The *Journal of Ethnobiology* is published semi-annually. Manuscripts for publication and book review sections should be sent to the appropriate editors as listed on the inside back cover of this issue.

ISSN 0278-0771

COVER ILLUSTRATION: Close up of cattail down in the mouth of a Salish mortuary figure (UBC Museum of Anthropology, A1980). Drawn by J. Rose after a photo by J. Ostapkowicz.

Journal of Ethnobiology

VOLUME 21, NUMBER 2 WINTER 2001

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ETHNOBIOTICA

It's time for me to sign off as your editor, having reached the point of being able to say, a mission accomplished. And now I have the privilege of introducing your new editor, distinguished archaeologist and ethnobiologist, Naomi F. Miller of the University of Pennsylvania Museum, who already has served the journal with high energy and competence in her capacity as an editorial board member. I am confident Naomi will make an excellent editor and that you will agree with me in that assessment upon receiving her debut issue (Summer 2002, volume 22, number 1). All article manuscripts should be now submitted directly to Dr. Miller; please consult the inside back cover of this issue for her contact and mailing information. I am pleased to welcome also Darron Collins of the World Wildlife Fund as the journal's new book review editor. Book reviews should now be sent directly to him at the address given on the inside back cover of this issue. At this time, and on behalf of the editorial board, I would like to thank Michael Steinberg for his superb service during the last three years as the journal's book review editor, and to wish him well in future endeavors. For their service in reviewing manuscripts over the course of the last three issues, and on behalf of the editorial staff, I gratefully acknowledge the following persons: Eugene Anderson, Cecil Brown, James Carpenter, Helen Sorayya Carr, Alejandro de Avila B., Lydia Nakashima Degarrod, Darna Dufour, Nina Etkin, Jill Forshee, Catherine Fowler, Gayle Fritz, Ted Gragson, Chris Healey, Robert Hill, Sheila Humphrey, Eugene Hunn, Timothy Johns, Allen Johnson, Leslie Main Johnson, Elaine Joyal, Harriet V. Kuhnlein, David Lentz, Dana Lepofsky, Andrew MacWilliam, Judith Maxwell, Will McClatchy, Brien Meilleur, Jay Miller, Naomi Miller, Daniel Moerman, Travis Pickering, the late Darrell Posey, Elizabeth J. Reitz, Mary Riley, Laura Rival, Ted R. Schultz, Les Sponsel, Mike Steinberg, Lena Struwe, Maria Cruz Torres, Nancy J. Turner, Gail Wagner, Steve Weber, and Lyndon Wester. Special thanks are due to Adeline Masquelier and Myriam Huet of Tulane University for expert editorial advice on the French abstracts to articles. Finally, appreciation is due to my in-house editorial assistants, here in the Department of Anthropology at Tulane, Janna Rose and James Welch, for their dedicated efforts in helping bring this issue to fruition. May the Journal of Ethnobiology and the Society for Ethnobiology continue to prosper and to advance human understanding of relations among biota, cultures, and languages.

Bill

Journal of Ethnobiology 21(2): 1–27 Winter 2001

ETHNOBOTANY OF KU-NU-CHE: CHEROKEE HICKORY NUT SOUP

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ABSTRACT.—A traditional hickory nut soup called ***ku-nu-che*** is consumed by many Cherokee people in eastern Oklahoma. A limited number of producers go through a two-stage process of cracking and pounding the nuts—primarily *Carya texana*—into a mixture of nutmeat and nutshell fragments that they form into balls for distribution to other households. Before being served as soup, these balls are dissolved in boiling water, strained to remove the nutshell fragments, mixed with cooked rice or hominy, and sweetened or salted. We interviewed six makers of ***ku-nu-che*** balls and describe their tools, their methods, and their motives for engaging in this labor-intensive practice. We also surveyed other tribal members to ascertain what ***ku-nu-che*** means to Cherokee people today. This study documents long-term persistence of an ancient Native American plant food and, in addition, has implications for the interpretation of plant remains from archaeological middens.

Key words: hickory nuts, ethnobotany, Cherokee Indians, Native American food plants, paleoethnobotany.

RESUMEN.—Una sopa tradicional preparada de nogal americano llamada ***ku-nu-chee*** es consumida por mucha gente Cherokee de Oklahoma oriental. Un número contado de personas usan un proceso de preparación en dos etapas. Primero, quiebran la cascara y después muelen la nuez (especie principal *Carya texana*) para formar pelotas de una mezcla de fragmentos de cascara y nuez molida que distribuyen a otras familias. Antes de ser usada para sopa, las pelotas se deshacen en agua hirviendo, se cuelan para separar los fragmentos de cascara, se mezcla con arroz o maíz cocido y se agrega sal o azúcar. Se presenta información de seis entrevistas con personas que se dedican a la labor de preparar pelotas. Se describen sus herramientas, sus métodos y sus motivos para hacer esta actividad muy laboriosa. También sondeamos a otros miembros del tribu sobre el significado de ***ku-nu-chee*** para la gente Cherokee en la época actual. Este estudio documenta la persistencia larga de una comida tradicional indígena norteamericana y tiene implicaciones para la interpretación de restos botánicos de basureros arqueológicos.

RÉSUMÉ.—La soupe de *Carya* spp. appelée ***ku-nu-che*** est consommée par de nombreux Cherokees dans la partie Est de l'Oklahoma. Une petite partie des producteurs adopte un processus en deux étapes de craquage et écrasement des noix (surtout *Carya texana*) pour en faire un mélange de pulpe de noix et de coquille, ensuite moulé en boules qui sont distribuées à d'autres familles. Pour préparer la soupe, ces boules sont dissoutes dans l'eau bouillante, filtrées pour en enlever les morceaux de coquille, mélangées à du riz cuit, puis sucrées ou salées. Nous avons interviewé six producteurs de boules de ***ku-nu-che***. Nous décrivons leurs méthodes, leurs outils, et les motifs pour lesquels ils se consacrent à cette tâche intensive. Nous avons aussi interrogé d'autres membres de la tribu pour comprendre la signification du ***ku-nu-che*** pour les Cherokees aujourd'hui. Cette étude fournit des données sur la persistence à long-terme d'une plante nutritionelle ancienne des Indiens d'Amérique, et a aussi des implications en ce qui concerne l'interprétation des residus de plantes dans les fouilles archéologiques.

INTRODUCTION

Cherokee people moving into northeast Oklahoma in the 1820s and 1830s were probably relieved to find an abundance of hickory trees (*Carya* Nuttall spp.) (Juglandaceae). Hickories would have been a welcome sight because nuts of thick-shelled species were—and still are—the basic ingredient of a traditional soup-like dish known as ***ku-nu-che*** (or "ga-nu-ge" or "conutchie" or "kinugee," among other variants). Hickory nuts had been a dietary staple in the Eastern Woodlands for thousands of years before the transition to American Indian agriculture, and the nuts remained a central ingredient in cuisines of indigenous farming societies before and after the arrival of Europeans. ***Ku-nu-che*** is still today prepared in the households of members of the Western Cherokee Nation, with its seat of government in Tahlequah, Oklahoma, and those living in the southern Appalachian Mountains, homeland of the Cherokees before most were forced west in the early nineteenth century, before and during the Trail of Tears in 1838–1839.

This study began primarily as an attempt to observe modern hickory nut processing in order to gain insights into the ways hickory nutshell entered the archaeological record. Archaeologists look to ethnographic and ethnohistoric descriptions of plant use in order to understand better how plant remains and artifacts may have been deposited in archaeological sites; in other words, to gain taphonomic and contextual insights. Interest by archaeologists in traditional foodways increased during the 1970s and 1980s in conjunction with ecological approaches to archaeology, accompanied by large-scale recovery of plant and animal remains through newly developed methods including flotation. Hickory nutshell is the most abundant type of food plant in many archaeobotanical assemblages, sometimes outweighing the ubiquitous wood charcoal. This is especially true for samples from the Archaic period (8000–1000 b.c.e.), but some Mississippian period (1000 c.e. to European Contact) sites are also dominated by thick hickory nutshell. Archaeologists have looked to historical and early ethnographic sources for descriptions of native nut processing techniques, but none have, to our knowledge, considered the living Cherokee men and women who gather hickory nuts and make ***ku-nu-che*** every year.

The fact that this food is still made and consumed by many Cherokee people today says a great deal about persistence of native values and appreciation of long-standing traditions. Although it might seem as if this particular tradition is in danger of disappearing, we found evidence to indicate that, because so many Cherokees continue to appreciate ***ku-nu-che***, the incentive exists to ensure its availability in the foreseeable future. Our objectives are, therefore, both ethnobotanical and ethnoarchaeological: to document in as much detail as possible contemporary ***ku-nu-che*** making processes as practiced by Cherokees in and around Tahlequah; to discuss the meaning and significance of ***ku-nu-che*** in modern Cherokee society; and to explore the ecological and archaeological implications of the harvesting and processing of hickory nuts by Cherokee people today.

KU-NU-CHE IN MODERN CHEROKEE COUNTRY, OKLAHOMA

Most adults and teenagers, and even many children, who live or grew up as members of a Cherokee community in northeastern Oklahoma are aware of ***ku-nu-che***. They may not eat it often, but it is available at gatherings such as holiday and birthday dinners, church socials, and family reunions. ***Ku-nu-che*** is usually distributed in the form of balls (Figure 1), which can be purchased directly from individuals who process the raw nuts. ***Ku-nu-che*** balls are also sold at tribal health clinics, community grocery stores, and Cherokee Nation governmental offices. As a friend of one of our consultants said during an interview in Tahlequah, "When

FIGURE 1.—Uncooked ***ku-nu-che*** ball on right; nutshell sifted from one cooked ***ku-nu-che*** ball in front; undissolved nutmeat sifted from cooked ***ku-nu-che*** ball on left; cooked hickory nut soup in jar at rear. Note: one ball mixed with water and hominy or rice fills two or three jars.

you get away from here, nobody knows about ***ku-nu-che***, but around here, everybody knows it."

Whitekiller (second author of this paper) recalls that ***ku-nu-che*** was made from scratch, starting with nuts collected from trees in and near their yards, by members of her grandparents' generation living in the cluster of homes and gardens owned by the extended Drywater family on the outskirts of Tahlequah. McIntosh (third author of this paper) remembers a jar of cooked ***ku-nu-che*** soup often being available in the refrigerator of his grandparents' rural home in Mays County when he was growing up. Grandchildren and other family members were free to help themselves to cold or reheated ***ku-nu-che*** as a snack whenever they desired. ***Ku-nu-che*** was (and still is) commonly served at church dinners. Members of the congregation serve themselves from a large pot, usually ladling it into styrofoam cups using a gourd dipper or large spoon. One of Whitekiller's brothers was such a frequent visitor to the ***ku-nu-che*** pot as a child that he was jokingly called "***ku-nu-che*** boy" by the other Cherokee children playing nearby. The richness of this dish, however, causes most people to consume it in moderate amounts.

Ku-nu-che balls are made by a limited number of Cherokees. Many others buy the balls, which tend to be about the size of softballs, for approximately $5.00 to $6.00 each. The price of a ***ku-nu-che*** ball a few decades ago was $2.00. People who actually gather, crack, and pound hickory nuts and make ***ku-nu-che*** balls for distribution to others have special tools, although individuals who make a few balls each year for use by the immediate family may use only common household tools such as hammers or mallets. Sellers of ***ku-nu-che*** balls have been known to advertise on local call-in radio swap-meet shows or in newspapers that specialize in non-retail, person-to-person sales. Most knowledge about availability is, however, spread by word of mouth.

After providing historical background information, we introduce six serious ***ku-nu-che*** makers and tell how, where, and why they produce and distribute balls. We follow them through the steps of gathering or acquiring the nuts from others, of cracking, sieving, pounding, and forming the balls, of distributing (usually selling) the balls, and of cooking them. We then discuss motives for making ***ku-nu-che*** today and assess attitudes of Cherokee teenagers that make us optimistic about the survival of this traditional food. Finally, we briefly explore the archaeological implications of modern ***ku-nu-che*** making.

ARCHAEOLOGICAL, HISTORICAL, AND NUTRITIONAL BACKGROUND

The archaeological record attests to the importance of hickory nuts in subsistence strategies of native peoples in the Eastern Woodlands as far back as Late Paleoindian times, 8300 b.c.e. (Detwiler et al. 1998). Middens dating to the Middle and Late Archaic periods, 6000–1000 b.c.e., typically contain masses of charred hickory nutshell, indicating that hickory nutmeat was a staple food, possibly the single most important plant food for many Woodland foragers (Asch, Ford and Asch 1972; Gardner 1997; Lopinot 1982; Yarnell and Black 1985). Prodigious amounts of charred hickory nutshell in archaeological sites might exaggerate the dietary importance of this resource due to its mass, its density and subsequent durability, and to the likelihood that cracked pieces of nutshell were deliberately burned more often than the remains of other food plants that do not make useful fuel. Even so, the "nutritional superiority" (Gardner 1997:175) in terms of caloric content and protein complement of hickory nuts over other nuts reinforces the claim that hickories were a "first-line" food resource (Asch, Ford, and Asch 1972) for foragers in what is now the eastern United States. Gardner (1997) points out that only 340 g dry weight of hickory nutmeat is required to supply 2200 kcal intake, compared to 427 g of acorn and 604 g of maize. The fat content of hickory nuts is double that of acorns and approximately sixteen times that of maize, a fact that "may have been of considerable nutritional importance to Eastern Woodlands foragers" (Gardner 1997:162). Hickory nuts are higher than either acorns or maize in eight out of the ten essential amino acids, falling only slightly lower than maize in leucine and slightly lower than acorns in lysine (Gardner 1997:164).

An assemblage of human paleofeces from Salts and Mammoth Caves in Kentucky demonstrates that hickory nuts were frequently consumed during the middle first millennium b.c.e., at a time and place where native seed gardening had been integrated into the economy of hunters and gatherers (Yarnell 1969). Munson (1986) and Gardner (1997), in fact, hypothesize that management of nut groves (girdling and clearing to favor highly productive trees) was ecologically conducive to local domestication of plants such as sumpweed (*Iva annua* L.) and chenopod (*Chenopodium berlandieri* Moq.). Southeastern American Indians did not abandon nut harvesting even after intensification of maize (*Zea mays* L.) agriculture at 800–1200 c.e. Early European explorers and entrepreneurs enjoyed hickory nut foods and oils (Battle 1922; Talalay et al. 1984), and described groves near Indian villages where nut trees were managed in an orchard-like fashion (Hammett 1992).

Several European observers described the pounding of nuts and rendering of milk-like emulsion and oil. William Bartram, who lived among the Creeks in Georgia at the close of the eighteenth century, wrote:

> I have seen above an (sic) hundred bushels of these nuts belonging to one family. They pound them to pieces, and cast them into boiling water, which, after passing through fine strainers, preserves the most oily part of the liquid: this they call by a name which signifies Hiccory milk; it is as sweet and rich as fresh cream, and is an ingredient in most of their cookery, especially homony and corn cakes (Harper 1958:25).

In 1799, Benjamin Hawkins made the additional observations that Creek hickory nut processors pounded the nuts in a mortar and winnowed the pieces "to free the kernels as much as possible from the shells" (cited in Talalay et al. 1984:352). Hawkins also distinguished between hickory nut oil, which was separated when it rose to the top after water was added to the winnowed, pounded nuts, and "the milk," which remained below and was not separated.

John Lawson's observation of hickory nut use by unspecified Carolina Piedmont natives in 1701 is unusual in that it describes consumption of solid nutmeat fragments rather than milk or oil. Lawson (1709:98) observed nuts broken "very small betwixt two stones till the Shells and Kernels are indifferent small; And this Powder you are presented withal in their Cabins, in little wooden Dishes; the Kernel dissolves in your Mouth, and the shell is spit out." Lawson (1709:98–99) described another dish, however, "the Soup which they make of these Nuts, beaten, and put into Venison-Broth, which dissolves the Nut and thickens, whilst the Shell Precipitates, and remains at the bottom. This Broth tastes very rich."

Use of finely pounded hickory nutmeat to flavor and thicken soups and gruels obviously persisted among the eastern Cherokees. Writing about early nineteenth century Cherokee diet in the southern Appalachian region, Malone (1956:132) mentioned that a "tasty and frequent dish was ***ca-nu-chi*** (or ***car-nut-chee***), consisting of corn meal mush mixed with crushed hickory nuts." It is not clear if Malone was applying a term he knew only from the twentieth century to early nineteenth century hickory nut soup or if he had evidence for much earlier use of the food's name. We assume it is a very old Cherokee word. It appears in a 70-page manuscript written in English by a Cherokee woman, Wahnenauhi, sent by her from Oklahoma in 1889 to the Bureau of American Ethnology (Keys 1966). Wahnenauhi, whose English name was Lucy Lowrey Hoyt (Mrs. Lucy L. Keys after her marriage) graduated in 1855 from the Cherokee Female Seminary in Tahlequah and recorded valuable historical and cultural information in this manuscript. Major John Wesley Powell, Director of the B.A.E., wrote to her, however, "You will . . . understand that its value to the Bureau is comparatively small," attempting to justify a purchase price of $10 (Kilpatrick 1966:182). In the manuscript, Keys (1966:194) tells about a band of eastern Cherokees who migrated as far west as the Rocky Mountains in the early eighteenth century (before 1730) to get away from White settlers:

> Although the greater part of the Tribe was very unwilling to have them leave, yet, finding their efforts to persuade them to remain, were unsuccessful, they assisted them in making preparations for the journey: some furnished "pack ponies," while others loaded them with "Cuh-whe-si, tah" [hominy], "Cuh-nuh-tsi," dried venison, and other things. . . .

In an editorial footnote, Kilpatrick (in Keys 1966:194) describes ***cuh-nuh-tsi*** as a soup made of hominy and crushed hickory nuts and says the Cherokee people consider it to be their national dish.

Myra Perry (1974), whose M.A. thesis focuses on wild plant foods used by Cherokees living on or near the Quallah Reservation in North Carolina, recorded a description of "ko-nu-chie" processing during her independent fieldwork, quoting Lish Sneed, a Cherokee elder, as specifying that hickory nuts are pounded between two stones, but the shells and meats not separated by hand because "you know that you can't shell a hickory nut." According to instructions provided to Perry by Geneva Welch, another elder, the fine, greasy meal is formed into a ball about two inches in diameter and dissolved into a quart of boiling water: "As it melts, you have soup. You would describe it more or less as a beverage. Sweetening with sugar is optional" (Perry 1974:40). This recipe calls for the formation of balls, which were not mentioned in earlier accounts, but it does not break nut processing into the two stages of cracking and pounding that we found to be the rule in Oklahoma today.

A slightly earlier recipe collected from the same region, however, does specify the two-stage process. In the book *Cherokee Cooklore* (Ulmer and Beck 1951), detailed instructions for making hickory nut soup ("ga-nu-ge") are shared by Aggie Lossiah, granddaughter of the nineteenth century Cherokee chief John Ross. This recipe, collected in 1949–1950, is quoted here in full here because it corresponds closely to the way ***ku-nu-che*** is made today in eastern Oklahoma, yet retains traditional aspects that we know about only as memories:

> Gather hickory nuts or scalybarks, dry on a rack before the fire. When the nuts are dry crack them by using a large flat rock placed in a flat basket lined temporarily with a cloth, use a smaller rock to pound the nuts when placed on the larger rock. When the nuts are all cracked sieve them through a sieve basket. Place the kernels and small hulls that passed through the sieve in the corn beater and pound until the substance can be made into balls. Roll this into balls until ready for use. These balls will keep fresh for several days if the weather is not too warm.
>
> When ready for Hickory Nut Soup place a ball or more in a vessel that will hold water, pour boiling water over the balls while stirring constantly. If this is made into a thick soup it may be served with any type bread or dumpling. If it is made into a thin soup it may be used as a drink. As soon as enough soup has been poured off to leave a very thick mixture more water may be added. Do not drink the very last of the mixture because that is where the little bits of hulls are (Ulmer and Beck 1951:48).

CHEROKEE KU-NU-CHE BALL MAKERS

Six experienced producers of ***ku-nu-che*** balls generously shared their methods and motives with us during the course of this study (1996–1999). Their tools and techniques might not be representative of all Cherokees who engage in the cracking and pounding of hickory nuts today. These individuals all speak English in addition to the Cherokee language and all live in easily accessible locations, facts that might distinguish them from non-English speakers in more remote, rural areas, although only two of their households had telephones in 1999. Nevertheless, our consultants were all raised in families where Cherokee was spoken and where traditional Cherokee values were taught.

Two are retired men, Blue Rock and Daniel Beaver, both of whom lived until recently in Tahlequah (pop. 10,400) and made ***ku-nu-che*** balls in their homes. Sadly, Blue Rock passed away in October, 1999. Daniel Beaver moved to a smaller town in northeastern Oklahoma at approximately the same time. Narcy Holcomb is a homemaker whose children are teenagers and young adults. Mrs. Holcomb lives in a rural community a few kilometers southeast of Tahlequah and makes ***ku-nu-che*** balls in and near a shed behind her house. Ramona and Charley Carey are a semi-retired couple with grown children. They live in a rural community 20 km west of Tahlequah and move between a shed behind their house and their kitchen when making ***ku-nu-che*** balls. Patrick Bearpaw is a 21-year old college student and musician who, when not at school in Muskogee, Oklahoma, lives a few kilometers east of Jay, a town of 2,220 souls located 70 km north of Tahlequah. He makes ***ku-nu-che*** balls on the porch of his parents' home.

We observed only Blue Rock and Narcy Holcomb in the actual process of cracking and pounding nuts. Daniel Beaver has recently retired from making ***ku-***

nu-che, but allowed us to examine his tools. The Careys and Patrick Bearpaw were interviewed during the summer, when balls are rarely made, but they, too, demonstrated their tools and described their production methods.

GATHERING THE NUTS

Modern makers of *ku-nu-che* balls either gather nuts themselves from accessible trees they know to be good producers or barter bags of nuts collected by people who furnish them to primary producers in exchange for a few balls. Several of our consultants pursue both strategies, remaining flexible from year to year. Ramona and Charley Carey rely primarily on nuts gathered themselves from the property of non-Indian neighbors who grant permission without any interest in using the nuts themselves or in receiving *ku-nu-che* balls.

We spoke to nobody who goes into heavily wooded areas to collect hickory nuts, even though hickory trees comprise one of the dominant genera of the oak-hickory forests of northeastern Oklahoma. Most if not all gathering takes place in anthropogenically-opened locations: yards, parks, savanna-like pastures and hayfields, and fence rows. Patrick Bearpaw, for example, frequently gathers nuts from the grounds of his church—Pineridge Baptist Church—on the outskirts of Jay. Clients who bring him bags of nuts usually gather them in their yards. We speculate (but have no firm evidence) that many of the hickory trees left standing on Cherokee-owned property have been recognized as valuable sources of nuts for *ku-nu-che*, like native pecan trees left uncut across the Southeastern United States.

Ongoing selective management whereby the heaviest nut producers (the

FIGURE 2.—Blue Rock in the process of cracking nuts inside a cardboard box in the bedroom of his home in Tahlequah, Oklahoma.

FIGURE 3.—Narcy Holcomb's Stage 1 cracking tools.

"thrifty" trees) are favored by clearing away competitors for sun and root space probably differs little from pre-Contact management practices in the homeland of the Cherokees and other Southeastern tribes. Although hickory trees growing in closed-canopy forests produce fewer nuts that are much harder to gather given the undergrowth and unchecked competition from squirrels (Talalay et al. 1984), some are likely to have been gathered on occasion, especially during hard times. Wilma Mankiller, former Principal Chief of the Cherokee Nation, for example, includes hickory nuts as one type of wild plant food gathered by her large family when she was a child, along with walnuts, wild onions, dandelions, poke, mushrooms, berries, and wild grapes (Mankiller and Wallis 1993:34). She does not specify, however, that the nuts were gathered in the woods.

All source trees shown to us belong to the species *Carya texana* Buckl., by far the most common upland hickory in northeastern Oklahoma. Although tree books, including *Trees of Arkansas* (Moore 1986), refer to this species as the Black

TABLE 1.—Summary of ku-nu-che makers and their tools.

Maker(s):	Daniel Beaver	Charley and Ramona Carey	Patrick Bearpaw	Narcy Holcomb	Blue Rock
Background:	Retired elder	Semi-retired elders	21-year-old college student	Active homemaker	Retired elder (passed away Oct., 1999)
Processing site:	Apartment in Tahlequah	Shed, yard, and kitchen of home in rural area near Hulbert	Front porch of house in rural area near Jay	Shed and yard of home in rural area near Tahlequah	Bedroom of home in Tahlequah
Stage 1 tools (for cracking):	Hammer on concrete slab	Iron wedge on cylindrical iron pedestal	Wooden pestle on flat rock with concavity in center	Custom-made metal tool on round metal base	Custom-made metal mallet on rectangular metal base
Sifting implements:	Not observed	Metal colander with additional holes punched through	Plastic bowl through which he punched holes	Standard kitchen colander	Large coffee can with holes punched through bottom
Stage 2 tools (for pounding):	Metal curtain weight (8 inches long) in hand-made wooden box with metal insert	Custom-made (rebar & sledge hammer head) pounder in hollowed-out tree trunk mortar	Hand-made wooden pestle in large coffee can	Custom-made wooden pestle in large tin can	Aluminum baseball bat (Bombat™) in cast iron stock pot
Sources of hickory nuts:	Some gathered himself in local parks; some furnished by clients	Most gathered themselves from non-Indian neighbors' land in open woods and pastures	Some gathered himself from yards & churchyard; some furnished by clients	Furnished by friends and clients; some gathered herself from unspecified locale	Furnished by friends and clients, mostly from trees growing in their home yards
Primary motives:	To supplement income and to supply to friends	To ensure availability to friends, family, and themselves	To supply ku-nu-che to father's old clients and to earn spending money	To ensure availability to friends, family, and other Cherokee people	To supplement income and to have for personal use

Hickory, Cherokee ***ku-nu-che*** makers do not use that common name. Other than distinguishing "scalybarks" (*C. ovata* [Miller] K. Koch), they classify hickory trees simply as "hickernuts." None of them expressed a preference for any particular kind of hickory nut, although a few specified that "pignuts" (the local name for *C. cordiformis* [Wang] K. Koch), are too bitter. Thick-shelled species such as *C. lacinosa* (Michaux f.) Loudon and *C. ovata* (Miller) K. Koch that grow primarily on terraces of larger streams are known to be gathered by people who have access to them.

Cherokee people like and eat pecans (*C. illinoensis* [Wang] K. Koch), few of which grow in the Cookson Hills surrounding Tahlequah, but cannot use them for ***ku-nu-che*** either because of the hard, sharp septal tissues or the failure of pecan meat to form the correct constituency of ***ku-nu-che*** when pounded, or both (our consultants disagreed on the limiting factor). Black walnuts (*Juglans nigra* L.), like pecans, are much easier than hickories to shell by hand and do not lend themselves to mass pounding due to the ridged nutshell that traps bitter-tasting residue from the messy outer hull.

Yields of hickory nuts, like those of pecans and walnuts, fluctuate from year to year. Producers and consumers of ***ku-nu-che*** expect that nuts will be rare during bad years, and take the fluctuations in stride. We managed to purchase a few balls from Narcy Holcomb in June, 1999, even after two consecutive bad years, but most people today seem reconciled to wait for the next bumper crop. Fortunately, this occurred in the fall of 1999.

THE PROCESS OF MAKING KU-NU-CHE BALLS

Before processing can begin, hickory nuts must be dried for several weeks. Boxes or bags of whole nuts are left near a wood stove if either the nut gatherer or the ***ku-nu-che*** ball maker has one in their home. The meat of well-dried nuts separates more readily from the shell than does the meat of freshly fallen nuts.

Ku-nu-che producers use a diverse array of tools for cracking and pounding hickory nuts, but people we interviewed all divide the process into two main stages. First, nuts are cracked one at a time. Narcy Holcomb uses and Blue Rock used custom-made metal tools (See Table 1 for a summary) that were welded for them in machine shops. Blue Rock's nutcracker was a mallet made from two hollow metal pipe segments welded at right angles to each other (Figure 2). The openings at the ends of the shorter segment, which come into actual contact with the nuts, are covered by metal. Blue Rock set each nut, one at a time, on a base consisting of a flat, rectangular iron block approximately 25 cm long, 13 cm wide, and 4 cm thick. As shown in Figure 2, the block was set inside a cardboard box, and cracked nuts were then pushed off to the sides. Narcy Holcomb uses a metal, semi-cylindrical cracking tool designed by her husband, with an expanded, flat working end opposite a rounded end that she covers with a cut-off sock to protect her hand (Figure 3). For supporting the nuts she uses an iron base set inside a box, like Blue Rock, but her metal base is round. Daniel Beaver and the Careys also use metal cracking tools: a standard hammer and a large (18–20 cm long), unhafted, firewood-splitting wedge, respectively. Mr. Beaver cracks nuts on a concrete slab. The Careys crack nuts on top of a cylindrical iron pedestal less than

FIGURE 4.--Patrick Bearpaw holding the wooden pestle passed down from his grandfather, Lee Watermelon, to his father and then from his father to him. Patrick uses the wider end of the pestle to crack nuts on a flat rock with a concavity in the center, and he uses the narrower end to pound the sifted nuts inside a coffee can.

13 cm in diameter and approximately 10 cm high. This pedestal is placed inside a box lined with a towel or other fabric. Several of the older consultants said they preferred metal to stone hammers because metal will not spall, but acknowledged that they used stone tools in the past or else had observed others using smooth, round rocks.

Patrick Bearpaw uses the slightly wider end of a ca. 1.2 meter long wooden pestle that was passed down from his grandfather for cracking nuts (Figure 4). He cracked the nuts on top of a flat rock that he reported had become increasingly concave with use. Because this rock had been lost after the winter of 1998–99, he expected to search stream beds for a new rock for the 1999 season.

Nuts must be cracked one at a time in order to avoid contaminating the ball with worms or with bitter, spoiled nutmeat. Patrick Bearpaw's wooden pestle is wide enough on the nut cracking end to handle several nuts at a time, but he stressed that he cracks one nut at a time—occasionally two at the very most—so that he will not have to discard good nutmeat mixed with bad during multiple crushing. One or two initial blows reveal whether or not the nutmeat is usable. Each good nut is cracked into rather large pieces during the cracking stage. After five to ten whacks, the fragments—shell and all—are pushed off the metal, stone, or concrete base onto the lining of the box, and the next nut is cracked.

Between the first stage (cracking) and second stage (pounding), larger pieces of nutshell are removed by sifting. Narcy Holcomb uses a large-holed aluminum colander (Figure 5), and the Careys use a standard kitchen colander through which they have punched a number of larger holes (Figure 6). Blue Rock used a 2 lb 7 oz coffee can with screwdriver-sized holes punched in the bottom (Figure 7), and Patrick Bearpaw uses a plastic bowl with holes punched in it. The Careys and Patrick Bearpaw save the nutshell to be used as fuel in their wood-burning stoves. The others currently discard the nutshell, although Blue Rock burned it when he lived in the country and had a wood stove.

The second stage involves pounding the nutmeat together with the small pieces of nutshell that passed through the holes of the sifter. This process is necessary not only to crush the solid fragments into very small pieces, but also to release the fats into an oily or "gummy" constituency that allows the meal to be shaped into balls. Our consultants engage in pounding for 30 minutes or more per batch. The Careys use large batches—a dishpan-full—and have a large wooden mortar, so it can take 50 minutes of pounding before the meal is ready to be shaped into balls.

Pounding tools and basins, again, vary according to the individual specialist. The Careys, who use a traditional, hollowed-out wooden tree trunk or "stump" as a mortar (Figure 8), have the most unconventional "pestle," custom-made from four segments of ca. 1.4 meter long reinforcing bar ("rebar") welded at one end onto the long sides of an unhafted sledge hammer head (Figure 9). Narcy Holcomb uses a ca. 60 cm long wooden pestle custom-made by her husband for pounding ***ku-nu-che*** (Figure 10). She sits on a chair and pounds inside a large tin can. Blue Rock used an aluminum baseball bat (Bombat™ brand) to pound inside an iron stockpot (Figure 11). Daniel Beaver uses a heavy cylindrical steel curtain weight to pound ***ku-nu-che*** inside a square-sided wooden box that he made and affixed to a wider and heavier wooden base for steadiness. A square sheet of thin

FIGURE 5.—Metal colander used by Narcy Holcomb to sift larger pieces of nutshell after cracking and before pounding.

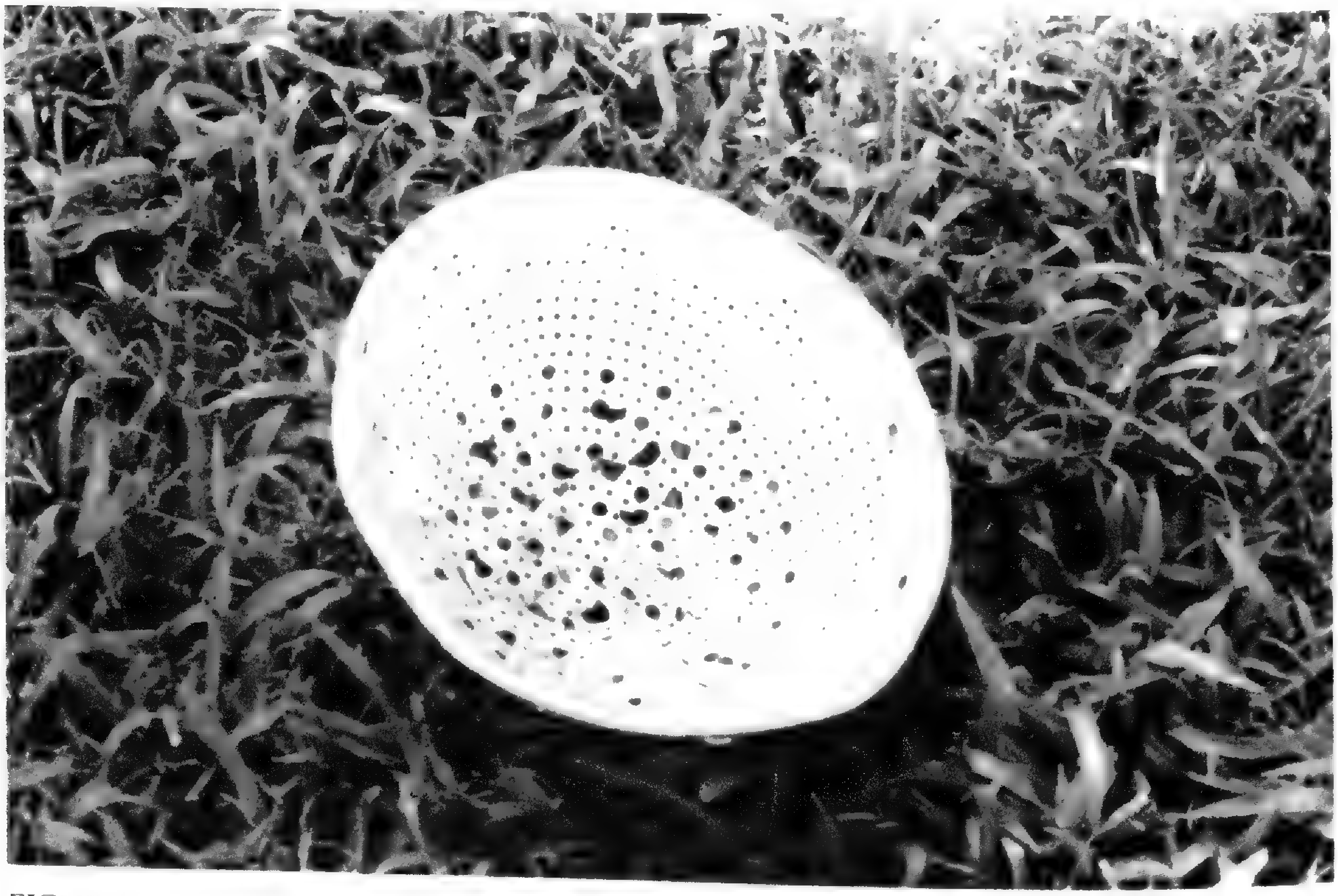

FIGURE 6.—Metal colander used by the Careys to remove larger pieces of nutshell between cracking and pounding.

metal is inserted into the inside floor of the box to form the pounding surface. This avoids splintering and allows the box to last longer.

Ku-nu-che balls tend to vary between 7 cm and 9 cm in diameter. Towards the end of his career, Daniel Beaver began selling the ***ku-nu-che*** meal loose inside plastic baggies rather than shaping it into balls, reasoning that the first step in the soup-making process is to break the ball back up into loose meal or dissolve it in hot water.

DISTRIBUTING THE PRODUCT

All but one of our experts sell their products without advertising. ***Ku-nu-che*** balls are sometimes commissioned ahead of time, with avid patrons furnishing the maker with more than enough hickory nuts to meet the buyers' needs, as mentioned earlier. Other interested clients begin inquiring about availability in November and December, and information spreads through the grapevine. Three of our consultants had no telephones, and it is likely that quite a few people who end up with their ***ku-nu-che*** balls also live without telephones. Word of mouth, therefore, is still a key mechanism for ***ku-nu-che*** distribution. Much of this communication takes place at church gatherings.

Patrick Bearpaw volunteered that people drive to his house to buy ***ku-nu-che*** balls from 50 or 60 miles (up to 100 km) away. Whitekiller and McIntosh have both observed balls in the offices of employees of the Cherokee tribal government and at Cherokee-run hospitals and health clinics. These balls had either been purchased on the premises or were available for purchase if one were to ask. Some

FIGURE 7.—Coffee can with holes punched through the bottom used by Blue Rock to remove larger pieces of nutshell before Stage 2 pounding.

FIGURE 8.—Hollowed-out tree trunk used by the Careys as a mortar for pounding already cracked and sifted hickory nuts.

of these balls, in the recent past, were produced by Blue Rock and Daniel Beaver. Patrick Bearpaw, Narcy Holcomb, and the Careys easily sell as many balls as they want to distribute out of their homes.

Members of the Cherokee community know that they can buy ***ku-nu-che*** balls in the late fall and early winter. Unused balls can be wrapped in aluminum foil and plastic baggies and stored in a freezer for several years. Uncracked nuts can be stored for months in a dry place such as behind a wood burning stove, but it appears that little nut processing in Oklahoma occurs after January and before November. Much of the hickory nut soup is served seasonally, as well, for Thanksgiving and Christmas holiday dinners. Frozen balls are saved for later occasions such as birthdays and anniversaries. Ramona Carey and her associates have served ***ku-nu-che*** soup made from the previous year's balls on the grounds of the Tsa-La-Gi Heritage Center for many years during Cherokee National Holiday,

FIGURE 9.—The Carey's pestle: four rods of "rebar" (reinforcing bar) welded onto a sledgehammer head. The rods are taped together with duct tape. Mr. Carey holds the tool upside down in this photograph to display the pounding end.

which is held over Labor Day Weekend, in early September. The Careys also enjoy eating ***ku-nu-che*** at the monthly gatherings of their large family.

COOKING HICKORY NUT SOUP

A ***ku-nu-che*** ball contains many small fragments of nutshell. Two balls, both made by Narcy Holcomb, were weighed separately before cooking and the nutshell weighed afterwards, having been strained through a flour sifter. The balls were found to consist of between 22% and 25% nutshell by weight. The recipe from *Cherokee Cooklore* (Ulmer and Beck 1951), provided above, does not call for straining to remove the nutshell, but rather for leaving a residue of nutshell fragments in the bottom of the pot. Everyone we consulted, however, including several

FIGURE 10.—Wooden pestle used by Narcy Holcomb for pounding nuts inside a metal can.

cooks who buy ***ku-nu-che*** balls but do not make them themselves, remove the shell fragments after dissolving the ball in hot water. The recipe in *Cherokee Cooklore* is also unusual in that it does not specify mixing melted hickory meal with hominy or rice, although it does mention bread or dumplings. Our experiences indicate that contemporary Cherokee cooks in Oklahoma usually use rice, but recognize that cracked hominy would be more traditional. Ramona Carey still prefers hominy, cooking it overnight in her crock pot before preparing ***ku-nu-che***.

Melvina King, a neighbor of Patrick Bearpaw, was kind enough to demonstrate the soup-making procedure in her kitchen. First, she boiled one-half bag of white rice in a large pot, cooking the rice until soft but leaving much water unabsorbed. When the rice was cooked, she put the ball into a one-quart (ca. 1 liter) measuring cup and added about two cups (ca. 0.5 liter) of hot water from the tap (other cooks said to add boiling water). The ball melted into a milky

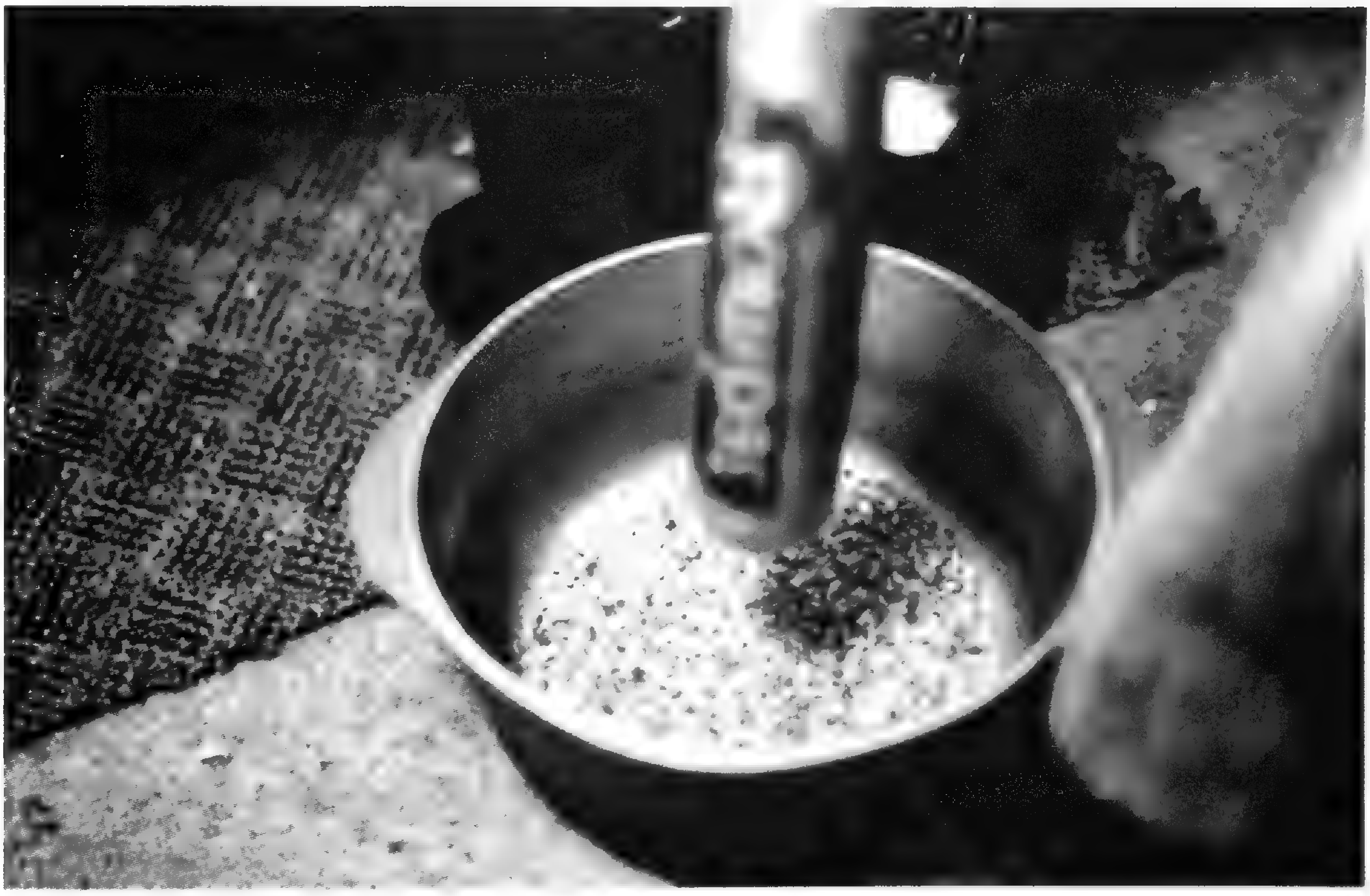

FIGURE 11.—Blue Rock's baseball bat (Bombat™) in use as a pestle, pounding cracked and sifted nuts inside a stockpot.

emulsion. Breaking up the lumps with a fork, Mrs. King poured this thick white fluid into a bowl through a standard flour sifter to remove the nutshell, and then added the hickory solution to the hot rice and unabsorbed water. Patrick Bearpaw said that a cloth is used for straining nutshell in his family, and Ramona Carey uses a sifter without a metal stirring apparatus (Figure 12). As the published recipe indicates, degree of thickness is a matter of personal preference.

Few Cherokees today, young or old, eat ***ku-nu-che*** without sweetening it with sugar. Due to health concerns, Mrs. King adds artificial sweetener rather than sugar. A few people we talked to said they know someone who prefers salt to sugar, and salting rather than sweetening the soup seems to have been more common in the past. ***Ku-nu-che*** is served hot, but eaten at community gatherings after it has cooled to room or outdoor temperature. The high fat content causes the soup to thicken as it cools. Those fortunate enough to have leftovers in their refrigerators can enjoy cold ***ku-nu-che***.

WHY MAKE KU-NU-CHE BALLS TODAY?

The people we interviewed who spend many hours each year cracking and pounding hickory nuts engage in this task for three main reasons. First, they are making a product that other members of their family and community desire. The product is particularly significant because it is a traditional Cherokee food, passed down through countless generations and key to the survival of their ancestors during famines. Narcy Holcomb's commitment extends to reintroducing ***ku-nu-che*** to native Muscogee communities near Okmulgee, west of Cherokee country,

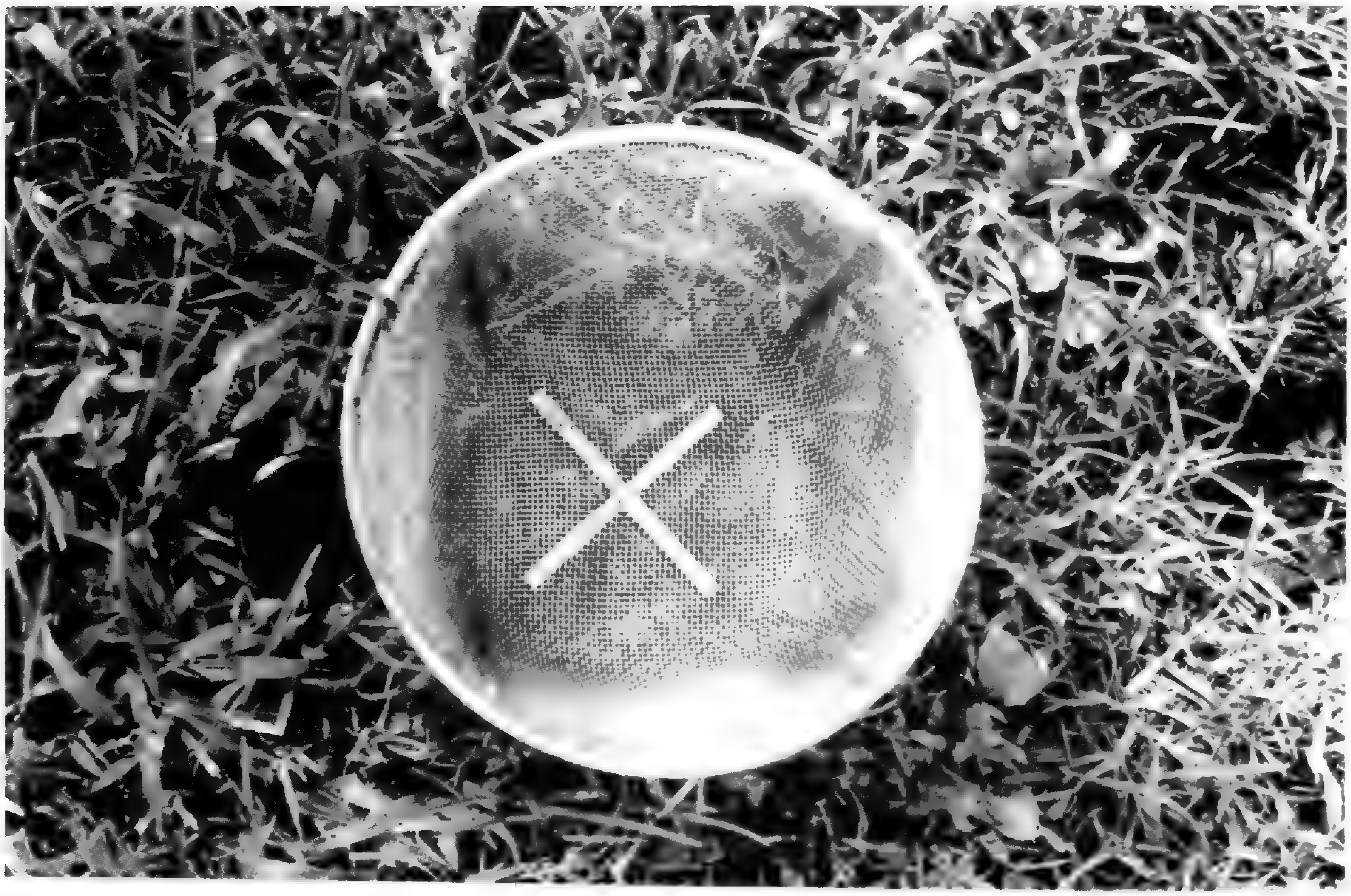

FIGURE 12.—Ramona Carey's sifter for straining out small pieces of nutshell while cooking hickory nut soup. Other cooks use muslin cloth or flour sifters with rotating handles.

where the tradition of hickory nut pounding seems to have been discontinued (Muscogee people prefer sofkee, a food more traditional for their tribe, made from sour corn meal mash). Second, most Cherokee nut processors enjoy eating ***ku-nu-che*** very much and want more than a few balls for themselves and their households. Blue Rock was the most avid ***ku-nu-che*** eater encountered during our study. His response to the question, "Why do you make ***ku-nu-che***?" was "I *love* ***ku-nu-che***."

Three of our consultants (see Table 1) also engage in the making of ***ku-nu-che*** in large or small part for economic reasons. When Patrick Bearpaw's father stopped making ***ku-nu-che*** four or five years ago, Patrick saw an opportunity to earn a significant amount of money as a teenager while working at home. At the same time, however, he knew he was providing a highly valued product to older relatives and other members of his father's clientele. The work is very hard, everyone agrees. Patrick Bearpaw was happy that it got easier as he grew and gained strength. Ramona and Charley Carey did not make ***ku-nu-che*** balls when they were younger because the balls had always been cheap and easy to buy in the past. When sources were no longer available, however, they took on the task.

We found it difficult to obtain quantitative information such as the number of hours spent gathering, cracking, and pounding nuts; total number of balls made in any given year; or amount of money earned. Blue Rock volunteered that by early January, 1998, he had earned $400.00 selling ***ku-nu-che*** that season. He had one more burlap bag full of nuts to process at the time. Few if any of our consultants make more than 100 balls per year, and the going price is $5.00 to

$6.00 per ball. Patrick Bearpaw's mother told about a year when her husband made 100 balls within a few days and had badly swollen hands.

In addition to those who make dozens of ***ku-nu-che*** balls for distribution, there are many other Cherokee men and women, probably helped by adolescents and children, who crack, sift, and pound enough hickory nuts for their families to have hickory nut soup at Thanksgiving, Christmas, or some other special occasion.

THE FUTURE OF KU-NU-CHE

In order to assess how younger Cherokees viewed ***ku-nu-che***, a survey was administered in April, 1996, by Whitekiller to 28 female students living in the dormitory and attending Sequoyah High School, a Cherokee Nation tribally operated boarding school in Tahlequah. The students ranged in age from 14 to 19 years and represented 18 various North American tribes, diverse in singular or multi-tribal heritage. Twenty-four (86%) of the students claimed tribal affiliation belonging to either the Cherokee or Creek, with each of these tribes representing an equal number of 12. In addition to the question determining tribal affiliation, students were asked the following questions:

1. What is your favorite food?
2. Do you know what ***ku-nu-che*** is? (A NO answer terminated the survey.)
3. Have you ever eaten ***ku-nu-che***?
4. If so, on what occasion: (a) family gathering; (b) church gathering; (c) cultural gathering such as a stomp dance; (d) holiday such as Christmas, New Year's Day, or Thanksgiving; (e) no special occasion?
5. How often do you eat ***ku-nu-che***: (a) one time only; (b) about once a year; (c) about once a month; (d) about once every two weeks or more often?
6. How important do you think ***ku-nu-che*** is to Indian culture: (a) very important; (b) somewhat important; (c) not at all important?
7. Do you know how to make ***ku-nu-che***? If so, who taught you how to make it: (a) grandparent(s); (b) parent(s); (c) other relative; (d) someone else?
8. If you do not know how to make ***ku-nu-che***, would you be interested in learning how to make it? If YES, who would you ask to teach you: (a) grandparent(s); (b) parents(s); (c) other relative(s); (d) someone else?

Eighteen (64%) of the students listed their favorite food as being pizza or hamburgers, with the remainder naming their preferred cuisine as Mexican, Chinese or "Indian tacos." When asked about ***ku-nu-che***, 14 (50%) of the students answered they did not know what it was, nor had they ever tasted it. Of this number, nine (64%) claimed no Cherokee tribal affiliation. Four others identified multi-tribal lineage including Cherokee. One student who identified herself as being only Cherokee did not know what ***ku-nu-che*** was and had never tried it.

Fourteen (50%) students reported they knew what ***ku-nu-che*** was, and 12 of the 14 had tried this food. For those who were familiar with ***ku-nu-che***, 11 (79%) named themselves as being Cherokee, while three (21%) claimed no Cherokee tribal affiliation. The two respondents who stated they had not tried it claimed Native heritage to more than the Cherokee tribe. When asked about the occasion(s) on which ***ku-nu-che*** was served, nine students (64% of those familiar with it) reported it was served on holidays such as Christmas and Thanksgiving. Two (14%) answered that ***ku-nu-che*** was present at family gatherings, with the remaining three respondents indicating they had seen this food served at cultural gatherings, church meetings, and for no special occasion, respectively.

In response to the question, "how often do you eat ***ku-nu-che***?," five (42% of those who had eaten it) answered they had it once a year. Four (33%) reported they had tried it one time, two (17%) had it about once a month, and one (8%) indicated she ate it about once every two weeks or more often.

Six (50%) of the 12 students who had eaten ***ku-nu-che*** responded they believed it to be 'very important' to Indian culture. Out of these six, two indicated they knew how to make it and were taught to make it, in one case by her parents and in the other case by 'someone else.' The remaining four stated they would be interested in learning how to make ***ku-nu-che***, with two indicating they would ask their parents or another relative to assist her. Two responded they would ask someone other than family to teach them how to make it.

Five (42%) of the students stated they believed ***ku-nu-che*** to be 'somewhat important' to Native culture. Four of these five indicated they would be interested in learning how to make it and would ask their grandparents or other relatives to teach them. One responded that although she thought ***ku-nu-che*** was somewhat important to Native culture, she had no interest in learning how to make it. All of these students with the exception of one responded that they were members of the Cherokee tribe. The remaining student (not identified as Cherokee) indicated she thought ***ku-nu-che*** was not at all important to Native culture and she had no interest in learning how to make it.

To summarize the results of this survey, half of the 28 high school females residing in a Native American boarding school in Tahlequah and representing various tribal affiliations were familiar with ***ku-nu-che***. Most of the students who knew what ***ku-nu-che*** was and had eaten it identified themselves as Cherokee and reported they had eaten the food at least once a year during holidays. All but one of this group of students indicated they believed ***ku-nu-che*** was very important or somewhat important to Native culture. Most in this group who did not know how to make it expressed a desire to learn and stated they would ask their parents or another relative to teach them.

In spite of a drop-off in frequency of ***ku-nu-che*** use during the late twentieth century, the tradition is still fairly strong. A demand for the balls exists in Tahlequah as well as rural parts of Cherokee, Sequoyah, Adair, and Delaware Counties. Men and women of various ages have demonstrated their willingness to take on the work of cracking and pounding hickory nuts after available sources dried up. When asked if any of her children had made ***ku-nu-che*** balls themselves, Ramona Carey said no, but that she herself had not done so at their age either, and somebody who now depends on her and her husband might well take over when they stop. This statement reinforces the Sequoyah High School student survey regarding students' perceptions of the importance of ***ku-nu-che*** making for continued Cherokee traditions and culture. Mrs. Carey pointed out that the process is labor-intensive and tedious, but straightforward. The tools are not elaborate, and no extended training period is required. Any motivated, able-bodied person can do the job. Incentives are both economic and cultural.

ARCHAEOLOGICAL IMPLICATIONS OF MODERN KU-NU-CHE

The early ethnohistoric record, to our knowledge, makes no mention of solid balls made of sifted and pounded hickory nutmeat mixed with smaller pieces of nutshell. Therefore, archaeologists have emphasized liquid products, especially the milk and oil rendered from boiling nutmeat and cracked nutshell (e.g., Gardner 1998; Reidhead 1981; Talalay et al. 1984). Cherokee people commonly use metal tools to make ***ku-nu-che*** balls today, but most use stone or wooden tools in at least one stage of the process, and all report that their ancestors used stone and wooden tools to make ***ku-nu-che*** in both the near and distant past. We can think of no technological reasons to dismiss the practice of forming nutmeat and shell into balls before European contact, and good reasons to infer that native people—especially those who were not fully sedentary or who gathered hickory nuts some distance from their dwellings—reduced the weight and bulk of the nuts by making balls close to the source. This would have been easier than carrying either bags of whole nuts or pots or skins full of oil when overland transport was necessary. This strategy might not have been workable in parts of the country where warm weather persists into late autumn, because balls would have spoiled within weeks without refrigeration. Many parts of the Eastern Woodlands, however, are cool enough by November for storing oily balls for several weeks at least.

Archaeological reports that include only counts or only weights of nutshell are inadequate for determining whether or not an assemblage represents the actual cracking and pounding stages. A low total nutshell weight—even with a relatively high nutshell fragment count—might be interpreted as indicating that hickory nuts were insignificant at a site where a great deal of pre-sifted nutmeat mixed with many small pieces of shell had been imported from elsewhere. A ratio such as number of fragments of nutshell divided by their weight would be more revealing than count or weight alone, although post-depositional factors at specific sites must be carefully considered.

A second ethnoarchaeological implication of modern ***ku-nu-che*** making is that the process involves two main stages: first cracking and then pounding, with sifting in between. Cracking is conducted one nut at a time so that bitter nutmeat and worms do not contaminate the meal. This is significant for at least two reasons. First, archaeologists who have experimented with cracking hickory nuts found the process to be more time-efficient when they started *and ended* with a wooden mortar and pestle in which numerous nuts could be crushed all at the same time, rather than reducing nuts to small pieces using *only* a grinding stone and hand-held mano that could crush only one or two nuts at a time (Reidhead 1981). It seems, however, that the process is not initiated in the mortar, although Patrick Bearpaw does use a wooden pestle to crack nuts—one at a time—over a large stone base. Regardless of which tools are used for Stage I cracking, each nut is whacked only a few times. Cherokee ***ku-nu-che*** ball makers do not use Stage I tools to render nuts into small pieces. Instead, they eliminate large pieces of coarsely cracked shell by sifting, then transfer the loosened nutmeat and smaller shell fragments to a mortar or mortar-like metal container for pounding into fine particles.

Another implication of the two-stage process is obviously that two sets of tools would have been seen as necessary or at least highly desirable. Archaeologists tend to associate wooden mortars and pestles with maize rather than nuts, but mortars—both wooden and bedrock—may have been used for thousands of years before maize was introduced into eastern North America. It is extremely interesting that wooden mortars are identified as "***ku-nu-che*** blocks" or "***ku-nu-che*** stumps" at two historical sites in eastern Oklahoma: Tahlonteeskee (Figure 13), and the birthplace of Sequoyah, inventor of the Cherokee alphabet. This terminology would be consistent with a developmental sequence in which wooden mortars retained their original Cherokee name even after they came to be used mostly for pounding maize rather hickory nuts. Even in regions where all nuts were rendered directly into milk or oil rather than into an intermediate solid ball form, a two-stage process means that two sets of tools were probably involved whenever possible.

A final lesson learned from modern ***ku-nu-che*** makers is that they consider hickory nutshell to make good fuel, and some people burn it in their wood stoves even today. This is a minor point, but the question has been raised during discussions of taphonomy and the degree to which hickory nutshell is over-represented in the archaeological record (see Lopinot 1982:729). Frequent use of nutshell for fuel is likely to have increased the numbers of fragments in the archaeological record of open sites and wet rockshelters, even though many specimens would have burned to ash in the process. If hickory nutshell had not been routinely and purposefully burned as fuel, a far higher proportion would have rotted away over the years.

CONCLUSIONS

Hickory nuts were for thousands of years a staple food and the source of cooking oil and soup stock used by ancestors of the Cherokees and other Eastern North American Indians. After intensification of maize agriculture (ca. 1000 c.e.), hickory nuts remained a highly valued supplement. They were the source of flavorful oil and stock used for cooking various dishes in which maize was usually the primary ingredient. Hickory nuts also constituted a critical fallback or famine food in years when crops failed. Several hundred years after initial European contact, the practice of rendering hickory oil apparently ceased, but the process of cracking and then pounding nuts and shells *en masse* and storing them in the form of balls to be cooked either alone or with hominy in soup-like dishes survived. Throughout the twentieth century, the Cherokee dish known as ***ku-nu-che*** persisted as a highly appreciated and frequently-to-occasionally served traditional delicacy.

Makers of ***ku-nu-che*** balls in Oklahoma today are pragmatic and flexible about their tools. Non-traditional implements are used if old-style stone or wooden tools are unavailable. Metal tools have advantages over stone tools that might spall or shatter and wooden tools that might decay. Several producers have built or commissioned unique tools used only by themselves for the purpose of crack-

FIGURE 13.—Traditional wooden mortar and pestle on display at Tahlonteeskee, near Gore, Oklahoma, capital of the Western Cherokee Nation between 1828 and 1839. The sign in the window shows a Cherokee woman using a mortar and pestle, along with the words "Ga-Na-Ge Ka-No-Na: The big end gives weight to pound corn (***selu***) or hickory nuts (***ga-nu-ge***) in the (***ka-no-na***) or stump."

ing or pounding hickory nuts. Sifting baskets have been replaced by metal colanders and sifters. In spite of the popularity of new, modern tools and the use of tools that look very different from their ancient counterparts, the process always proceeds through the stages of cracking nuts one at time, sifting out the larger pieces of nutshell, and then pounding the smaller pieces of shell and nutmeat until enough oils are released to allow the maker to form the mixture into balls. The making of balls out of hickory nuts may not have been described ethnohistorically, but we see no reason to doubt that the practice has considerable antiquity.

Today, hickory nut soup is served less frequently than in the past, but all signs point to its survival. Although the production of ***ku-nu-che*** balls consumes a good deal of time and demands physical labor, no lengthy apprenticeship or extraordinary skills are required, and appropriate tools can be purchased or fashioned without great expense. Younger Cherokees demonstrate the motivation to carry on the tradition out of dedication to their heritage, a desire to reinforce cultural identity, and a sense of responsibility to satisfy the desires of elders, combined with the incentive to make extra money. We hope that ***ku-nu-che*** will be enjoyed by tens of thousands of Cherokees for generations to come.

ACKNOWLEDGMENTS

We are grateful beyond measure to Patrick Bearpaw, Daniel Beaver, Ramona and Charley Carey, Narcy Holcomb, and Blue Rock for sharing their valuable knowledge. We extend sincerest sympathy to the Rock family and thank them for allowing us to observe some of the last ***ku-nu-che*** making hours of their beloved grandfather, father, and husband. Among the many other people who helped us during this project, we are indebted to Florence Cornell, Johnny and Luke Drywater, Lois Johnson, Melvina King, Julie Reid, and Betty Smith. Mrs. Cornell's aid was especially crucial in that she helped conduct the survey at Sequoyah High School and shared ***ku-nu-che*** traditions. Mrs. Smith told us how she makes ***ku-nu-che*** and provided useful comments on a draft of the manuscript. Sincere thanks go to Fiona Marshall, Nancy Turner, and Patty Jo Watson for also reading earlier drafts of the paper and suggesting improvements. Maria Bruno and Pascal Boyer kindly furnished the Spanish and French abstracts. Research was partially funded by a Faculty Research Grant from the College of Arts and Sciences, Washington University in St. Louis.

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Journal of Ethnobiology 21(2): 29–51 Winter 2001

PURSUING THE FRUITS OF KNOWLEDGE: COGNITIVE ETHNOBOTANY IN MISSOURI'S LITTLE DIXIE

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ABSTRACT.—This study investigates ethnobotanical knowledge variation in Little Dixie, a folk cultural region in Central Missouri. Data were obtained from twenty "experts" and twenty "novices" who free-listed the names and uses for wild plants and rated them according to cultural usefulness, ecological value, beauty, and overall appeal. It is hypothesized and demonstrated that novices privilege species that are perceptually distinctive and ecologically abundant, while experts emphasize species with high use potential. Accordingly, novices emphasize beauty, a form-based variable, in their evaluation of listed species, while experts emphasize cultural utility, a function-based variable. These results suggest that the acquisition of ethnobotanical expertise entails a shift from morphological, imagistic information processing to the cognitive assimilation of abstract, utilitarian factors gained through learning and cultural experience.

Key words: folk biology, cognition and expertise, free-listing, U.S. regional cultures.

RESUMEN.—Este trabajo investiga la variación del conocimiento etnobotánico en Little Dixie, una región cultural popular en Misuri central. Los datos se obtuvieron de veinte "expertos" y veinte "novatos" que escribieron una lista al azar de los nombres y los usos de plantas silvestres y las calificaron de acuerdo a la utilidad cultural, valor ecológico, belleza, y el atractivo general que tienen. Se hace hipótesis y se demuestra que los novatos privilegian las especies de plantas que son perceptualmente distintivas y ecológicamente abundantes, mientras los expertos hacen hincapié en las especies que tienen potencial alto de utilidad. Como corresponde, los novatos acentúan la belleza, una variable basada de forma, en su evaluación de especies puestas a lista, mientras los expertos ponen énfasis en la utilidad cultural, una variable basada de la función. Estos resultados sugieren que la adquisición de competencia etnobotánica conlleva un cambio morfológico, procesamiento de información basada de imágenes a la asimilación cognitiva del resumen, factores utilitarios ganados por el aprendizaje y la experiencia cultural.

RÉSUMÉ.—Cette étude examine la variation de connaissances éthno-botaniques dans le Little Dixie, une région culturelle du Missouri central. Les données ont été obtenues de vingt "experts" et vingt "novices" qui ont énuméré les noms et les usages de plantes sauvages et les ont évaluées selon leur utilité culturelle, leur valeur écologique, leur beauté, et leur attrait général. Il est démontré que les novices privilègient les espèces qui sont perceptuellement distinctes et abondantes dans l'environnement alors que les experts prêtent d'avantage attention aux espèce qui ont un usage potentiel élevé. En conséquence, les novices soulignent la beauté, une variable basée sur la forme, dans leur évaluation des espèces énumérées alors que les experts soulignent l'utilité culturelle, une variable basée sur la fonction. Ces résultats suggèrent que l'acquisition d'expertise éthno-botanique présuppose une modification allant du traitement morphologique et imagée de l'information à l'assimilation de facteurs abstraits et utilitaires grâce à l'étude et à l'expérience culturelle.

INTRODUCTION

Ethnobiological knowledge is a complex phenomenon based fundamentally on human recognition of the perceptual and functional attributes that characterize living things. Over the past two decades, considerable progress has been made toward understanding how people transform their natural worlds into meaningful cultural categories (e.g., Brown 1984, Hunn 1982, Berlin 1992, Medin and Atran 1999, Ford 2001, etc.). Relatively neglected, however, is the study of variation within ethnobotanical knowledge systems. Research indicates that the differences in how people perceive biological domains are related to levels of respondent expertise, whereby experts have access to more kinds of information about a domain than do novices, resulting in different patterns of domain organization. For instance, Boster and Johnson (1989) demonstrate that novices rely on mostly morphological cues when learning about and classifying marine fishes, while experts make use of morphological signals in addition to utilitarian information gained through personal experience. However, it remains yet undetermined whether or not experts and novices emphasize common referential features in their conceptualization of plants or if they maintain separate patterns of ethnobotanical cognition. To answer the question, this project will explore the structure of ethnobotanical knowledge among residents of a regional culture in the U.S. Midwest.

SCOPE OF THE STUDY

A defining feature of expertise is the ability to recognize and process multiple kinds of information about a cognitive domain. For example, becoming an expert usually entails commanding a diversified understanding of how things can be used practically or categorized cognitively. This is true for the rare coin expert, who knows the salient features to examine when appraising unusual currency, and for the wild plant expert, who is aware of the numerous cultural uses for local flora. Furthermore, cognitive anthropological research has noted that the acquisition of expertise brings about a gradual shift in the learning process itself. That is, novices demonstrate highly imagistic recognition and respond more readily to easily perceptible morphological features when describing a domain. Experts, on the other hand, utilize more abstract systems of discrimination and emphasize the less obvious utilitarian features when evaluating items (e.g., Boster and Johnson 1989, Chick and Roberts 1987, Kempton 1981). This progression has been noted in a number of related psychological studies, ranging from expert-novice understanding of physics problems (Chi et al. 1981) and X-ray pictures (Lesgold et al. 1988), to studies of how connoisseurs and amateurs appreciate wine (Solomon 1997) and art (Hekkert and Van Wieringen 1997).

Two hypotheses stem from these collective findings. Given the presumed differences in how experts and novices approach and process information about

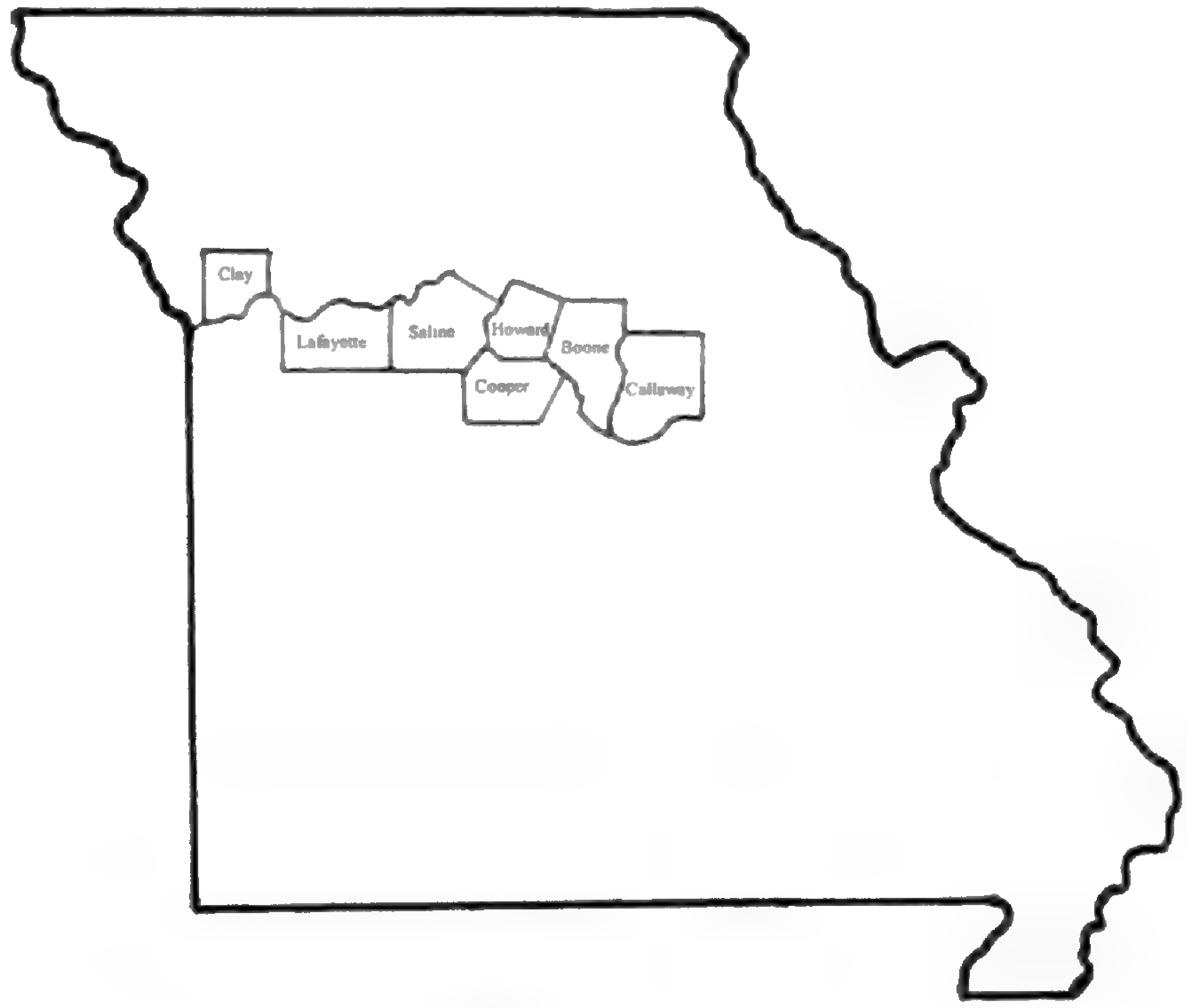


FIGURE 1.—Little Dixie Counties of Missouri.

a domain, it follows that novice and expert plant users emphasize different focal attributes in their cognitive articulation of wild botanicals. That is, novices are expected to prioritize species that are perceptually distinctive and ecologically abundant, while experts should focus on species with salient use potential. Secondly, it is proposed that novices prioritize beauty, a form-based variable, in their appreciation of plants, and that experts emphasize utility, a function-based variable, in their plant evaluations.

DESCRIPTION OF THE STUDY REGION

"Little Dixie" is the name given to the corridor of gently rolling farmland that straddles the Missouri River in the central section of the state. In an historical account of slavery and cultural life in Little Dixie, R. Douglas Hurt (1992) proposes a map of the area that includes Callaway, Boone, Cooper, Howard, Saline, Lafayette, and Clay counties (Figure 1). Situated roughly between the corn belt and the Ozark Mountain region, Little Dixie represents a transition zone of the United States where the glaciated plains join the Interior Highlands to the south. The landscape is ecologically diverse, and supports between 80 and 90 native plant species that are absent or rarely found elsewhere in the state (Yatskievych 1999). The region's physiographic character is one of rolling prairies, savannas, upland forests, and sandstone bluffs along the streams and rivers. Oak, hickory, and cedar predominate in the timbered hills and bluestem-dominated tallgrasses carpet the fields and savannas. Birch, maple, poplar, and willow are common along the bottomlands of the Missouri River and its numerous tributaries.

The Cultural Landscape.—Little Dixie has been described as "a section of central Missouri where Southern ways are much in evidence—an island in the Lower

Midwest settled mostly by migrants from Virginia, Kentucky, Tennessee, and the Carolinas, who transplanted social institutions and cultural expressions to the new landscape'' (Marshall 1979:400). Many of the early migrants were prominent families whose plantations and fortunes were built around farming tobacco, hemp, cotton, and indigo across the farmlands of the Upper South. These wealthy aristocrats brought with them their Southern culture, including a plantation economy that involved the use of slaves and the sale of crops to the commercial market. Other settlers of Little Dixie included subsistence farmers, merchants, builders, and teachers who also originated from Kentucky and Virginia. While the Civil War brought an end to slavery and plantation life in Little Dixie, the tenacious Upper South cultural heritage has persevered in lives and minds of the people. The distinctly Southern identity of Little Dixie is apparent today through the local dialect, antebellum architecture, foodways, traditional music, and the strong influence of the Democratic party (Crisler 1948; Marshall 1979, 1981; Skillman 1988; Hurt 1992). Agriculture remains a strong component of the present-day economy in Little Dixie, where soybean, hay, wheat, corn, cattle, and hogs are commonly raised. The economic base has diversified considerably to include education, health care services, manufacturing, and a strong retail and wholesale industry, each of which has brought growth and progress to the region.

Wild Plants, Social Relations, and Group Identity.—The people of Little Dixie are devoted to a lifestyle of relative independence. One of the ways in which people maintain and express their self-sufficiency is through the frequent and regular procurement of wild plants for a variety of purposes. A number of local species are valued for their purity and wholesomeness, and, in some cases, for their rarity. Whether enjoyed as food, taken as medicine, or valued aesthetically, wild plant procurement plays an important role in the social lives of the women and men of Little Dixie. The knowledge and work required in locating these plants from the outdoors and preparing them for personal use is developed over time by participating in family walks outdoors, helping out in the kitchen, and listening to the stories of mothers, fathers, and grandparents. Procuring and sharing wild plant resources symbolizes a neighborly communion with the local landscape, the sharing of personal skill, effort, and craftsmanship, a reverence for traditional customs, and the expression of group identity.

METHODS AND MATERIALS

In order to examine the patterns of variation in ethnobotanical knowledge and classification in Little Dixie, 20 experts and 20 novice (non-expert) consultants were selected from the seven counties within Little Dixie's borders. Most of the respondents were selected from Howard, Boone, and Callaway Counties, which constitute the cultural and geographic locus of the region. Howard County boasts a growing reputation as both a center for commercial plant growers and a hub for local herbalists. At least one expert and one novice respondent was consulted from each of Little Dixie's seven counties. Botanical knowledge has been shown to vary substantially among expert consultants (e.g., Medin et al. 1997). Therefore, to ensure an adequate representation of different types, experts in the sample included both males and females with both commercial and non-commercial interests in wild plant use. Some experts operate private herbal practices, others sell botanical products at stores or from their homes through mail-order business or have contracts to cultivate selected species, while others are simply local people—from farmers to schoolteachers—who have exceptional knowledge of local flora. Novices also included male and female Little Dixie natives of mixed ages, but for whom wild plant collecting is neither a commercial activity nor a serious hobby. Both expert and non-expert consultants were selected by reputation (Martin 1995), followed by the "snowball" technique (Bernard 1994) in which one respondent recommends another, who in turn recommends another, and so forth.

Using the same interview protocol for experts and novices, both groups were consulted during interviews that spanned from the summer of 1997 to the fall of 1999. Interviews consisted of a semi-structured interview containing open-ended questions, free-listing, and a sociodemographic survey. To begin the interview, consultants were casually queried about their personal experience with local flora. Questions included "how did you come to know about wild plants?" and "what do you find meaningful about using wild plants?". The first section of the survey included a free-list task (Weller and Romney 1988, Bernard 1994), an effective elicitation tool for ethnobotanists (Martin 1995, Cotton 1996). Respondents were asked to write down the names of as many kinds of locally available, useful wild plants as they could think of, using their own judgment of what is considered *useful*. Respondents were then asked to indicate how each plant is used (e.g., medicinal, edible, ornamental, etc.), the specific application for the plant (e.g., pie filling, heartburn remedy, etc.), the part of the plant that is used (e.g., stem, root, etc.), and the mode of preparation (e.g., air-dried, boiled in water, etc.). This data collection process, known as successive free-listing (Ryan et al. 2000), provides a rich, descriptive database for examining plant use patterns, and has been used in a number of ethnobotanical surveys.

There is reason to believe that experts and novices exhibit different expressive and aesthetic evaluations of the constituents of semantic domains[1] (e.g., Chick and Roberts 1987), which may in turn effect how domains are organized cognitively (Nolan and Robbins 2001). To explore these differences, a rating exercise was administered with the free-list task in which respondents of both groups were asked to assign a number between one and five to each named plant based on the evaluation of four different variables: overall appeal, usefulness, ecological value, and beauty. The mean ranks were calculated on all four variables for the most commonly mentioned plants, and a multiple correlation analysis was performed on these ranks to determine how the two groups compare in their conceptual evaluation of salient species.

RESULTS

Analysis of the Free-Lists.—Of the 187 plant names collected from both groups, experts listed a total of 160 plants, comprising 85.6% of the composite list. For the experts, list lengths ranged from 12 to 61 plant names, with a median of 25.5. The mean list length was 26.4 plant names, with a standard deviation of 13.3 and a coefficient of relative variation (CRV) of .504 (see Table 1 for a quantitative

TABLE 1.—Number of wild plants and applications reported by experts and novices.

	Number of plants mentioned		Number of applications listed	
	Experts	Novices	Experts	Novices
Mean	26.7	9.1	37.4	11.1
Median	25.5	8.5	36	10.5
S.D.	13.3	3.8	18.9	4.9
Maximum	61	17	88	21
Minimum	12	5	14	5

summary of free-list results, and Appendix 1 for an inventory of all listed species and uses). The total number of applications for wild plants listed by experts was 749, representing 77.2% of the total. The number of applications listed ranged from 14 to 88, with a median of 36. On average, experts listed 37.4 applications with a standard deviation of 18.9 and a CRV of .505.

Novices listed a total of 79 wild plant names, constituting 42.2% of the composite plant listing. The length of the novices' plant lists ranged from 5 to 17, with a median of 10.5. The mean list length was 11.4 with a standard deviation of 3.8 and a CRV of .333. Novices listed a total of 221 applications for wild plants, or 22.8% of the total inventory. These applications ranged in number from 5 to 21, with a median of 10.5. The mean number of listed applications for novices was 11.1, with a standard deviation of 4.9 and a CRV of .441. A comparison of the two groups reveals, as expected, a higher mean number of plants free-listed by the expert consultants. The difference in means, 26.4 plants listed by the experts and 11.4 for the novices, is statistically significant ($t = 5.4$, $p < .001$). Statistical significance was also found for the difference in the mean number of applications reported, 37.4 for experts and 11.1 for novices ($t = 6.02$, $p < .001$). Figure 2 graphically displays the positive correlation between the number of plants and the number of applications reported by both groups. As shown in Figure 2, knowledge of plant utilization rises incrementally with an increase in plant-naming knowledge for both consultant groups. The number of plants named and the number of applications reported are significantly correlated for novices ($r = .87$, $p < .001$) and experts ($r = .91$, $p < .001$). While there is some overlap between the level of ethnobotanical knowledge demonstrated by the two groups, the expert-novice distinction is reasonably clear, as indicated by the dispersal of data points on Figure 2.

The Salience of Listed Plants.—The B values given in Table 2 measure free-list salience, or the proportional precedence of a listed plant over others. B is computed as follows:

$$B = \frac{n(n + 2\bar{n} + 1) - 2\sum r(n)}{2n\bar{n}}$$

where n is the number designated subset items, $\bar{n}$ is the number of complement designated subset items and $\Sigma\, r(n)$ is the sum of the free list ordered ranks of the designated subset items (Robbins and Nolan 1997). Here, a B value was computed for each plant free-listed by experts and novices. To calculate individual salience

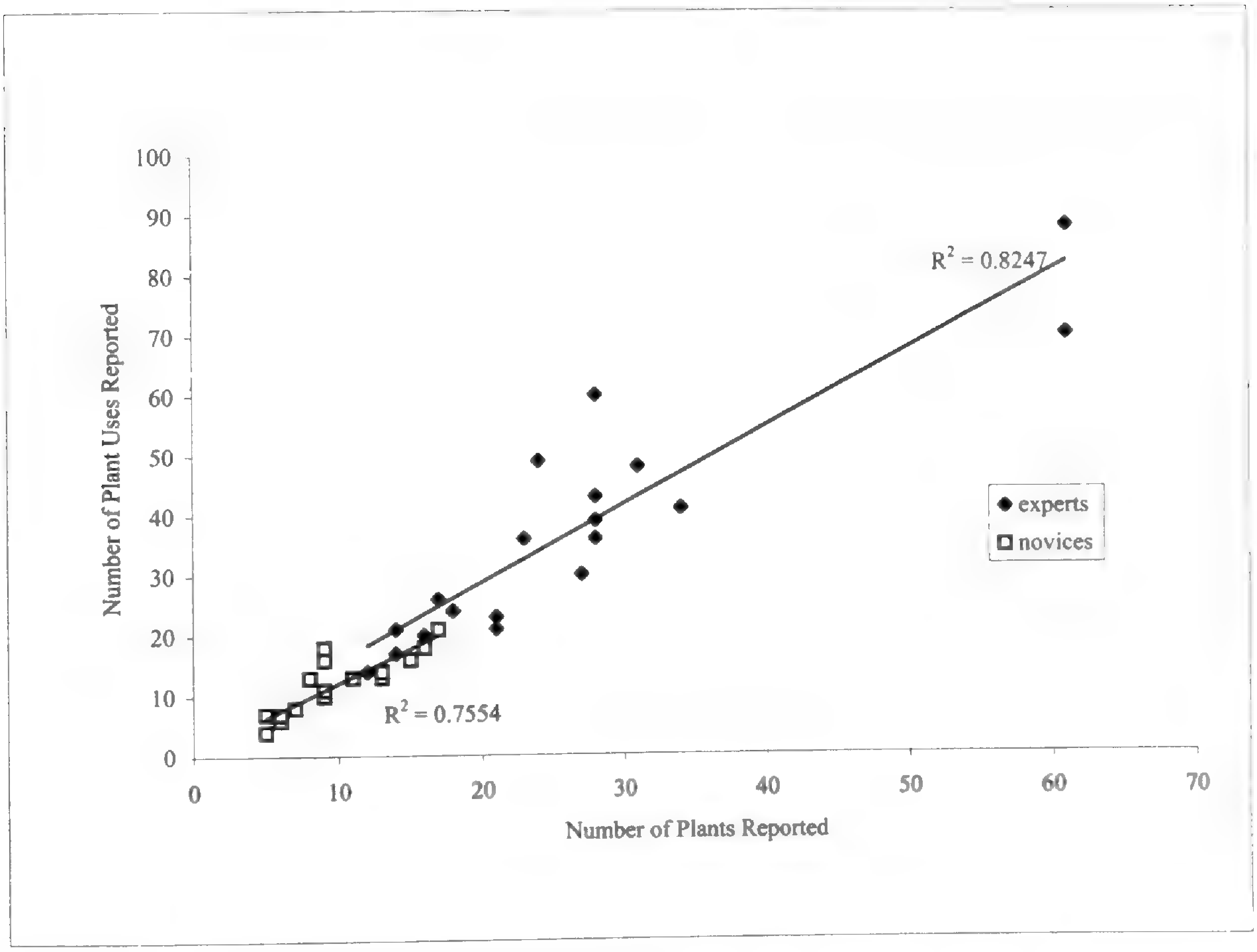


FIGURE 2.—Correlation of number of plants reported to number of plant uses reported in free-lists for experts and novices.

values for a given plant on a free-list, $n = 1$ and $\bar{n}$ = (the total number of listed items) − 1. Ranging between 0 and 1, the B value for a given item reflects the relative proportion of other items it precedes on the list. The B value for each species was summed across all lists and divided by the number of respondents listing the plant to generate a composite B value. To calculate a measure of *overall* cultural significance, the composite B value for each listed species was added to the proportion of respondents listing the plant and divided by 2.

As seen in Table 2, there are more plants with higher frequencies of mention on the experts' inventories than among the novices'. Consider, for example, the three plants mentioned most frequently by experts—blackberry, dandelion, and walnut, which were listed by 18, 15, and 14 experts, respectively. These frequencies are high compared to the three plants mentioned most commonly by novices—raspberry, dandelion, and blackberry, which were listed by only 12, 12, and 11 novices, respectively.

Interestingly, three of the five most frequently mentioned species (blackberry, dandelion, and walnut) are the same for experts and novices. All three of these plants can be used in a number of practical ways. For instance, walnut is a valuable source of food, medicine, lumber, and dyes. Blackberry is also highly venerated for its edible berries, known locally and in the Ozark Mountains to the south as "black gold," and for the food value of its young shoots and its medicinal roots that are often brewed into healing tonics to treat colds, fevers, and colic.

TABLE 2.—Frequency and salience of plants commonly listed by experts and novices.

	Experts				Novices			
Rank	Plant name	Freq.	%	B	Plant name	Freq.	%	B
1	Blackberry	18	0.9	0.579	Raspberry	12	0.6	0.35
2	Dandelion	15	0.75	0.434	Dandelion	12	0.6	0.498
3	Walnut	14	0.7	0.345	Blackberry	11	0.55	0.404
4	Gooseberry	13	0.65	0.379	Walnut	11	0.55	0.243
5	Sassafras	13	0.65	0.377	Mulberry	10	0.5	0.241
6	Lamb's quarters	12	0.6	0.338	Sunflower	10	0.5	0.25
7	Hickory	12	0.6	0.33	Pine	9	0.45	0.225
8	Pokeweed	11	0.55	0.272	Cattail	9	0.45	0.187
9	Plantain	11	0.55	0.315	Daisy	6	0.3	0.136
10	Persimmon	10	0.5	0.302	Wild onion	6	0.3	0.17
11	Wild mint	10	0.5	0.271	Maple	6	0.3	0.185
12	Dewberry	10	0.5	0.29	Morel	5	0.25	0.107
13	Sunflower	9	0.45	0.212	Wild apple	5	0.25	0.069
14	Oak	9	0.45	0.243	Oak	5	0.25	0.127
15	Burdock	9	0.45	0.265	Black-eyed Susan	4	0.2	0.093
16	Raspberry	9	0.45	0.324	Wild strawberry	4	0.2	0.112
17	Morel	8	0.4	0.138	Paw paw	4	0.2	0.101
18	Wild onion	8	0.4	0.21	Marijuana	4	0.2	0.128
19	Mulberry	8	0.4	0.141	Sassafras	4	0.2	0.084
20	Wild grape	8	0.4	0.2	Goldenseal	3	0.15	0.074
21	Cedar	8	0.4	0.154	Hickory	3	0.15	0.074
22	Wild plum	8	0.4	0.232	Wild cherry	3	0.15	0.033
23	Wild strawberry	7	0.35	0.177	Wild rose	3	0.15	0.114
24	Paw paw	7	0.35	0.221	Honeysuckle	3	0.15	0.088

The dandelion is similarly edible; its young leaves and flowers are eaten by both humans and animals, and like the others, it is used regionally in medicinal tonics to treat chills and fevers. Well-known even by those with minimal interest in local flora, it is no surprise to find these species at the top of the list for the novices as well as the experts.

Most interesting, however, are the differences between the two sets of respondents. As seen in Table 2, certain plants are cognitively privileged by one group or the other. Among those plants mentioned frequently by novices, but not by experts, are pine, cattail, daisy, maple, wild apple, and honeysuckle[2]. Similarly, several plants appear exclusively on the experts' inventory, including lamb's quarters, gooseberry, dewberry, plantain, persimmon, and burdock. One explanation for this pattern is the novice predilection for listing plants with high perceptual and ecological salience (e.g., Turner 1988). Plants that are morphologically distinct, bearing obvious physical features (e.g., pine, daisy, cattail) tend to be listed frequently among the untrained. Further, these species are, in general, widely available in the ambient environment. For the most part, novices need not roam far to encounter them. Thus, the perceptual distinctiveness and ecological abundance of these species probably accounts for their high frequency of mention among novice consultants.

On the other hand, species with relatively higher free-list frequency among the experts (e.g., lambsquarters, plantain, burdock) lack the easily distinguishable

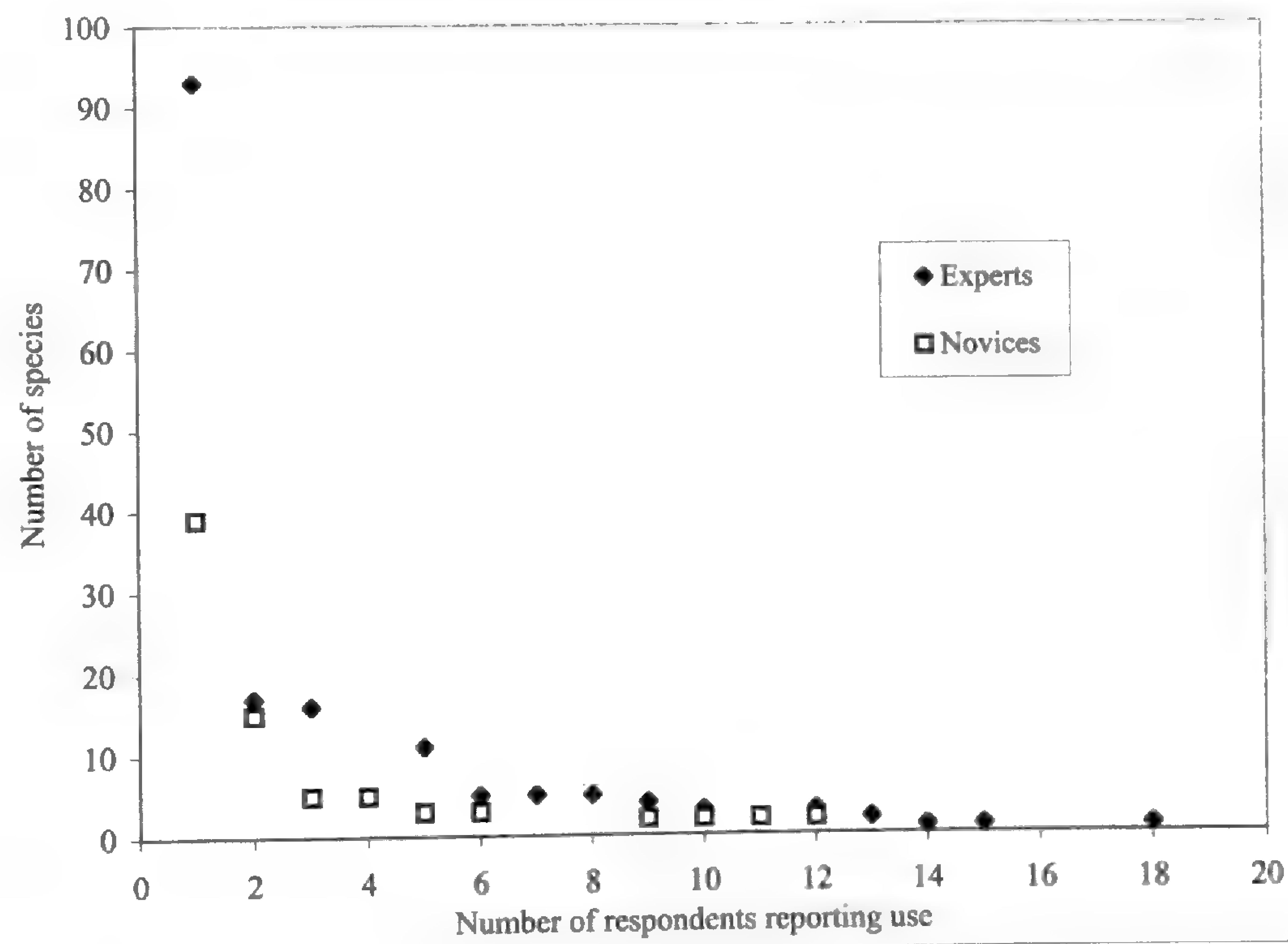


FIGURE 3.—Number of reports of use for all species listed by experts and novices.

features that characterize species with high perceptual salience. Weed-like herbs such as these are not immediately obvious to the untrained eye. Nonetheless, they are emphasized cognitively by the experts who are knowledgeable about their practical uses[3]. To illustrate, the leaves of lambsquarters and burdock are prized for their flavor, edibility, and nutrient value, and plantain leaves are used extensively by experts as a bandage or a poultice for exterior wounds.

The Diversity of Wild Plant Knowledge.—Figure 3 displays the number of reports of use for all wild plant species named by experts and novices in the free-listing task. While the overall knowledge pattern for experts and novices is similar, this abundance diagram conveys an interesting pattern that seems to characterize the plant knowledge of the two groups. That is, experts demonstrate a higher dispersal of knowledge, which is reflected by the higher number of unique, once-mentioned species listed among them. As shown on the diagram, considerably more plants were reported by a single expert (93 species) than were mentioned by a single novice (39 species)[4]. There are fewer instances in which several novices listed the same plant. Alternately, experts demonstrate a higher overlap of listed items. The overall pattern suggested by the abundance diagram is one in which experts have command of a greater diversity of plant knowledge than novices, resulting in both a higher proportion of collective, commonly shared knowledge *and* a higher level of esoteric, idiosyncratic knowledge in the form of once-mentioned species.

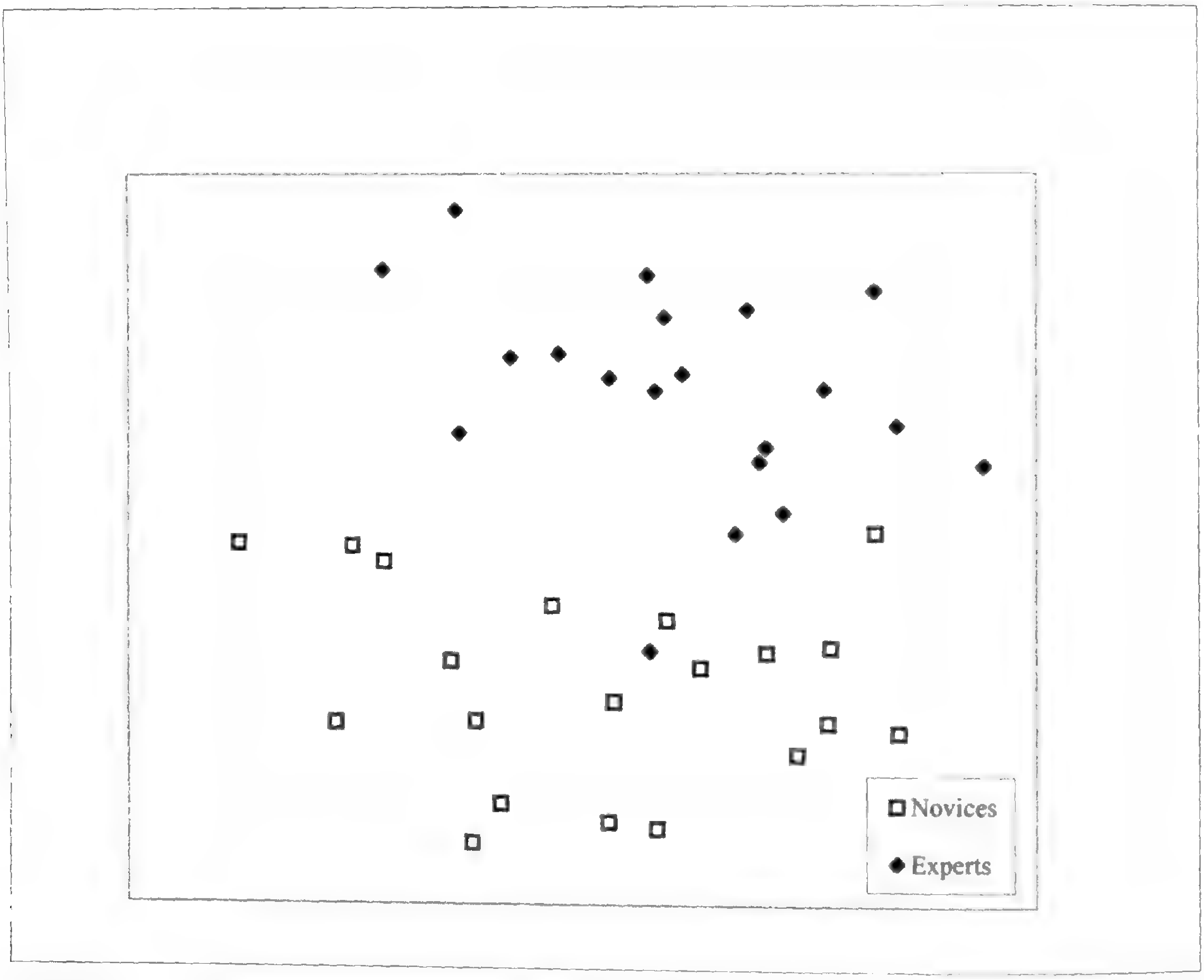


FIGURE 4.—Multidimensional scaling of positive matches between experts' and novices' free lists.

From a qualitative perspective, the differences between the experts' and novices' free-lists are also considerable. To determine the overall extent of free-list similarity, the number of positive matches between listed items was calculated for experts and novices in order to compare the two groups. The resulting coordinates were plotted using multidimensional scaling, or MDS, using the software package ANTHROPAC 4.95 (Borgatti 1998). MDS is a useful technique for visualizing the relations between points or items, whereby points that are closer to each other in two-dimensional space are thought to be more similar than points that are distant.

Figure 4 shows the MDS graphic for the experts' and novices' free-list responses, illustrating the degree to which all respondents mentioned the same plant names in their lists. Interestingly, there is a clear demarcation between the two groups, with novices appearing on the lower half of the graph and the experts at the top. While there is some overlap between the experts and novices, the pattern shown on Figure 4 reveals that experts share more listed items with each other than with novices, and conversely, novices are more similar to each other than to other experts. In other words, two rather distinct constellations of wild plants are mutually exclusive to each of the two groups. These results suggest that, in Little Dixie, two ethnobotanical knowledge structures exist—one for experts and one for novices—rather than a single shared system.

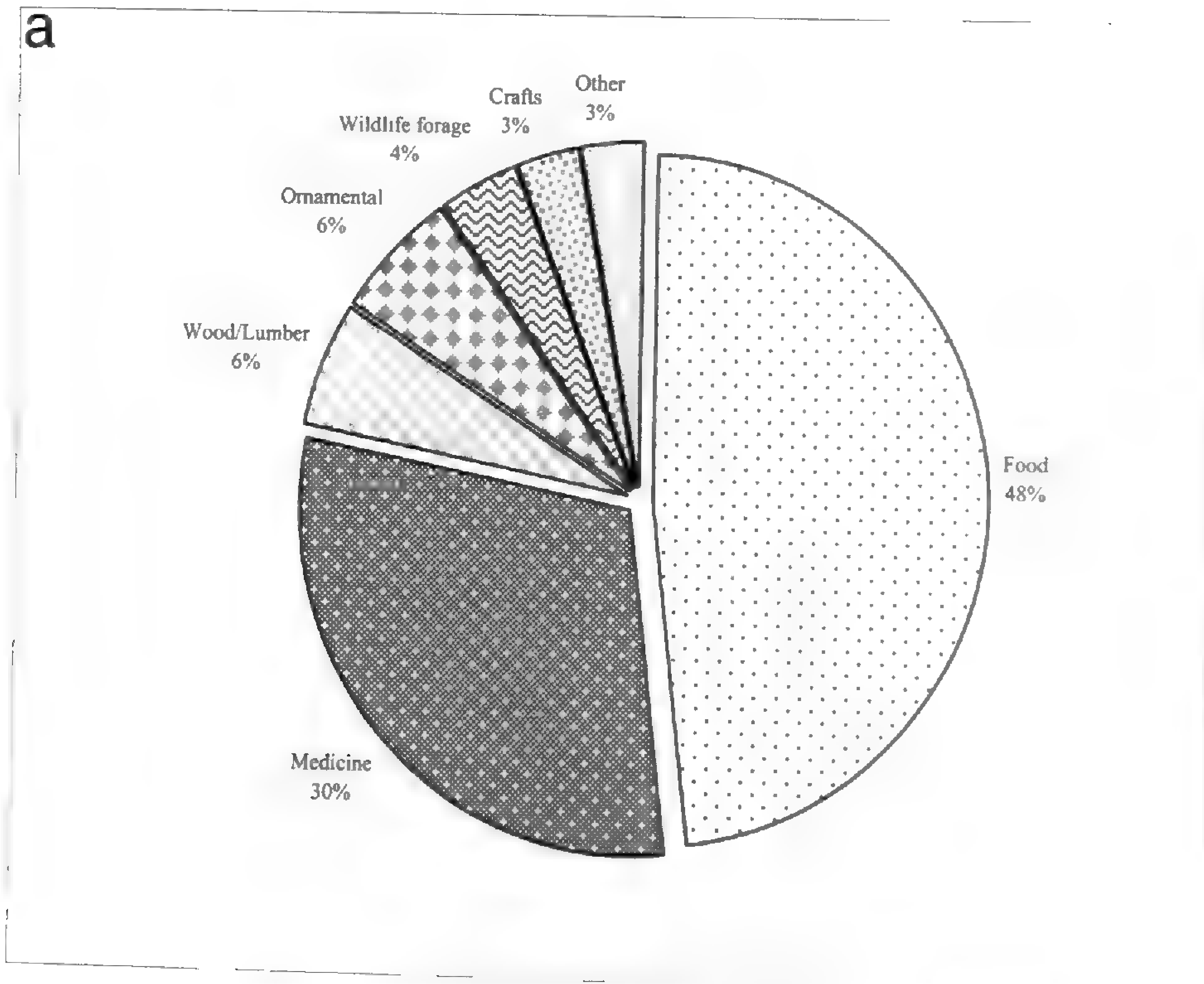
Contrasting Plant Use Patterns.—After each respondent was asked to list as many useful wild plants as they could think of, he or she was prompted to name as many uses for each plant as possible. A review of the collected applications yielded a total of seven different use categories for the named plants: food, medicine, wood/lumber, ornamental, wildlife forage, handicrafts, and other. All wild plant applications on each free-list were coded with their corresponding use categories[5]. On occasions when consultants offered several categories of use for the same plant, each category was recorded. The number of applications that fell into each category was summed and converted into percentages by dividing by the total number of applications reported by that group.

As displayed in Figure 5a and Figure 5b, food is the most commonly named use category for the plants listed by expert and novice respondents. At 48% and 52% of the total applications cited by experts and novices respectively, food is also the most culturally fundamental use for wild flora. In Little Dixie, edible plants constitute an important part of the traditional foodways that help characterize the region. The custom of gathering wild fruits, berries, and nuts from the local woods is shared and enjoyed by most local people, regardless of their level of botanical expertise, which probably accounts for this shared pattern of use.

The remaining use categories, however, are considerably different with respect to the proportion of applications cited by experts and novices. The second most commonly mentioned category for the experts is medicinal plants, comprising a sizeable percentage (38%) of the total reported plant uses by experts. The prevalence of edible and medicinal plants in the expert pharmacopoeia reflects the interest and knowledge in holistic living and natural healing that is pursued and practiced by a number of the expert herbalists who were consulted. The remaining uses given by experts were rather evenly distributed into the decreasingly smaller categories of wood/lumber, ornamental, wildlife forage, other, and crafts.

Among the novices, the food category was followed by ornamental (16%) and wood/lumber (11%). The relatively high percentage of ornamentals listed by novices reflects a significant pattern through the course of this project—the novice predilection toward a perceptually oriented knowledge of wild plants. Ornamental plants are deemed meaningful and useful by virtue of their physical characteristics and visual appeal. Knowledge of ornamentals is readily available to the novice, for it requires only an aesthetic appreciation for the beauty of form—and knowledge of the name of the plant—but not experience with use and function. Comprising only 6.5% of the total uses reported, the medicinal use category ranked fifth in frequency for the novices, after wood/lumber (11%) and wildlife forage (7%).

To compare the overall diversity of the plant use categories for experts and novices, the index of qualitative variation (IQV) was applied to the plant application data. Ranging between 0 and 1, the IQV measures the degree of evenness in the proportional distribution of a sample. The higher the IQV value, the more uniform or balanced the distribution is deemed to be. The IQV is computed as



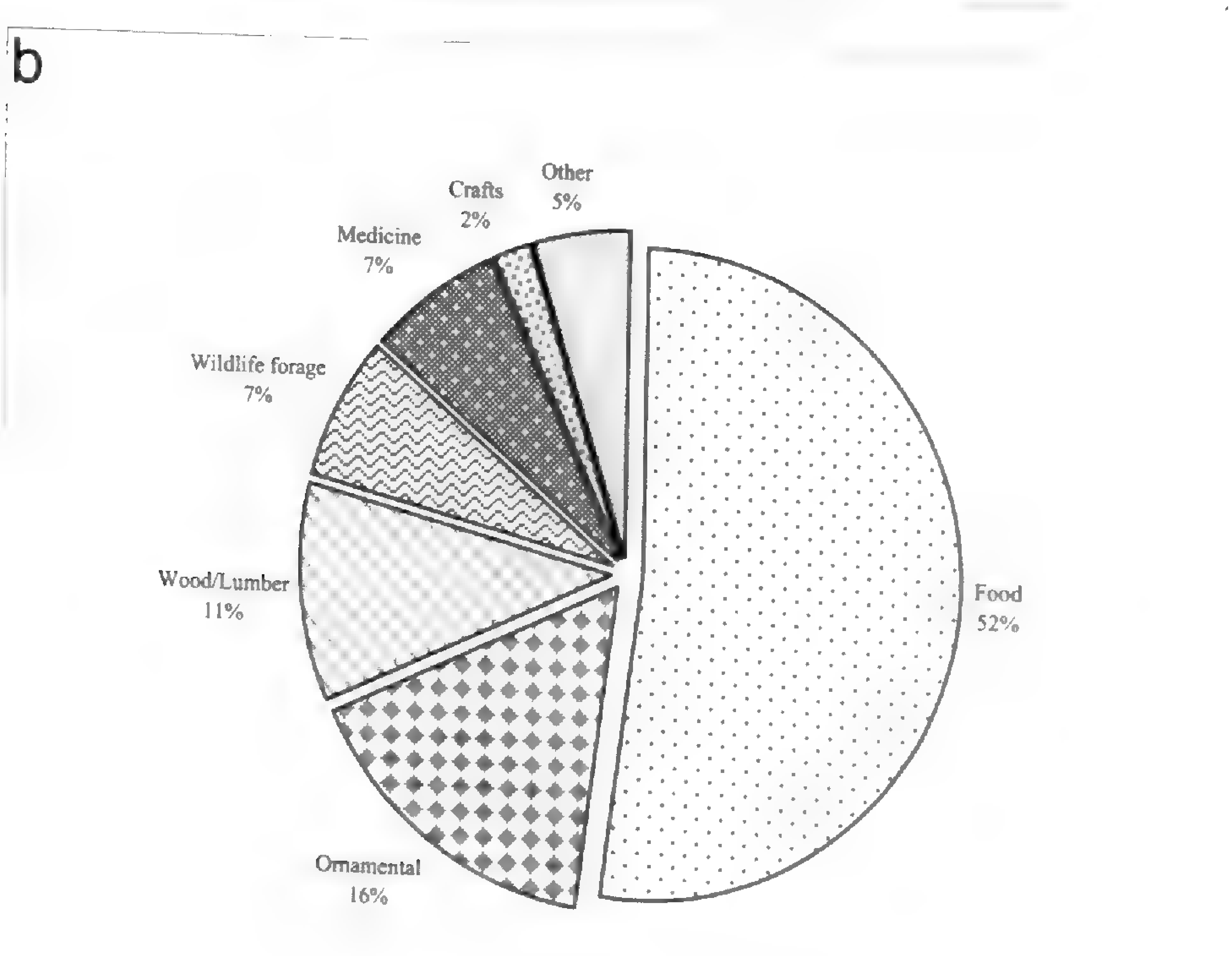


FIGURE 5a.—Distribution of expert uses for plants.

FIGURE 5b.—Distribution of novice uses for plants.

$$\frac{1 - \sum Pi^2}{1 - 1/k}$$

where Pi is the proportion of plant reports represented by each category and k is the number of use categories. For the experts, the IQV yields a value of .78, and for the novices the IQV is .79. These results indicate that, for each group, the relative degree of evenness in the distribution of plant applications is extremely similar. That is, the seven use categories show a moderately balanced representation for each group.

While the IQV measures distribution or evenness, the index of dissimilarity (D_s) is useful for assessing quantitatively the differences in overall use patterns. D_s is calculated as

$$D_s = \frac{1}{2} \sum |P_e - P_n|$$

where P_e is the proportion of expert plant applications in each category and P_n is the proportion of novice applications in each category. The index of dissimilarity also generates a value between 0 and 1, where 1 indicates perfect dissimilarity and 0 indicates perfect similarity between the groups' categorical distribution. Calculating the index of dissimilarity generates a D_s value of 24%, which means that 24% of either group's distribution would have to change in order to match the other group's distribution.

So where are these differences coming from? While the proportion of applications listed as food is very similar for the two groups, experts know considerably more about medicinal plants than novices, who report far more plants as ornamentally useful. Experts are also more intimately involved and experienced with plants in general, and have acquired through time a more extensive understanding of the cultural uses of plants—particularly the therapeutic aspects. While it takes an expert to understand how to use plants medicinally, anyone can appreciate the beauty of a given species and deem it worthy of ornamental display. This very fact may explain why novices report a much higher number of plants in the ornamental category. Novices know less of the esoteric medicinal functions of wild flora, which requires a level of botanical knowledge and interest more characteristic of expert respondents.

The Expressive Evaluation of Wild Plants.—In descending order, the correlations between the rating scores for experts and novices are: ecological value = .70 ($p < .001$), usefulness = .49 ($p < .05$), preference = .46 ($p < .05$), and beauty = .36 ($p > .05$). These r-values reflect the similarity with which experts and novices rated the plants, especially with regard to ecological value. It is noteworthy, however, that the groups do not correlate significantly when rating the plants according to beauty. These findings agree with those by Chick and Roberts (1987), who determined that machinists and non-machinists rated lathe parts very similarly with respect to complexity, but very differently with regard to beauty. Like the discovery by Chick and Roberts, these results show that the two groups agree most on the highly denotative variable, ecological value, and least on the most connotative variable, beauty.

Table 3 lists the intercorrelations among the four rating variables for experts and novices. For both groups, personal preference appears to be the most important underlying dimension in the evaluation of the wild plant domain. That is, plants that are preferred are also considered useful, ecologically valuable, and beautiful. One interesting expert-novice distinction is clear, however: the correlation values between usefulness and beauty. For the experts, there is a low cor-

TABLE 3.—Multiple correlation of mean ranks of wild plants on four variables (experts' values shown to the left, novices' values in parentheses).

Variable	Preference	Usefulness	Ecological value	Beauty
Preference	1			
Usefulness	0.72*** (0.68)***	1		
Ecological value	0.74*** (0.78)***	0.55* (0.44)*	1	
Beauty	0.62** (0.66)**	0.39 (0.92)***	0.68** (0.57)**	1

***p < .001, **p < .01, *p < .05.

relation for the two variables (.39), yet for the novices, the correlation is very high (.92). The difference between these r-square values was tested and found to be significant ($z = 3.31$, $p < .001$). In fact, the difference in r-square values between usefulness and beauty is the only significant disparity between the two groups. This difference, taken in concert with the low rating correlation on the beauty variable, indicates that novices emphasize beauty as an organizational factor in the conceptualization of wild plants. Novices are restricted to purely visual stimuli when abstracting an emotional and/or cognitive impression of a given plant. It follows that a plant's usefulness is a function of its overall perceptual appeal, or beauty. The salience of beauty in wild plant evaluation would also explain the high proportion of ornamental plants free-listed by novices. On the other hand, beauty is significantly de-emphasized in the determination of usefulness in the mind of the expert. Experts have more criteria for usefulness at their disposal (e.g., nutritional value, medical efficacy, etc.). Any of these esoteric factors are most likely used in concert by experts when evaluating the usefulness of different plants.

Thus, it is evident that the accumulation of expertise entails a shift in domain appreciation, or how the domain is evaluated and organized from an expressive point of view. The rating patterns by the two groups indicates that experts and novices have contrasting standards for appreciating wild plants, which appears to be linked to underlying differences in how the domain is organized conceptually.

SUMMARY AND CONCLUSION

It has been shown, as predicted, that experts and novices utilize different referential features in their articulation of wild plants in Little Dixie. These differences are evident by examining the plants and uses cited in the free-lists, which reflect how experts and novices acquire and develop information about ambient flora. Novices are more cognizant of plants with high perceptual and ecological salience, while experts focus on function and display knowledge of species with high use potential, regardless of their distinctiveness or abundance. Although food represents the major use category for both groups, experts use a high proportion of plants for medicinal reasons, while novices use plants much more frequently for ornamental purposes.

An examination of experts' and novices' expressive plant judgements reveals that novices emphasize beauty while experts prioritize cultural value when ranking the species. These findings reaffirm that experts are influenced most by usefulness and practicality, while novices are affected more by aesthetic variables in their organization of plant knowledge. Taken together, the results suggest that the acquisition of ethnobotanical knowledge entails a cognitive shift from morphological factors and sensory perceptions to a more complex comprehension of plants based on abstract, culturally acquired utilitarian factors. This information can be applied in a number of ways to understand how cultural experience shapes our comprehension and appreciation of our natural worlds.

NOTES

[1] For example, Chick and Roberts (1987) examined the evaluation of lathe parts by machinists and non-machinists. The authors discovered that the machinists display more agreement regarding the expressive aspects of lathe parts than the non-machinists, due to the experts' better understanding of how the parts are manufactured.

[2] However, these plants are not absent altogether from the experts' wild plant inventory—they appear further down on the composite list.

[3] Again, the species discussed here do appear on the novices' inventory, but with considerably lower rankings in frequency and salience.

[4] Similar use report patterns by plant experts appear throughout the ethnobotanical literature. For example, in a study of Mestizo plant use in rural Mexico by Benz and his colleagues, many unique or once-mentioned species were listed by expert consultants (Benz et al. 1994). Accordingly, Nolan (1998) found that wild plant experts of the Ozark-Ouachita Highlands listed relatively high proportions of idiosyncratic species. Cognitive anthropologists have found considerable knowledge variation to exist among expert respondents (e.g,. Boster and Johnson 1989, Nolan 2001). These studies offer something of a challenge to cultural consensus theory, which is built on the proposition that agreement or consensus among respondents is indicative of cultural expertise.

[5] The boundaries between certain use categories are often "fuzzy," particularly with respect to food and medicine. For this reason, it was necessary to code a number of plants into multiple categories, such as those used in spring tonics (e.g., sassafras, burdock, may apple). For insightful information on the categorical overlap of food and medicine in people-plant interactions, see Johns (1996, 1994).

ACKNOWLEDGMENTS

I would like to thank Editor William Balée and the reviewers for the *Journal of Ethnobiology* for offering many constructive suggestions for improving this paper. Many thanks also to Mike Robbins, Debby Pearsall, Gery Ryan, and Robin Kennedy for their guidance and support in the development of this project and the resulting manuscript. I am especially indebted to the hard working people of Little Dixie, who have entrusted me with a wealth of ethnobotanical and local cultural information. In spirit, this project belongs to all of you. An earlier version of this paper was presented at the 24th Annual Meeting of the Society of Ethnobiology, Durango, Colorado. Funding for this research was generously granted by the National Science Foundation's Doctoral Dissertation Improvement Award (BCS-9903983).

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APPENDIX 1.—Composite inventory of free-listed species and their reported uses.

Vernacular name	Scientific name	Uses for plant	Part of plant used
Alum root	*Heuchera americana* L.	medicine	roots
Amaranth	*Amaranthus* L. spp.	food	leaves, seeds
Apple	*Malus pumila* Mill.	food, wood	fruits, whole tree
Ash	*Fraxinus americana* L.	wood	trunk
Asparagus	*Asparagus officinalis* L.	food, tea	whole plant, leaves, seeds
Aster	*Aster* L. spp.	ornamental	flowers
Basswood	*Tilia americana* L.	lumber	wood
Bayberry	*Myrica* L. spp.	crafts, making candles	leaves, berries
Beebalm	*Monarda didyma* L.	ornamental, wildlife forage	all
Beggars lice	*Lappula echinata* Gilib.	wildlife forage, fix nitrogen in soil	plant, seeds
Big Bluestem	*Andropogon gerardii* Vitman.	wildlife forage	plant
Birch	*Betula* L. spp.	lumber, shade	wood, all
Bittersweet	*Solanum dulcamara* L.	ornamental	whole plant (not roots)
Black cohosh	*Cimicifuga racemosa* (L.) Nutt.	medicine	bark
Black haw	*Viburnum prunifolium* L.	medicine	roots
Black locust	*Robinia pseudo-acacia* L.	lumber	wood
Blackberry	*Rubus* L. spp.	food, medicine, wildlife forage, tea	berries, roots, fruits, leaves
Black-eyed Susan	*Rudbeckia hirta* L.	ornamental, flower gardens	flowers, whole flower, plant
Blazing star	*Liatris* Schreb. spp.	ornamental	plant
Bloodroot	*Sanguinaria canadensis* L.	medicine	root
Blue cohosh	*Caulophyllum thalictroides* (L.) Michx.	medicine	roots
Bluebells	*Mertensia virginica* (L.) Pers.	ornamental	whole
Bluestem	*Andropogon virginicus* L.	wildlife forage	whole plant
Boneset	*Eupatorium perfoliatum* L.	medicine	leaves
Burdock	*Arctium minus* Bernh.	food, medicine, blood purifier	leaves, roots
Burhead	*Echniodorus cordifolius* (L.) Griseb.	wildlife forage	seeds
Butterfly weed	*Asclepias tuberosa* L.	wildlife forage	plant
Cardinal flower	*Lobelia cardinalis* L.	water gardens, wildlife forage	all
Carpenters square	*Scrophularia marilandica* L.	medicine, food	leaves, greens
Catnip	*Nepeta cataria* L.	for cat tonic	leaves
Cattail	*Typha latifolia* L.	food, ornamental, sewage treatment	rootstock, stalk, seed head
Chamomile	*Matricaria chamomila* L.	sedative tea, medicine	flowers
Chestnut	*Castanea dentata* (Marsh.) Borkh.	food	nuts

Appendix 1 (continued)

Vernacular name	Scientific name	Uses for plant	Part of plant used
Chickweed	*Stellaria media* L.	medicine, food	leaves, stems, greens, blossoms
Chicory	*Cichorium intybus* L.	food, tea	roots, leaves, flowers
Chokecherry	*Prunus virginiana* L.	medicine	berries, bark
Chufa	*Cyperus esculentus* L.	wildlife forage	seeds
Cleavers	*Galium aparine* L.	medicine	stalk, leaves
Clover	*Trifolium repens* L.	wildlife forage, nitrogen fixing	whole plant
Coltsfoot	*Petasites hybridus* L.	medicine	leaf stem
Columbine	*Aquilegia canadensis* L.	ornamental	flowers
Coreopsis	*Coreopsis tinctoria* Nutt.	flower gardens	plants
Cornflower	*Centaurea cyanus* L.	ornamental	flowers
Cottonwood	*Populus deltoides* Marsh.	lumber	trunk
Cow parsnip	*Heracleum lanataum* Michx.	food	leaves
Crabapple	*Pyrus* L. spp.	food	fruits
Crabgrass	*Digitaria* Heist. spp.	ground cover	all
Currant	*Ribes odoratum* Wendl.	food	berries
Cypress	*Taxodium distichum* (L.) Rich.	lumber	wood
Daisy	*Chrysanthemum leucanthemum* L.	ornamental	flowers
Dandelion	*Taraxacum officinale* Weber.	food, medicine, wildlife forage	flowers, leaves
Daylily	*Hemerocallis fulva* L.	ornamental	flowers
Dewberry	*Rubus flagellaris* Willd.	food, wildlife forage	berries, fruits
Dill	*Anethum graveolens* L.	food, pickling	tops
Dogwood	*Cornus florida* L.	ornamental	whole
Duckweed	*Spirodela* Schleiden spp.	aquatic protection	all
Elderberry	*Sambucus canadensis* L.	food, medicine	berries
Ferns	*Polypodium* (Tourn.) L. spp.	food, ornamental	crowns
Fescue grass	*Festuca* L. spp.	food for cattle	stems, leaves
Feverfew	*Chrysanthemum parthenium* (L.) Bernh.	medicine	leaves
Foxglove	*Digitalis purpurea* L.	medicine	flowers, leaves
Gentian	*Gentiana quinquefolia* L.	medicine	roots, leaves
Ginseng	*Panax quinquefolius* L.	medicine, stimulant	roots
Goats rue	*Tephrosia virginiana* (L.) Pers.	fish bait	plant
Goldenrod	*Solidago* L. spp.	wildlife forage	blossom

Appendix 1 (continued)

Vernacular name	Scientific name	Uses for plant	Part of plant used
Goldenseal	*Hydrastis canadensis* L.	medicine, blood purifier	roots, leaves, plant
Gooseberry	*Ribes missouriense* Nutt.	food, forage	fruits, berries
Grass	various species of Poaceae	wildlife forage, stop erosion	stalk, leaves
Hawthorn	*Crataegus* L. spp.	medicine	roots
Hazelnut	*Corylus* L. spp.	wildlife forage, ornamental, food	whole plant, nuts
Hemlock	*Cicuta maculata* L.	poison	leaves
Hemp	*Cannabis sativa* L.	medicine, crafts, paper products	leaves, stalks, buds, fibers
Hickory	*Carya* Nutt. spp.	food, forage, lumber, crafts	nuts, wood, trunk, bark
Holly	*Ilex opaca* Ait.	ornamental	all, berries, leaves
Horehound	*Marrubium vulgare* L.	medicine	leaves
Horsetail	*Equisetum arvense* L.	scouring pads, musical instruments	stems, stalk
Huckleberry	*Gaylussacia baccata* (Wang.) K. Koch.	food	berries
Hyssop	*Hyssopus officinalis* L.	cleaning	leaves
Indian grass	*Sorghastrum nutans* (L.) Nash	wildlife forage	plant
Indian paintbrush	*Castilleja coccinea* (L.) K. Spreng.	ornamental, flower gardens	flowers, plant
Indigo	*Baptisia* Vent. spp.	crafts, fix nitrogen in soil	plant
Iris	*Iris* L. spp.	wildlife forage, ornamental	plant, all, root
Jack-in-the-pulpit	*Arisaema triphyllum* (L.) Schott.	ornamental	whole plant
Jewelweed	*Impatiens pallida* L.	medicine, poison ivy	leaves, stems
Joe Pye weed	*Eupatorium purpureum* L.	medicine, spring tonic	leaves, roots
Juniper	*Juniperus virginiana* L.	medicine, ornamental, food, windbreak	berries, whole tree
Ladyslipper	*Cypripedium* L. spp.	ornamental	flowers
Lamb's quarters	*Chenopodium album* L.	food, greens, purifier	leaves
Larkspur	*Delphinium* L. spp.	ornamental	whole
Lead plant	*Amorpha canescens* Pursh.	fix nitrogen in soil	plant
Lespedeza	*Lespedeza* Michx. spp.	fix nitrogen in soil	plant
Licorice	*Glycyrrhiza lepidota* (Nutt.) Pursh	food	roots
Lilac	*Syringa vulgaris* L.	ornamental	flower
Little Bluestem	*Andropogon* L. spp.	wildlife forage	plant
Maple	*Acer saccharum* L.	lumber, ornamental, food, shade	wood, whole tree, sap, trunk
Marijuana	*Cannabis sativa* L.	clothing, smoking, medicine	leaf, buds
May apple	*Podophyllum peltatum* L.	medicine, food	fruits

Appendix 1 (continued)

Vernacular name	Scientific name	Uses for plant	Part of plant used
Milkweed	*Asclepias syriaca* L.	medicine, wildlife forage	milk, pod, leaves
Miner's lettuce	*Lactuca* L. spp.	food	leaves, greens
Morel	*Morchella esculenta* L.	food, medicine	whole mushroom, tops
Mugwort	*Artemisia vulgaris* L.	insect repellent	leaves
Mulberry	*Morus rubra* L.	food, medicine, shade	fruits, berries
Mullein	*Verbascum thapsus* L.	ornamental, medicine, toilet paper	whole plant, leaves
Mustard	*Brassica* L. spp.	food	seeds
Nettles	*Urtica* L. spp.	crafts, medicine, food	leaves, fruit, greens
Ninebark	*Physocarpus opulifolius* L.	stabilize stream bank, medicine	whole plant, inner bark
Oak	*Quercus* L. spp.	lumber, crafts, forage, firewood, shade	wood, acorns, trunk, nuts
Ohio buckeye	*Aesculus hippocastanum* L.	good luck piece	nuts, wood
Osage orange	*Maclura pomifera* (Raf.) Schneid.	firewood, moth repellent	wood, fruit
Passionflower	*Passiflora incarnata* L.	medicine	leaves
Paw paw	*Asimina triloba* (L.) Dunal	food	fruits
Peach	*Prunus persica* L.	food	fruits
Pear	*Pyrus communis* L.	food	fruits
Pecan	*Carya illinoensis* (Wang.) K. Koch.	food, wood	nuts, wood
Pencil flower	*Stylosanthes biflora* (L.) BSP.	fix nitrogen in soil	plant
Pennyroyal	*Hedeoma pulegioides* (L.) Pers.	tea, medicine	leaves
Persimmon	*Diospyros virginiana* L.	food	fruits, seeds
Pickerel weed	*Pontederia cordata* L.	water gardens, wildlife forage	plant
Pine	*Pinus echinata* L.	lumber, ornamental, shade, food	wood, trunk, cones, needles
Plantain	*Plantago major* L.	medicine, food	leaves, roots, flowers, all
Pokeweed	*Phytolacca americana* L.	food, crafts, medicine	leaves, berries, greens
Poppy	*Argemone albiflora* Hornem.	food	seeds
Prairie cordgrass	*Spartina pectinata* Link.	stabilize stream bank	plant
Prairie dropseed	*Sporobolus heterolepis* (Gray) Gray	wildlife forage	plant
Prickly pear	*Opuntia humifusa* (Raf.) Raf.	food	leaves, fruits, flowers
Primrose	*Oenothera biennis* L.	flower gardens, food, medicine	plant, oil
Purple coneflower	*Echinacea purpurea* (L.) Moench.	medicine, wildlife forage	leaves, roots, flowers, all
Purslane	*Portulaca oleracea* L.	food	greens, leaves
Pussywillow	*Salix humilis* Marsh.	ornamental	stems
Queen Anne's lace	*Daucus carota* L.	attracting insects, wildlife forage	flowers, leaves

Appendix 1 (continued)

Vernacular name	Scientific name	Uses for plant	Part of plant used
Quinine	*Parthenium integrifolium* L.	medicine	roots, leaves
Raspberry	*Rubus strigosus* Michx.	food, medicine	berries, roots, leaves, fruit
Rattlebox	*Crotolaria* L. spp.	fix nitrogen in soil	plant
Rattlesnake master	*Eryngium yuccifolium* Michx.	crafts	leaves
Red clover	*Trifolium pratense* L.	wildlife forage, medicine	flowers, leaves
Redbud	*Cercis canadensis* L.	ornamental, shade	whole plant
Royal catchfly	*Silene regia* Sims.	flower gardens	plant
Sarsaparilla	*Aralia nudicaulis* L.	food	leaves
Sassafras	*Sassafras albidum* (Nutt.) Nees.	food, medicine, tea, lumber	roots, bark, trunk, leaves
Senna	*Cassia marilandica* L.	medicine	leaves
Shadbush	*Amelanchier arborea* (Michx. f.) Fern.	ornamental	whole plant
Sheep sorrel	*Rumex acetosella* L.	food	leaves
Shepherd's purse	*Capsella bursa-pastoris* (L.) Medic.	medicine	leaves, stem
Shooting stars	*Dodecatheon meadia* L.	ornamental	plant
Slippery elm	*Ulmus rubra* Muhl.	medicine	bark
Smartweed	*Polygonum* L. spp.	wildlife forage	seeds
Snakeroot	*Eupatorium rugosum* Houtt.	medicine, treatment for snakebite	root
Snow on the mountain	*Euphorbia marginata* Pursh.	ornamental	plant
Solomons seal	*Polygonatum* Mill. spp.	medicine	leaves
Sorrel	*Rumex* L. spp.	food	leaves
Spearmint	*Mentha spicata* L.	food, tea	leaves
Spiderwort	*Tradescantia subaspera* Ker.	ornamental	whole plant
Sumac	*Rhus* L. spp.	medicine, spring tonic	berries, bark, fruit
Sunflower	*Helianthus annuus* L.	food, ornamental, wildlife forage	seeds, whole flower, plant
Sweet clover	*Melilotus alba* Medic.	wildlife forage	nectar
Sweet William	*Phlox divaricata* L.	ornamental	whole plant
Switch grass	*Panicum virgatum* L.	wildlife forage, levee stabilizer	plant
Sycamore	*Platanus occidentalis* L.	lumber	trunk
Tansy	*Tanacetum vulgare* L.	insect repellent	flower, leaves
Teasel	*Dipsacus sylvestris* Huds.	ornamental	head, stem
Trumpet vine	*Campsis radicans* (L.) Seem.	ornamental	all
Violet	*Viola* L. spp.	ornamental, medicine, food, perfume	leaves, flowers, greens, blossoms

Appendix 1 (continued)

Vernacular name	Scientific name	Uses for plant	Part of plant used
Walnut	*Juglans* L. spp.	food, medicine, poison, firewood, forage	nuts, hulls, bark, wood
Watercress	*Nasturtium officinale* R. Br.	medicine, food	leaves, greens, blossoms
Waterlily	*Nymphaea odorata* Ait.	ornamental	all
Weeping willow	*Salix babylonica* L.	shade	whole tree
White clover	*Trifolium repens* L.	fix nitrogen in soil	plant
White sage	*Artemisia ludoviciana* Nutt.	medicine	leaves
Wild cherry	*Prunus serotina* Ehrh.	food, medicine, lumber	berries, bark, fruit
Wild chervil	*Anthriscus cerefolium* (L.) Hoffm.	food, garnish	stems, leaves
Wild garlic	*Allium canadense* L.	food	bulb
Wild ginger	*Asarum canadense* L.	medicine	roots
Wild grape	*Vitis* L. spp.	food, wine, ornamental	fruits, vines
Wild mint	*Mentha arvensis* L.	food, medicine, tea	leaves
Wild oats	*Uvularia sessilifolia* L.	food	grain
Wild onion	*Allium stellatum* Ker.	food, medicine, blood purifier	bulb, roots, leaves, stalk
Wild parsnip	*Pastinaca sativa* L.	food	roots
Wild plum	*Prunus americana* L.	food	fruits
Wild rose	*Rosa* L. spp.	food	berries
Wild strawberry	*Fragaria virginiana* L.	food	berries, fruits
Willow	*Salix alba* L.	medicine, crafts, ornamental, food	bark, whole tree, stalks, leaves
Winter cress	*Barbarea vulgaris* R. Brown	food	greens
Yarrow	*Achillea millefolium* L.	medicine	leaf stem, flowers
Yellow dock	*Rumex crispus* L.	blood purifier, medicine	roots, bark, leaves

Black Rice: The African Origins of Rice Cultivation in the Americas. Judith A. Carney. Harvard University Press, Cambridge. Pp. xiv, 240, photographs, maps. ISBN: 0-674-00452-3 ($37.50, cloth).

African slaves introduced the rice technology that made the Carolinas great in the 18th century. This has been known for two decades, but only now has a book appeared that treats adequately the botany and technology as well as the history and food ethnography involved. Judith Carney's work is a major achievement. Not only does it complete the effort of restoring to prominence an African-American contribution to American life; it also stands as one of the best short studies of the way a particular crop and its production technology influenced history.

African rice, *Oryza glaberrima,* was domesticated at least 2,000 and probably more than 3,500 years ago in West Africa, quite independently of the earlier domestication of *O. sativa* in East Asia. To produce it, process it, and cook it, complex and sophisticated technologies developed, especially along the coasts of Senegambia and Guinea. The Wolof, Mandinka, Baga, Mende and Temne were among the major peoples involved. As rice developed in the Carolinas, slaves from this region became more important, and eventually most blacks in the United States were from the "rice coast." Carney does not elaborate on the cultural effects of this beyond food technology, but it is to this that we owe the distinctive quality of black culture in the United States, especially in music, folktales, folk speech, and visual art. The blues derive from Senegambian traditional music, the banjo was a Senegambian instrument, and the words "hippie" and "hipcat" may be Wolof loans in English (see e.g. Palmer 1981).

Carolina rice was almost exclusively *O. sativa,* apparently derived from Madagascar and India, but Carney shows that *O. glaberrima* was locally grown there and elsewhere in the New World. Eventually, *O. sativa* made it back to West Africa, where—alas—it now threatens to replace *O. glaberrima,* including many wonderful varieties developed over the centuries.

The Carolina rice industry was thus built on the skills of the African slaves—as well as on the horrific exploitation of their labor, death from sheer exhaustion being common and routine in the 18th century. Thus, a brilliant and successful industry developed in Africa and America, but its developers got little beyond torture and death for their contributions.

This book will surely become a classic in the literature on history seen through particular crops. It reminds one of the longer and more comprehensive works of Salaman (*The History and Social Influence of the Potato,* 1985), Mintz (*Sweetness and Power,* 1985) and the Coes (*The True History of Chocolate,* 1996).

A small irony says it all. On page 72, we meet Captain John Newton, who in 1750 "bought nearly eight tons of rice for feeding 200 slaves" on his ship. Captain Newton was later to repent of his horrible trade, and spend years in deep depression and guilt. Finally finding solace in religion, he wrote the song "Amazing Grace." This song, often sung in thoroughly Senegambian-derived style, remains vitally important in African-American communities today. Human achievement is a strange, ironic, often cruel thing, but sometimes it can—in the words of another spiritual—"outshine the sun."

This book adds to the many that document the African Diaspora's contributions to the New World. Until recently, African contributions were widely thought to be minimal. Pioneers in research in this field, such as Melville Herskovits and Harold Courlander, were ignored or depreciated. Apologists for the plantations and for racism denied that Africans could contribute; worse, many well-meaning writers were so anxious to show blacks as 'victims' that they ignored or dismissed Black cultural legacies. Today, many ethnobiologists, as well as musicologists, art historians, and others, have documented a great range of contributions.

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Journal of Ethnobiology 21(2): 55–72 Winter 2001

CAVES, URSIDS, AND ARTIFACTS: A NATURAL-TRAP HYPOTHESIS

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ABSTRACT.—European cave deposits often contain the remains of extinct cave bears (*Ursus spelaeus* and *U. deningeri*) and artifacts or human remains. Two twentieth-century explanations for the apparent association of the remains and artifacts are: 1) late Pleistocene hominids preyed upon the bears; and 2) late Pleistocene hominids and bears occupied the caves at different times thus making the remains and artifacts appear behaviorally associated when they are not. The former option is dismissed in most cases based on taphonomic criteria and ursid mortality data. In caves with multiple entrances—particularly cases where at least one entrance is a vertical shaft comprising a natural trap—another option serves to better explain the presence of ursid remains and artifacts in the same deposits. Ursid-bone assemblages created by accidental entrapment of bears in vertical shafts result in a distinctive mortality pattern. This pattern reveals proportionally more prime adult individuals than expected in a living population. A consideration of North American black bear (*U. americanus*) physiology and behavior reveals that this distinctive mortality pattern should be *expected* from natural trap assemblages. Thus, in assemblages from caves with horizontal and vertical entrances, mortality data can be used to decipher whether ursids died from natural hibernation deaths, human predation, or accidental falls through vertical shafts.

Key words: ursids, mortality, natural trap, cave.

RESUMEN.—Los depósitos en las cuevas europeas frecuentemente contienen restos de osos extintos (*Ursus spelaeus* y *U. deningeri*) y artefactos. Dos explicaciones a la aparente asocíación de restos y artefactos son: 1) que los osos fueron víctimas de los homínidos del pleistoceno tardío; y 2) que estas cuevas fueron ocupadas en diferentes momentos tanto por homínidos como por los osos; permitiendo que la presencia de artefactos y restos aparezcan como temporalmente asociados, cuando en realidad no lo están. Esta última situación, que ocurrió poco frecuentemente si en realidad ocurrió, puede ser abandonada en la mayoría de los casos empleando criterios de taphonomía y datos sobre mortalidad de los osos. En cuevas con múltiples entradas podemos encontrar otra explicación a la presencia de restos de osos y artefactos; particularmente en los casos donde una de las entradas es vertical y profunda en la cual el oso cae en una trampa natural. La contextudelidad de los restos de oso representativos de este tipo de muerte accidental demuestran características muy distintivas. Considerando la fisiología y el comportamiento del oso negro de norte américa (*U. americanos*) este tipo de trampa revela patrones distintivos en la mortalidad de los osos. En este caso los datos de los restos encontrados en cuevas con entradas verticales y horizontales pueden ser empleados para decifrar si los osos murieron por hibernación natural, predación humana, o por caidas accidentales en las entradas verticales y profundas de las cuevas.

RÉSUMÉ.—Les dépôts sédimentaires de cavernes européennes contiennent souvent des restes humains ou des objets façonnés associés à des restes osseux d'espèces éteintes d'ours des cavernes (*Ursus spelaeus* et *U. deningeri*). Il y a deux scénarios actuels pour expliquer cette apparente association de restes osseux et d'objets façonnés: 1) les hominidés de la fin du pléistocène chassaient les ours; et 2) les hominidés de la fin du pléistocène et les ours ont occupé les cavernes à des moments différents, donnant la fausse impression que les ossements et les objets façonnés sont associés culturellement. Dans la plupart des cas, le premier scénario, qui semble s'être réalisé rarement ou pas du tout, peut être rejeté en utilisant des critères taphonomiques et des données de mortalité ursidée. Pour les cavernes avec entrées multiples (particulièrement celles où au moins une entrée a des parois verticales constituant un piège naturel), un autre scénario explique mieux la présence dans les mêmes dépôts de restes ursidés et d'objets façonnés. Les assemblages d'ossements ursidés crées par la chutte accidentelle des ours dans des entrées à paroies verticales semblent présenter un profil de mortalité distinct. Ce profil révèle une proportion d'ours d'âge adulte plus importante que l'on pourrait le prévoir d'après une population vivante. Une revue de la physiologie et du comportement de l'ours noir nord américain (*U. americanus*) revèle que les pièges naturels *devraient* produire des profils de mortalité ursidée distincts. Pour les assemblages trouvés dans des cavernes avec entrées horizontales et verticales, les données de mortalité peuvent donc être utilisées pour déterminer si les ursidés sont morts naturellement pendant l'hibernation, suite à la prédation humaine, ou suite à une chutte accidentelle dans une entrée à paroies verticales.

INTRODUCTION

The co-occurrence of cave-bear (*Ursus spelaeus* and *U. deningeri*) remains and artifacts in European caves has been interpreted during the twentieth century to indicate that (1) humans hunted cave bears and deposited the ursid remains or (2) humans and cave bears occupied the same caves at different times—the bear remains were deposited via natural hibernation deaths (e.g., Gargett 1996) and the artifacts were deposited during unrelated use of the same caves (Kurtén 1976; Stiner 1998). Arguments that humans hunted cave bears [Abel and Kyrle 1931; Bächler 1940, 1957 (cited in Kurtén 1976, Stiner 1998)], though popular, have been dispelled by mortality and taphonomic data [Koby 1953 (cited in Kurtén 1976); Kurtén 1976; Stiner 1998; Webb 1988)]. The routine interpretation of apparently associated cave-bear and cultural remains is that humans and ursids used localities at different times, but another interpretation supported by a unique ursid mortality pattern merits consideration.

Taphonomic histories of cave assemblages are complex (Arsuaga et al. 1997; Oliver 1989; Stiner et al. 1996, 1998; Wolverton 1996), and though taphonomic and mortality data indicate that humans did not regularly hunt cave bears, another accumulation agent (other than alternate use of the caves by ursids and humans) might explain the co-occurrence of cave-bear and human remains in some European caves. In particular, caves that have or had in the past horizontal *and* vertical entrances may have served as shelter to humans and traps to cave bears.

Vertical shafts comprising natural traps act as accumulation agents that produce mortality patterns distinguishable from ursid hibernation-death assemblages. In some cases—one of which is discussed here—the taphonomic histories of cave-bear/artifact assemblages should incorporate natural entrapment of ursids as a possible accumulation agent because cave structures change through time (e.g., Arsuaga et al. 1997)—entrances open and close.

Stiner (1998, see also Webb 1988) provides detailed discussion of expected mortality effects of hibernation deaths and human predation. Hibernation-death assemblages should produce mortality patterns that are biased toward young and old adults—U-shaped mortality—because those individuals are more susceptible to attritional death agents such as disease or starvation (Stiner 1998; see also Lyman 1994a). Human predation on hibernating bears, on the other hand should reflect L-shaped mortality or "affect prime adults, old adults, infants, and adolescents randomly, emulating their natural proportions in the living population sequestered in dens each year" (Stiner 1998:309; see also Lyman 1994a).

Natural traps attract young-adult bears; it follows that ursid mortality patterns from natural-trap deposits are biased toward high representation of young-adult remains compared to their representation in stable living populations. Two cave assemblages are discussed herein to demonstrate that this unique mortality pattern offers valuable taphonomic insight into the co-occurrence of cave-bear remains and artifacts/human remains in European caves with horizontal and vertical entrances. The first is a paleontological assemblage of North American black bear remains (*Ursus americanus*) from the Midwestern United States (central Missouri) that dates to the late Holocene (AA38931, 233 ± 39; AA38932, 207 ± 34; CAMS-27141, 170 ± 60 C14 yr B.P.). The second assemblage comprises cave-bear remains (*Ursus deningeri*) from Sima de los Huesos (Spain), a cave with a vertical shaft and possibly buried horizontal entrances, the deposit of which contained cave-bear and human remains (Arsuaga et al. 1997).

Lawson Cave.—Lawson Cave is located in central Missouri. The cave, in profile, is a bottle-shaped solution fissure formed through long-term dissolution of limestone parent material. The modern entrance is a 178 by 79 cm opening located along the top of a forested ridge (long axis oriented approximately east to west); this entrance drops 11½ m straight to the cavern floor. The upper 3 m of the shaft are wet and mossy; the chimney opens into the southeastern portion of the cavern ceiling. The shaft widens as it extends down toward the cavern. A collapsed horizontal entrance conjoins the vertical shaft 4½ m above the cave floor and runs west to east. When open the horizontal entrance would not have provided an exit from the trap because the lower cavern walls are steeply inverted. Lawson Cave's structure suggests it is unlikely that it served as a bear den.

Today the cave is moist with dripstone flowing from the ceiling. Portions of the cave floor were excavated during the 1950s, though the bedrock floor is covered with as much as 1 m of sediment; the identified mammalian remains recovered from the cave are listed in Table 1. Visibility of the modern cave entrance is poor; the opening cannot be seen by humans in daylight from outside of 5 m in all four cardinal directions (Wolverton 1996). Because the sample of bear remains is small (10 individuals), I postulate two explanations for the preponderance of

TABLE 1.—Taxonomic abundances at Lawson Cave.

Taxon	Abundance (NISP)
Ursus americanus	445
Sylvilagus floridanus	238
Sus scrofa	170
Marmota monax	66
Canis sp.	66
Didelphis marsupialis	42
Neotoma sp.	33
Microtus ochrogaster	19
Peromyscus sp.	18
Mephitis mephitis	12
Sciurus sp.	7
Odocoileus virginianus	5
Scalopus aquaticus	3
Procyon lotor	1
Caster canadensis	1
Geomys bursarius	1

young-adult bears: (1) the Lawson Cave mortality pattern is the result of random capture of black bears from the (historically extirpated) central Missouri living population or (2) the pattern is not the result of random capture, but young-adult bears are more susceptible to natural-trap mortality than bears of other ages. As demonstrated below, the mortality pattern appears unlikely to be the result of random accumulation of ursids in Lawson Cave.

Taphonomy of Lawson Cave.—Quantitative units used to discuss taphonomic variables include: number of identified specimens (NISP), minimum number of elements (MNE), and minimum animal units (MAU). NISP is the number of bone or tooth specimens (fragmentary and complete) identified to element and taxon. MNE is the "minimum number of complete skeletal elements necessary to account for observed specimens" (Lyman 1994b:290), or the number of elements represented by the identified complete and fragmentary specimens. MNEs are calculated by determining whether or not two or more specimens overlap; if two fragments overlap—e.g., one distal right humerus overlaps one complete right humerus—then the specimens must be from two separate bones, which equals an MNE of two. If the specimens do not overlap, then they could be fragments from the same element, hence the MNE would equal one. If two or more fragments (or unfused parts) refit, they equal an MNE of one. MAU is similar to MNE except it accounts for some elements occurring more or less frequently in one skeleton than others (e.g., one cranium vs twenty 1st phalanges in the same skeleton) by dividing MNE by the number of times the element occurs in the skeleton (Lyman 1994c).

Intensity of fragmentation, calculated as an NISP:MNE ratio, monitors how many fragments (NISP) occur per distinguishable element (MNE). If Lawson Cave served as a bear den, then high NISP:MNE is expected because trampling increases fragmentation intensity (Lyman 1994a; Stiner et al. 1995). NISP:MNE ratios are calculated for black bear (*U. americanus*) and cottontail (*Sylvilagus floridanus*) long-bone remains from Lawson Cave; the ratios incorporate only fragments

TABLE 2.—NISP:MNE and %Whole for black-bear and cottontail long bones.

	Fragmentation intensity NISP:MNE	Extent of fragmentation % whole
Sylvilagus floridanus		
Humeri	10:8 = 1.25	15/23 = 65.2%
Ulnae	12:12 = 1.0	2/14 = 14.3%
Femora	21:14 = 1.50	11/25 = 44%
Tibiofibulae	35:22 = 1.59	12/34 = 32.3%
Total	78:56 = 1.39	40/96 = 41.7%
Ursus americanus		
Humeri	22:14 = 1.57	2/16 = 12.5%
Ulnae	14:12 = 1.17	1/13 = 7.7%
Femora	22:14 = 1.57	3/17 = 17.6%
Tibiae	10:8 = 1.25	5/13 = 38.5%
Total	68:48 = 1.42	11/59 = 18.6%

as the purpose of the ratio is to measure the degree of fracture of *broken* specimens (complete elements are unfractured). *Extent of fragmentation*—calculated as %Whole—incorporates fragmented and complete black bear and cottontail long bones. It measures what proportion of the bones (MNE) are complete (Lyman 1994b).

The Lawson Cave ursid and cottontail limb bones are extensively fragmented; the abundance of complete elements is low indicating most long-bones were fractured at least once (Table 2). Intensity of fragmentation for the rabbit and bear limb bones, however, is low (Table 2). Each broken identifiable ursid limb element is represented by 1.42 fragments; for cottontails the ratio is 1.39 NISP per MNE. An intensely fragmented assemblage results in several NISP per MNE (Lyman, 1994b:292); such is not the case here. Low intensity of fragmentation suggests that post-depositional processes (including carnivore damage and trampling) were limited likely because the deposit was well sheltered within the natural trap from weathering and other attritional agents. Extensive fragmentation—that is, the fact that most of the specimens are incomplete—suggests that individuals fell into the cave breaking their bones from the fall.

Evidence of carnivore damage is present on remains from Lawson Cave (Table 3); however, substantial gnawing results in density-mediated destruction of bone. The structure of low-density elements leads to their destruction by carnivores, thus low-density elements should be rare or absent in ravaged assemblages. Whether or not density-mediated destruction has occurred can be monitored by comparing the abundances of distal (dense) ends to those of the proximal (relatively less dense) ends of long bones (Binford 1981). Ratio values (RVs) between the abundance of high and low density ends are calculated by "determining the MNE for the proximal end and for the distal end of each bone, and then dividing all four values ([e.g.,] proximal humerus, distal humerus, proximal tibia, distal tibia) by the largest of the four values" (Lyman 1994a:400). Binford's (1981) "zone of destruction" and "zone of no destruction" in Figure 1 are derived from empirical observation of carnivore ravaged and non-ravaged faunal assemblages (see

TABLE 3.—Carnivore damage on ursid remains.

Element	MNE	Carnivore gnawed
Zygomatics	12	0
Mandibles	17	0
Scapulae	14	3
Humeri	16	10
Ulnae	13	6
Radii	11	3
Innominates	14	9
Femora	17	7
Tibiae	13	5
Total MNE	127	43 (33.9%)

Lyman 1994a:398–402). Carnivore ravaged assemblages produce RVs that fall within the zone of destruction.

Density mediated destruction of the Lawson Cave ursid and cottontail remains is monitored using tibia/tibiofibula and humerus RVs (Table 4). The resulting graph (Figure 1) illustrates that little or no density-mediated destruction has occurred; that is, low-density proximal tibiae and humeri occur at about the same frequency as high-density distal ends. Ursids undoubtedly temporarily sur-

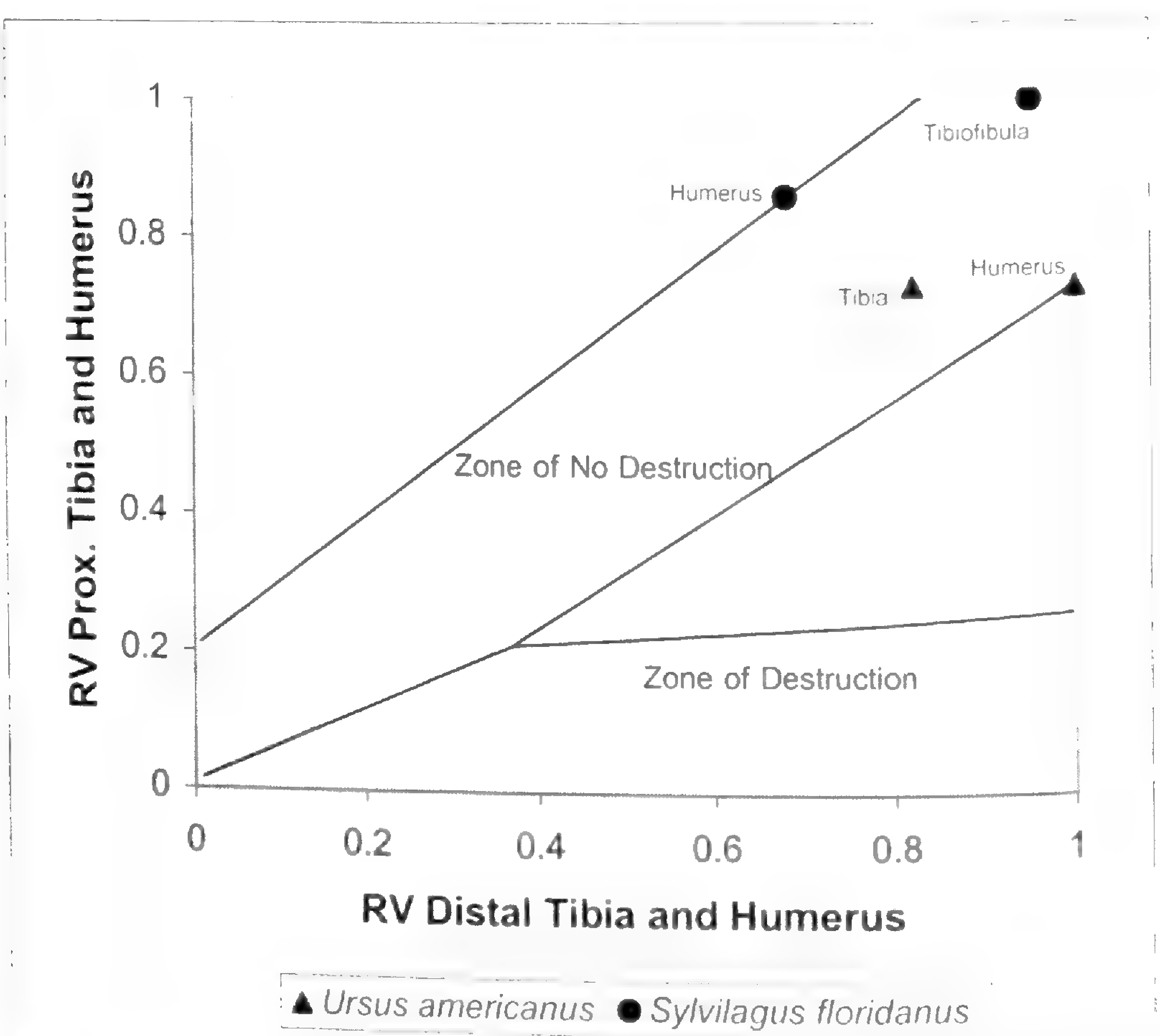

FIGURE 1.—Destruction graph: The ratio values of ursid and cottontail tibiae/tibiofibulae and humeri illustrate that low-density proximal ends occur in the sample. The RVs fall within or near Binford's (1981) observed "zone of no destruction."

TABLE 4.—Ratio-value data for ursid and cottontail humeri and tibiae/tibiofibulae.

	MNE	Ratio value
Ursus americanus		
Distal tibia	9	0.82
Proximal tibia	8	0.73
Distal humerus	11	1.0
Proximal humerus	8	0.73
Sylvilagus floridanus		
Distal tibiofibulae	21	0.95
Proximal tibiofibulae	22	1.0
Distal humeri	15	0.68
Proximal humeri	19	0.86

vived falls into Lawson Cave as indicated by the presence of large carnivore gnaw marks on many specimens (Table 3); however, the RV plot indicates that any density-mediated destruction of ursid and cottontail elements by fall survivors was minimal. Taphonomic assessment of the assemblage reveals that fragmentation damage, though extensive, was not intense; further, carnivore damage was limited during the cave's accumulation history indicating the cave was not a den but a natural trap.

Sima de los Huesos.—Sima de los Huesos is a natural trap located within the Sierra de Atapuerca karst system in north-central Spain. The cave deposits date to the middle Pleistocene (roughly 200 to 300 kya), and the remains of cave bears (*U. deningeri*), humans (*Homo* sp.), and numerous carnivore taxa co-occur in the deposit (Arsuaga et al. 1997). The modern entrance is a 13 m vertical chimney connecting to the cave system. The presence of tooth marks on ursid and human remains as well as cave-bear claw marks on the chimney walls indicate that bears (and possibly other carnivores) survived falling into the cave but were trapped at the base of the chimney.

The cave system above Sima de los Huesos contains dens and complete skeletons of cave bears; it is likely that cave bears used the karst system for hibernation. Arsuaga et al. (1997; see also Garcia et al. 1997) interpret the high abundance of carnivore remains (particularly those of cave bears) and the absence of herbivore remains in the pit to mean that Sima de los Huesos never served as a den; rather, they postulate that bears and other carnivores were attracted to the vertical shaft because of carrion at the base of the chimney (Arsuaga et al. 1997; Garcia et al. 1997). Arsuaga et al. (1997) base their interpretation on taphonomic evidence; however, they also hypothesize that a closed horizontal entrance might have existed for Sima de los Huesos at some period in the past—perhaps accounting for the presence of human remains in the cave. Cave-bear mortality data suggest that ursids entered Sima de los Huesos via the vertical shaft not horizontal entrances.

THE AGE SCORING TECHNIQUE

Bear teeth have attracted considerable attention among researchers for the last few decades (e.g., Gordon 1977, 1986; Gordon and Morejohn 1975; Graham 1991;

Grandal-D'Anglade and Vidal-Romaní 1996; Marks and Erickson 1966; Rausch 1961; Smith et al. 1994; Stiner et al. 1996, 1998; Tucker 1984; Wolverton and Lyman 1998). This is so for two reasons; first, relative ontogenetic ages of bears can be determined from their teeth, and second, teeth are often the only preserved skeletal remains in paleontological and zooarchaeological assemblages. Zooarchaeologists and paleontologists find that dental wear exhibited by bear teeth diagnoses age fairly well (Kurtén 1958; Rausch 1961), and the techniques used to assess wear are nondestructive.

The age-scoring technique proposed by Stiner (1998) allows analysts to order isolated teeth, mandibles, and/or maxillae by age-at-death relative to teeth of other individual bears. Within a given cohort—a group of individuals born within the same limited time period (Begon et al. 1995; Lyman 1987, 1994a)—tooth wear is variable and depends largely on the amount of abrasive food in the diet of bears (Rausch 1961). Stiner's (1998) technique assigns bear teeth to one of nine cohorts; those cohorts are collapsed to three life history phases of unequal duration that correspond to physiological changes in female mammals—juveniles, prime adults, and old adults (Stiner 1990, 1994, 1998). It is *because* Stiner's units are theoretically informed, ecologically warranted, and suitable for small samples that her system is applied to the Lawson Cave ursid remains in this analysis.

Although Stiner's (1998) age-scoring technique is designed for European cave bears (*U. deningeri*), the technique can be used on other members of the genus *Ursus* (except polar bears, *U. maritimus*). It is widely believed that cave bears consumed diets higher in gritty material than modern members of *Ursus* resulting in more rapid rates of tooth wear (e.g., Kurtén 1976). Stable-isotope data indicate that European cave bears and modern black and brown bears have similar hibernation metabolisms (Nelson et al. 1998), though the dentition of cave bears suggests pronounced herbivorous specialization (Kurtén 1958, 1976). Bocherens et al. (1994) report, based on analyses of carbon and nitrogen stable isotopes, that most ursids are predominately herbivorous. The stable isotope evidence indicates that cave bears (*U. spelaeus*) were more herbivorous than modern bears (Bocherens et al. 1994). Stiner's tooth-wear phases are applicable to the Lawson Cave black-bear teeth despite differences in diet among different species of *Ursus* because the phases are ordinal scale and calibrated to fundamental life-history periods.

METHODS AND MATERIALS

Isolated and inset mandibular and maxillary molars (MNE = 60) from Lawson Cave were age-scored using Stiner's wear-chart illustrations (1998:312–313, figures 2 and 3) and assigned to one of nine age cohorts (Table 5). Following Stiner, cohorts 1 to 3 were grouped as the juvenile phase, 4 to 7 were grouped as the prime-adult phase, and 8 and 9 were grouped as the old-adult phase. Lower and upper fourth premolars (MNE = 2 left upper, 2 right upper, 4 left lower, 4 right lower) were excluded because of their low abundance in the collection; this includes a mandible with an erupting permanent, lower-fourth premolar. Similar mortality patterns should emerge from each type of molar based on Stiner's (1998) research.

Garcia et al. (1997) use four *stages* of tooth development and wear in their

TABLE 5.—Frequencies (MNE) of each tooth type aged to age cohorts and life-history phases.

Age cohort	Left M^1	Left M^{2*}	Left M_1	Left M_2	Left M_3	Right M^1	Right M^{2*}	Right M_1	Right M_2	Right M_3
1 Juv.	—	—	—	—	—	—	—	—	—	—
2 Juv.	—	—	—	—	—	—	—	—	—	—
3 Juv.	1	1	—	—	—	1	—	1	—	—
4 Prime	—	2	1	1	—	1	2	1	1	1
5 Prime	3	3	2	2	1	3	2	2	2	2
6 Prime	1	—	1	1	1	—	—	1	—	1
7 Prime	1	1	1	1	1	1	—	1	1	1
8 Old	—	—	1	1	1	1	1	—	1	—
9 Old	—	—	—	1	1	—	—	—	—	—

* The M^2 is highlighted here because it is the tooth used by Garcia et al. (1997).

analysis of the Sima de los Huesos cave-bear remains (Table 6). For the Sima de los Huesos assemblage, Garcia et al. (1997) add the deciduous stage (d3) shown in Figure 2A. Note that the word "phase" is used here to refer to life-history periods derived from Stiner's age-scoring technique, the word "stage" is used in discussion of Garcia et al.'s (1997) units, which were derived from Kurtén's (1958) earlier work, and the word "cohort" refers to one of Stiner's original nine age-scoring units later collapsed to three life-history phases.

No attempt was made to convert the Sima de los Huesos mortality data to the form recommended by Stiner (1990, 1994, 1998)—conversion would require access to the collection. Similarly, the Lawson Cave data were not assessed using Garcia et al.'s (1997) stages. The three-phase scheme is clearly the most appropriate for the small assemblage from Lawson Cave. Although Kurtén (1958) *estimated* actual ages based on his original wear stages, I treat Garcia et al.'s stages as ordinal scale though they are derived from Kurtén's scheme. Stiner's and Kurtén's/Garcia et al.'s aging techniques, thus, use different numbers of age units to measure life span—three units are used in Stiner's scheme and four units are used by Garcia et al. There exists no lowest common denominator between the two scales, thus data from the natural traps cannot be directly compared. Nevertheless, indirect visual comparison of the graphs is possible and is pertinent to the argument made here.

For comparative purposes, I include mortality data from three cave-bear assemblages thought to have been accumulated by hibernation deaths based on U-shaped mortality patterns. The Yarimburgaz (Turkey) cave-bear (*U. deningeri*) mortality data are available in the three-phase format of Stiner (1998). Lawson

TABLE 6.—M^2 wear stages used by Garcia et al. (1997).

Wear stage	Description
I	open roots at the apices, walls forming, unworn crowns
II	roots closed, cusps clearly visible, crowns polished, narrow attrition facet along the internal ridge
III	attrition facet enlarged, loss of large parts of enamel
IV	facet more enlarged, enamel disappeared, cementum eroded

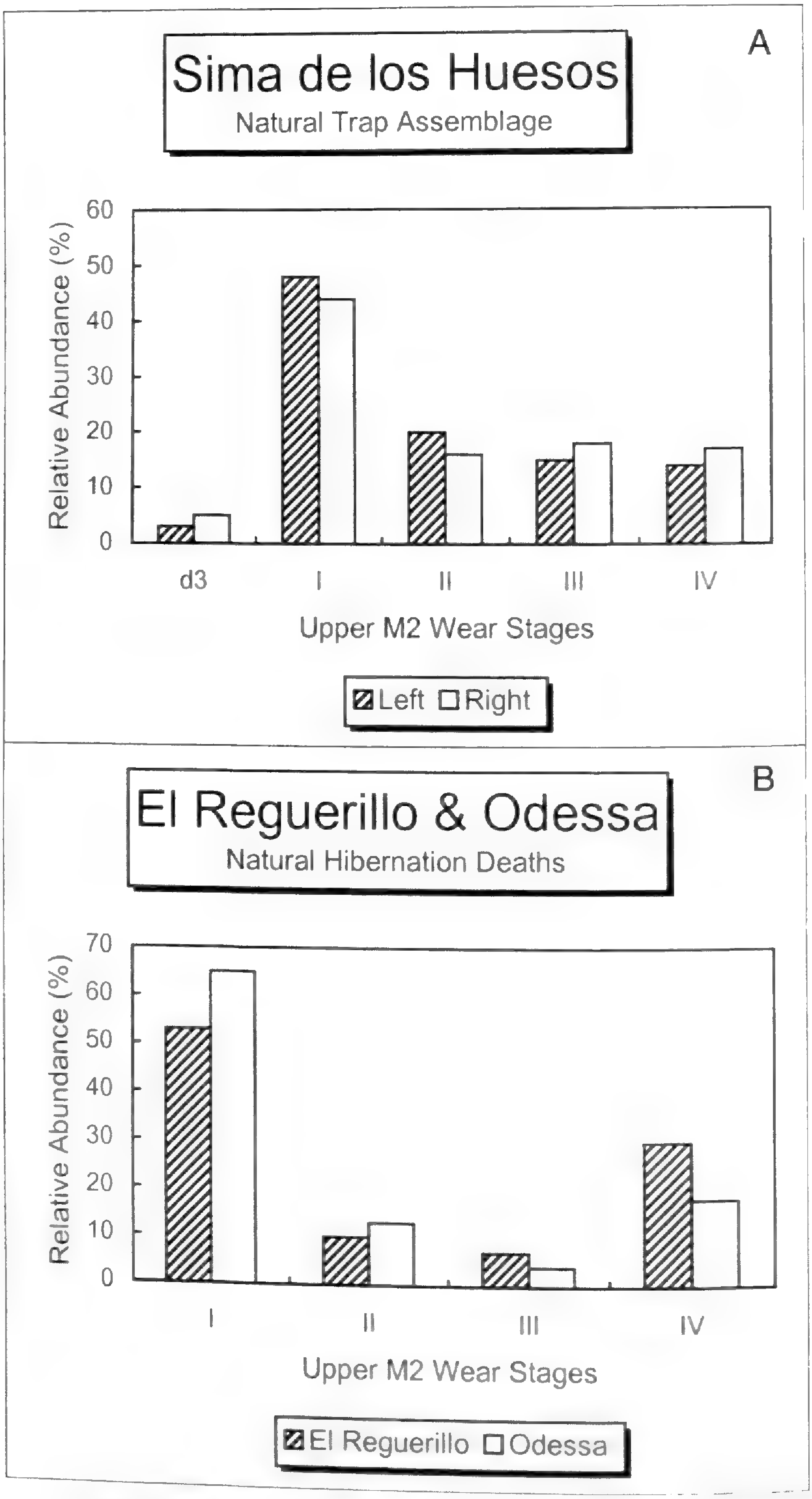

FIGURE 2.—Cave-bear mortality profiles from Sima de los Huesos (*U. deningeri*), El Reguerillo (*U. spelaeus*), and Odessa (*U. spelaeus*) (after Garcia et al., 1997, figs. 6, 7, & 8: 167–168).

Cave and Yarimburgaz Cave ursid mortality patterns are, thus, directly comparable. The El Reguerillo (Spain) and Kurtén's (1958) Odessa cave-bear (*U. spelaeus*) mortality patterns are presented by Garcia et al. (1997) in four-stage format and are compared to the Sima de los Huesos assemblage. Both El Reguerillo and Odessa are thought to be natural, hibernation-death assemblages (based on mortality criteria discussed above).

In order to evaluate the Lawson Cave ursid mortality pattern, three populations were modeled (Figure 3). Each population comprises 100 individuals; all three are variations of the "idealized stable structure" (L-shaped) living population discussed by Stiner (1990:308–309; Lyman 1987). The percentage of prime-adults differs for each population. Fifty samples of 10 individuals each were drawn from each modeled population to determine the likelihood that the prime-dominated pattern—comprising a higher proportion of prime adults than expected in a living population—from Lawson Cave is the result of random capture of prime adults.

RESULTS

The natural-trap assemblages—Sima de los Huesos and Lawson Cave—exhibit proportionally more prime adults than expected in a living population, which should approximate an L-shaped profile (Lyman 1987, 1994a; Stiner 1990). This pattern is visible in both assemblages despite the use of different aging formats. The Sima de los Huesos assemblage noticeably boasts more subadults and young adults (Figure 2A) than assemblages thought to be deposited via hibernation deaths, such as those from El Reguerillo and Odessa (Figure 2B). Further, the Sima de los Huesos pattern is not L-shaped.

The mortality pattern from Lawson Cave is heavily prime dominated [$> 80\%$ of molar specimens are prime aged (Figure 4)]. Following Garcia et al. (1997), 83% of the M^2s (MNE = 12) are from prime adults (Table 5). Graphic comparison to the presumed hibernation-death pattern from Yarimburgaz Cave (Stiner 1998) highlights the distinctiveness of the Lawson Cave pattern (Figure 4).

Validity of the Lawson Cave Ursid Mortality Pattern.—Samples of the model populations yield no mortality patterns as prime-dominated as that from Lawson Cave (Table 7). Eight of the fifty samples drawn from Population A were prime-dominated (the samples contain more prime adults than expected from the modeled population); two of those samples included 60% prime adults. The fifty samples from Population B, which consisted of more prime adults than A, included seven prime-dominated samples. Two of those samples comprised 60% prime adults, and one consisted of 70% prime adults. The fifty Population C samples included thirteen prime-dominated samples. One of those contained 60% prime adults and another contained 70% prime adults. Based on the samples drawn from these model populations it is reasonable to conclude that prime-dominated assemblages can be produced randomly from stable-age structure living populations. However, it appears unlikely that assemblages as heavily prime-dominated as that from Lawson Cave regularly result from random sampling of stable living populations. Given these results it is more reasonable to conclude that the prime-dominated

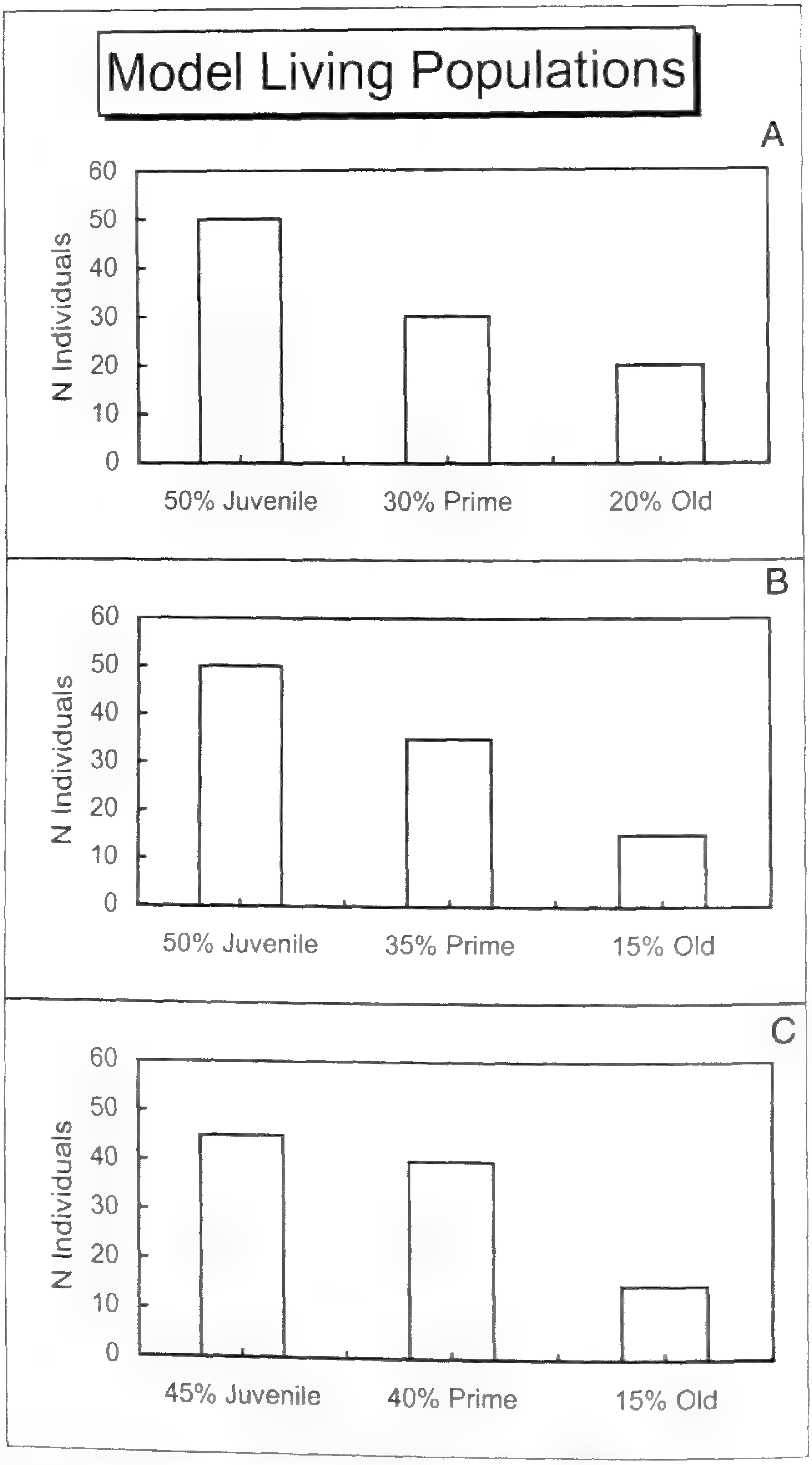

FIGURE 3.—Age structures of modeled living-structure populations.

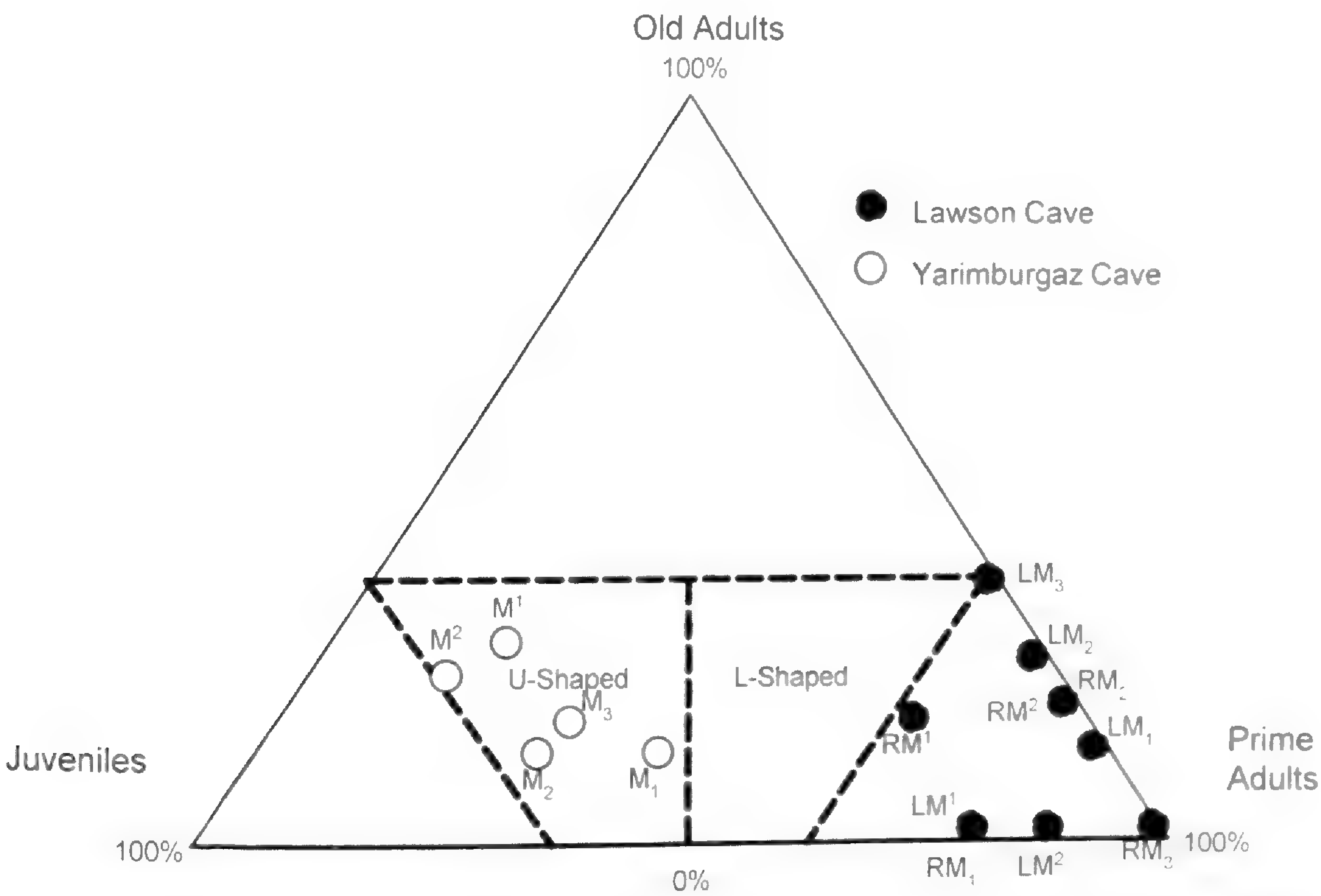

FIGURE 4.—Three-pole graph illustrating ursid mortality patterns from Yarimburgaz Cave (*U. deningeri*) and Lawson Cave (*U. americanus*).

pattern at Lawson Cave is the result of physiological and related behavioral characteristics of young prime-adult bears.

DISCUSSION

One can argue that Lawson Cave and Sima de los Huesos acted as similar faunal accumulation agents based on cave structure alone; Lawson Cave is 11.5 m deep and Sima de los Huesos is 13 m deep (Arsuaga et al. 1997). The mortality patterns of these two assemblages are likely more similar than appears because of a minor recovery bias at Lawson Cave; smaller elements occur in lower than expected frequencies in the collection (Wolverton 1996). Neonate and juvenile

TABLE 7.—Results of model-population random sampling.

	Population A	Population B	Population C
50 samples (n = 10) drawn per population			
% prime-dominated samples drawn at random	16%	14%	26%
Number of samples containing 60% prime adults	n = 2 (4%)	n = 2 (4%)	n = 1 (2%)
Number of samples containing 70% prime adults	n = 0	n = 1 (2%)	n = 1 (2%)
Number of samples containing 80% prime adults	n = 0	n = 0	n = 0

TABLE 8.—Condition of black bears in western Washington (Poelker and Hartwell, 1973).

Health status	Females (n = 12)	Males (n = 13)	M & F (n = 25)
Poor to fair condition	*Y = 1	Y = 1	Y = 2
	SA = 2	SA = 3	SA = 5
	A = 2	A = 1	A = 3
Good to excellent condition	Y = 1 (anestrus)	Y = 1	Y = 2
	SA = 1 (estrus)	SA = 0	SA = 1
	A = 5 (2 estrus)	A = 7	A = 12

* Y = Yearling, SA = Subadult, and A = Adult.

teeth from friable mandibles and crania might not have been recovered because they were not recognized or they did not preserve. The presence of one neonate mandible (with an inset deciduous premolar) might lead to the inference that Lawson Cave served as a den; however, such an interpretation contradicts all indications, such as cave structure and taphonomic data, that Lawson Cave was a natural trap. Garcia et al. (1997) report no visible recovery bias in the Sima de los Huesos assemblage. Should the Sima de los Huesos data ever be converted to Stiner's three phases, a more clear young-adult dominated pattern than that shown in Figure 2A might emerge because the two aging schemes operate on separate ordinal scales.

As stated by Garcia et al. (1997:172) "the most likely scenario compatible with the structure of the Sima de los Huesos carnivore assemblage is a natural trap (very likely the current pitfall) attracting carnivores to accidental deaths." A simple physiological analogy—implicating a carrion attractant—is useful to understand the proximate reason that ursids, given their keen senses of smell (Brown 1993; Schullery 1992), were attracted to both pits. Modern bear-bait trapping utilizes meat or carrion to draw ursids into barrels or other enclosures (Conover 1983; Craighead et al. 1995; McLaughlin and Smith 1990; Oliver 1995). Clearly U-shaped mortality patterns cannot be expected in natural-trap ursid assemblages. Why, then, do there appear to be proportionally more prime adults in the Lawson Cave and Sima de los Huesos assemblages than might be expected in a stable living population? Why wouldn't bears of all ages be equally susceptible to natural-trap deaths, which would result in L-shaped mortality patterns?

Again, a modern analogy provides a plausible answer. There appear to be high relative abundances of *young* prime adults in the Lawson Cave assemblage; the same can be argued for Sima de los Huesos based on the proportion of individuals in stages I and II. Most of the prime-adult-phase molars from Lawson Cave fall in the two early, prime-adult cohorts (4 and 5). Sixty percent of the left molars and seventy-four percent of the right molars were aged to cohorts four and five within the prime-adult phase (Table 5). It is arguable, then, that these molars represent old sub-adults or young adults within the prime-adult phase.

Poelker and Hartwell (1973:121) demonstrate that Washington-state subadult black bears—those individuals no longer with their mother and in the process of establishing home ranges (Powell et al. 1997)—are the least healthy of all age classes (Table 8). Health was gauged in terms of disease and parasite loads and general hematology; only one subadult was considered healthy (Poelker and Hartwell 1973). Powell et al. (1997) discuss two limiting resources that shape bear home ranges: food and prospective mates [see Craighead et al. 1995 for discussion related to grizzly bears (*U. arctos*)]. Adult male black bears tend to have large home ranges and do little immediate sharing of resources with conspecifics (Powell et al. 1997; see also Beecham and Rohlman 1994; Boileau et al. 1994; Craighead et al. 1995; Klenner 1987; Klenner and Kroeker 1990). If home ranges overlap among males it is because the areas are large, not because of cooperation. Male home ranges only tend to shift in response to movement of potential mates, but not in response to food availability. Adult females use overlapping home ranges that change relative to food availability (Powell et al. 1997).

Within this matrix are young prime-adult bears establishing home ranges. It is likely that access to both limiting resources (food and mates) is unpredictable; thus, young prime adults are less healthy (e.g., more in need of food) than older prime-aged adults with established ranges. For example, among 56 black bears studied by Garshelis and Hellgren (1994:180) in Minnesota, the relatively young males tended to "be underrepresented as breeders. However, wounds incurred from aggressive encounters with other bears" were common. Prime-aged males with established home ranges tended to have higher serum-testosterone levels early in the breeding season—they had early access to mates. McLellan et al. (1999:917) report that young male grizzly bears (*U. arctos*) in the Pacific Northwest have higher mortality rates than well-established adult bears; "perhaps due to their large ranges and inexperience, young males are more prone to encounter human attractants and be killed as problem bears than [members of] other sex-age classes." Adult males and females with established home ranges have better access to preferred food resources and mates; as a result they have lower mortality rates.

Given the argument presented here, subadult and young adult black bears are under greater nutritional stress than adult bears; they lack access to limiting resources (food and mates). It follows that subadult and young adult bears are susceptible to carrion attractants in natural traps. The apparent preponderance of young prime-adults in the Lawson Cave assemblage supports this notion because young-adult bears undergo considerable stress during their attempts to establish home ranges (Garshelis and Hellgren 1994; McLellan et al. 1999; Powell et al. 1997).

CONCLUSIONS

As the title to this paper suggests, the results here are best cast in the form of a natural-trap hypothesis regarding ursid mortality. This is so for two reasons: 1) only two natural-trap assemblages are examined here using different aging methods, and 2) one of those assemblages (Lawson Cave) is small. Nevertheless, the high proportional abundance of young adult ursids in these two natural trap assemblages is markedly distinct from their low proportional abundance in winter-death, U-shaped mortality profiles. Further, the documented natural-trap mortality patterns contrast with those expected to result from human predation on vulnerable, hibernating bears. There is a physiological/behavioral reason that ursids are attracted to natural traps; in particular young-adult ursids are most susceptible to death in natural traps.

Ursid mortality data from sites such as Sima de los Huesos provide another line of evidence with which to understand accumulation histories of palimpsest assemblages, such as those from caves—whether archaeological, paleontological, or mixed. An important component of the argument presented here is that the Lawson Cave assemblage is a non-cultural assemblage; it can be used to ferret out expected characteristics of remains deposited via natural entrapment. In particular, mortality data can be useful for understanding accumulation histories of assemblages that contain artifacts/human remains and ursid remains. This is particularly relevant for faunal assemblages from caves with multiple entrances.

ACKNOWLEDGMENTS

I thank R. Lee Lyman, Mary C. Stiner, Travis Pickering, Mitchell Sullivan, Sergio Herrera, Alejandra Gudiño, Michelle Drapeau, and Blaine Schubert for assistance with parts of this paper and anonymous reviewers of earlier drafts for constructive comments. Previously unreported radiocarbon dates were funded by the National Science Foundation (grant # SBR-9912118)

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People, Plants, and Justice: The Politics of Nature Conservation. Charles Zerner, ed. New York: Columbia University Press. 2000. Pp. 416. $49.50 (cloth).

People, Plants, and Justice: The Politics of Nature Conservation makes three major contributions debates on the ethics of nature conservation. First, the theoretical and methodological approaches presented by the contributing authors to this volume advance political ecology scholarship. Second, the book suggests alternative models, principles, and perspectives that, if adopted, will enable conservation organizations to improve rather than abuse human rights. Third, it boldly exposes potential and actual human rights abuses caused by conservation projects by critiquing specific guiding models, principles, and perspectives. The data that are presented in this book support the proposition that the conservation of biodiversity does not necessarily coincide with the protection of human rights. In other words, the objectives of conservationists are not always the same as the objectives of indigenous and/or local people. It is possible to reach common ground, however, if conservationists can become less ethnocentric, learn from past mistakes, and—as is repeatedly emphasized throughout the book—relinquish control to local people.

The contributors to *People, Plants, and Justice* contextualize conservation programs in the political economic struggles that characterize the contemporary world. Their substantial evidence includes data on historical and contemporary social relations involving natural resource management in Africa, Latin America, Oceania, and Southeast Asia. Many of the authors juxtapose the perceptions and practices of local communities to those of conservation organizations, examining social relations between actors who are internal and external to environments that house valuable resources. Rather than romanticizing indigenous peoples or demonizing the multiple other groups of actors who are subjects of analysis, the book presents a non-essentialized, empirically-based analysis of the social relations of conservation. Nonetheless, either because of the realities of our contemporary world or the bias of the authors, the "scales of justice" (Zerner 2000:17) weigh heavily against conservation organizations.

The book is divided into two parts. Part One, "Across the Terrain," consists of three chapters that define the subject matter, establish the book's approach, set the prevailing tone for the writings, and review other chapters in the book (sometimes applaudingly and other times harshly). The organization of this book is quite unique among edited volumes since three chapters and three authors perform tasks that are typically accomplished in just one chapter. Far from being mere summaries of the chapters in Part Two, "On Location," however, the three chapters in Part One combine critical commentary with rich data from the authors' own research in insightful comparisons. In the official "Introduction" (subtitled "Toward a Broader Vision of Justice and Nature Conservation"), Charles Zerner, the editor, leads the reader through the volume's major issues of hierarchical social formations, community dynamics, culturally constructed images of nature, the commodification and global circulation of nature, and democratic reform of resource management regimes. Zerner challenges his audience to conduct further critical research, design "better" social-ecological-political-economic institutions, and re-align the political economy with human rights. In Chapter 1, "Contested

Communities, Malignant Markets, and Gilded Governance: Justice, Resource Extractions, and Conservation in the Tropics," Michael Watts uses his review of the case studies in Part Two to scrutinize 'community' as a concept that is trendy and instrumental yet unsound and even dangerous in terms of increasing the risk of social injustices. In Chapter 2, "Beyond Distributive Justice: Resource Extraction and Environmental Justice in the Tropics," Richard Schroeder questions the standard theories of conservationists suggesting that they are culturally-bound, market-driven, and insufficient agendas and challenging the merits of "distributive justice," a common model for sustainable development that the World Wildlife Fund and other organizations follow in their conservation projects. Together Schroeder, Watts, and Zerner preface the prevailing temper of all the book's contributors by simultaneously deconstructing and expanding—through the insertion of democracy, cultural relativity, and local control—conceptions of conservation.

Part Two consists of 13 case studies that produce mixed emotions in the reader because they are at once revealing, shocking, discouraging, and inspiring. The authors confront us with the oppressive potential of imaginations including our own conceptualizations of local communities and those of institutions such as the state, development organizations, and conservation projects. For example, in Chapter 3, "Justice for Whom? Contemporary Images of Amazonia," Candace Slater describes typical American views (shared by many of the people who will read her article) of the Amazon and Amazonian residents. As she describes the historical development of our conceptualizations, Slater gives us contradictory demographic and ethnographic evidence to demonstrate that the reality of the Amazon does not coincide with the fantasy. The reader should beware: this article may cause painful self-reflections.

Another illustration of the danger of inaccurate imaginations is found in Chapter 9, "Global Markets, Local Injustice in Southeast Asian Seas: The Live Fish Trade and Local Fishers in the Togean Islands of Sulawesi," by Celia Lowe. Lowe criticizes the routine paradigm that is used in designing regulatory policies that identifies local people as the cause of unsustainable resource use. This is a restricted, hence inaccurate/incomplete, conceptualization of environmental degradation because it does not consider the influence of external political economic forces, or the innumerous local-global links in commodity chains.

Another topic that is addressed in the book is social inequities resulting from commodity chains that de-value the labor and knowledge of people at the source of a natural product while exponentially increasing the value of the product itself. In Chapter 12, "Profits, Prunus, and the Prostate: International Trade in Tropical Bark," Anthony Cunningham and Michelle Cunningham incriminate pharmaceutical industries and international consumers in the thievery of indigenous knowledge, showing that they/we have contributed to the massive over-harvesting of *Prunus africana* and the widespread destruction of forest habitat.

Ignorance or mis-perceptions of local management regimes is another major issue related to paradigms for development and conservation that is discussed in this book. The authors of Chapter 7 (Genevieve Michon, Hubert de Foresta, Kusworo, and Patrice Lewang) and Chapter 8 (Stephanie Gorson Fried) demonstrate the sustainability of local damar production in Krui, Sumatra and indigenous rattan production in East Kalimantan, Borneo, respectively. The environmental policies of Indonesia deny the validity of indigenous agroforestry, in the process de-legitimizing the basis of local property rights. The official ignorance of the state enables the appropriation of vast amounts of acreage and the establishment of less-rational forms of commodity production that are not based on local environmental knowledge.

While the objective of conservation organizations is to solve ecological problems, they often cause social problems. In Chapter 13, "A Tale of Two Villages: Culture, Conservation, and Ecocolonialism in Samoa," Paul Cox compares the operational procedures of a democratic, community-controlled successful environmental project in one Samoan village to a top-heavy, externally-designed unsuccessful environmental project in another Samoan village. Cox goes so far as to label ethnocentric conservation projects that are insensitive to indigenous perspectives "ecocolonialism." To avoid contributing to global imperialism, Cox (2000:343) suggests three aspects that ought to be incorporated into environmental projects in indigenous communities: "*Consent* of the indigenous people, *respect* for their culture, and *submission* to indigenous political control." Jill Belsky documents the ways that conservation programs in central Belize exacerbated social and ecological dysfunction. In Chapter 11, "The Meaning of the Manatee: An Examination of Community-Based Ecotourism Discourse and Practice in Gales Point, Belize," Belsky deconstructs the "community-based conservation" model and ecotourism as a solution to ecological degradation.

Although the three chapters in Part One are all reviews of the 13 chapters in Part Two, there is little if any redundancy. Zerner, Watts, and Schroeder notice different themes, contextualize the case studies in variant yet overlapping bodies of scholarship, and take off from them in personalistic directions. Moreover, organizing the volume so that there are three introductory chapters in the beginning eliminates the need to have a concluding chapter following the case studies. Thus, there is no summary chapter at the end of Part Two. Instead, the book ends with a case study that Zerner (2000:9) describes as an "analytical tour de force." Indeed, the audience enjoys a fiery finalé as Bronwyn Parry guides us through a history of plant collecting providing a chronology of the changing bases for valuation beginning with the early era of exploration, when the value of botanicals was based on novelty and exotic-ness, through the current bio-techno era in which botanical value is determined by efficiency in communicating knowledge.

This book speaks to environmental and social advocates, policy makers, and scholars. It is a call to action. Conservationists should not read this book as an attack on their views and goals. Instead, they should use this book as a manual for becoming more culturally aware of the particular geographical areas, social groups, and natural resources with whom they work. Through this optic, conservationists can consider the growing literature on the social relations of conservation as attempts to improve, not dismantle, their projects. This is an opportunity to combine the need for environmental protection with social justice. Academics also can use this volume to improve upon their work in a number of ways. For instance, the writings in this volume enhance reflexivity, problematize common concepts, pose important questions, and provide answers to some crucial questions as well. Most importantly, the book's articles supply scholars with models for conducting more ethical research and tools for improving social conditions cross-culturally.

Since the publication of *People, Plants, and Justice: The Politics of Nature Conservation,* it will never again be possible for the assortment of people who manage plants—ranging from herbarium collectors to biotechnicians—to claim that their endeavors are benign. As suggested by the subtitle of this book, their activities are embedded in global politics. Participants in nature conservation—from consumers of "rainforest" candybars to ecotourists—can no longer assume that their learned perceptions of 'other' ecosystems or their contributions to "save" the environment are cross-culturally true or socially just.

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Journal of Ethnobiology 21(2): 77–90 Winter 2001

THE USE OF CATTAIL (*Typha latifolia* L.) DOWN AS A SACRED SUBSTANCE BY THE INTERIOR AND COAST SALISH OF BRITISH COLUMBIA

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ABSTRACT.—The economic uses of plants are often more accessible to researchers working with actual material remains from early ethnographic and archaeological sources than are ritual uses. Nevertheless, it is clear from the ethnographic literature of the Northwest of North America that plants also served many important ritual and ceremonial functions. During the examination of two Salish wooden mortuary figures currently housed at the Museum of Anthropology, University of British Columbia, a compact, fibrous white mass was observed lodged in the back of the mouth of one of the figures. A sample of the material was identified as *Typha latifolia* L. This paper discusses the ritual uses of cattail down, particularly with regards to funerary customs, among the Coast and Interior Salish of the Northwest of North America.

Key words: cattail, Salish, mortuary rituals.

RESUMEN.—Las aplicaciones económicas de las plantas siguen siendo, a menudo, más accesibles a los investigadores que trabajan con material real de fuentes ethnográphicas y arqueológicas tempranas que las aplicaciones rituales. Sin embargo, está claro que en la literatura ethnográphica del noroeste de Norte América las plantas también sirvieron muchas funciones rituales y ceremoniales importantes. Durante la examinación de dos esculturas mortuarias de madera de Salish, contenidas actualmente en el Museo de la Antropología, la Universidad de Colombia

Británica, se observó una masa blanca fibrosa alojada en la parte posterior de la boca de una de las figuras. Una muestra del material fue identificada como *Typha latifolia* L. Este papel pone el resultado en contexto, en que discute las aplicaciones rituales de la pelusa de la espadaña, particularmente con respecto a las costumbres funerarias, entre las populaciones Salish de la costa y el interior de la costa noroeste de Norte América.

RÉSUMÉ.—L'utilisation économique des végétaux est souvent plus accessible que leur usage rituel aux chercheurs travaillant sur les restes matériels provenant de sources ethnohistoriques ou archéologiques. La littérature ethnographique concernant le Nord-Ouest de l'Amérique du Nord montre néanmoins clairement que les plantes ont également eu de nombreuses fonctions rituelles et cérémonielles. Au cours de l'examen de deux figurines mortuaires en bois, actuellement conservées au Musée d'Anthropologie de l'Université de Colombie Britannique, une masse blanche, compacte et fibreuse, fut observée à l'arrière de la cavité buccale d'une des deux figurines. Un échantillon de cette substance a été identifié comme *Typha latifolia* L. Le but du présent article est de re-situer cette trouvaille dans son contexte, en discutant des usages rituels de chaton, particulièrement dans le cadre de coutumes funéraires, chez les populations Salish du littoral et de l'intérieur des terres du Nord-Ouest de l'Amérique du Nord.

INTRODUCTION

Though there is some record of the ritual uses of plants in the Northwest (Turner 1982; Compton 1991), the record for their economic uses is relatively more complete (e.g. Compton 1993; Turner 1995, 1997, 1998). This is in part due to the fact that though First Nations people may have described rituals in general terms for the early ethnographers, there was a reluctance on some occasions to share knowledge about the rituals associated with specific plants. This would have been particularly true for knowledge that was owned and guarded by individual households. Later in the historic era, when ceremonial life was disrupted by drastic depopulation (Boyd 1990, Carlson 1997a) and the performing of traditional ceremonies was suppressed or prohibited outright (Carlson 1997b; Cole and Chaikin 1990; Fisher 1992), some details about the ritual roles of individual plants were lost.

The identification of plants used to make ritual artifacts or those found in ritually important contexts (cf. Carlson 1999) is an avenue for understanding ceremonial uses of plants in the past. In particular, the identification of such plants provides information on cultural prescriptions for the appropriate plant for specific ritual contexts. Such information, in turn, provides a broader understanding of traditional ceremonial life and of the larger worldview, and may furthermore suggest new lines of interpretation and investigation.

In this paper, we discuss the identification of cattail (*Typha latifolia* L.) down found in the mouth of one of a pair of Salish wooden mortuary figures.[1] We begin with a brief overview of the Salish, followed by an account of the figures that provides the context for the cattail down. A review of the ethnographic and ethnobotanical information for the Interior and Coastal Salish reveals that cattail served a variety of economic needs, but was also an important element in several

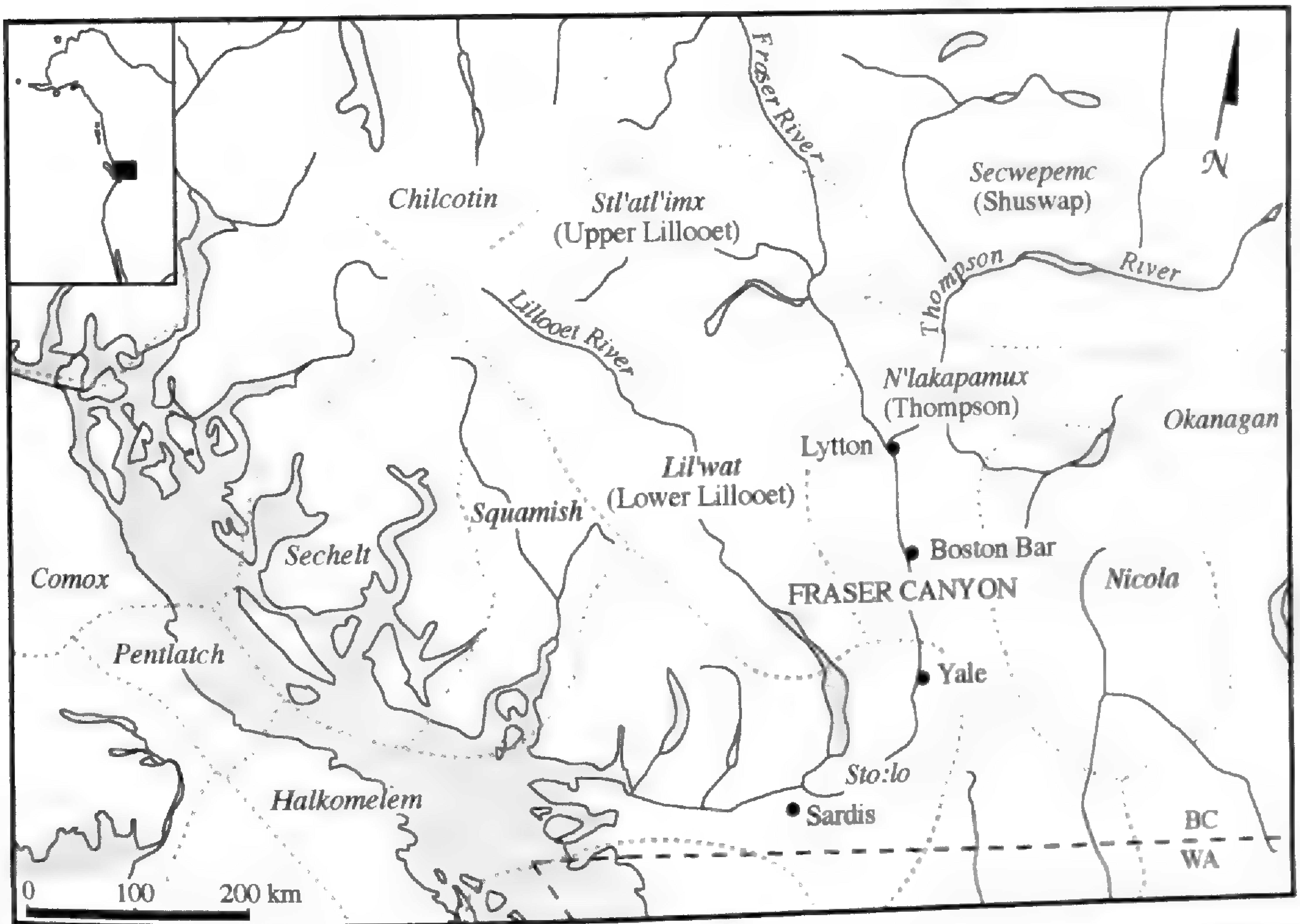

FIGURE 1.—Map of southwestern British Columbia, showing locations of selected Salish groups and places discussed in the text.

aspects of Salish ritual life. In particular, cattail down was strongly associated with traditional funerary rites among the Salish. The ritual significance of the down may be in part associated with the symbolic importance of the color white in the worldview of the Coast and Interior Salish.

THE SALISH

In British Columbia, traditional Salish territory extends across much of the southern part of the province (Figure 1). The most basic division of this territory is that between the Coast and Interior Salish, reflecting a major language division as well as cultural differences. According to late nineteenth century and early twentieth century ethnographic and ethnohistoric information, Salish social and economic organization was based on the extended family unit, several of which made up a household. On the coast, family units lived in large shed-roof plank houses, while in the interior, smaller plank houses and semi-subterranean pit-houses were used. In some areas, villages were quite large, with several hundred inhabitants. The subsistence economy was based on the collection and management of wild food resources, including fish, mammals, root foods, and berries. Political authority was largely hereditary and invested in the heads of high ranking families, especially among coastal groups. In the interior, social and political organization was more flexible, although still showing a strong hereditary component (Barnett 1955; Teit 1900, 1906). Both Coast and Interior Salish societies were semi-sedentary, with highly complex material culture and ceremonial life

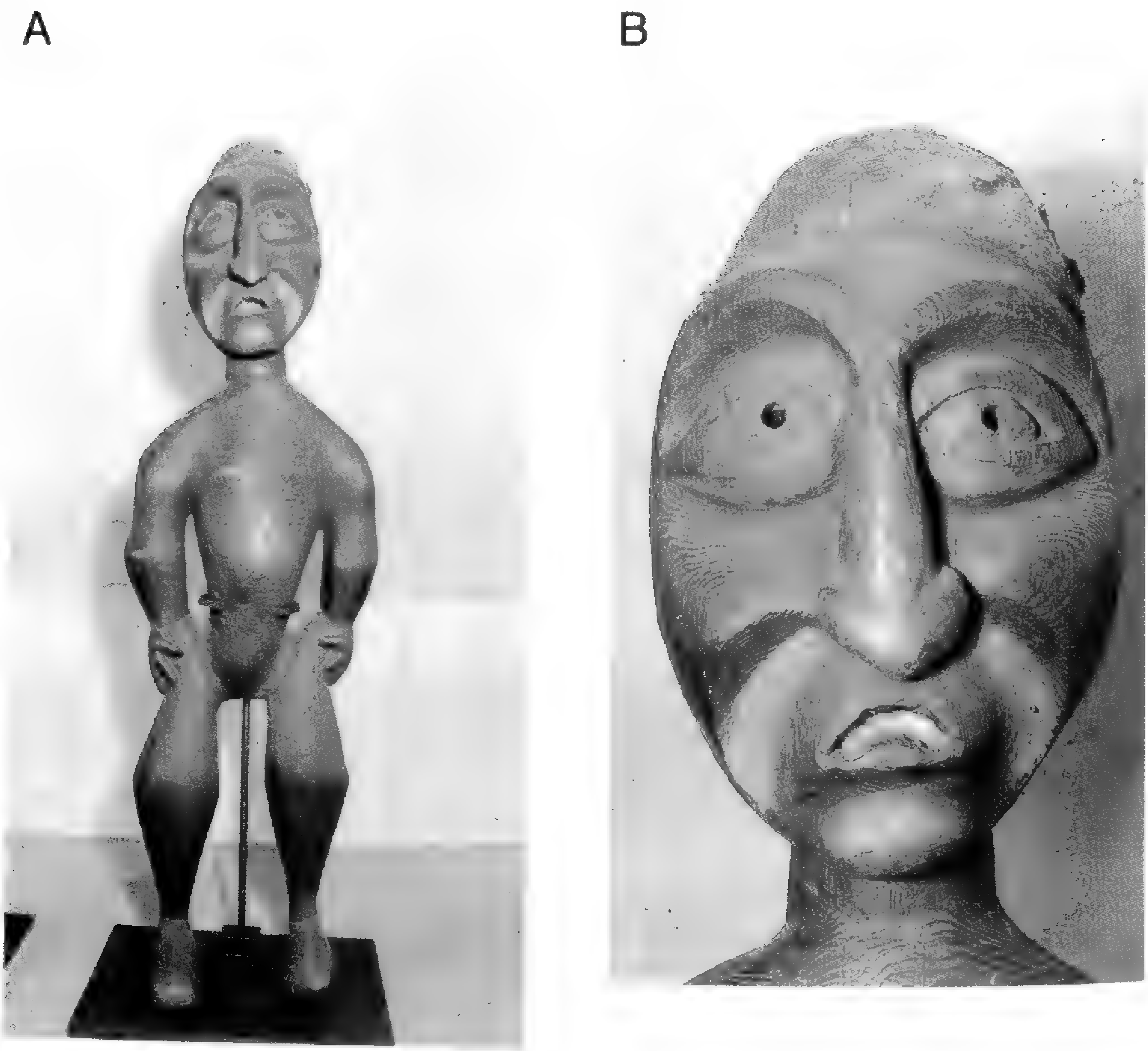

FIGURE 2a.—Salish mortuary figure (UBC Museum of Anthropology, A1780).

FIGURE 2b.—Close up of the cattail down in the mouth of the mortuary figure (Photographs by J. Ostapkowicz).

based largely around the acquisition of personal spirit power (Kew 1990; Suttles 1987, 1990a).

THE GRAVE FIGURES

The grave figure with the cattail down in its mouth is one of a pair of carvings currently housed at the Museum of Anthropology, University of British Columbia (A1780; Figure 2a). Though both figures are clearly Salish in origin, their exact provenience, and thus specific group affiliation, is uncertain. The museum attributes them to the Stó:lō—the Coast Salish of the central and upper Fraser Valley—however, others have attributed the figures to the N'lakapamux (Thompson), an Interior Salish group[2] (Figure 1).

Freestanding, fully sculptural depictions of the human figure, such as the pair under discussion, were typical of Coast and Interior Salish mortuary art. Mortuary figures—depicting men, women, and ***sxwayxwey***[3] dancers—were carved as representatives of the deceased, and were erected for commemorative purposes at Salish grave sites. The practice of erecting these figures in front of family grave houses and box burials spanned much of Coast and Interior Salish territory from at least the beginning of the nineteenth century to the early twentieth century in British Columbia (Ostapkowicz in press). Upwards of eighty figures are known from museum collections and archival photographs (Ostapkowicz 1992), although the one under discussion here is the only example known to be associated with cattail down. Serving as memorials, the figures were painted and dressed in the deceased's clothing (Teit 1906:273).

Those responsible for commissioning the carving of the figures were likely the heads of families of high status. Teit (1900:330), in writing about the N'lakapamux, commented: "The Indians state that the only reasons for placing these figures near graves were to keep the dead relative fresh in the memory of the living; to show that the person respected the dead relative; and to let people know who was buried there, and that the dead had living relatives who were above the common people as to wealth and able always to renew the clothes of the figure." The prominence of the figures and the ceremonies surrounding their erection and subsequent reclothing, were a means through which the living expressed their status, wealth, and close link to their ancestors.

The mortuary figures discussed here display marked similarities to one another and are clearly intended as a matched pair, perhaps carved by the same artist. The larger of the two figures contains the cattail down in the back of its mouth (Figure 2b). This figure is 168 cm in height and according to the museum accession records is carved from cedar (probably western red cedar, *Thuja plicata* Donn). Strips of leather have been nailed to the head and groin area. Only traces of white paint are visible today on the chin and cheeks, but red and black pigment were observed on the figure some decades ago (Wingert 1949:136).

These figures are distinguished from most other examples of Salish mortuary art by their unusual facial carving, which invokes the ***Tal*** mask. Like the facial features of the figures, ***Tal*** masks are characterized by large, deeply sunken cheeks and eyes, an open, down-turned mouth, and bent nose. Such masks were representations of a legendary female giant (a Coast Salish version of the **Kwakwaka'wakw** ***Tsonoqua***, an 'ogress' who was also the provider of great wealth), and their ownership was a hereditary privilege as well as a mark of wealth and prestige (Barnett 1955:170–171; Lévi-Strauss 1988:66). The masks were used during winter dances and life crises rites, including commemorative ceremonies. Barnett (1955:236) notes that the "... appearance of a ***Tal*** mask at a ceremony honouring a deceased father signalized the transference of that mask to his heir. Effigies of the dead were made for these ceremonies and their faces covered with the mask." We expand upon the significance of the association of the ***Tal*** and the cattail down below.

ECONOMIC USES OF CATTAIL AMONG THE SALISH

Common cattail is a perennial that thrives in shallow marshes, ponds, wet ditches, and lakeshores. The familiar 'cat's tail'—the brown, velvety spike located at the tip of the main stem—bears the flowers which turn into a white, cottony fluff in the late summer and fall. The plant is harvested for its leaves in late summer, and then left to air dry (Turner and Efrat 1982:58; Turner 1998:121–123). The seed down found in the figure's mouth was likely collected in the late summer/early fall and may have been used immediately or stored for future use.

Though the rootstock and pollen of cattail were collected for food by several Interior Salish groups (Turner et al 1990; Parish et al. 1996; Turner 1997), the plant's leaves were most highly valued on the coast and the interior as weaving material (Steedman 1930:496; Turner and Bell 1971; Pojar and MacKinnon 1994; Turner 1988, 1998; Turner et al. 1990). Indeed, among the Island Salish, cattail is considered "... probably the most important basket and mat weaving material" (Turner and Bell 1971:77). Baskets, bags, clothing, twine, cradles, nets, canoe sails, and mats were woven from the leaves and stems (see Teit 1900:188–190, for an overview of the weaving process). Woven cattail mats, for example, were used in various ways, such as for wall insulators and temporary summer shelters (Turner et al. 1990:145; Turner 1998:122–123). Cattail weavings would also be used as clothing (cloaks, robes, hats, headdresses) and would occasionally be combined with dog hair for added warmth (Barnett 1955; Curtis 1970; Turner and Bell 1971: 77; Turner 1988). Teit (1900:256) also notes the use of rafts made of cattail bundles among the Nicola. Based on these utilitarian uses, Turner (1988) ranks the plant in the 'High Significance' category for the Lillooet in her Index of Cultural Significance (ICS). Elder Rosaleen George notes that cattail has the same significance to the Stó:lō of the Fraser Valley as the cedar tree (pers. comm. to A. McHalsie).

Cattail down, because it was absorbent and soft, also served a variety of everyday needs. In particular, the Coast and Interior Salish used the down as stuffing for pillows, mattresses, for wound dressing, and for infant diapers (Steedman 1930:498; Pojar and MacKinnon 1994:338; Parish *et al.* 1996:359; Turner 1998: 123). Cattail down was also woven into mountain goat wool blankets—a point we will return to below.

RITUAL USES OF CATTAIL AMONG THE SALISH

Although cattail had several mundane uses, it also served more esoteric purposes. Among the Saanich, of Vancouver Island, cattail charcoal was used for tattooing (Jenness in Turner and Bell 1971; Turner 1998:123), a practice reserved for the wealthy (Barnett 1955:74). Tattooing and face and body painting were also practiced by the Interior Salish N'lakapamux (Teit 1930). The Songish, again of Vancouver Island, offered a mixture of burned cattail root with *Lomatium* sp. and red paint in First Salmon Rites (Turner and Bell 1971:77). Among the N'lakapamux, cattail leaves were incorporated into shamans' headdresses (Turner et. al. 1990:145), and the stalks were used to weave burial shrouds in the Nicola Valley (Smith 1900:405).

There is a particularly strong association between cattail down and burial rituals of the Coast and Interior Salish. Hill-Tout (1905:137) writes that among the Stl'átl'imx (Lower Lillooet), "[t]he body was customarily washed all over, the hair combed and tied back, the face painted, and the head sprinkled with the down of bull-rushes [cattails], which was potent in checking the evil influences attending corpses."[4] This was done by a special funerary shaman, immune to the dangers involved in dealing with the corpse. Among the Chilliwack, a Stó:lō group of the central Fraser Valley, Hill-Tout (1978:54) noted that, "After the body of the dead person has been taken from the house the 'olia' ['the soothsayer'] would take quantities of the down of bulrushes [cattails] and spread it all over the bed on which the deceased had lain."

The connection between cattail down and the dead is further demonstrated in the protohistoric burial of an infant found near the modern town of Yale, at the northern boundary of traditional Stó:lō territory and the southern limit of N'lakapamux territory. The infant had been interred inside a copper trade pot which, together with the other copper grave offerings, led to remarkable preservation conditions resulting in the preservation of soft tissues and plant fibers. Among the plant fibres was a downy white material which had been placed, together with red ochre, around the infant's anterior fontanelle. Red ochre was also placed inside the infant's mouth. As elsewhere, red ochre is a sacred substance among the Salish, and is often found in burial contexts among the Coast and Interior Salish (Schulting 1995). The white material has been examined microscopically and is consistent with cattail down (Schulting 1992), although the absence of attached seeds precludes a definite identification.[5] If the material is indeed cattail down, this and the fluff in the mortuary figure, represent the only known examples of ritual use of cattail down outside of ethnographic sources.

The association of the ochre and the down with the head of the infant is significant given the spiritual importance of the head in Northwest Coast societies (e.g., Cybulski 1978). In Northwest Coast rock art, for instance, the head is almost always larger and more detailed than representations of the body (Lundy 1983) and modification to the head, through head deformation, facial tattooing, and the wearing of labrets were used to mark membership in social groups (Suttles 1990b). Specifically, Barnett (1955:221–222) notes that among the Coast Salish, the soul was "taken to be the vital quality of the heart or head . . ." and makes reference to a Saanich shaman retrieving a lost soul and placing it into the patient's head. That similar concepts prevailed among the Interior Salish is apparent from Teit's (1900:363) comment concerning the N'lakapamux belief that the soul was supposed to leave the body through the frontal fontanelle. It is reasonable to suggest, then, a scenario in which the spirit of the deceased, leaving the body through the fontanelle, was purified by passing through materials such as cattail down and ochre. The placement of the red ochre in the Yale infant's mouth could be viewed similarly, since this is where the breath—or life force—leaves the body, and may provide another parallel to the placement of cattail down in the mouth of the mortuary figure.

The ritual importance of cattail is further highlighted by its connection with particular places which are considered sacred. This is clearly illustrated by the Halkomelem place name ***Xatsuq'*** (***Xaxa***, sacred, spiritually potent; ***saqe'***, cattail), for a lake in the Fraser Valley (Hatzic Lake) which supports extensive stands of cattail. The association of cattail and sacredness in the place name may refer in general to the fact that cattail is used in sacred contexts. However, the fact that at least two other locations within Stó:lō territory where cattails grow are dangerous and off-limits to those who are spiritually unprepared (but are used by Indian doctors on spirit power quests), suggests particular patches of cattail may be sacred (Keith Carlson, pers. comm. to D. Lepofsky, 2000). Cattail collected from such locations may have residual spiritual power in them, and may have been the source of down which was used in mortuary and other rituals, while cattail destined for more prosaic uses could have been gathered from other, less dangerous, locations.

DISCUSSION

Among the Coast and Interior Salish, purification, or the 'cleansing' of the deceased was an important aspect of mortuary rituals. ***Sxwayxwey*** dancers, for example, would be called in to 'wash' the corpse (Barnett 1955:217), and normally a year after burial, they would again be hired to 'wash' the mortuary figure (Barnett 1955:220). Barnett (1955:217) notes that the cleansing rituals involving the ***sxwayxwey*** and surrounding the burial "... did not differ from that employed for 'washing' a pubescent, a newly named adult, an infant, a dancer initiate, or any other individual assuming a new social position." Occasionally, figures bearing the ***sxwayxwey*** mask would be permanently erected at the burial sites of families who had rights to the masks—a long term, public affirmation of the family's good standing and their accordance with the proper ritual observances. The use of ***skowmidgeons***—supernatural creatures most akin to fishers (a large member of the weasel family)—was another important aspect of mortuary cleansing rights, and representations of these creatures would often appear on mortuary figures and posts (Ostapkowicz 1992).[6]

The various Salish groups considered several plants to be important in cleansing ceremonies and used them in rituals surrounding an individual's death. According to Hill-Tout (1978:34), Squamish and Lillooet "... burnt cedar (*Thuya gigantea*) [stet] as well as salal-berry (*Gaultheria shallon*) branches and whip the whole dwelling with boughs, particularly that part where the body lay, to drive away the presence of death, sickness and ghosts, all of which are supposed to linger there." Spruce boughs (*Picea* sp.) are placed both at the head and under the bed of the husband or wife of the deceased as a protective measure against sickness and death, and food is eaten off these boughs for a month after the funeral (Hill-Tout 1978:35). Among the Coast Salish, the body of each participant in a bereavement ceremony was cleansed by smoking branches, while those who were in direct contact with the body (undertaker, coffin-maker, pallbearer) washed with various herbs after the completion of the ceremony (Barnett 1955: 219). The N'lakapamux also used Douglas-fir (*Pseudotsuga menziesii* [Mirbel] Franco) during rituals for the bereaved (Turner et al. 1990:58). In sum, various plants were vital to the fulfillment of a number of important, highly ritualised events, and through the associated actions natural materials were transformed into spiritually potent substances.

Though the Salish used several plants in funerary rituals, cattail down seems to have held particular importance. It is now apparent that the down was used in several aspects of mortuary rituals: it was strewn over the place where the deceased had lain prior to burial, it was sprinkled on the head of the deceased in preparation for burial, and it was placed in the mouth of grave figures. The recurrent association of down with the head, a focal point of the human body, mind, and spirit in Salish belief systems underscores its ritual value.

Another significance of the cattail down in this particular case is seen in its conspicuous placement in the mouth of a ***Tal***. Both the ***Tal*** and the down are instruments of cleansing, yet the mask would be ineffective in cleansing rituals without the use of what Suttles (1987:104) calls the 'ritual word'. Indeed, the ritual word was at the heart of cleansing rites, charging the instruments used during these ceremonies with efficacy. Wearers of the ***Tal*** masks presumably had associated power songs, or specific ritual words, that were private and used only during important events. Hence, the placement of the cattail down in the mouth of the mortuary figure may be interpreted as emphasising the power of the spoken word.

The underlying theme linking cattail down and concepts of death, the afterworld and spiritual cleansing may be the symbolic potency of the colour white. Tepper (1994:75), in outlining the importance of colour among the N'lakapamux, points out that different colours are associated with ". . . abstract concepts usually linked to a system of religious beliefs". Teit (1930:419) recognized the symbolic importance of colour among the N'lakapamux, and drew attention to the white as a 'spirit' colour, linked to ". . . ghost, spirit world, dead people, skeletons, bones, sickness, coming from the dead". The white down of cattail, associated as it is with burials and burial figures, hints at such a symbolic association.[7]

In addition to its links with the ritual aspects of death, the colour symbolism of white has overarching associations with status and spirituality. In Salish society, items made of white wool were often highly valued elite and ceremonial objects. For example, white blankets made from mountain goat wool or wool shorn from dogs actively bred for their white pelage, were highly treasured items (Schulting 1994). Cattail down was sometimes woven into these blankets as well (Barnett 1955:119; Gustafson 1980:69). Furthermore, such blankets were a prominent aspect of funerary rites, being used to wrap the dead (Barnett 1955; Schulting 1994), again suggesting a concern with purification. Mountain goat wool was also incorporated into shamans' or ritualists' rattles and other items used during cleansing rituals. Initiates of certain secret societies would wear headdresses of cascading mountain goat wool (see Kew 1990: Fig. 1), as would individuals receiving their new names (see Suttles 1990a: Fig. 10). Ritualists attending ceremonies would weave wool into their hair (Barnett 1955:153), and goat wool and other white material, such as "down" (origin unspecified), would be sprinkled onto the hair of a young girl daily during the seclusion following her first menses (Barnett 1955:151). N'lakapamux shamans would dance with eagle down in their hair (Teit 1900:363), and ***sxwayxwey*** dancers' regalia was covered with white swan feathers and down.[8]

Cattail down seems to differ from the other white, sacred substances, in that it was relatively abundant and easy to acquire. However, we know nothing of the collection of cattail that was intended for ritual purposes. The collection of this material may have been restricted to ritual specialists, who collected the down in particular ways, possibly only from specific stands which were appropriate for ritual use (such as ***Xatsuq'***). Alternatively, any cattail down may have been appropriate, and only its inclusion in rituals transformed it into a sacred substance.

Redcedar boughs used in ritual cleansings might be another example of a common plant that is transformed during ritual performances.

Materials such as white cattail down were, at least in part, visual indicators of the status of the ritual practitioner (mediating between the spirits and the realm of the living) or of the supernaturally vulnerable initiate or patient. The link between spirituality and higher moral, social, and economic status is a prominent feature of Salish society (Hayden and Schulting 1997; Suttles 1987). For the Salish, as with many cultures, the ability to out-perform ordinary community members in the observances of what are regarded as the proper rituals both confers and justifies the high standing of certain families (cf. Owens and Hayden 1997). In the case of cattail down, the connection with the elite was made in several ways: it was part of a larger ceremony that included the carving and erection of a large mortuary figure, the hereditary right to carve a ***Tal*** mask (with its wealth connotations), the clothing (and periodic reclothing) of the figure, and presumably a relatively elaborate graveside ritual.

Cattail was thus at once a useful practical source of material for a variety of purposes, as well as having a series of more symbolic associations with death, purity, and social standing. The use of its seed down during life crises rituals, sprinkled on the head of a young girl during her puberty rituals or the head of the deceased during the cleansing of the body for burial, emphasized the individual's changing status—from child to woman, from man to ancestor. Cattail down marked and helped to facilitate the change. It was a means of cleansing the individual, thereby preparing their spirit for the journey ahead; in addition, it helped to protect the living from the uncontrolled and dangerous influences attendant upon the corpse.

This example of an economic/symbolic dichotomy is not unique for (or to) the Salish. Many plants, in many societies, present the same complex relationships. Our task is to try to understand and appreciate both ways of viewing the world.

NOTES

[1] The identification was based on the morphology of the fluff as well as the attached seeds.

[2] The most widely accepted version states that they were collected ca. 1893–1930 by G.H. Raley, a missionary and teacher in the Sardis area in the central Fraser Valley. According to this account, they were found after a massive flood washed them ashore (though the presence of the cattail down in the mouth of one of the figures casts some doubt on this scenario).

In an account by J.S. Matthews—the founder of the Vancouver Archives and an archivist there until 1970—the figures were found at a grave site between Boston Bar and Lytton, B.C, within the traditional territory of the N'lakapamux (Thompson). According to Matthews, around 1930, the figures were loaned by the Parks Board to David Spencer, Ltd., for display purposes. Spencer did not return them to the Parks Board, but gave them instead to G.H. Raley, whose collection of artifacts was later purchased by H.R. Macmillan (Vancouver City Archives, IN.N.63.P.115). An archival photo taken by Mr. Harold Escott in 1925, and referred to by J. S. Matthews, shows the figures standing in front of a forested backdrop. Escott indicates that he found the figures '. . . in a shed in Stanley Park' [Vancouver], and set them out to photograph before returning them back to the shed. This would indicate that the figures may not have been in the Raley collection at this time, and suggests yet another version of events.

The University of British Columbia Museum purchased the mortuary figures in 1948 (UBC Museum accession records).

[3] The term ***sxwayxwey*** has come to refer to both the characteristic Salish mask with protruding cylindrical eyes as well as the associated dances and ceremonies that feature this mask. Different names are recorded for various ***sxwayxwey*** masks (see Suttles 1987:109–111), which are distinguished by additions of bird or animal heads in addition to the frequently seen round collar and/or a crest of feathers. Such masks and dances function as instruments of cleansing.

[4] The common name "bulrush" is often used interchangeably with "cattail". True bulrush (*Scirpus* sp.) does not produce a fluffy seed head.

[5] The morphology of the down alone is insufficient to distinguish among the many species of plants which produce seed fluff (Cathy D'Andrea, pers. comm.).

[6] Jenness (1934:73) notes the myth related to ***skowmidgeons***, and how they had the power to 'wash away the tears' of the bereaved: "Later Khaals changed some members of this group into fishers, and said to Seleeptim: "These animals will comfort you in generations to come. They shall be your çxwte'n, a solace to drive away your tears. When a child dies, or some dear kinsman, you shall kill two, four, or even six fishers, dry their skins, and store them in safety. Then you shall utter the prayer that I will now teach you, and they shall wash away your tears."

[7] The white berries of snowberry (*Symphoricarpos albus* L.) are often associated with the dead. In several languages on the coast and interior the berries are given names like 'corpse berry'. For instance, the berries are referred to as 'the saskatoon berries of the people of the Land of the Dead' in one Stl'atl'imx story (Pojar and MacKinnon 1994:70).

[8] Numerous northern Northwest Coast peoples incorporate eagle or swan down into various ceremonies. During certain dances, the headdress is filled with down and when the dancer tilts his head, he causes the down to fall to the ground. Holm (1990[1982]:86–7) notes that the down incorporated into such headdresses was ". . . shaken out and scattered by sharp movements of the dancer's head, then swirled and drifted around him and over the assembled watchers. Following headdress dances, the floor of the house was covered with drifts of white down". Again, there is the connection between the sacred, the colour white, and the head.

ACKNOWLEDGMENTS

We appreciate Cathy D'Andrea's efforts to identify the down found in the infant burial, as well as her on-going support of all things paleoethnobotanical. Many thanks also to Alan McMillan and Keith Carlson, and to the anonymous reviewers, for their insightful comments on an earlier draft of the paper. Thanks to Andres Valle-Domenech and Marcena Olguin-Alverez for their help with the translation of the abstract into Spanish. Ann Stevenson of the Museum of Anthropology at the University of British Columbia was most helpful in arranging for the down from the Salish figure to be sampled and identified.

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Journal of Ethnobiology 21(2): 91–127 Winter 2001

CONTRIBUTIONS TO THE ETHNOBOTANY OF THE *CUP'IT* ESKIMO, NUNIVAK ISLAND, ALASKA

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ABSTRACT.—Ethnobotanical information on the Native use of 47 species of indigenous plants on Nunivak Island, Alaska is presented. Changes in subsistence use among the Cup'it Eskimo of Nunivak, throughout the twentieth century, have resulted in the loss of traditional ethnobotanical knowledge. While previous studies have presented limited information on the importance of particular plant species to the local diet, additional data regarding the role of indigenous plants and subsequent changes in plant use have recently been recorded. They are discussed here in light of the adoption of western foods and medicines and increased contact of the Cup'it with mainland peoples. Current knowledge of traditional plant use and the importance of plants to local dietary, medicinal and utilitarian uses are summarized.

Key words: ethnobotany, Cup'it Eskimo, indigenous plant use, Nunivak Island, Alaska.

RESUMEN.—Presentación de datos ethnobotánicos de 47 especies de plantas indigenas y las maneras de uso por la gente indígena de la Isla Nunivak en el estado de Alaska. Los cambios en los usos de estas plantas para la subsistencia por los Esquimales Cup'it de Nunivak a través del siglo XX han ocasionado la pérdida de conocimientos ethnobotánicos tradicionales. Mientras que los estudios anteriores han presentado datos limitados sobre la importancia de ciertas especies de plantas comestibles en la dieta local, recientemente se ha documentado información adicional respeto al papel de las plantas indígenas y los cambios en los usos de éstas. Esta nueva información se discute en este trabajo en vista de la adoptación de alimentos y medicinas occidentales y del aumento de contacto social entre los Cup'it y los habitantes del continente. El conocimiento actual sobre los usos tradicionales de estas plantas nativas y su importancia en la dieta local, asi que los usos utilitarios y medicinales de éstas, se resumen en este trabajo.

RÉSUMÉ.—Des informations éthno-botaniques sur l'usage de 47 espèces de plantes indigènes sur l'île de Nunivak sont présentées ici. Les changements dans l'usage de ces plantes comme moyen de subsistance parmis les Esquimaux Cup'it de Nunivak, au cours du vingtième siècle, ont abouti à la perte de connaissances éthno-botaniques traditionelles. Alors que les études antérieures ont présenté des informations limitées sur l'importance de certaines espèces de plantes dans le régime alimentaire régional, des données supplémentaires concernant le rôle des plantes indigènes et les changements dans l'usage de ces plantes ont été recueillies récemment. On en traite dans cet article en tenant compte de l'adoption d'aliments et de médicaments occidentaux et du contact social plus fréquent des Cup'it avec les gens du continent. La connaissance actuelle de l'usage des plantes indigènes traditionelles et l'importance des plantes dans les usages locaux quant au régime alimentaire et à la médecine et dans d'autres emplois utilitaires sont présentées ici en résumé.

INTRODUCTION

The Yukon-Kuskokwim Delta, a geographic and cultural area historically occupied by Central-Alaskan-Yup'ik speaking Eskimos in southwestern Alaska, encompasses an area of almost 81 million kilometers (31,250 square miles) or 8.1 million hectares (20 million acres). This region consists of a vast and largely roadless expanse of low lying tundra that has attracted limited attention from ethnographers in the past. Native villages are located along the area's major waterways with development largely limited to commercial fishing. The degree of contact between subcultural groups within the Delta cannot accurately be determined due to conflicting early historic data and later movements of peoples throughout the region, but villages are known to have been linked by extensive trade networks, intermarriage among village residents, and village alliances during times of warfare (VanStone 1984:224). Knowledge of the Native use of indigenous flora in the Yukon-Kuskokwim Delta remains quite limited. Early ethnobotanical studies in the region are limited to research on Nunivak Island (Fries 1977; Lantis 1946, 1959), Nelson Island (Ager and Ager 1980) and the village of Napaskiak (Oswalt 1957) located along the Kuskokwim River (see Figure 1). Nunivak Island, located approximately 37 kilometers (23 miles) west of the Alaskan mainland and 209 kilometers (130 miles) west of Bethel, the largest town in the Delta, has traditionally remained the most isolated area in southwestern Alaska. Nunivak is the only major off-shore island inhabited by Central-Yup'ik speaking people, the Cup'it[1] or Nunivarrmiut (VanStone 1989), who maintained their isolation until after World War II when an airstrip linked the island to the mainland. The present study summarizes the known traditional use of indigenous plants on Nunivak Island in addition to changes in plant use during the twentieth century, and provides comparisons of plant use with that of mainland Yukon-Kuskokwim Eskimo peoples. This information was obtained from Cup'it elders during a four year (ca. 1995–1998) collaborative anthropological project between the author and the community of Mekoryuk. Community members participated in all facets of the project, including archaeological excavations, oral interviews and artifact and plant identification, and were monetarily reimbursed for sharing their expertise.

REGIONAL SETTING

Nunivak Island is located in the Bering Sea off the western coast of Alaska between 165°30′ and 167°30′ West longitude and 59°45′ and 60°30′ North latitude. It is separated from the mainland in the vicinity of the Yukon-Kuskokwim Delta by the 37 kilometer (23 mile) wide Etolin Strait. Nunivak is approximately 112 kilometers long and 80 kilometers wide (70 miles × 50 miles), containing an area of about 4.4 thousand square kilometers (approximately 1.1 million acres or 445,000 hectares). The topography of the island is highly diverse. The west coast is dominated by high sea cliffs, reaching over 122 meters (400 feet) in elevation,

FIGURE 1.—Map of Yukon-Kuskokwim Delta showing villages discussed in text.

which provide a spectacular bird sanctuary for many species of sea birds. The southern coastline contains miles of sand beaches backed by active dunes. The north and east coastlines are comprised of relatively low lying tundra lands with rocky beaches and numerous coves and protective inlets. The island's interior contains an upland plateau-like area rising in elevation from 152 to 244 meters above sea level (498 to 800 feet), culminating in a mountainous area of volcanic origin. The lowland areas are generally well-watered and contain numerous lakes and ponds, while the mountainous areas have fewer lakes and ponds although most of the larger lakes are located within this latter region.

Nunivak Island is subject to a Subarctic maritime climate, influenced by the surrounding sea which produces a relatively stable temperature. Summers are generally cool and windy, with some areas experiencing frequent fog; winters are cold with both wet and dry periods. The island's mean annual temperature is −2° Centigrade (C) (20°F) with mean daily temperatures ranging from −25° C

(−13° F) in January and February to 10° C (49.9° F) in August (Swanson et al. 1986). Rain and snowfall is heavier than on the adjacent mainland, resulting in frequently overcast days with dense fogs. This difference from the mainland delta regions is due to the greater effect of the Bering Sea on the island environment. Precipitation is moderate with a mean annual rainfall of 40.6 cm (16 inches) and snowfall of 137 cm (54 inches).

The present flora of Nunivak has been intensively studied by Bos (1967), who built upon the earlier work of Palmer and Rouse (1945). The island's vegetation is predominantly comprised of Arctic tundra containing a variety of lichens, grasses, sedges, flowers, and shrubs. It is similar to coastal and coastal-upland vegetation found throughout western and northwestern Alaska. The tallest island plants are shrubby willows which can reach up to eight feet in height along some of the island's river courses. Major vegetational types (Figure 2) are comprised of wet tundra, dry tundra, and grass-browse (i.e., grass hummock and beach grass-forb). Wet tundra covers approximately 57% of the island and is most prevalent on the north side of the island between the villages of Mekoryuk and Nash Harbor, extending southward. Dry tundra covers most of the interior portions of Nunivak (13.6%) and includes two recognized subtypes: dry tundra found on areas of sloping terrain having good drainage, and alpine tundra found at higher elevations on hills and mountains. Grass-browse covers approximately 23.4% of the island and is found interspersed with the dry tundra subtype and along edges of streams and rivers adapted to periodic flooding.

PREVIOUS ETHNOBOTANICAL RESEARCH

Previous investigations of the Native use of Nunivak Island flora are limited to the works of Margaret Lantis and Janet Fries. Margaret Lantis spent a year on Nunivak (ca. 1939–1940) studying the social dynamics of the Cup'it people (Lantis 1946), with subsequent research efforts focusing on the development of children, local genealogies, the psycho-dynamics of Cup'it society, and community politics. A brief summary of local plant use was later published by Lantis (1959) along with comparisons to the Native use of plants throughout Alaska. In 1977, Janet Fries (1977) completed a senior honor's paper on the vascular flora of Nunivak which addressed the flora she found to be in current use at the time of her study. My investigation of the use and importance of island flora stems from my 1995–1998 Ph.D. anthropology research on Nunivak where I was able to work closely with Cup'it elders from the village of Mekoryuk, the only village remaining on Nunivak, and build upon these earlier studies (Griffin 1999). While my research focus was based on reconstructing changes in Native lifeways over time at the village of Nash Harbor, located approximately 43 kilometers (27 miles) west of Mekoryuk, I was also able to discuss traditional use of indigenous plants with island elders. This paper presents a summary of Cup'it plant use derived from elder interviews both in their homes and during collecting activities.

Indigenous plants were an integral part of the year-round diet of Eskimo people in addition to their incorporation in other facets of their life. Contrary to the popular perception of Eskimo people surviving solely on fish and meat, the Cup'it utilized a large number of local plants for food, medicinal, and utilitarian

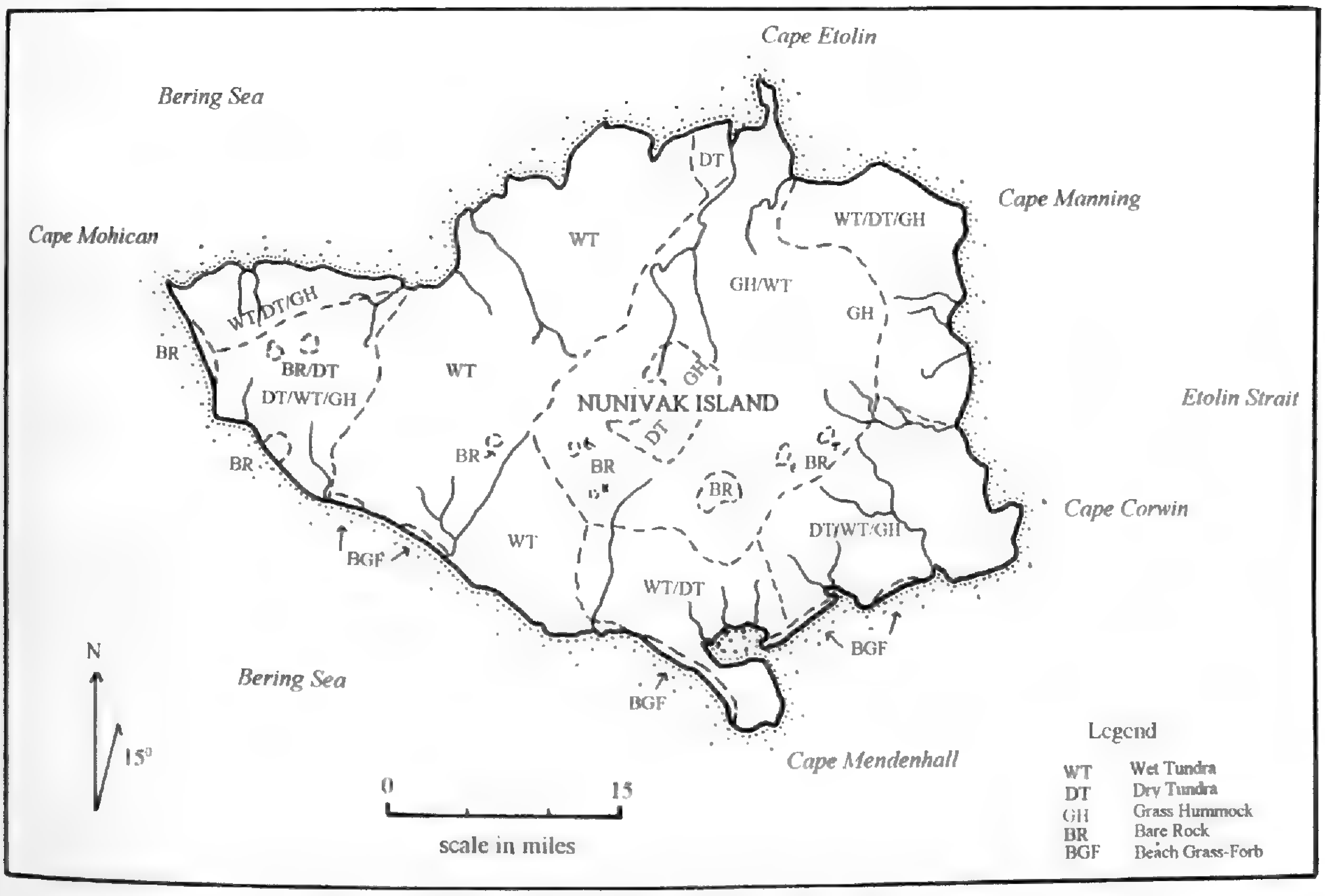

FIGURE 2.—Distribution of major vegetation types (adapted from Bos 1967).

purposes. An earlier Alaskan study estimated that up to 15% of the diet of Western Eskimo people (Kotzebue to Alaska Peninsula) is made up of vegetable resources (Young and Hall 1969:43). While plant resources remained sparse on some off-shore islands such as St. Lawrence Island (Young and Hall 1969), on Nunivak they provided a significant addition to the Cup'it's year-round diet. Table 1 provides a list of the seasonal use of indigenous plants by the Cup'it. A complete list of all utilized species (including subspecies, variations and synonyms), authority for scientific names and voucher specimen numbers is included in the Appendix.

NATIVE PLANT TAXONOMY

A dictionary of Cup'ig terms and their roots is in draft form and an analysis of Native root systems is not yet possible. However, an examination of general Yup'ik terms (Jacobson 1984) provides comparative data useful in distinguishing some basic plant terminology distinctions among the Cup'it. Yup'ik speakers (including the Cup'it) tend to divide plants into basic groups based on how plants were traditionally used, their similarity in appearance or physical characteristics. For example the Cup'ig plant name ***ciwassit*** translates to 'wild greens that can be cooked' and is used to denote several distinct species that are prepared in a similar manner (i.e., *Rumex arcticus* (sour dock), *Polygonum bistorta* (bistort) and *P. viviparum* (alpine bistort). ***Kumarutet*** is used to denote all moss species (e.g., *Pohlia nutans*) based on the traditional use of moss as a wick in lamps (***kuman*** = lamp, light). Examples of plants grouped by similarity in appearance or setting include: 1) ***elquat***—term used to designate several varieties of seaweed (e.g., *Palmaria pal-*

TABLE 1.—Seasonal use of indigenous food and medicinal plants on Nunivak Island.

Scientific name	Common names	Cup'ig names	Season	Plant part
Food Plants				
Angelica lucida	"Wild Celery"	***ik'itut***	S, Su	leaves, stalk
Arctostaphylos alpina	Alpine Bearberry	***kavlag***	Su, F	berries
Caltha palustris	Marsh Marigold	***wivlut***	S, W	entire plant
Carex spp.	Sedges	***pekneret***	F	root, stem
Cladonia spp.	Lichens		S	entire plant
Claytonia tuberosa	Tuberous Spring-Beauty "Wild Potato"	***ulpit***	S	corm
Conioselinum chinense	Western Hemlock-Parsley		S, Su	root
Draba borealis or *D. hyperborea*	"Wild Lettuce"	***inguqit***	S, Su, W	leaves
Dryopteris dilatata	Shield Fern	***cilqaarit***	Su, F	fronds
Empetrum nigrum	Crowberry	***paunrat, pauner***	F, W	berries
Epilobium angustifolium	Fireweed		Su	leaves
Eriophorum angustifolium	Tall Cottongrass	***pekner***	Su, F	base of stem
Fucus spp.	Bladderwrack	***elquat***	S, Su, F, W	plant
Hippuris tetraphylla or *H. vulgaris*	Mare's Tail	***tayaarut***	S, F, W	leaves, stems
Honckenya peploides	Beach Greens, Seabeach Sandwort	***tukullegat***	S, Su, W	leaves, stems
Ledum palustre	Labrador Tea	***ay'ut***	S, Su	leaves
Ligusticum scoticum	Beach Lovage, "Wild Parsnip/Parsley"	***tuk'ayut, ciukarrat***	S, Su	roots, leaves, stems
Mertensia maritime	Oysterleaf	***ciunerturpat***	?	leaves
Oxycoccus microcarpus	Bog Cranberry		Su, F	berries
Oxyria digyna	Mountain Sorrel	***quulistar***	S, Su, W	leaves
Palmaria palmate	Seaweed, Dulse	***elquat***	Su, F, W	plant
Parrya nudicaulis	"Wild Cabbage/Celery"	***inguqit***	S, Su, W	leaves
Pedicularis verticillata	Wooly Lousewort		S	flowers
Pohlia nutans	Moss	***kumarutet***	S	plant
Polygonum bistorta	Bistort, Pink Plumes	***ciwassat***	S, Su	leaves
Polygonum viviparum	Alpine Bistort, "Wild Rhubarb"	***ciwassit***	S, Su	rhizome
Ranunculus pallasii	Pallas Buttercup		S, Su	leaves, stems
Rubus arcticus	Nagoonberry	***puuyaragur***	Su	berries
Rubus chaemaemorus	Cloudberry	***atsar atsakutag***	Su, W	berries

Table 1 (continued)

Scientific name	Common names	Cup'ig names	Season	Plant part
Rumex arcticus	Dock, Sour Dock	***ciwassit***	S, Su, W	leaves, stems
Salix alaxensis	Alaska Willow	***qugyuguat***	S, Su	catkins
Salix pulchra	Diamondleaf Willow	***qugyuguat***	S, Su	catkins, leaves
Saxifraga spp.	Saxifrages	***quulissat***	S	leaves
Sedum roseum	Roseroot, Stonecrop	***megtat neqiat***	S	flowers
Senecio pseudo-Arnica	Ragwort, Fleabane		Su, W	leaves, stems
Streptopus amplexifolius	Twisted Stalk	***atsarllug***	Su	berries
Vaccinium uliginosum	Alpine Blueberry, Bog Blueberry	***currat***	Su	berries
Vaccinium vitis-idaea	Lingoonberry, Low-bush Cranberry	***tumaglir, tumaglikatat***	S, F, W	berries
Medicinal Plants				
Artemisia tilessi	Stinkweed, Wormwood		S, Su, F	leaves
Betula exilis	Dwarf Birch		?	leaves
Dryopteris austriaca	Shield Fern	***centurkar***	S, Su, ?	fronds
Epilobium angustifolium	Fireweed		Su	leaves
Eriophorum spp.	Cottongrass	***musqu, melqiutet***	S, SU	flowers
Ledum palustre	Labrador Tea	***ay'ut***	S, Su, F	leaves, stems
Rubus chamaemorus	Cloudberry	***atsar atsakutag***	Su, F	berries
Salix fuscescens	Willow	***qimugkararat***	S, Su, F	leaves, catkins
Salix pulchra	Diamondleaf Willow	***qugyuguat***	S, Su, F	leaves
Sedum rosea	Roseroot, Stonecrop	***megtat neqiat***	S	leaves
Utilitarian Used Plants				
Aconitum delphinifolium	Monkshood	***esetegneg***	?	unknown
Carex spp.	Sedges	***pekneret***	F	leaves
Cladonia rangiferina	Lichens, Reindeer Moss		S, Su, F, W	plant
Elymus mollis	Wild Rye Grass		S, Su, F	leaves
Equisetum arvense	Common Horsetail	***kenret***	S, Su, F	stems
Pohlia nutans	Moss	***kumarutet***	S, Su, F	entire plant
Rumex arcticus	Sour Dock, "Wild Spinach"	***ciwassit***	Su, F	leaves
Vaccinium vitis-idaea	Lingonberry, Low-bush Cranberry	***tumaglir, tumaglikatat***	Su, F	berries

mata [dulse], *Fucus* spp. [bladderwrack]), and 2) ***agyam an'a(i)***—used for all puffball species (*Lycoperdon* spp. and *Calvatia* spp.). In Yup'ik, ***agyam ana*** translates to meteor and meteors are traditionally said to turn into puffballs when they land (Jacobson 1984:48). Still other plant names highlight distinctions within a genus such as ***qugyuguat*** which is used to refer to all *Salix* (willow) species except those exhibiting catkins which are referred to as ***qimugkararat***. Further analysis is needed in order to fully understand the Cup'it's concept and categorization of local flora.

A similarity of plant use and some Native plant names between the Cup'it of Nunivak Island and the Inuit on the Seward Peninsula to the north were identified during the study. The Eskimo linguistic branch consists of two clearly differentiated sub-groups, Yup'ik and Inuit-Inupiaq (Woodbury 1984). Yup'ik was spoken aboriginally on the coast of the Chuckchi Peninsula in Siberia and in Alaska from Norton Sound south to the Alaska Peninsula and east to Prince William Sound. The Cup'it speak a sub-dialect of Yup'ik known locally as Cup'ig which is the most divergent dialect within the Yup'ik branch. The Inuit of Northern Alaska and Canada speak Inupiaq which is spoken by Inuit peoples from the Seward Peninsula in Alaska across Arctic Canada. Similarities between some Cup'ig, Yup'ik and Inupiaq plant names (e.g., ***kavlag—kavlak—kavlaq*** [*Arctostaphylos alpina*], ***paunrat—paunraq—paungaq*** [*empetrum nigrum*], ***pekner—pekneq—pikneq*** (*Eriophorum angustifolium*]) and food preparations (e.g., ***akutar—akutaq—akutuq*** [Eskimo ice-cream comprised of berries, seal oil, reindeer tallow (Crisco), snow and sometimes salmon eggs]) highlight extended contact between western Alaskan peoples over time. Further research is needed to evaluate the degree of sharing between these language branches with regard to the recognition and use of indigenous plants.

PLANT HARVEST, PREPARATION AND STORAGE

On Nunivak, most indigenous plants were traditionally gathered by women and children when the men were harvesting other available resources (e.g., caribou, waterfowl, seal) (Della Boesche, personal communication September 1995; Lantis 1946). While fresh spring greens provided a welcome addition to the diet, which in winter was based largely on dried and stored foods, other greens were harvested throughout the year as they ripened, and used with some of those stored for winter use. With the melting of the island's snow pack, local greens and berries not picked during the previous fall's harvest, begin to appear and were added to the local diet. Depending on the time the ice pack began to break-up, Cup'it families would leave their winter villages and move to spring seal camps. Cup'it men would journey out along the ice to harvest arriving sea mammals (i.e., seals, walrus) while the women would spend much of their time harvesting available plant resources (greens and seaweeds) and shellfish. Early spring plants included: marsh marigold (*Caltha palustris*), sour dock (*Rumex arcticus*), wild celery (*Angelica lucida*), wild lettuce (*Draba borealis* or *D. hyperborea*), wild parsnip (*Ligusticum Hultenii*), wild rhubarb (*Polygonum viviparum*), mountain sorrel (*Oxyria digyna*), Pallas buttercup (*Ranunculus pallasii*), and Labrador tea (*Ledum palustre decumbens*).

After the completion of the hunting season, families would move to summer fish camps. Fish comprised the most prolific and essential subsistence resource for many Alaskan Natives living in the Yukon-Kuskokwim Delta region and its harvest would occupy the majority of the families' efforts for several months. Traditional plants would continue to be harvested as they ripened and were eaten fresh or placed in underground caches for temporary storage. By late summer/ early fall, several berry species (e.g., *Rubus chamaemorus, R. arcticus, Empetrum nigrum*) and local greens (e.g., *Rumex arcticus*) were ready to be harvested and women and children would spend most days on the tundra gathering plant resources.

Most plants were available in a variety of locales and their harvest did not dictate moving the family to specific camps. Plants that grew in abundance in specific terrain, such as several varieties of cliff greens, usually offered other resources that could be harvested at the same time (e.g., fish, Sandhill cranes). Greens such as *Rumex arcticus* (sour dock) could be found throughout the island and all old camp sites are said to contain buried cache pits once used for plant storage (Williams and Williams 1995a). Still, several specific camps were highlighted in oral interviews for their abundance of particular greens. These camps would be visited seasonally and are often marked by the location of numerous stone cache pits used to store the greens until their removal in the fall to the harvester's winter residence.

As an example, when harvesting "wild spinach" or sour dock, elders state that they would stay in an area until they had harvested enough for their family's long-term needs (Amos 1991; Kiokun 1995a). After picking, they would cook the spinach a little bit before placing it into a cache dug underground.

> Cook em half way, just for the leaves to just shrivel up and not take much space, and they would dig ditches and line it with a certain type of twigs and grass and put em' in there until the weather gets colder, before the ground get hard, knowing that when it freezes, that ***Ciwassat***[2] (*Rumex arcticus*) would freeze in with the earth. So before that time they would go over there again, pull the ***Ciwassat*** out and this time leave em' on top of the ground .... They would cover them with grass, probably willows too to keep them together and they would leave them until it freezes (Amos 1991:16).

Before placing the spinach in the caches, the cooked leaves would be drained of juice and the pit lined with woven grass mats. "Some people rolled them up like a ball and put them away. Each roll was made enough for one meal. They rolled the spinach ball big enough for their dinner or a snack. That's how they took them out of the ground" (Amos and Amos 1989:25). Grass was placed on top before the cache was covered with rocks to insure it would not be disturbed until needed (Kiokun 1995a). Berries were stored in much the same way, except that these pits would be lined with rocks (Kiokun 1995a; Whitman 1995) and raw spinach was used as an inner lining (Kiokun 1995a). The berries would have no juice when removed, since they would have dried out while being stored underground. In the fall, people would return to their seasonal caches and transport their stored berries and greens to their winter village. Curtis (1930:36) describes

FIGURE 3.—Rock-lined cache pits at Nash Harbor Village, Nunivak Island, Alaska.

berry caches as "a small box-like structure of flat stones lined with grass and covered with sod until air-and water-tight." Examples of such features were discovered during recent archaeological excavations on the island (see Figure 3).

METHODS

Earlier ethnobotanical studies among the Cup'it (Fries 1977; Lantis 1946, 1959) identified many of the plants in use in the 1940s and 1970s. Information within these studies do not always agree regarding the traditional use of island vegetation (i.e., Lantis (1946:172) states that no plant poisons were used by the Cup'it in hunting or fishing while Fries (1977:32–33) states *Aconitum delphinifolium* [aconite] was used by "old-timers" to make poison darts or arrows). My research sought additional information and clarification on the Native use of indigenous plants and changes to this use over time.

During my investigation, collecting expeditions were conducted on the local tundra near the villages of Nash Harbor and Mekoryuk in order to gather examples of utilized plants. At Nash Harbor, Cup'it crew members participating in a community archaeology project (Griffin 1999), pointed out significant plants and shared information on their harvest, preparation, use, and storage. On several occasions, I was able to join families on plant forays to gather seasonal greens or berries. Plant specific information was shared on the use of various plants during these trips.

While information on Native uses of indigenous plants was gathered informally during the initial phase of this study, more detailed, plant specific information was obtained during subsequent interviews with Cup'it elders. Interviews took place between 1995–1998 and involved elders examining fresh and dried and pressed plant species, in addition to the identification of plants through published botanical guides (e.g., Schofield 1989). Interviews were conducted during all seasons of the year but fresh specimens were not always available during discussions. Pressed and dried specimens, collected while on the island, often proved of little use due to poor recognition resulting from color change and withered condition. In these cases, published botanical guides with large color plates were used to assist the discussion with information regarding plant identification later collaborated with Muriel Amos, a Cup'it educator who has conducted preliminary research on local plant species during the process of compiling a Cup'ig dictionary (Amos and Amos 1999).

Cup'it interpreters were used during all interviews to assist in gathering data on plant usage, although my limited knowledge of Cup'ig prevented me from freely conversing with most elders resulting in perhaps more abbreviated discussions of plant use. The majority of information was shared by Cup'it women (ages 66–85), although several Cup'it men (ages 73–95) also actively participated in these discussions. Ethnobotanical information shared by elders was generally consistent between interviews. However, knowledge of the use of a few plant species was known only by one or two individuals. When information was limited or contradictory, I have listed the source of my information in the following plant summaries. In cases where many elders offered data consistent with previously published sources, no new specific references have been cited.

PLANTS USED ON NUNIVAK ISLAND

The following species index details specific data on the Cup'it use of 47 indigenous plant species on Nunivak Island. This list is compiled from plants that I collected on Nunivak Island during the 1995–1998 field seasons, and supplemented with earlier reports of Native plant use (e.g., Fries 1977; Lantis 1946, 1959). In the following text, all species are arranged by alphabetical order (i.e., botanical name) with each species designated by its botanical name, common name, Cup'ig name, and any previously published Native name variation. In cases where the spelling of the Cup'ig name has not been approved, I have included the Yup'ik plant name for additional reference. Data regarding the location of each utilized plant species on Nunivak is also presented along with details regarding harvest, Native use, and storage. Previously published references on specific Cup'it plant use are included with documentation of current knowledge along with any comparative data with other Southwest Alaskan Eskimos. Previous ethnobotanical studies in the Yukon-Kuskokwim Delta include studies on Nelson Island (Ager and Ager 1980) and the village of Napaskiak (Oswalt 1957), in addition to some general data collected by Andrews (1989) and Lantis (1959) from several Lower Kuskokwim River villages (e.g., Eek, Kasigluk, and Nunapitchuk) and by Fienup-Riordan (1986) from several lower Yukon Delta and coastal villages (e.g., Alakanuk, Sheldon's Point, Scammon Bay). Figure 1 shows the location of Nunivak Island in relation to each of these villages. In addition to the villages mentioned above, comparisons of plant use are made with the Inuit from the Seward Peninsula in northern Alaska (Jones 1983) due to the similarity in plant use and spelling of some Native plant names (i.e., Cup'ig—Inupiaq).

The identification of plant specimens was obtained by using published guides to the flora of Alaska (Argus 1973; Barr and Barr 1983; Duddington 1971; Grout 1940; Hultén 1968; Viereck and Little 1972; Welch 1974;) with taxonomy following that of Hultén (1968), except in cases of identifying bryophytes, where I used Grout (1940) and Steere (1978), and for seaweeds, Abbot and Hollenbeck (1976) and Guiry (1974). Plant specimens were preserved in the field by drying in plant presses. Inclement weather and the general damp climate of Nunivak Island hampered the rapid drying of many plant specimens. In some cases, specimens deteriorated to such a degree that they had to be discarded. Voucher specimens of the remaining ethnobotanical plants are currently in the possession of the author but will soon be deposited at the Yupiit Piciryarait Museum, Bethel, Alaska. Not all plant species listed in the index were identified during the current study. Previous collections of Nunivak Island flora have been collected by Eric Hultén (1968), Margeret Lantis (ca. 1946), Janet Fries (ca. 1976), Peter Stettenheim (ca. 1954), and Charles Utermohle (ca. 1973). The results of previous investigations have been incorporated here in order to provide a comprehensive summary of Cup'it plant use. The location of earlier Nunivak botanical collections include: Hultén (State Museum of Natural History, Stockholm), Lantis (University of California Herbarium, Berkeley), Fries (Middlebury College, Vermont), Stettenheim (Michigan State University, East Lansing), and Utermohle (University of Alaska Herbarium, Fairbanks).

Food Plants

Angelica lucida L. "Wild Celery"

Cup'ig: ***ik'itut***

Location: Common along shores, dunes, backshores, and on grassy river banks.

Use: Very important food plant. Collected in abundance throughout the summer months and eaten fresh. Leaves and stalk first eaten at the end of June when only a large stem base and few leaves are present. Later, as flower stalk grows, they become very delicious. In late July and August older stalks become woody and lose their flavor. Not stored over winter. Elders state that plant turns bad when stored in barrels. Juiciest plants were found on bird cliffs along west coast (due to nutrient rich soil) and are still harvested by hanging over cliffs on ropes.

References: Andrews 1995; Fries 1977:44–45; Lantis 1946:178; Nowak 1975

Comparisons: Ager and Ager 1980:37; Andrews 1989:340; Jones 1983:17; Oswalt 1957:31. Siberian Eskimos inhale fumes of roasted root as seasick remedy and once carried root as amulet to ward off polar bears (Hultén 1968:705). The Inupiaq name for this plant (***ikuusuk***) is similar to that in Cup'ig (Jones 1983).

Caution: Plant closely resembles the deadly *Cicuta mackenzieana* (Water

Hemlock), one of the most toxic botanicals in North America (Schofield 1989:130).

Arctostaphylos alpina (L.) Spreng — Alpine Bearberry

Cup'ig: ***kavlag*** — Alternative: ***ga'valix***[3] (Lantis 1959)
Location: Common on peat mounds in wet tundra and on dry and alpine tundra.
Use: Berries eaten fresh in 1940s. While berries are large and edible, no evidence of continued use was found on Nunivak in 1970s or 1990s.
References: Fries 1977:46; Lantis 1959:61; Williams and Williams 1997.
Comparisons: Andrews 1989:496; Jones 1983:108; Oswalt 1957:21. The Inupiaq name for this plant (***kavlaq***) is very similar to that in Cup'ig (Jones 1983).

Caltha palustris L. ssp. *asarifolia* (DC.) Hult. — Marsh Marigold

Cup'ig: ***wivlut*** (leaves—***arnat***, bulbs—***anngutet***) — Alternative: ***wi'vilux*** (Lantis 1959)
Location: Found in marshes and along edges of creeks and rivers throughout island.
Use: In spring, before flowering, stems and leaves are eaten when tender; cooked with seal oil or seal flippers. Whole plant rarely eaten raw. Some store over winter.
References: Lantis 1959:60; Smith, Whitman and Shavings 1997a
Comparisons: Similar use recorded for Nelson Island (Ager and Ager 1980:35) and lower Yukon Delta (Fienup-Riordan 1986:113) while roots were eaten in Nunapitchuk (Andrews 1989:340, 496).
Caution: Plants contain irritant protoanemonin and should never be eaten raw (Turner and Szczawinski 1991:268).

Carex L. spp. — Sedges

Cup'ig: ***pekneret*** — Alternative: ***pa'knex*** (Lantis: 1959)
Location: Found near coastal areas in moist, silty, sandy soils.
Use: Root and lower part of stem eaten raw; not stored. Leaves peeled off but not eaten; only the basal stem eaten. Picked in fall and mixed with ***akutar*** (Eskimo ice cream).
References: Amos, Amos and Mike 1997; Lantis 1959:61; Smith, Whitman and Shavings 1997a; Williams and Williams 1995a, 1997

Cladonia Hill spp. — Lichens

Cup'ig: — Yup'ik: ***cirunеruat*** (Jacobson 1984)
Location: Found growing on rocks in tundra areas throughout island.
Use: Used in soups with other available food items. Used often during times of starvation but "old timers" liked it other times as well. No longer in use in 1990s.
References: Kiokun 1995b; Kolerok 1995

Claytonia tuberosa Pall. Tuberous Spring-Beauty, "Wild Potato"

Cup'ig: ***ulpit***
Location: Grows on bird cliffs along northwest coast of island.
Use: Harvested in June. Corm eaten like potato.
References: Tootkaylok 1997
Comparison: Possible use on Nelson Island (Ager and Ager 1980:35). Corm eaten boiled or roasted by some mainland Natives while leaves are eaten in salads (Hultén 1968:405).

Conioselinum chinense (L.) BSP. Western Hemlock-Parsley

Cup'ig:
Location: Common on back shores.
Use: Roots of plant can be found by digging below last year's dead flower stalks and are eaten in spring. Voucher specimen not collected in 1990s.
References: Fries 1977:44

Draba borealis DC. or *D. hyperborea* (L.) Desv.(?) "Wild Lettuce"

Cup'ig: ***inguqit***
Location: Grows quite large (>0.5m) high on bird cliffs and unconsolidated rocky slopes on the north shore.
Use: Appears in early spring and people begin to eat them when they are still sprouts. Leaves are washed and relished raw, dipped in seal oil or mayonnaise. Also boiled in water for few minutes and stored for winter. Sometimes mixed with *Rumex arcticus* (***ciwassat***). Species identification uncertain. Voucher specimen not collected in 1990s.
References: Amos & Amos 1989; Fries 1977:36

Dryopteris dilatata (Hoffm.) Gray (?) Shield Fern

Cup'ig: ***cilqaarat*** Alternative: ***ilqaarat***
Location: Located along stream banks and marsh areas.
Use: Harvested when plant is dying; not when fresh. Used as tea. Not considered a medicine. Identification uncertain. No voucher specimen collected.
References: Williams & Williams 1997

Empetrum nigrum L. Crowberry

Cup'ig: ***paunrat*** or ***pauner*** Alternative: *pa'unaxo'tax* (Lantis 1959)
Location: Dominant in dry and alpine tundra in addition to peat mounds in wet tundra and sand dunes.
Use: Fruit is not generally preferred but the abundant black berries are picked in fall and eaten fresh or stored and mixed with other berries and eaten during winter in ***akutar*** (Eskimo ice cream). Berries were also added to sour dock and stored in barrels.
References: Fries 1977:45–46; Lantis 1959:61; Nowak 1975:26; Smith, Whitman and Shavings 1997a; Williams and Williams 1997
Comparison: Use similar on Nelson Island (Ager and Ager 1980:37), the Kus-

kowim and Yukon Delta villages (Andrews 1989:496; Fienup-Riordan 1986:141), Seward Peninsula (Jones 1983:94), and Napaskiak but was not stored in the latter. The entire plant was also used to brew a tea by coastal people (Oswalt 1957:22). The Inupiaq name for this plant (***paungaq***) is very similar to that in Cup'ig (Jones 1983).

Epilobium angustifolium L. — Fireweed

Cup'ig:	Alternative: *ci'lkax* (Lantis 1959)
Location:	Found in disturbed areas along coastline. Common in backdune areas and mesic tundra.
Use:	Leaves boiled for tea and occasionally eaten when tender.
References:	Lantis 1959:5, 59
Comparison:	Used as tea in both Nelson Island (Ager and Ager 1980:34) and Napaskiak (Oswalt 1957:22). Young shoots also harvested in early summer and eaten raw or blanched, with seal oil on the mainland and Seward Peninsula (Jones 1983:23–24).

Eriophorum angustifolium Honck. — Tall Cottongrass

Cup'ig:	***pekner***
Location:	Located in bogs and wet tundra areas.
Use:	Base of stem was eaten raw and considered to have a sweet taste in the summer. Bulbous underground stem was collected by lemmings for winter use and caches were often found and eaten before freeze up. No knowledge of plant use as a food source identified in 1990s.
References:	Fries 1977:21–22; Smith, Whitman and Shavings 1997b
Comparison:	Stems were considered edible in Napaskiak (Oswalt 1957:27), plant greens were eaten in summer while roots were collected in fall along the lower Yukon Delta region, and the roots were eaten in Nunapitchuk while the reeds were dried and braided for use in construction of bags and mats (Andrews 1989:496). In the Seward Peninsula, the base of the stem was collected from mice or vole caches and eaten raw or boiled after the root hairs have been removed. Also preserved in seal oil (Jones 1983:120).The Inupiaq name for this plant (***pikniq***) is similar to that in Cup'ig (Jones 1983).

Fucus L. spp. — Bladderwrack

Cup'ig:	***elquat***
Location:	Found washed up on beaches year round
Use:	Harvested year-round but chiefly collected in late spring and early summer. Eaten raw or cooked with mussels or clams. Some people cook it by dipping in it hot water (turns green) then dipping in seal oil.
References:	Amos, Amos and Mike 1997; Williams and Williams 1995b, 1997

Hippuris tetraphylla L. or *Hippuris vulgaris* L. Mare's tail

Cup'ig: ***tayaarut*** Alternative: *taxa'xo* (Lantis 1959)
Location: Common in tundra ponds.
Use: In autumn, stems and leaves are cooked with seal blubber and salmon eggs. One informant said plants are collected just before ponds freeze, leaves and stems are chopped up, cooked separately, then beaten with salmon eggs and blubber. In spring, when plant floats on ponds, it's gathered and cooked in seal-meat soup. Only plant part above water used. Some stored over winter.
References: Lantis 1959:61; Smith, Whitman and Shavings 1997b; Williams and Williams 1997
Comparison: Ager and Ager 1980:37; Oswalt 1957:22; roots were eaten in Nunapitchuk (Andrews 1989:496).

Honckenya peploides (L.) Ehrh. ssp. *major* (Hook.) Hult. (syn. *Arenaria peploides* var. *major* Hook.) Beach greens, Seabeach sandwort

Cup'ig: ***tukullegat*** Altenative: *tuku'lixax* (Lantis 1959)
Location: Common adjacent to tidal zone on beaches around island.
Use: Actively harvested on Nunivak. Edible from spring to mid-August and collected before flowering. Leaves and stems are boiled and said to taste like buttered greens. Leaves are sometimes chopped and boiled with other plants such as *Rumex arcticus* (***ciwassat***) or with seal oil blubber & fish eggs. Leaves are often cooked inside of fish when baked in open fire. Greens are stored with dock leaves for winter.
References: Fries 1977:31–32; Lantis 1959:60; Smith, Whitman and Shavings 1997b; Tootkaylok 1997
Comparison: Ager and Ager 1980:35; Jones 1983:43–44

Ledum palustre L. ssp. *decumbens* (Ait.) Hult Labrador Tea

Cup'ig: ***ay'ut*** Alternative: *ai'yu* (Lantis 1959)
Location: Abundant on dry tundra and on peat mounds in wet tundra.
Use: Picked in spring/early summer before plant flowers. Leaves are delicious used in tea. Recently used primarily as flavoring in black tea.
References: Fries 1977:46; Kiokun 1995a; Lantis 1959:61
Comparison: Similar use in Nelson Island (Ager and Ager 1980:37–38), Nunapitchuk (Andrews 1989:340, 496), lower Yukon Delta area (Fienup-Riordan 1986:113), Seward Peninsula (Jones 1983: 61), and Napaskiak (Oswalt 1957:32) although the latter village also used dried stalks in healing practices to get rid of ghosts.
Caution: Plant contains andromedo toxins. Safe in weak tea solutions but should not be used too strong (Turner and Szczawinski 1991:267).

Ligusticum scoticum L. ssp. *hultenii* (Fern.) Calder & Taylor
Beach Lovage or "Wild Parsnip/Parsley"

Cup'ig: ***tuk'ayut, ciukarrat***

Alternative: *tuxkai'yuk* or *ciuga'Xax* (Lantis 1959)

Location: Common along backdunes and sandy areas in addition to the interior.

Use: First thing available in spring once snow melts. When plant first sprouts, roots eaten raw, dipped in seal oil or eaten without oil. Often eaten with dried fish in spring. Leaves and stems are eaten raw or dipped in seal oil or boiled and eaten as greens. By late summer, leaves gets large and are considered mildly poisonous. Cooked and added to ***akutar*** (Eskimo ice cream). Fresh leaves provide a good source of Vitamins A and C.

References: Fries 1977:44; Kiokun 1995a, 1995c; Lantis 1959:60; Smith, Whitman and Shavings 1997b; Williams and Williams 1997

Comparison: Ager and Ager 1980:37; Fienup-Riordan 1986:112; Jones 1983:14. The Inupiaq name for this plant (***tukkaayuk***) is similar to that in Cup'ig (Jones 1983).

Lycoperdon Pers. spp. and *Calvatia* Fr. spp. Puffballs

Cup'ig: ***agyam an'a(i)***

Location: Located in wet tundra near coastline.

Use: Said to be eaten by mainlanders but not on Nunivak. Considered "feces of the stars." Matthiessen (1967:23) earlier reported harvest of "red mushrooms" on Nunivak but no knowledge of the Native use of fungi is recalled today.

References: Williams & Williams 1997

Mertensia maritima (L.) S.F. Gray Oyster Leaf

Cup'ig: ***ciunerturpat***

Location: Along coastal areas.

Use: Leaves eaten on Nunivak long ago but harvest and preparation information no longer known.

References: Williams & Williams 1997

Comparison: On Nelson Island, the long leafy stems were placed whole in cold water and brought to boil. They were cooked briefly and eaten with seal oil. No longer used today (Ager and Ager 1980:38).

Oxycoccus microcarpus Turcz. (syn. *Vaccinium oxycoccus* L.) Bog Cranberry

Cup'ig: Yup'ik: ***uingiar*** (Jacobson 1984)

Location: Common in peat bogs.

Use: Berries eaten by people of Mekoryuk but not found in sufficient quantity to constitute an important part of the berry harvest.

References: Nowak 1975:26

Comparison: Ager and Ager 1980:37; Fienup-Riordan 1986:141

Oxyria dignya (L.) Hill Mountain Sorrel, "Sourgrass"

Cup'ig: ***quulistar***

Location: Abundant on cliffs in alpine tundra and in dry tundra near the coast.

Use: Beginning in spring, leaves are eaten raw, dipped in seal oil, or boiled. Larger leaves are relished by families that used to live at Nash Harbor where the plant grows in abundance along rocky slopes. Others prefer the leaves of the similar *Rumex arcticus* (***ci-wassat***), common near fish camps and Mekoryuk. Leaves were added to sour dock and berries and stored in barrels.
References: Fries 1977:29; Lantis 1959:61; Nowak 1975; Smith, Whitman, & Shavings 1997b
Comparison: Ager and Ager 1980:35; Jones 1983:65
Caution: Edible in moderation. If eaten in large quantities or over long periods of time, they can cause poisoning and interfere with the bodies calcium metabolism (Turner and Szczawinski 1991:211).

Palmaria palmata (L.) Stackhouse — Seaweed, Dulse
Cup'ig: ***elquat***
Location: Common on rocks in middle and upper tidal zones.
Use: Collected in summer or during winter when ice cracks expose seaweed on rocks. Eaten raw or in fresh soup with fish, mussels or seal meat. Dipped in hot water (turns green), seal oil and then eaten. ***Elquat*** appears to be a generic name for seaweed species however no other varieties were seen or collected during 1990s.
References: Kiokun 1995a; Lantis 1959:61; Nowak 1975:26; Williams & Williams 1995a

Parrya nudicaulis (L.) Regel (?) — "Wild Cabbage", "Wild Celery"
Cup'ig: ***inguqit*** — Alternative: *inu'kit* (Lantis 1959)
Location: Found along cliffs.
Use: Leaves usually eaten raw, occasionally boiled, or stored with dock leaves for winter use. Cliff greens. Species identification uncertain. No voucher specimen collected.
References: Kiokun 1995a; Lantis 1959:62

Pedicularis verticillata L. — Woolly Lousewort
Cup'ig: — Yup'ik: ***ulevleruyak*** (Jacobson 1984)
Location: Common on island back shores, wet tundra, and mesic tundra.
Use: Flowers of this genus are popularly called "Bumblebee food" and are picked and sucked for nectar.
References: Fries 1977:50
Comparison: In addition to the use of its nectar, Nelson Island Natives are known to harvest the roots of some *Pedicularis* spp. in the early spring and eat them raw with seal oil (Ager and Ager 1980:38).

Pohlia nutans (Hedw.) Lindb. (syn. *Webera nutans* Hedw. Descr.) — Moss
Cup'ig: ***kumarutet*** — Alternative: *ke'agenax* (Lantis 1959)
Location: Generally found in wet tundra areas.
Use: In spring, seal meat is boiled with moss for soup. Moss sometimes mixed with seal oil and fish eggs. Also used as tea. No longer used in 1990s.

References: Burg 1941; Kolerok 1995; Lantis 1959:61; Williams & Williams 1995b
Comparison: Ager and Ager 1980:33

Polygonum bistorta L. — Bistort, Pink Plumes

Cup'ig: ***ciwassat***
Location: Found on grassy hummocks in the interior.
Use: Cup'ig name is similar to that given to several other plants (e.g., *Polygonum viviparum, Rumex arcticus*) but is not thought to have been actively sought on Nunivak Island due to scarcity. No information on use available during 1990s.
References: Fries 1977:30
Comparison: Jones 1983:19
Caution: Leaves of several polygonum spp. are phototoxic. They should not be eaten in large quantities or over prolonged periods (Turner and Szczawinski 1991:24, 211, 272).

Polygonum viviparum L. — Alpine Bistort, "Wild Rhubarb"

Cup'ig: ***ciwassat*** — Alternative: *an.agocu'noax* (Lantis 1959)
Location: Common in many habitats particularly along the coastline.
Use: In the early spring and summer the rhizome is collected and eaten raw. Cup'ig plant name similar to that given to several other local plants (e.g., *Polygonum bistorta, Rumex arcticus*). Not stored.
References: Fries 1977:29; Lantis 1959:59
Comparison: Leaves of *P. alaskana* were gathered and eaten in early summer in Nunapitchuk (Andrews 1989:340, 496).
Caution: Leaves of several polygonum spp are phototoxic. They should not be eaten in large quantities or over prolonged periods (Turner and Szczawinski 1991:24, 211, 272).

Ranunculus pallassi Schlecht. — Pallas Buttercup

Cup'ig: — Alternative: *agolu'noux* (young), *pi'nasga'sax* (mature) (Lantis 1959)
Location: Common in tundra ponds (submerged or floating).
Use: Leaves and stems of plant are collected in spring and eaten boiled. They're considered very tender and delicious. After boiling, seal oil poured over them or else shoots are boiled in seal meat soup. In late summer they are cooked with dock leaves. (Fries states that they are locally called "wivalook" but she is probably referring to ***wivlut*** which is the same name given to *Caltha palustris* (marsh marigold). Species not identified in 1990s.
References: Fries 1977:33–34; Lantis 1946:178, 1959:61
Comparison: Ager and Ager 1980:35; Andrews 1989:340, 496; Fienup-Riordan 1986:112
Caution: *Ranunculus* spp known to contain varying quantities of an acrid, blistering causing juice which yields protoanemonin. Plant considered potentially poisonous to humans (Turner and Szczawinski 1991:104–105).

Rubus arcticus L. Nagoonberry, Arctic Raspberry

Cup'ig: ***puuyaragur***; bloom = ***puuyuraqur***
Location: Found in mesic tundra, backdunes and on peat mounds.
Use: Not many on island. Berries picked from mid-August to September and eaten fresh. Fries had earlier reported no evidence of harvest in 1970s although well known in 1990s.
References: Fries 1977:39–40; Kiokun 1997; Smith, Whitman & Shavings 1997b
Comparison: Oswalt 1957:23; Jones 1983:103

Rubus chamaemorus L. Cloudberry, "Salmonberry"

Cup'ig: ***atsar atsakutag*** Alternative: *a'tsax* (Lantis 1959)
Location: Abundant in many habitats including back shores, roadsides, peat mounds of wet tundra, and dry tundra.
Use: Fruit is abundant all over island in mid to late August. It is the most sought-after berry on the island. Berries are eaten raw, frozen for winter use (alone or with *Vaccinium uliginosum* (***currat***) and *Empetrum nigrum* (***pauner***), or mixed with other berries into ***akutar***. Cup'it believe that a long winter with lots of snow insures a large harvest the following summer. Berries were traditionally stored in seal-pokes without being cooked or stored in rock-lined underground pits that were lined with *Rumex arcticus* (sour dock) leaves, berries packed in, covered with more leaves, sod, then rocks.
References: Edwards 1995; Fries 1977:39; Nowak 1975:26; Williams & Williams 1997
Comparison: Andrews 1989:496; Fienup-Riordan 1986:141; Jones 1983:74; Oswalt 1959:23

Rumex arcticus Trautu. Sour Dock, Dock, "Wild Spinach"

Cup'ig: ***ciwassat*** Alternative: *ciwa'sax* (Lantis 1959)
Location: Common in wet tundra areas including along tundra ponds, peat ridges and standing water.
Use: Delicious and important edible plant for Nunivak people. Contains high amounts of Vitamins A and C. Young stems are eaten raw in spring, or chewed with juice sucked from them. Leaves are eaten raw with seal oil or boiled in summer. By late summer stalks are considered too stringy. For winter use, leaves were parboiled, juice drained off and placed underground in temporary caches. Braided grass mats were used to line caches with grass and willows placed on top for protection. Later stored in large wooden storage dishes; frozen. When removed from storage to make soup, it's cooked with salmon eggs and dried fish (fresh fish?) or salmon eggs and seal oil; or boiled with a little seal oil; or chopped and beaten up with fish and seal oil. Most abundantly used plant except possibly *Empetrum nigrum* (crowberries). Leaves are often chopped and boiled until all flavor enters water with the resulting sour tasting mixture frozen for use in winter and taken with sugar as a drink

or frozen dessert. Cup'ig plant name is similar to that given to several other plants (e.g., *Polygonum bistorta, P. viviparum*)

References: Curtis 1930:35; Fries 1977:28–29; Kiokun 1995a, 1995b; Lantis 1959: 59; Nowak 1975:26; Williams & Williams 1995a; Whitman 1995

Comparison: Ager and Ager 1980:35; Andrews 1989:340, 496; Fienup-Riordan 1986:112; Jones 1983:36; and Oswalt 1957:24. Plant also used in the Kuskokwim River area as a landmark and navigational aid in marshy areas because plant is known to always grow in the same place (Andrews 1989:340).

Caution: Plant contains soluble oxalatis which can interfere with calcium uptakes (Turner and Szczawinski 1991:267)

Salix alaxensis (Anderss.) Cov. Alaska Willow

Cup'ig: ***qugyuguat*** (common name for willow spp.)

Location: Found along slopes of stream banks and gravel bars.

Use: Eskimo children strip the catkins of this shrub and chew them. They are commonly referred to as "Eskimo bubble-gum" and are eaten before seeds ripen in June and July.

References: Fries 1977:28; Williams & Williams 1997

Comparison: Similar use reported for Nelson Island (Ager and Ager 1980:34–35), Napaskiak (Oswalt 1957:24–25) and the Seward Peninsula (Jones 1983:8), in addition to the tips of leaves being eaten raw with seal oil or added to meat or fish stews and soups. On Nelson Island, the shrub was also sometimes burned to produce ashes which were added to chewing tobacco or snuff.

Salix pulchra Cham. Diamondleaf Willow

Cup'ig: ***qugyuguat*** (common name)

Alternative: *ki'xmi°ax* (Lantis 1959)

Location: Located on wet tundra and along gravel bars and banks of rivers and streams.

Use: Flowers were eaten raw. In 1927, Curtis recorded the use of this plant as a food source. In 1940, Lantis states that while most Cup'it denied ever eating willow leaves, one old woman said the leaves were once soaked in seal oil and eaten with dried fish. In 1990s, elders state that willow leaves were traditionally picked by Natives in Northern Alaska and that some Cup'it had recently adopted the practice. There is no memory of the traditional use of this plant by the Cup'it.

References: Curtis 1930:35; Lantis 1959:60; Smith, Whitman & Shavings 1997b

Comparison: Jones 1983:10; Oswalt 1957:24. Young leaves are eaten raw with seal oil by Siberian Eskimos (Hultén 1968:359).

Saxifraga L. spp. Saxifrages

Cup'ig: ***quulisstat***

Location: Found in cliff areas

Use: Leaves are eaten fresh in spring. Tastes like lime. Species not positively identified during 1990s interviews but believed to be *S.*

	punctata or *S. spicata.* Cup'ig name similar to *Oxydria digyna* (Mountain Sorrel). No voucher specimen collected.
References:	Williams and Williams 1997
Comparison:	On the Seward Peninsula, *S. punctata* leaves were picked from spring through fall and eaten in seal oil with fish or meat or preserved in seal oil (Jones 1983:22).

Sedum rosea (L.) Scop. (syn. *Rhodiola rosea* L.) Roseroot, Stonecrop

Cup'ig:	***megtat neqiat*** Alternative: *ca'klax* (Lantis 1959)
Location:	Found along coastal cliffs and rocky slopes in addition to river banks, meadows, and peat mounds in wet and dry tundra.
Use:	Flowers boiled in water to make tea, not necessarily for medicine, just as a drink. Plant no longer in use in 1990s.
References:	Fries 1977:36–37; Lantis 1959:24, 60
Comparison:	In earlier times this plant used medicinally to treat sores in mouth on Nelson Island but it is no longer used (Ager and Ager 1980: 36). The entire plant (stems, leaves, young flower buds, and roots) are picked, eaten and preserved each spring in many northern Alaskan communities (Jones 1983:55).
Caution:	Various species contain oxalic acid and soluble oxalates and should be used only in moderation (Turner and Szczawinski 1991:268)

Senecio pseudo-Arnica Less. Ragwort

Cup'ig:	Alternative: *ko'xoyu'xoax* (Lantis 1959)
Location:	Found in well-drained sandy and gravelly soils on upper beaches and along crests of beach ridges.
Use:	Leaves and sometimes stems are boiled with fresh fish in late summer. Also stored and eaten with dock leaves.
References:	Lantis 1959:60
Comparison:	On Nelson Island, in addition to above usage, the top of shoot is often peeled and eaten raw with seal oil (Ager and Ager 1980:38). The root is considered poisonous by Napaskiak residents (Oswalt 1957:34).
Caution:	Plants contain pyrrolizidine alkaloids which can produce liver-damaging compounds. Ingestion is not recommended (Turner and Szczawinski 1991:16).

Streptopus amplexifolius (L.) DC. Twisted stalk

Cup'ig:	***atsarllug***
Location:	Found along river banks.
Use:	Berries make noise when chewed. Some are eaten but most spit out. Very bitter and seedy.
References:	Williams and Williams 1997

Vaccinium uliginosum L. Alpine Blueberry, Bog Blueberry

Cup'ig:	***currat***
Location:	Found in interior and along the coast on dry tundra slopes.
Use:	Berries are sought by natives in August.

References: Fries 1977:47; Williams & Williams 1997
Comparison: Ager and Ager 1980:37; Andrews 1989:496; Jones 1983:79; Oswalt 1957:25

Vaccinium vitis-idaea L. ssp. *minus* (Lodd.) Hult.
Lingonberry, Low-bush Cranberry

Cup'ig: ***tumaglir*** or ***tumaglikatat***
Location: Common in dry alpine tundra and on peat mounds of wet tundra.
Use: Berries are very sour and eaten fresh in fall. Local preference is to wait until after the first frost or the next spring and eat berries that have remained under snow all winter. Islanders occasionally make wine from them. Berries are sometimes stored. Now used in ***akutar*** (Eskimo ice cream) and bread.
References: Fries 1977:47; Lantis 1959:61; Smith, Whitman, & Shavings 1997a; Williams and Williams 1997; Tootkaylok 1997
Comparison: Ager and Ager:1980:37; Andrews 1989:265, 496; Jones 1983:87; Oswalt 1957:25–26

Medicinal Use of Plants

Artemisia tilesii Ledeb. Stinkweed, Wormwood, "Caribou Leaves"

Cup'ig: ***neqnialngut***
Location: Common on coastal cliffs and back shores.
Use: Leaves are boiled and 1–2 cups of the infusion taken daily for a variety of ailments including asthma. Mostly used by "old timers." Kolerok (1995) states use as medicine was introduced after arrival of Euro-Americans.
References: Fries 1977:52; Kolerok 1995; Smith, Whitman and Shavings 1997b
Comparison: On Nelson Island, tea was used as a laxative, for arthritic ailments, swollen areas, and as general tonic. Natives in both Nelson Island and Napaskiak applied leaves directly to wounds to stop bleeding, used on skin for infection, or crushed and applied to hands to remove or mask odors after cleaning fish (Ager and Ager 1980:38; Fineup-Riordan 1986:113). In Napaskiak, switches from this plant were also used during the sweatbath (Oswalt 1957:33).

Betula exilis (Sukatsch.) Hult Birch, Dwarf Birch

Cup'ig: Alternative: *cupu'yaxotet* (Lantis 1959)
Location: Found in dry tundra and peat mounds in wet tundra.
Use: Leaves boiled to make a tea. Medicine for stomach ache and intestinal discomfort. Fries found no use of birch in 1970s.
References: Fries 1977:28; Lantis 1959:5, 61

Dryopteris austriaca (Jacq.) Woynar Shield Fern

Cup'ig: ***centurkar*** Alternative: *sto'xkax* (Lantis 1959)
Location: Found near stream banks.
Use: Fronds put in boiling water and boiled a long time to make tea. Used as medicine for stomach aches and intestinal discomfort.

References: Lantis 1959:5, 61; Williams and Williams 1997

Epilobium angustifolium L. — Fireweed

Cup'ig: Alternative: *ci'lkax* (Lantis 1959)
Location: Common in backdune areas and mesic tundra; in disturbed areas along coastline.
Use: Leaves boiled to make medicine for stomach ache and intestinal discomfort.
References: Lantis 1959:5, 59
Comparison: Ager and Ager 1980:36–37

Eriophorum L. spp. — Cottongrass

Cup'ig: ***musqu'*** or ***melqiutet***
Location: Found near wet bogs and tundra
Use: Cotton-like flowers picked in spring and summer by children and given to old women for wiping eyes. Also used for cuts to staunch bleeding. No distinction in use between available species. Known species include *E. angustifolium, E. russeolum albidum, E. Scheuchzeri,* and *E. vaginatum.*
References: Lantis 1946:202; Smith, Whitman and Shavings 1997a; Williams and Williams 1997
Comparison: In Napaskiak, stems of plant were gathered in summer, dried, and woven for use as boot soles (Oswalt 1957:28). Cotton-like flowers were used in Eek to treat boils; method not reported (Lantis 1959: 17).

Ledum palustre L. ssp. *decumbens* (Ait.) Hult — Labrador tea

Cup'ig: ***ay'ut*** Alternative: *ai'yu* (Lantis 1959)
Location: Common throughout dry tundra, alpine tundra, and on peat mounds in wet tundra.
Use: Stems and leaves used as medicinal tea for stomach ache and intestinal discomfort and considered useful in curing colds.
References: Fries 1977:46; Kiokun 1995a; Lantis 1959:61
Comparison: On Nelson Island the leaves were also used as treatment "for those that spit blood" (Ager and Ager 1980:37). Plants even collected in winter when wind exposed them from snow.

Rubus chamaemorus L. — Cloudberry

Cup'ig: ***atsar atsakutag*** Alternative: *a'tsax* (Lantis 1959)
Location: Abundant in many habitats including back shores, roadsides, peat mounds of wet tundra, and dry tundra.
Use: Juice of berries drunk as medicine.
References: Edwards 1995; Fries 1977:39; Nowak 1975:26; Williams & Williams 1997

Salix fuscescens Anderss. — Willow

Cup'ig: ***qimugkararat*** (common name for willow with "cottonballs" [catkins]) Alternative: *pa'li* (Lantis 1959)

Use:	Leaves chewed to treat sore mouth; not eaten. Old men known to put willow cotton or "Alaska cotton" (cotton grass) in inner corner of eye, if suffering from watery eyes.
References:	Lantis 1959:60

Salix pulchra Cham. Willow

Cup'ig:	***qugyuguat*** (common name for willow spp.) Alternative: *ki'xmi°ax* (Lantis 1959)
Location:	Located on wet tundra and along gravel bars and banks of rivers and streams.
Use:	Leaves chewed to treat sore mouth.
References:	Curtis 1930:35; Lantis 1946:202, 1959:60; Smith, Whitman & Shavings 1997a
Comparison:	Nelson Island Eskimo used leaves from *Salix alaxensis* in similar manner (Ager and Ager 1980:34). Lantis (1959:5–6) reports that the inner and outer bark of willow (*Salix* spp.) was boiled and used as a gargle in one Kuskokwim River village while only the inner bark was used in another.

Sedum rosea (L.) Scop. (syn. *Rhodiola rosea*) Roseroot, Stonecrop

Cup'ig:	***megtat neqiat*** Alternative: *ca'klax* (Lantis 1959)
Location:	Found along coastal cliffs and rocky slopes in addition to river banks, meadows, and peat mounds in wet and dry tundra.
Use:	Leaves were boiled and used for medicinal tea for stomach ache or intestinal discomfort. Flowers eaten raw as aid for tuberculosis. No one recognized use of the plant in the 1970s or 1990s. Referred to as "bee's food."
References:	Fries 1977:36–37; Lantis 1959:5, 24, 60; Williams and Williams 1997
Comparison:	Nelson Island Eskimo used to chew roots raw to treat sores in mouth. The juice was then spit out and not swallowed. No longer in use (Ager and Ager 1980:36).

Utilitarian Use of Plants

Aconitum delphinifolium DC. Monkshood

Cup'ig:	***esetegneg***
Location:	Common in mesic tundra, backdunes and near old village sites.
Use:	Fries told that "old-timers" used to make poison darts or arrows from plant. Lantis states that no plant poison was used on Nunivak and denies use of plant. No knowledge of traditional use was recalled during the 1990s interviews.
References:	Fries 1977:32–33; Lantis 1946:172
Caution:	Plants considered highly toxic and potentially fatal. Contains aconitine and aconine (Turner and Szczawinski 1991:204–205)

Carex L. spp. Sedges

Cup'ig:	***pekneret*** Alternative: *pa'knex* (Lantis 1959)
Location:	Common in bogs and along coastline.

Use: Grassy leaves picked in fall, cleaned, dried, and smoked a little to make thinner for mukluk lining and socks.
References: Amos, Amos and Mike 1997; Lantis 1959:61; Smith, Whitman and Shavings 1997a; Williams and Williams 1997

Cladonia rangiferina (L.) Hoffm. — Lichens, Reindeer Moss

Cup'ig: — Yup'ik: ***tuntut neqait*** (Jacobson 1984)
Location: Common in bogs and tundra areas.
Use: Used for applying oil to kayak frame or pottery. Dipped in seal oil and applied to object. Plant no longer in use in 1990s.
References: Kiokun 1995b; Kolerok 1995

Elymus mollis Trin. — Wild Rye Grass, Dune Grass

Cup'ig: — Yup'ik: ***taperrnaq*** (Jacobson 1984)
Location: Found along coastline.
Use: Braided "seahorse grass" was traditionally used as menstrual pad for a girl's first menstruation. Leaves used for thread, woven mats and basket construction.
References: Lantis 1946:178–181; Noatak 1986; Pratt 1990:77
Comparison: Nelson Island Eskimo use grass in construction of baskets, mats, and ropes (Ager and Ager 1980:34). In Scammon Bay (Fienup-Riordan 1986:113) the grass is used for basket weaving and for braiding to aid in the spring harvest of herring and tom cod.

Equisetum arvense L. — Common Horsetail

Cup'ig: ***kenret***
Location: Found in a variety of habitats including marshy areas and tundra.
Use: Not eaten. Stalks are used by children as play matches
References: Smith, Whitman and Shavings 1997b
Comparison: On Nelson Island, upper stem is brewed in tea to stop internal bleeding. Black edible nodules attached to roots are also collected and eaten. Roots are often ground up when green and added to ***akutar*** (Eskimo ice cream), or mixed with fish eggs into soup (Ager and Ager 1980:33).
Caution: Common Horsetail is known to be toxic to livestock. Green vegetative shoots should never be eaten (Turner 1995:24).

Pohlia nutans (Hedw.) Lindb. — Moss

Cup'ig: ***kumarutet*** — Alternative: *ke'agenax* (Lantis 1959)
Location: Generally found in wet tundra and bog areas.
Use: Moss dried and used as children's diapers and dressing for wounds, or soaked in seal oil for fire starter. Earlier wrapped around clay pottery (i.e., greenware) before being fired. Moss no longer harvested in 1990s.
References: Burg 1941; Kolerok 1995; Lantis 1959:19, 61; Williams & Williams 1995b

Rumex arcticus Trautu. Sour Dock, Dock, "Wild Spinach"

Cup'ig:	***ciwassat*** Alternative: *ciwa'sax* (Lantis 1959)
Location:	Common in wet tundra areas including along tundra ponds, peat ridges and standing water.
Use:	Leaves used for lining underground cache pits used for storing berries.
References:	Kiokun 1995a

Vaccinium vitis-idaea L. Lingonberry, Mountain Cranberry

Cup'ig:	***tumaglir*** or ***tumaglikatat***
Location:	Common in dry alpine tundra and on peat mounds of wet tundra.
Use:	Berries used for dyeing dog hair for seal gut parka decorations or grass for baskets. No longer in use in 1990s.
References:	Fries 1977:47; Lantis 1959:61; Smith, Whitman, & Shavings 1997a; Williams and Williams 1997; Tootkaylok 1997

Plants recognized by Cup'ig name but without knowledge of Native use:

Botanical Name	*Common Name*	*Cup'ig Name*
Palmaria mollis (Setch. & Gard.) Meer & Bird (syn. *Rhodymenia palmata* (L.) Grev.)	Dulse	***elqurlut*** or ***cinarassit***
Ulva L. spp.	Sea lettuce	***cinarassit, cinarayet***
Alaria Greville spp.	Ribbon Kelp	***cinarassit***
Petasites Pers. spp.	Coltsfoot	***qallngaguar***

CHANGES IN PLANT USE

While oral accounts have added extensive details to previous knowledge of subsistence procurement and storage techniques of the Cup'it on Nunivak Island, one must keep in mind that the memories of earlier subsistence use may be affected by recent changes to island culture. The most obvious change in Cup'it indigenous plant use, from the time of Curtis and Lantis' earlier studies, is the current lack of use of many previously used plants. With the abandonment of all but two island villages by the early 1940s, and an increased reliance on western foods, fewer families rely on traditional subsistence resources (Nowak 1975). In time, information on earlier plant use may be forgotten and influences resulting from increased contact with mainland peoples can add or supplant earlier local knowledge. For example, in 1927 Curtis (1930:35) recorded the use of willow leaves (*Salix* spp.) as a food and medicinal item. In 1939, Lantis (1959:60) found only one elder who still recalled the earlier use of willow and today such traditional use is routinely denied by Cup'it elders. Recent influence of northern Eskimos on the island population has resulted in a renewed use of the plant, although contemporary Cup'it elders believe that its use is only of recent innovation. A similar pattern of traditional versus recent use has been noted for stinkweed/wormwood (*Artemesia Tilesii*).

It is easy to assume that observed Native lifeways in the early twentieth century reflect those practiced during the late prehistoric period or before. However, in spite of the evident continuity of tool use and general subsistence practices on Nunivak throughout the past 500 years (Griffin 1999), the Cup'it's traditional lifeways may have been different, possibly more complex than those historically recorded. Following increased contact with mainland Native peoples (i.e., trade, intermarriage) and Euro-Americans (after the island's "discovery" by Russia in 1821) during the nineteenth century, changes in the use of indigenous plants were probably an on-going process, influenced by the degree and type of contact with non-Cup'it people, as well as impacts from a serious loss in Native population resulting from the introduction of western diseases throughout the nineteenth century (Griffin 1999:205–208).

The Cup'it historically maintained close ties with the people of Nelson Island to the east and may have assimilated mainland refugees from regional internecine warfare during the eighteenth century (Griffin 1999:158–163; Nelson 1877–1881: 60–61). As such, one would expect a similarity in plant use between Nunivak Island and Alaska mainland peoples based on their degree of contact in the past. Differences in recorded plant use may be due to local cultural variations, outside influence since historic contact, and/or loss of knowledge of the extent of past plant use. Another factor which may affect the comparison of Cup'it plant uses with those of other Yup'ik groups is the general lack of ethnobotanical data from the Yukon-Kuskokwim Delta.

Previous research in Native communities within the Delta have focused on documenting changes to Native lifeways following the arrival of Euro-Americans to the region (e.g., Fienup-Riordan 1983, Lantis 1946) however, these studies have provided little detailed information on traditional use of indigenous plants. As with the present Cup'it study, the collection of ethnobotanical information was not the central focus of research efforts and a systematic analysis of Native plant use throughout region has yet to be undertaken. Given the incorporation of western foods in Native diets and a corresponding decline in the harvest of many indigenous plants, additional efforts to collaborate with Native communities need to be undertaken before information on traditional use of area vegetation has been forgotten.

CONCLUSION

The Cup'it of Nunivak Island traditionally occupied an isolated portion of southwestern Alaska with limited contact between island residents and mainland peoples until the late nineteenth century. Having to primarily rely on locally available resources for their subsistence, the Cup'it incorporated many of the island's indigenous plants into their year-round diet. As a result of working collaboratively with the residents of Nunivak Island, information on the traditional use of 47 indigenous plant species was collected along with details regarding seasonality of use, plant harvest and storage. Contrary to earlier stereotypes of Arctic peoples' heavy reliance on a meat-based diet for survival, island flora were routinely incorporated into the Cup'it's diet in addition to Native pharmacology and utilitarian tasks.

The present study comprises a survey of the Cup'it use of indigenous plants located along the north coast of Nunivak Island, Alaska, with focal areas around the villages of Mekoryuk and Nash Harbor. Given the general inaccessibility of the island's interior and southern dunes region (i.e., lack of roads and prevailing dense fog during the summer months), a wide variety of additional plant species, more acclimatized to the island's dry and alpine tundra and sand dunes may have been in common use by the Cup'it in the past but have yet to be documented. Prior to historic contact, the majority of island residents resided on the south side of the island near the Cape Mendenhall area (i.e., dune portion of the island). After 1930, a general shift in island population to the north side of the island (i.e., area dominated by low-lying wet tundra) occurred, induced by the establishment of an island trading post, school and mission (Lantis 1946). There have been no attempts to date, to document differences in variety and use of indigenous plants within Nunivak's dune region.

Extensive Native trail systems are known to have also once crisscrossed the island (Griffin 1999:333–334). Elders recall that trips through the island's interior were quite common before the island school was moved to Mekoryuk in 1940 and the majority of Cup'it villages on Nunivak Island were forced to be abandoned. Given the emphasis of the current Nunivak study on northern wet tundra areas, further research on indigenous plant use in other island vegetative regimes is needed to better understand traditional Cup'it plant use. Elders knowledgeable of traditional plant use on Nunivak remain few and younger generations have not expressed an interest in preserving this data. Except for the continuing harvest of a few popular plant species (e.g., *Angelica lucida* [wild celery], *Rumex arcticus* [sour dock], *Caltha palustris* [marsh marigold], *Rubus chamaemorus* [cloudberry]), much of their knowledge is not being passed on and will likely disappear with the passing of today's elders. It is important that additional research efforts to record traditional use of plants in these areas occur before knowledge of such use is forgotten.

NOTES

[1] The Cup'it of Nunivak Island have a distinct culture and speak their own sub-dialect of Yup'ik (Lantis 1984) known locally as Cup'ig (Drozda 1994) and by linguists as Cux (Hammerich 1958, Woodbury 1984). It is the most distinct dialect within the Yup'ik language family and serves to highlight the isolation and uniqueness of the Cup'it people.

[2] The current Cup'ig spellings of all plant and proper names are taken from the Cup'ig dictionary by Amos and Amos (1999) and have been placed in bold italics.

[3] Previously published Cup'ig names do not conform with current orthography (i.e., Amos and Amos 1999). All instances have been underlined in text.

ACKNOWLEDGMENTS

The fieldwork for this research was supported in part, by a Phillips Grant for Native American Research from the American Philosophical Society, and a National Science Foundation Doctoral Dissertation Improvement grant. I owe a special debt of gratitude to the many Cup'it elders who participated in my research and shared with me their extensive knowledge of the use of indigenous plants. Elders included: Nona Amos, Walter Amos, Bertha Andrews, Irene Davis, Richard Davis, Nancy Edwards, Nan Kiokun, the late Robert Kolerok, Harry Mike, Helen Noatak, Daisy Olrun, Susie Shavings, Mary Smith, Katie Tootkaylok, Sophie Weston, Mildred Whitman, the late Elsie Williams, and George Williams, Sr. A special thanks to Muriel Amos who provided me with the Cup'ig spellings of many traditionally used plants. I would also like to extend my appreciation to the three anonymous reviewers who provided many useful comments on an earlier draft of this paper.

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APPENDIX.—Catalog of plants utilized by the Cup'it.

Scientific name and identification[1]	Common names	Specimen numbers[2]
Equisetaceae (Horsetail family)		
Equisetum arvense L.	Common Horsetail	Fries/Shea 22–24, 116a, 186, 275, 276, 295, 308; NUN96-06
Aspidiaceae (Shield Fern family)		
Dryopteris dilatata (Hoffm.) Gray	Shield Fern	Fries/Shea 337, 223a
Dryopteris austriaca (Jacq.) Woynar	Fern	Lantis (1959)
Gramineae (Grass family)		
Elymus mollis Trin.	Wild rye grass, dune grass	Fries/Shea 329; Lantis 1946; NUN95-14, NUN96-11
Cyperaceae (Sedge family)		
Eriophorum angustifolium Honck.	Tall cottongrass	Fries/Shea 20, 36, 315; NUN95-13, NUN96-14
Eriophorum L. spp.	Cotton grass	Fries/Shea 292, 55, 18, 38, 79; Hultén (1968); NUN96-23
E. scheuchzeri Hoppe		Fries/Shea 292
E. russeolum E. Fries var. *albidum* Nyl.		Fries/Shea 55; Hultén (1968); Lantis (1946)
E. vaginatum L.	Hare's tail grass	Fries/Shea 18, 38, 79
Carex L. spp.	Sedges	Bos (1967); Fries/Shea 140, 176, 193, 296, 323, 324, 366; Hultén (1968); Utermohle (ca. 1973)
Liliaceae (Lily family)		
Streptopus amplexifolius (L.) DC.	Twisted stalk	Fries/Shea 171
Salicaceae (Willow family)		
Salix pulchra Cham.	Diamondleaf willow	Hultén (1968); Lantis (1959); NUN96-13
Salix alaxensis (Anderss.) Cov.	Alaska willow	Fries/Shea 102
Salix fuscescens Anderss.	Willow	Fries/Shea 4, 17; Hultén (1968); Lantis (1946, 1959)
Betulaceae (Birch family)		
Betula exilis (Sukatsch.) Hult	Dwarf birch	Fries/Shea 7, 196; Hultén (1968); Lantis (1959); NUN96-17

Appendix (continued)

Scientific name and identification[1]	Common names	Specimen numbers[2]
Polygonaceae (Buckwheat family)		
Rumex arcticus Trautu.	Dock, Sour dock	Fries/Shea 318; Hultén (1968); Lantis (1959); NUN95-01
Oxyria dignya (L.) Hill	Mountain sorrel	Fries/Shea 113, 152, 205, 223; Hultén (1968); Lantis (1959); NUN95-05
Polygonum bistorta L.	Bistort, Pink plumes	Fries/Shea 124
Polygonum viviparum L.	"Wild rhubarb" or Alpine bistort	Fries/Shea 160, 189, 360; Hultén (1968); Lantis (1959)
Portulacacaeae (Purslane family)		
Claytonia tuberosa Pall.	Tuberous spring-beauty, "Wild potato"	no sample collected
Caryophyllaceae (Pink family)		
Honckenya peploides (L.) Ehrh. ssp. *major* (Hook.) Hult. (Syn. *Arenaria peploides* var. major Hook.)	Seabeach sandwort	Fries/Shea 30, 62; Hultén (1968); Lantis (1959); NUN96-07
Ranunculaceae (Crow Foot family)		
Caltha palustris L. spp. *asarifolia* (DC.) Hult.	Marsh marigold	Fries/Shea 34; Hultén (1968); Lantis (1946, 1959); NUN96-05, NUN97-01
Aconitum delphinifolium DC.	Monkshood	Fries/Shea 224, 320
Ranunculus pallassi Schlecht.	Pallas buttercup	Fries/Shea 8; Hultén (1968); Lantis (1946, 1959)
Cruciferae (Mustard family)		
Parrya nudicaulis (L.) Regel	"Wild cabbage" or "Wild celery"	Fries/Shea 180; Hultén (1968)
Draba borealis DC. or *D. hyperborea* (L.) Desv.	"Wild lettuce"	Fries/Shea 204
Crassulaceae (Stone Crop family)		
Sedum rosea (L.) Scop.	Roseroot	Fries/Shea 15, 54, 118, 206; Hultén (1968); Lantis (1959); Stettenheim (Lantis 1959); NUN95-17
Saxifragaceae (Saxifrage family)		
Saxifraga punctata L. or *S. spicata* D. Don	Cordate-leaved saxifrage Spiked saxifrage	Fries/Shea 110, 200a

Appendix (continued)

Scientific name and identification[1]	Common names	Specimen numbers[2]
Rosaceae (Rose family)		
Rubus chamaemorus L.	Cloudberry	Fries/Shea 32, Hultén (1968), Lantis (1959), NUN95-12, NUN96-09
Rubus arcticus L.	Nagoonberry, Arctic raspberry	Fries/Shea 87, 262, 303, NUN96-10
Onagraceae (Evening primrose family)		
Epilobium angustifolium L.	Fireweed	Hultén (1968); Lantis (1946), NUN95-07
Haloragaceae (Water milfoil family)		
Hippuris tetraphylla L. or	Mare's tail	Fries/Shea 11, 94; Hultén (1968); Lantis (1959)
H. vulgaris L.		Hultén (1968)
Umbelliferae (Parsley family)		
Ligusticum scoticum L. spp. *Hultenii* (Fern). Calder & Taylor	Beach lovage or "Wild parsnip/parsley"	Fries/Shea 26, 352, 237; Hultén (1968); Lantis (1959); NUN95-02
Conioselinum chinense (L.) BSP.	Hemlock parsley	Fries/Shea 252; Hultén (1968)
Angelica lucida L.	"Wild celery"	Fries/Shea 167; Hultén (1968); Lantis (1959); NUN95-08, NUN96-04
Empetraceae (Crowberry family)		
Empetrum nigrum L.	Crowberry	Fries/Shea 3; Hultén (1968); Lantis (1959); NUN95-03
Ericaceae (Heath family)		
Ledum palustre L. ssp. *decumbens* (Ait.) Hult	Labrador tea	Fries/Shea 13; Hultén (1968); Lantis (1959); NUN95-04
Arctostaphylos alpina (L.) Spreng	Alpine bearberry	Fries/Shea 16; Hultén (1968); Lantis (1959); NUN95-18
Vaccinium uliginosum L.	Bog blueberry	Fries/Shea 127, 270, 335; NUN95-15
Vaccinium vitis-idaea L. spp. *minus* (Lodd.) Hult.	Lingonberry, Low-bush cranberry	Fries/Shea 117; Hultén (1968); Lantis (1959); NUN95-06
Oxycoccus microcarpus Turcz.	Bog cranberry	NUN95-33

Appendix (continued)

Scientific name and identification[1]	Common names	Specimen numbers[2]
Boraginaceae (Borage family)		
Mertensia maritima (L.) S.F. Gray	Oysterleaf	Reported by Bos (1967) and Utermohle (ca 1973); Hultén (1968); NUN96-03
Schrophulariaceae (Figwort family)		
Pedicularis verticillata L.	Wooly lousewort	Fries/Shea 120, 143, 161; Hultén (1968); NUN95-11, NUN96-08
Compositae (Composite family)		
Artemisia tilesii Ledeb.	Stinkweed, wormwood, "Caribou leaves"	Fries/Shea 207; Hultén (1968); NUN95-10; NUN96-12
Senecio pseudo-Arnica Less.	Ragwort	Hultén (1968); Lantis (1959); NUN96-18
Cladoniaceae (Lichen family)		
Cladonia Hill spp.		Lichens
Cladonia rangiferina (L.) Hoffm.	Lichen	NUN96-01
Bryaceae (Thread-moss family)		
Pohlia nutans (Hedw.) Lindb.	Moss	
(syn. *Webera nutans* Hedw. Descr.)	Moss	Lantis (1959)
Lycoperdaceae (Puffball family)		
Lycoperdon Pers. spp.	Puffballs	
Calvatta Fr. spp.	Puffballs	
Fucaceae (Brown algae)		
Fucus L. sp. (most likely *F. vesiculosus* L.)	Bladderwrack	NUN96-15
Palmariaceae (Red algae)		
Palmaria palmata (L.) Stackhouse		NUN96-16
(syn. *Rhodymenia palmata* (L.) Grev.)	Seaweed, Dulse	Lantis (1959)

[1] Scientific nomenclature and arrangement of species follows Hultén (1968), except in cases of identifying bryophytes (Grout 1940 and Steere 1978) and for seaweeds (Abbott and Hollenberg 1976 and Guiry 1974). Nomenclature for *Dryopteris austriaca* follows Lantis (1959).

[2] Voucher specimen numbers included for all referenced species: Fries/Shea specimen deposted at Middlebury College, Vermont; Hultén (1968)—State Museum of Natural History, Stockholm; Lantis (1946, 1959)—University of California Herbarium, Berkeley; Stettenheim (ca. 1954)—Michigan State University, East Lansing; Utermohle (ca. 1973)—University of Alaska Herbarium, Fairbanks; NUN#—currently in author's possession but will be deposited at Yupiit Piciryarit Museum, Bethel, AK.

Flora of the Gran Desierto and Río Colorado of Northwestern Mexico. Richard Stephen Felger. The University of Arizona Press, Tucson, Arizona. Pp. xi; 673, 2 maps, 19 B/W photographs, ca. 400 line drawings of plants, gazetteer, six appendices, bibliography, index. US$75.00 (hardcover). ISBN: 0-8165-2044-5.

Richard Felger's beautiful new flora—the latest volume in the University of Arizona's Southwest Center series—is a comprehensive and engaging account of plants and environments in the heart of the Sonoran desert and in the adjacent remnant wetlands of the Río Colorado delta. The area the book covers stretches from the U.S. border on the north to the Gulf of California on the south, and from the delta of the Río Colorado and the Mexican portion of the river on the west to about Mexico Highway 8 on the east. The roughly 15,000 square kilometers of desert plains, volcanic fields, granitic mountains, sand dunes, desert oases, small rivers, and wetlands within the flora area include some of the hottest and driest places on the North American continent. The area nevertheless supports a rather diverse flora of 589 species in 327 genera and 85 families. Of these, eight are pteridophytes, two are gymnosperms, and seventy-nine are non-native angiosperms, the latter confined mainly to disturbed urban and agricultural habitats. The rest are native angiosperms, with dicot species outnumbering monocots by about five to one. Felger's flora describes all 589 species, and provides keys and illustrations that should allow even the novice botanist to correctly identify the vast majority.

The extensive and excellent line drawings by noted botanical artists, and Felger's highly accessible morphological descriptions and keys, are reason enough to purchase his flora and plan a "botanizing" trip to the Gran Desierto. But the book is much more than a tool for identifying desert plants. It is instead a comprehensive introduction and guidebook to the plants, vegetation, and natural and human environments of a unique region that has fascinated Felger for over 25 years and which his book almost dares us to not also find compelling. The massive undertaking that produced *The Flora of the Gran Desierto* provided Felger the opportunity to share not only his extensive botanical expertise and genuine interest in plants, but also his interest and knowledge and enthusiasm for natural history, human history, and human-plant interactions in the Sonoran region. Readers familiar with Felger's earlier publications (Felger and Moser 1985; Felger et al. 1992) will expect to find ample information related to ethnobiology, and will not be disappointed.

The broad context of Felger's flora is established in a 36-page opening section ("Part I: The Environment and Human Interactions") covering paleoclimate, present climate, major habitats, history and human influences, growth forms, and botanical history. The focus on geography, habitat diversity, and human history established in Part I continues in Part II ("The Flora"), in which entries for individual taxa describe not just morphology but also geographical patterns in distribution, characteristic habitats and vegetation associations, and where relevant, aspects of human interaction with taxa and historical information on first recorded observations of introduced species. The gazetteer and six appendices that follow the floristic treatment offer further insight on the physical environment and human history of the flora area, as well as on the plants themselves. The gazetteer of place names and locations (with latitude and longitude accurate to the nearest second) includes information on, for example, the depths of natural bedrock waterholes, the ages and compositions of lava flows and the origins of their names, the early history of Mexican settlements, and the dates for the construction and paving of different roads in the flora area. The appendices include tables on growth forms and distributions of species (Appendix A); habitats of plant species in a volcanic crater (data for Syke's crater, but probably extrapolatable to others; Appendix B); commonly cultivated trees and shrubs, focusing on three settlements (Sonoyta, San Luis, Puerto Peñasco; Appendix C); non-native plants and habitats (ruderal, disturbed, natural; Appendix D); and the relative abundance and dependence on human disturbance (Appendix E) and geographic distributions (Appendix F) of grasses in the flora area.

This volume is a treasure that belongs in the library of every ethnobiologist, geographer, anthropologist, botanist, and ecologist working in North American deserts. Why then, does perusing this book bring me sorrow as well as delight? For the simple reason that I wonder how much longer books like this will be written. Are we training and encouraging and rewarding students of botany to have the depth and breadth of knowledge of plants and their environments that Richard Felger brought to bear in this splendid monograph? In a recent commentary in *Systematic Botany,* Lammers (1999) wondered about the direction the systematic community is headed, with more and more of its practioners involved solely in "cladistic analysis of gene sequences." He asked,

> "Will the 'taxonomist' of the coming century be someone who doesn't know plants as living organisms integrated in their environment? Will a diverse community schooled in multiple disciplines give way to a cadre of lab technicians . . . who know their plants only as extracts in a glass tube? Will no one be left who can write a Latin diagnosis, count chromosomes, perform experimental hybridizations, or use (much less write) a dichotomous key?"

Richard Felger's magnificent *Flora of the Gran Desierto and Río Colorado of Northwestern Mexico* is a potent argument that we should not—must not—let this happen. Buy it, read it, use it, and share it with your graduate students and with foundation and funding officers. Our understanding of biological diversity and ability to conserve and manage it depends on our ability to answer basic questions about the identity of plant species, how they differ from each other, and where they grow (Lammers, 1999). Our need for information on plants and their environments and interactions with human society will only grow in the more crowded world of the future. We need more, not fewer, books like this one, and we need to be training and supporting now the students who will someday write them.

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Journal of Ethnobiology 21(2): 133–144 Winter 2001

TAXONOMIC IDENTITY OF "HALLUCINOGENIC" HARVESTER ANT (*Pogonomyrmex californicus*) CONFIRMED

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ABSTRACT.—The use of California harvester ants (*Pogonomyrmex californicus*) for visionary and therapeutic ends was an important but poorly-documented tradition in native south-central California. In this brief report, a confirmation of the taxonomic identity of the red ant species used in California is presented, and the descriptive record of its use is supplemented with additional ethnographic accounts. This taxonomic identification of this species is of particular importance, as visionary red ant ingestion provides the only well-documented case of the widespread use of an insect as an hallucinogenic agent.

RESUMEN.—La utilización de hormigas granívoras rojas (*Pogonomyrmex californicus*) con fines alucinógenos y terapéuticos, fue una tradición de mucha importancia pero mal documentada en el sur y centro-sur de California. Este breve artículo confirma la identidad taxonómica de dicha especie y la descripción de su uso se hace a través de datos etnográficos adicionales. Esta identificación taxonómica es de especial interés, puesto que es el único ejemplo etnográfico debidamente documentado de un agente alucinógeno derivado de un insecto.

RÉSUMÉ.—L'utilisation des fourmis moissonneuses rouges (*Pogonomyrmex californicus*) à des desseins religieux et thérapeutiques était une tradition peu documentée mais importante dans la vie de plusieurs groupes autochtones du centre-sud de la Californie. Dans ce bref exposé on trouve la confirmation de l'identification taxonomique de la fourmi et à la description de la méthode de son utilisation s'ajoute des données ethnographiques suplémentaires. L'intérêt de ce sujet est considérable car il s'agit là du premier exemple ethnographique bien documenté d'un agent halluncinatoire que provient d'un insecte.

INTRODUCTION

This report supplements an article previously published in this journal under the title, "Ritual and Therapeutic Use of 'Hallucinogenic' Harvester Ants (*Pogonomyrmex*) in Native South-Central California" (Groark 1996). In this earlier paper, I presented an overview of a widespread, but poorly documented, tradition of visionary and curative red ant ingestion among native southern Californian Indians. Building on several key ethnohistoric accounts from the unpublished fieldnotes of Smithsonian ethnologist and linguist John P. Harrington (as well as a number of obscure published sources), I reconstructed the general details of this "ant ingestion tradition," outlining its cultural distribution and probable origins. The paper closed with a discussion of ant venom bioactivity and toxicology, as well as preliminary suggestions concerning likely biochemical bases for the psychoactive effects reported in the ethnographic record.

Recently, another early account written by J.P. Harrington has come to my attention. In addition to supplementing our understanding of ritual ant use with additional ethnographic details from the Luiseño-Juaneño Indians, Harrington also provides us with a precise taxonomic identity for the red ant species used in native southern California. This "new" account is particularly significant in its confirmation of the speculative taxonomic identification offered in Groark (1996). In addition, a set of *Pogonomyrmex* specimens collected by Harrington has been located in the ant collection of the Smithsonian Institution, further increasing the certainty of the identification.

In the present report, I provide a brief summary of the major features and distribution of ritual and therapeutic red ant use, followed by a presentation and discussion of the aforementioned Harrington account (which is currently accessible only in a very rare edition), as well as a description of the newly located specimens. The paper closes with a discussion of the significance of this taxonomic confirmation for future toxicological studies of *Pogonomyrmex* species and their utilization in visionary contexts. This identification is of particular importance, as it provides the only well-documented case of the widespread use of an insect as an hallucinogenic agent.

OVERVIEW OF CULTURAL DISTRIBUTION

Visionary Use of Red Ants.—Ingestion of red ants for visionary and shamanic ends was most highly developed among the indigenous groups of south-central California, seven of which are known to have engaged in the practice. The ants were swallowed alive and unmasticated, in massive quantities (often exceeding 400 ants), in order to induce a prolonged state of unconsciousness during which tutelary spirits (usually referred to as "dream helpers" or "**suertes**") appeared to the aspirant, often becoming life-long supernatural allies. These visions, which often took the form of animals or personified natural forces, were highly sought after by young men—quite apart from any specific skills they might confer, dream helpers (and the power they embodied) were critically important in leading a safe, healthy, and prosperous life. In addition, men who aspired to be shamans would ingest repeatedly red ants or the potently hallucinogenic **toloache** (more commonly known as Jimsonweed; *Datura wrightii* Regel) over a period of months or years. If they were fortunate, they gradually acquired multiple or specialized dream helpers who bestowed extraordinary shamanic skills upon them. (See Groark [1996: 7–11] for detailed accounts of the ritual administration and resulting visions.)

The ingestion of red ants in visionary contexts appears to have been strongest among the Shoshonean groups occupying the southeastern edge of the south-central region of California—the Kitanemuk (Harrington 1986b:rl.98, frs.449–450), Kawaiisu (Zigmond 1977:62, 1986:405), Tübatulabal (Voegelin 1938:5, 46, 67–68), and the various Hokan-speaking Chumash groups, particularly the Interior Chumash (Harrington 1986b:rl.98, frs.608–609, 648–652). In the Central Valley to the north, some of the neighboring Southern Valley Yokuts (particularly the Yawelmani) and Southern and Central Foothill Yokuts (Wikchamni, Yawdanchi, Bokninwad, Yokod, and Palewyami) also swallowed ants in order to gain dream helpers and shamanic power (Harrington 1986a:rl.94, fr.387; Driver 1937:99), but the practice among these latter groups appears in a somewhat attenuated form. The Northern Miwok are also reported to have ingested ants "for vision or power" (Aginsky 1943:440).

Collectively, these groups constitute the core of the visionary ant ingestion tradition. Based on the reported distribution, the practice appears to have developed among the Shoshonean-speaking groups of the southern Sierra Nevada region, spreading to the Interior Chumash to the west, then on to the various Yokutsan groups occupying the southern end of the San Joaquin Valley. Interestingly, this distribution is largely coextensive with the Toloache-Dream Helper complex, an egalitarian religion stressing individual contact with the supernatural and the acquisition of one or more dream helpers (usually mediated through the ingestion of *Datura wrightii* Regel).

Boys' Ant Ordeal.—A number of groups in southern California also administered the ants externally (and on occasion, internally as well) in the "ant ordeals" of boys' initiation ceremonies. These ordeals were ubiquitous among the Takic-speaking Cupan groups in southern California (Gabrielino-Fernandeño, Luiseño-Juaneño, Cahuilla, Cupeño), especially those involved in the proto-historic Chingichngish religion.[1] It should be emphasized, however, that these "ordeals" lacked the visionary component that formed such an important part of ritual ant use as reported from the south-central groups.

In 1852, Hugo Reid described the ant ordeal of the Gabrielino as follows:

> To make them hardy and endure pain without wincing (for cowardice as to corporeal suffering was considered even among the women as disgraceful) they would lie down on the hill of the large red ant, having handfuls of them placed in the region of the stomach and about the eyes. Lastly, to ensure a full dose, they swallowed them in large quantities, alive! [Reid 1968 (1852): 36].

In a revealing comment, one of Harrington's Kitanemuk informants identified these ants as being identical to the vision-inducing red ants used by the south-central groups described above (Harrington 1986a:rl.98, fr.443).

A number of ethnographic accounts indicate that similar ant ordeals were found further to the north among the Chumash (Hudson 1979:73), the Tübatulabal (Driver 1937:98), the Northern Miwok (Aginsky 1943:440), and possibly the Monache (Driver 1937:99). Among these groups, the ordeal often lacked the formal initiatory function found among the groups that were integrated into the Chingichngish religion. Instead, the practice served to mark the transition from youth to adulthood.

It is interesting to note that, although visions are not reported to have manifested, loss of consciousness was common during these ordeals and appears to have been an explicit goal. Profound loss of consciousness was considered essential to shamanic, visionary, and initiatory practice throughout the region, and was understood to represent a sort of "small death" in which the aspirant was "killed" by the supernatural agents which he wished to contact. Despite the lack of associated visions, the goal of the ant ordeal was largely identical to that of visionary ant ingestion—augmentation of individual strength and fortitude, and the establishment of a personal connection with supernatural power. Both visionary ingestion and the ant ordeal of boys' initiation ceremonies represent the individual's first personal contact with supernatural power—a connection which he could then draw on in daily life for vigorous health, luck in hunting or gambling, or for more esoteric purposes (see Groark [1996: 9–10, 16–17] for additional details).

Therapeutic Uses.—In addition to the esoteric uses outlined above, the ants played an important role in both curative and preventative medicine, treating a diverse inventory of common ailments, including: paralysis, gastrointestinal ailments, severe colds, pain, arthritis, and gynecological disorders (particularly those occasioned by childbirth). Ethnohistoric accounts indicate that initiatory and therapeutic ant ingestion persisted through the Mission Period (in some cases, surviving until at least the mid-1850's), but these practices appear to have been abandoned by the turn of the century (see Groark 1996: 11–16 for a detailed discussion).

A NOTE ON INDIGENOUS NOMENCLATURE

A brief survey of indigenous nomenclature reveals striking homogeneity in the name applied to this ant among Takic-speakers of both the Serran and Cupan branches. The ant used in these ceremonies was referred to by the Kitanemuk as **'anəqt** or **'anəht** (pl. **anəm**). Zigmond records the Kawaiisu name as **aanat** ("big red ant—eat for pain") (Unpublished 1937 fieldnotes of M.L. Zigmond; quoted in Anderton 1988:270), while the Luiseño-Juaneño term was **anut** ("red ant") (Kroeber 1925:672). It should be noted that this name was not a generic term for "red ant". Rather, it applied specifically to the "medicinal red ant" used in ritual and therapeutic contexts, with other local species being referred to by distinct names (see Anderton 1988: 597; Harrington 1933:164, note 128).

Neighboring non-Takic groups had very different names for this ant—the Chumashan groups appear to have used the term **shutilhil** (Walker and Hudson 1993), while various Yokutsan speakers of the Tule-Kaweah dialects (Yawdanchi, Wikchamni, Gawia, Bokninwad, Yokod), referred to these ants as **k'awk'aw**, "crazy ants," possibly in reference to their intoxicating potential (Harrington 1986a: rl.94, fr.382).

WAS *POGONOMYRMEX* THE SPECIES USED IN CALIFORNIA?

Despite the surprising detail and high quality of many of the sources cited above, these early accounts provide neither the common nor scientific name for the ant species in question. As a result, I was forced to assume a somewhat speculative tone in the previously published article (Groark 1996). Based on an analysis of the biological and behavioral details provided in the ethnographic literature, I concluded that the ant was most likely a *Pogonomyrmex* species, but acknowledged the problems inherent in any precise identification:

> The taxonomic status of the red ant species used in aboriginal California is uncertain. All ethnographic accounts describe them merely as "large red ants".... The accounts uniformly emphasize their large size, the fact that they build small mounded nests, and the excruciating pain of their sting... Unfortunately, no voucher specimens were collected when the ethnographic accounts were recorded, and the precise taxonomic identity of the ant species must therefore remain tentative. However, the taxonomic and toxicological literature strongly support the assertion that a *Pogonomyrmex* species was indeed the red ant referred to in the ethnographic accounts. Of all the ant genera present in California and the Great Basin, *Pogonomyrmex* is distinguished by the large size, exceptionally painful sting, and highly biodynamic venom of its representative species. [Groark 1996:3]

Based on the ecological distribution of the various *Pogonomyrmex* species present in California, it seemed probable that the most common and conspicuous species, *P. californicus*, was the ant referred to in the accounts. Based on this inference, I proceeded to examine the ethnographic accounts in light of general biology and toxicology in order to assess possible pharmacological underpinnings for the reported visionary and therapeutic effects.

While the results were far from conclusive, a survey of the toxicological literature indicated that the *Pogonomyrmex* species present in California possess potently toxic venom containing a number of highly bioactive compounds, including: kinins, peptides, and neurotoxins, as well as complex alkaloids previously known only from certain higher plant taxa. In large quantities, these venom constituents are capable of acting on the mammalian central nervous system, triggering a wide range of psychophysiological reactions that includes highly altered metabolic states resembling those reported ethnographically.

In addition, Harvester ants of the genus *Pogonomyrmex* have been shown to possess the most toxic insect venom recorded to date. Their venom has the highest known mammalian lethality of any arthropod—it is 5 times more toxic than the venom of the Oriental hornet, and 8 to 10 times more toxic than honeybee venom (Schmidt and Blum 1978a,b,c). Based on unpublished venom lethality data for *P. californicus* provided to me by Justin Schmidt, I determined that the doses employed in visionary contexts by California Indians were clearly within the range of pharmacological activity, representing approximately 35% of a lethal dose for an individual with a body weight of 100 lb. (45.5 kg). (See Groark [1996: 17–22] for a full discussion of venom toxicology and complete LD_{50} calculations).

Despite these compelling data, my argument was weakened by the uncertainty of the taxonomic identity of the ant. I was therefore extremely pleased to come across a key reference which resolved this ambiguity—a footnote written by John P. Harrington in his 1933 annotation of the *Relación Histórica,* Fray Gerónimo Boscana's classic Mission Period account of the Luiseño-Juaneño Indians of Southern California.

In this extensive note, Harrington clearly identifies the ant species in question as *Pogonomyrmex californicus* Buckley, and provides additional ethnographic details based on his own field research with surviving Luiseño-Juaneño individuals (the bulk of which was carried out intermittently between 1919 and 1933). Due to the rarity of these accounts, I will reproduce two variant versions of Boscana's original text as well as Harrington's annotation in full.

The "New" Accounts: Two Versions and an Annotation.—The author of these accounts, Gerónimo Boscana, was a Franciscan friar who lived among the predominantly Luiseño-Juaneño amalgamation of Indians at Mission San Juan Capistrano from May 1814 to January 1826. While there, he assiduously recorded all details of life in the pre-mission period with the help of three Luiseño-Juaneño men—two of whom were local chiefs, and the other a shaman. The resulting account, properly known as the *Relación Histórica,* was probably first compiled around 1822, and remains one of the earliest and most detailed descriptions of aboriginal life in native southern California.[2]

In several brief passages Boscana mentions the therapeutic use of large red ants by the local Indians when they were still "in their heathen state." The ants were applied externally in the treatment of unspecified "pains":

> . . . the most frequent and commonest practice, especially when in pain, was to whip the place where the pain was with nettles, and to put them right on the place of the pain, and likewise ants, and these latter especially on sores, and in this manner they cured themselves. [Harrington 1934: 49][3]

Boscana's most extensive description relates to the "ant ordeal" that formed the conclusion of the boys' initiation ceremony into the Chingichngish religion of the Gabrielino, Luiseño, and Juaneño Indians. All boys were subjected to this ordeal, which was performed during early adolescence in order to "harden" the youths, to provide luck and skill in hunting, and to ensure a long life. Robinson's 1846 translation of the *Relación Histórica* describes it in the following terms:

> The Indians were obliged to undergo still greater martyrdom to be called men, and to be admitted among the already initiated, for, after the ceremony of the **potense** [ritual initiatory branding with *Artemisia vulgaris* L.], they were whipped with nettles and covered with ants that they might become robust. This infliction was always performed in summer, during the months of July and August when the nettle was in its most fiery state. They gathered small bunches which they fastened together and the poor deluded Indian was chastised by inflicting blows with them upon his naked limbs until he was unable to walk. He was then carried to the nest of the nearest and most furious species of ants, and laid down among them, while some of his friends, with sticks, kept annoying the insects to make them still more violent. What torments did they not undergo! What pain! What hellish inflictions! Yet their faith gave them power to endure all without a murmur, and they remained as if dead. Having undergone these dreadful ordeals, they were considered as invulnerable, and believed that the arrows of their enemies could no longer harm them. [Robinson 1846; reproduced and annotated in Harrington 1933: 47]

A slightly different account of this event is found in J.P. Harrington's translation of the "Cessac manuscript" of the *Relación,* which reads as follows:

After this sacrifice [the **potense** ceremony], having been well lashed with nettles, they placed the patient on a nest of fierce ants, and another one was stirring them up to make them still fiercer, and since the patient had no more clothes on than what he brought from the belly of his mother, we can imagine in what condition he must have been, after having been thoroughly lashed with nettles, as a result of those fierce ants, which even cause fever. And so great was their patience, that they seemed like dead, without a groan or movement. These were the ones called cured. There were some who suffered through this torture several times over, and many went through it alone or with some companion, for they believed that when thus cured, they were from that time on more agile, and that the arrows of their enemies could not harm them." [Harrington 1934: 19]

In his annotation to the first of these two passages, Harrington elaborates on Boscana's basic account, including observations derived from his own ethnographic research among the Luiseño and Juaneño Indians:

The ants used in the ant stinging of the boys' ceremony were [called] **'aanat**, pl. **'antum**, *Pogonomyrmex californicus* Buckley, California Harvesting Ant. This is a good-sized red ant, the medicinal ant of these people. It is plentiful throughout the region, making large nests in the ground, and is not much of a climber, being unable to climb out of a bottle. When irritated, it stings with its abdomen, injecting formic acid, and bites with its mandibles at the same time. The ant dies after a time, his carcass still clinging to the skin of the person stung if the attachment is successful. The sting is claimed by the Indians to be as painful as a European bee sting, and hurts noticeably for fifteen minutes or more.[4] Doubtless when the Indians lay about the camps naked they were stung much more frequently than at present.

When these ants were used as medicine, to relieve rheumatism, internal pains, and the like, one method was to pick a number of the ants, one after another, and place them on the afflicted part, where they stung and were allowed to remain until they dropped off or got accidentally brushed off; Eustaquio [Lugo] once cured himself by putting a dozen or more of them on his bosom thus and leaving them on for hours. Another and evidently more modern method is to put a goodly number of the ants in a piece of cheesecloth and press it against the afflicted part, whereupon the ants sting through the cheesecloth. This cloth method is said to have been used in the boys' ceremony, but the earlier method was undoubtedly to seat and lay the named boy on a nest of these ants, or better to dig out the nest and seat and lay him in the teeming hole. There was not a part of the boy that was not stung and the ordeal was continued until the boy fainted or weakened, and all this without a murmur on the part of the boy. The ants were also administered as medicine given to sick people internally, being swallowed alive, but I have not found an informant who recalled that they were swallowed in the boys' ceremony . . . [Harrington 1933:164, note 128]

Later in the note, Harrington indicates that the Luiseño-Juaneño referred to this ritual as **'antush** (< **'aanat** "red ant")—literally, "an anting" (Harrington 1933: 164, note 128)!

Although this account was published in 1933, Harrington's notes indicate that he had been collecting data on ritual and initiatory ant ingestion intermittently since at least 1910 among the Kitanemuk, Interior Chumash, and various Yokutsan groups. Unfortunately, the descriptions contained in his manuscript fieldnotes contain only indigenous names for the ants—no common name or Latin binomial was provided. The above account is therefore of great importance, as it provides us with the first proper taxonomic identification of the species involved.

Harrington's Identification: Inference or Scientific Determination?—Despite the excitement of finding Harrington's note confirming my earlier speculative identification, a nagging question remained: How did Harrington arrive at this identification? Was it merely an inference derived from a general familiarity with the southern California environment, or was it based on properly determined voucher specimens?

We know that Harrington was an obsessively meticulous fieldworker. In addition to collecting careful data on indigenous nomenclature and usage, he was also a conscientious collector of botanical and zoological specimens (most of which, unfortunately, have not survived in an identifiable state). In an interesting twist to this story, Dr. Ted Shultz—a myrmecologist at the Smithsonian Institution—discovered a set of Harrington's vouchers in the Smithsonian's ant collection after reading a draft version of this paper.

Stored just 15 feet from his office door, Dr. Schultz found a specimen set consisting of six pins holding four workers, one male, and one female. The specimens are collectively identified as "*Pogonomyrmex californicus* (Buck) sp. det Roh.", and each bears an identical label reading: "J.P. Harrington, Collector." According to Schultz, the identification label indicates that the species determination was made by Sievert Allen Rohwer, a hymenopterist who worked at the Smithsonian's National Museum of Natural History from 1909 to 1951. From 1925 to 1937, most ant identifications were referred to Rohwer, suggesting that Harrington deposited the specimens during this period.

Although the specimen labels indicate that the ants were collected in Cottonia, Arizona (and not southern California), their discovery—when considered along with their probable date of deposit—strongly suggests that Harrington's 1933 identification was indeed based on properly documented and determined voucher specimens (or at the very least, that his published identification derived from voucher specimens collected after his Luiseño-Juaneño fieldwork, but before his 1933 Boscana annotation).

CONCLUSIONS

The combination of three lines of evidence—the physical and ecological description of the species, Harrington's precise 1933 entomological identification, as well as the discovery of his *Pogonomyrmex* voucher specimens—allows us to make a strong argument that *Pogonomyrmex californicus* was, in fact, the ant species used for visionary and medicinal purposes in native California. That such an identification can be confirmed more than a century after the species' last known use is eloquent testimony to the importance of voucher specimens in anthropological research, as well as to the importance of the collections that preserve such materials.

Despite the fact that our knowledge of red ant ingestion comes principally from a patchwork of early ethnohistoric accounts, these narratives—when considered in their entirety—provide us with a remarkably complete and well-attested ethnographic example of the use of an insect as an hallucinogenic agent. Although there have been scattered references to non-botanical hallucinogens, most prior claims have suffered from a lack of documentation—either inadequate ethnographic descriptions or a confusion surrounding the identity of the species in question.[5] With the publication of this report, the taxonomic identity of the red ant used in native California has been confirmed, and the descriptive record of its use is supplemented with several additional ethnographic accounts. This new taxonomic certainty places future toxicological investigations on a much firmer footing, adding a key piece to our reconstruction of "hallucinogenic" harvester ant use in native south-central California.

NOTES

[1] The Chingichngish religion is classified as one of two major religious subsystems that developed out of the *Datura*-based toloache cult of southern California (Kroeber 1925; Blackburn 1974). The Chingichngish religion appears to have originated among the Gabrielino during the proto-historic period, then spread to neighboring groups, possibly through indigenous evangelization (Bean and Vane 1978). Its doctrine centered around mythic accounts of a shaman-like culture hero named Chingichngish who taught the people a new set of beliefs, which appear to have become integrated with older local traditions. Unlike the toloache cult—an egalitarian religion based on vision seeking and the acquisition of "dream helpers" through the ceremonial ingestion of *Datura wrightii*—the Chingichngish religion was characterized by esoteric doctrine, highly formalized rituals and initiations, and the construction of ceremonial enclosures into which only the initiates were admitted (hence the frequent reference to the Chingichngish "Cult"). For more detailed information, see Johnson (1962) on the Gabrielino, and Sparkman (1908), DuBois (1908), and White (1963) on the Luiseño.

[2] There were at least three versions of Boscana's original account, only one of which is known to have survived. Based on the surviving copy, the original title appears to have been "*Relación histórica de la creencia, usos, costumbres, y extravagancias de los indios de esta Missión de San Juan Capistrano llamado la nación Acagchemem.*" The first full published version of Boscana's account was Robinson's (1846) English translation, retitled "Chinigchinich" and published as an appendix to the first-edition of his book *Life in California.* (Robinson chose the title "Chinigchinich" because of the prominence of this mythical figure in Boscana's account, and it has since become the *de facto* name for this document.) His translation appears to have relied upon two slightly different original manuscripts, both of which have been lost (however, stylistic peculiarities suggest that the Cessac manuscript described below was one of the source versions). In 1933, J.P. Harrington republished Robinson's translation, supplementing it with 132 pages of ethnographic annotations (as a result, this edition is often referred to as "Harrington's Chinigchinich.") Sometime during this period,

Harrington also succeeded in locating a "new lost original Boscana" manuscript in the Biblioteque Nationale in Paris. This version—now known as the "Cessac Manuscript"—is written in Boscana's own hand, providing us with the only surviving original manuscript. This version, which differs in some details from Robinson's translation, was published in English by Harrington (1934) and in the original Spanish by Reichlen and Reichlen (1971). For the sake of clarity, I will refer to all versions of the text as Boscana's *Relación Histórica,* but I cite them under the surname of the translator or editor in order to distinguish between the numerous variant editions.

[3] This practice appears to have been based on the principle of counter-irritation, and was widespread among southern and south-central Californian groups. Interestingly, the venom of the ant *Pseudomyrmex* has been shown to be an efficacious treatment for chronic rheumatoid arthritis (Schultz and Arnold 1978), and there is evidence that a component in honey-bee venom alleviates arthritic pain and associated symptoms (Dr. Roy Snelling, Los Angeles Museum of Natural History: personal communication 1995).

[4] *Pogonomyrmex* stings are exceedingly painful and long-lasting, and have been described as approximating "ripping muscles or tendons" or "turning a screw in the flesh around the sting site"—and all of this accompanied by a nervous, chilling sensation that sweeps upward from the site of the sting (Schmidt 1986).

[5] The only well-documented hallucinogen of non-botanical origin comes from the Sonoran Desert Toad (*Bufo alvarius* Girard), which accumulates prodigious quantities of 5-MeO-DMT in its venom glands (Weil and Davis 1994). A number of neotropical toads and frogs (mostly *Dendrobates, Phyllobates,* and *Phyllomedusa*) also secrete toxins which are used by the Amahuaca and Matsés Indians of the Peruvian Amazon in hunting magic, although visions are usually not reported (Carneiro 1970, Amato 1992). Interestingly, these intoxicating cutaneous alkaloids are not endogenously produced—rather, they are sequestered from dietary sources which include alkaloid-rich myrmicine ant species (Daly 1994). The only reference to an insect-based hallucinogen is an anecdotal report by Saint-Hilaire (1824) referring to a larval moth (*Myelobia smerintha* Huebner) used by the Malali Indians of Brazil to produce an opium-like, dream-filled sleep. While Britton (1984) has proposed that the gut or salivary glands of this larval moth be classified as a new hallucinogen, Ott (1993: 414) argues that, if confirmed, the moth is more accurately regarded as an "oneirogenic" or "dream-inducing" agent, and classifies all of these cases as "putative" hallucinogens.

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APPENDIX.—PLANT SPECIES AUTHORS AND VOUCHERS

Plant Species	Author	Voucher*	Matsigenka Name
Alibertia pilosa	Krause	GHS 918	*matsityanana*
Apuleia leiocarpa	(Vog.) Macbr.		*toaro*
Astrocaryum murumuru	Mart.		*tiroti*
Attalea butyracea	(Mutis ex L. f.) Wess. Boer		*shevo*
Attalea phalerata	Mart. ex Spreng.		*tsigaro*
Attalea tesmannii	Burret		*konta*
Bactris concinna	Mart.	GHS 424	*shianti*
Calliandra amazonica	Bentham	GHS 3345	*kovanti*
Cecropia membranacea	Trecul		*setiko / inkona*
Cecropia polystachya	Trecul		*tonko*
Cecropia sciadophylla	Mart.		*yaaro*
Cedrela odorata	L.		*santari / santaviri*
Cedrelinga cataeniformis	Ducke		*paria*
Ceiba pentandra	Gaertn.		*shirigari / pasaro*
Chrysochlamys cf. *ulei*	Engl.	MIT 351	*kachopitoki*
Clavija cf. *longifolia*	R. &P.		*piamentsishi / pakitsashi*
Cordia nodosa	Lam.	MIT 8	*matyagiroki*
Davilla nitida	(Vahl.) Kub.	GHS 1218	*tsororoapini*
Diplasia karatifolia	L.C. Rich	GHS 964	*imere*
Dipteryx polyphylla	Huber		*pageroroki*
Euterpe precatoria	Mart.		*tsireri*
Ficus insipida	Willd.		*potogo*
Ficus trigona	L.f.	GHS 1223	*tiiroki*
Gallesia integrifolia	(Spreng.) Harms		*shitiro*
Geonoma brongniartii	Mart.	GHS 890	*memerishi / metakishi*
Geonoma deversa	(Poit.) Kunth	GHS 1083	*tsikeroshi / choginashi*
Geonoma maxima	(Poit.) Kunth	GHS 1088	*tyonkinto / chigeroshi*
Guadua angustifolia	Kunth	GHS 1215	*manipi*
Guadua glomerata	Munro	GHS 4255, DWY 1910	*yaivero*
Guadua weberbaueri	Pilger	DWY 1703	*kapiro*
Guazuma crinita	Mart.	GHS 1346	*shinti*
Gynerium saccharoides	Bonpl.		*savoro*
Gynerium sagittatum	(Aubl.) Beauv.	GHS 1113	*chakopi*
Heliconia metallica	Pl. & Linden		*sagonto*
Hevea brasiliensis	Muell. Arg.		*koñori / konori*
Iriartea deltoidea	R. & P.		*kamona*
Macrocnemum roseum	(R. & P.) Wedd.	GHS 897	*niapashi*
Mauritia flexuosa	L.f.		*koshi / toturoki*
Ochroma lagopus	Sw.		*paroto*
Oenocarpus bataua	Mart.		*sega*
Phytelephas macrocarpa	R. & P.		*kompiro*
Renealmia breviscapa	P. & E.	GHS 695	*porenki*
Senna cf. *herzogii*	(Harms) I. & B.	GHS 1325	*shimashiri*
Socratea exorrhiza	(Mart.) H. Wendl.		*vakirintsi / kontiri*
Socratea salazarii	(Mart.) H. Wendl.		*kompapari / konkapari*
Swietenia macrophylla	King		*yopo*
Tessaria integrifolia	R. & P.		*impomeri*
Vernonia aff. *patens*	HBK	GHS 333	*puigoro*
Wettinia augusta	P. & E.		*kepito*

* Specimen collector codes: GHS—G.H. Shepard Jr.; DWY—D.W. Yu; MIT—M. Italiano.

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TABLE 13.—Correspondence between abiotically (Tables 1–4) and biotically-defined habitats (Tables 5–12). Widespread soil types S1–S3 (Table 3) have been omitted. Study sites: T.—Tayakome; Y.—Yomybato; M.—Mayapo/Huallana; C.—Camaná. (+) habitat occurs in vicinity; (*) does not occur in vicinity, but is known to occur at a distance.

	Topography/Hydrology																		
	Floodplain—Table 1										Uplands—Table 2								
Ref.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T10	T11	T12	T13	T14	T15	T16	T17	T18
Palms																			
Table 5																			
1			X	X	X	X		X	X										
2							X	X	X						X				
3			X	X	X	X		X											
4					X			X	X					X					
5				X								X							
6											X	X	X						
7													X	X					
8													X	X					
9													X	X		X			
10														X		X		X	
11			X		X	X	X	X	X			X							
12				X						X	X								
13				X				X		X	X	X							
14											X	X					X		
15						X	X	X						X	X				
16								X	X	X	X	X							
17													X	X					
18													X	X					
Bamboo																			
Table 6																			
19									X				X	X	X				
20													X	X	X	X		X	X
21			X																
22	X		X		X		X	X	X				X	X	X				X
23	X		X		X		X	X											
24													X	X	X				
Ferns & Herbs																			
Table 7																			
25								X	X			X				X	X	X	X
26			X					X	X							X	X	X	X
27												X	X	X					
28											X	X							
29	X	X																	
30	X	X																	
31			X	X				X											
32				X				X	X										
33																			X
34	X	X								X	X								
35									X	X	X	X							
36	X	X																	
Trees & Shrubs																			
Table 8																			
37			X					X											
38								X	X			X							

TABLE 13 (extended)

Disturbance Table 3								Soils Table 4							Study sites			
D1	D2	D3	D4	D5	D6	D7	D8	S4	S5	S6	S7	S8	S9	S10	T.	Y.	M.	C.
X															+	+	+	+
															+	+	+	+
X															+	+	+	+
															+	+		
X															+	+		
X												X			+	+	+	+
			X												+	+		
			X													+	+	+
																	+	+
															*	*	+	+
															+	+	+	+
X												X			+	+		
X												X					+	+
X									X			X			+	+	+	+
												X				+	+	+
X										X		X			+	+	+	+
															+			
																+	+	+
	X	X														+		
	X	X															+	+
X															+	+		
X	X	X			X										+	+	+	+
										X	X				+	+		
	X														+	+		
X													X		+	+	+	+
X													X	X	+	+	+	+
																+		
X												X			+	+	+	+
X								X							+	+	+	+
X					X			X							+	+	+	+
X															+	+	+	+
															+	+	+	+
				X											+	+	+	+
X												X			+	+	+	+
X												X			+	+	+	+
X								X							+	+	+	+
X															+	+		
		X				X	X								+	+		

TABLE 13 (continued)

	Topography/Hydrology																		
	Floodplain—Table 1										Uplands—Table 2								
Ref.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T10	T11	T12	T13	T14	T15	T16	T17	T18
39	X	X	X																
40	X	X	X																
41			X	X	X			X	X										
42													X						
43														X	X				
44														X	X				
45		X	X																
46			X	X				X	X										
47			X	X						X									
48													X						
49			X	X					X	X	X								
50			X																
Secondary Table 9																			
51	X	X	X							X	X					X			
52	X		X	X				X	X	X	X	X				X			
53	X		X	X				X	X		X	X		X					
54													X	X	X				X
55																			
56																			
57																			
Montaña Table 10																			
58																			X
59																			X
60																			X
61																			X
62																			X
63																			X
Vegetation Aspect Table 11																			
64													X	X	X				
65						X		X	X					X	X				
66						X							X		X				
67														X					
68																X			X
69																X			X
Fauna Table 12																			
F1			X													X			
F2			X	X				X	X			X							
F3													X						
F4											X	X	X						
F5													X		X				
F6											X	X							
F7													X						

TABLE 13 (extended, continued)

Disturbance Table 3								Soils Table 4							Study sites			
D1	D2	D3	D4	D5	D6	D7	D8	S4	S5	S6	S7	S8	S9	S10	T.	Y.	M.	C.
X													X			+		+
X															+	+	+	+
X							X								+	+	+	+
							X								+	+	+	+
							X										+	+
							X									+		+
X	X														+	+	+	+
X							X								+	+	+	+
X												X			+			
							X								+	+	+	+
X												X			+	+	+	+
X	X	X		X	X										+	+		
	X	X		X	X						X	X			+	+	+	+
X	X	X			X				X		X	X			+	+	+	+
X	X	X			X				X			X			+	+	+	+
	X	X			X	X									+	+	+	+
	X				X										+	+	+	+
				X	X	X	X								+	+	+	+
					X										+	+	+	+
																	*	*
																	*	*
																	*	*
																	*	*
														X			*	*
			X											X			*	*
							X								+	+		
							X								+	+	+	+
									X		X		X	X	+	+	+	+
	X								X		X					+	+	+
			X										X	X		*	*	*
			X										X	X			*	*
X	X									X	X				+	+	+	+
X	X									X	X	X			+	+	+	+
							X								+	+		+
X		X			X	X									+	+		
															+	+		
												X				+		
		X													+	+	+	+