

PEELED PONDEROSA PINE TREES:  
A RECORD OF INNER BARK UTILIZATION  
BY NATIVE AMERICANS

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**ABSTRACT.**—References by explorers, ethnologists and others to the utilization of pine (*Pinus* spp.) inner bark as a food indicate that some cultural groups of North American Indians may have used inner bark regularly, perhaps on an annual basis, while other groups may have used it primarily as an emergency food, such as during famine. The peeling dates and historical circumstances of one group of trees in the Gila Wilderness, New Mexico suggest that these trees were probably peeled by the Gila Apache when they were very hungry. Inventory of surviving peeled trees, and dendrochronological dating of the peeling scars may help answer remaining questions about the importance and utilization patterns of pine inner bark as a food source.

INTRODUCTION

Pine trees with large oval or rectangular scars on their trunks can be observed in many scattered locations in the western United States (Fig. 1). The physical appearance of these scars is different from scars created by fires or other disturbances (Table 1). These distinctive scars are attributable to the peeling of the outer bark by Native Americans to procure for food the soft, stringy layer of phloem and cambium cells that occur between the outer bark and the secondary xylem cells (wood) of the trunk (Martorano 1981; Newberry 1887; White 1954). This layer has been referred to as the "inner bark", and its utilization has been widely reported in the ethnographic literature, however, generally it has been mentioned only in passing.

The first part of this paper considers different utilization patterns of inner bark in a review and discussion of the ethnographic literature, with special emphasis on ponderosa pine (*Pinus ponderosa* Laws.) inner bark utilization in the southwestern United States. The second part discusses problems of sampling peeled trees for dendrochronological dating, and problems of interpreting estimated peeling dates. The third part reports the locations and peeling dates of three groups of peeled trees in New Mexico, and historic evidence concerning one of the groups. A summary includes comments on the potential importance and applications of peeled tree information for ethnographic studies.

INNER BARK UTILIZATION PATTERNS

There is extensive literature on the utilization of the outer bark and sap of many different species of trees for various technological, medical and ceremonial purposes by numerous groups of peoples throughout the world. This review and discussion is focused on the utilization of pine (*Pinus* spp.) inner bark for food.

The earliest original reference found was in the Lewis and Clark journals (Thwaites 1905). The use of pine inner bark was mentioned on two occasions in the journals, and the differences in these entries illustrate the difficulty of determining if there was a consistent usage pattern of inner bark. The first journal entry was by William Clark on September 12, 1805, while the party was in the Bitterroot Mountains of present-day Montana and consisted of one sentence:

I mad(e) camp at 8 on this road & particularly on this Creek the Indians have pealed a number of Pine for the under bark which they eate at certain Seasons of the year, I am told in the Spring they make use of this bark . . .

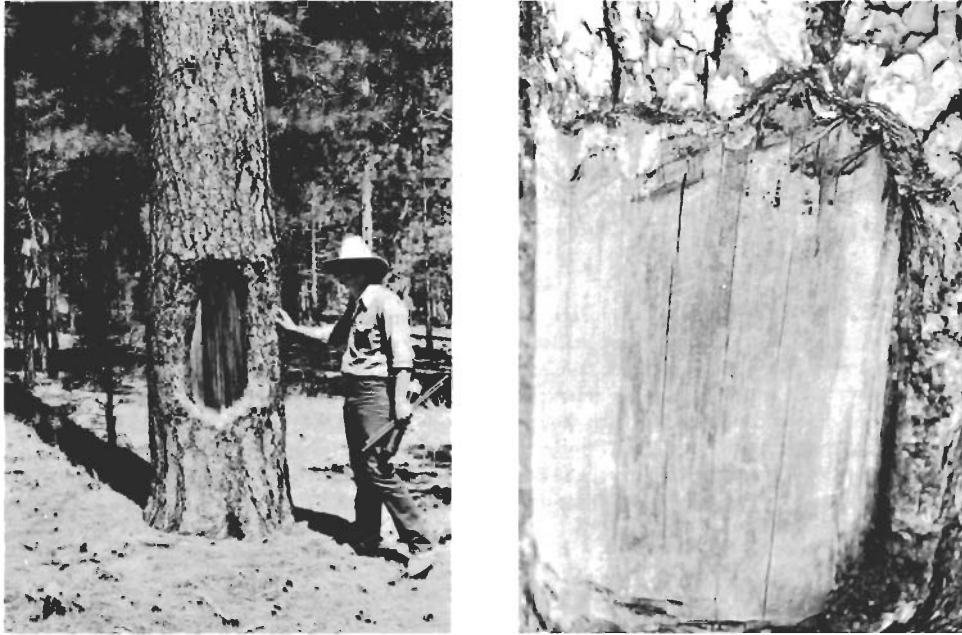


FIG. 1—Left, peeled tree in Lilley Park, Gila Wilderness New Mexico. Right, many peeling scars will show axe marks along the top and/or bottom of the wound.

Thus, the above sentence suggests that it was a seasonal or regularly used food. However, the second entry by Meriwether Lewis, on May 8, 1806, was in the context of a discussion of famine conditions during the previous winter when the Indians, possibly the Shoshoni, were reduced to boiling and eating the moss growing on pine trees. Although inner bark utilization was mentioned in the same paragraph as the famine discussion, it was not specifically referred to as food resorted to only during times of famine.

Other early references to inner bark utilization clearly indicate that it was an emergency food. For example, Sturtevant (1919:436) cites a paper presented by Brown to the Edinburgh Botanical Society in 1868:

In times of scarcity, says R. Brown, the Indians will eat the liber [inner bark]. Along both sides of the trail in the passes of the Galton and Rocky Mountains, many of the young trees of this species [*Pinus contorta* Dougl.] are stripped of their bark for a height of six or seven feet.

And John Strong Newberry, a distinguished physician and naturalist of Columbia University, based the following description on observations while traveling with government survey expeditions in the far west in about 1859 (Newberry 1887:46):

One article of subsistence sometimes employed by the Indians is only resorted to when they are driven to great straits by hunger. Around many of the watering-places in the pine forests of Oregon and California the trees of *Pinus ponderosa* may be seen stripped of their bark for a space of three or four feet near the base of the trunk. This has been accomplished by cutting with a hatchet a line around the tree as high as one could conveniently reach, and another lower down, so that the bark, severed above and below, could be removed in strips. At certain seasons of the year a mucilaginous film (the liburnum) separates the bark from the wood of the trunk. Part of this film adheres to each surface and

TABLE 1.—*Characteristics of various types of scars observed on tree trunks.*

Scar Type (cause)	Approximate Location	Distinguishing Features
Inner Bark Peeling (human)	Bottom of scar usually above ground level. Top of scar sometimes up to 3 meters above ground.	Oval or rectangular shape, or sometimes pointed at top. Axe marks occasionally visible at bottom or top. Occur in groups, often near campsites with water.
Trail Blaze (human)	Breast height or slightly higher. (1.4 meters above ground).	Small stripe, spot or both. Usually on both sides of tree. Occur on trails or other travel routes.
Survey or Witness Tree (human)	Breast height. (1.4 meters above ground).	Round or rectangular shape with numbers or other information carved, stamped or posted. Usually a single tree.
Fire	Ground level up to any height.	Triangular shape or elongated strip, widest at bottom. Charred wood, and sometimes concave at bottom. Often occur on uphill side of tree on slopes.
Lightning	Anywhere on bole, sometimes extending from top of tree to bottom.	Usually a narrow strip, sometimes spirals around tree. Occur randomly.
Animal Gnawing	Usually on branches or stems of smaller trees, or near tops of larger trees.	Irregular shapes, teeth marks sometimes visible.
Scrape (falling trees, rock slides, etc.)	Anywhere on tree.	Irregular shapes. Occur randomly.

may be scraped off. The resulting mixture of mucilage cells and half-formed wood is nutritious and not unpalatable, so that, as a last resort, it may be used as a defense against starvation. The frequency with which signs of its having been resorted to are met with is a striking indication of the uncertainties and irregularities of the supply department among savages.

Several specific Southwestern references for use of pine inner bark by the Zuni (Caster 1935:42; Cushing 1920:223; Standley 1912:448) and the Mescalero and Chiricahua Apache (Caster and Opler 1936:43; Opler 1941:358) indicate usage in times of unusual want, or especially when other foods were not abundant. On the other hand, Hrdlicka (1908:22) observed that the Mescalero and Jicarilla Apache ate inner bark "even when not in great want". Each of the above cited references indicate that the strips of inner bark were eaten fresh or made into a flour and baked as cakes. An exception is Cushing's (1920:223) account, which is a detailed description of the Zuni cooking inner bark strips with meat by boiling them in water in "closely-plaited basket vessels" with heated rocks.

The most detailed description of inner bark utilization and methods of procurement, based on direct information from native informants, is a paper by Thain White (1954),

*Scarred Trees in Western Montana.* White's main informant was Babtiste Mathias, a Kutenai born in 1879, who recalled collecting inner bark in the spring as a child.

Mathias produced two tools for White that he said were used for debarking and scraping. One was a wooden pole, sharpened on one end, that Mathias said was normally about 3 meters long, and was used for prying large slabs of bark off the trunk. The other tool was a hand held implement, approximately 11 centimeters long and 7 centimeters wide, that was used to scrape the inner bark from the bark slab or the tree trunk. Mathias made the scraping implement out of a flattened tin can, but White stated that earlier tools may have been made of mountain sheep (*Ovis canadensis*) horn.

White's paper is a wealth of information on inner bark utilization in western Montana, and a number of particularly interesting points are brought to light. For example, White's informants indicate that the peeling was primarily a strong woman's task, and that children helped their elders as they could. The peeling was carried out in the spring, usually in May and coinciding with the bitterroot season, because the sap in the trees was running at this time and they were easy to peel. The peeling was generally done near campsites, probably because it was carried out by women and children. The trees were first sampled by peeling a small test strip to determine if the trees were "good". The scraping of the inner bark was done at the site of the trees because the large bark slabs were too heavy to carry back to camp. The strips of inner bark were rolled into balls and stored in green leaves to prevent drying, or they were tied into knots so that they could be eaten more easily. White's informants state that inner bark was sweet and tasted good, and the overall impression is that it was a delicacy that was looked forward to and exploited every year. No mention is made of inner bark as an emergency food.

White indicates that the peeling of trees was discouraged by authorities at the time of white settlement because of damage to the trees. He suggests that the practice may also have been abandoned at this time because the availability of processed sugar replaced inner bark as a sweet in the Kutenai diet.

White (1954:7-9) also reported that peeled trees could be found along nearly every valley in western Montana and northern Idaho, and that this area seemed to be the center of inner bark utilization in the west. If the inner bark of pine trees was utilized in a regular fashion, year after year, it seems reasonable to expect that peeled trees would not be rare within an area used by people that followed this practice. Although peeled trees in the Southwest cannot be said to be very rare, they do not seem to be nearly as common as in Montana.

A major problem of studying peeled trees is the fact that logging and other disturbances have probably significantly altered the distribution and abundance of these trees in many areas. Therefore, inventories of numbers and distributions of peeled trees, as well as tree-ring sampling for estimating peeling dates, may reflect this bias. In some cases it may be possible to research past timber cutting activities in an area to determine if this may be a factor. Large protected areas that have never been logged, such as federal Wilderness Areas and Parks, may provide the best opportunity for avoiding a sampling bias in studies of peeled trees.

In any case, considering the reported abundance of surviving peeled trees in Montana, and the first-hand reports of White's Kutenai informants, it is probable that inner bark utilization in this area was on a regular seasonal basis. Indeed, for some native peoples, during some periods, it may have been true that annual use and emergency use of inner bark were the same thing, because food was very scarce every year during certain seasons. This type of situation, however, seems to be different than that described by White's informants, who imply that inner bark was a treat, and would have been eaten regardless of whether food was unusually scarce or not.

Eidlitz (1969:54-59) presents a wide ranging discussion of inner bark utilization in circumpolar areas, including numerous references to its use in Scandanavian countries,

Russia, Canada and Alaska. Even though some of these citations indicate an annual utilization pattern, in the majority of cases the predominant pattern of use seems to have involved times of food scarcity. It may be that in circumpolar areas, where food availability is more limiting during certain seasons than in temperate regions, inner bark provided much needed nourishment. In other words, the high frequency of inner bark utilization among circumpolar peoples may have reflected a situation where annual use of inner bark was a necessity. Whether or not this was the case for other Native Americans, such as the Kutenai, is questionable.

There is also the question of just how "good" inner bark is. Of course taste is a subjective matter, but the fact that White's informants stated that the trees were "tested" before peeling is some indication that not all trees tasted "good". Quantities of sugars and other chemical constituents of inner bark tissues, such as tannins and monoterpenes, vary between species and individual trees and may affect the sense of taste. Gaertner (1970:69-70) experimented with flours made from inner bark of pine (*Pinus strobus* L.) and balsam fir (*Abies balsamea* (L.) Mill.), and cited a Forest Service study that listed the percentage of reducing sugars in oven-dry-weight of pine bark as varying between 22 and 43%. However, she expressed her opinion that pine inner bark had a "disagreeable and strong flavour" because of the tannin-filled cells of the secondary phloem and resin canals that are encountered if more than the innermost layers of bark are included.

The living inner bark tissue, composed of phloem, cambium and perhaps some current years xylem cells, is likely to be a more valuable food source than the non-living outer bark or xylem cells because the living cells contain a variety of chemical constituents that may be of some nutritional value, especially the relatively high concentrations of sugars in the sieve tubes of the phloem (Noggle and Fritz 1983:331-332).

Both Cushing (1920:223) and Standley (1912:448) observed that pine inner bark was difficult to digest. Dimbleby (1967:30-31) stated that inner bark is rich in proteins and carbohydrates in the spring when the active growth period of the tree is beginning. However, when commenting on its possible medicinal properties he said: "... far from being a palliative for digestive troubles, is liable to cause them if exclusively used."

In addition to considerations of taste, nutrition, and digestability, the time and effort required to procure and prepare inner bark as a food may also have had a bearing on the value that people ascribed to it. Gaertner (1970:71) stated that the process of procuring and preparing inner bark as a flour, which according to many of the cited ethnographic sources was a commonly used form, was a time consuming and laborious task and could be recommended only in times of wheat flour shortage.

#### DENDROCHRONOLOGICAL DATING OF PEELING SCARS

*Necessary Sampling and Dating Techniques.* Peeled trees are unique among the many types of artifacts created by people in their search for food, in that it is possible, by using dendrochronology, to date their utilization to the year. Sampling peeled trees with increment cores, however, requires an intensive and careful technique. In order to obtain accurate estimates of peeling dates using increment core samples, I have found that it is necessary to obtain cores from the curled healing portion of the wound alongside the exposed surface of the peeling, and from the opposite, uninjured side of the tree (Fig. 2). The objective is to obtain an increment core that intersects the scar created by the peeling very near to the original boundary because when the bark was stripped off the tree, one or several rings may also have been removed from the wood of the trunk. Erosion by weather or fire may also have removed wood.

It is often very difficult to penetrate the resinous, dried exposed surface of the peeling with an increment borer (Fig. 2, point D). The dried outer rings on a core from this area are usually destroyed by the cutting tip of the bit, or they often break off from the

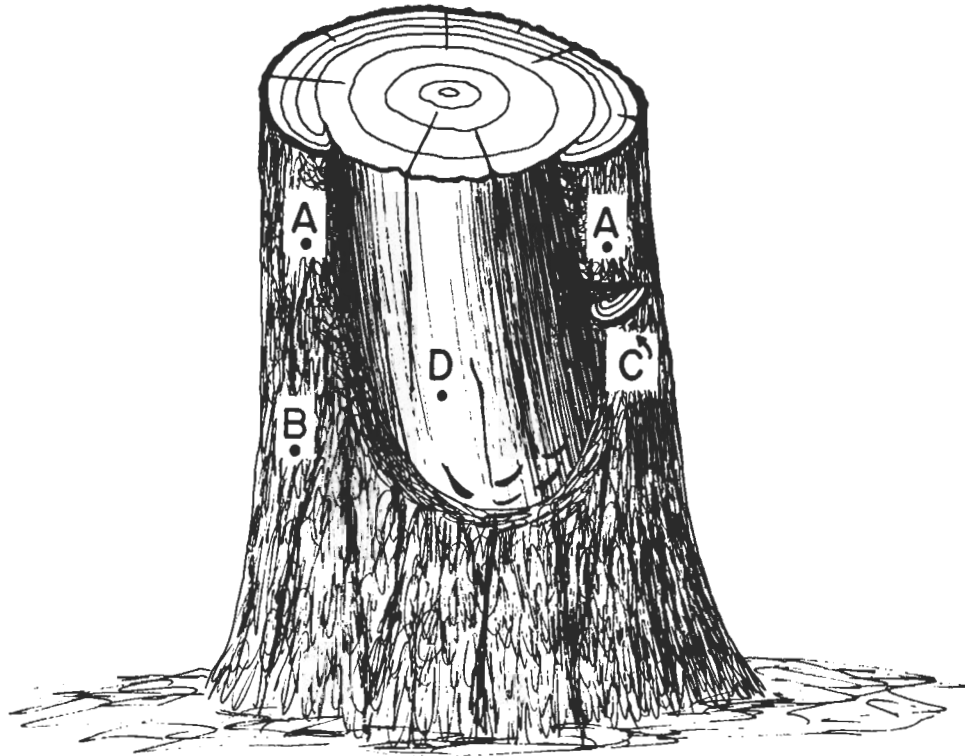


FIG. 2—Increment core sampling is recommended at positions A and B. White (1954) obtained increment cores from the sides of the peeling scar — A, and he also notched some of his sample trees — C, and then counted the annual rings from the bark in to the scar. Martorano (1981) obtained increment cores from the exposed surface of the peeling — D, and from the uninjured side of the tree — B.

rest of the core and are lost. Therefore, increment cores taken directly from the exposed surface of the peeling generally provide a date that is earlier than the actual peeling date.

Dating the peeling event by counting or crossdating the rings from the bark in to the break caused by the scar is generally not reliable because the rings are often very distorted along the curved portion of wood, and one to several rings may not appear near the wound. It is best to core through the curled portion of the trunk on the sides of the wound and penetrate into the tree as near to the pith as possible, so that a sequence of rings extending from the pith area out to the original scar surface can be obtained for crossdating. Crossdating, as distinguished from simple ring counting, is a method of matching ring-width patterns within and between trees, so that growth anomalies such as locally absent or false rings can be accounted for, and accurate dates of formation can be assigned to individual annual rings (Douglass 1941).

Figure 3 is a schematic illustration of a peeling scar and what is typically observed when a series of increment cores is taken near the edge of the wound. Even when a series of increment cores is taken from the area of the original wound boundary, the estimated peeling dates among the cores may differ by several years. In this case, the latest estimated peeling date is probably the closest to the actual peeling date.

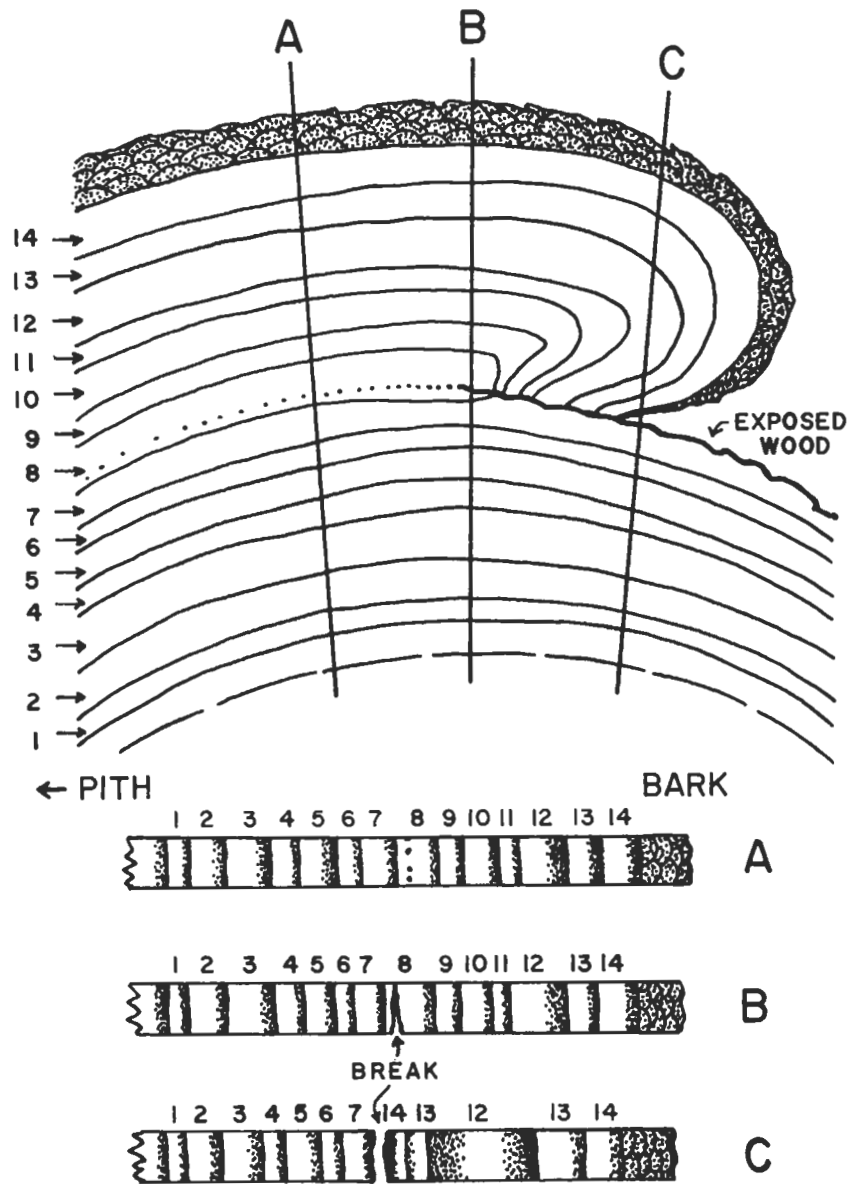


FIG. 3—An increment core taken along radius A would not intersect the original wound boundary and the core would not have a break caused by the exposed surface. The ring containing the scar may have features such as damaged tracheid cells or traumatic resin ducts. A core from radius B would be very close to the original wound boundary and may show the peeling scar entering the correct ring. A core from radius C would include a break, but the last visible ring before the break may be one or more years earlier than the actual peeling date. Note that the ring sequence from the bark in to the break will not include annual rings 8-11, and rings 13 and 14 may actually appear twice!

In addition to the difficulties of intersecting the original wound boundary with an increment borer, scarred trees are frequently very resinous, and many have heart rot or insect galleries, thus the increment borer often becomes jammed with broken pieces of core and resin. Because of these problems, it is very difficult to obtain the exact date

of any type of event that scars a tree using only increment cores. Cross-sections are preferable to cores because the entire scarred area is visible and the exact ring where the wound enters can usually be determined. Unfortunately, taking a cross-section obviously destroys living trees.

*Interpretation of Peeling Dates.* The distribution of peeling dates, arrived at by careful sampling and crossdating, can potentially provide a test of utilization patterns. For example, if the trees in a particular area were peeled on a regular, or annual basis, then many different peeling dates spread out over long periods of time may be expected. On the other hand, if the trees were peeled on an irregular, or emergency basis, then the peeling dates should cluster around one or a few years, or a certain period.

White (1954) attempted to estimate the peeling dates of 47 trees from the locality of Flathead Lake, Montana. He used two techniques for dating the peelings. One technique involved notching the sides of the wound with a handaxe and counting the annual rings from the bark in to the scar. The other technique involved taking increment cores through the bark along the sides of the wound, and presumably counting the rings from the bark in to the appearance of a break caused by the original peeling (Fig. 2). The peeling dates White arrived at varied from an early date of 1739 to 1928. Only a few of White's peeled trees have the same estimated peeling date, although most of the dates appear to cluster during the period 1880 to 1910. There is some uncertainty, however, about the accuracy of White's estimates because he counted only the annual rings from the bark into the wound and did not crossdate the ring width patterns.

A recent study in Colorado involved an extensive survey of three groups of trees that were probably peeled by Ute Indians (Martorano 1981). Martorano measured and analyzed numerous physical features of the peeling scars on 84 trees, and also attempted to estimate peeling dates. She cored through the exposed surface of the wound, and through the bark somewhere along the uninjured side of the tree (Fig. 2). The paired increment cores from the exposed face of the peeling and from the uninjured side of 39 trees were compared and crossdated to estimate the peeling dates. The estimated dates of these trees varied from 1793 in one group to 1959 in another, although she indicated that the later date was questionable, because the scar did not appear to be that recent.

For two groups of trees located in south-central Colorado Martorano obtained many different peeling dates spread out over relatively long periods of time, although there were also clusters of dates from about 1820 to 1830, and gaps without any dates. She hypothesized that these trees were peeled by the Ute on an annual or semi-annual basis. The other group of trees from north-central Colorado had peeling dates that were mostly clustered in the 1850 to 1860 period, and she hypothesized that these trees may have been peeled on an emergency basis (Martorano 1981:110-113).

It can be argued, however, that Martorano's peeling dates lacked the precision necessary to answer the question of utilization pattern. The Colorado samples were crossdated, which would avoid inaccuracies due to false or missing rings, but since the cores were taken through the exposed surface of the scar, instead of near the original boundary of the wound, it is possible that some of the observed variability in peeling dates is due to the sampling technique. If the dating were more precise it is possible that more peeling dates would cluster around certain years or periods.

It is also worth noting on this point that Indian Agent Michael Steck reported that in 1853 about 40 Ute families (mostly women and small children) were camped on Culebra and Costilla Creeks and were said to be starving, and eating the bark of pine and aspen trees for subsistence (Schroeder 1965:65-66). These drainages are approximately 100 km south of the two groups of trees that Martorano hypothesized were peeled by the Ute on an annual or semi-annual basis. Thus, it is apparent that inner bark was at least occasionally used by Ute for an emergency food.



An additional aspect of sampling peeled trees for dendrochronological dating, and interpretation of estimated peeling dates, is the problem of distribution of these trees. For example, if only one group of dated trees were peeled on the same year, while many other undated groups were scattered throughout the area, it may not be possible to conclude that the dated group was peeled on an emergency basis, because collectively all of the other trees may have been peeled during many different years over a long period of time. In some areas, it may not be possible to determine whether other peeled trees existed because of past logging activities or other disturbances.

#### NEW MEXICO PEELED TREES

*Locations:* The largest group of peeled trees that were sampled is along the bottom of Chimayo Canyon, which is a small drainage approximately 24 km north of Santa Fe. A smaller group of peeled trees is in Escondido Canyon approximately 16 km southwest of Tres Piedras, and the third group of trees is in Lilley Park, near the center of the Gila Wilderness in southwestern New Mexico. Table 2 lists locations (latitude and longitude), the number of trees that were sampled, and approximate total number of peeled trees in each area.

The three locations are all within ponderosa pine forests, although the Chimayo Canyon group is the lowest in elevation (2134 m) and some piñon (*Pinus edulis* Engelm.) and one-seed juniper (*Juniperus monosperma* (Engelm.) Sarg.) are growing near the peeled trees. A perennial stream flows in the bottom of Chimayo Canyon. The Lilley Park and Escondido Canyon groups are higher in elevation (both sites are at 2438 m), have grassy understories, and are near large meadows. A stream flows near the Escondido Canyon trees, and there is a spring near the peeled trees in Lilley Park. All three of the groups of trees are near areas that would likely be attractive campsites.

*Sampling and Dating.* The New Mexico peeled trees were sampled by taking increment cores from the curled healing portion of the wound alongside the exposed surface of the peeling, and from the opposite, uninjured side of the tree (Figs. 2 and 3). The peeling scars were dated by crossdating the inner portion of the cores taken from the wound area with a master tree-ring chronology established for the area (Stokes and Smiley 1968). The cores from the uninjured side of the tree were also crossdated and used for comparison with the cores from the wounded side. The tree-ring chronologies used were the Upper Rio Grande chronology (Schulman 1956) for the Chimayo Canyon and Escondido Canyon trees, and the McKenna Park, Gila Wilderness chronology (Swetnam 1983) for the Lilley Park trees.

TABLE 2.—Locations and numbers of New Mexico peeled trees.

	Location		Elevation	No. of Trees	
	Lat.	Long.		Sampled	Total <sup>1</sup>
Lilly Park	108°28'	33°19'	2438 m	6	12
Chimayo Canyon	105°52'	35°55'	2134 m	12	70
Escondido Canyon	106°13'	36°35'	2438 m	2	20

<sup>1</sup>Total number of trees at each site is an estimate.

*Peeling Dates.* Table 3 lists the number of trees sampled, the estimated peeling dates of trees that were successfully crossdated and comments and notes on the dating. The Chimayo Canyon trees were very difficult to core because nearly every tree was infested with ants and most of the peeled trees had rot behind the scars. As a result, very few usable cores were obtained and the peelings on only five trees could be dated out of the 12 trees that were sampled. The trees at this site were also climatically stressed, and a number of rings were absent from the cores during years that were probably dry (e.g., 1801, 1818, 1819, and 1822). As it turned out, a number of the usable cores showed peeling scars sometime during the 1818 to 1822 period, and so it was difficult to cross-date these trees with absolute confidence.

Only two trees were sampled from Escondido Canyon. The cores from these trees were free of rot and crossdated well with the Upper Rio Grande chronology. The dates are listed in Table 2.

The Lilley Park trees were also free of rot and they crossdated satisfactorily with the McKenna Park chronology. Only one of the six trees that was sampled was not dated. The undated tree had a very complacent ring series (low variation in ring-widths), and crossdating was not apparent. The Lilley Park sampling is the most complete of the three groups of trees since cores from nearly half of the estimated total number of peeled

TABLE 3.—*Estimated peeling dates of sampled trees.*

Site	Tree ID	Estimated Peeling Date	Comment
Lilley Park	1	1865	possibly 1866 <sup>1</sup>
	2	1865	possibly 1866 <sup>1</sup>
	3	1865	most reliable date <sup>2</sup>
	4	1865	last visible ring before scar 1864 <sup>3</sup>
	5	1865	last visible ring before scar 1864 <sup>3</sup>
Chimayo Canyon	1	1818	possibly 1819 <sup>1</sup>
	2	1832	dating uncertain <sup>4</sup>
	7	1831	dating uncertain <sup>4</sup>
	8	1857	possibly 1858 <sup>1</sup>
	11	1815	dating uncertain <sup>4</sup>
Escondido Canyon	1	1872	possibly 1873 <sup>1</sup>
	2	1872	last visible ring before scar 1864 <sup>3</sup>

<sup>1</sup>Peeling date may be one year later than estimated date because the core sample may not have been very near the original wound boundary.

<sup>2</sup>Most reliable date for this site because a core included the original wound boundary showing the scar entering 1865 ring.

<sup>3</sup>The last visible ring before the break on the cores was the indicated date, but it was apparent that the cores were not very near the original boundary, so the peeling date was estimated to be one or several years later.

<sup>4</sup>Dating uncertain because absent rings were common in these trees, especially during years near the peeling scars.

trees at this site were dated. Some of the cores from the trees in Lilley Park had a break in the 1864 ring and some had a break in the 1865 ring, but there were indications that these cores were still some distance from the original wound boundary, and so the 1865 or 1866 ring may have been missing. Cores from one tree clearly showed the original wound boundary, with the scar entering the 1865 ring. It is most probable that all of these trees were peeled in 1865 or one year later in 1866.

*Historical Evidence.* The dating of the Lilley Park trees posed an obvious question. Who were the people that peeled these trees and was their motivation unusual hunger or were they merely exploiting a food resource that they utilized every year or every few years? The first part of this question was easy to answer since the Gila Wilderness was the homeland of the Gila Apache, at least during historic times. The Gila Apache were composed of at least two local groups of Chiricahua Apache, the Mogollon and the Mimbrenño, who were linked by intermarriage and other habits (Opler 1941:1; Thrapp 1974:63-64). The second part of the question is somewhat more difficult to answer, but I believe the evidence strongly suggests that the Lilley Park trees were peeled by the Gila Apache when they were unusually hungry.

The primary evidence is historical. Under the leadership of Mangus Coloradas, the Mimbrenño Apache were reported to have been involved in the famous battle at Apache Pass in Arizona on July 14, 1862. Following this battle, General James H. Carleton commanding the Union forces of the California Column gave the following orders to Brigadier General Joseph R. West (Thrapp 1974:82): "... immediately organize a suitable expedition to chastize what is known as the Mangus Colorado's Band of Gila Apaches. The campaign to be made must be a vigorous one, and the punishment of that band of murderers and others must be thorough and sharp."

Carleton's orders were indeed carried out with vigor during the next year (1863) and numerous battles with the Gila Apache took place within and around the Gila Wilderness (Thrapp 1974:83). Keleher (1952:291) states that by mid-summer 1863: "... the Gila Apaches in southwestern New Mexico had been driven back, slowly and relentlessly, from their country, starving and homeless, into the wilds of Arizona and Mexico". However, it is likely that the Gila Apache moved in and out of the Gila Wilderness and vicinity during 1864 and 1865, as it was their home-land and it was also an extremely remote and rugged country which was ideal for hiding out.

Victorio became the leader of the Gila Apache after the murder of the captive Mangus Coloradas by his soldier guards in January 1863. Skirmishes between soldiers and the Gila Apache continued into 1865, when Victorio attempted to make contact with Carleton to discuss peace. Carleton sent an emissary in May of 1865 to talk to Victorio in the Gila area, and he later quoted Victorio as saying (Thrapp 1974:91): "I and my people want peace—we are tired of war—we are poor and we have little for ourselves and families to eat or wear—it is very cold—we want to make peace, a lasting peace . . ." Unfortunately, Carleton was intransigent, and lasting peace did not come until after the death of Victorio and most of his warriors in 1880 in a battle with the Mexican General Terrazas (Thrapp 1974:293-314).

It seems quite clear that the Gila Apache were experiencing unusual hunger during 1865 and 1866. Although the historic evidence is circumstantial, it appears to be a very compelling argument for the emergency food utilization pattern, at least for the Gila Apache and the peeled trees in Lilley Park.

It should also be noted that the Gila Wilderness and adjacent Aldo Leopold Wilderness and primitive areas are quite large (approximately 300,000 ha), and no commercial timber cutting activities have taken place within these boundaries. Although it is likely that there are other peeled trees within these areas, they are certainly not very common, as the Lilley Park trees are the only ones that I have observed on extensive travels through

the Gila area. Therefore, the Lilley Park trees probably do not represent a sampling bias because they are only one of many groups of peeled trees in the area, or because of past timber cutting.

Further testing of the hypothesis that any particular group of trees were peeled on an emergency basis, or otherwise, could utilize similar historic evidence, but consideration should be given to the sampling problems. Historic evidence that may explain the peeling of trees at Escondido Canyon or Chimayo Canyon has not yet been pursued to any great length because the sample sizes from these two groups are too small, or the dating too uncertain, to determine whether the majority of trees at these sites were peeled during specific dates or periods. A more intensive sampling of these trees is planned, so that the emergency food hypothesis can be further tested.

#### SUMMARY

The published references suggest that there were different patterns of cultural utilization of inner bark. Some cultural groups may have peeled pine trees and eaten the inner bark every year because it was valued as a sweet or delicacy. Other groups may have used inner bark only as an emergency food on relatively rare occasions. And yet others may have eaten inner bark every year, or every few years, because of a combination of necessity, cultural tradition, and taste. Inner bark may not have very high nutritive value, digestion of this fibrous material is difficult, and the taste may or may not be appealing. It seems probable that inner bark was not a very important food for Southwestern cultural groups that used it, but it was more likely a minor or peripheral item in the food economy that was more or less exploited depending on the abundance of other foods and customs of the people.

It is my contention that the Gila Apache of southwestern New Mexico utilized inner bark as an emergency food. The dendrochronological dating of one group of peeled trees in the Gila Wilderness, and the historical circumstances of the Gila Apache at the time the trees were peeled, supports this view. I suspect that other groups of peeled trees in the Southwest and elsewhere in the western United States were also peeled by people during years when they were very hungry.

Additional research is needed to determine utilization patterns for any particular people or group of trees. Inventories of the numbers and geographical distribution of surviving peeled trees is needed. If the problem of changes in distribution and abundance of peeled trees in historic times can be avoided, or accounted for, inventories may help to determine the importance of inner bark in the food economy of different cultural groups. The distribution of these trees may also help determine the location of seasonal campsites and movements of nomadic peoples.

Dendrochronology can provide a tool for determining whether groups of peeled trees were exploited seasonally, or during times of unusual food scarcity. Trees that were peeled on an emergency basis can provide evidence that a group of people were experiencing hardship, possibly due to famine brought on by warfare, climate or other circumstances.

I would emphasize that intensive and careful sampling is necessary to obtain usable increment core samples for dating purposes. Crossdating, rather than simple ring counting, is also necessary to arrive at accurate dates because missing and false rings are not uncommon in trees, especially trees that have suffered large wounds on their trunks. Cross-sections or wedge-sections from peeled trees would greatly facilitate the dating of peeling events. Destructive sampling of living trees may not be acceptable, but it is possible that cross-sections could be taken from standing dead trees or downed logs with peeling scars. With cross-sections, it may also be possible to determine whether trees were peeled during the dormant season (fall, winter and early spring) or during the grow-

ing season (late spring and summer) by noting the relative position of the peeling scar within the annual rings.

Finally, it should be recognized that there is some urgency in the task of identifying peeled trees and preserving them where it is possible to do so. No doubt many of these trees have been cut down for lumber over the years, without any recognition of their cultural or historical significance. Timber cutting activities have increased in recent years within the few remaining virgin, old growth stands of ponderosa pine. These are the areas where peeled trees are most commonly found.

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## Book Review

**Ralamuli Nutugala Go'ame (Comida de Los Tarahumaras)**. Albino Mares Trias. Published privately by: Don Burgess McGuire, 911 12th Street, Safford, Arizona 85546. 1982. 502 pp. \$10.00.

Most ethnobiological works are written by outsiders who come from very different cultures, and who have to struggle to understand the ways of the people they are studying. This book, however, the fourth written by Mares, a Tarahumara of Guazapares, Chihuahua, Mexico, discusses over 100 edible plants, fungi, and caterpillars, both wild and domesticated, consumed by the natives of the author's home area. It is written in the native Tarahumara language with a parallel text in Spanish, and contains descriptions of the different varieties of each species, and the manner in which each is utilized, plus photographs of most of the species. Most of the photographs are excellent, although a few did not reproduce very well. The book also includes an introduction by Don Burgess McGuire of the Summer Institute of Linguistics, and an appendix by Dr. Robert Bye of the University of Colorado, listing the scientific binomials of most of the species discussed.

Written by a nonprofessional, the book does tend to be a bit folksy in spots, although it appears rather thorough in what it attempts to do. The appendix is difficult to use, with no apparent order to the listings. The book is interesting primarily because of its novelty, and because of its inherently emic point of view, which is unusual in ethnobiological literature.

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