CALIFORNIA INDIAN MUSEUM & CULTURAL CENTER

Weaving Native Culture into the Future

Native Maker Program Lesson Plan

Redwood Bark House

The CIMCC Native Makers Program was funded by a grant from the Institute of Museum and Library Services and The San Manuel Band of Mission Indians.

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Native Maker Program Lesson Plan

Summary: This activity in geometry and environmentalism concerning California tribal structures.

Goal: Students will learn about the diversity of housing among California tribes and the traditional and ecological knowledge used by tribes in designing these structures. Students will use geometric and ecological lessons to create a model of a redwood bark house.

Material:

Ruler
Scissors
Tape
Pictures of Redwood Bark Houses

Redwood Bark House

Redwood bark houses, also known as kotchas, were made by the Coastal Miwok and used by the Yurok in various ways. California Indians oriented, or positioned, their traditional houses in relation to the sun. They understood the sun's movement through a day and a year — its cyclical, seasonal passages across the sky. They made its constancy and energy work for them. Houses were placed to admit the welcome warmth of the low winter sun as well as to block chill winds. In summer, orientation was reversed, limiting exposure to hot afternoon sun and admitting fresh air. The Sierra Miwok sited bark slab houses on sunlit leeward slopes, above cold ravines but below windswept ridges. In the mountains, the eastern side of the cone for both the Maidu and the Miwok houses is angled sharply to prevent snow accumulation. The placement of buildings in relation to the sun, wind, and landscape affects daily and seasonal heat gain and loss. A house that is properly oriented and insulated can be heated or cooled by natural, sustainable means. Orientation is common sense. It's a lesson as old as the sun and coyote, but as new and as certain as tomorrow's sunrise. Conical bark slab houses were built by California's coastal and mountain tribes. In cold, damp or foggy areas, large slabs of redwood and cedar (or other conifers) were arranged on end in a conical shape. The thick, bark slabs were either freestanding or supported by a cone-shaped sapling frame. Earth was banked against the base. The Miwok referred to their conical bark houses as kotea, "a place where real people live." **Adapted from Universal House**

Cultural Information

In the northern redwood region, some of the Native American peoples and cultures were very similar to the people of Alaska's southern coastal areas, living mainly along salmon streams and obtaining much of their food by fishing. Evidence of this derivation is found in their languages, culture, boat building techniques, and plank houses. Other groups apparently came to the north coast from the south and from the central valley. In the southern redwood region, the Native Americans obtained more food by hunting and gathering than by fishing. At least 15 different tribal groups inhabited the redwood region

when the Europeans arrived in the 1700s. Native Americans in each area adapted to their local environments, utilizing the natural resources, including the redwoods, in a variety of ways.

The major groups in the northern part of the redwood region were the Tolowa, the Wiyot, and the Yurok. The Tolowa lived in northern Del Norte County in the Smith River area, while the Yurok inhabited an area from Wilson Creek in Del Norte County to Little River south of Trinidad Head in Humboldt County. They lived in over 70 villages ranging in size from one family to fifty people. The Wiyot lived along the coast from Little River south to the False Cape/Bear River Ridge just north of Bear River. Tolowa and Yurok houses and other buildings such as sweathouses and assembly halls were made mostly of redwood planks. While somewhat different in design, Tolowa and Yurok buildings had much in common. The planks were typically made from trees that had fallen in the forest and from driftwood. The trees were split into planks using wedges made from elk antlers that were pounded with stone mauls, and shaped with mussel shell adzes. The boards might be several inches thick and 1 to 4 feet wide. These rectangular buildings might be up to 50 feet on a side, but were generally smaller. To conserve heat, and to protect against animal or human intruders, access was through a round opening, barely large enough for a person to crawl through, cut into a plank. Redwood's resistance to decay helped these buildings last more than a hundred years. While most of the redwood used by the Native Americans came from fallen trees, they apparently did occasionally use fire to cut trees down. Hot stones and fire were used to char and burn a "cut" in one side of the tree. The charred wood was scraped away and the process repeated. When one side was partly burned through, another "cut" was made higher up on the opposite side. Fortunately for early users, much of the old-growth wood was knot-free, which made it easier to split. This facilitated the making of planks from the abundant old-growth trees and logs.

The territory of the Northern Pomo extended from just north of Fort Bragg to near the mouth of the Navarro River, while the Central Pomo territory began there and extended south to the mouth of the Gualala River in southern Mendocino County. The territory of the Kashaya (another group of Pomo speakers) stretched from the mouth of the Gualala River to Duncans Landing. Members of these groups sometimes built cone-shaped houses of bark by leaning large slabs of redwood bark against a central support pole. Layers of bark were laid on top of each other, shingle-like, until the only openings were a smoke hole at the top and a small "door." They also used redwood planks to build structures similar to those of the Yurok and Tolowa, sometimes adding bark to the planks as additional weather proofing and insulation. Like most other Native American groups of the redwood region, the Pomo generally didn't live in the redwood forest itself. Rather, they lived along the coasts, rivers, and mixed oak/grassland. The Pomo did enter the redwood forests in search of plants such as ferns, establishing seasonal camps that they might use for a few weeks each year.

The Coast Miwok inhabited the area that is now Marin County, around Tomales Bay and Point Reyes, but also ranged north to Duncan's Point. Groups of Miwok speaking various dialects, lived in the central valley and the Sierra, including Yosemite. From the Golden Gate south to the Sur River in Monterey County, the Ohlone (or Costanoans) were the predominant group, and they, like the northern groups,

sometimes built winter shelters with slabs of redwood bark. In the milder areas such as Monterey County, the Costanoans slept in the open much of the year, using shelters of sticks and brush in the winter. Tule reeds were used for building shelters and making canoes.

Even as the gold fields played out, demand for redwood continued to increase. Examiners provided a labor force that turned to harvesting, milling, and shipping redwood throughout California and around the world. Most of the redwood forests were soon owned by private individuals and timber companies. Redwood became a major building material throughout California. Continued development of logging and milling technologies made it easier and more profitable to produce redwood products ranging from siding and framing timber, to decks and water towers, to shingles and grape stakes. Since the gold rush brought in a population explosion in the San Francisco Bay area, the logging of the coast redwoods first became a major industry in the central region from Sonoma County to Monterey County. The first sawmills were built around the San Francisco Bay. The town of Redwood City developed as a shipping center for redwood in the 1850s, and Woodside and other towns in San Mateo County were founded by the logging industry.

When the redwood logging industry developed in the 1850s, north coast Native Americans often used boards that were discarded by sawmills and boards that washed ashore from shipwrecked lumber schooners. Some very large trees were cut in Sonoma County, especially along the Russian River.

Trees that grow slowly produce closely spaced rings. Most of the redwood used in the historical buildings was from "old-growth" forests, which were very shady, resulting in closely spaced rings. Old-growth trees growing in an opening, however, may have produced widely spaced rings. Trees may also grow slowly for a while, then more rapidly if the forest canopy opens, then slow down again when the canopy closes up again. Most redwood harvested today is from young growth forests, which are generally more open, resulting in more rapid growth and more widely-spaced rings. **Adapted from Redwood Ed Guide**

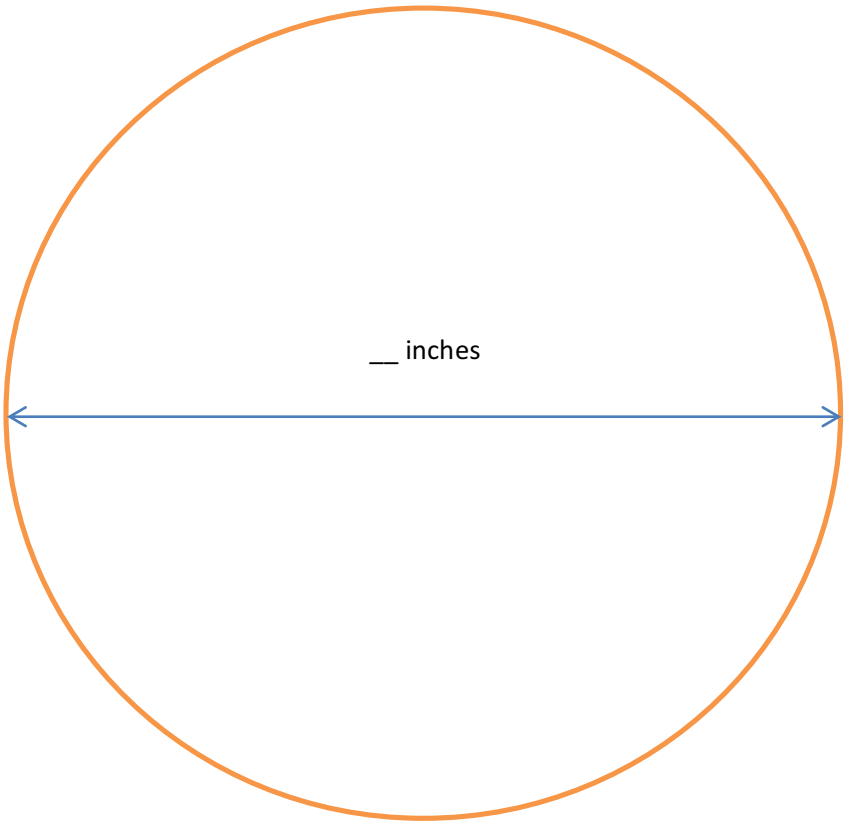
Overview:

- Brief history of traditional California Indian housing structures
- Cultural information of Redwood Bark House
- View pictures of Redwood Bark House
- Distribute material to make a Redwood Bark House
- Describe the process by doing a demonstration
- Find the circumference
- Find the area and surface area
- Find the volume
- Create model
- Showcase model

Lesson 1 – Circumference

The circumference of a circle (C) = π x diameter (d)

C = πd



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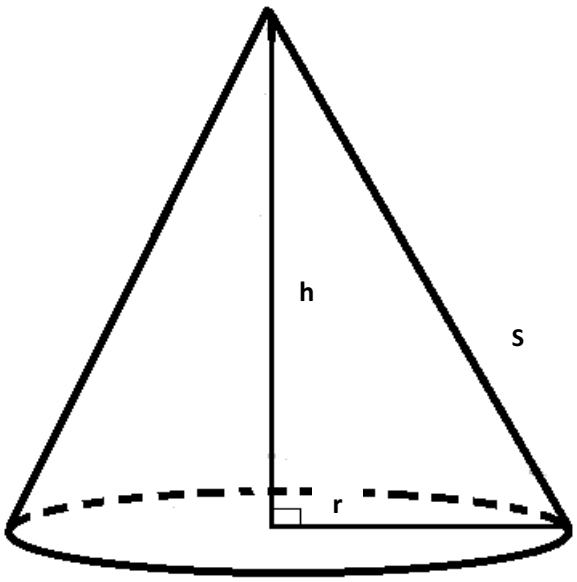
Lesson 2 – Area

Area of the cone πrs

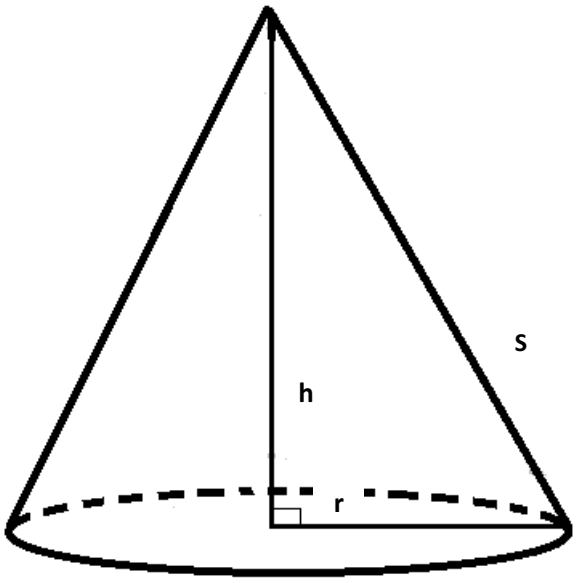
Area of the base πr^2



Lesson 3 – Surface Area

Surface Area

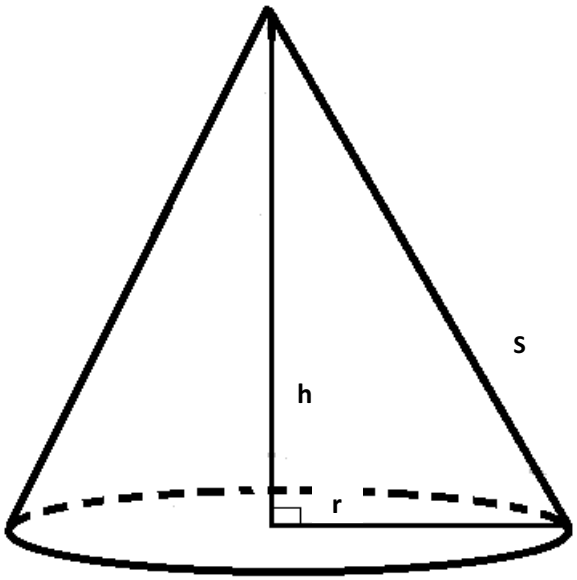
SA = πrs +π r^2



Lesson 4 Volume

Volume

$$V = \frac{1}{3}\pi r^2 h$$



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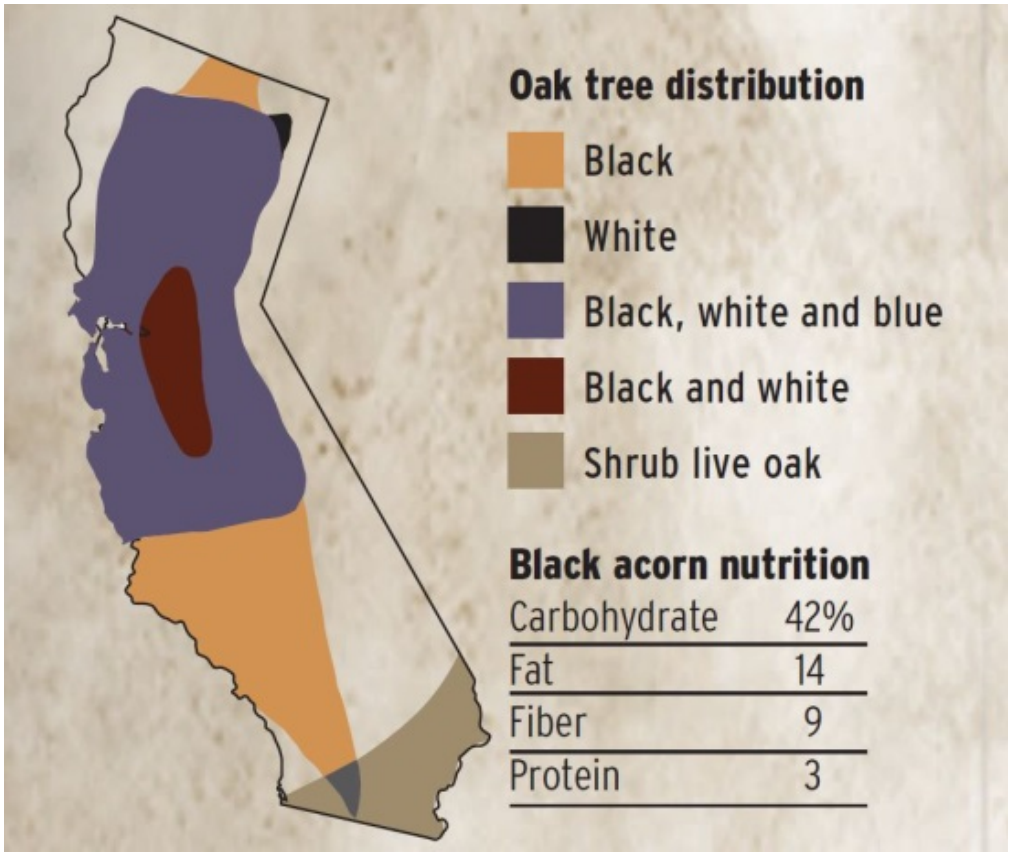
Resources:

Exploring a Prehistoric Pit House: https://www.youtube.com/watch?v=MkdQ3g8df18
How to Build a Wigwam: https://www.youtube.com/watch?v=NXICbL2l33I
Kara English: https://www.youtube.com/watch?v=jnP_y8q4zws

Universal House: http://www.energyquest.ca.gov/teachers_resources/documents/180-99-001_UNIVERSAL_HOUSE.PDF
Redwood Ed Guide: https://www.parks.ca.gov/pages/735/files/03seciihumanhistorych1to3.pdf
Save the Redwoods - Date a Tree: http://www.savetheredwoods.org/wp-content/uploads/activity_date.pdf

Native Maker Program Lesson Plan

Acorn



Coronilla, S., (2013) *California Indians Food*. Orange County Register.

The CIMCC Native Makers Program was funded by a grant from the Institute of Museum and Library Services and The San Manuel Band of Mission Indians.

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Native Maker Program Lesson Plan

Summary:
Acorn is an important part of the diet of California Indian Tribes. Students will learn about the importance of Native diets to familiarize oneself with the traditional and contemporary way of acorn process.

Goal:

Material:

Acorn

Acorn

There are in the United States more than 50 species of oaks, of which 30 occur in the Eastern States and about 15 in the single State of California. Acorn flour makes a rich glutinous food and contains a surprisingly large quantity (18 to 25 percent) of nut oil of obvious nutritive value. (Merriam, H. C., (1918) *The Acorn, A Possibly Neglected Source of Food*.)

Acorns are also highly nutritious, and flours made from them, like other nut flours, are gluten free. A pound of shelled acorns yields 1,265 calories, and the nuts are high in carbohydrates, fat, vitamin B6, magnesium, potassium and calcium. (Edible Monterey Bay, (2015) *Roadside Diaries: Acorns*.)

Diet has changed dramatically for American Indians. Colonized diet is known to be a contributing risk factor to diabetes, obesity and CVD. Current foods eaten by American Indians contain more fat, sugar, preservatives, and artificial ingredients than the traditional foods. Eating a regular diet of native and natural foods will help American Indians prevent and control many of today's chronic diseases. (Kennedy, S., (2005) *California Food Guide: Health and Dietary Issues Affecting American Indians*.)

Cultural Information

For thousands of years, acorns were life for the majority of California Indian peoples. As a staple food source, acorns figured prominently in the diets and daily lives of individuals for countless generations.

A few hundred years later, despite catastrophic demographic collapse, removal from ancestral lands, and vast environmental change, California Indian peoples continue to consider acorn use important in sustaining their cultural identities.

In pre-contact times, acorns were eminently suitable as a food resource because of their availability, productivity, storability, and nutritional content. Anthropologist Alfred Kroeber estimated that more than 75 percent of native Californians relied on acorns for food on a daily basis. In all, 18 species of oak,

including shrubs and trees, are distributed throughout the state of California. Indian people probably had little trouble accessing oaks except in some areas of the Central Valley as oaks grow principally in riparian zones, alpine environments, and desert areas. With the exception of the Tanbark Oak (Lithocarpus densiflora), all of the oaks belong to the genus Quercus, meaning "fine tree" in Latin.

The nutritional value of acorns is high, and depending on the species, acorns can contain up to 18 percent fat, 6 percent protein, and 68 percent carbohydrate, with the remainder being water, minerals, and fiber. Modern varieties of corn and wheat, in comparison, have about 2 percent fat, 10 percent protein, and 75 percent carbohydrate. Acorns are also good sources of vitamins A and C and many essential amino acids.

The changes in native peoples' use of acorn and of their cultures in general must be viewed in the context of Euroamerican contact, and colonization.

The initial version, Senate Bill 54, was authored by John Bidwell, who was a member of the first group of emigrants to arrive in California over land in 1841. Bidwell's bill permitted Indians to continue their traditional practices or "usual avocations" of "hunting, fishing, gathering seeds and acorns for the maintenance [sic] themselves and families." It also stated that "in no case shall [I]ndians be forced to abandon their village sites where they have lived from time immemorial." The protection of California Indians' traditional practice of gathering acorns, and explicit recognition of their ancestral lands were never included in the final version of the law passed by the Legislature on April 22, 1850.α

A year later, in April 1851, three commissioners sent to California by President Millard Fillmore commenced negotiating 18 treaties with California Indian nations and tribes. The Indians who signed the second treaty, the Treaty of Camp Barbour (dated April 29, 1851), successfully negotiated recognition of their right to continue to hunt and gather acorns.

Although the acorn is no longer the focus of daily life, Indian people still prepare and eat acorn foods at special gatherings, Big Times, and other celebrations. Many autumn festivals are centered around the first acorn harvest, to this day, and many acorn foods are prepared and celebrated**. Adapted from Anthropology Museum, California State University, Sacramento, (2005)** ***Past and Present Acorn Use in Native California: eGuide for Acorn Use in Native California, a Mobile Classroom Outreach Trunk***

Overview:

- Brief history of Acorn
- Cultural information of Acorn
- View pictures of Acorn
- Distribute material for Acorn
- Describe the process by doing a demonstration
- Conduct activity
- Discuss end product

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Lesson 1 – The Importance of Native Diets

Nutritionists believe than a man needs about 3,600 or more calories per day to maintain his weight and his health. 4, 000 calories if he is doing hard physical work. Women and children need somewhat fewer calories per day than men, but women who are pregnant or nursing a child need more.

The missionaries did not allow neophytes to eat their traditional foods in the missions such as the grasses and other plants they cultivated, acorn, and game although this type of food is highly nutritional and was at first still readily available (before overgrazing by mission herds had taken toll). Instead the neophytes were restricted to a diet based on foods raised at the missions, such as wheat and corn. Researchers have determined that the diets in the missions contained only about 2,600 calories day or less, yet Indians were forced to labor hard, burning up calories even quicker. What do you think happened to the people who had to live on this kind of diet?

Some of these are:

It can cause people to be more susceptible to disease
It can cause disease itself due to vitamin deficiencies
It can kill through starvation
It can cause birth defects in unborn babies

Comparisons of Acorns to Mission Foods and Contemporary Foods

(1 ounce = 28.3495 grams)

	Protein	Fat	Fiber	Carbohydrates
Acorns (leached) (1 oz)	1.3 g.	5.6 g.	.60g	21.1 g
Corn Meal (1 oz)	2.6 g.	0.5 g.	.30 g	21.1 g
Wheat Flour (1 oz)	3.2 g.	0.3 g.	.06 g	21.4 g
Beans (cooked) (1/4 cup)	3.7 g.	0.2 g.	5.00 g	9.9 g
Cheese Pizza (1/8 slice of 14 inch pie)	7.0 g.	12.0 g.	1.00 g	31.0 g
Macaroni & Cheese (1/4 cup)	4.3 g.	6.0 g.	0.24g	10.3 g
Peanut Butter (smooth) (2 Tbs.	8.0 g.	16.2 g.	2.50 g	2.6 g

Source: Indians of Northwest California

Compare the nutritional value of acorns, a traditional staple food of California Indian people and the typical mission foods of wheat and corn. Are acorns comparable to the mission foods?

Compare the nutritional value of acorns to foods that we often eat today. Are there differences?

One ounce of acorns contains 21.1 grams of carbohydrates. How many more carbohydrates does one ounce of wheat flour contain?

We know that fiber is important for a healthy body. Which food on the chart contains the most fiber? Which contains the least amount of fiber?

How many more grams of fiber do acorns contain than cornmeal?

What is the difference in grams of protein between acorns and corn meal?

Add up all the grams of fat for all foods listed. What is the total amount of fat?

Fats gives us energy and help to keep is healthy, although we know that too much fat is not good for us. List three foods on the chart that have the most fat.

List three foods on the chart that have the least amount of fat.

Find the four foods that have the highest amount of carbohydrates. Add them together and give your total.

What is the difference in grams between the food with the most carbohydrates and the food with the least carbohydrates?

If you ate a meal of one cup of beans and two ounces of corn meal (in a slice of cornbread) how many total carbohydrates would you consume? Show your work. **Adapted from Indians of Northwest California**

Resources:

Little Acorn: https://www.youtube.com/watch?v=Eq7drk3wHuc
Bread from Acorn: https://www.youtube.com/watch?v=Rj7mgJUsQNA
Acorns: https://www.youtube.com/watch?v=OFwNomKqAbc

Identity Acorns http://californiaoaks.org/wp-content/uploads/2016/04/investigating_the_oak_community.pdf
Acorn preparation
http://www.lessonsofourland.org/sites/default/files/CA%20food%20teaching_kit.pdf
http://www.lessonsofourland.org/sites/default/files/ILTF%20acorn%20pp.pdf

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Native Maker Program Lesson Plan

Basket Bots

The CIMCC Native Makers Program was funded by a grant from the Institute of Museum and Library Services and The San Manuel Band of Mission Indians.

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Native Maker Program Lesson Plan

Summary:

Basketry in California is a cultural tradition passed from generation to generation. Students will learn the cultural significance and use of baskets, and techniques to create a basket bot.

Goal:

Material:

Cultural Information

Pomo basketweavers have continually stressed that an essential part of learning the art of basketry is learning the art of root collection. Root digging is often a family affair, with men, women, children, and old people participating. Many times' they'd make a big trip of it, camp a week at a good spot,' with everyone collecting and the men doing the 'heavy work.' In the early days, a fire-hardened, singlepointed, hardwood digging stick was used to loosen the soil and expose the roots.

Five interrelated qualities are recognized by basketmakers in assessing sedge roots: length, color, straightness, strength, and pliability. The importance of these qualities varies according to the intended use of the basket, which in turn determines the basketry technique required. (Peri, David and Scott Patterson (1976) *The Basket is In the Roots, That's Where it Begins*.)

Pomo people have been making baskets for at least 1000 years. They are considered to be one of the most artistic basket makers in the world, and their baskets can be found in many museums. Pomo baskets are made for the purpose of storing, preparing and serving food, and to carry out daily tasks. However, the Pomo also created more artistic baskets for ceremonies or as gifts, such as when a Pomo bride gives baskets to the husband's family as part of a marriage agreement. These wedding and ceremonial baskets are typically beautifully decorated with feathers, shells and beads. The Pomo used a variety of plant materials for making baskets, such as willow, sedge (Carex), the bark of redbud (Cercis), the root of bulrush (Scirpus), and the root of the digger pine, but mostly sedge was used. Before the harvest, ritual prayers and offerings are made, as the natural material is considered alive and has to be treated with respect. Pomo baskets come in all sizes and shapes and exhibit a variety of patterns which are mostly asymmetrical and discontinuous. The Pomo are one of the few groups where men and women weave baskets; however, it is the women who make the fine baskets, and the men who weave fish traps, baby carriers, burden and storage baskets. (Fassbender, Johanna, (2006) Pardee Home.)
Adapted from Pardee Home and The Autry

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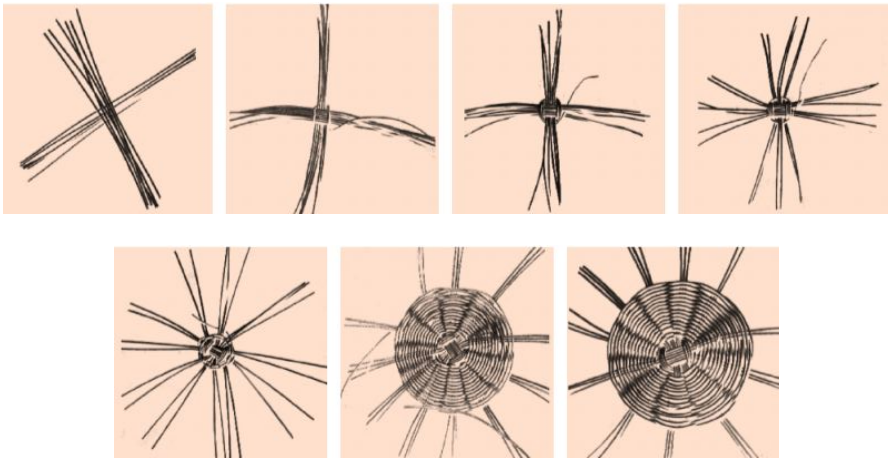
Overview:

- Brief history of basketry
- Cultural information of basketry
- View pictures of basketry
- Layout material to make a basket bot
- Describe the process by doing a demonstration
- Create basket bot
- Discuss shapes, designs used



Resources:

Pomo & Miwok Round Reed Basket Kit: https://www.youtube.com/watch?v=4jPE47S0NaM
Julia and Lucy Parker in Yosemite National Park California:
https://www.youtube.com/watch?v=vWYDNapbxXw
Alice Elliot: https://www.youtube.com/watch?v=jFMPIaMNfb4

Make a Round Reed Basket:
https://theautry.org/sites/default/files/documents/education/california_indian_basketry.pdf
Basketry:
http://www.pardeehome.org/Basketry_module.pdf

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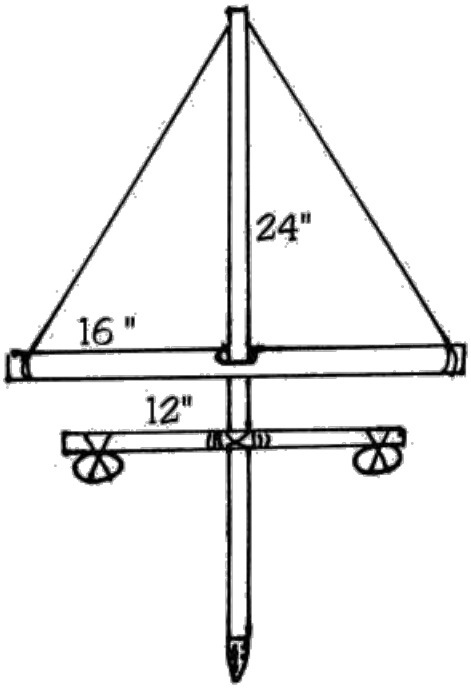
Native Maker Program Lesson Plan

Pump Drill



Wooden Pump Drill - The pump drill is a wooden tool that drills little holes/circles into a certain item. Native people have used the pump drill for centuries to start fires and drill holes. This tool was ideal for making holes in bone, wood or shells and for making beads.

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Summary:

Introduce California Indian shell money currency and pump drill tool used throughout California and beyond.

Goal:

Material:

Cultural Information:

Prior to the European migration into California, the Native Americans used sharply pointed stones (chert or quartzite) as drills. These stones were secured with sinew to a stick. This tool, when rotated between the palms, would slowly drill a hole in a shell or produce the spark needed for fire. Later, when the Mexicans moved in to this area, they brought the pump drill. It was made of wood and hide thongs with a metal drill. The Native Americans soon adopted the metal bit. The stick with the bit attached twirls around when the upright cross-stick is pumped up and down. Native American tools came from the local natural surroundings or were acquired in trade with other nearby tribes. A common unit of exchange in the Bay Area, was made from olivella or shell disks that had been carved, polished, and strung on fine string. This money was used like our paper money is today, and it was often used in trade. With strings of money the early California Native Americans could buy items from all over the western geographic area that were unavailable in their locale. **Adapted from Early California Indians: An Environmental Focus**

Ohlone people first used the hand drill with a stone point. After contact with the Spanish, they used the pump drill with a metal point. The pump drill was more effective since it was faster and easier to use. One way Ohlone people used these drills was to create holes in shells used in making jewelry, for example, an abalone shell necklace. **Adapted from Santa Clara County Parks & Recreation Chitactac-Adams Heritage County Park Teaching and Activity Guide**

Overview:

- Brief history of shell money and pump drill
- Cultural information of shell money and pump drill
- View pictures of shell money and pump drill
- Distribute material to make jewelry/pump drill
- Describe the process by doing a demonstration
- Create accessory/pump drill
- Share what students created

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Lesson 1- Operation of Pump Drill:

Slide pump handle down the shaft and insert leather string into the groove at the top of the shaft. Wind the leather string around the shaft by turning it. Placing your fingers on pump handle exert downward pressure. The string should rewind with each stroke. If not, apply less downward pressure. (Northeast Georgia History Center Native American Travel Trunk)

A pump drill is made of three parts: a drill shaft on which a string may twist and which is tipped with the drill bit; a fly wheel which provides momentum after each downward thrust; and a bow and string which change vertical action to rotary action.

The Drill Shaft

A slim, round shaft of well-seasoned hardwood 18-24 inches long is needed for a drill shaft. A peeled sapling or shoot can be used, or it can be whittled from a large stick. Three-eighths inch diameter at the top is good to taper to 1/2 - 3/4 inch at the bottom. A narrow shaft gives more rotations to each "pump". Too narrow a shaft may bend or wobble with each stroke. The upper end can be drilled to receive a bow string so it will stay in place well; a notch makes the apparatus easier to disassemble without untying the bow each time. When you have completed a nicely tapered shaft, smooth it with sandpaper or rub it on sandstone for a nice finish. Check it for straightness by sighting along its length. Rolling it on a flat surface will also show bends. Warm the warped area over heat and bend it true with your hands. If you hold it until cool, it should retain this adjustment. The bottom of the shaft must have a bit attached to it which can cut in either rotation. If you are in a hurry, some hardware stores carry drill bits for a modern "Yankee" pump screwdriver, if you use a "Yankee" bit, you'll have to grind some flats on that part which will be inserted into the shaft to keep it from rotating in the shaft instead of the work. The little notches which are intended for the screwdriver tool just aren't enough. By the way, don't bother with regular twist drill bits which cut only in a clockwise rotation. Stone points can be re-flaked right on the drill shaft to re-sharpen them until not enough material remains for a good point. The same is true for a steel point. In this context, remember that primitive drills seldom were intended to bore deeper than an inch and holes often were drilled from opposite sides to meet in the middle of the work. Mechanically precise diameters were not important. Also remember that these holes were usually conical, not cylindrical.

The Drill Bow

The bow needs no flexibility. It can be made of any wood or even a long piece of bone. It can be quite short, less than 8 inches, or as large as 2 or 3 feet. A convenient rule-of-thumb might be to make the bow half the length of the drill shaft. Although a simple round stick can be used bow and-arrow fashion at the side of the shaft, a flat bow, about 1/2 by 1 inch in section, is better and can be drilled in the center with a hole larger than the drill shaft above the flywheel. Thus, the shaft is pushed up through the bow's hole so that the bow cannot slip off during use. The ends of the bow can be notched or drilled to receive the bow string. You'll not want to make this attachment permanent, because you'll probably need to make adjustments in tension from time to time. A good craftsman will want to put a nice finish on the bow, but a nice finish does not add to its function. Any cord can be used for a bow string. Original

pump drills used a buck skin thong. If you use buckskin, cut it as even as possible. If you use a cord, get a strong, thin one which is limp so that it will wind smoothly around the shaft. Tie one end of the bowstring on the bow, insert the shaft (with the flywheel in place) through the bow's hole, and put the string through the hole or notch at the top of the shaft. The attachment of the string through the top of the shaft should not be permanent to allow for adjustments later. Tie the free end of the string to the other end of the bow so that the bow can be suspended from the shaft about 2-3 inches above the flywheel. The closer it is, the longer each pump-stroke can be, but, if it's too close, you will find it difficult to operate the drill as your fingers get in the way of the flywheel. Adjust the string in the shaft top so that the bow is in a horizontal position. Slide the bow up and down a few times to see that the shaft can twirl in the hole freely.

The Flywheel

Flywheels are made of stone, ceramic, or wood. The weight of stone is preferred, but the process of manufacture is more involved and is not worth the time unless you intend to put the drill to much use. Any type of stone can be used. Try to find a beach pebble which is already worn to a flat, circular, disc-shape. Peck or grind this to a true circle as much as possible. A stone 3-5 inches in diameter and less than an inch thick should give plenty of momentum for your drill. Clay is easy to shape but will need to be fired before use. A tree branch or small log can be sawed crosswise to produce a flat disc. A disc about 3/4 inch thick and 4-6 inches in diameter needs little refining to make a good wheel. With cross-cut wood such as this, you may have some problems with cracks as the wood dries. These cracks will not diminish its function unless the wood cracks in half. In general, the size of the flywheel is dependent upon the size of the drill and the weight of the material used. Shape the flywheel by whatever means is appropriate to the material you have selected to make it nearly perfect in shape and thickness. Drill a hole in its center large enough to receive the shaft. The flywheel should slip down the shaft to a point close to the bit end — a few inches from the tip. This is necessary to give a bottom heavy weight to the shaft to keep it rotating without wobbling. Enlarge the hole or narrow the shaft accordingly. In any case, the fly wheel should be seated snugly so that the wheel and shaft rotate together. Twirl the shaft and wheel in your hands to see if any adjustment can be made on the flywheel to make it as balanced as possible. A wood wheel can be trimmed, and a stone one can be pecked a little more on the heavier portion to run more balanced. A wheel a little out of balance will run well, but not perfectly well. As much as possible, see that the hole in the wheel and the section of the shaft oval are squared with a shoulder on the shaft below to keep the wheel from slipping too far down. In this way, the flywheel can be changed easily from one shaft to another with little worry about it rotating itself. **Adapted by the Northeast Georgia History Center Native American Travel Trunk**

Lesson 2 - Ask students to identify which of the shellfish were used traditionally:

- Mussel – food source/the shell is used as a woman's eating spoon
- Clam – food source, small clam shells were used for regalia
- Olivella – regalia (necklaces and ceremonial dresses)

- Abalone – food source and regalia (necklaces, ceremonial dresses, quivers)
- Dentalium – money and regalia (necklaces)
  Shell Money - Abolone, Blue, Glass, Red Beads, Callus Shells, Clamshell Beads, Dentalium Shells, Haliotis Shells, Magnesite Beads, Olivella Shells, Venus Shells, White Beads.

  Show students pictures of the regalia items and help them identify the different kinds of exoskeletons that are being used. **Adapted from Lessons of Our Land**

  Pump Drill Project

  I. Project Ideas

  Project 1: Using Different Sizes of Pump Drill on Different Materials

  Background: I think you could still make this a project by using different sizes of pump drills and materials. In the article (and bear with me, because I think it is a white guy appropriating Native technology), the author talks about using different sizes of pump drills for different jobs. He said that using a pump drill that is too big on shells will break them because it uses too much force.

  Goal: Teach the students problem-solving skills.

  Activity: For the activity, you could give the kids a worksheet with different sizes of pump drills and different materials and ask them to match up the corresponding materials with the correct drills. This activity will teach them problem-solving skills.

  Steps
  - Pass out the worksheet
  - Students build the pump drills on the stand
  - Using the worksheet, the students log in how the pump drill works on each different type of material (did it break? Was it hard to drill into?).
  - If students have trouble drilling into the material or are unable to drill into it, ask them to identify the material on their worksheet and explain why.
  - Turn in/present worksheets at the end

Drawback: This activity would require us to build different sizes of pump drills and collect different materials to drill. It could take a while to fine tune the project, but it could be something that can be used for a long time.

Project 2: Building Different Sizes of Pump Drill from a Pile of Assorted Parts

Activity: Alternatively, you could have kids follow instructions to assemble a pump drill. You could even give a group of kids a pile of materials for different sized pump drills and ask them to construct a few pump drills by separating the different parts for the different drills. If you want to make the activity easier, you could make the parts for each drill a specific color, so that the kids have an easier time sorting the parts. This activity would teach them teamwork, leadership, problem-solving, and construction skills.

Drawback: Again, this project may require trial and error to complete (I am not sure how easy it will be to assemble a pump drill from scratch and then disassemble it for the next group).

Project 3: Pythagorean Theorem and Pump Drills

Activity: In the Bushcraft article, the author states that an ideal pump drill is made from a triangle with dimensions that are proportional by 3, 4, and 5 on each side. These dimensions create a Pythagorean triangle, also called a 3-4-5 triangle. A Pythagorean triangle is a triangle with a right angle, whose sides can be calculated using the Pythagorean theorem: $a^2 + b^2 = c^2$. In a 3-4-5 triangle, c = the hypotenuse of the triangle.

You can teach kids about the 3-4-5 triangle and then demonstrate why it works with pump drills by building drills that do not use 3-4-5 triangles and having them test each drill. See the Bushcraft article for how to apply the 3-4-5 triangle to the pump drill.

Pump Drills and the Pythagorean Triangle

As you are constructing your pump drill, keep in mind that an ideal pump drill uses the dimensions of a Pythagorean triangle, or a 3-4-5 triangle. This triangle is a right angle, with its sides proportional to 3 and 4 and its hypotenuse proportional to 5.

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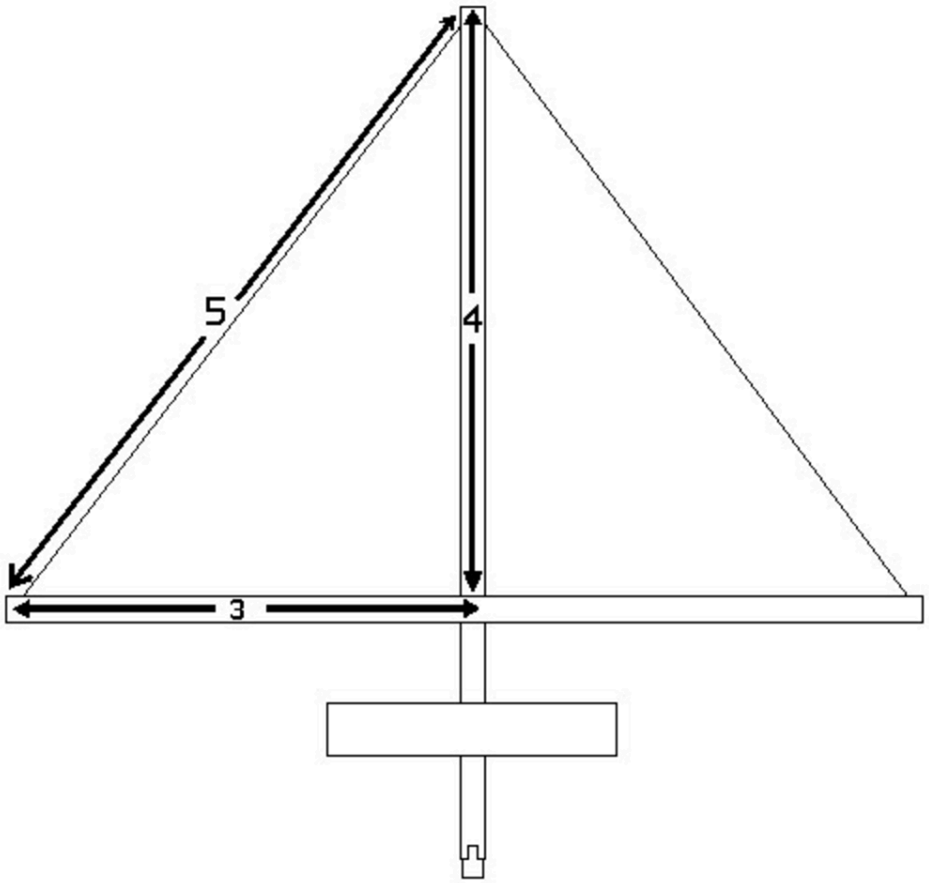
Take a look at the diagram below:



A Pythagorean triangle is a triangle with a right angle, whose sides can be calculated using the Pythagorean theorem: $a^2 + b^2 = c^2$. In a 3-4-5 triangle, c = the hypotenuse of the triangle. Try to find materials to make a pump drill that uses the Pythagorean triangle for the best results.

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Pump Drill Activity Worksheet

Type of Material Used	Were You Able To Drill A Hole In It?	If Not, Why Do You Think It Did Not Work?

II. Sources

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- See pages 46-52

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  - Pythagorean triangles
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  - Website for kids that demonstrates the Pythagorean theorem/triangle

Resources:

Shell Necklace Kit: https://www.youtube.com/watch?v=pQDockLdTiw

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