

Native Americans from many regions chewed the sap from trees to freshen their breath, promote dental health, and address a variety of other health issues.

2

The sap of the sapodilla tree, known as chicle, was chewed by native peoples in Central America. It was used as the base for the first mass-produced chewing gum and is still used by some manufacturers today.

Inuits, indigenous peoples of the Arctic, carved goggles out of wood, bone, or shell to protect their eyes from the blinding reflection of the sun on the snow.

3

Goggles made from wood, bone, or shell were a precursor to modern sunglasses and snow goggles, which protect the eyes from ultraviolet rays.

Aztecs and Mayans living in Mesoamerica harvested sap from what we call the “rubber tree” and made an important contribution to team sports.

4

The Olmec, Maya, and Aztec peoples of Mesoamerica used the sap from certain trees to make rubber balls. The Maya still make them today! These balls are considered a precursor to the bouncing ball used in modern games.

Native peoples in Mesoamerica developed a method of cooking ground corn with alkaline substances. This method produces a chemical reaction that releases niacin. Niacin softens the corn, increases its protein content, and prevents against a skin disease called pellagra.



This alkali treatment process (called “nixtamalization”) is used in the production of several foods that are eaten across the Americas, such as grits, corn tortillas, and tamales.

A wide variety of grain plants were domesticated by indigenous peoples across the world over thousands of years.

6

Cereal is a food made from processed grains such as barley that Americans often eat as the first meal of the day. A wide variety of grain plants were domesticated by indigenous peoples across the world over thousands of years.

Native Mesoamericans were the first to cultivate the vanilla plant and perfected the complex curing, heating, and drying process that brings out the plant's flavor.



Not only is vanillin (the compound that creates the flavor and smell of vanilla) a popular flavoring for sweet foods, it is also commonly used in the manufacture of perfume.

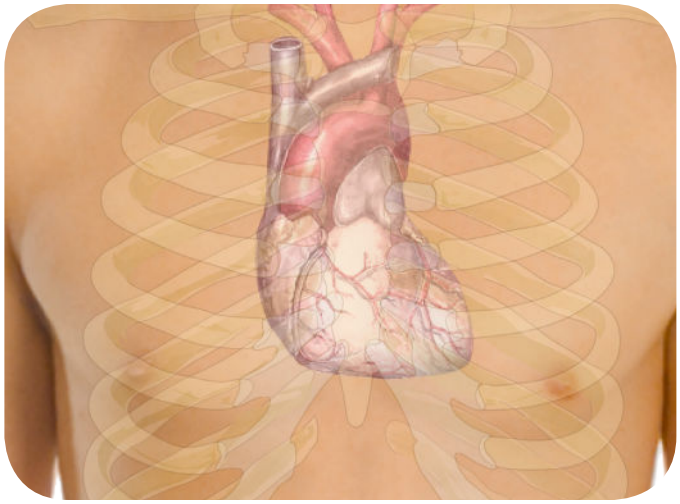
Native Americans and other indigenous cultures throughout the northern hemisphere used parts of the willow plant for pain relief.

8

Aspirin contains acetylsalicylic acid extracted from willow and other salicylate-rich plants. Although Aspirin has only been manufactured since 1897, the medical use of this main ingredient has been used for thousands of years.

Native peoples in northeastern North America carefully administered small doses from the toxic foxglove plant to treat heart problems.

9



Today, chemicals from the foxglove plant are used to treat a variety of heart problems, including heart rate regulation.

To create a long-lasting source of food, the Inca people (and today, their direct descendants) would freeze potatoes overnight, walk on them to squeeze out the moisture, and then allow them to dry.



Freeze-drying removes water from food and makes it last longer by slowing down decomposition. Many of the foods that astronauts take into space are freeze-dried so they can last a long time and rehydrate quickly.

This crop is native to the Andes Mountains of Bolivia, Chile, and Peru. It is a high-energy grain that has been eaten for over 5,000 years.



Quinoa has been an important food in indigenous cultures for thousands of years. The Inca thought the crop was sacred and referred to it as “the mother of all grains.”

This grain is composed of tall grasses that grow in marshes or open water. Its dark-colored seeds have been traditionally gathered for food by indigenous peoples of the northern United States and Canada.

12

Native Americans traditionally harvest wild rice by canoeing into the plants, bending stalks over a canoe with wooden sticks, and knocking off rice kernels into the canoe.

The cultivated peanut was eaten over 4,000 years ago by the people of the Ñanchoc Valley in Peru. It is now grown throughout warm regions of the world.



Peanut oil can now be used to power biodiesel motors. It is also commonly used to fry foods.

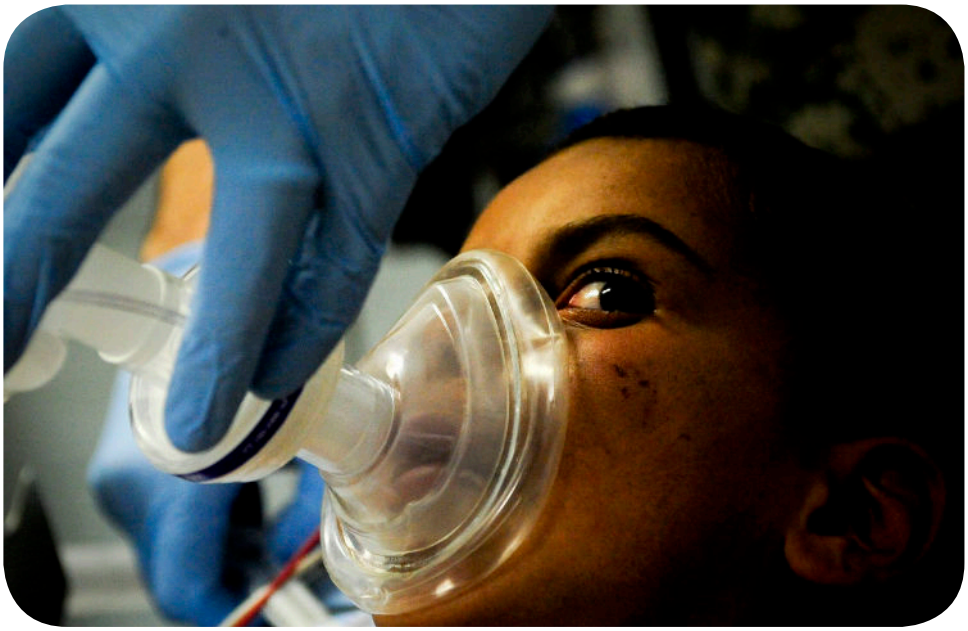
Beans are one of the oldest cultivated plants in human history. Native peoples across the Americas grew beans for food and in combination with other plants (often squash and corn) to promote soil fertility.



A variety of beans native to North America are now used around the world as cover crops– plants that are used to naturally increase nutrients in soils for food production.

The Yagua, indigenous to the Amazon, painted a poison gum (derived from vines) on the tips of their arrows and darts. This poison produced a paralytic effect.

15



The poison, known as curare, was found to be an effective muscle relaxant and numbing agent when used in small doses. Today, more stable, synthesized drugs are more commonly used.

The Menominee people, native to Wisconsin, used the leaves, bark, or twigs of the witch hazel plant to treat skin conditions, soothe muscles, and treat coughs and colds.



Witch hazel extract can be used to constrict body tissues. It is a common ingredient in products used to treat skin irritations like bites, burns, and inflammation.

Native peoples in the Andes region of South America were the first to cultivate the potato plant, which became an essential crop in many parts of the world.



Potato starch is valued for its binding qualities. Scientists working in the bioplastics industry have created biodegradable trash bags, food packaging, and even golf tees using potato starch.

The Quechua people, native to South America, used the bark of the cinchona tree to create a medicinal drink.



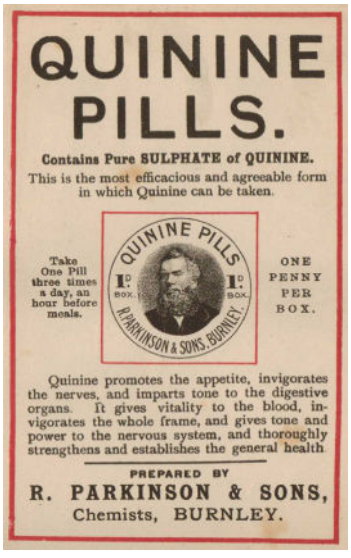



photo by ParkinsonsLtdBurnley

Quinine, a chemical compound derived from the bark of the cinchona tree, was used as early as the 1600s to combat malaria and is still considered an effective treatment for malaria today.

Place text here.

#

Place text here….