LEARNING ECOLOGY: ETHNOBOTANY IN THE SIERRA TARAHUMARA, MEXICO

by

FELICE SEA WYNDHAM

(Under the Direction of Brent Berlin)

ABSTRACT

This dissertation investigates social-environmental factors contributing to differential ethnobotanical expertise among children in Rarámuri (Tarahumara) communities in Rejogochi, Chihuahua, Mexico. This research contributes to understanding processes of transmission and acquisition of environmental knowledge and to the development of an ecological, interactionist model of indigenous education.

The first section describes an ethnography of Rarámuri childhood, focusing on children's life stages, work, play, and family environments. Some aspects of Rarámuri epistemologies of learning are explored. Among these is the importance of relationship maintenance through ritual and thinking/behaving well. Structured interviews with Rarámuri children between the ages of 5 and 18 showed consensus as to the primary importance of mothers, fathers, aunts and uncles as teachers of plant knowledge. Secondarily, siblings, cousins and playmates were identified as teachers.

The second section presents a quantitative study of children's knowledge of a set of 40 culturally significant local plants in three use-categories: medicinal, edible, and other material utility. The social-environmental factors significant in predicting levels of plant

knowledge among children were, most notably, which primary school (of two local choices) children attended and, to a lesser extent, age of the child completing the interview. Plant-name and plant-use interviews suggest that many children today are not acquiring their parents' full repertoire of plant knowledge, but rather, exhibit knowledge of a restricted set of plants that are most salient culturally and ecologically.

The discussion of results highlights the importance of understanding how knowledge distribution patterns correspond to social relationships, social roles, and individual and family interest and experience. From the ethnographic and interview data presented in this dissertation, a Rarámuri model is suggested in which the richest and most extensive plant knowledge is held and practiced by select families, based on their interest and abilities. Children raised in these families are more likely to learn and practice this knowledge, regardless of other social-environmental factors such as schooling and bilingual ability. Implications for educational and conservation applications are discussed. The research described in this dissertation was completed in Rejogochi and surrounding areas over an 18-month period, from July 2001 to December 2002.

INDEX WORDS: Rarámuri, Tarahumara, ethnobotany, ethnoecology, cultural transmission, human ecosystems, human ecology, informal education, indigenous education, Sierra Tarahumara, Northern Mexico.

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Dedication

For my mother, Edith Wyndham

and

for my father, Charles Wyndham,

for introducing me to the Sierra.

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on many occasions, for which I am indebted. Sandy Brown's friendship, companionship on many hairy adventures, and unwavering positive enthusiasm made my stay in the Sierra so much more exciting. Bill Merrill and Janneli Miller shared their own field (and post-field) experiences with me in important ways.

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The mistakes and shortfalls are all mine.

Matéteraba!

Table of Contents

Chapter 1

Introduction

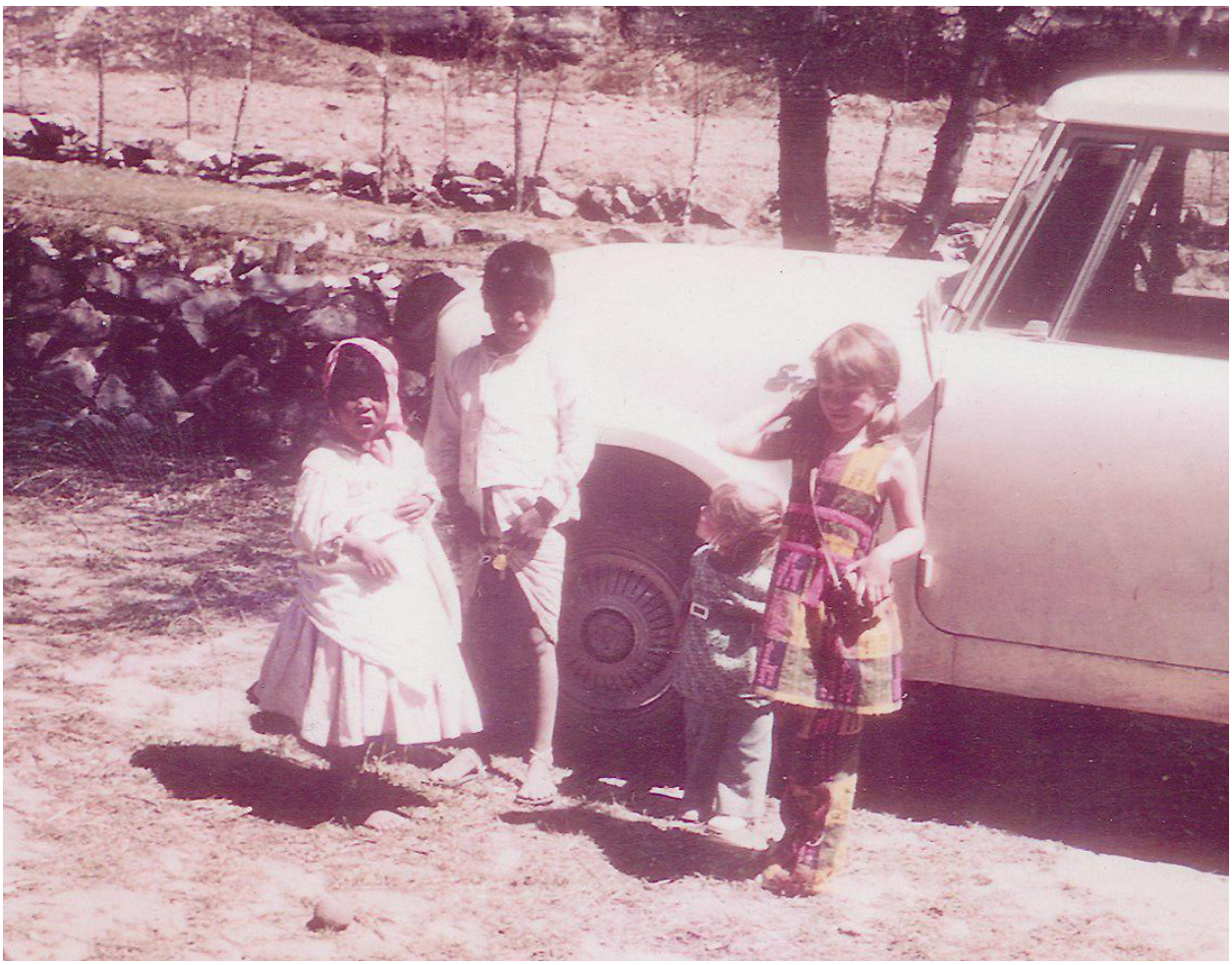

Figure 1.1. From left to right: two (future) research collaborators, the author and older sister in the spring of 1972, Basíhuare, Municipality of Guachochi.

How is it that we are born into this world knowing little or nothing, live short lives and die, and yet our cultures and societies maintain truly remarkable richnesses, depths and complexities that

transcend us as individuals? This question has been asked in one form or another since the dawn of anthropology and earlier, and it is one of the fundamental questions that motivates my own research.

It has been claimed that human evolution in the past millennia has worked primarily through cultural rather than biological adaptations (Boyd and Richerson 1985). If this is so, social systems of knowledge reproduction and their cognitive underpinnings are of utmost importance in understanding human relationship with the biophysical environment. In many areas of the world, traditional environmental knowledge systems have been shown to be key to maintaining and innovating sustainable human-ecological relationships. There has been interest in recent decades in documenting and conserving indigenous and local ecological knowledge. However, concurrent *in situ* conservation is necessary if knowledge and practice are to persist and change as dynamic, functioning systems. Local biological and cultural diversity are the foundations for conserving options for creative response to change. It is thus important to learn about the processes of knowledge acquisition and transmission for two reasons: 1) to enhance our basic understanding of human learning processes in different environments and 2) to work toward effective biological and cultural conservation efforts (Zent 1999). This dissertation addresses only one aspect of the many complex patterns of ecological knowledge acquisition—the learning of plant names, uses, and children's perceptions of plants in the Sierra Tarahumara of northern Mexico.

The first objective of this dissertation is to develop an ethnography of Rarámuri childhood, towards understanding Rarámuri

informal education systems. The second objective is to document plant knowledge variation among children and identify environmental factors that may explain this variation. To what extent are children learning an adult repertoire of local plant knowledge? What social and experiential factors might account for differential acquisition of knowledge among children?

An ultimate goal, begun with aspects of this dissertation, is to develop a model for understanding the role of cultural transmission and knowledge shifts during times of ecosystem transformation. Most Rarámuri communities of northern Mexico are currently engaged in socioeconomic and environmental changes on a scale to rival that at European contact. The great diversity of languages, cultural practices, knowledge systems, plants, animals and ecological niches of the Sierra Tarahumara region may (or may not) be threatened by some of the structural and informational changes that are occurring. Understanding the interrelations and interdependencies of the sociocultural and biophysical environments in this region is a critical first step to understanding short term and long term ecosystem transformations and affording informed choices to residents about their futures.

The research described here was completed in the Sierra Tarahumara of Mexico, in a Rarámuri community. This mountain range extends nearly 500 kilometers from the U.S. border through the northern Mexican states of Chihuahua, Sonora, Durango and Sinaloa. The central portions of this range are the ancestral territories of the Ódami (Tepehuan), O'óba (Pima), Warijío (Guarojío), and the Rarámuri (Tarahumara). The Sierra Tarahumara is a region of great

plant and animal diversity, in large part because its dramatic canyonlands create climates that range from desert and semitropical at the bottom of the canyons, through pinyon-juniper-madrone forests, to temperate pine-oak forests in the highlands. Each of these ecological niches harbors a wealth of endemic plants and animals that are only beginning to be described by western science. However, local peoples making a living here, as in other places of the world, have developed systematic and comprehensive relationships with these landscapes that include material values, spiritual relations, health-care strategies, and ecosystem management. These relationships are lived through language, belief systems and daily practice. The interrelationships and interdependencies of biological, cultural and linguistic variation, or biocultural diversity, are critical for sustaining ecosystem health and, in turn, human health and options for responding creatively to change (cf. Maffi 2001). Environmental or ecological knowledge is a critical link between humans and their environments, inasmuch as knowledge guides behavior. This study describes one portion of this biocultural diversity, plant knowledge, to examine the reciprocal link: how children's experiences growing up affect their repertoire of ecological and environmental knowledge.

Rarámuri communities have successfully lived in the relatively dry and difficult landscapes of the Sierra by supplementing corn and bean agriculture with wild plant and animal foods, fertilizing fields with moveable livestock corrals, swidden planting in oak groves, controlled burns and semi-domestication of several plant species. Another major social adaptation is dispersed settlement across the landscape. Because the land is marginally productive, farming

households are by necessity located in the narrow fertile valleys, sometimes kilometers away from their nearest neighbors. Social life and labor cooperation, then, requires much travel between homesteads, or *ranchos*, and usually happen around *tesgüinadas*, or corn-beer parties, in which the invitees work and drink with their hosts, sometimes for several days at a time. In this system, "rather than some households or communities lying on the periphery of a centrally based organization, the organization itself shifts" (Graham 1994:22). This has implications for how knowledge is shared and distributed in a community. For example, these patterns may in part be responsible for high levels of idiosyncrasy and variation—this has been documented for such phenomena as beliefs about human souls (Merrill 1988) and microregional dialects. In this research I found much variation, mostly by household, in pronunciation of plant names as well as reported uses for plants in Rejogochi and surrounding areas.

Traditional knowledge in global contexts

As the world becomes increasingly interconnected by way of interactions and exchanges of information and goods, the Sierra Tarahumara has developed through the extraction of natural resources (Weaver 1996), the sale of natural and cultural attractions through tourism, and a thriving trade in narcotics. These benefit Rarámuri communities only peripherally in the short term. They likely impose additional pressures in the long term due to erosion of arable land and decrease in rainfall from deforestation, as well as increasing competition for land from Mexicans, tourism developers and drug

growers. In the community where I work, each year many families are forced to leave the Sierra or even the state of Chihuahua to find work. Many of them have no land in their community, so return to visit only occasionally or to help their parents plant and harvest. As the means of making a living and the healthcare options change, so does the knowledge and know-how sought after and taught to youngsters. They have less incentive to learn traditional uses of wild plants. As one ***owirúame*** (healer) told me, "Only the poorest of the poor need to know about edible wild plants anymore."

Nonetheless, I have found that use of wild plants in Rarámuri communities is alive and widespread. Plant cures are commonly used for maladies such as colds, coughs, fright, minor soul loss, stomach mushrooms[1], diarrhea, and skin infections. Though there are no formal herbalists, most people know whom to go to for advice or help in finding and preparing medicinals, dyes, and edible wild plants. More serious illnesses, such as those caused by major soul loss and sorcery warrant going to specialist healers who use plants to cure as spiritual allies rather as than prescribed medicinals. Knowledge of the powerful plant-beings (such as ***híkuri*** (*Lophorora* sp. and others), ***bakánowa*** (*Scirpus* sp.), ***rikúhuri*** (*Datura* sp.)) is thought to be acquired differently from other knowledge—in individual dreaming lessons with the plant beings themselves, with God, or the Devil if one is a sorcerer, and in some cases apprenticeship to established healers or sorcerers. Several knowledgeable people have commented to

[1] A Rarámuri illness in which fungi are thought to grow inside people's stomachs, especially as a result of eating dirt, or sitting on dirt, thus primarily affecting children.

me that, though they perceive that plant knowledge is waning and children are not using and eating wild plants as they once did, they do not see this educational shift as a crisis, because if that know-how is needed again in the future, God will provide the information. Thus, they say, the most important relationship to maintain to ensure survival in the future is that between Rarámuri and ***Onorúame***, or God. My studies have focused on useful wild plants: medicinals, edibles and of material use, not including those that are considered to be powerful spirits.

This dissertation provides information on the link between biological environments and knowledge about them. Though research has been done on Rarámuri botanical knowledge, this is the first (along with a dissertation by Michael Casaus, in preparation) to investigate how plant knowledge is distributed across the social landscape.

A particular methodological[2] challenge lies in understanding the relationships among action at different hierarchical levels in the system: the individual, community, and larger social system. Early functionalist studies in structural anthropology were criticized for their failure to account for individual agency, social change, or conflict (Colomy 1992), but increasingly, researchers are reexamining theories of social system formation and evolution with the aim of understanding the role of dialectic tensions between structure and process, consensus and diversity, continuity and change (Barber 1992). Methodological insight is gained with the analytical reconciliation of different levels of social hierarchy; that is, the active cognitive

[2] Here, and throughout this dissertation, 'methodology' refers to principles of inquiry; 'techniques' refers to data collection procedures.

role of the individual in the constitution of community knowledge and vice versa. The role of learning and knowledge in the constitution and evolution of culture has also become an important theme in sociocultural and educational anthropology (Atran and Sperber 1991, Cavalli-Svorza and Feldman 1981, Hirschfeld and Gelman 1994, Ingold 1999, Kropotkin 1904, Lave and Wenger 1991, Mead 1964).

Some personal reasons for the research

I first traveled to Basíhuare as a small child, on what became almost-yearly Easter week family trips from Southern California to the Sierra Tarahumara until I was eight and we moved to South America (see Figure 1.1, picturing two of my main research consultants, myself and my older sister circa 1972). My father was an experimental filmmaker who made several 16mm films in Rarámuri lands in the 1960s and 1970s. Later, in the 1990s, several of my family members reconnected with the place, and my mother completed Master's research in Basíhuare (Wyndham 1996). Though my memories of the place as a child are few, they are vivid, and this early connection drew me back for the first time as an adult in 1996 for a short visit during which I was invited to "baptize" a two-year old Rarámuri girl, becoming her *madrina* (godmother) and *comadre* to her parents, who are my age. I have returned to visit this family almost every year since. On one early visit, my goddaughter's eight-year-old brother guided me up the main Basíhuare valley to a hot spring, and on the way he answered my questions about the plants and animals we saw. I was impressed by his extensive knowledge about which plants to eat and use as medicine, in

which season to harvest honey from wild hives and so on. I did not forget the boy's lessons, and I became interested in how children learn ecological knowledge in subsistence societies and the extent to which social and cultural transformations affect this body of knowledge. I decided to pursue the question through academic anthropology. Ironically enough, when I returned to the Sierra Tarahumara for full-time study I found that several of the items in my young guide's repertoire, such as how maguey (*Agave* spp.) sap can be drunk as milk, turned out to be (possibly) informational pranks on his part (maguey sap is caustic and causes extraordinarily itchy rashes[3]). My *compadres* and their children migrated to an urban Rarámuri settlement in Chihuahua City before I arrived in the Sierra to begin full-time dissertation research, but I continue to visit them often. I spoke with their eldest son, whose botanical elaborations had motivated my research, when he was about thirteen. I asked him how he felt about leaving the rural life in the mountains, and his defiant reply was, "I'm never going back to the Sierra—I'm going to be a mestizo." Thus, his comments and experiences still challenge me to understand the effects of changing lifeways and transformed environmental relationships among Rarámuri of the Sierra Tarahumara, in ever more complex ways.

[3] The botanical misunderstandings of this prank are also the subject of a well-known Rarámuri folk tale in which Eagle convinces Buzzard to wash his head in maguey sap so as to impress the beautiful Heron, but he ends up hideously bald due to the itchy caustic effect of the sap. My young guide may have been practicing a subtle form of social commentary by placing me, the nosy foreigner, in the role of Buzzard.

Overview

This research identifies some social-environmental factors contributing to differential ethnobotanical expertise among children in a Rarámuri community in Chihuahua, Mexico. The importance of these factors for learned ethnobotanical expertise are evaluated through naming and use knowledge elicitation interviews and situated in ethnographic context. Ultimately, the research contributes to the development of an ecological, interactionist model of indigenous education, linking individual learning and community processes of change.

Chapter Two provides a background on Rarámuri social, cultural, biological and physical environments. Chapter Three focuses on Rarámuri children's worlds, experiences and culture. Some of the material presented in Chapters Two and Three is adapted from Wyndham (2004). Chapter Four examines the culture of learning, knowledge acquisition and transmission in Rejogochi. Structured interviews with Rarámuri children between the ages of 5 and 18 show clear consensus about the importance of parents and other close kin as teachers of botanical knowledge and practice. Secondarily, siblings, cousins and playmates were identified as teachers. Chapter Five outlines a quantitative study of children's plant knowledge and identifies social environmental factors significant in predicting levels of plant knowledge. These were, most notably, which school (of two local choices) children attended and, to a lesser extent, age of the child completing the interview. Plant-name and plant-use elicitation interviews suggest that many children today are not acquiring their

parents' full repertoire of plant knowledge, but rather, exhibit knowledge of a restricted set of plants that are most salient culturally and ecologically. Since children in Rarámuri society have a great deal of choice as to their education, this is in part due to their own decisions about whether and where to go to school.

Chapter Six places this case study in a larger theoretical frame and concludes with ideas for future research in this area. Because each chapter includes different pieces of the whole research, each chapter discusses the research methodology and techniques used for that portion.

The research described in this dissertation was completed in Rejogochi and surrounding areas over an 18-month period, from July 2001 to December 2002. The first six months were spent in participant observation, Rarámuri language study, and plant collection. The following year continued these activities, with the addition of structured interview elicitations, informal interviewing, work on several small projects, teaching in two local schools and the supervision of the formation and building of a new artisan's cooperative. Because I traveled back and forth to the United States on several occasions the total time committed to dissertation research in the Sierra Tarahumara was 13-14 months. Permission to live in *ejido* Basíhuare and complete this research was sought from the local Rarámuri governing body in August 2001 and granted at a Basíhuare Sunday community gathering in that month after a presentation on the research objectives and methods and community discussion. The research was approved by the University of Georgia human subjects/ IRB office on July 12, 2001 and re-approved for an extra six months in July 2002.

Notes on language and orthography

Over the 18 months I lived in Rejogochi my Rarámuri language skills improved substantially, and by the end I was able to understand the gist of most conversations and hold simple conversations myself. My language education did not proceed as quickly as I had hoped, in large part because today most Rarámuri in Rejogochi and surrounds speak and understand Spanish. Thus, especially in the beginning, most of my informal conversations took place in Spanish, a language I am completely fluent in, for convenience's sake. However, to be corrected by Rejogochi residents I regularly tried to say as much as I could in Rarámuri, and I am grateful for the patience of the many folks who taught me vocabulary and grammar in this way. My interactions with women were more likely to be dominated by Rarámuri language, because on the whole women, especially older women, are less conversant in Spanish. Nevertheless, during *tesgüinadas* I was often surprised at individuals' Spanish fluency and realized that, for many, shyness or *verguenza* inhibits them or is used as a form of protection from and control over whom they communicate with. Direct quotations and recorded discourse are reproduced here in the language it was spoken in and translated into English. I report what people said to me with single quotation marks if I paraphrased or gist-translated their remarks in my field notes at the time or as remembered later; if I use double quotation marks or indented text, this means that the comment or phrase was recorded verbatim or close to verbatim and translated by me or one of my collaborators. For ease of differentiation, words from

the Rarámuri language are in bold Italics and words from Spanish are in Italics.

Rarámuri phonemes are: (voiceless stops and affricate) ***p***, ***t***, ***č*** (***č***, ***c***), ***k***, ***'***; (voiced stops) ***b***, ***g***; (voiceless fricatives) ***s*** (***s***, ***š***), ***h***; (nasals) ***m***, ***n***; (liquids) ***r*** (flap), ***l*** (***l***, ***l.***); (semi-vowels) ***w***, ***y***; (vowels) ***i***, ***e***, ***a***, ***o***, ***u***; (stress) ***V́*** (Pennington 1983:276). Spelling of Rarámuri words follows Spanish orthography where possible, with the following exceptions: "k" is used instead of "g" to express the Rarámuri sound which is somewhere in between the two, as in ***kimá*** (blanket); "w" is used instead of "ua" or "ui" as in ***ba'wí*** (water). "S" in Rejogochi is sometimes pronounced with a slight "sh" as in ***simí*** (go); there are two kinds of "r" in Rarámuri, one that resembles the Spanish "r" (slightly rolled) and one that is close to "l"—the pronunciation of Rarámuri is often ***Ralámuli***. For the most part here I use 'r' instead of 'l,' following other orthographers in the area. Personal names have been changed to protect confidentiality.

Benefits to the community

Documentation of local botanical and ecological knowledge can have long-term benefits for the research communities. Land claims, conservation projects, usufruct rights on public lands, and intellectual property claims are strengthened by thorough ethnobotanical documentation. This dissertation contributes in a small way to these objectives. The Rarámuri of the Rejogochi area are experiencing increased pressures as they negotiate their cultural and biological survival *vis a vis* deforestation, land and water

degradation, encroaching mestizo and other settlers and national development plans. Documentation of plant use and social changes, such as knowledge shifts between generations, could potentially provide negotiating points in dealing with these pressures toward a goal of political and educational self-determination and control of natural resources. Additionally, biocultural conservation efforts increasingly recognize the importance of understanding current and long-term interactions of human systems and local organisms and landscapes, particularly in terms of indigenous or traditional ecological knowledge (Posey 1999, Slikkerveer 1999, Toledo 1997, Zent 1999).

While in the Sierra Tarahumara I collaborated with two schools: Basíhuare secondary and Rejogochi primary. I taught several classes and initiated collaboration with the Rarámuri language and culture teacher and his students on edible wild plants documentation and traditional foods preparation. The exchange included training in ethnobotanical collections, documentation and curation, and interviewing techniques. Additionally, while living in Rejogochi I served as a consultant organizer for several individuals interested in starting an artisans' cooperative to sell their locally made goods in a wider market.

Chapter 2

Rarámuri Sociocultural and Biophysical Environments

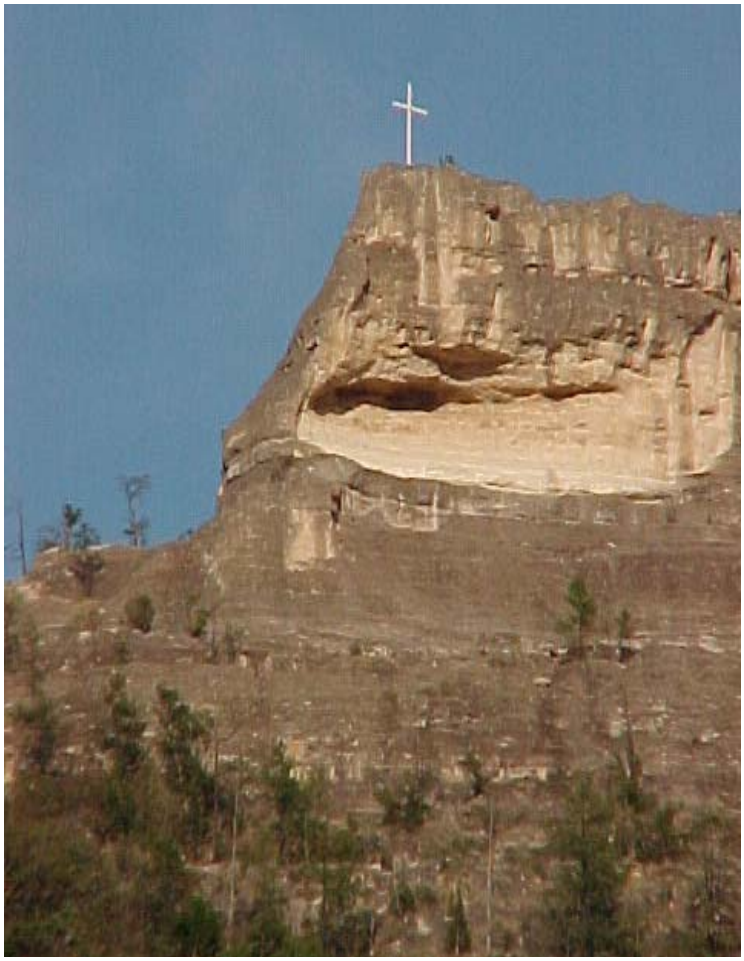

Figure 2.1. This wooden cross is maintained by the residents of the extensive *rancho* below, who use it to calculate their planting calendar. It is placed so that, from the perspective of a viewer at the home site, the sun passes directly behind the cross in late spring when it is time to sow maize.

The historical homelands of the Rarámuri are the mountain ranges of the Sierra Madres, western Chihuahua, northern Mexico, covering approximately thirty-five thousand square kilometers on either side of

the continental divide (Merrill, 1988:17). Today, in addition to highland (*sierra*) and lowland (*barranca*) communities, a significant number of people live in urban settlements in Chihuahua City and Juárez, Chihuahua, and are found in every Mexican state. The work discussed in this dissertation was carried out in the *ejido* of Basíhuare, in the municipality of Guachochi, Chihuahua (Figure 2.2). I lived and worked primarily in Rejogochi, the site of largest Rarámuri population in the *ejido*, and surrounding communities. Rejogochi (or at least the lower portion) is also referred to as ***Ipó*** (valley/flatland) by its inhabitants, for it consists of a wide, long valley contributing to the Urique river watershed, at about 6500 feet (2000m) above sea level. The communities in *ejido* Basíhuare as a whole are not centrally settled, but rather consist of single- or multi-household *ranchos* dispersed along valleys, united by ties of kinship, *ejido* government, and labor trade networks. The settlement patterns at Rejogochi are somewhat uncharacteristic of Rarámuri *ranchos*, in that they are closer together and of denser population, because the valley is unusually wide and long[1]. The majority of rural Rarámuri families probably live in more isolation than in Rejogochi. For my purposes, to study the Rarámuri language and complete research that entailed many interviews with children and adults, it was ideal. I rented a two-room adobe house from a Rarámuri family, near the primary school in the widest part of the valley, near a perennial stream.

[1] The resident population in Rejogochi has roughly doubled in the last thirty years and is probably more than can be supported by produce from the land.

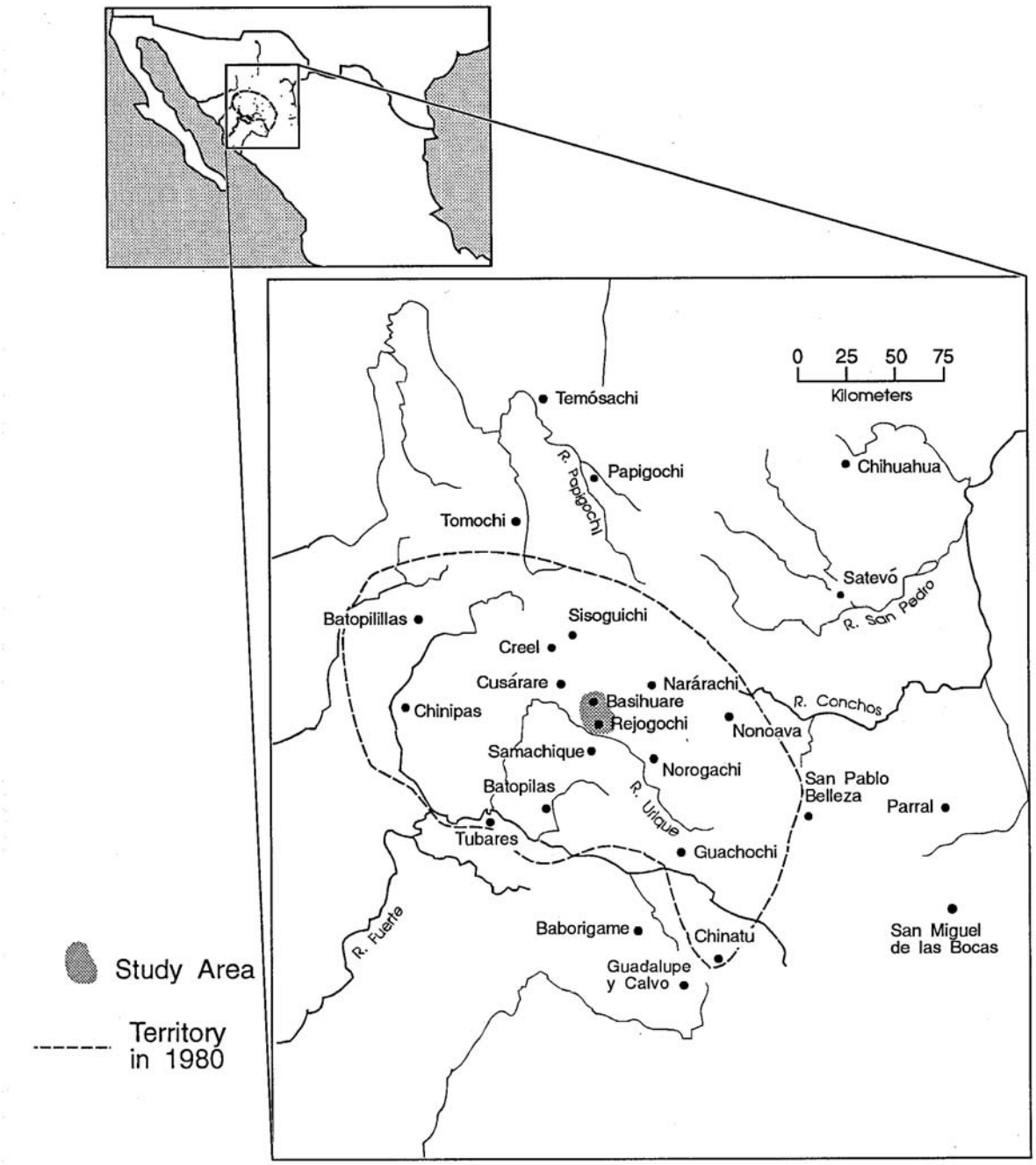

Figure 2.2. Study area of Basíhuare and Rejogochi and the approximate (1980) Rarámuri territories in the Sierra Tarahumara, Mexico. From Graham (1994:3), reproduced with permission from the publishers.

Brief history of the region

During the colonial period Rarámuri occupied the western and eastern canyons of the Sierra Madre Occidental and the fertile foothills to the east and south of the mountains, the present-day area of Cuauhtemoc and Chihuahua City (Deeds 1998:12). Parts of the area that today comprises the unofficial territories of the Rarámuri (see Figure 2.2) were regions of refuge during the colonial period, because of their relative inaccessibility and the marginal productivity of their lands (Crumrine and Weigand 1987, Deeds 1998:12). Rarámuri moved into the rugged Sierra Tarahumara to avoid infectious diseases, being pressed to service in the Spanish mines, and conflict with their Ódami (Tepehuan) neighbors to the south. It was not until 1639 that Jesuits founded their first missions within Rarámuri territories, and the 1670s that they moved into central Rarámuri lands in the high country. The last unified rebellions of the Tarahumara took place in the late 1600s, "within a generation or two of the first serious demographic invasions by Spaniards and were responses to the cataclysm of labor demands, population decline, *congregaciones*, and psychological pressures that ensued" (Deeds 1998:23). Smaller rebellions, uprisings, and resistances occurred throughout the historical record.

The Jesuits were expelled from Mexico in 1767; in the Sierra Tarahumara their missions were distributed among secular clerics and Franciscans, but the former were largely unable to maintain a presence in the area, and those missions declined (Merrill n.d.:6).

During the 1800s, the Sierra Tarahumara was explored by outsiders who reported their experiences and ethnographic observations in

popular accounts (Lumholtz 1902, Schwatka 1893). The Catholic missions reestablished themselves in the Sierra, and Mexican developers took serious interest in exploiting the natural resources of the region, primarily in the form of cattle ranching, mining, and forestry (Merrill n.d.). The Chihuahua-Pacific railroad was built, allowing egress for vast wealths in lumber and minerals. Tensions between Rarámuri and outsiders resulted in various local uprisings, but did not stem the flow of mestizo immigration into the Sierra Tarahumara and the displacement of Rarámuri families from choice lands. After the Mexican revolution, the Jesuits were able to build up their missions in earnest, establishing boarding schools and day schools as well as production workshops for Rarámuri to learn crafts and earn wages (Merrill n.d.:13). In the 1920s the government established schools in the Sierra Tarahumara but these were largely unsuccessful in recruiting Rarámuri students. By the 1950s there were 126 primary schools throughout the Sierra Tarahumara. The government schools operated with an explicit goal of cultural and social assimilation through immersion, and most instruction was in the Spanish language. From the 1970s onward, government organizations, notably the *Instituto Nacional Indigenista, INI*, changed their ideological stance and renounced their commitment to assimilation as a primary goal, instead focusing on the preservation and defense of Rarámuri cultural autonomy (Sariego 1998). Recent years have seen a strong involvement on the part of Rarámuri educators toward this goal.

Until the early 1900s the Basíhuare/Rejogochi area was relatively isolated from outsider contacts. At this time the *pueblo* of Basíhuare became an important stop for mule-trains, as it lies along the *camino*

real that links low-country gold and silver mining towns such as Batopilas with Creel and Chihuahua City. The Basíhuare mule station (called *Basicuách* at that time, according to a plaque on the building) was heavily fortified with stone walls several feet thick to protect valuables stored there. Interaction and trade with outsiders increased with the construction of a road through this region in the mid 20th century and, again most recently, when this road was widened and paved in the mid 1990s (see Merrill 1988:30-52 for the most comprehensive published history of the Basíhuare region).

Population

The Rarámuri are the largest ethnic group in Northern Mexico and the second largest in North America (after the Diné Navajo). In the year 2000 the Mexican national census recorded more than 86,000 Rarámuri language speakers in Chihuahua and 6,000 Rarámuri speakers elsewhere, mostly in the states of Durango, Sinaloa and Sonora.

Approximately 84% of residents in *ejido* Basíhuare self-identify as Rarámuri and the rest are of *mestizo* or European-indigenous Mexican descent. Males and females are equally represented in this area. Figure 2.3 depicts male and female populations in the two largest Rarámuri communities in the *ejido*, Rejogochi and Umirá. This pyramid graph shows a majority of children—over half the population is under age 20. It is likely that these younger generations are seeing more

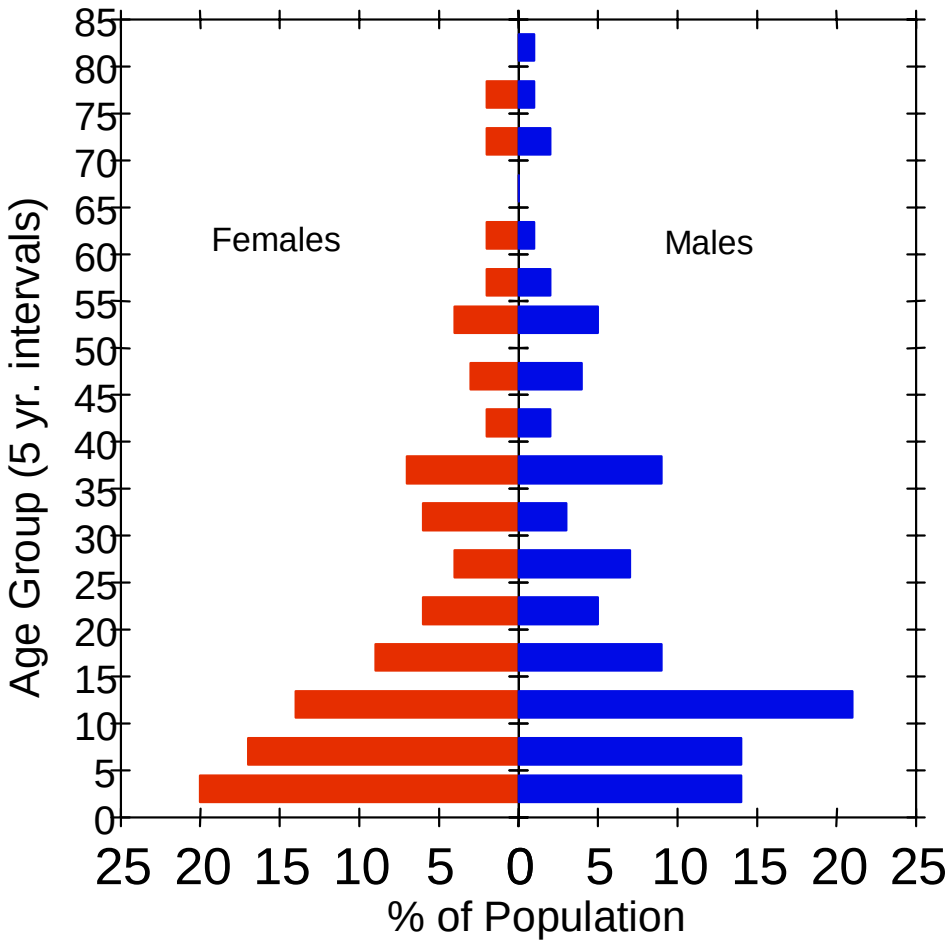

Figure 2.3. Population of males and females in Rejogochi and Umirá, 2002.

rapid shifts in economy and ecology than many of their forebears, and they will be the ones to make the decisions about how to respond politically and socially, as individuals and as communities. The marked drops in population at around ages 30-34 and 40-44 may be due to seasonal out-migration, though this does not explain why there are relatively more people in the range 34-40. A more detailed understanding of the composition of the three most populous communities in *ejido* Basíhuare can be had by examining Table 2.1, which summarizes demographic data obtained from the 2002 *IMSS* (*Instituto Mexicano del Seguro Social* or Mexican Institute of Social Security) census, conducted by the clinic staff in Basíhuare. The community of pueblo Basíhuare (note that the *ejido* is named after this pueblo) is home to a majority of all the mestizo inhabitants of the *ejido* and dominated politically by one extended family, descendants of the first mule-station *veladores*, or caretakers.

Social and cultural overview

Here I present an overview of some of the social and cultural dynamics of Rarámuri life. I focus on the aspects that are most relevant to the goals of this study. The Rarámuri population as a whole is numbered between 80,000 and 90,000, in territory that is geologically and biologically diverse and, until recently, difficult to traverse. As a result, Rarámuri communities have diverse histories, dialects, religious practices, and lifestyles, making generalizations about their culture as a whole difficult. The information here pertains generally to high Sierra Tarahumara and specifically to the

Table 2.1. Summaries of demographic statistics for the communities of Rejogochi, Umirá and Basíhuare, 2002. Source: compiled from the 2002 population census (*IMSS Estado de Chihuahua Equipo de Salud Basíhuare*).

	Rejogochi	***Umirá***	***Basíhuare***	**Totals**	**% of Pop'n**
Number of households	53	19	44	**116**	
Number of residents	259	104	139	**502**	
Women and girls	131	50	72	**253**	50.40%
Men and boys	128	54	67	**249**	49.60%
Ethnicity					
Self-identify as indigenous	259	91	70	**420**	83.67%
Self-identify as non-indigenous	0	13	69	**82**	16.33%
Language					
Bilingual (Rarámuri & Spanish)	112	68	59	**239**	47.61%
Monolingual (Rarámuri)	147	27	5	**179**	35.66%
Monolingual (Spanish)	0	9	75	**84**	16.73%
Marital status					
Unmarried (12 years & older)	41	30	29	**100**	19.92%
Married (12 years & older)	101	36	64	**201**	40.04%
Formal education (highest level)					
Read & write	22	4	18	**44**	8.76%
Primary school (some or completed)	55	42	35	**132**	26.29%
Secondary school (some or completed)	10	7	21	**38**	7.57%
Higher (*preparatoria*/ professional)	0	0	23	**23**	4.58%
Subsistence/ occupation					
Agriculturalist households	49	16	11	**76**	65.52%
Professionals/ business owners/ other	4	3	33	**40**	34.48%
Individuals emigrate 3+ times/yr.	34	7	46	**87**	17.33%
Households w/ Social Security and/or *Familia Progresa*	0	1	42	**43**	37.07%

pagótame (‘baptized’ or Christian) communities in the Basíhuare area, in the municipality of Guachochi.

The Rarámuri of the Sierra Tarahumara are predominantly subsistence agriculturalists, though many now work as teachers, health workers, and laborers in agriculture and other industries. Rural Rarámuri’s main field crops are corn, beans, and squash; other foods include potatoes, cabbage, apples and peaches, and a great variety of greens and wild foods. Goats, sheep, and cattle are kept as capital investments and for the manure’s value as fertilizer though they are eaten on ritual occasions. Most Rarámuri live in *ranchos* or homesteads dispersed across mountainous landscapes, but are affiliated with *ejidos*, political entities that include mestizos (Euro-Mexicans), usually based in a *pueblo*, or town, with a church, school and other missionary or government facilities. Local governance is by elected Rarámuri officials, who are responsible for organizing community feast days, advising on correct behavior, disciplining wrongdoers, and mediating with outsiders. Additionally, *ejido* officials are elected by all *ejido* members, in the Basíhuare region, primarily to manage the extraction and sale of lumber resources. Elected authorities are almost always men, and it is almost exclusively men who vote. This may be due to Spanish/ Mexican influence, as the positions of governance in Christianized communities are modeled after early colonial political organization, consisting of a hierarchy of governor, lieutenant, general, captain, mayor, and soldiers. In some communities with more contact with mainstream Mexico, women are elected to leadership positions. Historically, Rarámuri women have limited their interaction with non-Rarámuri probably because of threats of sexual

violence, thus restricting their political influence to the private sphere, where their opinions and ideas are respected as equal to those of men. Widows and other single women do exercise their voting rights to receive the benefits due to *ejido* community members. Rarámuri men are increasingly involved in indigenous rights movements in Mexico as representatives from particular communities; there is as yet no pan-Rarámuri political representation structure in place. Many Rarámuri families move seasonally between summer and winter residences, though less so than in the past, and also between multiple *ranchos* to tend their various fields. Thus the Rarámuri have been described as transhumant or residentially mobile agriculturalists (Graham 1994:18, Hard and Merrill 1992).

The basic social unit among Rarámuri is the nuclear family, in which married partners play equally important and highly complimentary roles in subsistence, social relations, and control of resources. Rarámuri families are linked in important relations of reciprocal obligations that constitute their larger social environment. Increasingly, Rarámuri rely on seasonal work outside of their communities for supplemental cash income and thus travel to and from Mexican communities during the year. Logging enterprises throughout the Sierra Rarámuri are often operated jointly by Rarámuri and mestizo *ejido* members, and most Rarámuri communities have a long history of interaction with Mexicans through local trade, missions, land disputes, and schooling.

Religion, belief systems, and spiritual practice

Most Rarámuri today identify as ***pagótame*** or Christian-baptized people. A minority belong to ***simaróni*** (from the Spanish *cimarrón*, wild/feral) or 'gentile'/ unbaptized communities who successfully resisted or retreated from missionizing by Christians, though both groups show considerable borrowing of Christian concepts in religious practice (Kennedy 1961, Kennedy 1963:621, Kennedy 1970, Levi 1993). The ***pagótame*** are much more numerous, and because all the communities I worked in identified as ***pagótame,*** I focus mainly on them here.

The processes of religious transformation, syncretization, resistance and choice are still central in Rarámuri communities. In Rejogochi I found variation in individuals' stances on Catholic practices. A few young men were active and vocal in their resistance to what they saw as a trend toward more conformity with the Catholic ritual calendar instead of local seasonal 'indigenous' religious observance (for example, more and more families are holding their death *fiestas* on All Saint's and All Soul's Days instead of three or four months after the death). These men and their wives boycotted pueblo *fiestas* they considered to be becoming too Catholic, such as *Día de San Juan* (24th June, the date associated with the onset of summer rains), recruiting others to observe this important festival with 'indigenous' ***tutubúri*** dances and curing ceremonies on the *rancho* instead, as has been the norm for decades past. This carried overtones of dissatisfaction with the current governor's leadership as well.

I also observed quiet resistance to ringing of the church bell before Mass on Sundays. While I lived in Rejogochi there was a zealous foreigner, a self-described 'benefactor,' who procured funds to

renovate the original mission church in pueblo Basíhuare. When this was done, he took it upon himself to 'organize' Sunday proceedings, including assigning a bell-ringer to ring the church bell; invariably, the bell-ringer failed to show up or 'forgot' to ring the bell before Mass, incurring the wrath and frustration of this man, who vocally upbraided the whole line of Rarámuri authorities over it. This was an outrageously rude procedure by Rarámuri standards of conduct, though typical of poor-thinking ***chabóchis*** (non-Rarámuri/non-indigenous). The next Sunday, still no one rang the bell so the foreigner climbed the tower himself, compelling the bell-ringer to do 'his job'. Deeds (1998:14) remarks that Rarámuri of the 17th century "associated the ringing of church bells with plagues"; I never heard any overt comment suggesting a dislike of church bells, but observed first-hand the effectiveness of passive resistance to outsider meddling.

A significant portion of Rarámuri communities today, including in *ejido* Basíhuare, identify as evangelical Protestants, or *hermanos* (Spanish: brothers). In Rejogochi large numbers converted about 6 or 8 years ago, when missionaries offered incentives such as free used clothing, but most dropped out once they experienced the restrictions on drinking, dancing, *tesgüinadas,* and other Rarámuri observances. Additionally, because secular governance is thoroughly intertwined with religious observance (e.g., public sermons, trials, and marriages all take place on Sundays or religious *fiestas*), conversion to Protestantism effectively restricts participation in local politics and decision making, meaning that those who stayed 'with the *hermanos*' tend to be whole valley communities or extended families who became somewhat isolated from general social networks.

Public religious practice is dominated by men, especially when it is associated with political leadership. Political leaders are expected to give spiritual and moral advice and deliver 'sermons' (***nawésare***) on Sundays, religious holidays, and any public gathering in addition to their political and judicial roles. On Catholic feast days, the ritual offices are performed by the elected male authorities, with the exception of a female ritual official—a *tenanche* or ***moréami*** (Kennedy and López 1981). Women play an essential though less visible role in the preparation and distribution of special feast foods and *tesgüino* (corn beer). Ritualized, costumed dance is performed mostly by men, though women do dance, especially the ***yúmari***, *pascol,* and ***nutuá*** (offerings dance). In general, women play a more central role in 'less-Christian' religious events that take place on local ranches rather than the church, such as death fiestas and curing ceremonies. Often, a healer's wife plays an active supporting role in his healing practice, which is essentially religious in nature and may specialize in particular illnesses or treatment of babies and women. ***Onorúame***, or 'he who is father,' is a male Creator deity now modeled after the Christian God, but also associated with the sun. The moon (***mechá***) is considered to be female, identified also as ***eyerúame*** or 'she who is mother,' an entity who loves and cares for her Rarámuri children at night (cf. Levi, 1993:290). In ***pagótame*** Rarámuri worship, the moon has likely been assimilated into the identity of the Virgin Mary and as such became part of a spiritual hierarchy, sometimes identified as 'God's wife' and ranked below God and Jesus in power. According to one consultant, in the past the sun and moon may have been considered the male and female aspects of one spiritual entity,

rather than two beings dually opposed. The Devil (***riáblo***) is male, and sometimes is conceived of as having a wife. Other minor spirit beings that inhabit or inhabited the landscape, such as diminutive water people, cliff-walkers, and giants, are conceptualized as living in similar ways to Rarámuri. Most Rarámuri human origin myths identify the first humans as a pair, man and woman or boy and girl, who were created at the same time and became the parents of all Rarámuri.

Sweat/smoke baths or ***molobákiami*** were held on several occasions during my stay in Rejogochi to ask God for more *ánimo* (energy/vitality/heart/soul-strength) to keep going for more years. Men, women, and children participate separately. ***Ahorí*** (*Juniperus* sp.) branches are spread over hot coals in a hole dug in the dirt, with blankets over the top to contain the steam and heat. Liquid cures of ***wasía*** (*Ligusticum porteri*) and root of ***waposí*** (*Erythrina* sp.) are applied to the people and animals attending.

The matrix of Rarámuri social rhythms is recognition of others, of the invisible ties that bind people together (see Cardenal 1993:226; Salmón 2000), of the ties that bind people to the earth and other living things. Children's ties to the otherworld are severed periodically, as they form invisible ties in this world as they grow older. At death, the threads connecting the dead person to living people and to spirit beings (e.g. ***híkuri***, peyote) and other beings must be severed ceremonially. The newly dead are encouraged to make new social ties in the world of the deceased (Merrill 1988:186). The essence of living is being enmeshed in these ties to other people. These are affirmed through gift exchange, *tesgüino* exchange, labor exchange, cooperation and collaboration. Rarámuri inherited ties

consist of nuclear family, extended family, general community. Ascribed and chosen ties are made while growing up, including gender, *compadrazgo*, political positions, plant spirits, and relations with deities and other powerful beings.

Particular salient among Rarámuri spirituality is a sacred quality to *relationships*, between individuals, between individuals and ***Onorúame*** or other spirit beings, and also with crops and animals. This is expressed most clearly during ***noríruachi*** or Easter Week, during which one's actions take on special significances. It is an extremely sensitive time, ecologically and socially. If ***Onorúame*** is not pleased the world might not be renewed; rain will not fall, and corn will not grow. Merrill (1981:186) reports that during Easter Week in Basíhuare of the late 1970s people were supposed to refrain from hitting anyone or cutting anything, because it would be as though they were hitting or cutting ***Onorúame***. I found this belief to be held during my field stay in the same area twenty years later. God is spoken of as being immanent in every object and being at this time: therefore, every action a person makes expresses a direct relationship to God. A man in his thirties explained to me that his mother had told him as a boy not to throw stones, not to hit anybody, even animals, and not to eat in the days preceding Easter Sunday. Though he remarked that he thought that these ideas were less respected today than in the past, he noted that at least one of the Rarámuri teachers in Rejogochi had instructed her students in these beliefs, because his pre-schooler came home asking him about it. At Easter, designated 'dreamers' report what God instructed them to say about proper relations with the land. In the spring of 2002 they told the populace to ensure a good harvest by pre-

soaking seed corn instead of sowing it dry and to plant it on a specific date.

Gender and gender roles

The two prevalently recognized gender categories among Rarámuri are female (***bamirá***) and male (***owíra***). These terms also apply to nonhuman animals. Homosexuality in women and men (***nawíki***, ***rinéki,*** or ***kamú***) is also recognized, though relatively uncommon. Gender is biologically determined but not restricted; in other words people are born as females or males, but may undergo gender changes during their lifetimes. Often, 'homosexuality' is more akin to 'transexuality,' conceived of as a monthly switching back and forth between female identity and male identity (Kennedy 1996:232). One way for this to happen in the Rejogochi area is for a person to visit a certain mountain where an ancient rock shelter home still contains household tools. If the person approaches without the proper knowledge and propitiation (i.e., they are not ***owirúames*** or healers), and handles ancient household items associated with the opposite sex, they will, in theory, from then on experience periodic shifting of their gender.

Women are generally thought to have four main souls and men three, and these are the symbolic numbers associated with each gender (for a thorough discussion of Rarámuri souls see Merrill 1988). This is reflected in almost every ceremony and ritual by women performing in sets of four and men in sets of three (for example, four death fiestas are required for deceased women and three for men). Women are thought of as intrinsically strong, and at the same time as having less 'strength' than men have, because their souls go out wandering

more than men's do. One of a woman's souls is almost always out wandering, exploring, leaving the other three 'at home' taking care of the body. On return the wandering soul switches off caretaking duties so another soul can go out. Men's souls wander less, which is why they have more 'strength' to run long distances, for example. Women also use up extra strength while carrying babies and giving birth; one informant speculated that their additional soul may help in the conception of babies.

Female and male gender categories are marked culturally by dress, hairstyle, and accepted behavior. From a young age (six months to one year old) girls and boys are dressed to resemble their elders: girls are usually dressed in hand-sewn tiered cotton skirts and blouses, often with a head kerchief and small *rebozo* or shawl; boys are dressed in store-bought shirts and trousers or, more rarely now, in ***sitagóra***, the traditional men's muslin loincloth. Women now generally wear their hair long, tied at the back, with a head kerchief, though older women adhere to earlier styles worn by both genders of a short bob below the ear with a long cloth headband tied and hanging down the back. Similarly, most young men today have adopted hairstyles like those of mainstream north Mexico: short all around, topped with a cowboy hat. Older men and some young men wear longer hair, bobbed to mid-neck or shoulders, with a bandanna or headband. Though a cultural ideal of physical attractiveness is not rigidly defined for either sex, being well-dressed and well-kempt is valued in a mate as are individual beauties and, for both men and women, ability and willingness to work hard, intelligence, and good humor.

Though men's and women's roles in society are somewhat separated, they are highly complementary and recognized as interdependent. Education of youngsters is considered to be equally the responsibility of elder men and women. The basic social unit in Rarámuri communities is the nuclear family and the bond between husband and wife is essential. In public and in the social institutions of governance, professional healing, and religious practice, however, men and women perform separately.

Both men and women control their personal land and property throughout their lives, but contribute their resources to the family as a whole, recognizing the mutual dependence of couples and family in subsistence farming. The responsibilities and contributions of both men and women are considered essential to living well and are equally valued. Most important decisions, such as the sale of livestock, when and where to move households, or children's schooling choices must be discussed and agreed on by both husband and wife. In cases in which the Rarámuri family is in more contact with mainstream Mexican culture and cash economy, gender equality may be compromised, as women have less access to the Spanish language, paid work opportunities, and control of resources outside of their home communities. Men who work seasonally outside of their communities not only bring back cash and manufactured goods, but also may bring hard liquor and associated domestic violence, new ideas about gender hierarchy, or, on the other hand, increased awareness of gender equality issues in public governance. In general, women and men control their own sexual activity and marriage choices, though in the recent past it was more common for marriages to be arranged by their parents and Rarámuri

officials. Fertility choices (the use of contraceptives or fertility-improving curing treatments, for example) are important to both partners and likely result from discussions between them.

Sexuality, marriage, and the family

Both men and women view sex among Rarámuris as natural and healthy, but private, as is the physical expression of affection. Thus the flaunting of sexuality in dress, speech, or behavior, especially in women, is considered immodest and usually inappropriate. Sexual relations with non-Rarámuri is considered to be dangerous and polluting, with high risks of contracting venereal diseases, HIV, or other illnesses. Sexual urges are considered to be naturally strong, and thus it is often assumed that men and women alone together will give in to them. For most Rarámuri, marriage consists of starting a sexual and domestic relationship with a partner, and it is expected that couples go through a 'try out' period of living together before any official ceremony is performed, though the official ceremony is not needed for them to be considered 'married.' If they find that they don't get along, they may separate and look for another mate. Thus, teenage sex is expected for both genders, while they look for long-term partners, though sexual promiscuity is frowned on for both men and women. Extramarital sex at any stage in life is considered to be bad behavior for both genders. It is more condemned—and less common—among women and is a considerable preoccupation and cause of jealousy and fighting (whether the infidelity is real or imagined) among insecure couples.

Physical affection is rarely shown in public, though flagrant transgressions of modesty occur during joking and play at *tesgüinadas*. Both men and women may lift skirts, loincloths, grab their own or others' genitals, make lewd and suggestive jokes and simulate intercourse in public, generally breaking the rules that apply when sober. Usually this sexual play occurs between individuals linked in joking relationships and is also used, in more subtle ways, in everyday life.

Rarámuri marriage is generally monogamous and almost ubiquitous. Few people never marry. It is not uncommon for people to have had several husbands or wives in a lifetime, due to deaths or separations. Most people start looking for partners and marry between the ages of fifteen and twenty and, if separated or widowed, will usually start looking for a new spouse within a few years; there are no specific rules or preferences for remarriage. To be alone or single is considered intrinsically sad: as sadness is dangerous as a cause of illness, and contagious, it is in some ways considered the responsibility of the whole community to make marriage matches. It is also practically difficult for a man or woman to make a living alone because of the many tasks involved; single adults often remain in or return to their parents' households. In the event of separation, children usually decide where they prefer to live and may go back and forth between mother and father or pick one parent to live with. If very young they stay with their mother; in the event of remarriage some children choose to live with grandparents if they do not get along with their stepparents.

In Rejogochi it is not uncommon for young men to be married to women twice (or even three times) their age; less common for young women to marry much older men. Men or women who identify as cross-gendered cohabit with and marry members of either the opposite or same biological sex, depending on personal preference. Marriage with another Rarámuri is preferable to matches from other ethnic groups, though partners may be sought from distant communities if there are few unrelated candidates nearby. In the past marriages were often forced against the will of the youths, who sometimes managed to escape by running away to live with other relatives. In the event that a ceremony is performed, it is integrated into another public celebration, commonly Easter or Epiphany. The couple kneels together before the ***siríame*** (governor) or ***mayóli***, who gives a speech about correct married behavior. The couple may hold hands. The ceremony is short and simple, and the couple is expected to dance later on in the celebrations. Polygynous marriages are rare, accepted but considered feasible only for wealthy men. In such cases the wives (usually not more than two) may live in separate households, or together in the same household.

The husband-wife relationship is ideally characterized by love, privately expressed affection, companionship, mutual dependence and respect. It is the central relationship on which households are built and subsistence depends. Husbands and wives and their children eat together, sleep together, work together, and make important household decisions together. Many household tasks are clearly divided into women's work and men's work, but crossover occurs frequently, as needed. Men may cook, grind corn or wash clothes if their wives are

ill; women may search for firewood or plough fields if necessary. Married couples rely on each other for friendship, successful subsistence, problem solving, physical caretaking, emotional support, and intimacy. Though jealousy over mates is common among Rarámuri women in a community, it is not the rule. A neighbor of mine was debilitated for a long time with an illness and could not keep up with the endless household work of grinding *pinole,* hauling water, doing laundry, and making ***remé*** (*tortillas*). I was surprised to see her husband's first wife (whom he had left many years earlier for my neighbor) returning repeatedly to Rejogochi from her home community (where she had a new husband) to care for my ill neighbor, administer herbal remedies and keep up with household tasks for her. She worked hard for her former husband's new wife, cheerfully and in a sisterly way, and she mostly ignored her former husband.

Domestic violence is relatively common, usually associated with alcohol consumption and perpetrated by both women and men against spouses, though serious physical harm is more often caused by men against wives. I estimate that approximately half the households in my region of study had high recurrent incidences of violence, from beatings with fists, sticks, axe-handles, to extreme cases of attempted hangings and other forms of murder. Pastron (1974) outlines a theory to account for the levels of violence among Rarámuri in which their very salient ethos of non-aggression and non-violence compels individuals to repress all hostile and aggressive feelings, which are released in rather extreme forms during *tesgüinadas*, when they are not held fully responsible for their actions, since their 'reason' leaves them at these times.

Childbirth is considered a private affair, the responsibility of a woman, helped perhaps by her husband or mother and often taking place in the forest or in a remote shelter. Midwives and formal birth assistants are rare or nonexistent in Rarámuri communities. Both young men and women spend a great deal of time with their new babies, learning to parent and care for them with the help of extended family.

Newly married couples are neither strictly matrilocal or patrilocal, but decide to live with the parents of the husband or wife depending on which benefits them most (more fertile land, available living space, food security) or which family needs them most (many young children to care for, an ailing relative, extensive land to work) or simply, which family they prefer. Couples may move back and forth between households for several years or all their lives, often building houses and maintaining fields in several sites. Though kin terms distinguish mother's relatives from father's relatives (for example, mother's mother is referred to differently from father's mother), there are no distinct matrilineal or patrilineal kin groups. The Rarámuri generally use a bilateral, neo-Hawaiian kinship system. For a discussion of Rarámuri kinship and kin terms see Beals (1961), Kennedy (1978:182-185) and Passin (1943). Each of these researchers has recorded some slightly different kinship terms, particularly about differences in speaker's gender, and there is to date no complete treatment of regional variation. Rarámuri usually keep track of genealogies two or three generations back, calling those who lived beyond memory in the distant past ***kiyáwame*** (literally, those of 'before') and ***anayáware*** (the dead, ancestors; those who have lived in times past, including very old people).

Local economies, leisure, and recreation

Both men and women inherit land and property bilaterally. Married couples work their lands together but maintain individual ownership; in the event of separation both retain their own. At death, land ownership is divided among the deceased's children or, if there are no children, among sibling; very rarely does land go to a spouse. Often, these lands are given to children upon their marriage for their new family's subsistence base. In general, men are responsible for maintaining corn and bean fields (clearing, plowing, fertilizing), gathering firewood, woodworking, hunting, building, and working for *ejido* (communal lands) lumber operations. Women are responsible for preparing food, childcare, sewing clothes, weaving wool and baskets, fetching water, preparing *tesgüino*, and usually caring for livestock (goats, sheep, horses, and cattle). Both genders participate in planting, weeding, harvesting and storing crops, and gathering wild foods and medicines.

Many men and some women work outside of the community for cash on a seasonal basis, often as migrant agricultural laborers in the lowlands of Sinaloa, Sonora, and Chihuahua. Others work permanently in Mexican cities, coming to the Sierra only to visit on holidays. Some women and fewer men sell traditional artisanry for cash and there is limited employment in the tourist trade of the Copper Canyon, mostly as guides and hotel employees. Division of labor is defined but not immutable; depending on personal affinity men may participate in any or all of 'women's work' and vice versa without fear of ridicule or censure. However, women tend not to travel and work far from home.

The most important form of exchange in Rarámuri communities is labor reciprocity, in which both men and women participate. Though most fertile land is owned by individuals, much of it is worked in cooperative work-*tesgüino* parties. Often, those who work together are neighbors, kin, or fictive kin (*compadres* or coparents, for example) and the harvest might be shared later in the year if one family comes up short. Other forms of trade include deals between individuals for the exchange of livestock, food, liquor, clothes, other goods, land, and increasingly, money. ***Noráwa*** are formal trading partners or clients, usually among the wealthiest men or women of a community, who preferentially trade or sell livestock to one another. Material goods are re-distributed among community members principally through reciprocal gifting, trading, and gambling on the outcome of footraces.

Leisure time and recreation are not demarcated in Rarámuri culture, but exist on a continuum of work, religious practice, sports and play. In general men have more leisure time than women do, mainly because agricultural responsibilities sometimes wane, while household tasks do not. Women and men spend their leisure time in similar ways, primary among them socializing among family and peers at *tesgüinadas* though work is often integrated here. At *tesgüinadas* men and women play music, dance, drink, perform rituals and healings, tell stories and joke with each other. Men and women attend equally, but usually maintain gender-separated groups during the communal work and drinking but as festivities progress, become more and more mingled. In daily life, the association of neighbors, relatives and friends in *tesgüinadas* or corn beer parties is an essential part of economic, religious and social practice (Kennedy 1963, 1978). Humor is an

important part of any Rarámuri gathering; wit and humor are highly prized skills among both men and women. Humor is used as a powerful socializing tool during gatherings and in households, for and by children and adults alike.

Footraces are another important recreational, social, economic, and spiritual activity for the Rarámuri (Kummels 2001). Men and women and boys and girls run races of between twenty and several hundred kilometers, during which the supporters, those who have bet on their team's winning, run portions of the race along with the runners to light the way in the night and to give them strength. Clothes, money, blankets, woven belts, cloth, soap, beads, and other personal belongings are wagered on the success of their team runners. Men run while flipping a small wooden ball ahead of them with their foot (***rarajípa***); women run while flipping a small wicker hoop ahead of them with curved sticks (***ariwéta***). Men often play throwing games in their free time, such as *cuatro*, in which they take turns throwing stones or coins into a square court. Pennington (1963:174-177) describes several other stick throwing dice games, gender specific team games, and archery games. Both men and women spend free time visiting friends and family, often in distant ranches, and most enjoy spending time 'in the woods,' hunting, fishing, or gathering wild foods.

Health and medicine

Health and happiness are the same word in Rarámuri: ***kaníri***. They are conceptualized as causally linked; that is, if people are happy and joking and laughing they are also healthy. Sadness and crying invite disease and illness. Thus, babies and young children are

especially encouraged to laugh and smile at the playful antics, funny faces and noises from the adults and children around them, in part as a prophylaxis against illness (Kummels 2003:71). A sad, lonely, or depressed member of society can be dangerous to others' health, because being sad, ***o'móna***, can be catching. Thus, if sadness is expressed, typically while drinking, one or another companion takes up the task of making that person happy again, by talking it through and empathizing, bringing more *tesgüino*, playing the harmonica, making ridiculous or obscene jokes, and such.

Curing is maintaining good relations with God, the beings and persons in the surrounds. It is both preventative and active. Kennedy describes it thus:

> ...[A]s time unfolds people, as well as all living organisms, such as plants and animals, tend to become enmeshed in invisible webs, which mostly, like the *remugá* threads, are produced by their own bodies. These webs entangle the souls, and by restricting their movements, make the person, or other living thing, much more vulnerable to the many supernatural threats which fill the environment. The ritual gestures cut these encumbering webs, freeing the souls, for a time, to move around in their natural and healthy manner (1996:163).

These curing ceremonies are important for fields, livestock, homes and people. Another aspect of the curing is the application of curative water that has steeped in the aromatic ***wasía*** root (*Ligusticum porteri*), ***korí*** (*Capsicum annuum*) fruits, ***mé*** (*Agave* spp.) or other plants. This water is sipped by people being cured[2] or sprinkled on fields to symbolically cleanse them of 'worms and plague.' When curing fields, ***kobísi*** (ground parched corn) is ritually given to the

[2] One elderly woman said this was done to "keep the children fat."

livestock and ***tónari*** (ritual meat stew) is 'fed' to pests in the cornfields so they will not consume crops.

Health problems are often be ascribed to sorcery. One middle-aged man remarked to me that he had been told by an ***owirúame*** that his chest pain and 'heart' problems were caused by neighbors' jealousies and that someone had witched him: "*me decían de por qué siempre yo no más trabajaba en Basíhuare…*" (they kept asking me why only I was working for pay in Basíhuare). This man is a skilled, motivated, and conscientious worker and is always in demand when there are construction or other jobs to be done, and he seems to prefer this work to farming (he owns only a small plot of land insufficient for feeding his family). But egalitarian custom dictates that every able man gets a chance to earn *pesos* by taking turns working the few jobs that come up in the *ejido*, and this probably is the source of the grumbling and jealousies he felt.

Biophysical landscapes and ethnoecology

The Sierra Tarahumara is primarily formed of volcanic rock, part of the Sierra Madre Occidental, which was laid down as a kilometer-thick layer of andesite during the Laramide Orogeny (90-40 million years ago) and then "uplifted and eroded into a deeply dissected topography" (Martin et al. 1998:14). In the middle Tertiary (35-23 mya) volcanics spewed another kilometer-thick layer of rhyolitic tuff on top of the andesite, covering 275,000 square kilometers and 1200 kilometers along the length of Mexico, forming the imposing Sierra Madre Occidental. In the Miocene (5 to 15 mya) while the rest of the

region buckled, tilted, and cracked, creating basin-and-range topography, the deeply buried granites under the mass of the Sierra Madre held stable, creating a long narrow mountain range (Martin et al. 1998:16). The Sierra Tarahumara today is deeply scored with rivers that have eroded dramatic canyons throughout the region, making diverse habitats for plants and animals. Where plateau basalts come into contact with a softer tuff at river level, small and shallow caves or shelters commonly erode out, leaving a ceiling of basalt or other material and a floor of tuff (Martin et al. 1998:18). These were used extensively as shelters and homes by prehistoric peoples in the Sierra Tarahumara and are still important to Rarámuri today as temporary homes and storage areas.

Rarámuri ethnobotany and ethnoecology

Europeans and their descendants have been interested in the biological resources of the Sierra Tarahumara and envisioned development scenarios in the region since they started coming to the area, as this excerpt from the Croatian Jesuit missionary J.M Ratkay's (1683) account illustrates:

> From Mother Nature [the province of Tarahumara] has received a more healthful climate than the other provinces, and it has a better location. Alike to its own people and to those who come from afar it presents a charming variety of hills, plains, and mountains, and all men find it desirable. For on the one hand Mother Nature, rich in mines of silver and gold and fertile in precious metals, bestows this wealth in abundance upon nearly the whole of America, and from America it passes to Europe; and on the other, through the fruitfulness of the flocks and herds, she makes life easy for the inhabitants. In the multitude of the streams, in the beauty of the level and far-extended plains, there is good cause for rejoicing. The land does not burn with heat, as does Africa, nor are the rigors of cold excessive. The inclemency of the weather as a rule is

tempered by gentle breezes. Impatient of heavy snows, the country is usually clad, on the contrary, with a garment of flowers and thick verdure. When the Sun moves at his highest among the summer signs of the Zodiac, the land is refreshed with healing rains, and the meadows, colored with beautiful blossoms of many hues, invite the eye to rest. Then of the kind which we call Turkey corn, in great abundance ripens for harvest, and fruits and vegetables of all kinds are to be had in great plenty, both those which nature herself produces and those which the skill of man brings to maturity. Nor would the land fail to produce grapes, if their cultivation were permitted. But lest the extracted juice of the grape drive these people, always excessively prone to drunkenness, into greater vices and sins, and, moreover, not to destroy the profits of dealers in this merchandise, in Spain, the Indians are forbidden to plant vines.

Furthermore, because in Tarahumara birds of all species and colors are to be found—as, for example, the birds, red all over, which are called cardinals, parrots green, yellow, and blue, and every other beautiful bird that one could desire—these would introduce additional variety to diet if only the natives could be lead [sic] by curiosity or desire or expediency to use them. The reason why there is often a dearth of such commodities is because the Spaniards, as a rule, are at work in the mines and the Indians are prevented from procuring them both by their natural indolence and also by the slight esteem in which they hold such things.

In fact, if some nobler spirit could rouse the vital forces of these Indians and cause them to appreciate the new and the advantageous, or if a more glorious blood could lead them to desire and seek such things, or, finally, if a better standard of living could provide the stimulus, this country could be put on a level with any country in Europe. And it has its own beauty in mountain-scenery, with the thick forests of oak and pine. Along the rivers poplars [cottonwoods] offer welcome shade. Moreover, Nature has given it many wholesome roots and herbs for the curing of bodily ills. Among these, in particular, is one which immediately counteracts the poison of snakes. Another renders harmless the venomous bite of the tarantula. Still another, with its healing power, cures the swellings made by poisoned arrows. There is another plant from which the Indians make a drink which they call *mescal*; it resembles our brandy (*vino educto*), and is not unpleasing to the palate nor harmful to the body. Many other plants there are, too, the properties of which are for the most part unknown, because only a few of them are used for medicinal purposes. (Ratkay 1683:17-20)

The greater Sierra Madre Occidental flora has not been exhaustively studied, but it is known to be a center of botanical diversity and home to an estimated 2000-4000 plant species (Bye 1994:20). It is a center of species diversity for pines, oaks, junipers, succulents and perennial herbs. Within this region, which is a subset of the Sierra Madre Occidental, Bye estimates that 400 plant species are used as medicine in this region and about 300 species are included in local diets (Bye 1994:22). At least another 100-200 are of material value, for building, weaving, dying and other uses. Bye compared registers of useful plants collected in the region by Edward Palmer in the late 1800s with lists of plants used today and estimated that about 37% of ethnobotanical knowledge may have lost currency over the past century (Bye 1994:22).

Over the past decades many studies have been done of Rarámuri ethnobotanical and ethnoecological knowledge (Bye, Burgess, and Trias 1975, Bye 1976, 1979a, 1979b, 1985, Cardenal 1993, Pennington 1963, Salmón 1999, 2000), recording uses for hundreds of species and identifying practices that can be shown to maintain plant diversity and agricultural viability over the long term (Bye and Linares 2000, Bye 1979b, 1981). However, the Sierra Tarahumara hosts one of the richest floras in Mexico, itself one of three top megadiversity countries in the world (Ramamoorthy et al. 1993), and work remains to be done to understand the complex relationships between its plants and people. This work is especially urgent today because of the rapid political, economic, and ecological change happening throughout the region (Haenn 1999, Simon 1997, Simonian 1995).

Plant spirits

Among the most intense and potentially dangerous relationships some Rarámuri seek are those with so-called 'plant-people', or powerful plant spirits (I am not aware of any categorical name for these in Rarámuri). These include ***híkuri*** or peyote (*Lophophora* spp), ***rikúhuri*** or datura (Datura spp.), ***wichurí*** cacti (*Mammilaria* spp.), and ***bakánowa*** (*Scirpus* spp. or *Ipomea* spp. in some cases), among others (Bye 1979a). A minority of adults choose to take up relations with these plant-beings to increase their personal power or for healing or sorcery, but children are invariably protected from contact with them and are warned not to touch or walk near them for fear of illness or death. A young man who had converted to Protestantism and did not attend most of the Rarámuri or Catholic ceremonies commented to me as we hoed his bean field free of weeds that he does not believe in the power of ***wichurí***, "*si tienes miedo te puede pasar algo—todo depende de lo que piensa uno*" (If you are fearful, something could happen to you—everything depends on how one thinks).

Rarámuri landscapes

Late one summer I was walking up the Rejogochi valley with an older man, my *comadre's* father. I asked him about the corn growing in the fields we were passing—"It looks different from the usual corn plants, with wide leaves and it's not flowering yet, while all the other *milpas* have flowered..." He remarked that he thought it must be an experimental variety brought in by extension workers from Creel of Guachochi, "*hay maiz que tiene flojera; no camina recio. Es mejor usar el maiz de aquí que crece bien en la sierra*" ("There are corn

[varieties] that are lazy, they don't walk fast. Its better to use the corn that grows well in the Sierra").

There is a sense in which all land is alive for Rarámuri of Rejogochi. Some place names suggest a metaphorical mapping of human geographies onto physical spaces. For example, a high mountain at the downstream entrance to Rejogochi valley is named ***Mo'órachi***, which was translated as "head-place," "because it is the head of the valley, as if it were a man lying down." Further downstream is an area called ***Umirá***, or "back-place." Salmón (1999) describes a larger scale metaphorical conceptualization of the whole Sierra Tarahumara as a backbone, but people whom I asked in the Rejogochi area had not heard of this terminology.

Slaney (1997:280) writes that "Tarahumaras see themselves as being permeated by, and vulnerable to, an inherently unstable landscape. Through their superior ritual techniques they hope to control the ebb and flow between unbounded Tarahumara bodies and a vertically organized cosmos…" She goes on to construct a symbology organizing Rarámuri conceptualizations of personhood and ethnicity. Her description of how Rarámuri situate themselves as individuals mediating relations to their landscape via ritual is apt, though if the landscape is unstable, it is in predictable and regular ways.

Chapter 3

Growing up Rarámuri

Figure 3.1. Walking to school on a rare snow day, while caretaking a young sister. January 2001.

The purpose of this chapter is to provide a contextual understanding of Rarámuri children's social and cultural environments. Given that the Rarámuri are considered the second largest North American indigenous group in terms of population, there have been relatively few studies done among Rarámuri to date, and few published ethnographies that systematically include women's and children's cultural experience (notable exceptions include Kummels 2003, Miller

2002). This chapter gives a general overview of Rarámuri children's environments; Chapter Four goes on to specifically discuss enculturation and learning in these environments. I'm interested in how people's knowledge about their environments structures their relationships with their environments, and influences their responses to ecosystem change. Here I illustrate how plant knowledge and learning is integrated in Rarámuri social and cultural contexts. This and further studies of the interactions between human social ecology and biological ecology indicate how systems are produced, reproduced, and transformed over time.

Additionally, this study reiterates what many indigenous educators have been saying for a long time—that education is about social relationship as much as knowledge content (Freire 1994); an education-as-knowledge-banking procedure is inappropriate when the goal is to engage students in the reproduction of dynamic, changing intellectual ecosystems.

And finally, the social integrity of the informal education system in any community is an important factor for long-term resilience in a system because it allows for *creative responses* to social and ecological change, in the integration of new and old.

Ethnographic methodology and techniques

In the descriptions of this chapter, I put together observations made in many households in Rejogochi, comments, stories, and answers to my questions made by many different men and women and children. Thus, I cannot claim that this portrayal represents all or even most

of the residents of Rejogochi, but rather, it is my construction. I attempt to give a general impression of cultural norms, supported and detailed by my accounts of what I saw and heard and what was reported to me. Many of the pieces of information are anecdotes. That said, there are remarkable consistencies between what was reported by the very first outsiders to put their observations to paper (Bennett and Zingg 1935, Lumholtz 1902, Schwatka 1893), and the patterns observed today in Rejogochi and many other communities in the Sierra (for example, de Velasco Rivero 1987, Gomez Gonzalez 1980, Kennedy 1978, Merrill 1988, Rascón 1979). In some ways it is the consistency that needs to be explained rather than the diversity.

Many social scientists have reported difficulties working in the Sierra Tarahumara, principal among these is limited access to women's knowledge on the part of male researchers. I found that this difficulty was by no means solved by being a woman researcher. Though socially I participated almost exclusively with Rarámuri women, I found that none of the women I first solicited as field guides/ translators/ consultants were able to take this role. Though several were interested, they told me that that kind of work was more appropriate for a man, or that their husbands would not allow them to work with me, because they were too jealous. Also, women are almost always busy with never-ending domestic work and could not spare the considerable amounts of time required. The two women I was able to hire as collaborators were unmarried and in their late teens. I found that women were much less likely to respond to a direct question from me about philosophical issues, beliefs, worldviews, or theory. They would often laugh and change the topic. There were a few exceptions,

and these were women who, by Rarámuri standards, are outspoken and care less than usual about conforming to norms. My research with women, then, took place almost entirely in the informal sphere, opportunistically, and as much organized and directed by the Rarámuri women as by myself. My women friends in Rejogochi knew what my interests were, and, when they deemed it to be an appropriate time and place (usually at *tesgüinadas*), they would take me aside and explain something or show something to me, that I had asked them about perhaps weeks or months earlier. Older women, especially, helped by showing me the rules, almost always by example or mime rather than verbally. This took the form of, for example, a hand subtly coming out to stop me if I was about to do something inappropriate or unadvised (such as obey a summons from a drunk official during a *tesgüinada*), gently prodding me forward to join in dancing, giving me warning looks and short shakes of the head if I looked to them for advice on whether to do something, and expressing embarrassed disapproval by looking at the ground, turning their backs, or covering their faces with a *rebozo* when I did something inappropriate, such as smiling and talking face to face with a man in their presence.

I found it difficult not to converse and work with men for several reasons, though I knew that it was considered inappropriate. First, one of my main contacts in Rejogochi was a man, who had befriended my parents as a boy. He happens to also be very interested in plants and is an accomplished natural historian. Second, as interlocutors with ***chabóchis***, men generally believed that it was their place to teach and explain things to an outsider whose research activities they had formally accepted in the community. Third, men

spoke Spanish more openly than women, so in the beginning to communicate with any level of complexity I had to converse with men. So I maintained a delicate balance between working with men and women and socializing with women. I made especial efforts to befriend the wives of the few men I regularly worked with and to invite them on every outing or work project we undertook.

Though all my interviewees volunteered the hour or so to complete the task, I was continually breaking unspoken rules by asking children directly to identify plant names and uses for me and the message came through in several ways: kids' body language, nervous laughter, professed ignorance. These and other cues added up to subtle guidance and management of my research program. Fieldwork is a two-way process, designed to be so at a conscious level and also at a subconscious level; ethnographers recognize that some insights come from the interstices of what we first think of as 'problems' in technique. In this case I learned ways to ask without asking, and to know when someone expected me to observe rather than inquire (Briggs 1986).

Rarámuri life stages

Rarámuri do not denote life stages strictly or mark each especially with rites of passage, though there are important curative ceremonies that are needed at intervals of their maturation. Children and adults are considered primarily as individuals, each of whom develops at their own pace. Thus, children, adults, the elderly, and physically or mentally handicapped people are fully integrated in society and given chores and roles according to their abilities.

Nonetheless, parents do look for signs of particular brightness and 'good thinking' in their children as they grow up and orient their lessons and lectures to that end.

Rebozo* babies—*múchi

Young babies and lap children are doted on by a wide circle of extended family. They are in bodily contact with their caregivers almost constantly, either in arms or carried on the back in a *rebozo* (shawl), sheet, or blanket. Babies are held, stroked, dawdled, and sung and talked to by family members and visitors. One sweet lullaby I heard goes, "***Shh, churuwí, ma kuchinára**a…, shh, churuwí…*" (Hush, bird, sleep now; hush, bird…). One father who was originally from the Norogachi area explained, as his three-month old girl with long fingernails scratched his face as he held her, that Rarámuri do not cut babies' nails because "*si se corta las uñas se corta la vista*" (if you cut the nails you cut their sight) which, he explained with a grin, is why Rarámuri usually do not need to use eyeglasses. It is desirable for babies to show that they are beginning to "think well," especially by talking early. One young father of six told me that one should pass a cricket over a baby's mouth so they will speak before their first birthday. One of my *comadres* shyly boasted to me one day that her seven-month-old boy started talking to her in full sentences when no one else was around, telling her, for example, "let's go find my father."

Shortly after birth (ideally three days after for boys and four days after for girls), babies are given a ceremony called ***rajirépema*** (lit. passing fire between [pots]; performed for other curing purposes

also), or ***na'yé ta múchuri*** (lit. stoke/fuel[1] a fire—little baby), though it was usually referred to as *quema* (Spanish: burn) in conversations with me. Slaney (1997:283,297) reports Panalachi informants calling it ***wekomérachi***, ***na'éma*** (similar to ***na'yé*** above), and ***molebámara*** (juniper smoke baths), and refers to De Velasco Rivero's recording of the term ***moréma*** (to smoke) to describe the ceremony. It is usually a quiet family affair conducted by healer or relative of the baby, who gives the baby a 'burn' name and then becomes the 'godparent of the burn,' paralleling in this respect the Catholic baptism rites that take place in church. Though Slaney (1997) refers to this as 'fire baptism' I found no evidence in Rejogochi to support her thesis that this rite plays a central role in the constitution of Rarámuri identity and personhood. Rather, I would describe it as one of many rituals that Rarámuri use to construct identity and manage relationships that are important to them, within their community, between their community and God and between their community and outsiders (see Merrill and Quezada 1997 for more debate on this issue of ethnographic interpretation). The ceremony is medicinal/curative and spiritual/prophylactic, the first of many of its kind for every child.

Others report this newborn ceremony taking place at *tesgüinadas* (Slaney 1997) and public fiestas, though I saw this only for older children. Prayers are said, protection from lightning invoked for the baby, and smoldering corncobs (three for boys and four for girls) are passed over the crown of the baby's head, shoulders, chest, and joints

[1] As in blowing on a coal or spark to make it glow when kindling a flame.

to sever invisible threads that connect them to the world from whence they came, the sky/heaven or God. A knife may also be used to sever these threads. Figure 3.2 shows more details of the ceremony. The threads are called ***rumigá***[2] and have been variously described to me as resembling spider silk (they can sometimes be seen floating in the breeze) and like poky short sticks at the top of the head (these contrasting descriptions may refer to pre- and post- cutting). Some people said there was only one thread from the top of the head; others reported several and additional ***rumigá*** at other parts of the body. I've also been told that the ***rumigá*** are invisible to most people; only ***owirúames*** can see them. One ***owirúame*** said that a boy's or man's threads are bluish in color and a girl's or woman's are yellow. Kennedy (1996:162) reports that they are white fibers. If these threads aren't cut by an ***owirúame***, they will grow and grow and increase the risk of the child (and possibly the dwelling) being struck by lightning. It was said of one ten-year-old girl that she was particularly *brava* or ***parúame*** because she had not had her ***rumigá*** cut as a child, because her parents had temporarily converted to Protestantism when she was young. Evangelist missionaries discouraged their converts from performing this and other Rarámuri ceremonies.

Several informants from the same extended family told me that if a baby or child dies with intact ***rumigá*** they may be more likely to convince God to send down hail to damage their parents' crops in

[2] I recorded the word as pronounced ***rumigá***; Merrill (1992:218) recorded it as ***rumugá***; Kennedy (1996:162) as ***remugá***. Brambila's (1983:476) speculative definition of ***rimugá,*** mainly used in the verb form ***rimugápuma***—"to conjure, cut the dreams of bad omen" probably confuses cutting threads with the verb 'to dream,' ***rimugá*** (as noted by Merrill 1992:218) though the conceptual links between ***rumigá*** and ***rimugá*** may yet be explored productively, since syllables are often transposed in Rarámuri speech.

Figure 3.2. A local curer gives an agave water cure after 'burning' the ***rumigá*** from the crown of a newborn's head with a glowing corncob. His wife and the newborn's brother look on. Rejogochi, Spring 2002.

punishment for letting them die. Thus, deceased babies are given ample food and water and have their ***rumigá*** severed before they begin their journey. One man described ***rumigá*** as being "like (radio) antennae"—they facilitate communication with God but increase the risk of being struck by lightning and so they are trimmed periodically. The ***rajirépema*** "curing" is usually performed on growing children several times a year in public rituals such as ***tutubúri*** and Easter ceremonies. Pregnant women are especially at risk for lightning strike, because their unborn babies' ***rumigá*** is strong. Bennett and Zingg (1935:234) and Zingg et al. (2001:35-36) mention that women should have the

rumigá cutting ceremony right before birth to make labor easier. I was told of a woman who had been struck by lightning while pregnant in the next valley over. She was sitting next to the stovepipe when hit; she miscarried and her baby was born dead, black and singed. The cure for mild lightning strike is to feed the victim black soot from the stove.

Middle childhood—*kúuchi*

The most salient aspect of these years is a marked change in relations with parents, becoming more distanced and less demonstrative. Once children are old enough to start walking by themselves, they usually spend more time with siblings, and less with their mother, who might have other infants to care for. Latorre (1976:55) reports, in her analysis of mother-child interactions, that the three-to-four year old girl in her study was already quite independent and didn't ask her mother to perform tasks that she could do herself (e.g. eating, shelling corn, carrying water). No destructive or pain-inflicting behavior was observed during her study. Mother and child communicated mostly in gestures and talk and had little physical contact (Latorre 1976:58).

By about age four or five, children begin to assume responsibilities and help with household tasks. In toddlerhood parents begin to limit the physical affection shown to their children, though the bond between them is apparent in other ways, such as working closely together, traveling together, and showing the trust and respect given to young children who contribute by cooking, minding animals, and doing household chores. Physical affection is still

lavished on children by their grandparents, especially grandmothers, but their relations with parents become more formal, and take on the character they will have for the rest of their lives. The following field notes excerpt describes a typical interaction between parents and children, though in this case the son was an adult in his mid-thirties.

> On our way back from a visit to some pictographs we ran into Ventura's mother, who was out of breath, hurrying back to her house. She stopped when she saw her son in the road, though neither made any gesture of recognition to the other. She and Ventura talked rapidly, both facing upstream, bodies angled away from each other and hardly looking at each other except in sweeping glances as though pretending to look at something else, even though she was excited, as her elderly neighbor was very ill, fainting and with a 'bad heart' and she was looking for his grandson to take him to the clinic.

This avoidance or ignoring pattern between parents and children, especially between opposite genders, was noted also by Kummels (2003), who observed that the six-year old girl in the house she stayed in was almost never addressed or looked at directly or touched by her parents. I recorded similar interaction patterns, sometimes the main verbal communications between parent and child being chastisements (*regaños*). A frequent source of grief among women at *tesgüinadas* is their feelings that their mothers do not love them, as exemplified in the following interaction among three generations of women at a *tesgüinada*:

> *Thursday, 22 August 2002*
> Towards evening, a crying bout among the women. Chucha [in her 70s] was weeping because her daughter-in-law Santa Lucía [50-60 years old] had, *regañando* (scolding), disclaimed any relation to her. Ribuchi, Chucha's granddaughter and Santa Lucía's daughter, was crying in sympathy with her grandmother, who she confided to me, "*yo quiero mucho*" (I love her very much), and at her own

> feelings that her '*mami*' doesn't love her either. "*Me regaña siempre… ella no me quiere. Yo le digo, tienes que pensar mejor, porque ¿quién te va a cuidar después? Porque tú eres mami…*" (She always scolds me… she doesn't love me. I say to her, you have to think better, because who is going to take care of you later? Because you are the mama…). Santa Lucía also told Ribuchi that I don't care about Ribuchi, which upset her—she recounted that to me, hurt, saying, "don't I help you when you need it?" Chucha said, about Santa Lucía, in the most Spanish I have heard from her, "*Esa muy malo, muy diablo. Me hace triste*" (That one is very bad, very devil. She makes me sad).

Bonds between women in a family can be very strong. Sisters and especially twins are often referred to using the same term of reference. For example, when a man my age referred to an older woman as his mother, (***chíchi***) I was perplexed, as I had understood someone else to be his mother. He explained to me that she was his mother's twin sister, and because they came into the world at the same time he calls her "mother." This kin terminology use was confirmed by others who were twins or had twin relatives. Similarly, children call a niece or nephew "***ni kúuchiri***" or "my child," and first cousins are termed brothers and sisters, and sometimes aunts and uncles are called "mother" and "father." A friend of mine in Rejogochi had had twin babies about twelve years ago, a girl and boy. She agreed that twins were "like the same person," and added that when twins were not the same gender, one tended to lose strength and die. Her twin daughter died at eight months of age. It is possible that in some cases, in times of food scarcity two infants at once are too much stress on a family system, and one baby may be significantly neglected. A young man about 14 years old commented to me on a different occasion that he angrily watched his adult cousins-neighbors favor one toddler twin son of theirs over the other, such that one was always hungry and,

according to my consultant, only survived because he always went to his grandmother's house for food and shelter. A belief that is perhaps related to these ideas of twin-hood, that several women confirmed, is that babies with two hair-whorls on the crown of their heads (where the hair begins) are said to have 'two heads' (I discovered this after observing two whorls on a beautiful baby I was holding and commenting to his mother about it, who laughed and said, 'yes, he has two heads!').

Children have particular modes of speech that are left behind with adulthood. For example, kids say, "***we ra'ínka***" and adults "***we ra'íame***" for "it tastes good;" "***ké machíkwa***" instead of "***ké machíke***" for "I don't know." The Mexican teachers at the Rejogochi boarding school mentioned that adults often made fun of them for speaking childish Rarámuri that they learned from their students.

Puberty and adolescence

Adolescence is not named among Rarámuri, nor is puberty marked by specific rites or celebrations. The transition from childhood to adulthood is gradual, individually paced, and consists primarily of an increase in responsibilities. To my knowledge menarche is not particularly celebrated, but considered to be part of a natural and healthy transition to womanhood. Menstruation and menstrual blood is not considered particularly dirty or polluting and does not necessarily limit sexual relations. A *comadre* of mine commented to me once that she knew some men who became uncomfortable seeing menstrual blood, citing a time when some dripped onto the floor, and she was

glad that her husband was not one of those! Most women wear extra underskirts while menstruating as absorbers in the absence of underwear. Polyester skirts are favored for this purpose, because they wash out easily.

My gestalt impression is that adolescence today is a particularly stressful time for Rarámuri in the Rejogochi region, because they have to confront difficult choices. There is not enough fertile land to support local populations via traditional subsistence methods, and many adolescents have to leave home and work as migrant labor in lowland Chihuahua, Sonora, or Sinaloa. Others get involved in drug growing and distributing, which is violent and lawless business in the Sierra Tarahumara. Those who continue their education at the secondary school in Basíhuare (grades 7 through 9) often experience a great deal of pressure from their elders, who do not always value this type of education and accuse their children of becoming "*achabochado,*" like ***chabóchi***, dressing and behaving as mestizos. This is especially true for girls who study, as exemplified by the following interchange I observed at the same *Día de los muertos* fiesta discussed below.

> We had to drink up the *tesgüino* outside the graveyard walls before leaving. It was raw and smoky and full of chaff and not pleasant to down. Petronilo, who is Crescencia's cousin-brother, tried to force his teenage daughter Fermina to drink with him. She refused. She does not greet him or speak to him. She dresses in mestizo clothes, attractively and in seeming quiet rebellion. Fermina left precipitously with her friend. Petronilo was angry and hurt, deprecating her and his wife Ribuchi, who crumpled to the ground, crying, at the painful scene between her daughter and husband. Petronilo blamed Fermina's behavior on her schooling, and on Crescencia's influence. Crescencia grew stern with him, saying repeatedly (in Spanish) "we do not have the right to scold our children when we are drunk. It is not right." And she defended Fermina's right to study, saying Fermina worked hard, that she loved Fermina very

> much, and that she supported her, paying for her food and clothes, so what was Petronilo complaining about? "If she were a boy it would be different," he said. "What use is she to me?" "What use is her studying to me? She doesn't help me; I don't love her and I won't love her."

Other parents, particularly mothers who regret not getting a formal education themselves, actively support their children's schooling. Adolescents who go to school are exempted from some household responsibilities and are often discouraged from drinking *tesgüino* or other alcohol. Regardless, most adolescents experience identity pressures, from the mestizo world that generally denigrates the value of Rarámuri life ways, and from the Rarámuri world that regards ***chabochi*** life ways as inferior spiritually, philosophically, and ethically. Most adolescents today must negotiate both these worlds to make a living. Teenage suicide and murder rates seem high, though I do not know of any formal study that documents this I heard of four such deaths while living in the area. Judging from women's accounts, molestation, rape, and incest, particularly on the part of stepfathers, are real dangers for teenage girls. Several women I talked with left their natal *ranchos* as teens or pre-teens to get away from violent situations at home—taking domestic work as a *muchacha* in mestizo towns or cities, or making their ways to migrant worker slums in other states, which present their own dangers for a woman alone. Because the established pattern of repressing emotions that are expressed and worked through at *tesgüinadas*, young teenagers who are not yet drinking socially have few outlets to express their feelings. Recreational drug and hard alcohol use is on the rise among adolescents, mostly in Basíhuare, where students from all over the

Sierra come to the secondary school. See the subsequent field notes excerpt for an example of the very different social environment this creates; the "Tomás" in my description is a thoughtful and interesting teen when sober; his brother had been recently murdered when the incident I observed took place.

Teenagers and adult women ideally should avoid speaking with members of the opposite sex who are not their relatives and be modest in dress, behavior and speech. These rules apply to young men as well, but to a lesser extent, as men are expected to interlocute with the non-Rarámuri world and thus permitted more leeway. Young adults begin to take on religious responsibilities and may join a group of dancers, host their first *tesgüinadas* (corn-beer parties) on religious *fiestas*, and are expected to attend Sunday meetings in which community political and religious matters are dealt with.

Transition to adulthood

Girls are called ***tiwé, tewé,*** or ***tiwéke*** (plural ***iwé***) from birth and boys are called ***towí*** (plural ***kúruwi***). These names are used throughout childhood, both to refer to girls and boys in general and as terms of address. They are used to refer to married or elder people jokingly or affectionately. Children, regardless of gender, are called ***kúuchi***. Some time after puberty a woman is called ***mukí*** (plural, u***mugí*** or ***igómale***) and a man ***rejói*** (plural, ***rejói*** or ***rarámuri***). Elder women are called ***weráame*** and elder men, ***chérame***. Passage from one stage to another occurs gradually and is generally unmarked for both genders. Social responsibilities, governance and economic power are generally

assumed by adults of child-raising age or older; religious and healing responsibilities fall mainly to elder men, though it has been reported to me that in earlier times it was more common for women to be healers as well.

No special rites of passage indicate a transition from boyhood to manhood or girlhood to womanhood. This change in status is gradual, though generally considered to come with marriage and especially with attendance at *tesgüinadas*. Nowadays most courtship is undertaken by unmarried men and women themselves, especially among those teenagers who attend school together, but in the recent past of 15-30 years ago matches were often made by an elected official, the ***mayóli*** ('mayor') (Kennedy, 1996: 199). In the past most families lived in greater isolation from each other, and youngsters may have had very little chance to interact with unrelated peers. The ***mayóli*** is approached by the parents of youths of marriageable age and asked to find appropriate mates for them. One Sunday after the governor's ***nawésari*** I approached the ***mayóli*** to ask for an interview about his duties and experience, and, knowing that I was unmarried, he half-jokingly, half-seriously began to list out loud all the eligible Rarámuri bachelors he might match me with, assuming that was what I wanted to talk to him about. A marriage may or may not be officiated publicly, depending on the wishes of the couple and their parents, but if so, it is usually after the couple has lived together for a while. Both girls and boys tend to marry between the ages of fourteen and twenty and assume adult responsibilities at this time, though they usually still live with and are guided by the wife's or husband's family. Married women and men

are expected to work hard and help their relatives and neighbors in subsistence activities. The following excerpt from my field notes illustrates one woman's experience of a forced marriage, difficult in-laws and early widowhood.

> *Sunday 3rd of November, 2001*
> Last Sunday I visited with Crescencia in Basíhuare before heading down to the plaza. She showed me her collection of photographs. Among her photos were a couple of her at her 'wedding' when she was just 11 or 12. Now she is 36. Crescencia's husband-to-be, then about 19 years old, had been pressuring her and her parents to let him marry her. Her parents agreed as, she said, they didn't want to buy her food or clothes any more and considered it a waste for her to go to school. She wanted nothing to do with him but he threatened to kill her if she didn't marry him. On the day of the photographs (it must have been mid 1970s) her father was a *fiestero* (ritual host) and she was up in the rock shelter grinding corn for ***batári*** (corn beer) when a group of *soldados* (ceremonial officers/soldiers) appeared, grabbed her and took her down to the plaza to be married. She had no idea what was going on, but at her protests she was told that she'd be thrown into the river if she didn't go along with it. She cried.
>
> Her mother in law was cruel to her—wishing her dead and not speaking to her for many years. She was irrationally jealous and accused Crescencia of sleeping with her father-in-law. Crescencia's husband beat her. She cried when they 'made love' as she called it. She was very clear about wanting to be open and unashamed of what happened to her—she said she had told her children the whole story, so they would know how things were. Her husband died about six years ago, run over by a car in Chihuahua City. She invited me to stay at her house the following week as she made *tesgüino* and killed two chickens as the final death *fiesta* for her husband (*Día de los Muertos* is Nov 1st/2nd).
>
> I went to her house on Thursday afternoon. She lives with her three sons and several boarders—girls from the high school and one girl who dropped out of school at her father's jealous insistence that she will get pregnant if she keeps studying—better that she get married. It was my impression that Crescencia has taken on the role of protector for these girls. They clearly love her and she them.
>
> After visiting the public fiesta, around midnight I went back up to Crescencia's, her kerosene lamp shining in the window. She was in a slip, ready to sleep an hour or two before getting up to check on the naked chickens

cooking on the stove and prepare the food for the dead. I settled into my sleeping bag near the jars of *tesgüino* at one end of the big adobe room that is her house. The *tesgüino* jars (two lovely old clay jars and one green plastic trashcan) had thorny barberry-like sprigs over the basket lids. This was to keep the spirits out of the booze in the night. I was told later that if 'those who live in the graveyard' drink first from a *tesgüino* jar it will lose all its strength and won't get the living drunk. No sooner had we settled down, chatted in the dark companionably and let the silence of drifting sleep fall in the house than the three-year-old boy who had been sleeping in Crescencia's bed woke up, and finding his mother gone, started screaming. He was outraged, stiff with anger, screaming. He got up, was momentarily quieted in wondering if I was his mother as I rustled in my sleeping bag, but then screamed again, ran over to the door and stood at the hinge crack, frustrated at being trapped inside. Crescencia eventually got up, opened the door and yanked him out under the moonlight, showing him where his mother was, down below in the town center. He just screamed. Must have been at least an hour of vigorous, high-decibel screaming. He stopped when his mother came back with the guitar players. Another hour of brisk rancheras belted out at the top of drunk lungs. I somehow dozed. Until adrenaline pheromones suddenly filled the air when Tomás, one of the middle school students I had been in class with earlier that day, burst into the house violently, cursingly drunk and wanting more *pisto*. He is stocky and strong with a newly shaved head and the baggy pants of a *cholo*. He fought and cursed, kicked and swung at the men, who laid aside their white cowboy hats and guitars to grab him. I was reminded of the cow roped for slaughter I had seen earlier that day lurching against her captors. Twice he was bodily thrown out the door and twice he burst back in with a bang, breaking through the flimsy lock, a big nail bent to swing across the plank door. He threatened to strike Crescencia and called her terrible things. All the rest of us women and kids were huddled at one end of the room but she stood her ground at the threshold, trying to reason with Tomás and insisting that he get out. Again I admired her. Finally the men in the room decided to take care of him once and for all and went out after him saying that they would truss him up and lock him in the *presidencia* if he didn't clear out. I only heard the thumps. We all decided to go to ***Sowétare*** ("swallow") rock shelter where the main party was so as not to leave anyone alone in the house. We walked along the rocky cliff path wrapped in our *rebozos*, the moon bright. Looking back I saw Tomás being flung down the hillside and lie still. I hoped he wasn't dead. It would be easy to break a neck on these steep bouldered cliffs. I was

relieved to see him get up four or five minutes later and stagger across the river to the school dormitories.

Drinking and pissing at the cave. Stirring the beef stew ***tónari***. The dancers had moved up there and continued to dance and drink at the edge of a steep cliff. We went back to Crescencia's house at about five in the morning. I may have slept a half-hour or so. Then up at six. Crescencia had already de-boned the chickens and made tacos and *ocote* crosses to put in front of the *tesgüino* altar. Kneeling, crossing ourselves in turn. Orchestrating a *pascol* dance out of the house to the guitars. I carried a two-gallon jug of *tesgüino*. We went to the Basíhuare graveyard. Delay as the best entry was discussed. *Maguey* leaf was found and put in a plastic baptism souvenir glass with some river water. The sun's rays finally reached into the valley and warmed us. We danced into the yard, around the rock piles that were graves, turning in circles and crossing ourselves at each. Several other groups were there, dancing and playing guitars at the gravesites, offering *tesgüino* to drink and tortillas to the sunken, weed covered graves. Short speeches of thanks to Crescencia's dead husband, earnest talking to him, in the first person. "You were good to my daughter who was your wife. ***Matéteraba***." The musicians cried; they were his relatives or his good buddies. Crescencia was dressed beautifully, with bead earrings, her lime, blue and pink outfit on and her good plastic *huaraches* with heels. She had prepared everything to a T for her dead husband but did not cry. I thought I saw a gleam of irony in her eyes when her husband was praised. She had told me he was an abusive drunk, but she had also told me that she spent many sad years after he died.

Stereotypic Rarámuri female behavior is quiet, soft-spoken, modest and shy, most especially with strangers, while males can be more outgoing and vocal. In reality, diverse personalities are expressed by both sexes. Children up until the age of five or six are allowed relatively free expression of their emotions, but as they get older girls and young women are more firmly socialized to avoid unrelated members of the opposite sex, to be soft-spoken in the presence of others, to be nurturing, strong, cooperative, responsible and to avoid conflict. Boys are socialized similarly, but are allowed more freedom of movement and a wider circle of social interaction,

which only increases as they mature into men. Older women and men, especially past child-rearing age, enjoy relaxation of the social norms and often become more outspoken and interact more freely with both sexes. Many of these stereotyped personalities break down during *tesgüinadas* (drinking parties). While drinking, it is culturally expected and accepted that both men and women more freely express their aggressions, resentments, jealousies, attractions and affections.

Middle age and old age

In middle or old age Rarámuri men will assume public leadership roles. Political leaders are ideally elected for their experience, ethical integrity and spiritual wisdom, all of which are thought to be undeveloped in the young. Healers, sorcerers and spiritual leaders, almost all men nowadays, are self-identified or chosen by God through dreaming, usually during middle or old age, though some are chosen in youth. Middle-aged women may take on more vocal and influential leadership roles within women's social circles, and in general may behave more freely. Elder women and men who can no longer subsist on their own are considered the responsibility of their younger relatives, and ideally are fed and cared for by their families until their deaths and after, in the form of death fiestas. Elders are generally respected as sources of wisdom and tradition.

Death

According to one ***owirúame*** I talked to, babies are born with predetermined life spans in the form of sheaves or 'books' of papers or '*registros*,' which count out the years or months that have been allotted to that person. When people approach death, this personal 'book' is returned to god. ***Owirúames*** know how to petition for additional books when people are ill and at death's door. The healer might say, "*Ya está acabando su libro. Vamos a pedir otro; aver si hay chanza*" (Your book is almost done. Let's ask for another one; see if there's a chance [that our petition will be granted]). After the accidental death of a teenage girl who was swept away by a flash flooding of the Urique river in August, I asked one of her relatives about the circumstances of her death, and he replied, "*ya se le acabo el tiempo*" (her time was up). I pressed, asking if she had been bathing in the river at the time, and he replied that she was fishing at a waterfall (thus did not hear the roar of the flash flood), but that was not the reason she died—she died because her time was up. The dead and their family members need to be 'cured': "the invisible ties that link the deceased to their family members are cut with a knife, deer antler or cow horn, or fire—some glowing corn cobs—so that he will not want to take them with him nor make them ill, which he might want to do out of loneliness" (Cardenal 1993:226, my translation). These ties are like ***rumigá***.

Dead babies can be a source of danger for their families and, indeed, their neighbors as well. They have a close link to God, presumably because they had recently left his domain to be born on

earth, and will talk with God after death, telling him to punish their parents if they did not provide proper food and care. One mother of six told me that many years ago, when her oldest son was a baby, he was crying for milk, but she was too busy cooking to feed him right away. That night she dreamt that she was speaking with God, who chastised her, saying, "Why don't you take care of your babies? If you don't take care of them I will take them back." The next morning her son woke up ill, and she resolved to pay more attention to his needs. The following excerpts from my field notes give an account of the tragic death of the 15-year-old daughter of one of my closest collaborators, a talented basket weaver I knew well who suffered from epilepsy. Spasmodic attacks among children and teenagers are disturbingly common in this area and were frequently cited as the reason for summoning healers and going to the clinic; some were due to cistercercosis (a swine-borne parasite that can form cysts in the human brain that cause attacks): others diagnosed as epilepsy, though perhaps more investigation is warranted to confirm the diagnoses. The second excerpt below was recorded six months after the first and illustrates the after-death process for the living and the dead—the newly deceased take some time to fully comprehend or accept their condition and try to engage their loved ones, whose responsibility it is to counsel them on how to move on. This period can be difficult, but in this case it seemed less frightful for the survivors than bothersome and sad (for more on death see Merrill 1988:153-190).

> *Monday, March 26 2002 clear skies, hot, blue*
> Yesterday Sabina died. She had an attack near the stream, fell into the shallow water and drowned. Her two-year-old brother was with her, minding goats down where they pile up

the pine logs. He ran home to tell his parents; his mother and sister went down there and found Sabina already dead. The sister was sent home to notify her father, who was curing the little boy of the *susto* he had taken. Her father brought home her body in a wheelbarrow. I had gone to Creel in the morning with several sick kids; I came home with two Mexican former schoolteachers who were visiting for Easter week. Upon our arrival in the evening a couple girls stopped our car as we drove into the valley and told us the sad news. The teachers, a Rarámuri neighbor and I went to pay our respects and convey sympathy. The family was in bed except for the father. He was still in shock, hair askew. Sabina was laid out in the little plastic sheet-walled room attached to their log cabin, candles lit at the head of the bed, dripping wax in broken glass mugs. Beside her on an upturned cardboard box was a stereo, a tied wire antennae snaking out up to the roof. Her comb, a plastic cup with *pinole* water and a spoon, a pocketknife. She was wrapped up entirely in a plaid blanket. On the bed at her side were her wear-frayed skirts and a *rebozo*. Outside a short distance from where her head lay, a hand-made wooden ladder had been placed, leaning on the upper branches of a peach tree. Scant peach blossoms glowed pink in the moonlight. The house is wholly built atop a huge flat boulder surrounded by peach trees. From the threshold of the log house there is a flat rock porch. One has the sensation of being up among the branches of the peach tree growing below. The lower rungs of the ladder were draped with Sabina's skirts, rebozos, a man's pair of jeans and higher up, a baby's zipper suit. I imagined that the ladder was placed to lure her souls straight up into the sky, where the stars shone in the night. In actuality, I don't know that the ladder's placement was significant or not. We stayed an hour or so, accompanying the father in his wake. Early the next morning I could see from my house that family and neighbors went by to visit them in turns, and some stayed to help nail together a pine board coffin. I went back to their house in the late morning. I strung together a necklace of four job's tears seeds on orange nylon twine (Sabina's mother was doing it and juggling a nursing baby at the same time, so I offered to take the necklace from her). Sabina's paternal grandmother tied it around Sabina's neck. Sabina's mother cried quietly when her father-in-law cured the dead body with a lit match—he made crosses above her head, her chest, her legs; and then repeated these actions with maguey water. Sabina's mother went to one side of the house, out of view, and tried to compose herself before coming back into public. The grandfather gave a short ***nawésare***, addressing Sabina, his voice breaking. That's when I cried too. The women got together her things as though preparing her for a journey: two plastic bags stuffed with her ***sipúchis*** (hand-made

skirts), ***napáchis*** (blouses), and *rebozos*. They put in four corncobs of beautiful speckled blue and yellow, her anti-spasmodic pills and a small box of her jewelry and trinkets. A handkerchief bundle with *pinole*, tortillas. A tiny bucket in which to mix pinole and a bottle of water. People finished off a quart of *pisto* between them and sent for another liter. The coffin was finished. I offered to ask to borrow a truck to take the coffin to the *camposanto* (cemetery). I met them at the dirt road; they rolled the coffin up there in a wheelbarrow (they had planned to wheel her all the way up valley) and we drove her to the cemetery, about two kilometers up the valley. There four or five men unloaded the coffin and walked it counterclockwise around a rotting post, which I then realized used to have a crosspiece: a cross. Finally they set down the coffin, deliberated over where to dig the grave, considered the water drainage, decided on a spot next to the deceased's uncle. Dug the grave. Laid all the things of Sabina's in the coffin, nailed the lid on and lowered it down. Another ***nawésare*** by her grandfather. Throwing handfuls of dirt in. Sabina's mother brought her two-year old son over and urged him repeatedly to throw in dirt, showing him how to do it. A young girl stepped on a small grave nearby and was thoroughly reprimanded by her father. Large rocks were placed around the dirt pile and we left. There is still a glow of candlelight from the bereaved family's house that I can see out my window now as I write, about half a kilometer away.

Friday, September 06, 2002

Last Friday at a *Santa Rosa*—green corn or first harvest—*tesgüinada*, a young mother commented to me that the two girls who died recently come around bothering her at night, tickling her in her bed. She described seeing and talking to Sabina the day she drowned. She and her brother came by her house for pinole on their way downstream, and told her: 'I am never going to die. I will get better (referring to her attacks) and live for a long time.' After Sabina died my *tesgüinada* companion had to chide her several times, reminding her that she was dead and had to move on. Her ghost would come bothering, tickling at night. Now it no longer happened, but now another dead girl, the one who was swept away in a flash flood, comes around bothering her. This was her cousin and she was very fond of her, like a sister. She had lived a sad life, she said, with a relative who didn't like her, who sent her off taking care of goats all day alone. If she took any of his children with her, he said, he would hit her. When she was at the river about to be swept away, he just watched and didn't help her.

> Sabina's father told me a couple days ago that after his daughter's death he too saw her sometimes coming over the hill from downstream. She would call out to him, saying 'Take me home with you, why are you leaving me behind, take me home with you.' She would hold on to his leg and drag along after him as he walked. He had to tell her that she was dead and must move on. He said he hadn't felt her presence until a little while after she had died. He hasn't done a death fiesta yet because he doesn't have any *tesgüino* pots and hasn't been able to afford it. His wife is planning to make some pots but they won't be adequate for making *tesgüino* for a while yet. (You have to put fermenting *tesgüino* in them at least 5 times to let the *tesgüino* 'get in to the pot' so it will ferment alone in it.) They are planning a first death fiesta for Sabina on the 2nd of November.

Rarámuri include all bodily parts and products as important components to their whole selves, which they will need after death to proceed to the next life. Because of this there seems to be a prohibition on burning bodily fluids, and an effort to keep track of body pieces lost over a lifetime. For example, at a birth that accidentally took place in the back seat of my Volkswagen beetle in Rejogochi valley, the cloths and paper towels that had been soaked with the mother's blood and afterbirth were preserved, kept together in a pile. When I offered to dispose of them, the father said he would have to make sure they were not burned or the mother and baby might break out in a rash (see Zingg et al. 2001:34 for a similar account). He said his wife would bury them with the afterbirth. This may play a part in why women say that they want to bury their own placentas, and some women have a favorite place in the mountains for giving birth and burying the placentas of their babies. One mother of six told me that she preferred to give birth in a special place in the forest about 5 km away from her home, up and over a couple thousand feet of precipitous cliffs. It may also be an important spiritual tie that

links people with their birthplaces. A friend commented to me once with tears in his eyes, while drunk in Guaéachi, that his placenta was buried up on a pine-covered hillside. He gestured towards it, above his childhood home in Guaéachi valley, and that he felt a very strong emotional attachment to the place. His mother had carefully shown him the spot when he was a boy so that he would know where to collect all his body parts after death (the placenta is likely conceived of as belonging to the baby rather than the mother). Later, two Rarámuri teachers at the secondary school who are originally from Norogachi area explained to me that after death, every bit of the living body must be sought; only once a person has found and collected all bodily fluids and body parts may they go on to 'heaven.' This includes mucus; I was once chastised by an older woman for blowing my nose into a tissue and throwing it into the fire.

Interpersonal and emotional life within the family

Biological mothers and fathers are the primary caregivers for children, but from birth babies are cared for and socialized by an extensive network of family. Older siblings, especially sisters, spend a great deal of time carrying, feeding, and entertaining children. Grandparents, aunts, and cousins often play important caretaking and socializing roles too. Though women spend the most time with babies and children, and are thus the primary physical caregivers and discipliners, both men and women are openly affectionate and tender with youngsters, and both take responsibility for guiding and socializing their children. Babies are cherished as 'gifts from

Onorúame (God/ he-who-is-father)' and are closely attended, breast fed, and seldom out of bodily contact with their caregivers. Children stay near home or close to their mothers or sisters as babies and toddlers, but by the age of four or five are considered to begin 'thinking well' enough to venture out accompanied by siblings or other children, to play, explore, gather wild foods, and help herd goats. Around this time girls and boys will tend to form separate peer groups if there are enough children near their homes, and they begin to learn and play overtly gender-specific roles, such as grinding clay to make mud tortillas and driving wooden trucks around extensive miniature dirt highways. Kummels (2003) made a similar observation in Kaborachi. Fathers increasingly take sons to help them in their tasks, and girls accompany and help their mothers in theirs. As children grow, girls are usually closer to their mothers and boys to their fathers, in confidences shared, friendship, and mutual cooperation.

Children have especially close and affectionate relationships with their grandparents, who are respected and cherished for their role in imparting traditional values, stories and technologies (Merrill, 1988:59; Kummels 2003:69). '***Ramoélma'***—joking play—is expected between children and their classificatory grandparents (which includes great-aunts and great-uncles), aunts and uncles, and between in-laws, especially brothers and sisters-in-law. Sexual joking occurs equally between relatives of the same sex or opposite sex and includes young children and babies. Aside from this sanctioned joking children and adolescents, especially females, are not encouraged to express their sexuality in public, and adults primarily while drinking.

Thursday, 22 August 2002
Tesgüino at Remedios' and Quirino's place. Men hoeing beans. Women cooking, cleaning wool. Remedios's young daughter was there, with her 6-month-old son and husband. Extensive ***romoélma***—me as her ***ripolí*** (sister in law)… with frequent asides reassuring me that they were only '*vagueando*' (fooling around). Santa Lucía, Seferino's (Remedios's teenage son) classificatory grandmother, I guess, pretended to fight me for him and pretend fought with him. When I brought a *hueja* (gourdful of *tesgüino*) for Remedios, Santa Lucía said loudly, "Why don't you give some to Seferino—he's sitting right there"—and in Spanish, "Give him some squash to eat". This was met with raucous laughter. Remedios' daughter pointed out Remedios to her baby, saying "Look, there's your wife. Isn't she good-looking?" And Remedios responded by licking her hand suggestively from the wrist to fingertips, laughing (with everyone else) and then licking her hand again. Seferino repeatedly called his six month old nephew '***we nasinákuri***' *mira que gordo está* (so lazy—look how fat he is).

Beyond family members, the elected authorities are considered responsible for the moral education of youngsters and may be called on to chastise or advise a child who has seriously or repeatedly misbehaved. A large proportion of children with access to schooling do attend, starting at about age six and depending on whether they are needed at home to care for goats or younger siblings. Often one daughter in a family is exempted from schooling to stay at home and help her mother in household tasks and in raising younger siblings. In general, boys are more encouraged than girls to study past the sixth year, as it is considered more appropriate for boys to learn Spanish, interact with Mexicans and foreigners (generally those in control of the schools) and work outside the community. Rarámuri siblings and cousins form close ties that last through adulthood. Unmarried teenage girls will often spend a great deal of time working to help their married siblings and cousins with child rearing, cooking and work in the fields.

Daily life for Rarámuri children

Play

Rarámuri children spend a good deal of time at play, that is often integrated into their work and other responsibilities. I rarely saw large groups of mixed-gender children at play, except when orchestrated by schoolteachers or on school grounds. Most children play alone, in groups of two or three, or in larger same-sex groups. Latorre (1976:61) recorded mostly solitary play on the part of the three-to-four-year-old girl in her study. Zingg et al. observed in the 1930s, "[q]uite frequently, I saw the little children alone or in pairs playing with stones, plants, or rocks in lieu of human playmates" (2001:35). He goes on to speculate that Rarámuri children's isolation in youth is a central factor in their personality development, "making them ill at ease even when they are together." Though I think may be more likely that Zingg observed people to be ill at ease because of *his* presence, I agree that children's experiences playing and working in the magnificent landscapes of the Sierra Tarahumara, and their self-sufficiency and independence while minding livestock, contribute to personalities that can cope with social isolation. Nonetheless, over the past few decades in the Rejogochi area, many families have moved closer and closer to the main valley if possible, sometimes abandoning far-flung *ranchos* as being too lonely.

Boys and girls race regularly in Rejogochi; boys run ***rarajípa*** (kick-ball races) and girls ***ariwéta*** (hoop-and-stick races). Though children often stage 'practice' races for fun on their own, serious

races are regularly held with the full involvement of the parents of the racers and other adults. The children are expected to assume all the roles of an adult runner, which include inviting people to wager on behalf of his or her team, orchestrating the betting before the race (sometimes a four-or-five-hour affair), and distributing winnings after the race. These races situate children as central actors for their local communities, because adults and other children stake significant material possessions on their team winning (see Figure 3.3). It has also been suggested to me that racing plays a part in keeping God happy enough to send rain. Parents become very invested in their child's team success, and, like soccer parents in the U.S., they encourage, coerce, wheedle and scold their sons or daughters. They support their runners with juniper or alcohol leg washes, coffee, *pinole*, water and food and perhaps even sorcery as they run laps with their team throughout a night of racing. Mothers and fathers will run along for stretches, yelling instructions, or ***iwériga iwériga*** (have strength, have strength), or, simply, ***tá tá tá tá tá! tá tá tá tá tá!*** Once, running with the racers for a stint, I saw one elderly man, the grandfather of the boy who was one of the main racers, make all the runners laugh, even though they were tired, by running in front of them and hopping along on one leg with the other in the air, farting profusely and loudly.

Children become excited and exuberant during racing. The director of the secondary school told me of a time when he was giving one of his 11-year-old students, an accomplished ***ariwéta*** racer, a ride back to Rejogochi from the Basíhuare school, at dusk. Coming into the

Figure 3.3. The two main runners in this boys' race negotiate the betting between down-valley (seated on the left under the school eaves) and up-valley (not visible, to the right) wagers. Here they are matching wagered clothes items; approved wagers are in two piles next to them. August 2002.

valley proper, the truck's headlights picked out two groups of young runners with their pitch-pine torches, kicking their wooden ball ahead of them. Normally a quiet and shy girl around adults, she became so excited watching the race that she started yelling out to her teacher, "There's the ball, shine your headlights over there...," and finally jumped out of the truck and joined the runners in the night.

Another game is called ***nakibúri***. Two old corn cobs (without kernels) are tied together with a short length of string, cloth or fiber (about 4 inches), and this is flung ahead of the girl or boy with the curved end of a specially made stick. Children (mostly girls,

but some boys too) play this at a leisurely pace, often alone or in pairs as they meander across a valley minding their goats or going to school. It was reported to me as introduced from Guaguachique, and it has caught on in Rejogochi.

Track-making is still a popular game among young children. Children tie or hold tin cans, bottles, or other objects on their hands and hop along like rabbits or toads to make four-footed tracks. Zingg (1932:108) mentions children using specially carved sticks to make goat or cow tracks. When I asked adults in Rejogochi, they remembered playing with such toys in their childhood. Small tires or carved wooden wheels attached to sticks for rolling through the dust are also common toys. Young boys also like to tie bunches of long grass together across paths so as to trip people.

Collecting: I have observed some prodigious collections of plastic soda bottle tops saved by children in big plastic gallon jugs. In one house I noticed a large lard bucket filled with hundreds of oak galls (***karápisi***). When I asked about it, the 9-year-old daughter shyly admitted that it was her collection. Her grown-up sister and brothers elaborated, saying that they too, when children, would collect as many oak galls as they had goats, and play with them, herding them along paths and slopes while they also watched the live goats under their care. "We taught ourselves how." Children also create dolls out of natural materials, for example, the brushy ends of pine branches are tied to create skirts and wrapped in cloth. Children remember playing the game of pretending to be bulls fighting, with branches held to their heads, also mentioned by Zingg et al. (2001:65) in the 1930s.

Miniature worlds: the most common artifacts of children's play are their imaginative creations in the form of miniature houses, *metates*, trucks, and highways. I come on these imaginative worlds in settlements and while hiking far from any *rancho*, made by children while they let their goats and sheep graze. One consultant led me to an area where he had played as a child, where his young brothers maintained a complex network of highways ground into a large flat sandstone rock by stone trucks (see Figure 3.4). He explained that the entire Sierra Tarahumara was represented in this map, showing me the road to Creel, Guachochi, Chihuahua City, and Batopilas. He was amused to see that his brother had recently 'paved' a long section of highway with red clay.

The majority of these works are domestic recreations, mostly by girls and young boys. A house or work area may be laid out with rocks, sticks or *rebozos* as walls, and filled with an ordered collage that creates endless opportunity for play, in parallel to adult worlds (see Zingg 1932). Adults generally ignore these creations; I never observed an adult playing with a child in the child's territory. Indeed, adults seemed uncomfortable with my interest in the topic, probably because it was seen as a lack of respect for the children's privacy. Children never invited me to play; even children who in other circumstances were regular friends became insulted or hostile if I attempted to invade their play spaces.

Figure 3.4. Carved 'highways' representing the road systems of the Sierra Tarahumara. The young man pictured here helped create them as a kid; now his younger brothers play here.

Dangers in the landscape

The Rarámuri landscape must be navigated with some care, especially by children, the most vulnerable members of society. The following are general dangers for anyone, but they especially affect children because they are less developed, less strong, and less able to defend themselves.

Walúroa/ walúluwi: these are water monsters/snakes that inhabit certain pools in streams and rivers. They are especially dangerous for children. My neighbor was very vexed with her 5-year-old son and nephew when they crossed the bridge over one such pool alone, as they

were unprotected and could become ill (diarrhea or worse) on account of the ***walúroa*** there. While I lived in the Sierra, a story was circulated about a snake living in the artificial lake Arareko, near Creel. Several people told me that in recent years an enormous snake, a hundred feet long and a meter in diameter, had been coming out of the lake and eating Rarámuri women and children who sell artisanry at the shore. When it attacked some tourists, the police came out and shot it with their pistols, but it just retreated back into the lake (giant snake tales are found throughout Middle America and the Western United States). Brambila (1983:584) mentions that ***wasároa*** (*Palo mulato*) is used as an amulet on a necklace so that children are not attacked by serpents at water holes. The community of Rosákachi is said to have a somewhat treacherous resident bull (*toro*) that snorts and blows underwater at a particular water hole, though with the recent drought, it has been absent.

Ripíbiri: if one of these small whirlwinds/ twisters passes near or over a person, it can 'hit' them with a hunch back or a bad knee, perhaps by disrupting the flow of soul-strength in that part of the body. This can be remedied with a juniper bough sweat ceremony. One woman told me that when these are seen traveling along paths toward someone's house, that household may expect a death in the family.

Konomí: rainbows are considered dangerous for children and women. From a young age children are taught not to look at them.

Kosémi or ***ba'wichí piréame***: diminutive water people who live under streams, rivers and seas. They are responsible for clearing the waters of flotsam and debris, which they stack on the shores. They do

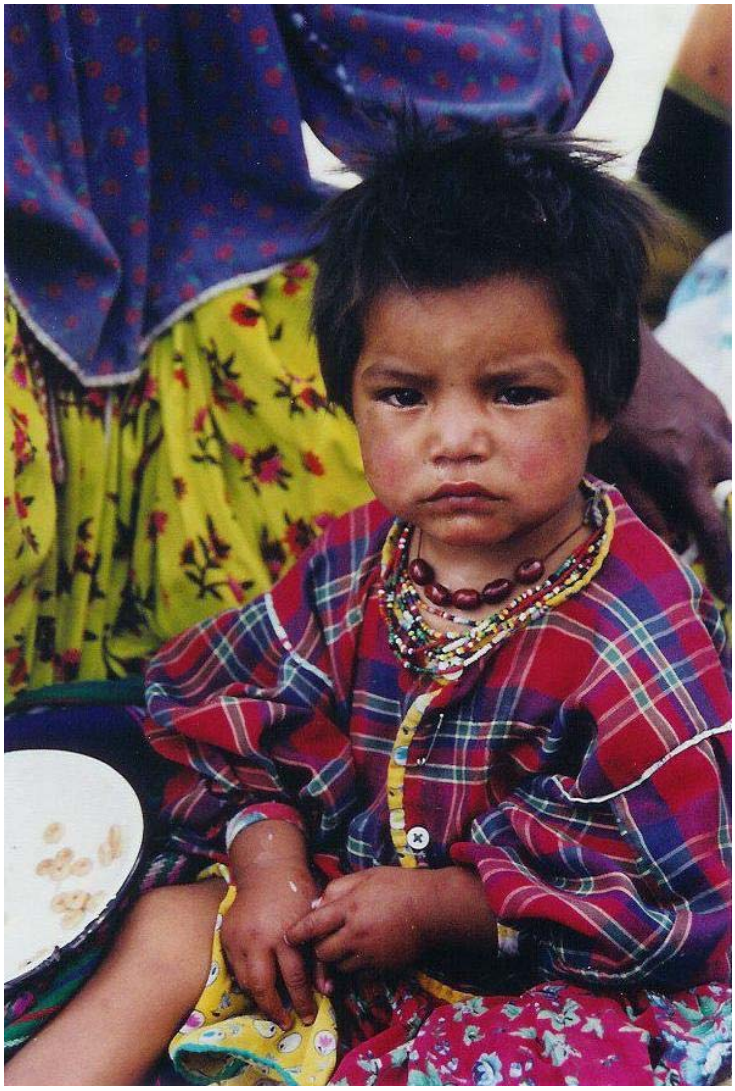

Figure 3.5. A two-year old girl wearing an *Erythrina flabelliformis* (***waposí***) seed necklace to protect her from water-associated beings.

not eat food, but subsist on the vapors and smells of food, which explains why they do not have anuses (***"kosí"*** means anus). According to one source, ***kosémi*** eat by holding their foods in front of them, sniffing in the essences, and then they announce, "Now I'm going to shit," and throw the food over their shoulder.

Other people and animals live under the streams in mirrored lives to those above ground. Though not generally harmful to Rarámuri, they

are occasionally blamed for or implicated in taking lives, as in the case of a teenager who drowned in a stream while I lived in Rejogochi. I attended one curing ceremony that was aimed toward communicating with and mollifying these people, because a young boy in the family who lives near Rejogochi stream had been repeatedly ill. An ***owirúame*** lectured and petitioned the water beings after a juniper sweat bath and paid them several stacks of coins in return for leaving the children in peace. (The coins were old Mexican pesos from before the 1990s devaluation; I later asked the ***owirúame*** whether the underwater people cared that the coins were of little worth, and he grinned and said, "No, they don't know the difference," then implied that what was worthless here was valuable down there and vice versa.)

Sukurúame: sorcerers or witches, those who chose the black paper when offered it, are a constant threat to children. On September 11th, 2001, while I was washing clothes in the stream with the school laundress, Epigmenia, she told me that her sister-in-law had seen a giant bird flying over the mountains from the direction of a nearby inhabited valley. Tied onto the bird's back was a young girl. This was how she knew that a child would soon die in that valley, which did occur, according to Epigmenia, a couple weeks later. This was related to me as though seen in waking-time, I asked repeatedly, "She saw that with her own eyes? Right there?"—the mountains she referred to were right in front of us. In retrospect, it was likely to be a dream-time observation, which Rarámuri generally count as direct experience. Epigmenia then told me that she had heard on the radio that several

planes had crashed into buildings in my country that morning. That story I thought hyperbole.

Wichurí: (*Mammillaria* sp.). In the Rejogochi area ***wichurí*** refers primarily to a species of spiny ball cactus that grows in the surrounding mountains (cf. Bye 1979a:31) and is feared as a powerful spirit being akin to peyote. Children are especially vulnerable to it if they touch it or eat its flowers accidentally. One young man commented, 'When out in the woods logging, one time we were about to drag a trunk right over a ***wichurí***. The other man stopped the horse and said he didn't know what to do as there was no other way around the cactus and he was afraid that his neck would get twisted backward if he scraped over the plant. I scoffed and said I wasn't afraid of it, picked up the cactus and moved it to one side so we could continue.'

Rikúhuri: (*Datura* sp.). Touching this plant can make a person's souls vulnerable to kidnapping; people are liable to wake up in the night to find themselves at the pinnacle of a cliff, not knowing how they got there.

Híkuri (*Lophophora* sp. and others): The dangers of this plant-spirit may linger for decades or even centuries in the receptacles used to contain the plant. One woman, when asked if any artifacts or bones from rock shelters are dangerous to touch or take away, replied that it could be dangerous to touch potsherds that had held ***híkuri*** or ***bakánowa*** in the past, because those who harbor and use such spirit plants usually store them in rock shelters far away from their dwellings, so as not to inadvertently harm children or others who might come in contact with them.

Wild animals: Rattlesnakes, other poisonous snakes, and certain lizards (especially the ***ropojó'pari***) are watched for as dangerous. Bears and coyotes are often cited, often jokingly, as dangers to women and girls; bears are called ***apalóchi*** or grandfather by Rarámuri and are thought to have a propensity for kidnapping women to keep as concubines. Praying mantises are killed on sight as dangers to livestock because if they are eaten with fodder they cause the stomach to bloat.

Lightning: as mentioned before, lightning is considered a continual threat, especially for children who are often out on rocky outcrops with their goats and who are less likely to survive a strike. I met one elderly man at a *tesgüinada* in Aboreachi who asked me if I knew of any medicines for burns. I mentioned a couple and asked him if he had been burned. He said he had been hit by lightning recently, and showed me a massive burn running from his fingers up his arm, across his body and down one leg to his foot.

Children's work

Children participate fully in household tasks, such as fetching water and firewood, cooking, and minding animals and children. These are often performed with other children, providing opportunities for knowledge exploration and exchange (Figure 3.6).

Children between the ages of about six and ten are often the primary responsible caretakers of a family's goats and sheep. They spend the majority of their time taking livestock to graze in the forest or meadows, bringing them back to fertilize their family's

fields at night. This energetic input of manure on the corn fields is an ecological keystone to Rarámuri subsistence; without it or some other fertilizers most cornfields would be depleted after a few harvests. Thus, children's labor is an essential part of the Rarámuri ecosystem. Formal schooling often disrupts these family responsibilities—families who send their children to school may keep one child home, who then may get a disproportionate share of daily tasks. Or, if the herders do go to school, they miss a great deal of school while they balance both responsibilities.

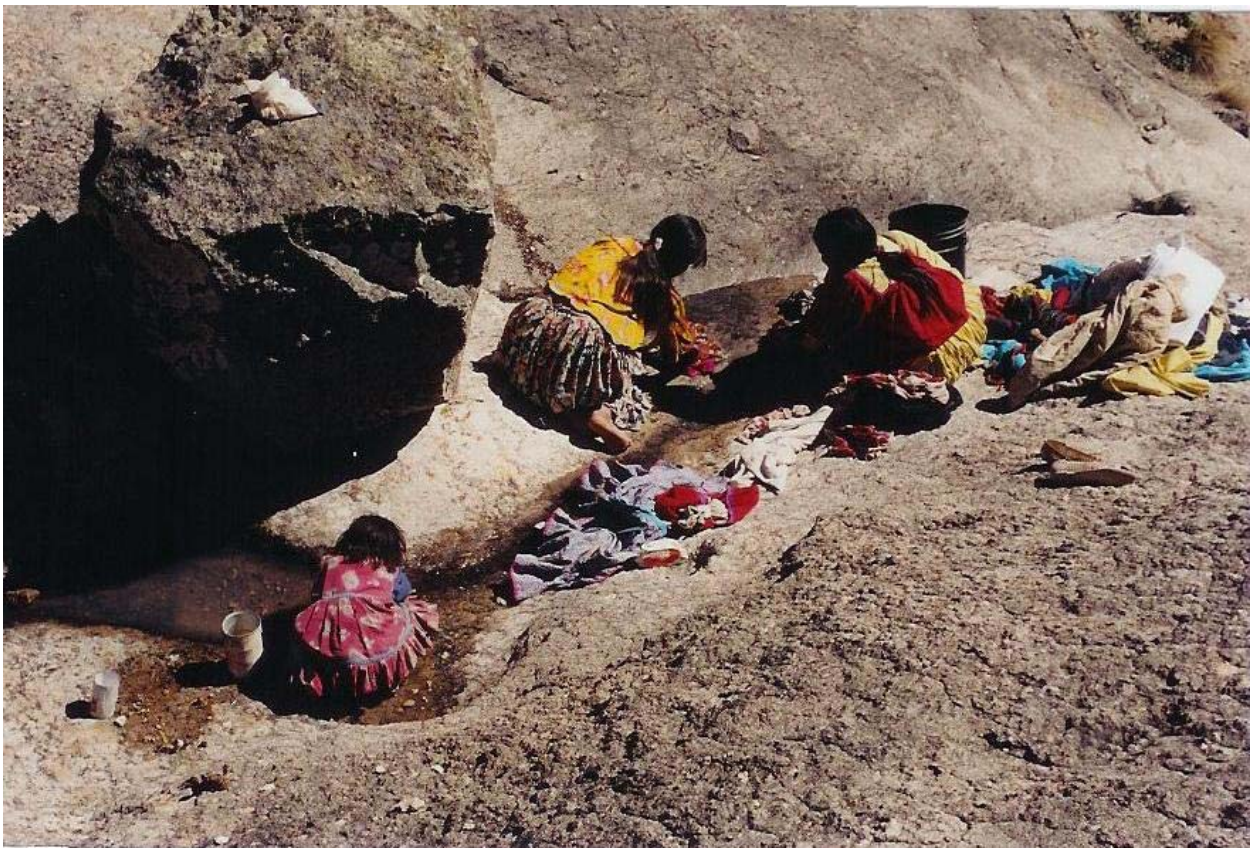

Figure 3.6. A toddler, her teenage sister and mother washing clothes near their rock shelter home near Rejogochi. Winter 2001.

Table 3.1. summarizes the results of interviews with Rarámuri girls and boys about the kinds of work they do. Their responses varied somewhat according to what time of year they completed the interview; they were more likely to report the tasks of the season, such as plowing, planting, harvesting, and such.

Some children go along with their parents to do agricultural or other work for cash in other parts of Chihuahua, Sonora, or Sinaloa. One young man between ten and twelve, who is extraordinarily knowledgeable about plants and became the man of the house when his father died of pneumonia in the summer of 2001, spent six or more weeks in the spring 2003 doing agricultural work out of the state, traveling with an older, unrelated man from Rejogochi. Though he was able to bring back some cash for his mother, it was also said that about half of his wages were 'confiscated' by his traveling companion, and he returned with some health problems such as swollen limbs.

Children, *tesgüino* and other alcohol

Children often form small bands and rove from place to place while their parents are drinking, sometimes for days. The older ones take care of the toddlers and babies, fix food and light fires at night. Often they seek out relatives who were not out drinking to stay with. These groups of kids often came to my house if I was not out drinking too, where I welcomed their company with hot coffee and books and crayons. During the big fiestas, though, when all the adults make the trip to Basíhuare for several days and leave their children at

Table 3.1. Rarámuri girls' and boys' work (self-reported).

	Task Description	# of Times Mentioned	% of Respondents Mentioning	Average Rank (per respondent)	Smith's S (Salience measure)
GIRLS	FETCH WATER	30	68	1.367	0.608
	MAKE TORTILLAS	20	45	2.35	0.283
	WASHING	18	41	2.5	0.257
	FIREWOOD	15	34	2.333	0.184
	ANIMAL CARE	9	20	2.667	0.114
	MAKE PINOLE	8	18	2.75	0.114
	GRIND	6	14	2.333	0.089
	COOK	5	11	2.6	0.065
	SWEEP	5	11	2.8	0.066
	CHILD CARE	4	9	2.75	0.042
	FIELD WORK	3	7	3.667	0.035
	NOTHING	2	5	1	0.045
	TOAST CORN	1	2	2	0.017
	SHELL CORN	1	2	1	0.023
	MAKE BEDS	1	2	4	0.009
	SORT BEANS	1	2	5	0.005
	ARTISANRY	1	2	1	0.023
	WAGE LABOR	1	2	2	0.011
BOYS	FIREWOOD	54	89	1.667	0.683
	FETCH WATER	36	59	2	0.398
	ANIMAL CARE	16	26	2.625	0.136
	PLOW	13	21	1.615	0.179
	HARVEST CROPS	7	11	1.429	0.105
	PLANT FIELDS	5	8	3	0.037
	STUDY	4	7	2.5	0.044
	ADOBE BRICKS	4	7	3	0.026
	LOGGING	2	3	3.5	0.014
	WASHING	2	3	2	0.022
	NOTHING	2	3	1	0.033
	HOUSE BUILDING	2	3	3	0.014
	COOK	1	2	3	0.008
	HARVEST APPLES	1	2	2	0.013
	MAKE TORTILLAS	1	2	2	0.013
	CLEAN UP TRASH	1	2	3	0.005
	SHELL CORN	1	2	2	0.011
	BATHE	1	2	3	0.010
	WEEDING	1	2	2	0.012
	GUARD FODDER	1	2	2	0.012
	SELL FRUIT	1	2	3	0.008
	HELP MOTHER	1	2	3	0.005
	MIX CEMENT	1	2	2	0.012
	CHILD CARE	1	2	3	0.005
	GRIND	1	2	6	0.003
	EVERYTHING	1	2	2	0.011

home to mind the livestock, only children populate the valley. For some this is a time of freedom and fun, but generally it is a stressful and anxious time for the children left behind.

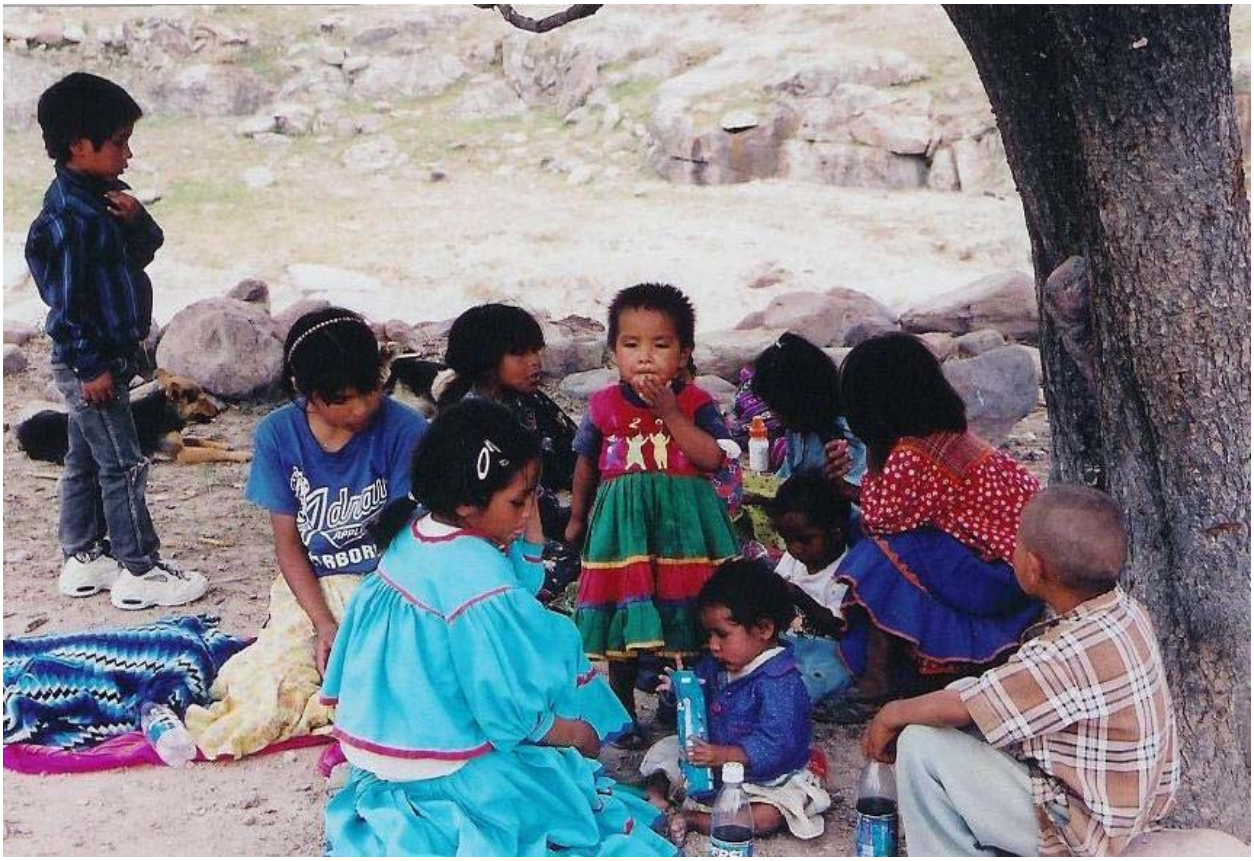

Figure 3.7. A "*tesgüino* pack." This group of children formed when their parents attended a *tesgüinada* nearby. The older girls cared for the babies until evening, when several of them returned to their homes several kilometers away.

The increasing consumption of purchased alcohol (usually *pisto*, white grain alcohol) that occurred after the highway connecting Creel and Guachochi was paved, affects children in negative ways. *Pisto* drinking was implicated in almost all of the accounts of spousal and child domestic violence I heard about or witnessed and was a common topic of conversation among women as a problematic cause of fights,

bad thinking, failure to fulfill responsibilities, and physical and emotional abuse. Among adults children rarely comment on the behaviors of their elders, but they do in their play. In the fall of 2002 I observed three young girls of about 9 or 10 years old playing house in the unfinished adobe rooms of the artisan's cooperative in Rejogochi. Unaware of my presence, one girl stood, pressing a plastic Coke bottle filled with water upon another girl, saying, "***Bajísa***" (drink!) in the manner typical of her elders offering *tesgüino* or other alcohol to guests. The second girl aggressively shouted, in Spanish, "*¡No quiero pisto!*" and angrily knocked the bottle to the dirt floor. I came around the corner at that point and the girls hastily broke up their play-acting, but not before I had eavesdropped on her social commentary.

Chapter 4

Rarámuri Learning Ecology:

Guided Reinvention of Culture

Figure 4.1. Children's Easter observances, coordinated by the local school in Rejogochi and held a week prior to the adult Easter ceremonies. These *fariseo* boys are dancing at the summit of one of the highest mountains near Rejogochi valley, in 'traditional' Rarámuri dress for the occasion. Offerings of beans, maguey water and corn beer are in the foreground. March 2002.

> What do people in this setting have to know and do to make this system work?… If culture, loosely defined as "shared knowledge," is mostly caught rather than taught, how do those being inducted into the group find their "way in" so that the system is maintained? (Wolcott 1999:69)

At a ***tutubúri*** in January 2002 I overheard a Rarámuri friend say, to the party at large, "there are four who are responsible for making sure a child is brought up thinking well: first, his mother, second, his father, third, the healer godparent of the burn, and fourth, the elected authorities." This chapter addresses the question of how children learn what they know in Rarámuri society, with a particular focus on plant knowledge. Chapter Five outlines the results of an investigation of what children know about plants, and possible environmental influences on that knowledge.

As the ***tutubúri*** quote above indicates, educational philosophy and methodology is a topic of interest for many Rarámuri. My ethnographic methodology for this question was primarily informal, listening and observing, and asking for further elaborations on a topic later. When permitted, I did informal focal follows with children in their daily routines (e.g., herding livestock, foraging for wild foods or craft materials and experience in school) to document how children spend their time during different seasons and how they interact with each other. I paid special attention to documenting kinds of knowledge largely in the children's domain (for example, the harvesting of certain wild foods, games, toy making, etc.). I discuss some of the implications of increased schooling opportunities on children's cultural development and ecological expertise. Several themes were

explored in semi-structured interviews with adults. These include adult perceptions of how they learned about plants, from whom and in what circumstances; adult perception of how they teach children and how children learn.

Socialization

Girls and boys are equally valued in most Tarahumara families, though ideally a family has some of both. Gender socialization starts in early childhood, as girls and boys are expected and encouraged to start helping with gender-specific household tasks as soon as they are able to 'think,' talk and walk. Thus, girls learn to prepare and cook food, care for younger siblings, wash clothes and dishes, sew and weave baskets and textiles. Boys learn to fetch and chop firewood, plough fields, and fish. These tasks are only generally gender-specific, and it is common to see either girls or boys performing 'cross-gender' tasks. Both girls and boys herd goats and sheep from an early age, fetch water for family use, gather wild foods, and help plant, weed and harvest corn and bean fields. Children learn their expected roles primarily from parents, but also from grandparents, aunts, uncles, siblings and peers. Mothers and older sisters often use a particular stereotypic voice when chastising or directing small children. It is a lilting, exclamatory tone that sort of grumbles along and then pitches into a high whine and can go on and on until the child does what is required of him or her. Often, the children's response to this is to pout with lips out and brows furrowed, or to snap their heads from side to side, ear to shoulder, ear to shoulder.

The following excerpt from my field notes illustrates an example of sibling socialization.

> *Saturday, 16 February, 2002*
> Several children were over for dinner at my house today. Corpus (age 11) was pushing back and forth good-naturedly with Juanchi (age 7), both boys perched on one chair at the table. Gervasio, Juanchi's older brother (age 10 or so) was on another chair with his sister Refugia (age 2). Corpus and Juanchi hugged each other and pretended to kiss, Corpus joking that Juanchi was his "***muki***" (woman). Then Corpus joked some more, saying that Juanchi was Ramechi, one of the eldest women in the community, a former healer who is now mostly deaf and somewhat senile. Juanchi retorted that Corpus is Tibechi, another old woman they both know. Gervasio looked on disapprovingly, and as the joking escalated, the boys calling me Tibechi/ Ramechi, he pulled on his brother's sleeve and with a whisper face of disapproval said in Rarámuri, "no, don't joke about that…" His facial expression was serious, with warning eyes, a purposeful closing of the eyelids and a minimal sideways shake of the head. The words were whispered so quietly that they were almost just a mouthing of the words. I recognized the face and the whisper, as given to me often by elder women looking out for me at *tesgüinadas* and correcting my actions when I unwittingly broke protocol (by serving *tesgüino* to people in the wrong order, for example, or offering it to men when I should only serve women). The boys kept on with the disrespectful jokes. Gervasio grew more upset, telling his brother to go outside, then in Spanish, "Be quiet. Shut you mouth. Shut up, don't say that." They left shortly afterwards.

Physical punishment is rarely meted out to children (cf. Latorre 1976:57), since any aggression or violence is strongly disapproved of at any time, between any members of society. This does not mean it doesn't happen, however, probably primarily when parents are drunk (and thus not didactic in nature) (Pastron 1974). This is another reason children keep their distance and stick together in groups when adults are drinking. Though I saw only, at most, a cuff to a child's head or slap during my stay in Rejogochi, it is common for adults to recount experiencing beatings in their childhood, usually from fathers

to sons, and verbal abuses from mothers to daughters. Passin cites evidence that Rarámuri sons are especially fearful of their fathers' disciplinary wrath and speculates that there may even be a standard fiction among Rarámuri boys that their fathers killed a man (1943:473). My own experience and observations on children's fear of fathers corroborate this for some families but by no means all—I heard as many positive as negative stories about childhood and relations with parents (all the accounts were from adults—children did not comment on their home lives).

Schooling

The first influences of foreign schooling in the Sierra Tarahumara were felt in the 1600s, when

> …[T]he foot-dragging of adults increased the missionaries' resolve to win the hearts and minds of children, an already time-honored conversion tactic. They concentrated their efforts on catechizing this group in long sessions during which children boarded at the church. Since Tarahumara parents tended to be permissive with their children, it is difficult to assess how the missionaries' bestowal of status on children may have disrupted traditional familial patterns. At the very least, the transmission by elders of advice about good conduct in the customary public sermon was challenged in a similar repetitious format employed by catechists. (Deeds 1998:15)

Deeds cites the report of Tardá and Guadalajara, (15 Aug 1676, fols. 377-78): "*ni el padre va contra lo que quiere su hijo*" (even the father will not go against what his son wants). She also mentions reports of parents becoming enraged by corporal punishment meted out to their children (this could in part be because a violent blow can put a child in danger of soul-loss and serious illness).

An important factor in Rarámuri educational environments today is the presence of three schools in the area, first, a primary day/boarding school run by the Mexican Board of Education in Basíhuare and second, a day/boarding school the other by the Jesuit parish (day/boarding school in Rejogochi). Until 2000, the schools only went through primary levels; now there is a third innovative middle school called *Cruz Rarámuri* in Basíhuare with the goal of integrating traditional Rarámuri knowledge into the general curriculum. Children attend more-or-less voluntarily and content is generally based on Mexican national curriculum, though lower grades are conducted in Rarámuri.

During the year and a half I lived in the Sierra, I worked with students at these three schools in Rejogochi and Basíhuare. In addition to interviewing children, I taught several classes and worked with teachers developing ethnobotany activities for the classroom. One of the objectives of the study was to ascertain whether formal schooling has a negative impact on children's plant knowledge acquisition, based on the simple premise that they would be spending less time outdoors with knowledgeable people.

Rarámuri have great respect for children's individual autonomy, so children of all ages often choose for themselves whether to go to school or not, and which school to attend. In one family with only two young boys and a toddler girl left in the house, the older boy, Gervasio (10), had never attended school, because he didn't want to. His father died when I first arrived in Rejogochi, and Gervasio took on the responsibilities of the man of the house, working, collecting

wild foods, and attending Sunday meetings with the men. When his little brother Juanchi went to pre-school in 2002, Gervasio was proud of him and often walked him to and from the Basíhuare school. When they came to my house, Gervasio would often ask Juanchi to demonstrate the letters he had learned to write at school, and in this way he was taught by his younger brother.

Children and *tesgüino* networks

For adults, *tesgüinadas* are important sites of information sharing, storytelling, and gossip. For children, they can be frightening, but also are times of social learning through observation and play and social organizing. On a rainy August afternoon in 2002 I visited a *rancho* that had hosted a *tesgüinada* the night before. As I talked quietly with Ribuchi while she wove a woolen belt, we heard her four-year-old niece around the corner of the log cabin, singing melodiously: "***má rikúta-ba a, má rikúta ba***…" (I am so dru-unk, I am sooo dru-unk…). We laughed, and Petronilo commented that the little girl had heard people singing this common drinking song the day before. A little later, the girl's two-year-old cousin took up the song too, and they sang it together for the rest of the afternoon.

Rarámuri *tesgüino* labor-exchange networks entail frequent travel to distant ranchos to help friends and relatives plow, plant, harvest or fertilize their fields, and celebrate with corn beer. While their parents are busy working and drinking, kids tend to band together in small groups to take care of each other. During the week-long ceremonies at Easter, for example, when the adults move to Basíhuare

ceremonial center ten kilometers away, Rejogochi valley becomes virtually a children's realm. At other times children will travel with their parents and socialize with other children at the *tesgüinada*; this is one of the main ways for kids to socialize if they choose not to go to school, and they thus inherit to some extent the relations of their parents' social *tesgüino* networks. Depending on the season, kids use this time to play, forage for wild foods such as fish, tadpoles, berries, squirrels, greens and seeds, and also take care of household chores, livestock and young siblings. It can be stressful for children alone, but they know they have recourse to older siblings, cousins, aunts and uncles, or perhaps an elderly relative who has also stayed behind. By and large they take their responsibilities seriously, as full contributing members of their households. I suspect that these times are critical for Rarámuri children to learn the rules of social organizing as well as wild food gathering and preparation.

Rarámuri concepts of learning: "thinking well" and "*binéreri*"

For many Rarámuri, education means learning to 'think well,' ***ga'rá nátame***. Thinking well encompasses intellectual, moral, emotional, behavioral and spiritual intelligences. Babies are born unable to think, but as they grow, their abilities increase. By age five or six they think well enough to venture away from the domestic sphere with their siblings and peers to play, collect wild foods, and take care of goats. From then on, throughout their lives, it is primarily up to the individual to develop their abilities to think well. It is secondarily the responsibility of their family members,

friends, elected authorities and elders to guide them and to give them counsel when they stray from correct ways of thinking and behaving. A common reproach when a child does something undesirable or dangerous is, "***ke náta mó!***"—you are not thinking! This can be a serious insult among adults. Thinking well is phenomenological in that it is an expression of relationship and interaction, with the people, other living beings, spirit world and physical world of an individual's environments. It is about one's attitude towards these relationships, the care given to sustain them, or the lack of care leading to their erosion. The conceptualization of 'thinking well' is central to understanding the seeming paradox in Rarámuri sociocultural structure: great emphasis on individuality coupled with strong communalist values.

Biníriame, or ***binériame*** means, "to teach" (literally, to make one learn). ***Biniméa***, "to learn," is also used for the verb, "to suck" as in sucking juice from fruit (Brambila 1983:77), and ***bi'nimea*** means "to pick one by one" (Ibid.), perhaps similar to our English metaphors of "absorbing" knowledge and "picking up" a language. ***Machimé*** also means "to learn," connoting more abstract, philosophical learning. ***Machí*** (***ma'chí*** is "outdoors" or "out in the open") literally means "clarity" or "light" (Brambila 1983:289), and is used in Rarámuri to connote knowledge or judgment (as in, "***ke machí"—***I don't know; "***mujé machí***"—you know best). It is a parallel metaphor to our English terms "to enlighten", "to illuminate", "it was clear to me…"

In a conversation about school and schooling in a Chihuahua City Rarámuri settlement, one of my *comadre's* sons, about ten years old,

said that he had gone to school for a while, and used to know how to add and subtract, but he had taught this to another younger boy, who "took [the knowledge] from him," and now he doesn't know how to do it. His mother, listening, nodded in agreement.

When asked who taught them about plants, many children and adults first respond that they taught themselves, or learned alone, reflecting the conceptualization of individuals as the active learners.

Learning from goats; learning from God

Another perspective that came up frequently in interviews is "I didn't learn from anybody" or "I learned by myself." This is important in part because it gives a clue to Rarámuri perceptions of living and education—people ***learn*** in school, particulate knowledge such as reading and writing; knowledge of life skills and plant names and uses is absorbed while going about the business of living. This may also be because, in any culture, it is difficult to articulate how experiential learning happens. In Figure 4.2, a grandmother gave her three-year old granddaughter half a squash, and when she started scooping out the seeds, the elder said, "What a hard worker, what a hard worker," effectively encouraging her participation.

Many people reported frequent conversations with *Onorúame*, God, as to the proper ways to think and behave, specifically about environmental relation. Healers and dreamers reported that they were taught what they know about plants and healing by God, with ongoing detailed instructions on how and when to apply the knowledge.

Figure 4.2. Structuring environments in which a child 'learns alone.' Guaéachi, October 2002.

Though many young Rarámuri adults are concerned about environmental knowledge loss and actively addressing these concerns through education initiatives and community projects, several elders I talked to expressed the opinion that it does not matter if kids are not learning about plants: the important thing is that they maintain *their relationships with God,* because then they can always ask for the information they may need. For Rarámuri, maintaining relations with God entails responsible caretaking of His plantations, the pine forests and their inhabitants. In a way, this position comes full circle to an ecosystemic perspective, in that it prioritizes holistic

relationship over particulate knowledge in individuals. It may also reflect a prejudice on the part of spiritual healers, who don't necessarily know much about medicinal plants *per se*, against local 'herbalists' who prescribe plant medicines on a very informal basis, and do not have the prestige of the ***owirúame*** (Bill Merrill, pers. comm. April 2004).

Another frequent answer from adults was, "I learned about plants from my animals." Ethnobotanists around the world have documented reports of this kind, indicating years of careful observation of animal-plant interactions (Logan and Dixon 1994:27). Because Rarámuri children often spend whole days and nights alone with goats and sheep in the mountains, its not surprising that the time is important educationally. I plan to investigate this phenomenon more in later research, to get at more details of just what is learned and how. Dogs are taught to take care of goats by encouraging a ewe to adopt and suckle young puppies in training, who then grow up imprinted on their goat and sheep herds.

Lifelong learning

Most adults remain active learners all their lives. Though Rarámuri adult learning and culture sharing is not the focus of this study, it is an important piece of a holistic information ecology. The following anecdote illustrates one aspect of how information and ideas may flow through adult Rarámuri communities. In September of 2002 I was sitting outside of my adobe house chatting under the weeping willow with neighbors, a most common pastime. Knowing of my interest

in the subject, Aureliano mentioned that he had recently interviewed one of the oldest ***sipáame*** (rasper-singer doctor) who lives about twenty kilometers away, asking him why the rains were not coming as much as they used to. The elder and his wife answered that it was because the people no longer respected the old ways; people were misbehaving and cutting down the pines. As Aureliano was relating this, another (unrelated) friend, Isabel, walked up and joined us, but after a quick greeting of palm to palm she stood a bit apart, picking and braiding grass stems, seemingly paying no attention to Aureliano's conversation. Later, after Aureliano left, Isabel and I talked and drank coffee together. I said something about the possibility of rain that afternoon, and Isabel replied, "*¿Cómo va a llover si cortamos así los pinos*?" (How is it going to rain if we are cutting down the pines like that?), in an echo of Aureliano's earlier statements.

In the family: learning and teaching about plants

Plant knowledge in this community is learned informally through multiple pathways and in diverse social situations: for Rarámuri children sites of learning especially include, school, work, family, peers, and ritual. As outlined in chapter five, I found that, contrary to expectations, the majority of children I interviewed knew few names but many uses for plants that their elders identified as culturally important. The exceptions were children who, not surprisingly, were more fully integrated in work, play and other social interactions with plants and people knowledgeable about plants, these knew both names and uses. The following is a brief discussion of the social contexts

of informal and experiential learning of plant knowledge in this Rarámuri community.

Babies spend much time out in the ***kawichí***, (mountain lands) tied onto the backs of their parents or siblings. Though they are often sleeping or have limited view because their heads are covered by the rebozo or cloth, I often observed small babies intently watching their surrounds while hiking with their families. In contrast, once children are too old and heavy to be easily carried long distances over steep paths, they are usually left at home in the care of other family members[1]. Toddlers aged three to five or six, then, have a restricted environment of interaction and spend little time in the ***kawichí***. This does not mean they are isolated from wild plants and animals, however, because older sisters and brothers bring back resources to share with them. For example, one fall evening I saw an eight-year old girl who was the primary caregiver for her family's large flock of goats with a plastic coke bottle that she had filled up with ***wíchiri,*** or manzanita (*Arctostaphylos* sp.) fruits and was giving them one by one to her four-year-old sister. When they were gone, the little sister took the bottle and began to fill it with black ***rurusí*** fruits growing in my garden. I have also witnessed older children bringing large tadpoles, fish and other small animals to feed to their young siblings (see Figure 4.3 below).

At around age six and above, children's experience in the wild increases greatly, as they take responsibility for minding livestock

[1] Most rural Rarámuri babies and toddlers are low-weight compared to their non-Rarámuri peers, and though this is a distinct disadvantage to their health it does mean that they are carried on their mother's backs longer.

Figure 4.3. Sharing wild food bounty with younger siblings. This tadpole snack was intercepted by these girls' mother, because it hadn't been cooked.

and/or hike to school twice a week. Some small children walk upwards of fifteen kilometers to attend school. One boy of five or six walked to Rejogochi school and back once a week from Sitánachi, a *rancho* about seven kilometers and several tremendous canyons away. His father would accompany him part of the way, up the first thousand foot climb, then wait at the top of the ridge while his son made the steep descent alone, crossed a stream and hot springs, and climbed the next major ridge, where he then waved at his father in the distance to show he was alright and continued the rest of the way to school. The father in this case commented that doing this made his son "less afraid."

As in many other indigenous North American groups, Rarámuri children are expected to be observant, active but quiet learners, not

questioners (cf. Latorre 1976:58). It is important that they not boast about knowing things.

The most direct route to valuing biological diversity is by using and appreciating plants on a daily basis in the presence of people you respect. Figure 4.4 captures a moment in which such valuing was probably going on for the four children in this family. We were sitting around outside when the oldest boy came running up to the house and, panting, announced that one of his goats had been bitten by a rattlesnake. Manuel, his father, sent one daughter off to get the goat and another one to collect a *Brassica* plant (unidentified to species). The younger daughter came back a few minutes later with handfuls of stems and leaves, but her father glanced at it and said,

Figure 4.4. Treating a goat for rattlesnake bite with medicinal plants.

"No, that's the wrong one, get the one that grows along the fence". On the second try she came back with the medicinal plant, which was poulticed onto the goat's leg; the goat lived.

Children are regularly included in rituals and ceremonies that teach responsibility to spiritual relationships with plants. For example, the ***tutubúri*** and 'curing' of the cornfields, 'curing' children whose souls are kidnapped by dangerous plant-beings, and ***noríruachi*** (Easter) ceremonies to ensure the renewal of the world and its inhabitants. These prayers and dance and offerings and ritual acts communicate at a meta-level, both conscious and subconscious, the importance of maintaining the proper relationships with the plant-world.

Reported learning and teaching networks

I asked almost 100 children in Rejogochi and Basíhuare to list four people in their lives who they perceive as having taught them about wild plants of the mountains (***kawichí nirúame kasará,*** grasses/plants that belong to mountain-places). I also asked them to list four people whom they perceive that they themselves teach or share plant information with. I recorded both the names of the people reported and the cited relationship to the interviewee. In most cases, I was able to confirm the relationship through my own knowledge of their family, or my assistants' knowledge of the interviewee's family, or through recorded genealogies. The relationships between interviewees and those they mentioned are reported here as frequency percentages out of all of the people mentioned in the exercise. I

interviewed 41 girls and 55 boys ranging in age from 5 to 18 years old.

The results of my interviews on who children learn plant knowledge from show the overwhelming perceived importance of mothers in informal teaching, with fathers coming second, then grandmothers and grandfathers. Girls reported higher incidences of learning from their grandmothers and elder sisters, and boys from their grandfathers and elder brothers, reflecting the separation of genders in social life.

When I asked who children teach plant knowledge *to,* they primarily reported their immediate peers, their cousins, friends and siblings. This concords with my observations about interactions that go on while working together, playing together and supporting each other in times of need. Figure 4.5 shows reported teachers for just the first person each girl or boy mentioned on the assumption that the first is perceived to be the most significant.

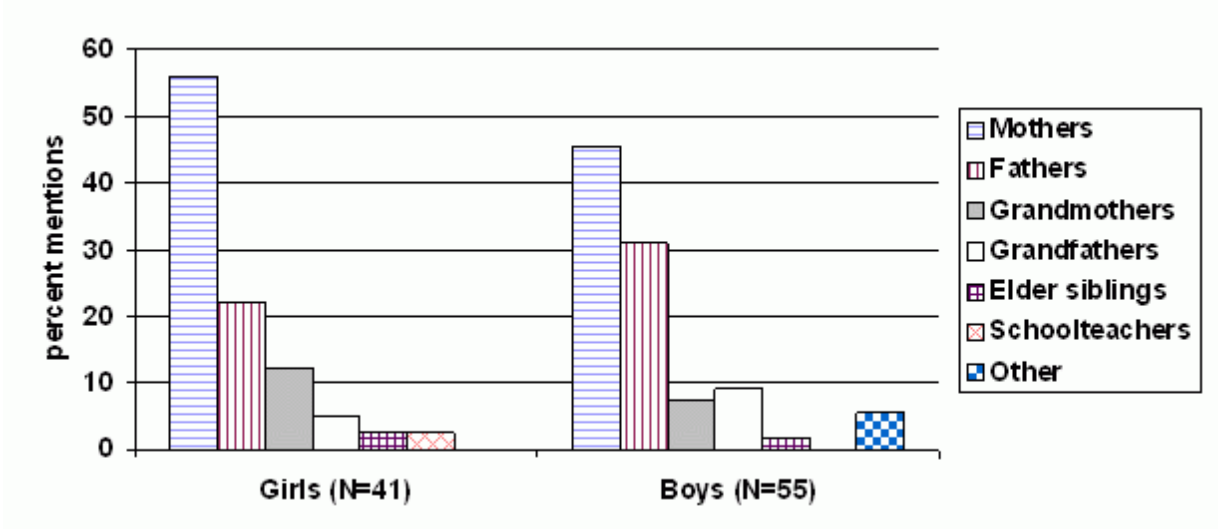

Figure 4.5. First-mentioned teachers of plant knowledge for girls and boys.

When all four reported teachers are included in the chart (Figure 4.6) there is an evening out of perceived importance between mothers, fathers, aunts/ uncles and grandparents, and the additional reporting of cousins and schoolteachers. Aunts and uncles are usually emotionally close to children, sometimes almost comparable to parents. They are also often peers and playmates of their nephews and nieces and share many childhood experiences. It is particularly notable that here boys reported aunts and uncles as teachers more often than even mothers and fathers.

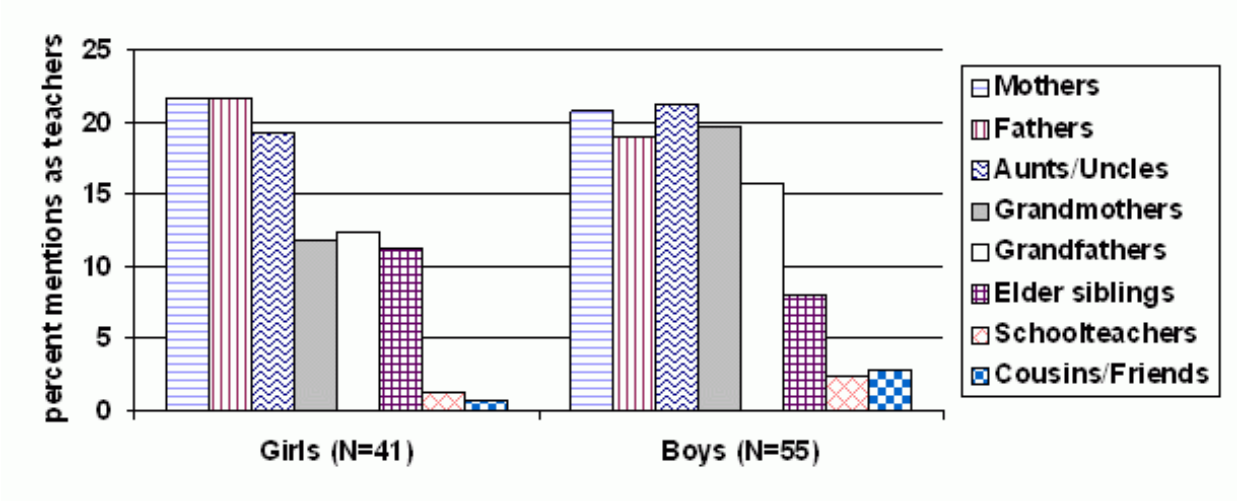

Figure 4.6. Percent mentions of teachers for girls and boys (all mentions included).

Figure 4.7 shows the people the girls and boys I interviewed said they taught about plants. Most Rarámuri children grow up close to their cousins, and refer to them with kin terms for brothers and sisters. So it is not surprising that so many cousins were identified as important in the teaching-learning exchange.

By age six or so, Rarámuri children who don't go to school spend considerable amounts of time outdoors. This is often in groups of

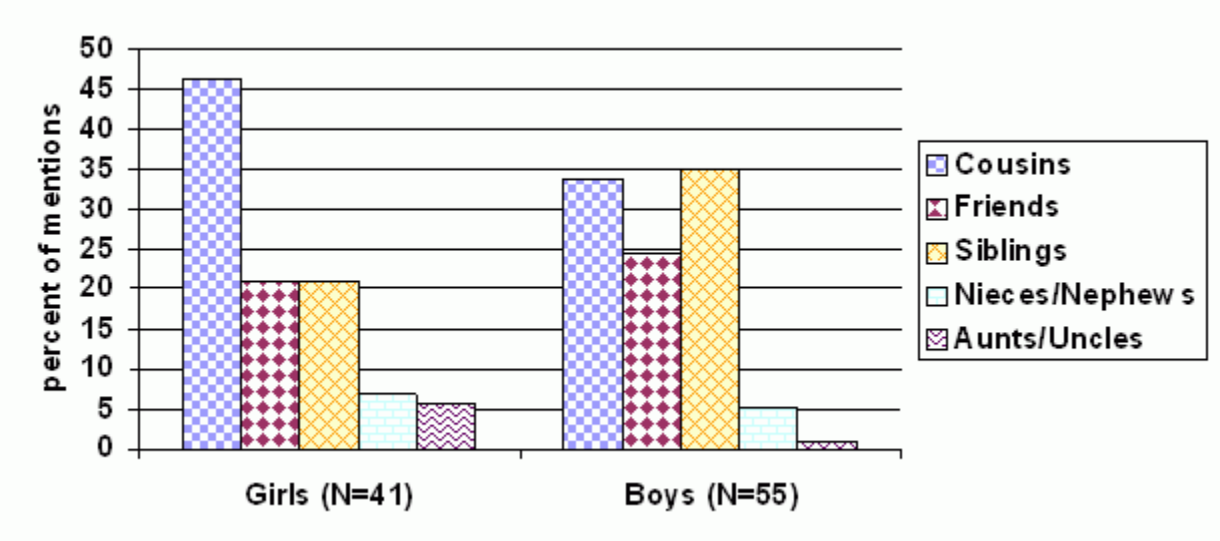

Figure 4.7. Who girls and boys teach about plants (all mentions included).

mixed age kids, especially when their parents are at drinking parties, and is a time when useful plants may be pointed out, used in emergencies, eaten, or collected for use later on.

It is important to note that these interviews at least partially reflect a cultural idealization of teachers and learners. As stated at the *tesgüinada* mentioned at the beginning of this section, mothers and fathers are first among those who are thought of as imparting knowledge to their children. Godparents 'of the burn' are often also grandparents of the child, who spend a good deal of time with them in household tasks. No child mentioned an unrelated elected authority as a teacher of plants, so we may conclude that the statement including them as guides refers generally to 'thinking well' rather than to something as specific as plant knowledge.

Merrill's (1988) ethnography of theoretical (spiritual) knowledge variation and reproduction in Rejogochi provides insight into the formal and informal modes of knowledge transmission. He notes that

while theoretical knowledge is publicly reproduced via weekly sermons by pueblo officials, most transmission is "informal, and like the knowledge itself, part of the flow of everyday life" (Merrill 1988:12). Merrill (1988:59) observed that children learned primarily from their parents, grandparents and siblings in an opportunistic fashion, as the various subjects arose. He also noted that variation in children's expertise in, for example, medicinal plant knowledge, depended in at least one case on the level of interest in that subject on the part of the child's parents (Merrill 1988:60). The results of this study concur with these observations.

Chapter 5

Intracultural Variation of Plant Knowledge

Figure 5.1. Harvesting ***siré*** (*Dasylirion* sp.) for basket weaving. The central, more pliable leaves are pulled out without harming the whole plant. This young boy accompanied his friend and his friend's mother (at right) and father on a short collecting trip several kilometers from Rejogochi. Summer 2001.

The description of knowledge variation and distribution in a community can be used as an indirect way of understanding learning process. Variation is investigated at the individual, household, extended social networks, community, extra-community and extra-ethnic

levels. The heterogeneous and evolving nature of knowledge has been increasingly recognized in ethnographic and ethnobotanical studies (Boster 1987b, Brunel 1974, Garro 1986, Glowka, Burhenne-Guilmin, and Synge 1994, Simpson 1994). A model that regards culture as information that is "received or created, stored, retrieved, transmitted, utilized, and even lost" (Roberts 1964:438) recognizes also that information is differentially distributed in communities. The socially embedded nature of knowledge produces patterned social distributions of cultural knowledge; these patterns then allow us to infer how learning takes place (Boster 1991:203).

Objectives

One of the central objectives of this study is to elucidate the role of immediate environmental interactions in acquired plant knowledge. Daily life experience such as schooling choices, participation in traditional occupations (especially herding, foraging), relative isolation or connectivity of households and family characteristics (number of siblings and neighbors, parents' occupation) are thought to play a role in how children learn about their biological worlds. This study measures plant naming and use knowledge and correlates these with several social factors to begin to describe how these may affect the transmission of traditional ecological knowledge in Rarámuri communities. One central question is: how does schooling affect traditional knowledge? Rarámuri children's scores on naming and use-knowledge interviews are evaluated in light of their different schooling experience, both in terms of time spent

and the kind of school they attended. The two primary schools available to Rarámuri in the Rejogochi area employ different curriculum and provide different social environments to their students. Culturally, the Basíhuare school is primarily Mexican or mestizo, whereas Rarámuri teachers and parents guide operations at the Rejogochi school to a greater extent. I expected that children attending the Spanish-language state school in Basíhuare would have the lowest plant naming and use-knowledge for their ages; children attending the primarily Rarámuri language non-government school would have higher expertise; and children who attend little or no school at all would have the highest expertise at the earliest ages. I expected that members of extended families would agree more about both names and uses for plants; in other words, that overall, variation in plant knowledge is greater between Rejogochi families than within families. Members of families with a plant knowledge specialist (e.g. herbalist, artisan) are expected to show higher competences, at least for a specialized group of plants.

Another objective is to understand the influence of individual characteristics (and associated social roles) on ethnobotanical expertise. I tested for significant variation in knowledge associated with the factors age, gender, and bilingual ability. Children's plant knowledge was evaluated in terms of adult competency. I expected to see that children achieve average adult-level competency by about age 12 and that overall, patterns of expertise parallels culturally constructed stages of development. For the Rarámuri, this is a gradual increase in expertise and understanding that continues through

adulthood as individuals practice 'thinking better.' I expected that girls and boys have specialized knowledge of subsets of plants based on associated social roles, but overall I expected little or no gendered difference in expertise.

Methods and techniques

Data collection: plant name and use elicitation interviews

I investigated children's knowledge of three categories of materially significant uncultivated plants: medicinal, edible, and those used in manufacture. This left out some categories of Rarámuri plant relations, such as those in the spirit-religious realm, domesticated and semi-domesticated species, each of which merits its own study. During the summer and fall of 2001, and the spring of 2002, I made ethnobotanical collections of about 60 species for this study, under the guidance of my primary botanical consultant (and a few others on occasion). Our collections were made by exploring the region around Rejogochi and Basíhuare on foot, setting out in a different direction each time, following footpaths as well as bushwhacking. We made an effort to collect from the many diverse ecologies of this area including meadows, pine forests, oak groves, natural springs oases, swidden burn areas, garbage-flora skirting rock-shelter homes, ruderal species around living areas, canyons and mountaintops. I avoided collecting fully domesticated plant species, but a portion of my specimens are from anthropogenic ecologies. Collections were made of all plants deemed culturally significant enough to warrant inclusion

in the knowledge elicitation tests (this judgment was made by myself and my consultant) and not necessarily dependent on the abundance of the species—either my consultant brought a notable plant to my attention and explained its use, preparation and significance, or I asked him about novel or salient plants I was unfamiliar with. Though several cactus and mushroom species are significant in Rarámuri ethnobotany, I did collect these due to the difficulties children had identifying dried specimens. Names and uses (as given by my botanical guide/consultant) were recorded, as well as location and botanical characteristics for all specimens collected, and they were pressed, dried and mounted on paper. A replicate set of the plants collected are curated at the herbarium of the Instituto Politécnico Nacional in Durango, Mexico (CIIDIR). Additional voucher specimens and documentation were presented to the elementary school in Rejogochi for use in traditional knowledge curriculum.

I first attempted to select the plants for this sample by doing freelisting exercises with adults—asking the question, "What are all the kinds of (variously: medicinal, edible, manufacture-use) plants in the world?" Curiously, this was largely unsuccessful, because both men and women tended to cite so few plants as to be unhelpful, and several cited animals such as squirrels and fish as edible plants, and Vick's *vaporub* as a medicinal plant. The problem could lie with my Rarámuri language abilities at the time, in translation problems (there is no unique beginner term for "plant" in Rarámuri; the term ***kasará*** is used for "herbaceous plants" but also denotes "grass"), or in interviewees'

reluctance to engage in this kind of exercise. I am confident that it does not mean that research participants knew few plant names.

A set of 53 plants were selected for testing with interviewees; these were laminated in plastic on 42 cm x 29 cm herbarium mounting cardstock. These were selected to cover a roughly equal number of medicinal, edible and manufacture-use plants and to range from what I expected to be very easy identifications to medium and difficult identifications. After about twenty interviews I winnowed the set to make the interview shorter (to 30-60 minutes long), removing specimens that elicited few answers from children, to a final number of 41 specimens (40 species, listed in the section below) which were used from then on and constitute the sample discussed here. Two of these were the same species, in order to test for consistency in interview answers and to ascertain whether children were guessing at answers one species was represented by two specimens. One specimen was placed at the beginning of the interview and the other towards the end). The specimen elicitation sequence was ordered so as to have widely known plants in the beginning so children would understand the task and warm up; kinds of plants and kinds of uses were mixed throughout the set.

The plants used in elicitation interviews

The plant species used in this study are listed below by Rarámuri name (see Table 5.1 for name variants). Appendix 1 indexes all the plants I collected by scientific name, family and collection number. Those listed here are ordered by principle use: medicinal, edible and manufacture-use. Note that these three categories, while recognizable

to Rarámuri as use categories, do not necessarily reflect Rarámuri categorization of the plant world. Here the Rarámuri name is listed alphabetically, followed by parentheses with the Latin genus/species and family names, then Spanish names, and if available, an English translation of the Rarámuri name between quotation marks. The descriptions and uses listed below were for the most part provided by my main botanical consultant and guide while collecting the plants or by other adults in the course of participating in daily activities. More details can be found for many of these plants in Bye (1976, 1979a, 1985); Bye, Burgess and Trias (1975); Cardenal (1993); LaRochelle and Berkes (2003); and Pennington (1963).

Medicinals

Chorónare *(Galium mexicanum* RUBIACEAE; "sticky")—the whole plant is ground and used to wash the head for aches or pains.

Júpisi *(Agastache micrantha* LABIATAE; "smelly")—used to treat respiratory infection; the highly aromatic leaves are placed in the nostrils. The leaves are also boiled and eaten with ***kobísi*** (ground parched corn).

Mahtó (*Buddleia cordata* LOGANIACIAE: Spanish: *tepozán*)—a tea is taken for *empacho* and the strongly aromatic root is ground and applied to the body in case of fright (soul-loss) from slipping in the stream. It can be combined with ***wíchare*** and ***chikwá*** to treat intestinal parasites.

Masérachi (*Ratibida* sp. COMPOSITAE)—the roots are used as an infusion in the ritual 'curing' of cornfields and as a poultice for bruises.

Matarí (*Psacalium decompositum* COMPOSITAE)—the roots are boiled and the decoction is drunk for tuberculosis and cough, or they are toasted, ground, and applied to contusions and swellings.

Metakúchare (*Echeveria* sp. CRASSULACEAE; Spanish: *siempre vivo*; "small child of agave"*)*—the leaf sap from this succulent are dropped into the eye to treat infections.

Mochoáka (*Cheilanthes angustifolia* POLYPODIACEAE; "brain-like")—this fern is used to treat children suffering from fright (*susto*) or to treat fever or skin rashes. The leaf is mashed and applied to the body, or taken as tea.

Napilúti (*Euphorbia* cf. *sphaerorhiza* EUPHORBIACEAE; "ringed/ridges or linked/in sequence")—used to treat stomach ailments, especially parasites. The root is washed, ground with water; ½ cup is drunk and vomiting ensues. It "cleans the heart/chest from the inside."

Pasóchi (*Chenopodium ambrosioides* CHENOPODIACEAE; Spanish: *epazote*)—the leaves and stem of this plant, sometimes also called ***húpichi*** (stinky), are infused as a treatment for diarrhea and fever, especially for children. It is also taken to mitigate heavy menstruation and cramping, and as a beverage tea.

Sebanél (*Tagetes subulata* COMPOSITAE; "goat's bell")—treats diarrhea, boiled in water and applied to the body or taken as tea; treats *empacho* due to overeating. It is heated, rubbed and applied to the stomach. The name describes the sound of this plant's dried seed cases rattling in the wind like goats' bells.

Sowíware *(Eryngium* cf. *heterophyllum* UMBELLIFERAE; Spanish: yerba del sapo; "spiny")—this prickly blue-flowered herb commonly grows in

meadowlands, and is often used to protect *tesgüino* jars from thirsty spirits of the dead (drinking after the dead can make the living ill). It is also used to treat rabies in dogs or humans, by mashing the whole plant with water, boiling and applying to the head or drinking as tea.

Warisí (*Cucurbita foetidissima* CUCURBITACEAE)—stomach-ache, especially due to stomach 'mushrooms' (a folk-illness in which fungi are thought to grow inside children's stomachs) is treated with this plant by placing a leaf on the stomach, or tying a length of the vine around the stomach.

Wasía (*Ligusticum porteri* UMBELLIFERAE; Spanish: *chuchupate*; may be related to ***wasíra*** (refers to 'tail' or 'a woman's mother-in-law')—Widely valued by and traded with mestizos, Rarámuri in Rejogochi seem to use this aromatic root primarily for ritual curing of fields and people with an infusion of the root, and for treating stomach-ache. My collaborator noted that the specimen we collected was three years old, which was evident from the growth scars at the base of the stem.

Edibles

Amári (*Dahlia sherffii* COMPOSITAE; Spanish: *camote*)—this lovely yellow- and orange- flowered herb grows on rocky and steep cliff sides, and is prized for its tasty tubers, by children and adults alike. These grow in finger-like clusters that are dug up, the largest ones removed, and the small ones re-buried for regeneration. They can be eaten raw after scraping off the skin and dipping in salt, or roasted in hot ashes. They taste like perfumed *jícama*.

Baniwá(ka) *(Desmodium* sp. LEGUMINOSAE; "covers everything")—this ground-hugging creeper frequents anthropogenic habitats such as unused rock shelters. The leaf was identified as a famine-food additive to corn for *esquiate* (corn gruel). This name is also given to algaes due to similar growth habit.

Kasará sitákame (*Juncus* sp? JUNCACEAE; "red grass") This plant is used as a *tesgüino* additive, to increase the fermentation and strength of the beer. It is ground with ***basiáware*** (*Bromus* sp.) and poured into the *tesgüino* after it is strained and cooled. My collaborator also named it as a kind of ***bakánowa*** (*Scirpus* sp.).

Kihúbare (*Cosmos bipinnatus;* COMPOSITAE)—a popular potherb when young and tender (leaves and stem), this plant is common in anthropogenic ecologies, but can be found (usually of much smaller size) along forest paths as well.

Rorogóchi/rorokóchari (*Plantago australis;* PLANTAGINACEAE)—my consultant speculated that the name may derive from the fact that the ***koró*** bird (Spanish: *grullo;* perhaps a kind of lapwing) eats lots of this herb during its southerly migration. Its leaves are eaten by people as greens, preferably sautéed and with beans.

Sipé (*Bidens odorata* COMPOSITAE)—an important pot herb when young and tender, this plant is ubiquitous at the margins of corn fields and other trash areas, dispersed via its barbed awns by humans and livestock. It is considered to be the '*milpa*,' or cornfield, of the ***sikwá*** toad, who sows it as Rarámuri sow corn. Interestingly, Mabberly (2002:86) mentions salamanders dispersing these seeds in Ontario,

presumably stuck to their skin; the toad anecdote may reflect natural history observations.

Sibarín (*Tagetes lucida* COMPOSITAE; Spanish: yerba anís)—popular beverage tea made by steeping the whole plant or leaves in hot water; it is also boiled with salt and drunk as a treatment for diarrhea.

Mazána (*Vaccinium confertum* ERICACEAE; Spanish: *manzanita*)—edible fruit, and a beverage made from the leaves. The tea treats pimples/rash and itching.

Urúpisi (*Arbutus xalapensis* ERICACEAE; Spanish: *madroño*; name may be derived from ***ku***, "wood," that burns fiercely)—edible fruit. Cough and sore throats are treated by eating raw leaves. The wood is highly prized for carving large bean spoons, ***batéa***s (dough-mixing troughs) and violin "ears" (heads).

Víviri (*Zornia thymifolia* LEGUMINOSAE; Spanish: *yerba de la víbora*)—makes a popular and pleasant tea beverage from the whole upper plant, also used to treat diarrhea.

Wasorí (*Amaranthus hybridus* AMARANTHACEAE; Spanish: *aguas*; "going around (visiting)")—prized as greens (***kiribá***, probably a Rarámurization of the Spanish/Nahuatl *quelite*), the leaf is boiled and eaten mixed with beans. Probably semi-domesticated.

Wíchare (*Arctostaphylos pungens* ERICACEAE; Spanish: *manzanilla*; "branchy")—the flowers and fruits of this shrub are prized by children as snacks. The leaf can make a tea beverage, and is also taken to treat cough. Admixed with ***mahtó*** and ***chikwá*** for intestinal parasites.

Material and manufacture-use/other

Basúl (*Bidens* aff*. ferulifolia* COMPOSITAE*;* possibly means "goes walking" or from the Spanish for "blue" (azul))—a yellow dye can be made from the flowers of this plant, boiling with scant water and sheep's wool.

Ikí (*Bletia aff. macristhmochila* ORCHIDACEAE; Spanish: *resistol del monte*; "Bites")—a very strong glue is made from the bulb of this ground orchid, used in the construction of violins, guitars and rattles. The fresh bulb is heated in hot ash, then scraped with a knife to produce a paste.

Moóchare (*Machaeranthera stenoloba* COMPOSITAE; "big-headed/dread-headed")—the flowers are boiled with wool as a yellow dye.

Okó'sare (*Pinus engelmannii* PINACEAE; "long-leaf pine")—used in construction and as firewood, especially fatwood. Its needles are used in adobe brick manufacture. The needles and fatwood are also employed as an infusion to treat sore throats and colds.

Rité bo'wára (*Usnea/ Teloschistes* USNEACEAE; "rocks' wool")—this common lichen is used as a wool dye (colors: yellow, orange, peach). It is boiled with ***wíchare*** leaves (manzanita) and ***kuchaóra*** leaves (mistletoe) and taken as a tea for intense cough. It is also applied in dried powder form to wounds.

Sawá (*Pinus lumholtzii* PINACEAE; Spanish: *pino triste*; "leaf")—this ubiquitous pine is used to construct log houses, corrals, and for firewood. The needles are used in adobe brick manufacture.

Siwá (*Milla biflora* LILIACEAE)—***Siwá*** simply means "flower," so this plant may have other Rarámuri names. The dried bulb of this small wild

lily was used by children in the past as toy buttons (for clothing) and flying tops.

Siwáchare *(Tillandsia recurvata* BROMELIACEAE; "flower")—this plant is similar to the ***rosabóchame*** used as decoration during Easter week on the pine bough arches, but no other uses were reported to me.

Sopépare (*Senecio hartwegii* COMPOSITAE; "similar to palm")—a strong piscicide; the mashed root is dumped into a river or stream (preferably dammed) to stun or kill fish. The mashed root is also applied to livestock to kill external parasites such as fleas and ticks.

Torí wasíra (*Dryopteris cinnamomea* POLYPODIACEAE; "chicken tail")—also identified as ***mocho'á***. This fern helps produce especially good *tesgüino.* The leaves are laid down as a bed on which to sprout soaked corn kernels for beer, with oak branches layered on top. See Lappe and Ulloa (1989) for a thorough accounting of the microbiology of *tesgüino* production and other plant species used in the production process.

Wa'á (*Cupressus lusitanica* CUPRESSACEAE; Spanish: *táscate*; my consultant translated this name as referring to ***wé na'awá***—"very angry" when burning. It pops and crackles loudly). This wood is commonly used to make violins, using a harvesting technique that is thought to have been used (to create juniper bow-staves) as far north as Nevada, U.S.A. (see Wilke (1993) for an excellent account of how this activity is preserved in the biological record). Once a tree is selected, a transverse cut is made at the top of the piece desired, to arrest its growth, and bark may be peeled away. The dead section of wood is then cured for several years on the tree and removed when needed to

construct a violin. Juniper branches are used in ***morúbama*** (sweat and smoke bath curings) and in infusions or alcohol tinctures to be rubbed on the legs while running races. A tea of the leaves is taken for cough. Chipmunks eat the seeds of this tree. It is prized as excellent firewood; one ten-year old boy always identified when juniper was burning in my stove upon entering the house—"***wa'á***. It's so angry (*enojado*)."

We simé omáware (*Phytolacca icosandra* PHYTOLACCACEAE; "brings menstruation fast")—there may be other names for this plant, or my informants may have been reluctant to name it, because it was identified as a relation to ***rikúhuri*** (*Datura* sp.) though less poisonous. My main consultant said that it should not be touched, especially by boys, otherwise "When they grow up they will have to buy lots of bars of soap to wash clothes since their wives will have continuous menstruation." Both this plant and ***wichátare*** are associated with this admonishment and both bear fruits that are juicy and stain deep red. An elder woman prescribed the fruits of this plant mashed into hot water to treat menstrual cramps. Others said the fruits were poisonous, though dogs eat them.

Wichátare *(Comarostaphylis polifolia* ERICACEAE; "many-branched/hard to get through")—my consultant identified this as a plant that women should not touch, or they will menstruate all the time; if men touch it they too will begin to menstruate.

Wiwaráka (*Nicotiana tabacum* SOLANACEAE)—according to my consultant, the Rarámuri name may be a modification of the Spanish *tabaco;* it may also be related to ***iwéra*** or soul-strength/breath. This is a popular

strong smoking herb; many elders grow it for their own use, and it is found growing primarily in anthropogenic habitats, especially unused rock shelters. For propagation, a seed-bearing inflorescence should be hung from a small *ramada* and the tiny seeds allowed to fall to the ground and sprout there. Another easily confused species is called ***wipá***. Before use, the leaves are well massaged, then left in the sun to cure before shredding and smoking.

Wiyó (*Pinus strobiformis* PINACEAE; Spanish: *pino blanco* (Brambila 1983:609))—this pine is used to carve ***mosóbere*** (yokes) and violins (this latter may be doubtful, since *Cupressus* is usually preferred for violin manufacture).

Plant knowledge elicitation interviews

To examine social patterns of knowledge about these forty plants my research assistants and I completed interviews with 113 girls and boys under 18 years of age and 4 female and male adult plant experts. I asked interviewees to name and identify uses for each of the 40 species. Attention was given to how children presented what they know at various ages/ developmental stages. I collected personal information for each participant, including age, sex, ethnicity, place of residence, years of schooling, bilingual abilities, names of family members, and occupation. This information was coded and kept confidential.

Conditions of interviewing

Children were recruited in a convenience sample, with an attempt to contact each child in the research communities and invite them to participate. I tried to maintain a balance between girls and boys, age groups, and attendees at different schools. I conducted plant elicitation interviews with a total of 117 children, representing about 70% of the population in the age range 5-18 years (only 104 of these are used in the results discussed below). Though the sample was not random, I am confident that it is generally representative, with one caveat. There is a potential bias due to the fact that children who attend school were willing to engage in the interview process more readily than children who never attended school, spoke no Spanish and had little experience interacting with foreigners. Thus, my sample may lack a full quota of totally unschooled children. However, even children who were not attending school at the time of my research had usually attended at one time, so I recorded the number of years each child was in school.

The interviews, almost always conducted in the Rarámuri language, lasted from 30-60 minutes, depending on how readily children answered the questions. Most interviews were conducted at my house, seated at a table. Some children needed quite a bit of prompting and repetition of questions. If the plant was aromatic, the interviewee was offered a smell prompt as well as visual. I employed four research assistants over the period of research (two young men and two young women) to help with interviewing, and in some cases, to do the interviews on their own. Often, I interviewed young girls alone if they were

reluctant to speak in the presence of unrelated young men. My overall impression was that children were more likely to be modest about their expertise in Spanish speaking and plant knowledge when the Rarámuri research assistants conducted the interviews.

These elicitation interviews were conducted over a ten-month period, through several seasons, which may have affected children's answers. Children have more exposure to names and uses of plants during summer growing seasons and thus may recall this information more easily during this time. The elicitation instruments were in the form of a 'traveling herbarium' of dried, pressed and laminated plant specimens (Berlin et al. 1990). Though most of the plants in the set were readily recognizable, for some of the species their decontextualization had an effect on children's ability to recognize them. For example, many children mistook the orchid ***ikí*** (*Bletia macristhmochila*), which grows in high altitude oak forest, for the corn-sprout ***pachí*** (*Zea mays*), something that would never happen in the wild.

Age in years is not reckoned as very important for Rarámuri, and so many of the children (and adults) reported guesses as to their ages. Age related results should be interpreted with this in mind. Similarly, children's language ability as monolingual Rarámuri or bilingual Rarámuri/Spanish speakers was self-assessed and thus subject to varying standards. Girls were more likely to downplay their Spanish speaking abilities.

Though I made efforts to make the interviews as relaxed and as enjoyable as possible (providing snacks or tea to the interviewees,

for example), the formal atmosphere of the structured interviews transgressed several etiquette rules that may have affected children's responses, especially for those children who did not know me well (cf. discussion of the effect of social context in Boster's ethnobotanical interviews, in Berlin 1992:226). Asking questions directly and persistently (these interviews consisted of over eighty direct questions in a row) is considered rude and impatient. In contrast, Rarámuri are expected to learn by observation and perhaps subtle comment. Children are taught to fear, mistrust and avoid ***chabóchis*** and ***chabóchi*** behavior—even when I was not present and my assistants were administering interviews, the interviews were still a thoroughly ***chabóchi*** experience. I believe that these factors, along with the procedure of interviewing children alone, separated from their peers, had a somewhat paralyzing effect on children's responses, such that they professed to know less than might be observed in natural social and biological environments. Additionally, among Rarámuri in general (non-healers) I consistently found a reluctance to profess knowledge or expertise, which meant that people were uncomfortable in structured, direct questioning interviews. My collaborators felt this stress as well, and one of them quit, expressing to me that the adult interviewees (for interviews other than plant-knowledge) chastised him for being too inquisitive (on my behalf), as well as unfairly receiving compensation while working for me. Other collaborators expressed similar pressures, and gradually stopped working; the one that worked the longest with me had the fewest social ties and obligations in the community.

To check for informant consistency and/or guessing, two plants in the interview were the same species (*Bidens ferulifolia*). Out of 99 interviews, 28 responders changed their answer from one stimulus to the next, however, only 8 of these were substantive name changes; the other twenty were using suprageneric (life form) or descriptive terms. This result suggests reliability for the answers overall.

Analysis

Consensus analysis/ analysis of agreement

The results of the ethnobotanical elicitation interviews were entered into analytical matrices and analyzed using a cultural consensus technique and the analysis software ANTHROPAC 4.0 (Borgatti 1992). Consensus analysis provides an estimate of the 'knowledge competence score' for each interviewee, in which knowledge is defined as shared information (Romney, Weller, and Batchelder 1986, Weller and Romney 1988). These competence scores, or more correctly, agreement scores, proved not to be useful for assessing competence from an adult perspective, because many children 'agreed' on the 'wrong' answers; in other words, they made the same mistakes. Thus, those children who were conservative and only answered the few plants that everyone knows, had higher scores than the adult experts, who cited names that few children knew, so these results do not assess 'knowledge competence' from an adult perspective.

Nonetheless, this analysis is useful because it does tell us that there is a coherent "culture" of shared knowledge among children, even

if this knowledge includes misnomers for plants and identifications at inflated taxonomic levels. In other words, the ways the mistakes are made are *shared*, and this is relevant to understanding ontogenetic processes of knowledge development. This is most evident by looking at the structure of the factors, which in this case includes an all-positive single factor, with a first eigenvalue of 68.62 and a second of 8.67. That the first factor (estimate of competence/agreement) is about eight times as large as the second factor indicates a strong cultural agreement on the domain of plant knowledge, or that this factor "accounts for all of the structure in the matrix other than sampling variability" (Romney, Weller, and Batchelder 1986:323). The second (last) factor accounts for the adult interviewees and the first factor accounts for the Rarámuri children. Thus we may proceed knowing that the interviewees are indeed from a single culture navigating a domain they agree about.

Plant naming and use proficiency scores

One hundred and four Rarámuri children's interviews were analyzed in the final sample: 46 girls and 58 boys from 5 to 18 years old. This represents approximately 68% of the total population in this age range and about 29% of residents of any age (from greater Rejogochi and Umirá, the primary source communities for students at Basíhuare and Rejogochi schools and this research project). Each interview was scored using an answer key derived from the plant names given by a recognized plant expert in the community, my 38 year old consultant, and checked with the answers of three other community elder women and

men. The response data were made uniform; the answers "***ke machí***" (I don't know), "*se me perdió el nombre*" (I lost the name) and "***ke tabíri***" or "***ke namúti***" (nothing/none), "***ke chiborá***" (of no use) were all processed as no-answer data. Though it is conceivable that one might get additional information from differentiating between "I don't know" and "Its good for nothing" responses, to simplify analysis I lumped them. While recognizing that 'correctness' of a plant name is perhaps a false concept in relative terms, it is used in this study to indicate the word agreed upon by adult Rarámuri to describe a botanical discontinuity in nature (Berlin 1992). The phonological variation of plant name pronunciation was recorded and is discussed below.

The reported uses for each plant were scored in a similar way to the reported names, except that, because each child was asked to give all the uses they knew, some received more than one "point" per plant, and in many cases there were several possible "correct" answers. Most answers could be put in one of three use-categories: medicinal, edible or of material value. Other uses cited include plants valued as *tesgüino* additives, fish poisons, animal foods, 'cures' for fields, plants that keep spirits and ghosts out of the *tesgüino* jars, plants as indicators of fertile soil and plants used in steam baths.

Both naming and use-knowledge scores were analyzed using analysis of variance tests to determine the relative effects of children's different characteristics: age, years of school attendance, which school they chose to attend, and bilingual ability[1].

[1] I am grateful to Jaxk Reeves and Yi Mei Cai at the UGA Statistical consulting center for their assistance in this analysis.

Plant salience scores were recorded from the proportion of children who correctly identified each species and its uses. Ontogenetic trends in plant naming ability were identified and compared to other similar studies (Anglin 1995, Dougherty 1978, Stross 1973, Zent 1999), and errors in naming were examined to elucidate general trends in cognitive process, classification and botanical salience. Plant salience scores were examined for correlation with cultural use or significance as well as physiological and ecological character to account for their prominence or lack thereof in children's plant vocabulary.

Results

There are two major subsets of results: those that relate to how well children could name the plants in the interviews and how well children could identify the utility of these plants. The results for plant naming knowledge and plant use knowledge will be discussed separately first, followed by a discussion of how they are linked. Overall the response levels (how many answers children gave) were lower than I expected, and the expertise (how many correct answers children gave, from an adult perspective) were lower than I expected. However, there is enough variation in the results to warrant interpretation in the discussion section below. First we turn to a short discussion of the phonological variation found among children’s pronunciation of plant names.

Plant naming variation

Table 5.1 shows the plant name variation recorded for fifteen plants in the interview sample[2]. Of the forty plants these fifteen showed the most variation in pronunciation. Note that for scoring purposes in the knowledge proficiency measure discussed below, all of the variants listed for each species in Table 5.1 were considered a "correct" answer. The example of highest naming variability is that of the aromatic herb in the marigold family, *Tagetes lucida*, used widely to treat diarrhea and colds and as a hot beverage. I documented at least twenty name variants (three of them are of Spanish origin). Some of the variation may be an artifact of having three different people (myself and two assistants) recording answers to interview questions at different times. Some of the variants are a product of Rarámuri metastasis (Brambila 1983: III), or switching of syllables or letters in a word. This is commonly heard, and seems to be done, in part, according to preference or emphasis desired by the speaker, as well as due to micro-regional or generational differences. For example, a subset of my interviewees said ***sakará*** instead of ***kasará*** for the word "grass"/ "herb"/ "plant." Several adults said that this was because the children's families were originally from Rosákachi, about fifteen kilometers upstream from Rejogochi. Many children used ecological locators as proxy for names, saying, for example, '***kawichí***' for a plant that grows in the mountains; '***bawichí***' for a plant that grows in or near water. The suffix "chi" is a locative, commonly used to denote "place of..."

[2] Note that these are phonetic, not phonemic transcriptions.

Table 5.1. Plant name-variants for the fifteen plants with highest variability in pronunciation. The number after each name indicates the number of mentions of that variant out of approximately 100 informants.

Tagetes lucida		*Zornia thymifolia*		*Pinus engelmannii*		*Eryngium heterophyllum*		*Chenopodium ambrosioides*	
yerbanís	19	***víviri***	34	***okó sawáre***	10	***so'owá***	33	***pasóchi***	15
sibaríni	18	***yerba vívora***	12	***okósari***	10	***so'wiri***	6	***húpichi***	6
sibarín	14	***yerba de la víbora***	9	***okósni***	8	***sowíware***	2	***pasóte***	3
siwaríni	5	***víbora***	4	***okósare***	6	***so'í***	1	***epasóchi***	2
schabarín	3	***vívari***	3	***okó sawára***	2	***so'iw'ari***	1	***pasónte***	1
ribanís	2	***la víviri***	2	***okósiri***	2	***so'owíri***	1	***pasóta***	1
sebaríni	2	***tavíviri***	2	***okósli***	2	***so'wá***	1	***pasóti***	1
sibarí	2	***vívaro***	2	***okó sali***	1	***so'w'ara***	1	***payóchi***	1
sibarína	2	***la víbora***	1	***okó sawá***	1	***sowí***	1	***pazóte***	1
anís	1	***lavíra***	1	***okó sué***	1				
sabaníl	1	***vívara***	1	***okósawe***	1				
sabarín	1	***viviria***	1						
sebaníl	1	***víviro***	1						
sebarí	1	***vívisi***	1						
sebarín	1								
sebarína	1								
seberaní	1								
seberanízo	1								
sibaní	1								
sibarínchi	1								

Arbutus xalapensis		*Arctostaphylos pungens*		*Bletia macristhmochila*		*Psacalium decompositum*		*Cucurbita foetidissima*	
urúbisi	82	***wíchari***	76	***iki***	8	***matirí***	24	***warisí***	24
kurúbisi	6	***wíchiri***	14	***rikí***	6	***matarí***	2	***arisí***	14
arúbisi	1	***wíchare***	3	***anakí***	1	***batirí***	1	***barisí***	10
hurúbisi	1	***wíchi***	2	***ichí***	1	***mataríki***	1	***barisín***	1
kurúbasi	1	***mazánkame***	1	***kirí***	1	***materí***	1	***karisí***	1
kurúsi	1	***wích***	1	***mi'kí***	1				
urúbisa	1	***wícha***	1						

Pinus lumholtzii		*Amaranthus hybridus*		*Bidens odorata*		*Cosmos bipinnatus*		*Dahlia sherffi*	
sawá	18	***wasorí***	50	***sipé***	62	***kihúbare***	6	***amári***	40
sawáche	1	***basorí***	6	***sepé***	4	***kahubari***	1	***yamári***	1
sawáre	1	***asorí***	2	***sipéke***	3	***kuhúbara***	1		
sawári	1	***rosorí***	2	***sepéke***	1				
sawé	1								

This kind of phonological/pronunciation variation gives us clues about the mutability of plant names and leads to speculation about drift and dialect-formation among isolated communities. It is relevant here to show that among Rarámuri, individuals have considerable leeway in name pronunciation while preserving meaning. Indeed, among Rarámuri diverse modes of presentation, innovation and individuality is encouraged and abetted for this and other domains. This is an example of a knowledge diversification or centrifugal effect, in which diversity of expression is fostered, as opposed to a knowledge/pronunciation homogenization effect which may be related to literate and centralized modes of communication and learning.

Plant naming proficiency

The plant name elicitation interviews were scored individually, by comparing the name given by the interviewee for each of the 40 plants with the name given by four knowledgeable adults who were considered to be plant experts in the community (approximate ages 38, 40, 60 and 65; one woman, three men). This simple procedure produced a raw score and percentage score for each interviewee. I scored the interviews in two ways: first, using a 1/0 system, giving a point only for the correct name approximating species or genus level (as used by the adults); second, to accommodate the plants that were very commonly mistaken for a close relative, I used a 1/0.5/0 scoring system, so that children got 'partial credit' for answers that showed some knowledge of which family or genus the plant is in. For example, if a child identified the ***wichátare*** (*Comarostaphylis polifolia*) specimen as ***wíchare*** (*Arctostaphylos pungens*) they received half a point because

these two species belong to the same plant family (Ericaceae). Similarly, a child who identified ***sawá*** (*Pinus lumholtzii*) as ***wiyó*** (*Pinus strobiformis*) received half a point because these two species are in the same genus. The most well-known or prototypical plants in a family or genus tended to be cited when a child did not know the name of a plant[3]; because I included the prototypical plants in the elicitation interview as well as their lesser-known close relatives I was able to judge their relatedness in order to assign these extra half-points. This second system raised overall scores slightly, but did not change the trends found with regard to the objectives of the study. Only the results of the second scoring system are reported here.

The results were mostly clustered, with two outliers (a girl and boy who scored much higher than predicted by the distribution of scores). Though boys scored a little higher, there was no significant difference between girls' and boys' mean naming ability scores (22.8% and 26.0% respectively; ANOVA SS=41.27; MS=41.27; F=2.95; p<0.0888, ns)[4], so their results will be undifferentiated in this discussion. When each plant was analyzed to see if there were individual plants that boys or girls knew more consistently, only one emerged as being (significantly; p<0.0383) more often identified by boys. This was *Cucurbita foetidissima*.

[3] The adults in the study were more likely to name plants they did not know as, "similar to x" or "a relation (***rijimára***) of y."
[4] Assumptions for ANOVA test include, 1) a random sample; 2) independence of variates; 3) normal data. The data presented here conform to assumptions 2 and 3, and, though the sample was not collected randomly, it constitutes a large percentage of the population and can be considered representative (see earlier discussion).

The correct identification scores ranged from about 10% to 61%, with a mean of 24.4%. These scores were lower than I expected to find; possible reasons for this will be outlined in the discussion section below. To determine the relative influence of several social characteristics on the variation observed, separate analyses of variance (ANOVA) tests were done on the children's scores and their 1) ages, 2) years of formal schooling experience, 3) school attendance, 4) bilingual ability. Then a general linear model procedure was run on all four characteristics to elucidate the relative influence of each when all the others were taken into account at the same time. First I report the results for each variable, then summarize the results of the general linear model in Table 5.2.

Plant naming scores by age

An ANOVA analysis was performed on children's plant naming scores (raw correct identifications) and their age, to determine how much of the variability may be explained by the age of the participant. Participants were divided into four age classes of roughly the same N. The coefficient of determination (R^2) is 0.109, indicating a relatively weak positive relationship between age and naming competence for the set of plants in the study. In other words, age explains approximately 11% of the variance (df=3, 100; F=4.10; p<0.0087). These results are depicted graphically in Figure 5.2.

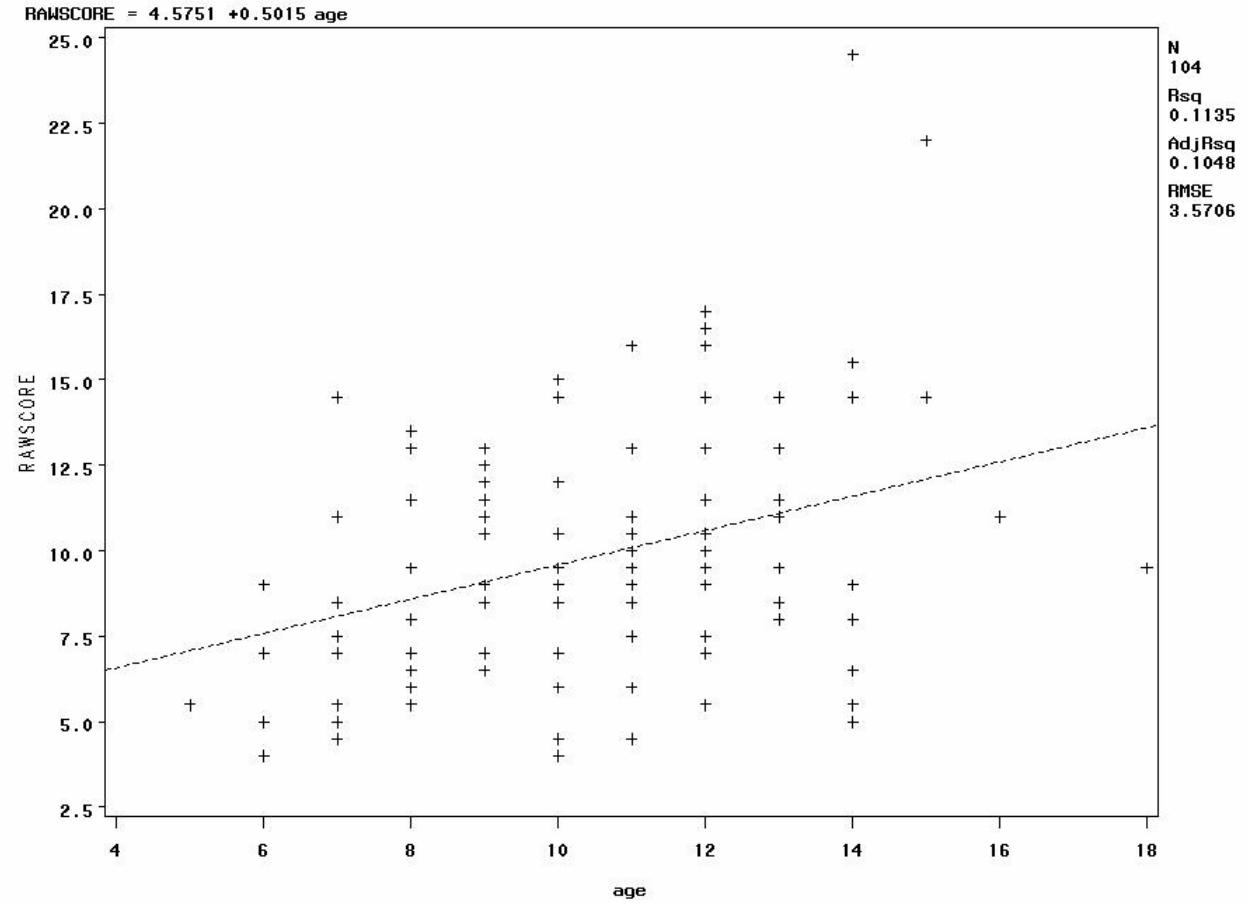

Figure 5.2. Scatter plot of children's plant naming scores (out of 40 possible correct) by age.

Plant naming scores and schooling choice

Interviewees in this study either attended the Rejogochi school, the Basíhuare school, or no school at all. Another ANOVA analysis found that the school attended did significantly account for about 4% of the variance observed (R^2 =0.0364; df=1,99; F=3.74; p<0.0558). Those children who attended the Rejogochi primary school were more likely to correctly name plants than those attending the Mexican state primary school or secondary school in Basíhuare.

Plant naming scores and years of formal schooling

The next ANOVA analysis was performed for the relationship between naming scores and the years of formal schooling each interviewee has experienced. The results indicate a non-significant relationship (df=1,102; F=0.01; p<0.9353), which we interpret to mean that years of schooling has no effect on children's ability to correctly name the plants in the interview set, though once adjusted for the other factors (such as age), this characteristic is significant (see General Linear Model analysis results, below).

Plant naming scores and bilingual ability

Interviewees' self-reporting of being a monolingual Rarámuri speaker or bilingual Rarámuri-Spanish speaker also had no significant effect on plant naming scores (df=1,102; F=0.08; p<0.7754).

Plant use knowledge

Use-knowledge refers to answers to the open question, "What is this plant used for?" which was asked for each plant in the interview set, once the participant replied to the query about the plant name. One point (up to three total) were given for each 'correct' answer for each plant specimen, which should be taken into account when assessing the following scores (they are reported as total uses known for the 40 plants rather than as percentage scores). The use-knowledge scores ranged from 1 to 34 reported uses. The mean use-knowledge scores for girls and boys were 15.2 and 17.4 respectively, a non-significant

difference (df = 1,102, F=1.95; p<0.1660, ns). Thus, girls' and boys' results will be discussed together.

Use-knowledge and age

In contrast to the plant-names analysis, age showed no significant influence on interviewee's use-knowledge scores (df=3,100; F=0.44; p<0.7227).

Use-knowledge and school choice

As with the plant-names analysis, school attendance choice *did* account for some of the variance observed (df=1,99; F=19.88; p<0.0001). The coefficient of determination (R^2) is 0.167, which indicates that approximately 17% of the variation can be associated with which school the interviewee attended. Those who had attended the Rejogochi school had a mean score of 19.0 correct uses; those who had attended Basíhuare primary or secondary had a mean score of 12.6 correct uses.

Use-knowledge and years of schooling

Though there was a slight negative correlation, years of schooling did not significantly affect use-knowledge scores (df=1,102; F=1.22; p<0.2713).

Use-knowledge and bilingual ability

Self-reported monolingual or bilingual ability did not significantly affect use-knowledge scores (df=1,102; F=0.01; p<0.9337).

General linear model analysis

Because these data were not collected in a completely balanced design, i.e., equal numbers in every category, a general linear model was used to assess each measured variable's relative influence as a source of variance, *taking into account* all the other variables and adjusting for them. For example, in this procedure, the effect of age on years of schooling is adjusted for. This procedure yielded similar results to the individual analyses, though slightly more extreme, lending additional weight to the previous results (Table 5.2).

Table 5.2. Summary of results of General Linear Model procedure for plant naming and use scores. Those marked with an "*" are considered statistically significant.

Source of variance	df	Sums of Squares (SS)	Mean Squares (MS)	*F*	*p*
Plant Naming Scores					
Age*	3	253.7	84.6	7.47	<0.0002*
School choice*	1	46.29	46.29	4.09	<0.0461*
Years of schooling*	1	72.19	72.19	6.37	<0.0133*
Bilingual ability	1	1.69	1.69	0.15	0.70
Plant Use Scores					
Age	3	96.8	32.3	0.65	0.59
School choice*	1	1001.2	1001.2	20.1	<0.0001*
Years of schooling	1	0.81	0.81	0.02	0.90
Bilingual ability	1	63.9	63.9	1.28	0.26

Plant species salience

One aim of this study is to understand how biological and cultural influences interact to influence a child's cognitive perception of the botanical realm. Trends in plant salience scores bear examining with this in mind. When the study plant species are ranked from greatest to least perceived salience scores (percentage of children who correctly identified the plant), as in Table 5.2 and Figures 5.3 and 5.4, almost all plants ranking in the top third of salience scores also show strong affiliation with either or both biological and cultural attributes that might account for their rank. Conversely, those plants which very few or no children identified correctly, at the bottom of Table 5.2, had few or no distinguishing characteristics in either domain. As is to be expected, the common denominator among plants with high salience scores seems to be high frequency of contact in children's daily experience, either because the plant is of high use-value (e.g. *Arctostaphylos* and *Arbutus*) or because it is very abundant in the area, or both. Children were able to cite names and uses for many more edible plants than medicinals or other useful plants. They did over three times as well on edible naming tasks and over twice as well on use-identification tasks.

Of the ten lowest ranked species (little perceived salience) by name, the uses reported were all somewhat obscure and/or secondary to another plant used for that purpose. The same ten species could not be attributed any outstanding biological or ecological characteristics.

When plant salience scores are depicted graphically (Figures 5.3 and 5.5), it is apparent that children's knowledge of the experimental

plant subset is distributed regularly, from 100% to 0% recognition of plant names and uses. Figure 5.3 and 5.4 can also be used to infer the sequence of name learning by children; it is the case that the plants with the highest perceived salience scores were the (only) ones recognized by the cohort of three-to-six-year olds, while the few children able to identify the plants of low perceived salience (e.g. the eleven lowest ranked) were all older than ten years. These results show that in a particular botanical environment, children's vocabulary set of first-learned plant names is regular and shared, with some amount of variation in content and growth rate.

Discussion

There have been few studies in the Sierra Tarahumara that have utilized the kind of structured, formal interviewing and quantitative analysis that this part of my study employed; I believe there are particular challenges to doing this kind of research in Rarámuri communities, and particularly with children, the effects of which must be acknowledged. In the present case, I believe the social and cultural environment of interviewing resulted in a 'dampening' of overall results; in other words, these results are a conservative representation of what children know about plants. The strengths of these data include their replicability, the inclusion of a large sample of informants, and value for triangulating towards understanding in conjunction with other kinds of evidence, such as ethnographic data. What could a researcher do differently to avoid

Table 5.3. Rank of plant species by relative salience (name and use) (104 interviews).

Latin botanical name	Rarámuri name	Salience rank		# of correct names	% correct names	# of correct uses	% correct uses
		Name	Use				
Arctostaphylos pungens	***wíchari***	1	3	95	91	95	91
Arbutus xalapensis	***kurúbisi***	2	1	91	88	99	95
Tagetes lucida	***sebanél***	3	2	82	79	97	93
Zornia thymifolia	***yerbavívora***	4	8	66	63	71	68
Bidens odorata	***sipé***	5	6	62	60	83	80
Amaranthus hybridus	***wasorí***	6	7	58	56	71	68
Cucurbita foetidissima	***warisí***	7	36	48	46	10	10
Eryngium heterophyllum	***sowíware***	8	20	43	41	44	42
Pinus engelmannii	***okósawe***	9	4	41	39	84	81
Dahlia sherffii	***amári***	10	18	38	37	49	47
Pinus lumholtzii	***sawá***	11	14	37	36	55	53
Pinus chihuahuana	***sawá***	12	12	36	35	57	55
Agastache micrantha	***húpichi***	13	9	31	30	68	65
Usnea/ Teloschistes	***rité bo'wára***	14	13	30	29	57	55
Vaccinium confertum	***mazana***	15	39	29	28	4	4
Juncus sp.	***kasará sitákame***	16	10	27	26	64	62
Psacalium decompositum	***matarí***	17	16	25	24	54	52
Chenopodium ambrosioides	***pasóchi***	18	11	22	21	57	55
Milla biflora	***siwá***	19	40	19	18	0	0
Bletia macristhmochila	***ikí***	20	33	14	13	13	13
Senecio hartwegii	***sopépare***	21	38	10	10	8	8
Ligusticum porteri	***wasía***	22	37	8	8	10	10
Nicotania tabacum	***wiwaráka***	23	24	7	7	34	33
Buddleia cordata	***mahtó***	24	15	7	7	54	52
Echeveria sp	***metagóchari***	25	35	6	6	11	11
Cosmos bipinnatus	***kihúbare***	26	19	5	5	48	46
Plantago australis	***rorogóchi***	27	23	5	5	35	34
Cupressus lusitanica	***wa'á***	28	5	3	3	83	80
Dryopteris cinnamomea	***toríwasira, mocho'á***	29	22	2	2	38	37
Euphorbia sphaerorhiza	***napilúti***	30	27	1	1	27	26
Tillandsia recurvata	***siwáchare***	31	32	1	1	15	14
Galium mexicanum	***chorónare***	32	31	1	1	22	21
Machaeranthera stenoloba	***mo'óchare***	33	28	1	1	27	26
Phytolacca icosandra	***ba'wí***	34	29	0	0	25	24
Ratibida sp. (?)	***basúl***	35	26	0	0	29	28
Agastache pallida	***masérachi***	36	17	0	0	53	51
Bidens ferulifolia	***chorónare***	37	25	0	0	34	33
Comarostaphylis polifolia	***wichátare***	38	30	0	0	24	23
Tagetes subulata	***sebanél***	39	34	0	0	12	12
Desmodium sp.	***baniwá***	40	41	0	0	0	0
Salvia sp.	na	41	21	0	0	43	41

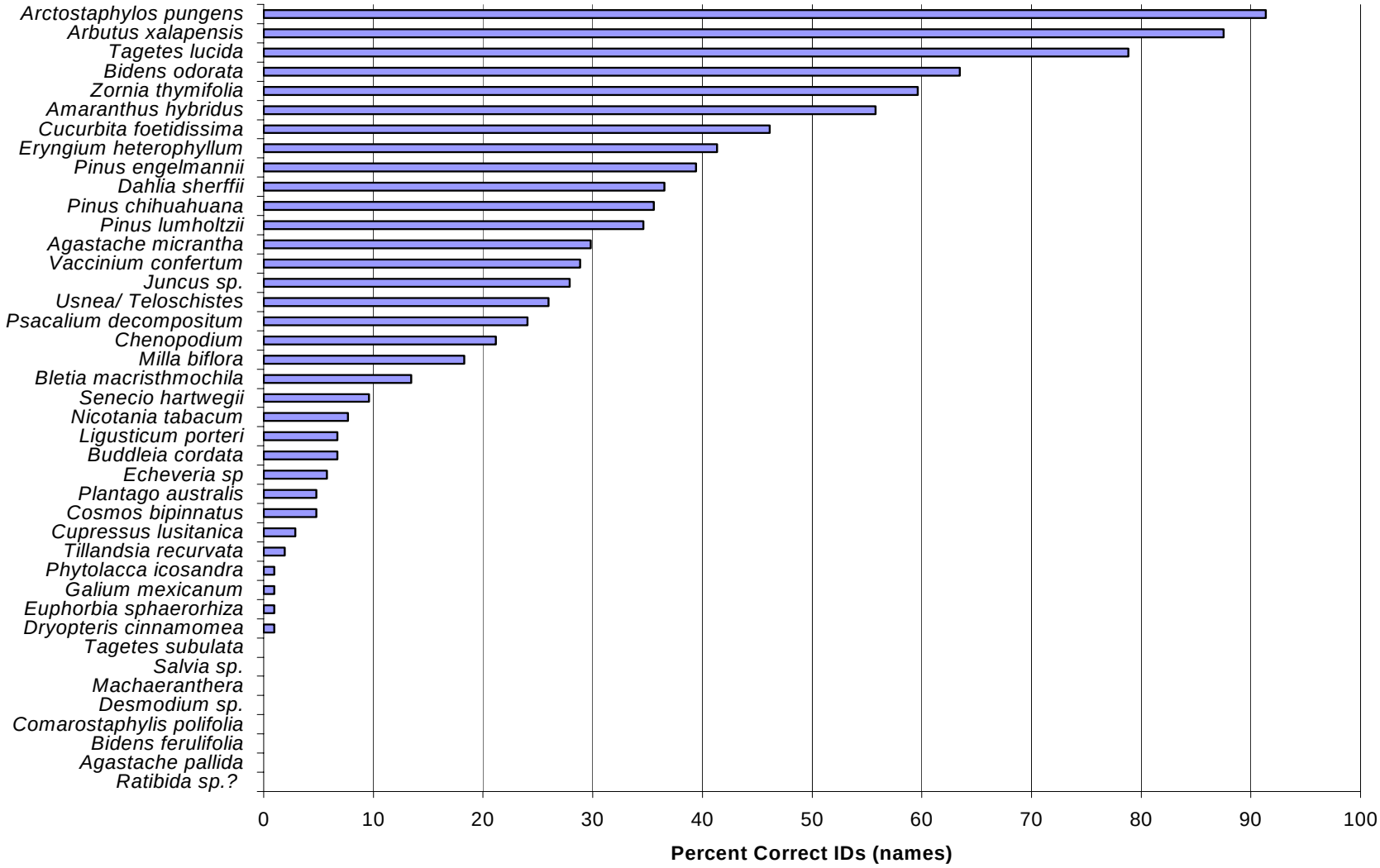

Figure 5.3. Plant species salience scores by percent correct identifications of names.

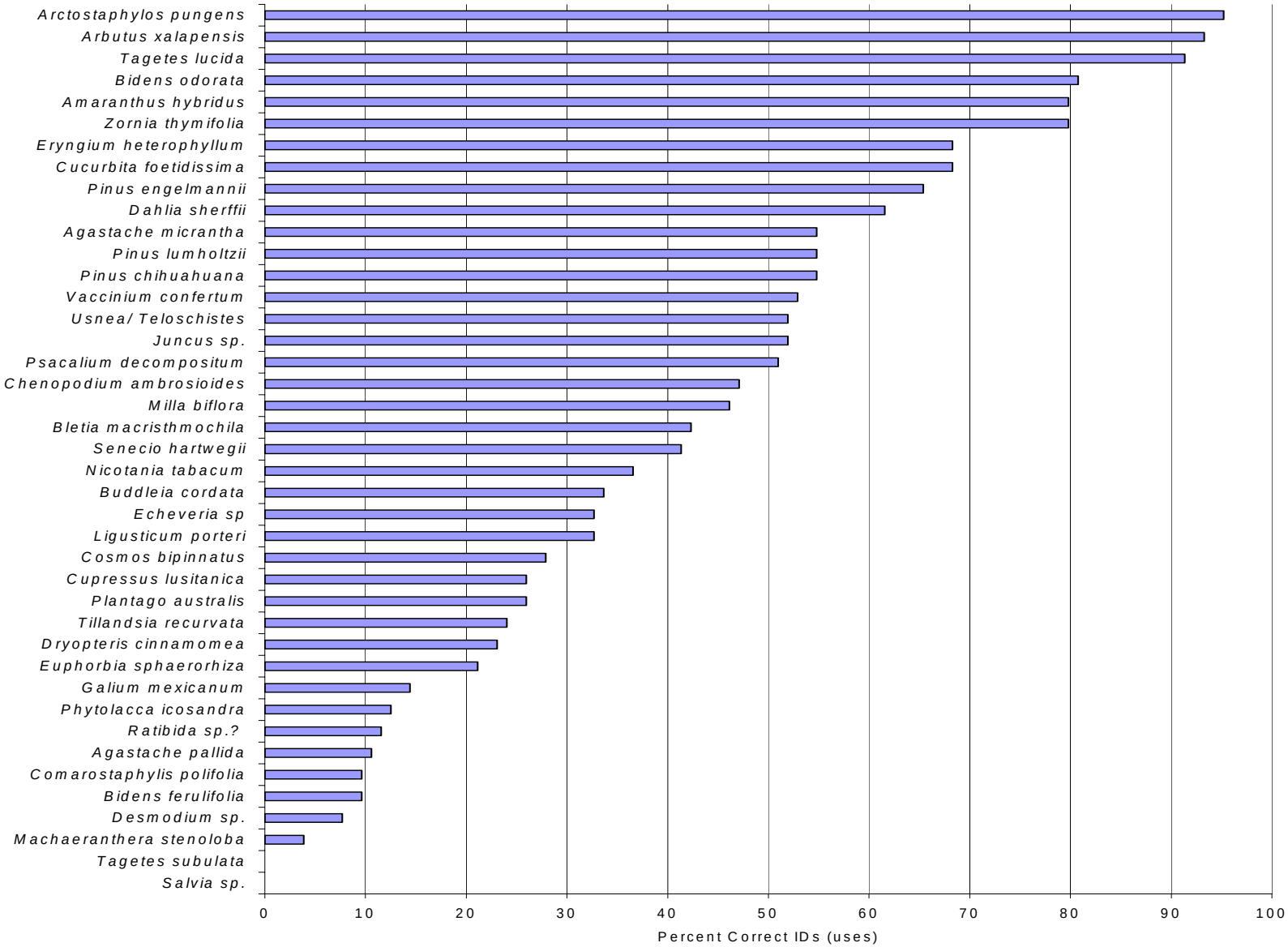

Figure 5.4. Plant species salience scores by percent correct identifications of uses.

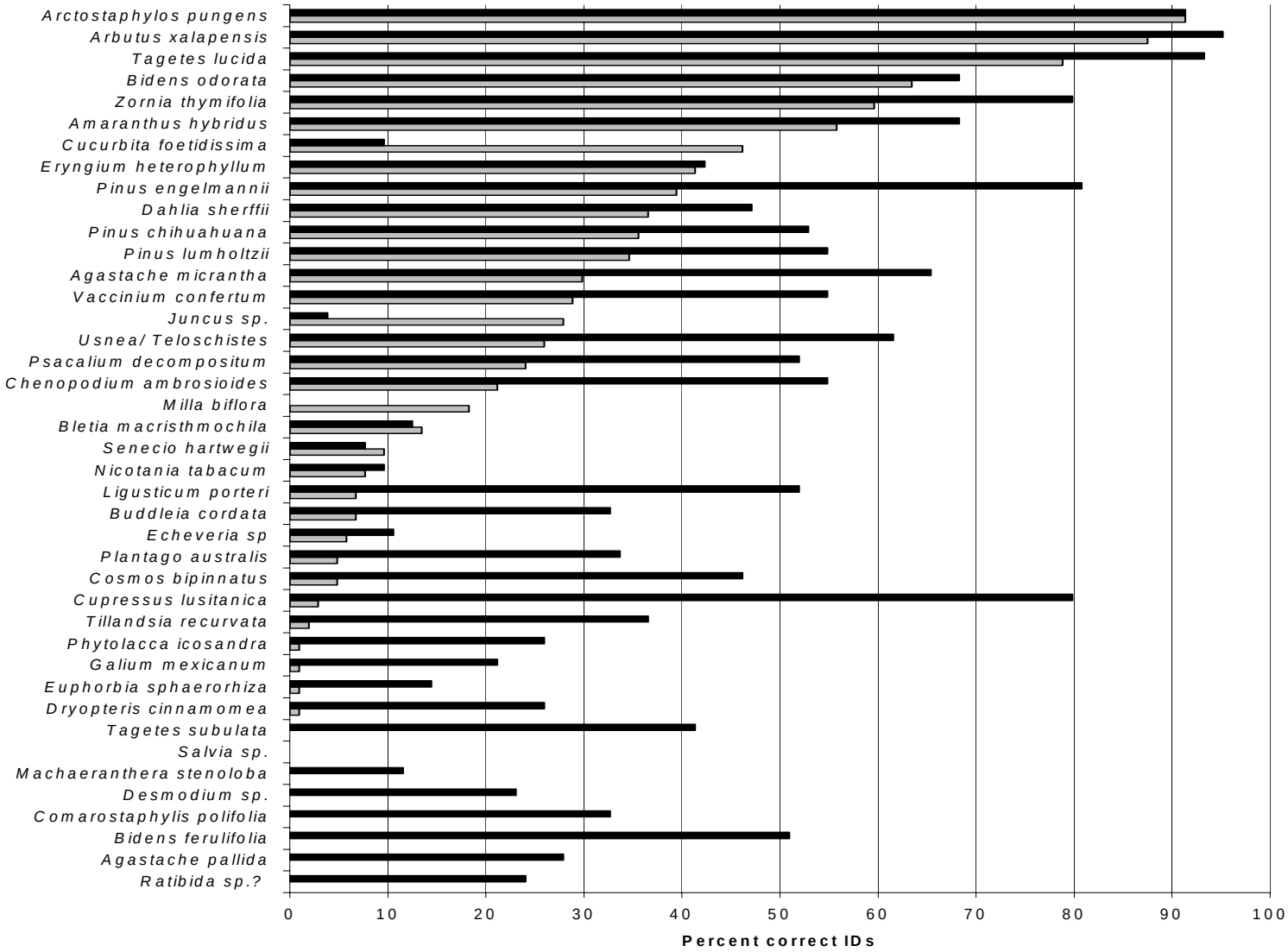

Figure 5.5. Plant species use-salience (black) compared to naming-salience (gray).

some of the interviewing difficulties I describe here and yet maintain empirical rigor? I suggest that the highest-quality data for the domain of children's plant knowledge comes from opportunistic observations and informal discussions with consultants who are interested and invested in the research, of whom are not lacking in Rarámuri communities. Structured data-collection should mimic natural environments as much as possible, and forfeit some reliability if necessary to achieve this. For example, children might be more productively interviewed in groups, or invited to organize specific research questions and data collection themselves.

Consensus and variation

Though the consensus analysis procedure proved unhelpful as a tool for ranking children according to adult 'expertise' or 'proficiency' it revealed the interesting result that children share a 'culture' of plant knowledge that is different though related to that of adults. In other words, children agree in regular ways about which plants they name and how they are going to name them, and these differ from the adult culture of plant naming. A prevailing (western) cultural model of education as incremental bits of information 'transmitted' or 'acquired' and accumulated might interpret this as simply an intermediate stage 'on the way' to becoming adult. The discussion below, on discernable patterns of plant knowledge among children, also attempts a more Rarámuri-centric approach that

describes and evaluates children's knowledge as a whole system in itself, discussed further in chapter six.

Two kinds of knowledge variation are discussed here: 1) variation as expressed in patterns of knowing, associated with different social characteristics (what explains the community-level patterns we see), discussed below, and 2) idiosyncratic, individual-level variation that may or may not be patterned, such as the many variations in pronouncing plant names (Table 5.1). The second kind of variation is well documented for Rarámuri communities and Rejogochi in particular (Merrill 1988); it is an expression of individuality and personal preference as well as particular micro-histories. This type of informational diversity may be characteristic on non-literate societies and reflect emphases on higher-order agreement rather than conformity to details (Merrill 1988). Conceptual or cognitive variation is not treated here.

It is notable that of the fifteen plants in Table 5.1 three of the top five with the most variation in phonetic pronunciation are names of Spanish origin (*Tagetes lucida, yerbanis; Zornia thymifolia, yerba vibora; Chenopodium ambrosioides, pasochi*). This may reflect pronunciation of words that do not have productive meaning in the Rarámuri language, and thus are subject to individual whim (akin to the great diversity found among English-speakers' pronunciations of Spanish loan words).

Plant naming and use-knowledge proficiency

Children's overall scores for naming and use-knowledge of the experimental subset of forty plants were lower than I expected. It is important to remember that the scores here are specific to a particular group of plants; and one should be conservative in using these scores to represent each child's *general* plant knowledge. Overall trends and relative rank are most relevant, though reasons for the overall low scores, especially the naming scores, may be explored.

One interpretation of the overall low scores is that Rejogochi community members were 'more knowledgeable' in the past and that competing interests of schooling, alternate livelihoods, goods available for purchase and medical clinics have made extensive plant knowledge less intrinsic to Rarámuri life ways, and less available to children growing up today. Unfortunately my data here do not comment on the historical aspect of this interpretation, though it is clear from oral and recorded histories that these trends have impacted traditional Rarámuri education practices.

Another, less plausible interpretation is that extensive knowledge of plant names are not particularly important for all Rarámuri, apart from a core group of culturally and biologically salient species. Evidence to support this include my observations that many adults did not know or remember names for medicinal plants they collected, traded and kept as household remedies. They knew what they were used for, where to find them, or who to contact if they needed more. Informal specialists who profess abiding interest in plants make up a minority of highly knowledgeable people in the community. These

people are usually not formal healers, but often play a consulting role for other community members, advising which plants to take for certain illnesses and where to find them. In this interpretation, plant knowledge must be evaluated both at the individual level (what each person knows) and at the community level (do enough centrally connected people know the information such that it is available to individuals when they need it?). In this interpretation, 'community knowledge' is not a simple aggregate of all individuals' knowledge, but includes structural social communication networks as well.

A third interpretation is that these results simply show the natural progression of knowledge acquisition: children have low scores because they have less experience and cognitive skills than adults, and they will attain adult levels of competence eventually. This is implausible, however, because even the teenagers had low knowledge scores. The patterns of knowledge scores show that high competence is attainable for children even at a young age. It is thus most likely that the overriding influence on children's plant learning is their immediate familial environment.

The general results show the importance of individual interest and pursuit of plant knowledge, starting from a young age and highly influenced by the availability of a mentor or family environment of botanical interaction. Of the two high-scoring outliers in the study, one was a boy who was currently attending school in Basíhuare, and the other a young teenage girl who had attended school in her youth for a few years. This girl's sister was the next-highest scorer; their family places a great deal of emphasis on the study of natural

history. The lowest scorer was a young boy who is extremely bright and observant, but who had only recently returned with his parents from living in his mother's natal community near Guachochi and working in Mexican towns. Thus, he was unfamiliar with the flora and even took a while to begin to speak in Rarámuri again.

No significant variation could be attributed to gender specificity, except for ability to name one plant, *Cucurbita foetidissima* (though even this one may be due to chance). It is not surprising that overall girls and boys scored more or less the same, since both genders participate in outdoor work and botanical activities from a young age. The slightly higher scores by boys may be due to boys' slightly wider range geographically and socially. ***Warisí*** (*Cucurbita foetidissima*) fruits were often cited as a substitute for ***rarajípa*** balls by boys, so this may account for its higher salience among them.

The results of the naming proficiency patterns show only age, school choice and years of schooling as significant factors in determining how well children did (using the adjusted GLM results), but they are relatively weak correlations, age accounting for only 11% of the variation and school choice for 4%.

Language ability was not significant, which is not surprising since this was self-evaluated on the part of the interviewees and varied greatly in interpretation. The ages of participants were from five years old to eighteen years old; that age was so uninfluential requires explication. This is the kind of result one would expect in a community with differentiated groups with very different environmental

experiences; i.e., lack of learning occurring among certain portions of the population, such that we find enough knowledgeable youngsters and ignorant elders to balance each other out. Based on ethnographic experience, I interpret these results as indicating a learning environment in which certain children with the right relationships coupled with personal interest, become knowledgeable of a wide selection of plants at a young age, while other children learn only the basic, most biologically and culturally salient plants around them and increase their repertoire slowly.

The overall use-knowledge scores were almost twice as high as naming scores (mean of 16 uses cited for 40 plants, or 40%, though this is slightly inflated by possible multiple uses per plant, vs. mean of 24.4% correct names). This supports the conclusion that use-context is more salient or easier for children to remember than names. Surprisingly, the name and use-knowledge did not overlap fully, as can be best seen in Table 5.3 and Figure 5.5. However, some of the most extreme discrepancies can be explained by considering the individual plants. *Cupressus lusitanica* was ranked fifth in use-recognition (firewood and medicinal) but twenty-eighth in naming recognition. This is certainly due to the regular confusion of ***wa'á*** with ***ahorí*** (*Juniperus* sp.) by children. Similarly, the *Pinus* species were often confused with each other, which lowered the naming scores; since these species all have similar, highly culturally and biologically salient uses, use-knowledge remained high.

Within the plant-use knowledge results, only school choice was significant in predicting how well children would score, accounting

for about 17% of the variation observed. As with the plant names, this reflected better scores on the part of children who attend or had attended the Rejogochi primary school rather than the Basíhuare school. The Rejogochi school (run by the Catholic diocese) teaches primarily in Rarámuri language by Rarámuri teachers (for beginning grades); these students scored higher than students who went to the Spanish-instruction boarding school in Basíhuare. The Rejogochi school also has implemented curricula and activity programs to integrate traditional Rarámuri knowledge into classes, including field trips to collect and study wild useful plants, perhaps suggesting that programmatic changes in educational structure and format works to maintain active traditional knowledge bases for children. The results of this study may be attributable to this educational orientation, or to the fact that this school is in many ways more integrated in the local community in terms of teacher-parent participation. Also, it is easier for Rejogochi students to miss school without penalty to participate in traditional tasks or rituals. Another possible explanation is that Rejogochi students had more experience with the set of plants used in the study, which were mostly collected in the area. Basíhuare students come from a wider catchment area that includes differing botanical ecologies.

Cultural and biological salience from a learning perspective

The role of childhood environments in cognitive development has been well researched (Lerner et al. 1995, Valsiner and Voss 1996), but relatively few studies have focused specifically on the acquisition of

biological or ecological knowledge. It has been suggested that childhood processes of learning to forage in local environments improves individual cognitive ability to describe and predict levels of biodiversity (Chipenuik 1995). Gary Nabhan and others have also stressed the important role that interactive knowledge of one's biotic environment plays in children's social, psychological, intellectual and spiritual development (Nabhan and Trimble 1994). Dougherty's (1978) research on urban U.S. children's biological classification suggests that the relatively low importance of botanical interaction for urban children led to attrition in naming abilities as well as a shift from generic names (Berlin 1992, Stross 1973) to life form names in classification.

In contrast to urban cultures, the Rarámuri and the Tzeltal Maya of Highland Chiapas (Stross 1973) provide rich contexts for child-plant interaction and we expect correspondingly high levels of naming ability. Brian Stross' research in the 1960s using plant trail identification tasks with Tzeltal children affords productive comparisons to the results of this study. Stross reports patterns in the development of Tzeltal nomenclature that parallel those found among Rarámuri children. After age six or seven, both Rarámuri and Tzeltal children were found to make a switch from naming plants as life forms to using generics or species names. This corresponds with Keil's suggestion that a "distinct domain of biological thought does not emerge until quite late in the course of cognitive development, often not until 6 or 7 years of age" (1994:235). Stross reports an increasing likelihood of answering "I don't know" rather than an

incorrect generic or correct suprageneric by older children, and vice versa for younger subjects, as was found among Rarámuri. Another parallel between the two studies is the propensity among young and old alike to give suprageneric names for members of the class 'grasses'.

Stross notes the use of characteristic descriptors by young children, interpreted as making up for inability to name the plant, whereas use descriptions are positively associated with naming ability. This was the case among Rarámuri children in this study as well. This implies that use and interaction increases plant salience for children in both cultures, while Rarámuri may also encourage children to pay particular attention to ecological/ life history cues.

Stross notes that "developmentally, the interesting thing is the composition of the class of plants that a child of a given age cannot name....[a]s the child grows older, the plants that he cannot name become fewer, less culturally important, and less frequently encountered" (1973:128). This statement is apt for Rarámuri children too, with the addition of "less biologically salient" to the list. It is clear that both cultural and biotic factors influence plant perceptual salience for children. Some of the characteristics of salience relevant to the present discussion are presented in Table 5.4.

It is important to note that many features of biological salience are in reality intrinsically related to cultural salience and vice versa. This reciprocity and dynamic interaction cuts to the heart of plant-human relationship in evolutionary and cultural realms and is likely to be central in actual cognitive and perceptual process.

Table 5.4. Some features of biological and cultural salience that may play a role in children's differential plant recognition.

Features of Biological Salience	Features of Cultural Salience
prevalence/ abundance	prevalence in social environment
size (relative to humans)	primary/secondary food source (domesticated, managed, etc.)
phylogenetic/ morphological uniqueness (monotypicality)	material value (construction, manufacture, medicine, other)
potential danger (spines, toxicity)	commercial importance
	prevalence and qualitative role in folklore, ritual, religion, world view

Conclusions

This cross-sectional study has highlighted the interrelationships between community, cultural and biological influences on children's acquisition of plant knowledge. Results suggest that experiential and interactional learning are of primary importance in shaping the content of botanical knowledge, which seems cross-culturally to follow regular patterns of cognitive development. In rich botanical environments, holistic learning processes respond to both biological and cultural salience. In designing biological and cultural conservation plans, it would seem necessary to ensure the vitality of ecological knowledge systems by paying particular attention to young people's productive access and interaction with their biological environments. Larger contexts of economic and cultural development and assimilation should also consider possible impacts on endogenous knowledge transmission systems and repercussions for sustainable

present and future relationships between human and biological communities. Transitions to formalized education systems should incorporate culturally encoded environmental knowledge, experiential learning, and community participation in teaching traditional ways of knowing about environments.

Chapter 6

Conclusions and Beginnings

Figure 6.1. Pine-bough arch with ***rosabóchame*** 'flowers,' bows and coatimundi quivers. The three crosses represent loci for ***Onorúame***, his wife (~Mary) and Christ (~morning star). Children's Easter, Rejogochi 2001.

This dissertation contributes a case study of one component of a contemporary Rarámuri information ecosystem: the transmission of ethnobotanical knowledge and people-plant relations. The implicit model that is often invoked to explain knowledge shifts (i.e., that socio-economic, organizational and technological changes from outside the system force an impoverishment of traditional, subsistence-based knowledge) is reevaluated with the aim of developing an ecosystem ethnography that investigates processes of change that are integral to the system as well as those from outside that must be negotiated. Here I briefly summarize previous research in this framework, followed by a short outline of how this dissertation research on Rarámuri ethnobotanical learning ecology fits into and contributes to the inquiry.

Interactionist perspectives on learning and teaching in cultural context

Learning is essential to the production and reproduction of culture, and thus to human survival and expression. Here I examine works that contribute to a holistic and context-centered analysis of cultural transmission. Students of cultural transmission have taken diverse approaches. While the approach to knowledge transmission as a culturally contextualized phenomenon implicitly recognizes biological and (Darwinian and Lamarckian) adaptive underpinnings of teaching and learning, it focuses on group level dynamics and social interaction. A general theory of cultural transmission has yet to be developed,

though several have taken steps in the direction (Boyd and Richerson 1985, Dobbert et al. 1984, Gearing 1984).

The contextual perspective on learning is closely related to studies of socialization, which have tended to focus on the acquisition of cultural norms, values and beliefs, and interaction rules. These studies focus on "how infants and children are taught to think, act, and feel appropriately" (Pelissier 1991:82), rather than how learners acquire specific skills or knowledge (cf. Diamond and Bond 1983, Hewlett and Cavalli-Svorza 1986). Education is used in this context as synonymous to cultural transmission, incorporating all instances of learning. The community is viewed as the relevant context in which the learning process occurs. A holistic, systemic approach situates the child in an environment of multiple interaction, in which s/he is "able to account for an event in its totality and learns to predict others' behavior in a given interaction" (Dobbert et al. 1984). In other words, children learn whole patterns rather than fragmented pieces of information, and have an active role in the learning process (Rogoff 1990). This framework parallels Rarámuri conceptualizations and theories of learning.

Building upon a simpler unilateral communication paradigm, an interactive model employs the idea of active learning via multiple messages (Gearing 1984). Both the agents of socialization and the socialized engage in negotiation over the construction of reality (Gearing 1984). The child or the novice "is not a passive recipient of sociocultural knowledge but rather an active contributor to the meaning and outcome of interactions with other members of a social

group" (Schieffelin and Ochs 1986). This negotiation or positioning often surfaces in cross-cultural instruction situations, as described by Pelissier (1991) with regards to Native American and Hawaiian students in Anglo education systems, and apt for Rarámuri schooling as well (cf. Tello Díaz 1994). Learners are situated in non-neutral contexts and experience is 'loaded' both emotionally and psychologically (Gearing 1984). Relationships of alliance and apposition play a central role in these environments of cultural transmission.

A related conceptual framework, proposed by Lave and Wenger (1991) is used to look at "how people become full participants in, and in the process participate in reproducing, communities of practice." Called legitimate peripheral participation, learning here is interpreted as increased participation in a community of practitioners. Instead of focusing on the individual as passive recipient of information or skills, this model provides a view of learners as actors in their social contexts or communities of practice.

An interactive and contextual model of learning can incorporate variegated cognitive roles in learning, depending on the kind or domain of knowledge transmitted (Atran and Sperber 1991). Some kinds of knowledge, such as folk tales or broad biological classifications (Boster 1987a) may be acquired by imitation or individual perception and deduction.

Approaches such as legitimate peripheral participation tend to avoid dichotomizing learning contexts, instead employing multiple

communication/ learning instances. It can be useful, however, to identify the various contexts of learning in order to understand the multi-modality and multi-situational nature of human knowledge acquisition. For example, many in the transmission literature distinguish primarily between formal and informal/non-formal/spontaneous learning (Atran and Sperber 1991; Pelissier 1991; Dobbert et al. 1984; Diamond and Bond 1983). Formal learning is considered deliberate, premeditated, and usually in contexts other than that in which knowledge is to be applied. Language and other abstractions are used to convey principles and skills (Dobbert et al. 1984), and formal learning is often associated with social institutions (eg. schools, apprenticeships) and functions in the one-to-many mode of transmission (Cavalli-Svorza and Feldman 1981).

On the other hand, informal (also called non-formal, experiential or spontaneous) learning usually occurs in activity contexts in which interaction with social and biophysical environments provides feedback in the learning of concrete skills. Imitation, casual instruction and observational learning are central in informal education contexts (Atran and Sperber 1991).

Cavalli-Sforza and Feldman (1981) have hypothesized modes of cultural transmission and how these might affect patterns of change and cultural evolution. Some of the important learning contexts and strategies they identify include modeling, group learning, social conflict learning, play, habitat learning, and instruction. Humans are polyphasic learners, meaning that we acquire information simultaneously through multiple modalities—visual, aural, olfactory,

tactile, kinesthetic, and cognitive (judgment, awareness and perception).

Recent work on distributed cognition highlights the social nature of much learning and behavior (Hutchins 1996); some research suggests that knowledge, learning and practice always transcend the boundaries of the individual and is most productively examined as processes functioning within structured cultural, social and biophysical contexts (Bateson 1988, Bateson 2000, Bateson and Rieber 1989, Hall 1983, Kirshner and Whitson 1997, Lancy 1996, Salomon 1993). It is the externalization of cognition in physical objects, social interaction, and language use that makes possible the learning and socialization of new individuals in a language and a culture. Learning is located in the individual *and* in their cultural, social, biological and physical environments.

Learning, cultural transmission and ecosystem transformation

Netting notes the importance of working towards a "unified approach to the interrelations of natural environment, technology, and human social organization through time" using the tools of ecological anthropology (Netting 1986:vii). It is the interface between environments that is the interactional matrix of knowledge: "Between the physical environment and human activity there is always a middle term, a collection of specific objectives and values, a body of knowledge and belief: in other words, a cultural pattern" (Forde 1963:463 cited in Netting 1986). Though ecological anthropology should probably still be considered to be adolescent in its development,

there is value in striving for a holistic view as prescribed by Netting. Part of the goal of this study was to lay some groundwork with which to understand one knowledge ecosystem and its transformations: that of the Rarámuri of the Sierra Tarahumara. The scope and scale of such an inquiry requires a continuous elasticity of analysis and may involve the sacrifice of other desirable aspects of inquiry, such as thoroughness in all subdivisions of the endeavor. The logical reasoning is as follows:

Human systems rely on externalized cognition (language, symbolic expression, material artifacts) to sustain the complexity of their sociocultural and biophysical relations in their environments for within-generation and between-generation transmission of ideas and knowledge. This transmission of knowledge is a foundational subsystem within the whole system, as the mechanism for maintaining continuity over time *and* accessing creative responses to change. Human ecosystem change occurs because of a) change in an informational subsystem that radically changes the whole, or b) change in a biophysical subsystem that radically changes the whole (Rappaport 1999). In the first instance, knowledge systems play a causal role; in the second knowledge systems play a responsive role.

Human ecosystems are important examples of second-order cybernetic systems, that is, systems that critique and comment upon themselves. Information systems, including transmission of knowledge, belief and practice, are central to understanding how these processes work, as they constitute major subsystems in every known human ecosystem and may play special roles in distinguishing change in human

systems from change in other systems. Here, systems are defined as immanent in processes and transactions; they are inferred by observing patterns of behavior and informational expressions. We assume that information systems are non-determinative and not necessarily functional.

Toward a model of Rarámuri education: knowing plants vs. plant knowledge

Rarámuri conceptualizations of the importance of relationships between people, between people and ***Onorúame*** and between ***Onorúame***-people-environment are central structural and processual components of Rarámuri education. The ***rumigá*** thread-like cords that connect people to God and other beings can be interpreted metaphorically as conceptual manifestations of all Rarámuri-environment relationships. These connections also grow between people in intimate relationships such as parents and children, husbands and wives, and between people and plants and animals in their environment. Curing rituals actively manage these relationships for individuals and communities. During Easter renewal ceremonies God is spoken of as being immanent in every object and being, and I suggest this underlies Rarámuri thought and behavior during the rest of the year as well. It is relevant to understanding plant knowledge patterns in that knowing is a relationship between cognizer and cognized and it is in this sense that knowing (non-spiritually powerful) plants may be considered both material/pragmatic and spiritual/sacred for Rarámuri, though perhaps

no more than any relationship maintained by Rarámuri during their lifetimes.

By using a conceptualization of Rarámuri learning as relationship or process, immanent in interaction, we are able to reconcile several observations. First, the unspoken uncertainty on the part of Rarámuri research participants as to the utility of my techniques for measuring plant knowledge (i.e., decontextualized environmentally and socially, knowledge treated as discrete, measurable parts rather than interaction-based). Second, the heterogeneity of plant name pronunciation suggests a de-emphasis on naming plants "correctly." Observations of people's interactions with plants suggest, instead, an emphasis on knowing how to use plants and/or who in their social networks to go to for advice. Third, children in this system are twice as likely to know plant uses as plant names[1]; this supports the importance of experiential knowledge and use-interaction in cultural transmission.

I contend that, in this Rarámuri system, if not all systems, it makes sense to think of learning ecological knowledge as wholly contingent upon relationships--—with other people as well as other living things. Cultural repertoires are acquired through guided reinvention (Lock 1980), in which adults and other people create learning environments for children (intentionally or unintentionally), and children take an active role acquiring and modifying the information and behavior around them. Atran's description of such a

[1] This is approximate; see discussion in Chapter 5.

system among the Itzaj Maya, which he calls an "emergent knowledge structure" is appropriate also for the Rarámuri:

> An emergent knowledge structure is not a set body of knowledge or tradition that is taught or learned as shared content. Neither is it equally distributed among individual minds in any given culture or systematically distributed among the individual minds in any recognizable culture or subgroup (e.g., experts) to a reliable extent. The general idea is that one's cultural upbringing primes one to pay attention to certain observable relationships at a given level of complexity. By coaxing rather than determining adaptive behavior, this cultural upbringing also allows individual people the leeway to discover for themselves and appreciate the relationships that best fit their life circumstances. Yet, each person is also culturally attuned to the relevant discoveries of other individuals whose knowledge forms part of the emergent cultural consensus. (Atran 2001:155)

This model highlights the importance of understanding how knowledge distribution patterns correspond to social relationships, social roles, and individual and family interest and experience. From the ethnographic and interview data presented in this dissertation, a Rarámuri model is suggested in which the richest and most extensive plant knowledge is held and practiced by select families, based on their interest and abilities. Children raised in these families are more likely to learn and practice this knowledge, regardless of other social-environmental factors such as schooling and bilingual ability. Discovery and new knowledge may be most likely to arise among these experts/specialists. Their knowledge repertoire consists of a basic set of plants that is shared by most community members *plus* knowledge of rarer, specialist plants and more obscure uses for them. Other individuals and families may need to learn or be interested in learning a more limited set of plant relationships, those most biologically and culturally salient in their environments. When

measuring knowledge (e.g., names and uses for plants) in such a social landscape, we expect to find a few outstanding individuals who score higher than their peers. We also expect that individuals from the same family or *rancho* show similar knowledge scores, whether high or low.

Further studies on social interaction networks in Rarámuri communities will provide a description of the kinds of relationships between community members and overall interaction structures that constitute emergent knowledge structures of environmental knowledge. The central role of household learning ecologies and the dispersed settlement patterns of Rarámuri communities supports a model in which knowledge varies greatly even in small communities, as was observed in this study. Some kinds of knowledge sharing rely on relatively formalized patterns, as seen at reciprocal *tesgüino* (corn beer) parties and Sunday sermons, but plant knowledge seems to be incorporated into individual repertoires according to personal and family interest as well as opportunity.

In subsistence societies like that of the Rarámuri, plant knowledge is a critical resource for survival, as food, medicine and shelter. The reproduction of this knowledge from generation to generation contributes to cultural continuity in human-environment relations and associated social and cultural organization. The processes of knowledge reproduction may in turn be structured by the nature of community organization and interaction, resulting in knowledge variation and diversity among community members. This study contributes to our understanding of the ways in which social and ecological systems are inextricably linked and co-constitute each

other. It also lends a detailed case study of how knowledge is distributed at household and community levels, speaking to conversations in human systems ecology and cognitive anthropology about how information lives beyond the boundaries of individuals. The overall study and ethnography contributes to articulating the complex and continually renewed linkages between individuals and their societies.

For the long-term success of any conservation or education project, it is critical to enlist participation and contributions from children, so that these issues remain part of daily life and governance far into the future. Children in traditional Rarámuri communities are often engaging their landscapes and foraging for wild foods—-they too have a real stake in a healthy diverse ecosystem and deserve a voice in decisions made about their environments.

Environmental education models and future research projects will benefit from including social connectedness as well as individual learning trajectories in their assessment of how children acquire traditional knowledge in social, cultural and spiritual contexts. If ecological knowledge is to be valued and be a part of educational and biodiversity conservation efforts, then we need to understand the ways knowledge and learning are embedded in community relationships, social structures and informal education processes. For example, in a system in which certain individuals or families are recognized as particularly knowledgeable, it is important for formal education to recognize and support the social relationships that enable access to these knowledgeable individuals, as well as structuring lessons about

plants for individual students. Children's home educational environments and peer interactions are central to understanding processes of knowledge transmission and acquisition and recognizing changing knowledge structures. For the Rarámuri, changing knowledge structures are but one part of a larger process of political, economic, ecological and cultural transformations.

The questions we ask as to the nature and process of the reproduction of ecological knowledge are important ones, not only to conservationists, nutritionists, healers and indigenous rights advocates, but also to the core of anthropological inquiry. The topic is at the heart of understanding how human societies reproduce and evolve.

References Cited

Anglin, J. M. 1995. Classifying the world through language: functional relevance, cultural significance, and category name learning. *International Journal of Intercultural Relations* 19:161-181.

Atran, S. 2001. "The vanishing landscape of the Petén Maya lowlands: people, plants, animals, places, words, and spirits," in *On biocultural diversity: linking language, knowledge, and the environment*. Edited by L. Maffi. Washington, D.C.: Smithsonian Institution Press.

Atran, S., and D. Sperber. 1991. "Learning without teaching: its place in culture," in *Culture, Schooling and Psychological Development*. Edited by L. Tolchinsky-Landsmann. Norwood, NJ: Ablex.

Barber, B. 1992. "Neofunctionalism and the theory of the social system," in *The Dynamics of Social Systems*. Edited by P. Colomy. London: Sage Publications.

Bateson, G. 1988. *Mind and nature: a necessary unity*. Toronto: Bantam Books.

—. 2000. *Steps to an ecology of mind*. Chicago: University of Chicago Press.

Bateson, G., and R. W. Rieber. 1989. *The Individual, communication, and society: essays in memory of Gregory Bateson*. *Studies in emotion and social interaction*. Cambridge: Cambridge University Press.

Beals, R. L. 1961. Kinship terminology and social structure. *The Kroeber Anthropological Society* 25:129-148.

Bennett, W. C., and R. M. Zingg. 1935. *The Tarahumara, an Indian tribe of northern Mexico*. Chicago: University of Chicago Press.

Berlin, B. 1992. *Ethnobiological classification: principles of categorization of plants and animals in traditional societies*. Princeton: Princeton University Press.

Berlin, B., E. A. Berlin, D. E. Breedlove, T. Duncan, V. Jara, R. M. Laughlin, and T. Velasco. 1990. *La herbolaria médica Tzeltal-Tzotzil*. Tuxtla Gutiérrez, Chiapas Mexico: Instituto Cultura Chiapaneco.

Borgatti, S. 1992. "ANTHROPAC 4.0." Columbia, SC: Analytic Technologies.

Boster, J. S. 1987a. Agreement between biological classification systems is not dependant on cultural transmission. *American Anthropologist* 89:914-919.

—. 1987b. Introduction (Intracultural Variation). *The American Behavioral Scientist* 31:150-162.

—. 1991. "The Information Economy Model Applied to Biological Similarity Judgment," in *Perspectives on Socially Shared Cognition*. Edited by L. Resnick, J. Levine, and S. Teasley, pp. 203-225. Washington, DC: American Psychological Association.

Boyd, R., and P. J. Richerson. 1985. *Culture and the evolutionary process*. Chicago: University of Chicago Press.

Brambila, D. 1983. *Diccionario Rarámuri-Castellano*. Mexico D.F.: Obra Nacional de la Buena Prensa, A.C.

Briggs, C. L. 1986. *Learning how to ask: a sociolinguistic appraisal of the role of the interview in social science research*. Cambridge: Cambridge University Press.

Brunel, G. 1974. Variation in Quechua Ethnobiology. Ph.D. diss., University of California.

Bye, R., D. Burgess, and A. Trias. 1975. *Ethnobotany of the western Tarahumar of Chihuahua, Mexico*. Harvard University 24.

Bye, R., and E. Linares. 2000. "Relationships between Mexican ethnobotanical diversity and indigenous peoples," in *Biodiversity and Native America*. Edited by P. Minnis and W. Elisens, pp. 44-73. Norman: University of Oklahoma Press.

Bye, R. A. 1976. *Ethnoecology of the Tarahumara of Chihuahua, Mexico*. Ph.D. Dissertation, Harvard University.

—. 1979a. Hallucinogenic plants of the Tarahumara. *Journal of Ethnopharmacology* 1:23-84.

—. 1979b. Incipient domestication of mustards in northwest Mexico. *Kiva* 44:237-256.

—. 1981. Quelites--ethnoecology of edible greens--past, present and future. *Journal of Ethnobiology* 1:109-123.

—. 1985. "Medicinal plants of the Tarahumara Indians of Chihuahua, Mexico," in *Two mummies from Chihuahua, Mexico, San Diego Museum of Man Papers, No. 19*. Edited by R. Tyson and D. Elerick. San Diego: San Diego Museum of Man.

—. 1994. "Prominence of the Sierra Madre Occidental in the biological diversity of Mexico," in *Biodiversity and management of the Madrean archipelago and sky islands of SW U.S. and Northwestern*

Mexico, vol. Report RM-GTR-264, pp. 19-26. Ft. Collins, CO.: USDA/FS/Rocky Mtn. Forest and Range Experimental Station.

Cardenal, F. 1993. *Remedios y practicas curativas en la Sierra Tarahumara*. Chihuahua: Editorial Camino.

Cavalli-Svorza, L. L., and M. W. Feldman. 1981. *Cultural transmission and evolution: A quantitative approach*. Princeton: Princeton University Press.

Chipenuik, R. 1995. Childhood foraging as a means of acquiring competent human cognition about biodiversity. *Environment and Behavior* 27:490-512.

Colomy, P. 1992. "Introduction," in *The Dynamics of Social Systems*. Edited by P. Colomy. London: Sage Publications.

Crumrine, N. R., and P. C. Weigand. Editors. 1987. *Ejidos and regions of refuge in Northwestern Mexico*. Vol. No. 46. *Anthropological Papers of the University of Arizona*. Tucson: University of Arizona Press.

de Velasco Rivero, P. 1987. *Danzar o morir*. Mexico: Centro de Reflexión Teológica.

Deeds, S. M. 1998. "First-generation rebellions in seventeenth-century Nueva Viscaya," in *Native resistance and the pax colonial*. Edited by S. Schroeder, pp. 1-29: University of Nebraska Press.

Diamond, J., and A. B. Bond. 1983. The transmission of learned behavior: an observational study of father-child interactions during fishing. *Ethology and Sociobiology* 4:95-110.

Dobbert, M. L., R. A. Eisikovits, M. A. Pitman, J. K.Gamradt, and K. Chun. 1984. Cultural transmission in three societies: testing a

systems-based field guide. *Anthropology and Education Quarterly* 15.

Dougherty, J. W. D. 1978. Salience and relativity in classification. *American Ethnologist* 5:66-80.

Freire, P. 1994. *Pedagogía del oprimido*. Coyoacán, Mexico: Siglo Veintiuno editores, s.a. de c.v.

Garro, L. C. 1986. Intracultural variation in folk medical knowledge: A comparison between curers and noncurers. *American Anthropologist* 88:351-370.

Gearing, F. O. 1984. Toward a general theory of cultural transmission. *Anthropology and Education Quarterly* 15:29-37.

Glowka, L., F. Burhenne-Guilmin, and H. Synge. Editors. 1994. *Article 8(j). A guide to the convention on biological diversity*. Gland: IUCN.

Gomez Gonzalez, F. 1980. *Rarámuri: mi diario Tarahumara*, 2nd edition. Chihuahua, Mexico: Editores Chihuahuenses, A. C.

Graham, M. 1994. *Mobile farmers: an ethnoarchaeological approach to settlement organization among the Rarámuri of northwestern Mexico. Ethnoarchaeological series 3.* Ann Arbor, MI.: International Monographs in Prehistory.

Haenn, N. 1999. The power of environmental knowledge: ethnoecology and environmental conflicts in Mexican conservation. *Human Ecology* 27:477-491.

Hall, E. T. 1983. *The dance of life: the other dimension of time*. New York: Anchor Books/Doubleday.

Hard, R. J., and W. L. Merrill. 1992. Mobile agriculturalists and the emergence of sedentism: Perspectives from Northern Mexico. *American Anthropologist* 94:601-620.

Hewlett, B., and L. Cavalli-Svorza. 1986. Cultural transmission among Aka Pygmies. *American Anthropologist* 88:992-943.

Hirschfeld, L. A., and S. A. Gelman. 1994. *Mapping the Mind: Domain Specificity in Cognition and Culture*. Cambridge: Cambridge University Press.

Hutchins, E. 1996. *Cognition in the wild*. Cambridge: MIT Press.

Ingold, T. 1999. "Social relations, human ecology, and the evolution of culture: an exploration of concepts and definitions," in *Handbook of human symbolic evolution*. Edited by A. Lock and C. R. Peters, pp. 178-203. Oxford: Blackwell Publishers Ltd.

Keil, F. C. 1994. "The birth and nurturance of concepts by domains: the origins of concepts of living things," in *Mapping the mind: domain specificity in cognition and culture*. Edited by L. A. Hirchfeld and S. A. Gelman. Cambridge: Cambridge University Press.

Kennedy, J. G. 1961. A Tarahumara gentile community: social organization and extracultural influences. Ph.D. Dissertation, University of California.

—. 1963. Tesgüino complex: the role of beer in Tarahumara culture. *American Anthropologist* 65:620-640.

—. 1970. *Inápuchi, una comunidad tarahumara gentil*, First edition. México: Instituto Indigenista Interamericano.

—. 1978. *Tarahumara of the Sierra Madre: beer, ecology, and social organization*. Arlington Heights, Ill.: AHM Pub. Corp.

—. 1996. *Tarahumara of the Sierra Madre*, Second edition, revised. Pacific Grove, CA: Asilomar Press.

Kennedy, J. G., and R. A. López. 1981. *Semana Santa in the Sierra Tarahumara: a comparative study in three communities*. *Occasional papers of the Museum of Cultural History, University of California, Los Angeles; no. 4*. Los Angeles: Museum of Cultural History University of California.

Kirshner, D., and J. A. Whitson. Editors. 1997. *Situated cognition: social, semiotic and psychological perspectives*. Mahwah, N.J.: L. Erlbaum.

Kropotkin, P. 1904. *Mutual aid: a factor of evolution*. London: William Heinemann.

Kummels, I. 2001. Reflecting diversity: variants of the legendary footraces of the Rarámuri in northern Mexico. *Ethnos: Journal of Anthropology* 66.

—. 2003. Un vistazo en la vida cotidiana de los niños Rarámuri: autonomía a pequeña escala en la región Tarahumara, México. *Pueblos Indígenas y Educación* 52:65-81.

Lancy, D. 1996. *Playing on the mother ground: cultural routines for children's development*. New York: Guilford Press.

Lappe, P., and M. Ulloa. 1989. *Estudios étnicos, microbianos y químicos del tesgüino tarahumara*, 1. edition. México: Instituto de Biología Universidad Nacional Autónoma de México.

LaRochelle, S., and F. Berkes. 2003. Traditional ecological knowledge and practice for edible wild plants: biodiversity use by the Rarámuri in the Sierra Tarahumara, Mexico. *International Journal of Sustainable Development and World Ecology* 10:361-376.

Latorre, M. 1976. An operant analysis of mother-child behavioral interactions in a Tarahumara family. Master's thesis, University of Texas.

Lave, J., and E. Wenger. 1991. *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lerner, R. M., D. R. Castellino, P. A. Terry, F. A. Villarruel, and M. H. McKinney. 1995. "Developmental contextual perspective on parenting," in *Handbook of parenting, vol. 2. Biology and ecology of parenting*. Edited by M. H. Bornstein. Mahwah, NJ: Lawrence Erlbaum Assoc.

Levi, J. M. 1993. Pillars of the sky: the genealogy of ethnic identity among the Rarámuri-Simaroni (Tarahumara Gentiles) of northwest Mexico. Ph.D. Dissertation, Harvard University.

Lock, A. 1980. *The guided reinvention of language*. London: Academic Press.

Logan, M. H., and A. R. Dixon. 1994. "Agriculture and the acquisition of medicinal plant knowledge," in *Eating on the wild side: the pharmacologic, ecologic, and social implications of using noncultigens*. Edited by N. L. Etkin, pp. 25-45. Tucson: University of Arizona Press.

Lumholtz, C. 1902. *Unknown Mexico: a record of five years' exploration among the tribes of the Western Sierra Madre: in the tierra*

caliente of Tepic and Jalisco; and among the Tarascos of Michoacan. Vol. 1. New York: Charles Scribners and Sons.

Mabberley, D. J. 2002. *The plant-book: a portable dictionary of the vascular plants*, Second edition. Cambridge: Cambridge University Press.

Maffi, L. Editor. 2001. *On biocultural diversity: linking language, knowledge, and the environment*. Washington, D.C.: Smithsonian Institution Press.

Martin, P. S., D. Yetman, M. Fishbein, P. Jenkins, R. V. Devender, and R. K. Wilson. Editors. 1998. *Gentry's Rio Mayo plants: the tropical deciduous forest and environs of northwest Mexico*. Tucson: University of Arizona Press.

Mead, M. 1964. *Continuities in cultural evolution. The Terry Lectures*. New Haven: Yale University Press.

Merrill, W. L. 1981. The concept of soul among the Rarámuri of Chihuahua, Mexico: a study in world view. Ph.D. Dissertation, University of Michigan.

—. 1988. *Rarámuri souls: knowledge and social process in northern Mexico. Smithsonian series in ethnographic inquiry*. Washington, D.C.: Smithsonian Institution Press.

—. n.d. "Los Rarámuris en el siglo XX," pp. 62.

Merrill, W. L., and M. H. Quezada. 1997. Debate - Rarámuri personhood and ethnicity: another perspective. *American Ethnologist* 24:302-306.

Miller, J. 2002. Birthing practices of the Rarámuri of Northern Mexico. Ph.D. Dissertation, University of Arizona.

Nabhan, G., and S. Trimble. 1994. *The geography of childhood: Why children need wild places*. Boston: Beacon Press.

Netting, R. M. 1986. *Cultural ecology*, Second edition. Prospect Heights, IL: Waveland Press.

Passin, H. 1943. The place of kinship in Tarahumara social organization. *Acta Americana* 1:360-495.

Pastron, A. G. 1974. Collective defenses of repression and denial: their relationship to violence among the Tarahumara Indians of Northern Mexico. *Ethos* 2:387-404.

Pelissier, C. 1991. The anthropology of teaching and learning. *Annual Review of Anthropology* 20:75-95.

Pennington, C. W. 1963. *The Tarahumar of Mexico: their environment and material culture*. Salt Lake City,: University of Utah Press.

—. 1983. "Tarahumara," in *Handbook of North American Indians*, vol. 10. Edited by A. Ortiz, pp. 276-289. Washington, D.C.: Smithsonian Institute.

Posey, D. A. 1999. "Introduction: culture and nature--the inextricable link," in *Cultural and spiritual values of biodiversity: a complementary contribution to the global biodiversity assessment*. Edited by D. Posey, pp. 1-18. London: United Nations Environment Programme, Intermediate Technology Publications.

Ramamoorthy, T. P., R. Bye, A. Lot, and J. Fa. 1993. *Biological diversity of Mexico: origins and distribution*. Oxford: Oxford University Press.

Rappaport, R. A. 1999. *Ritual and religion in the making of humanity*. *Cambridge Studies in Social and Cultural Anthropology*. Cambridge: Cambridge University Press.

Rascón, F. I. 1979. *Cerocahui: una comunidad en la Tarahumara*. Chihuahua City, Mexico: Centro Librero de la Prensa, s.a. de c.v.

Ratkay, J. M. 1683. *An account of the Tarahumara missions*. Mexicana 17, Bolton Papers, Bancroft Library.

Roberts, J. M. 1964. "The Self-Management of Cultures," in *Explorations in Cultural Anthropology*. Edited by W. H. Goodenough, pp. 433-454. New York: McGraw-Hill.

Rogoff, B. 1990. *Apprenticeship in thinking: cognitive development in social context*. New York: Oxford University Press.

Romney, A. K., S. C. Weller, and W. H. Batchelder. 1986. Culture as consensus: a theory of culture and informant accuracy. *American Anthropologist* 88:313-338.

Salmón, E. 1999. Sharing breath with our relatives: Rarámuri plant knowledge, lexicon and cognition (Mexico). Ph.D. Dissertation, Arizona State University.

—. 2000. "Iwígara: A Rarámuri cognitive model of biodiversity and its effects on land management," in *Biodiversity and Native America*. Edited by P. Minnis and W. Elisens, pp. 180-203. Norman: University of Oklahoma Press.

Salomon, G. Editor. 1993. *Distributed cognitions: psychological and educational considerations. Learning in Doing*. Cambridge: Cambridge University Press.

Sariego, J. L. Editor. 1998. *El Indigenismo en Chihuahua*. Chihuahua: Escuela Nacional de Antropologia e Historia- Unidad Chihuahua.

Schieffelin, B. B., and E. Ochs. 1986. Language Socialization. *Annual Review of Anthropology* 15:163-91.

Schwatka, F. 1893. *In the land of cave and cliff dwellers*. New York: Cassell Publishing Co.

Simon, J. 1997. *Endangered Mexico: an environment on the edge*. San Francisco: Sierra Club Books.

Simonian, L. 1995. *Defending the land of the jaguar: a history of conservation in Mexico*. Austin: University of Texas Press.

Simpson, B. M. 1994. Gender and the social differentiation of knowledge. *Indigenous Knowledge and Development Monitor* 2.

Slaney, F. M. 1997. Double baptism: personhood and ethnicity in the Sierra Tarahumara of Mexico. *American Ethnologist* 24:279-301.

Slikkerveer, L. J. 1999. "Ethnoscience, 'TEK' and its application to conservation," in *Cultural and Spiritual Values of Biodiversity*. Edited by D. Posey, pp. 167-260. London: United Nations Environment Programme.

Stross, B. 1973. "Acquisition of botanical terminology by Tzeltal children," in *Meaning in Mayan languages*. Edited by M. S. Edmonson. The Hague: Mouton.

Tello Díaz, M. 1994. *El mismo diablo nos robó el papel: Dos estudios de educación y resistencia cultural entre Mixes y Tarahumaras.* Mexico D.F.: Consejo Nacional para la Cultura y las Artes.

Toledo, V. 1997. "New paradigms for a new ethnobotany: reflections on the case of Mexico," in *Ethnobotany: evolution of a discipline*.

Edited by R. E. Schultes and S. von Reis, pp. 75-88. Portland: Dioscorides Press.

Valsiner, J., and H.-G. Voss. Editors. 1996. *The structure of learning processes*. Norwood: Ablex Publishing Company.

Weaver, T. 1996. Mapping the policy terrain: political economy, policy, environment, and forestry production in Northern Mexico. *Journal of Political Ecology* 3:37-68.

Weller, S. C., and A. K. Romney. 1988. *Systematic data collection*. Vol. 10. *Qualitative research methods*. Newbury Park, CA: Sage Publications.

Wilke, P. J. 1993. "Bow staves harvested from Juniper trees by Indians of Nevada," in *Before the wilderness: environmental management by Native Californians*. Edited by T. C. Blackburn and K. Anderson, pp. 241-277. Menlo Park: Ballena Press.

Wolcott, H. F. 1999. *Ethnography: a way of seeing*. Walnut Creek, CA.: Altamira Press.

Wyndham, E. W. 1996. The *ejido* Basihuare: Tarahumara *ejidatarios* in a changing world. MA thesis, New Mexico State University.

Wyndham, F. S. 2004. "Tarahumara," in *Encyclopedia of sex and gender in the world's cultures*, vol. 2. Edited by C. R. Ember and M. Ember, pp. 877-884. New York: Kluwer Academic/Plenum Publishers.

Zent, S. 1999. "The quandary of conserving ethnobotanical knowledge: a Piaroa example," in *Ethnoecology: knowledge, resources, rights*. Edited by T. Gragson and B. Blount, pp. 90-124. Athens, GA: University of Georgia Press.

Zingg, R. M. 1932. Juguetes y juegos de los niños Tarahumaras/ Tarahumara children's toys and games. *Mexican folk-ways* 7:107-110.

Zingg, R. M., H. Campbell, J. A. Peterson, and D. L. Carmichael. 2001. *Behind the Mexican mountains*, 1st edition. Austin: University of Texas Press.

Appendix A

Plant Species and Rarámuri Names Collected, Listed Alphabetically by Family

Plant species and Rarámuri names collected, listed alphabetically by family. Determinations were kindly made by Dra. Socorro González Elizondo of the *Instituto Politécnico Nacional* of Durango, Mexico, where voucher specimens are deposited (CIIDIR herbarium).

FAMILY ***Genus species* Authority**	**Rarámuri name(s)**	**F. Wyndham collection #**
AMARANTHACEAE		
Amaranthus hybridus L.	***wasorí***	16
APOCYNACEAE		
Telosiphonia hypoleuca (Benth.) Henrick.	***urél***	22
ASCLEPIADACEAE		
Asclepias linaria Cav.	--	48
BROMELIACEAE		
Tillandsia recurvata (L.) L.	***siwáchare***	47
CHENOPODIACEAE		
Chenopodium ambrosioides L.	***pasóchi***	50
COMPOSITAE		
Acourtia thurberi (A. Gray) Reveal & R. M. King	***basagóri, buríti nakára***	35
Bidens aff. *ferulifolia* (Jacq.) DC.	***basúl***	52, 7
Bidens odorata Cav.	***sipé***	6
Cosmos bipinnatus Cav.	***kihúbare***	11
Dahlia sherffii Sorenson	***amári***	1*
Machaeranthera stenoloba (E. Greene) Shinners	***mo'óchare***	10
Senecio hartwegii Benth.	***sopépare***	13*
Tagetes lucida Cav.	***sibarín, yerbanís***	8
Tagetes subulata Cerv.	***sebanél***	18
CRASSULACEAE		
Echeveria sp.	***metakúchare***	28
CUCURBITACEAE		
Cucurbita foetidissima HBK.	***warisí***	30
CUPRESSACEAE		
Cupressus lusitanica Mill.	***wa'á***	46
Juniperus deppeana Steud.	***ahorí***	58
Juniperus aff. durangensis Martínez	***barará***	59
ERICACEAE		
Comarostaphylis polifolia (HBK.) Zucc. ex Kl.	***wichátare***	23
Arctostaphylos pungens HBK.	***wíchare***	29
Vaccinium confertum HBK.	***mazana***	32
Arbutus xalapensis HBK.	***urúbisi***	41
EUPHORBIACEAE		
Euphorbia cf. *sphaerorhiza* Benth.	***napirúti***	25
FAGACEAE		
Quercus hypoleucoides A. Camus	--	54
Quercus mcvaughii Spellenberg	***rokoró***	55
Quercus viminea Trel.	***machíchari***	56
Quercus coccolobifolia Trel.	--	57
Quercus depressipes Trel.	***péchare***	60
Quercus arizonica Sargent	--	61
Quercus cf. *durifolia* Seem.	--	62

FAMILY ***Genus species* Authority**	**Rarámuri name(s)**	**F. Wyndham collection #**
GARRYACEAE		
Garrya ovata Benth.	***wiinó***	33
GENTIANACEAE		
Gentianella sp.	***vainilla***	36
LABIATAE		
Agastache micrantha (A. Gray) Wooton & Standl.	***júpisi***	34
Agastache pallida (Lindl.) Cory	***chorónare***	37
Salvia sp.	--	51
LEGUMINOSAE		
Zornia thymifolia HBK.	***víviri, sayá***	12
Desmodium sp.	***baniwá***	27
LILIACEAE		
Milla biflora Cav.	***(siwá)***	15
LINACEAE		
Linum australe Heller	***rochá wasíra***	20
LOGANIACEAE		
Buddleia cordata HBK.	***mahtó***	26
LORANTHACEAE		
Phoradendron sp.	***kuchaóra***	40
ORCHIDACEAE		
Bletia aff. macristhmochila Greenm.	***ikí***	14
PHYTOLACCACEAE		
Phytolacca icosandra L.	(***we simé omáware***)	38
PINACEAE		
Pinus engelmannii Carr.	***okósare***	42
Pinus strobiformis Engelm.	***wiyó***	43
Pinus lumholtzii Rob. & Fernald	***sawá***	45
PLANTAGINACEAE		
Plantago australis Lam.	***rorogóchi***	49
POLYPODIACEAE		
Cheilanthes angustifolia HBK.	***mochoáka***	17
Dryopteris cinnamomea (Cav.) C. Chr.	***torí wasíra***	53
RANUNCULACEAE		
Thalictrum sp.	***kuchínuare***	19
ROSACEAE		
Prunus serotina Ehrh.	--	62-a
RUBIACEAE		
Galium mexicanum HBK.	***chorónare***	31
SOLANACEAE		
Nicotiana tabacum L.	***wiwaráka***	39
UMBELLIFERAE		
Eryngium cf. heterophyllum Engelm.	***so'wíware***	9
Ligusticum porteri Coult. & Rose	***wasía***	2*
USNEACEAE		
Usnea sp. or *Teloschistes* sp.	***rité bo'wára***	24

*These specimens were identified by the author and are not deposited in the CIIDIR herbarium.

Appendix B

Instruments Used

Plant elicitation form

Fecha (d/m/a)_____ # Código de Participante _____
Lugar_____ Observaciones:_____

No. de planta	*Nombre(s) de la Planta*	*Usos*	*Observaciones*

Personal information form

Fecha (d/m/a)_____ # Código de Participante _____ F / M
Lugar_____ Observaciones:_____

1. ¿Cómo se llama usted? **Chu mu rewé? _____**
2. ¿Cúantos años tiene usted? **Chu kipu bamíami ju muje? _____**
3. ¿De cuales ranchos vienes? **Komi naware muje? _____**

   _____
4. ¿Ahora en cuales ranchos vives? **Jipe komi bité? _____**

   ¿Cuando? **Chu riko? _____**
5. ¿Cúantos años tienes viviendo aquí? **¿Chu kipu bamíti ati muje? _____**
6. ¿Hablas Rarámuri? ¿Español? **Rarámuri raíchara? _____Chabochi raíchara?_____**
7. ¿Vas/ Fuiste a la escuela? ¿Dónde? **Muje bakimea escuela? _____**

   Komi bineri muje? _____
8. ¿Cúantos años estudiastes? **Chu kipu bamíami bineri muje?_____**
9. ¿Que trabajos hace? **Piri notcha? _____**

10. a.¿Hace usted artesanías?
    Muje niwari bire kusí? Muchos mas o menos pocos no

    b. ¿Sabes usar yerbas medicinales?
    Muje juma bire o'waame kasará? Mucho mas o menos poco no

    c. ¿Comes plantas silvestres?
    Ayena komea kawichí nirúame ko'aame? Mucho mas o menos poco no

11. ¿Tiene chivas/borregos/ ganado? **Muje buqúeame chivá, bowá, wakashí? _____**

    ¿Quien los cuida? **Chiká ni sera? _____**

Plant collection form

Comunidad_____ Localidad especifica_____

Tipo de vegetación: Clima: Suelo:

Forma de Ser: yerba arbusto arbol zacate trepadora

Otro (especificar):

Altura_____ Diámetro_____ Color del flor_____de fruta_____

Otros observaciones_____

Estacion de florecimiento_____ de fruta_____

Nombre en Raramuri_____ Traducción_____

Uso_____

Preparación_____

Uso_____

Preparación_____

Otras notas_____

Quien dio la información_____

Colector_____ N°_____ Fecha_____