

Understanding Traditional Knowledge for Ecological Restoration:

A Qualitative Study with the Eastern Band of Cherokee

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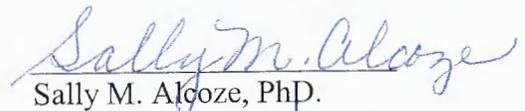
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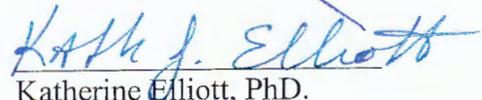
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ABSTRACT

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This study documents and examines historical land management practices, specifically burning, of the Cherokee who have maintained this knowledge through oral practices also referred to as traditional ecological knowledge. A review of historical, ecological and anthropological literature about southeastern woodlands was conducted that included information about Native burning of the southern Appalachians, a region historically and currently occupied by the Eastern Band of the Cherokee Indians. The literature identified dominant tree species and the forest composition of the region. In addition, qualitative interviews with Cherokee tribal elders were conducted and then transcribed. The transcribed interview data were analyzed inductively to identify emerging themes that described traditional burning practices on Cherokee land. The conclusions demonstrate the significance of Cherokee oral history that reveals historical land management practices embedded in traditional ecological knowledge. Interview data were analyzed and applied to a flame length model that gave information on the fire intensity of Cherokee fires. The results indicated that Cherokee burning practices resulted in carefully managed, healthy stands of hardwoods and conifers now in jeopardy or absent on the southern Appalachian landscape. Implications of how the data may inform methods for contemporary land management treatments are presented. This research can serve as a significant contribution to current land management strategies.

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PREFACE

The purpose of collecting and analyzing traditional ecological knowledge of the Eastern Band of Cherokee Indians was to gain insight into the fire history of historic Cherokee lands. An understanding of the fire history of an ecosystem is essential to designing effective practices for ecosystem management and health.

Cherokee tribal members have traditional ecological knowledge about burning practices for land care passed down to them from previous generations through oral practices steeped in ritual and tradition for purposes of cultural teaching. These burning practices were applied before the arrival of European explorers and settlers and afterwards, until fire suppression policies were put into effect in the 1930s. Cherokees used fire to reduce fuel accumulation, insect and disease populations, and competitive plants and sustain desired forest species, thus contributing to the management and health of their historic lands. Data from traditional ecological knowledge provided information about flame lengths from Cherokee fires and their effects on tree species culturally significant to the Cherokee. This information is compared to plant data available from the Fire Effects Information System (FEIS) and published ecological studies in southeastern woodlands. The conclusions from this study are presented in the format of a publishable article, chapter three of this thesis, for submission to professional journals such as *Ecological Applications*, *Restoration Ecology*, and *Biological Conservation*.

CHAPTER ONE

INTRODUCTION

Native American tribes sustained themselves and their families in the southeastern region of the US at least 10,000 years before European settlement, using fire for agricultural and hunting purposes (Keel 1976, Stewart 2002). The Cherokee, who historically occupied the southern Appalachian region, used fire to create conditions suitable for hunting, agricultural and harvesting purposes until their forced removal from this region along the infamous Trail of Tears (1728-1838). The current Eastern Band of Cherokee Indians (E.B.C.I), descendants of the people who escaped the removal by U.S. government soldiers and those who managed to return in more recent times, currently occupy land in western North Carolina known as the Qualla Boundary. Today, the Cherokee have retained their cultural history, which is evident in their stories and teachings as told to their people and passing visitors. Cherokee elders still recall historic land care practices taught to them through active participation in traditional burns and through stories passed down from previous generations.

For Native people, traditional teaching stories and cultural narratives, not the written accounts valued by the academic scientific community, have always been the methods for preserving and bequeathing cultural history. Despite modern technology and influences, this tradition is maintained in Native communities. Published documentations of Cherokee land management practices are rare and the validity of oral history is often challenged and marginalized. Only recently have ecologists, foresters, and land managers taken an interest in how Native people utilized fire to manipulate and influence the distribution and productivity of plants and animals (Lewis 1991, Anderson 1996, Close 2004).

PURPOSE OF THE STUDY

The principal goals of this project were (1) to document and analyze Cherokee traditional ecological knowledge (TEK) about fire management practices and general land care, (2) to use the results of this information to describe historical Cherokee burning practices, and (3) to examine TEK and the fire effects of Cherokee burning practices for dominant and culturally important tree species. The historic southern Appalachian forest is composed of species found in archaeological, ethnobotanical, and historical records of the region using the Archaeo-reconstruction Technique (Alcoze and Hurteau 2001). Specific data about Cherokee burning practices were collected over a three-year period (2001-2003) during open-ended interviews with thirteen Cherokee elders. The flame lengths described from Cherokee traditional ecological knowledge concerning land care practices that utilized fire were used to predict heat intensities (Agee 1993). These flame lengths and heat intensities were compared with the flame lengths and heat intensities required for significant mortality of tree species present in the historic forest. I compared flame lengths and predicted heat intensities from Cherokee burning practices with Fire Effects Information Systems (FEIS) (FEIS 2004) data to determine if Cherokee burning practices could have maintained forest stand equilibrium.

SIGNIFICANCE OF THE STUDY

Stewart (1949) advises that the role of Native peoples' use of fire in southern Appalachian ecosystems has not been adequately studied and should be recognized as a factor that significantly shaped the environment. Delcourt and Delcourt (1997) note that Native peoples' land management techniques, specifically the use of fire, are disregarded in modern land management applications primarily due to the lack of published studies. The study reported in this thesis is the first research to use traditional Cherokee knowledge regarding the use of fire to examine the impact of Cherokee fire regimes on forest species. This comparison informs our understanding of the fire history of the land historically occupied by the Eastern Band of Cherokee Indians and offers an explanation other than the region's humidity and consequent wood decay rate for the absence of catastrophic wildfire evidence in the soil record (Delcourt and Delcourt 1996 and 1997). Delcourt and Delcourt evaluated pollen and charcoal particles from bogs to determine the fire history of southern Appalachian forests (1996 and 1997). These paleoecological studies focus on bogs for data and do not rely on archaeological records or historic descriptions to strengthen the study (Delcourt and Delcourt 1996).

The validity of TEK of Native peoples' use of fire as a land management tool has been questioned as to whether it is factual enough to include in scientific studies (Russell 1983). Since European settlement non-Natives have generally viewed Native people as too uncivilized to know the uses and effects of fire. This view generated the belief that Native people could not have had any significant impact on the environment (Kretch 1999). The traditional ecological knowledge of Native people is still being debated, but there is a large body of evidence, mostly accumulated in the last fifty years, that indicates Native peoples used fire and a variety of other methods to manage the land they inhabited

for subsistence (Stewart 2002). My study documents and analyzes the historic land care practices of the Cherokee embedded in stories and experiences handed down to present-day elders of the Eastern Band of Cherokee Indians.

North American ecosystem management has been largely based on modern scientific methods since early land managers first introduced fire suppression to forest management in the early 1900s (Evergreen Magazine 1995). Narrow views of science exclude Native peoples' knowledge about land management when in truth they may possess significant information about ecosystem components and functions (Richards 1997). For thousands of years, Native people have managed the landscapes of North America, a period long enough for Native land management practices to be considered part of the evolutionary environment of native plants and animals (Williams 2001). Native resource management practices included extensive hunting, burning, and cultivation as well as gathering of wild and domesticated plants (Anderson 1996). These activities have had profound impacts on broad areas of North America, including the eastern deciduous and coniferous forests (Denevan 1992). The merits and tradeoffs of reintroducing any or all of the traditional practices of Native people warrant consideration among scientists, land managers, and other stakeholders (Alcoze 1999). This study, a documentation and analysis of traditional Cherokee land care practices that helped shaped historic southern Appalachian ecosystems, has implications for the development of restorative management approaches for contemporary ecosystems.

For example, the American chestnut (Marsh.)Borkh.) once covered 35-90% of southeastern forests but the introduction of chestnut blight (*Cryphonectria parasitica* Murr. Barr (= *Endothia parasitica* [Murr.] P.J. And. & H.W. And.)) virtually eliminated the American chestnut, making it almost extinct (Burnham 1988). The chestnut tree

produced a staple food for the Cherokee who cared for the trees by using fire to eliminate and/or reduce invading insects, diseases and plants (Hamel and Chiltoskey 1975). In addition, the Cherokee used fire to assist in the harvest of American chestnuts by removing the litter on the forest floor. The traditional ecological knowledge of the Cherokee provides information useful to land managers about the care of southern Appalachian forests prior to fire suppression

DEFINITION OF TERMS

Throughout the paper I use terms that I feel must be defined thoroughly in order for the reader to understand the results of this study. The following definitions provide a foundation for important terms used throughout this thesis. *Tradition* is the communication between “ancestors to descendants by word only; transmitted from age to age without writing.” *Subsistence* is described as “that which furnishes support to animal life; means of support, or that which produces provisions.” In modern society an *elder* is often looked upon as one who is “superior to another or others, as in rank” but in Native communities’ *elders* are looked upon as “older, influential members of a family, tribe, or community”(Merriam Webster Dictionary 2004).

Traditional Ecological Knowledge (TEK) is the Native peoples’ (also referred to as First Nations people, Indigenous, Aboriginal) knowledge of “the use, management and conservation of the environment and natural resources.” It is transmitted and preserved orally among “individuals in a community and this knowledge is maintained for subsistence” (Hansen 2002). Canada’s Traditional Knowledge Working Group (2003) defines traditional knowledge as “...an avenue to truth different from those held by non-aboriginal people whose knowledge is based largely on European philosophies.”

The technical definition of *fire intensity* is the heat energy released by a fire (National Fire Plan 2004). James K. Agee in his 1993 textbook defines the intensity of a fire as the “magnitude of a disturbance event.” *Historic range of variation* (HRV) is the “recognition that complex systems, including ecosystems, have a range within which they are self-sustaining, and beyond which they move into a state of disequilibrium” (Egan and Howell 2001) (pg 7). In addition, Egan and Howell give two reasons for giving preference to HRV: (1) “it recognizes that Native Americans influenced ecosystems at various scales in many, although not all, areas where present-day restoration activities take place; and (2) it avoids the use of the word *natural*, which has been rightly attacked as being too ambiguous (MacCleery 1998, Jordon 1999)” (p.7).

GUIDING QUESTIONS

This study answers the following questions: (1) What practices do Cherokee elders say they and their ancestors used to manage the land and forests of their region? (2) What practices and perspectives regarding land management, specifically burning, are embedded in the traditional knowledge of the Cherokee people? (3) What are the estimated flame lengths and heat intensities from Cherokee burning practices? (4) How would these flame lengths and heat intensities impact mortality rates of dominant and culturally important tree species using FEIS data? (5) What can modern ecologists learn from the land management practices embedded in Cherokee traditional knowledge? (6) How does traditional knowledge relate to the historic fire records, land management, and pre- and post-removal landscape conditions in this region?

In order to answer these questions, the objectives of this research were to:

- 1) Determine the species composition and distribution of the historic landscape (1720-1838) using the Archeo-environmental Reconstruction Technique (ART) (Alcoze and Hurteau 2001);
- 2) Compare the historic range of variation with landscape conditions developed from analysis of qualitative interview data;
- 3) Describe traditional burning practices derived from qualitative interviews with Cherokee elders;
- 4) Describe the resulting flame lengths and heat intensities of the historic range of variation of forest stand species subjected to Cherokee burning practices;
- 5) Compare the flame lengths as described by the Cherokee people and the predicted heat intensities with flame lengths and heat intensities that could result in mortality of dominant and culturally important species in a forest stand based on FEIS information;
- 6) Analyze the impact of Cherokee burning practices on the forest's historic range of variation to determine if the Cherokee burning practices would result in the historic forest described in interview data and correlated with historic reference sites obtained from research using ART.

STATEMENT OF SUBJECTIVITIES

Qualitative research is the research methodology I chose to examine the central database for my study – the words of Cherokee elders regarding land management practices and historic forest species embedded in the traditional and historical narratives told to generations of Cherokee children. This study, conducted in the Cherokee community by a non-Cherokee researcher, required six weeks during the first summer of research to accomplish the initial task of “gaining entry” and establishing credibility as one who would follow the research protocols required by EBCI. The first summer of research included some pilot interviews, all of which had to be approved by the Cultural Resources Director, but six weeks out of eight were spent building rapport, finalizing paperwork, and securing official approval from the Tribal Council to conduct the research.

Qualitative methodology requires a statement of my subjectivities, or biases because I am the instrument for data collection and analysis of the words the elders spoke. A clear statement of the biases I thought might have affected my research is given here for these purposes: 1) to inform the reader of the predispositions, preconceptions, and partialities that are a part of my biography; 2) to acknowledge to myself the subjectivities that are a part of my identity; and 3) to identify limitations for this study. It is this subjectivities statement that defines the biases consciously set aside and the boundaries of respect for my participants, my readers, and the scientists who will examine my research to determine its usefulness for contemporary land management.

My name is Nicolette Cooley and I am a 24 year-old Diné woman. I was born and reared on the Diné Nation in Shonto, Arizona. Most of my childhood was spent herding my grandparents’ sheep and riding horses, and I often began my days before

sunrise and ended them after sunset. In addition, I frequently helped my grandfather and parents tend to their crops of corn, squash, watermelon and sunflowers. Sheep herding and farming meant being outdoors and learning to care for the plants and animals that were my family's livelihood. Being outdoors gave me the freedom and independence to explore the land. My upbringing also consisted of being taught stories about respect and honor for the land. Since then I have always remained true to that philosophy of "hózó bii' naasháa dooleel" or always walking in beauty and harmony. This philosophy of walking in beauty and harmony is always included in our prayers and teachings, and is the Navajo way of life. Growing up and living my life in the beauty and harmony of mother earth has had a significant influence on my professional and academic perspectives. Tending to my grandparents' sheep, riding horses and farming were just the beginnings of many adventures.

Prior to this study, I had been formally trained in quantitative research methods for ecological research. My research skills consisted of setting up environmental monitoring plots and searching for fire scars on ponderosa pines. The research was physically challenging work in the outdoors that included hiking in severe Arizona climates, negotiating rugged high desert terrain, carrying heavy equipment that included chain saws, and packing out large fire scar samples. Since I was constantly around people, my teamwork skills improved immensely. The other research assistants and I had the same amount of knowledge about setting up plots, identifying reliable fire scars, identifying and collecting plant samples, and the data we gathered were analyzed by research technicians and assistants in the lab at the Ecological Restoration Institute at Northern Arizona University. These research experiences helped shape future decisions about my professional and academic career.

In the summer of 2001, I began the study in North Carolina that was to lead to the research reported here. It was *my* project, a fact that astounded me then and still astounds me. I was a 21 year-old Diné woman who had never seen or heard of another Diné woman leading a research project and here I was, in North Carolina with my colleague and co-researcher Lisa Dunlop, to begin what was to become a three-year study. Research conducted by just two researchers was vastly different from the methodology I had learned that required a large group of people and where I was absolutely content with someone else in charge to direct the research. In Flagstaff, a one-week training session prepared us for the summer field season of intensive data collection. The expectation was for us to learn exactly what we were to do, leading me to assume that when conducting a research project the researcher has to know *everything*. My first summer with the Cherokee community taught me that my assumptions were wrong, researchers are required to learn many things through experience, and I had to quickly learn to set daily goals to accomplish my research.

Working with the Cherokee people in their own environment taught me an important lesson. I entered a community as an unknown, non-Cherokee scientist wanting specific information from Cherokee elders. My culture, Diné, southwestern, English-speaking and as a young person enrolled in a distant university, was very different from the Cherokee elders who spoke Cherokee, lived in the southeast, and were the ages of my grandparents and older. It is *not* true that Indian researchers are automatically accepted in every Indian community. For elders who spoke Cherokee, qualitative interviews included a translator. For elders who spoke English, I still had to be properly introduced by another community member. Even when participants viewed my Diné identity positively, I had to negotiate the sounds and vocabulary of southern Appalachian dialect.

It is important to recognize that a limitation of this study were constraints around accessing people with traditional knowledge who were outside of the circle of people, for various reasons, my “gatekeepers” could influence to speak with me. A qualitative interview study can go on for years, until finally exhausting the entire pool of qualified participants, but this study was limited by my time in school, my program of study, and my “gatekeepers’” abilities to assist me to network.

From the time of European settlement, the Cherokee culture has been studied by a largely Anglo academic community, creating a general dislike for researchers among tribal members. These researchers were often viewed as untrustworthy and greedy because they almost never contributed their findings back to the Cherokee community. Many of the research findings were capitalized on for honor and sometimes money in the research community. During my research, I often wondered if the roles were reversed, what would my reaction be to a Cherokee or non-Indian researcher’s questions about my people. This became such an unresolved question, that I discussed it with a Cherokee elder I had come to know, confiding in him my discomfort about interviewing people who might not even want to give me any information. This Cherokee elder told me that he gave me information because he believed my research would help his people and others in terms of ecological knowledge. He thought my research would help acknowledge Cherokee contributions to land care. This Cherokee elder voiced what I believe: if I chose to share my traditional ecological knowledge with a researcher I would have to *believe* and *trust* that the information would be for a good purpose.

The initial stages of the research for this study it began during the final year of my undergraduate program and continued through my graduate master’s degree program. In short, I am a *student* researcher. I am grateful to the Eastern Band of Cherokee Indians,

my committee, and my various mentors for assisting me to acquire the skills of a qualitative researcher, yet I am still a novice researcher learning the procedures for two scientific methodologies.

The stories and beliefs I was taught as a child are rich in traditional knowledge about caring for the land and all its resources. The difficulty lies in expressing the concepts contained in those stories to a non-Native audience. I began this study determined to acquire the knowledge and skills to carefully interpret the traditional stories Cherokee elders shared with me to the scientific community. They trusted me to interpret their words well. I am reminded however, that clear communication requires responsible conduct from all parties. I trust the reader will weigh my biases and the limitations of this study, listen carefully for the meaning in the words of the Cherokee elders, and be willing to consider their perspectives.

CHAPTER TWO

LITERATURE REVIEW

Overview of American Indian Burning Practices

Prior to the arrival of European settlers and explorers, the Cherokee and other neighboring tribes occupied present-day North and South Carolina, Virginia, Tennessee, and Georgia (Hudson 1976). These tribes prospered in the vast woodlands of the southern Appalachians by manipulating the ecosystem to produce resources for the survival of their people. Many tribes, including the Cherokee, used a variety of trees such as white oak (*Quercus alba* L.), American chestnut (*Castanea dentata* (Marsh.)Borkh., red oak (*Quercus rubra* L.), and hickory (*Carya* spp.) to build homes, weave baskets, make weapons and provide food and firewood (Hamel and Chiltoskey 1975). Native people inherently knew resources gathered from the forest had to be maintained to insure sufficient materials would be available for future use. Fire was the most important management tool the Native people used to manipulate the environment (Kay 2000). In the eastern part of the country specifically, evidence such as the lack of lightning-caused fires, conditions and changes of the forest structure since European arrival and documented observations of the southeast by naturalists such as William Bartram are evidence of an ecosystem long influenced by Native burning (Kay 2000). The ecosystem modifications by Native people at the landscape level greatly influenced present conditions of southern Appalachian forests (Stewart 2002). The view of Native peoples' involvement in the manipulation of the land has never been widely appreciated or accepted as a part of contemporary land management as proven historically by the U.S. forest service (Evergreen Magazine 1995).

Since European settlers and explorers set upon the New World, speculation concerning the benefits of deliberately set fires by Native people has been an on-going controversy. The lack of consensus among ecologists, scientists, foresters and land owners of the extent of Native peoples' knowledge and/or involvement of land management practices can be attributed to existing information that is "scattered 17th and 18th century descriptions of forests and Indian activities" (Russell 1983). The controversy may be traced to early land managers such as Gifford Pinchot, John Muir and Henry Graves. Pinchot was the founder and first chief of the U.S. Forest Service and one who led opposition against fire as a management tool (Pyne 1982). Muir, a well known and respected conservationist, also strongly opposed burning and Graves who eventually replaced Pinchot as Chief of Forest Service was quoted as saying, "Merely setting fire to the woods without control is nothing less than forest destruction" (Evergreen Magazine 1995). The U.S. Forest Service actively and publicly opposed the use of fire throughout the country. This opposition to fire as a management tool shaped an environment completely different from one that the Native people knew (Pyne 1982). The opposition to fire also led foresters and land managers to frown upon fire as a method for conserving and protecting significant natural resources. The sequence of fire suppression policies stimulated the debate about the use of fire by Native people for the overall health of the forest. In addition, European settlement brought on a number of uses for the forest. Widespread logging had a significant effect on the land in the late 1800s and early 1900s and aligned with later fire suppression policies. Intensive logging across the southern Appalachians resulted in heavy accumulations of dried slash that were prone to ignition, causing wildfires that were difficult to extinguish because of their size and intensity. Such fires were uncommon to a landscape adapted to frequent, low-intensity fires (Brose

et al. 2001). It was these intense wildfires that contributed to the nationwide campaign for fire suppression that became a priority of the U.S. Forest Service (Evergreen Magazine 1995, Pyne 1999, Williams 2000, Brose et al. 2001).

Speculations about Native burning practices have comprised a number of studies, articles and debates among ecologists and foresters who challenge the validity of written accounts by European settlers, explorers and Native people. In the Myth and History: The Ecological Indian, Shepard Kretch (1999) illustrated how people in the nineteenth century viewed Native people as “technologically incompetent” to even know the effects and outcomes of fire. Kretch (1999) cited United States Department of Agriculture (USDA) documents in the 1940s that stated there was no proof that “Indians regularly set” fires because they “lacked matches”(p.102). In addition, Kretch (1999) quoted several forest ecologists who claimed fire to be destructive and “made every effort to halt them in national forests and parks” (p. 102). “Paiute forestry” was a phrase conceived by John Wesley Powell who observed and studied the Paiute’s use of fire in southern Utah. Paiute forestry was the birth of a controversy and of the term “light-burning” which many, including Pinchot and Muir, strongly opposed (Pyne 1999, Williams 2000, Evergreen Magazine 1995). Emily Russell (1983) disputes the historical evidence and published articles of accounts/observations of “Indian-set fires” because there were no first hand accounts by the authors or by the people they quoted. She implies that those articles and descriptions of the eastern woodlands written in the late 19th century and early 1900s must have been inaccurate because they “seem to have been designed to attract settlers” (p. 81). Russell (1983) states that the lack of “ethnographic accounts [of] eastern woodland Indians” proves that the Natives could not have been “sufficiently organized to carry out systematic burning” (p. 85). Finally she concludes, “in pre-

colonial forests, in the forest at large, fires accidentally caused by Indians merely augmented the number of natural fires” (p. 86). These views of Native peoples’ use of fire on their land are shared by many ecologists, scientists and historians who conduct studies to critique, disprove or advance the quality of previously conducted scientific studies. In the field of ecology and forestry, most notably, researchers often ignore the relationship between humans and the environment (Alcoze 1999). It would seem obvious to acknowledge people who have knowledge about the historic conditions of the land pre-dating the arrival of European settlers and explorers. Unfortunately, the racial interactions between Native peoples and European settlers, many of which exist to this day, evidence a long history of the dismissal of traditional ecological knowledge (Stewart 2002).

Despite those who dismiss Native land care practices, there are those who support Native peoples’ use and methods of burning. Kay (2000) discusses how Native people used fire to improve the environment at the landscape level and create conditions necessary for survival. Day (1953) cited numerous texts that stated how Native peoples of North America used fire specifically for subsistence. For example, burning was applied to the landscape to improve visibility, facilitate travel, increase abundance of plant species, and reduce fuel accumulation (Kay 2000, Noss 1983). Day refers to Maxwell (1910) and Swanton (1928) who state that burning was a common practice of the southeast Native people. Pyne (1983) reiterates Day’s (1953) reasons for Native peoples’ use of fire by maintaining their dependency on fire for economic necessities. Particularly in the southern Appalachians, Native people have been burning for agricultural and hunting purposes for 10,000 years (Keel 1976). Goodwin (1977) described the practice of burning as a “tremendous economic advantage” (p. 64) to the

Cherokee lifestyle. By burning the landscape, Native people acted as a functioning component contributing to the health of the landscape and preventing fire from becoming a destructive force. Goodwin (1977) concurs, stating that Native people burned forests to prevent uncontrolled fires and fuel accumulation, and decrease undesirable weeds. He discusses how Natives burned longleaf pine (*Pinus palustris*) forests to eliminate brown-spot needle disease and competitive vegetation and describes the importance of longleaf pine for shelter materials, canoes, and firewood. Pyne (1983) reiterates that Native peoples' wide variety of uses for burning included communication through smoke signals, felling trees for shelter, shaping canoes, and reducing insect populations and fuel load. Kat Anderson has observed and studied the Native people of California who continue to use an array of shrubs and trees, maintained by fire and other management practices, to create desired basketry, weapons, and housing materials (Anderson 1996). These authors may not all have had personal first hand accounts of observing "Indian-set fires" (Russell 1983), but have consulted with Native people in the region of study and recognized the importance of acknowledging relationships between humans and the environment. These relationships extend beyond the basic knowledge of plant and animal names to the holistic relationship Native people have with the land. To acknowledge this holistic relationship is significant in understanding the historic conditions of the land before the implementation of fire suppression and the elimination of Native peoples' rights to care for their land.

Historic Record of Southeastern Forest Structure

Prior to European settlement and until the late 1800s, many of the plant species in the southern Appalachian forests were primarily maintained by “manmade fire,” referred to today as Native burning (Betsill 2002). Harmon (1982) discusses how European settlers may have continued the process of burning that was “initiated by the Indians” (pg. 78). By using fire to manipulate the land Native people replaced natural disturbances, specifically fire, to create certain effects on the land, and they largely succeeded (Goodwin 1977). As in other regions of the continent, southern Appalachian forests have been subjected to fire suppression since European settlement (Day 1953) and most recently the 1930s when the U.S. Forest Service initiated fire suppression efforts (Evergreen Magazine 1995). Fire suppression allowed plant species that were normally reduced by fire to grow in large quantities and begin to take over other species (Van Lear and Waldrop 1989).

The historic forest of the Southeast is often referred to as a “climax” forest, one that was shaped by fire (Russell 1983, Betsill 2002). Early explorer and botanist William Bartram is praised for his documentation and descriptions of the historic landscape and vegetation as he traveled throughout the southeastern region. Bartram’s journals describe open meadows, old Indian fields and vast savannas (Bartram 1791). These descriptions have been dismissed by researchers until recently (Betsill 2002). In addition, Bartram documented plant species such as the American chestnut (*Castanea dentata*), white oak (*Quercus alba*), red oak (*Quercus rubra*), chinquapin (*Quercus muehlenbergi* = *Castanea pumila* Mill.), walnut (*Juglans alba* = *Juglans cinerea* L., *J. nigra* L.) and hickory (*Hicoria ovata* = *Carya ovata* (Mill.) K. Koch var. *ovata* and *Carya tomentosa* (Poiret) Nutt.) (Bartram 1791)). The United States Army field notebooks contain land survey

and reconnaissance records of the Cherokee land during the mid 1800's. These Army land surveys describe a landscape that contained open woods covered with oak, hickory, chestnuts and pines of young and medium growth (National Archives 1975, volume 3 and 4).

Data Specific to Historic Species

The following species are those that have been and still are being used by the Cherokee: American chestnut, white oak, red oak, (*Pinus virginiana* Mill.) and mockernut hickory (*Carya tomentosa*). According to the Fire Effects Information System (FEIS 2004) the general distribution of these particular species ranges from Pennsylvania to northern Alabama, but most importantly for the purposes of this study, North Carolina and Tennessee. In addition, these species are found in oak-hickory forests as described by Braun (1950). Although historically the Cherokee's vast territory included what are now the Carolinas, Georgia, Tennessee and the Virginias (Goodwin 1977), I will focus on western North Carolina because it is where the Qualla Boundary is located and eastern Tennessee because of the extensive archeology work conducted on its historic Cherokee towns.

The American chestnut was once thought to cover over forty-five percent of southern Appalachian forests before the onset of the chestnut blight (Keever 1953) that devastated the species in the early 1900s (Burnham 1988, USDA Forest Service 1983). Before the chestnut blight the American chestnut tree's mature height reached up to a hundred feet with a diameter of twenty feet (Treadwell 2004). It was a popular tree that was excellent lumber for furniture, firewood, telephone and telegraph poles and fence posts, and tannin from its bark was used for tanning heavy leather (Burnham 1988, USDA Forest Service 1983, Treadwell 2004). To the Native tribes of the eastern

woodlands, specifically the Cherokee, as well as Appalachian settlers/families and the abundant wildlife, the nuts of the American chestnut were significant as a food source (Hamel and Chiltoskey 1975, Treadwell 2004). Pure stands of the American chestnut have been obliterated from southern Appalachian forests and replaced by red maple (*Acer rubrum* L.), beech (*Betula* spp.), yellow poplar (*Liriodendron tulipifera* L.) and pines (*Pinus* spp.) (Treadwell 2004). Today's sprouting seedlings of the American chestnut never reach maturity (Irwin 2001). Delcourt and Delcourt (1997) maintain that fire suppression may have influenced the decline of the American chestnut and other oak species in the southern Appalachians.

According to the Fire Effects Information System (FEIS 2004) white oak is a deciduous tree species that is shade intolerant when growing beneath dense canopies and depends on periodic fires for its perpetuation. Brose (et.al 2001) refers to the importance of low intensity surface fires in the maintenance of pre-settlement mixed-oak forests. Northern lower slopes of the southern Appalachians serve as the best growing conditions for white oak and it occurs in pine-oak-hickory and mixed-hardwood forests (FEIS 2004). White oak is an important timber species used for furniture, firewood and baskets (Sander 1979, USDA Forest Service 1983) and the acorns were important to Native people (FEIS 2004). It reaches a mature height of sixty to eighty feet and a diameter of over five feet (FEIS 2004) but historical photos suggest they reached diameters of more than twenty feet (USDA Forest Service 1983). Fire suppression has inhibited the regeneration of the white oak in the southern Appalachians (Van Lear and Waldrop 1989).

Northern red oak has an intermediate tolerance to both shade and fire and typically reaches heights of sixty-five to a hundred feet. This type of oak is used for

furniture and firewood, and its acorns are a considerable source of food for Native people (Van Dersal 1938). Red oak is susceptible to gypsy moth (*Lymantria dispar* (L.) (*Lepidoptera: Lymantriidae*) among other insects that negatively affect its growth (Mueller-Dombois et al. 1983). Red oak regeneration is more evident following a fire, as it is adapted to periodic fires (FEIS 2004). Although red oak is inclined to be immediately affected by fire, mature trees have a positive regeneration response to frequent low-severity fires (FEIS'2004).

Virginia pine is a shade intolerant species with a medium tolerance to fire and a growth height of fifty to seventy feet at maturity. It has been used for charcoal, firewood and mine props (FEIS 2004) and for medicinal purposes by Native people (Hamel and Chiltoskey 1975) who maintained pine forests through burning. In addition, Virginia pine is tolerant of low to moderate severity fires; intense crown fires will cause mortality (Christensen 1981).

Mockernut hickory is a deciduous tree that is shade intolerant and intolerant of fire at high levels of severity. This variety of hickory is abundant in southwest Virginia, Florida and North Carolina (FEIS 2004) and is used for lumber, firewood and tool handles (USDA Forest Service 1956). Mockernut hickory is sensitive to fire because of its thin bark (Niering et al. 1970).

Data Specific to Flame Lengths and Heat Intensity

James K. Agee's book, Fire Ecology of Pacific Northwest Forests, discusses how the intensity of a fire can be measured by the "energy content of fuel, the mass of fuel consumed, and the rate of spread of fire" (1993). He describes how the length of the flame can give an estimate of the fire's intensity. Agee (1993) provides an equation that can be used to determine fire intensity, one that will be discussed in further detail in chapter three.

SUMMARY

Traditional ecological knowledge of Native people's land care practices are similar to the general concept of prescribed burning in the forests for the purpose of decreasing mass fuel loads, insect populations, and to encourage growth of specific flora. The difference arises in the notion of acknowledging and applying the ecological knowledge that comes directly from Native people to current land management practices. Native peoples' knowledge, specifically historic knowledge of caring for the land, is unavailable as published documents for scientists, foresters and ecologists to review, critique and evaluate. To Native tribes oral history is a part of maintaining their way of life and their identity in a society that is constantly changing. The dependence on published studies to further our scientific knowledge still continues (Day 1998) and Native people still respect their traditional oral practices.

The research literature indicates that scientific methods for accessing and assessing traditional ecological knowledge have been limited, even though anecdotal, historical and archaeological evidence of Native burning practices abound. The qualitative interviews for this study, conducted with members of the Eastern Band of

Cherokee Indians, are for the purpose of implementing a respected scientific methodology to access Cherokee traditional knowledge about burning practices and understand how those practices maintained an ecosystem with plant species that supplied materials necessary for Cherokee subsistence. The data and literature reviewed for this study offer meaningful insights about the traditional ecological knowledge of Native people and provide information about historic landscape conditions in the southern Appalachians.

In order to accomplish the objectives of this study, the traditional ecological knowledge of Eastern Cherokees describing the flame lengths of Cherokee fires and a review of published studies on the fire history of the southern Appalachians were analyzed. The following species were historically and still are culturally significant to the Cherokee: American chestnut, white oak, red oak, Virginia pine and mockernut hickory. The Cherokee used these species among others for basket, shelter, food and medicinal materials (Duncan 1998, Hamel and Chiltosky 1975, Hill 1997). The literature review provides information on how these particular tree species are affected by fire. Based on the qualitative interviews, the literature review, and calculations of heat intensity likely to result in tree mortality, I will determine whether the Cherokee's traditional ecological knowledge of fire was able to maintain the forest they describe.

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CHAPTER THREE

Cherokee – People of the Fire: Fire History of the Historic Cherokee Landscapes in the Southern Appalachians

ABSTRACT

This study documents and examines the historic burning practices of the Cherokee people who have maintained this knowledge through oral transmission from generation to generation, practices often referred to as traditional ecological knowledge. A literature review of the fire history of the southern Appalachians was completed to identify land care themes and resource use patterns of the Eastern Band of Cherokee Indians who continue to occupy this region as their ancestral homeland. The literature review draws from contemporary, historic and anthropological literature sources that represent both supportive and controversial interpretations of land care practices of the Eastern Band of Cherokee Indians. Qualitative interviews with thirteen Cherokee tribal elders that focused on traditional ecological knowledge about land care were conducted and transcribed. The transcriptions were analyzed inductively to identify emerging themes that described traditional burning and land care practices on Cherokee lands. These practices were analyzed and applied to a flame length model to determine the fire intensity of Cherokee fires. The resulting fire intensity data were compared with fire intensity data from the FEIS database required for tree mortality. These comparisons indicate that Cherokee burning practices resulted in carefully managed, healthy stands of hardwoods and conifers now in jeopardy or absent on southern Appalachian landscape. This information can serve as a significant research contribution to modern land management and demonstrate the significance of historic land management practices embedded in traditional ecological knowledge. Implications of how the data may inform methods for contemporary land management treatments are presented.

INTRODUCTION

Overview

For thousands of years, Native people have maintained their rich history through stories and cultural narratives, not the published accounts valued by the scientific community. Despite availability of modern technology, the oral practice of preserving and bequeathing cultural history is maintained in Native communities. The validity of traditional ecological knowledge¹ is challenged by some ecologists, foresters and land managers because of the lack of published documentations of Cherokee land management practices (Delcourt and Delcourt 1997). Only recently have ecologists, foresters, and land managers taken an interest in how Native people manipulated the land to enhance the productivity of plants and animals (Lewis 1991, Anderson 1996, Close 2004).

The descendants of the Cherokee who escaped removal by US government soldiers and some of those who were removed to the Indian Territory in present day Oklahoma (Ehle 1988) currently live on the Qualla Boundary, land reclaimed by the Cherokees in the late 1950s (Duncan and Riggs 2001). Many Cherokee elders recall stories and teachings taught to them by their elders and describe their participation in the burning of the woods. Fire played an intricate role in the shaping of southern Appalachian forests (Van Lear and Waldrop 1989) and Native people maintained healthy forest ecosystems using fire for agricultural, hunting and other purposes (Stewart 2002). By burning the woods the Cherokee created conditions for managing the habitats of desirable plants for the people and the wildlife they hunted.

The *Historic Range of Variation* (HRV) of these southern Appalachian ecosystems, specifically with regard to historic fire regimes prior to the arrival of

European settlers and explorers, are characterized by lightning ignitions in the spring and summer of limited extent due to typically high humidity, elevated fuel moisture levels and nocturnal conditions that tend to extinguish fires in light fuels (Egan and Howell 2001). The contemporary fire regimes of the southern Appalachian forests are characterized according to the complexity of forest types that range from mesic and mixed mesic, mixed oak-hickory and hemlock forests. Wildfires in southern Appalachian ecosystems generally burn with varied heat intensities. Higher intensity fires tend to be concentrated on ridge tops and south-facing slopes, where the high fuel moisture content of the cove forests limit fire severity even during droughts or dry seasons (Southern Appalachian Forest Coalition 2004).). Recent studies demonstrate that Native American burning practices promoted a diversity of habitats, increased “the edge effect” and stabilized resource fluctuations (Williams 2001, Botkin 1990).

Literature Review

Numerous published articles and books document Native peoples’ burning practices across North America. The literature was reviewed for specific information regarding the fire history of the southern Appalachian woodlands, Cherokee burning practices, use of fire to enhance the environment, and types of plants used for subsistence. The Cherokee used trees such as white oak, American chestnut, red oak, white oak, Virginia pine and hickory, among others, for food, shelter, baskets, firewood, and weapons (Hamel and Chiltoskey 1975). Fire was an important tool that Native people used to enhance the productivity of plants important to the tribe (Kay 2000). The use of fire by Native people at the landscape level influenced pre- and post-settlement conditions of southeastern forests (Stewart 2002). Several articles challenged the validity of the published accounts by early explorers, naturalists and settlers because they were

not first hand accounts and therefore, hearsay (Russell 1983). This frame of mind was promoted by influential figures such as Gifford Pinchot and John Muir, first chief of U.S. Forest Service and popular conservationist respectively, in the land management history of the American forests. When the U.S. Forest Service was established in the 1930s the agency actively and publicly opposed the burning of the land, even though burning was a common practice by Native people (Evergreen Magazine 1995, Pyne 1999, Williams 2000, Pyne 1982).

STATEMENT OF THE RESEARCH PROBLEM

Traditional ecological knowledge of Native people has been observed, studied and documented by non-Natives since European settlement. These published documents include numerous accounts by explorers and settlers who saw the effects of Native burning in the Southeastern woodlands (Betsill 2002, Stewart 2002). Williams (2001) states that the “evidence for the purposeful use of fire by American Indians (also termed Native Americans, indigenous people, and First Nations/People) in many ecosystems has been easy to document but difficult to substantiate” (p. 1). Despite these repeated accounts of Native burning many scientists and ecologists dispute these observations as second-hand descriptions that are invalid in the scientific community (Russell 1983). Botkin (1990) concluded that “there is ample evidence that Native Americans greatly changed the character of the landscape with fire, and that they had major effects on the abundance of some wildlife species through their hunting” (p. 169). The traditional ecological knowledge of Native people, notably that of the Cherokee elders involved with this study, is being offered as data derived from a respected scientific methodology so

that the data can be considered for use in modern scientific research and modern land management practices.

This study examines the question:

Do the burning practices embedded in the traditional ecological knowledge of contemporary Cherokee elders result in sustainable forest conditions characterized by large, dominant old growth tree species in southeastern Appalachian forests?

This study will be the first to use traditional ecological knowledge of the Eastern Band of Cherokee Indians, specifically of fire, to inform land managers who use contemporary ecological knowledge for land management in the southern Appalachians.

RESEARCH SETTING

Geographic Sites

The study was conducted on the Qualla Boundary in western North Carolina. The Qualla Boundary, the largest tract and adjacent, smaller tracts of reservation land are home to the Eastern Band of Cherokee Indians (E.B.C.I.). Together, these tracts cover over 56,000 acres and extend into the Great Smoky Mountain National Park. The Eastern Cherokee are a federally recognized and sovereign nation with a population of about 12,500 people within the Qualla Boundary (Cherokee 2004).

Cultural Context

It is important to note the cultural context for the qualitative interview data and to acknowledge the origins and lineage of the events the participants related. Three major themes emerged from the interview data that illustrate the origins of the participants' stories, their understanding of how to care for their world, and their memories of how Cherokee landscapes once looked.

Origins of participants' knowledge

Cherokee elders interviewed for this study explain how they came to have the traditional ecological knowledge they report.

You grow up knowing those things by the time you're ten and that goes for all the other plants, stories concerning every other plant, every other animal, every tree, you know. By the time you're ten years old you have a pretty good grasp of how you're supposed to act, you know, what you're supposed to do and when you're supposed to do it and when you're not supposed to do it. So you spend the rest of your life doing that.

Jesse Litefoot

...I first heard it from my father, who told me what his mom and his dad had told him about that [fire, land care]. He talked about it with people when he was growing up, talked about how they remembered stories about when they lived here since we're, at this point, we're 164 some years removed from her [NC]. The Cherokee had been in Oklahoma for about thirty years, the Cherokees go there in 1839, actually just about twenty-five years prior to my grandmother's birth. So the stories that she learned in her childhood growing up and stuff like that were fresh stories from those [Removal] times.

Jesse Litefoot

Of course [I remember stories about the importance of taking care of the land]! You learn by living. It's not like they sit you down and [say], "Okay, today we're going to have 'Preserve the Forest 101.'" You just learn by experience and I guess...it's just so much a part of your life, the way they did things. You took it for granted so not until you're grown do you realize and think, "Oh, so that's why we did that and that's why we did this," because that not only preserved our heritage, you know, [it] preserved the land.

Denise Walker

Old ones talked about the time when they would be gone and the time is here. Old ones could see in the future, things wouldn't be the way it was back then. They were told then, they wouldn't be able to do things the way they used to.

Barry Shilo

Cherokee understanding about land care

Elder Jesse Litefoot offers statements that summarize his own thoughts and those of other elders about their philosophy of land care.

Even the frog doesn't drink up the water he lives in. Jesse Litefoot

...after 30,000 years [of residence on the land] they knew the best times to do that [burn] to ensure the forest that the mountains would replenish themselves.

Jesse Litefoot

We were always here. We didn't move! The earth moved.

Denise Walker

Memories of Cherokee landscapes

The elders provide descriptive comments about historic Cherokee landscapes that were part of their own experiences and the stories their elders had told them.

...in those days they said the mountains were like a park. Yeah! You could walk up in the mountains and there were huge trees everywhere and there was grass even in between the trees and not that much brush. And so it was like a walking park, you know, and now if you go up there there's just a lot of brush, a lot of different kinds of things.

Jesse Litefoot

It would help trees if we set the land on fire because there's a lot of insects out there. Grandma told me. I feel like setting it on fire. If we could do it every fall we could replenish the woods. If we could do it, it would be a gift. [We] could replenish the woods and make straight, good timber.

Nolan Wyle

Huckleberry came plentiful after a fire. [My] grandmother sent me to collect berries. I would see women going up the mountain with buckers to gather berries. Huckleberries were so plentiful they were in clusters like a corn [cob]. Down in Cherokee someone set a fire and it burned very hot, but boy, did the berries come back afterwards!

Nolan Wyle

[You] could hear the acorns falling for bear. You don't see that hardly, where bears forage. They are starving. Pigs ran freely, roamed the woods. Pigs in the forest feasted on nuts...[they] tasted good afterwards!

Nolan Wyle

The participants were taught land care practices by their parents and grandparents, many of whom were born shortly after the Removal and had learned how to care for the land

from their parents and grandparents. Memories of the results of that land care and the traditions embedded in them were passed down with the stories and teachings. The elder participants generously shared their knowledge and descriptions of historic Cherokee landscapes and land care practices with me for this study.

PARTICIPANTS

The qualitative research design relied entirely on interviews with thirteen tribal elders who agreed to be interviewed. Participants were chosen by network sampling, a qualitative sampling method that enables the interviewer to select participants most likely to have experiences with the research topic. The tribal research approval protocol introduced me to several Cherokee leaders who suggested I contact elders they knew to be knowledgeable about Cherokee land care practices and beliefs. Over the course of three summers, the elder network on the Qualla Boundary provided the participant pool of thirteen elders for this study, all of whom were knowledgeable about stories and customs of the people. These elders were well known in the Cherokee community for their contributions and teachings about traditional Cherokee dances, stories, and history.

Each participant was given a pseudonym to protect their identity. The demographic information of the participants is featured in Table 1.

Table 1. Demographics about Cherokee elders who agreed to be interviewed*.

Name	Age	Gender	Community	Role/Job	Yrs on Qualla Boundary
Mary Johnson	51	F	Wolfstown/Painttown	Teacher	Lifetime
Denise Walker	87	F	Birdtown	Retired	67
Nelson Smith	60	M	Cherokee	Storyteller	8
David Smiley	67	M	Wolfstown	Retired	Lifetime
Jesse Litefoot	50	M	Birdtown	Counselor	11
Noah Talker	55	M	Painttown	Maintenance	Lifetime
Lacy Feathers	70	F	Cherokee	Retired	Lifetime
Nolan Wyle	87	M	Cherokee	Retired	Lifetime
Barry Shilo	87	M	Big Cove	Retired	Lifetime
Eddie Nice	48	M	Wolfstown/Painttown	Storyteller	Lifetime
Betty Sky	88	F	Big Cove	Child care	Lifetime
Charlie Mustang	57	M	Wolfstown	Maintenance	Lifetime
Jonny Carver	64	M	Birdtown	Woodcarver	Lifetime

*Eight of the elders interviewed provided comments directly relevant to fire and fire effects; the remaining elders provided more generalized reflections about land care and information about the context of traditions outside the bounds of this study.

Limitations of the Study

1) The time period for collecting interview data was restricted to eight to ten weeks each summer between the spring and fall semesters of my university program. During the first summer, at least six weeks was required to “gain entry” into the community, understand and complete tribal protocols for research and achieve an initial understanding of the modern-day Eastern Band of Cherokee Indians. Another time restriction was related to housing. During the first two summers, I lived in student housing at the USFS Coweeta Hydrologic Laboratory, and drove between Otto, NC and Cherokee to accomplish interviews. The daily trips from Otto to Cherokee restricted the time I could spend establishing rapport and collecting data from elders and leaders who had busy schedules.

2) My culture, Diné, southwestern, Navajo and English-speaking and that of a young person enrolled in a distant university, was very different from the Cherokee elders who spoke Cherokee and English, lived in the southeast, and were the ages of my grandparents and older. For elders who spoke Cherokee, qualitative interviews included a translator. Even when participants spoke English, I had to negotiate the sounds and vocabulary of southern Appalachian dialect.

3) Another limitation of this study was the constraint around accessing traditional knowledge from elders outside of the circle of people, for various reasons, my “gatekeepers” could influence to speak with me.

4) The research for this study began during the final year of my undergraduate program and continued through my master’s degree program. During that time I acquired skill in conducting research, yet I am still a novice researcher learning the procedures for two scientific methodologies.

MATERIALS AND METHODS

Data collection was accomplished for four distinctly different sets of data: 1) traditional Cherokee knowledge about burning practices; 2) the historic range of variation for forests based on archaeological and ecological data; 3) flame length and heat intensity data for the Cherokee fire regime; and 4) wildfire sensitivity for five dominant and culturally important species in the historic forest.

Cherokee Traditional Knowledge about Burning

Permission was obtained from the Cherokee Cultural Resource Center and Tribal Council to interview tribal members. These qualitative interviews were conducted with thirteen Cherokee elders who were known to have substantial traditional knowledge. A standard set of open-ended interview questions regarding traditional ecological knowledge was developed for the interviews. At each initial interview, I reviewed the purpose of the research study and the qualitative interview protocol that relies on open-ended questions to elicit rich, detailed narratives of the participant's experience and knowledge. Additional prompts clarified and expanded information that the participant offered. At the end of each interview, I determined whether further interviews were needed by evaluating my notes and audiotapes for clarity and completeness. Any future interviews were scheduled at the convenience of the participants.

After each participant provided demographic information (Table 1), he or she was invited to respond to a series of broad, open-ended questions requesting information about experiences of learning about or applying land management techniques. The interview protocol consisted of the following prompts approved by the Institutional Review Board at Northern Arizona University and the Cultural Resources Office of the Eastern Band of Cherokee Indians, with bulleted follow-up questions or prompts:

1. Think of a time when you were learning about the importance of specific land practices Cherokees used. Tell me about that experience and the information you learned.
 - Are there other experiences you had that taught you how to care for the land? Please tell me about them.
2. Tell me about your experiences when you were growing up and the sorts of things

you saw your parents or grandparents do to care for the land.

- Did you help your elders care for the land? Tell me about that.
3. Think of the descriptions your elders told you about their land. Tell me about those descriptions.
 4. What did you learn about fire as a land care tool?
 - Describe what you learned and saw related to fires Cherokees set to manage the land.
 5. Tell me other things you think are important for me to know about how Cherokees cared for their land.

Interview questions such as these, common in qualitative interviews, elicit stories from participants rich in cultural narratives, life experiences, and family histories. These data support the primary purpose of qualitative research: comprehensive, detailed descriptions of human communities.

Qualitative data analysis was inductive and on-going throughout the time period of the entire study. Transcriptions of each interview were carefully analyzed using a deliberate, recursive process. First, an initial analysis identified themes and their frequencies in each interview. Second, the themes and their frequencies over all interviews were compared to determine supporting data, conflicting data, or expanding data. Next, I compiled data across interviews that reflected taxonomies about related information for specific topics. In this way, qualitative analysis enabled detailed descriptions of research topics that “emerged from the data.”

It should be noted that since the purpose of qualitative research is to provide a rich, taxonomic description of human experience, it is unnecessary to require all participants to report the same experiences or describe them in exactly the same way.

Rather, analysis allows descriptions, and a presentation of relationships and balance of personal stories *within the context of the participant pool and their human community*. Qualitative data is judged valid when there is “participant corroboration, theoretical and empirical consistency, rigorous review by peers familiar with similar methods, content, and populations, personal reflection...and the later contributions of other scholars to the same areas” (Lecompte and Preissle 1993, p. 331).

Historic Range of Variation Based on Archaeological and Ecological Data

The historic range of variation for southern Appalachian forests was derived from data representing numerous intersecting lines of evidence that collectively provide confirmation for results and conclusions. This method of analysis is termed triangulation in qualitative research (Lecompte and Preissle 1993). Literature regarding archaeological and ecological data on Native burning practices in southeastern woodlands and Cherokee culture were obtained from a number of sources. The first source of data collection was university libraries. The University of Georgia and Western Carolina University both have outstanding collections of information about Cherokee history and anthropology. The Internet was used for searching the library catalogs. The second source of written information was the Cultural Resource Center located on the Qualla Boundary in Cherokee, North Carolina. Two archaeology reports were obtained through the permission of the Cultural Resource Director and Cherokee Tribal Council. The technical reports completed for the Ravensford Land Exchange Tract between the Great Smoky Mountain Nation Park and Eastern Band of Cherokee Indians and Magic Waters tract (site 31JK291) were reviewed for tree species recovered at each site. The Native American sections in bookstores, especially those located within the Qualla Boundary and operated by tribal members, were the third source of published information.

The Archaeo-environmental Reconstruction Technique (ART) was used to collect and analyze data obtained from archaeological, ethnobotanical and cultural records about the historic species composition and distribution of dominant trees in southern Appalachian forests (Alcoze and Hurteau 2001). These records were also examined for data concerning Native burning practices and the benefits and affects these fires had on the southern Appalachian forests, specifically in Cherokee country.

Flame Length and Heat Intensity Data for Cherokee Fire Regimes

Cherokee interviews about traditional ecological knowledge, specifically the use of fire, identified typical flame lengths in Cherokee fires. The Fire Effects Information Systems (FEIS), an up-to-date database that provides information about the fire ecology of plants and animals in the U.S., was used to determine the fire ecology and effects of fire on the five tree species identified in the interview data and historic records as dominant and culturally important species for the southern Appalachians (American chestnut, white oak, red oak, mockernut hickory and Virginia pine). Cherokee fire regimes were examined to determine the flame length of a typical Cherokee fire and estimate the heat intensity produced. This heat intensity estimate was compared with the heat associated with typical wildfire fireline flame length and heat intensities to show that Cherokee fire regimes could maintain the historic forest conditions described. Agee (1993), in his text Fire Ecology of Pacific Northwest Forests discusses how the intensity of a fire can be estimated by determining the “energy content of fuel, the mass of fuel consumed and the rate of spread of fir” (p. 14-15). He describes how the length of a flame can give an estimate of fire intensity using a constant to stand for the “energy content of fuel, the mass of fuel consumed, and the rate of spread of fire” (p. 14-15). The following equation was used to give an estimate of heat intensity based on flame length,

to compare wildfire intensities of the southern Appalachian forests with Cherokee fire regimes:

$$I = K \times FL^{2.17}$$

where **I** equals heat intensity in kilowatts, **K** is a constant that represents fuel energy, fuel mass and rate of spread (numerical representation of 258) and **FL** is the flame length in meters to the power of **2.17**.

Example A (2" flame): $I = 258 \times (.155m^{2.17}) = 258 \times .018 = 4.644$ kilowatts

Example B (12" flame): $I = 258 \times (.31m^{2.17}) = 258 \times .079 = 20.382$ kilowatts

The heat intensity values calculated for the Cherokee fire regime are given in both English and metric units. The final copy of the manuscript will be submitted to the Eastern Band of Cherokee Indians and the scientific community. It is appropriate to include English and metric units to assist both audiences with the interpretation of fire intensity results.

Wildfire Sensitivity for Five Species in the Historic Forest

The fire effects information (FEIS 2004) database was reviewed for the historically dominant tree species. Information was collected about each tree's sensitivity to fire, shade tolerance, fire regime, bark thickness, mature growth height, adaptation and susceptibility to fire (FEIS 2004). The fire ecology and fire affects of American chestnut, absent from FEIS, were obtained from published articles (Vandermaast et al. 2002, Burnham 1988, Treadwell 2004), Internet websites and Cherokee interviews. The FEIS database was reviewed for each tree's range and forest type in the southeast, specifically in North and South Carolina, Tennessee and Virginia, which is historic Cherokee country. The mature heights of the trees were chosen to illustrate the historic forest the Cherokee observed. The fire tolerance for these species was classified into three

categories: tolerant, mid-tolerant and intolerant based on a review of the FEIS database. Classification of a species into a specific category relied on descriptions about the fire ecology and fire effects as listed in FEIS.

RESULTS

Cherokee Burning Practices

The interview participants spoke at length about Cherokee burning practices. Three major themes emerged from the interview data: 1) procedures and frequencies for Cherokee burning; 2) seasons and weather conditions when burning took place; and 3) the resulting flame lengths from these Cherokee fires.

Theme 1: Procedures and frequencies for Cherokee burning

The participants were asked to describe land care practices they had seen their elders use or had participated in themselves. They spoke of ways the Cherokee burned the land and what happened when they had taken part in the burns. The following quotes from several elders describe how and when they used to burn the land.

I took part in that! Even before we prepared our fields, you know, for the garden and the fields, strike a match to it first. Let it burn all, you know, the dry grass and then you can cut down the corn stalks and it just kept on going up the mountain and it was only going to meet the other fire coming from the other side of the mountain. Yes, I would remember them just setting the fires. [They would start from the] bottom of the mountain and it would meet, you know, the other [person] lived on the other side of the mountain, you know, grandpa's fire would meet his fire.
Denise Walker

Well, the Indians know what to take care of. The fire didn't get all over the mountain when they got fires. They just went in strips and got to the top of the mountain...it would just go out itself. They used to burn them on down below [the mountain]. Then my father used to burn them up this way, up the mountain and there's a big field on both sides and...he used to burn these brushes and they never, never got away.
Betty Sky

A hunter would come across some [hot] coals and hot ashes out there and he would scatter them out and let them burn some more, you know. [The fire]

would come down the mountain here and let them burn. They didn't put it out
instead they just let it spread naturally.

Nolan Wyle

They used to just let them burn and it go out itself. When it rains...it would go
out itself.

Barry Shilo

From what I remember, you know, growing up, in taking care of the land, if my
parents were going to do a garden they would clear a spot. The area that they had
cleared, which wouldn't be too big, they would then burn it, close to the ground,
to get rid of the old cut. [They did this] in the spring, in preparation for the corn
fields. That's another thing too, burning the leaves...that gives to the land, to the
soil. We cut some too. They were very careful to watch the weather. They could
tell by the way it felt outside. Without all this modern technology! Now we have
a meteorologist. [They could tell] by the way it felt. And they knew when there
would be wind, just by the way it felt.

Mary Johnson

I don't think there was that much [big fires] and so those fires would burn very
swiftly and create a whole lot of smoke and stuff and the fire would just do its job.
More like this...burning off your back lot or something like that, you know, it'd
have to be real quick and it was over and it was done. They did have a method,
...that's how they made sure the medicinal plants that they used were
protected...because the speed of fire coming through, it wouldn't hurt that at all.
...rather than get burned out or destroyed, those plants just got stronger. And in
kind of a way, they were also cultivating. It's hard to imagine that you could
cultivate a forest...

Jesse Litefoot

Theme 2: Seasons and weather conditions when burning took place

The following quotes are from elders who explained when they saw or took part in burning the land. This includes specific months and weather conditions during which the Cherokee felt was the appropriate time to set fires.

Burning season, we burned early in the fall. In the fall of the year, most of the time - after the leaves have fallen...when they fall then that's when you burn. The fire didn't get big in those days...[we'd burn] annually because fire has taken care of all the, you know, the debris that'd been piled up...if you burn it every year then, you know, you're preserving the forest. It burned slow! It [went] in a slow pace just you know real [slow]. My dad used to say at night [the] fire moved slow, just like it's crawling. Yeah, and it would get all, you know, across the whole mountainside and it would go around out of sight [kind of] like a big snake or something. Oh, anyway, when you burn it yearly then it's a slow burn. They would annually burn the forest floor, doesn't make big flame; they would burn all fall leaves...

David Smiley

When the leaves fell, they got dry, well, they would set them anytime but most times in the fall, the leaves would be there, they'd be dry, they'd burn fast...little fires, it wouldn't hurt it. They knew what time of the year to set it.

Noah Talker

Now, now that's the way the old people [built] a fire and they set fire all, all over...in April. And sometimes in May when there ain't too much wind. And that's why they [built] a fire when it wasn't windy, they just let it go on and when it gets cooler at night the fire just [goes] out itself. And they'd burn them in May when the weeds come up a lot. [They would burn] every summer, about spring time. That's why they set the fire up and that kills all the worms...we didn't have no worms that eats up our beans. They raised a lot of beans way back and that's why they set the fire up so they can get all the worms away from the trees. [They would burn] all night long, they would set them every night. See, at the night time the wind dies down and that's when they wait until late in the evening, they started up. And you could see fires all over the mountains when I was about ten years old. But you have to wait until May until when the wind is not blowing. That's when they set the fire and they didn't have to worry about fighting fire.

Betty Sky

[I think] it would help land if we set [the land] on fire because there's a lot of insects out there. If we could do it every fall, we could replenish the wood. If we could do it, it would be a gift.

Nolan Wyle

In the spring mostly, that's when the leaves dries up. Wintertime it'd be snowing, when it'd rain it stays on the ground all the time so I just set them in the springtime. When a fire breaks out they just let it burn till the rain comes [it

would] put [the fire] out. And it makes it easier to go to the woods, too. There was a lot of chestnuts too [that] might help find [them] easier. Burned every spring, they burn it every spring.

Barry Shilo

...they set the woods afire to burn the leaves all so they can get the chestnuts. Burn the trash off of the chestnuts. The chestnuts would be just laying there. Yeah, I remember [they used to set the woods on fire in the fall], when the leaves fell, they got dry. Well, they set them anytime, but most times in the fall. The leaves would be there, they'd be dry, they'd burn so fast...in the fall of the year...

Noah Talker

Theme 3: Resulting flame lengths from Cherokee fires.

It burned slow! It [went] in a slow pace just you know real [slow]. My dad used to say at night [the] fire moved slow, just like it's crawling. Yeah, and it would get all, you know, across the whole mountain side and it would go around out of sight [kind of] like a big snake or something...[it] created a short flame (used his hands to show the height, approximately six inches).

David Smiley

Well, I saw the fire going many times and the last they had the fire when my boy, when he was little...it was in April and we was sitting on the porch and that fire was going straight, it was just about that wide [four inches].

Betty Sky

The area that they had cleared, which wouldn't be too big, they would then burn it, close to the ground, to get rid of the old cut.

Mary Johnson

...in the community where I'm from....there was not enough on the ground to create big fires. It would burn this year's leaves and that was it.

Denise Walker

Summary of Cherokee Burning Practices

These data indicate that Cherokees burned in fall and in spring. Decisions to burn were based on the time of year and relevant weather conditions. Burns at night took advantage of decreased wind, cooling temperatures and descending humidity that managed fires at surface levels and finally extinguished them. Families on opposite sides of a slope might begin a burn at the same time of the evening and expect the flames to meet on the ridge. Frequent burns ensured low fuel loads, typically leaves and small debris from a past season that hadn't been harvested for fuel wood or other purposes. Cherokees described their fires as slow moving and snake-like, close to the ground, with

flames no taller than about six inches. Interestingly, the Cherokee elders viewed fire as good, something they'd just let "do its work" and be extinguished when it rained or there was no more fuel. Hunters knew that spreading hot coals could facilitate a productive burn and the elders' reports of burning give a picture of viewing fire as a respected tool, a gift, and a regular way to clean the forest floor. This picture of a clean, clear forest is emphasized when the elders speak of today's "trashy" forests, filled with leaves, downed timber no one gets, fuel ladders caused by broken limbs against trunks, all making walking through the woods difficult. Several elders express sadness when they describe the forests their people once knew. Their sadness is epitomized in the voice of Noah Wyle when he speaks in Cherokee to his friend Mary Johnson:

When the old ones were talking about someday all this will be gone, so I guess they must have been feeling something...maybe they were seeing something already...they knew someday...but they're already gone.

Historic Forest from ART Data and Technical Reports

The technical report conducted for the Ravensford Tract (RT) land exchange in Jackson County, North Carolina between the Eastern Cherokee and Great Smoky Mountain National Park (GSMNP) was reviewed for floral remains (Webb 2002). The 168 acre (68 hectares) tract is located on the southeastern edge of the Great Smoky Mountain National Park and a few miles from the town of Cherokee. The tract consisted of fourteen sites of which three sites contained significant samples of tree species. The name of the site and individual test units where tree remains were recovered are given. Test units are defined as an area on a site that contains samples that require a detailed evaluation. Each site was assigned a prehistoric cultural or time period: Paleo-Indian; Archaic; Woodland; and Mississippian. Site 31SW74/74 contained samples from the

Middle Woodland period (ca. 400 B.C. – A.D. 800), a part of the Woodland period (ca. 1000 B.C.-A.D. 1000). Samples found at sites 31SW78/78 and 31SW373 were considered to be a part of historic Cherokee occupation archaeologically referred to as the Qualla phase (ca. A.D. 1450-1838), about the time of European arrival and settlement (Table 2).

The technical report completed for the site 31JK291 (Table 3) indicated the site was two acres (.81 hectares) in size and located on the Qualla Boundary near the GSMNP (Riggs et al. 1997). Tree species recovered from the site were considered to be a part of the Middle Woodland Period (ca. 400 B.C. – A.D. 800). Since the tract is smaller in size the number of tree remains recovered was less than the Ravensford Tract (Table 2).

Table 2. Tree species recovered from the Ravensford Land Exchange Tract during the Historic Cherokee occupation (A.D. 1450-1838) and Middle woodland period (400 B.C. – A.D. 800).

Floral Remains				
Site	Location: Unit	Latin Name	Common Name	Occupation Period
31SW78/78	27, 46	<i>Quercus alba</i>	White oak	Historic Cherokee (Qualla)
		<i>Quercus rubra</i>	Red oak	
		<i>Hicoria spp.</i>	Hickory	
		<i>Robinia pseudoacacia</i>	Black locust	
		<i>Juglans nigra</i>	Black walnut	
31SW78/78	84	<i>Quercus alba</i>	White oak	Historic Cherokee (Qualla)
		<i>Quercus rubra</i>	Red oak	
		<i>Castanea Dentata</i>	American chestnut	
		<i>Hicoria spp.</i>	Hickory	
31SW74/74	14-16, 47	<i>Juglans nigra</i>	Black walnut	Middle Woodland (Piegon)
		<i>Hicoria spp.</i>	Hickory	
			Hazelnut	
			Acorn?	
		<i>Pinus spp.</i>	Pine?	
		<i>Robinia pseudoacacia</i>	Black locust	
31SW373	67	<i>Hicoria spp.</i>	Hickory	Historic Cherokee (Qualla)
		<i>Quercus alba</i>	White oak	
		<i>Quercus rubra</i>	Red oak	
		<i>Robinia pseudoacacia</i>	Black locust	

Table 3. Tree types found on site 31JK291 in Jackson County, North Carolina during the Middle woodland period (400 B.C. – A.D. 800).

Floral Remains		
Site	Latin Name	Common Name
31JK291	<i>Corylus of americana</i>	Hazelnut
	<i>Castanea dentata</i>	American chestnut
	<i>Quercus spp.</i>	Oaks
	<i>Quercus rubra</i>	Red oak
	<i>Carya spp.</i>	Hickory
	<i>Gleditsia triacanthos</i>	Honey locust
	<i>Pinus spp.</i>	Pine
	<i>Liriodendron tulipifera</i>	Tulip poplar
	<i>Fraxinus spp.</i>	Ash
	<i>Castanea dentata</i>	American chestnut
	<i>Juglans spp.</i>	Walnut

Early Botanical Descriptions

William Bartram's Travels (1791) contained extensive descriptions of tree species in the forests as he traveled through the southeast in the late 1700s. As he journeyed through Cherokee country he saw:

(p. 258) "...vast oaks, hickory, mulberry, black walnut, and other trees and shrubs, which are left standing in the old fields."

(p. 262) "...vales and hills, forest trees and shrubs of various, i.e. *Quercus tinctoria*, *Q. alba*, *Q. rubra*, *Q. lobata*, *Acer rubrum*, *Acer saccharinum*, *A. Glaucum*, *Juglans hickory*, *Quercus dentata*..."

(p. 267) "...yet generally productive of forests with a variety of vegetables of inferior growth, i.e. *Quercus*, variable species, *Juglans hickory*, varieties, *Liriodendron*, *Fraxinus sylvatica*...."

(p. 273) "The first step after leaving the verdant beds of the hills, was a very high rocky chain of pointed hills, extremely well timbered with the following trees: *Quercus tinctoria*, *Querc. alba*, *Querc. rubra*, *Fraxinus excelsior*, *Juglans hickory* various species, *Ulmus*, *Tilia*, *Acer saccharinum*, *Morus*, *Juglans nigra*, *Juglans alba*, *Annona glabra*, *Robinia pseudacacia*..."

(p. 288) "Proceeding on our return to [Cowe], continued through part of this high forest skirting on the meadows...enjoyed a most enchanting view; and having gained its summit, enjoyed a most enchanting view; a vast expanse of green meadows and strawberry fields..."

(p. 294) After ascending Jore mountain: “My first descent and progress down the west side of mountain was remarkably gradual, easy and pleasant, through grassy open forests...”

(p. 295) “Next day proceeding on eight or ten miles, generally through spacious high forests and flowery lawns...”

Bartram’s descriptions of his journey exploring Cherokee country provide rich descriptions of a forest free of heavy fuel loads and a variety of mature trees. Bartram describes the forest as spacious and open, making travel trouble-free. The population of the oak species that Bartram documented have been reduced due to logging and fire suppression and are being gradually being replaced by fire sensitive and shade tolerant species such as red maple (*Acer rubrum* L.), blackgum (*Nyssa sylvatica* Marsh.) and eastern white pine (*Pinus strobus* L.) (Harmon 1982, Harrod et al. 1998, Harrod and White 1999, Brose et al. 2001, Van Lear and Waldrop 1989, Kay 2000).

The U.S. Army’s field surveys and reconnaissance records of Cherokee land from 1837-1838 provided descriptions of the vegetation and forest. These records were obtained from the microfilm collection at Western Carolina University’s Hunter Library.

The survey notes were examined for floral descriptions:

Volume 3:

“Woods not very thick and mostly pines.”

“[Land] covered with oak, hickory, chestnut & pines of young and medium growth.”

“[At Turtle Creek] oak, hickory, chestnuts, pines not very thick.”

“Woods scattering – chiefly oak & hickory.”

Volume 4: Survey from Fort [Britto] to the boundary line [between] Tennessee & North Carolina

“oak, hickory, and chestnut [highly] scattered.”

“...slope near the water has plenty of oak, maple & chestnut & pines of small and medium growth.”

“thick...growth of hickory in this ravine”

“This ridge thickly scattered with oaks but pines are principal growth.”

The Army records provide descriptions of what the soldiers observed as they were surveying through Cherokee country. The records show that there was an abundance of oak and hickory species and the forest was not dense with undergrowth (National Archives 1975).

Historic Forest – Interview Data

The Cherokee believe they have always lived in the mountains of the southeastern woodlands and their Creator put them there (Duncan and Riggs 2003). The history and traditions of the Cherokee have been orally passed through generations and the qualitative interviews of contemporary tribal members generate a picture of the historic forest. Tribal members described tree species such as the American chestnut (*Castanea dentata*) that are not as abundant today (Vandermast et al. 2002, Burnham 1988) along with hickories, and oaks.

Elder participants offered this information about the abundance of American chestnuts they remembered during their childhoods and the information about these trees they heard from their elders.

Growing up there were lots of chestnuts and [we'd] make chestnut bread. Natives [chestnuts] have the best flavor, [and they were] used whole in making bread. Chinese chestnuts are large and need to be chopped to be used in bread. [It] doesn't taste as good.

David Smiley

Huge chestnut trees right down from my house in a field. Grandmother gathered bushels of nuts every time, lived on corn and chestnuts, home grown food.

Nolan Wyle

...I've seen some beautiful chestnuts...matter of fact, [near the] school where I went in Big Cove...chestnuts were really huge.

Denise Walk

There was a lot of chestnuts [which the fire] too might help find [them] easier. Oh, they were just thick. Like if you was lost in the woods you couldn't starve [because] you'd eat chestnuts. Those chestnuts - they was good!

Barry Shilo

Mom's told me stories of when they would go to the mountain and into these [groves] of chestnut trees, [groves] of them and after that...after they put the forest on fire and the fires [swept through] they could go... and take a hoe or rake or something and gather the chestnuts.

Noah Talker

Big trees. Yeah, they used to be big trees and tall! And back when the chestnuts fell they [were] about that big [gestures with hands about size of trees]. We used to have lots of chestnuts way back.

Betty Sky

The elders gave these comments about hickories and white oak during the open-ended interviews.

So much easier when you went out to gather [after the fires], you know, the hickory nuts, because you could find them so much easier.

Denise Walker

There's very little hickory here. A great part of our diet had to do with chestnuts and hickory nuts especially in the fall. Those two things were gathered in the fall of the year. Hickory nuts were gathered and shelled and hickory nut meat...made it into balls, great big balls, probably about seven to eight inches in diameter. They would make a lot of those so they had to gather a lot of hickory in order to get that size and what they would do was save that for the winter when there wasn't going to be a lot of greens and stuff like that.

Jesse Litefoot

White oak improved through use of fire. White oak has wormholes; fire kills insects so fire increases resource.

David Smiley

Naturalistic Descriptions and Practices

Elders gave descriptions of the forest they remember caring for in their youth.

[You] could hear acorns falling for bear, don't see that hardly [anymore], don't see [or] hear that often, where bears foraged, they are starving. Pigs ran freely, roamed the woods, even cattle roamed freely, cattle left in valleys to forage and returned in fall, went no where...

Noah Wiley

They just took what they needed even if they had, you know, they had to dry it to preserve it for that wasn't in season. Just only enough to last them until the next season. In particular was ginseng. It's a sacred plant...so when you gather it you only take what you need.¹ And if you have any left over give it to somebody; that was their way of preserving it.

Denise Walker

Could see women going up the mountain with buckets to gather berries.

Noah Wiley

Anytime you deal with natural stuff like that, it had to be done that way, ... with that kind of reverence...that kind of seriousness had to be applied to it because after all you were dealing with every kind of life imaginable. The fish and the streams and all kinds, you know, everything that lives there and so you had to be really, really serious about that. It was [of] such a serious nature that it was a part of our religion, but only in a way in which we viewed our world. ...we believed that it was a gift, you know, and it was alive just like we were. We had to respect it or otherwise it wouldn't respect us."

Jesse Litefoot

[Fire] replenished the forest, I mean it cleared away all the undesirable stuff and it tempered trees. The heat acted as a purifier of the bark on the trees so unwanted insects couldn't make their homes.

Jesse Litefoot

They did have a method and that's how they made sure the medicinal plants that they used were protected. Because of the bulbs and the roots of those plants, the speed of fire coming through wouldn't hurt that at all. Piles of ash and nitrogen so that all of the medicinal plants that were used, and there were many of them, it wasn't just a few, you know those plants rather than get burned out or destroyed those plants just got stronger, you know.

Jesse Litefoot

It's (ginseng) a sacred plant, we just don't realize how sacred it really is. Because it was the ginseng that taught the healers all about medicine. Being a speaker [of Cherokee] we have the advantage of enjoying the stories as they're really told and the true meaning. It's impossible to translate Cherokee into English. It never comes out the same and it never gives the full meaning. But yet you can speak to your children and grandchildren and they get the full meaning even if you speak to them in English. But giving a lecture to say a classroom, especially if they're non-Indian, [it's] never going to come out the same because they, they manage to

hear it the way they want to hear it. They don't hear it the way it's said, they dramatize it.

Denise Walker

There are rules; you knew the rules and the rules were almost sacred. Well, in fact, the rules were sacred and they had stories behind them so you didn't... Ginseng wasn't harvested but just once a year and exactly just one plant, or you got to get two plants even though there may have been lots of ginseng. What they knew, the delicate nature of that plant, they only grew at a certain latitude. It only grew up to a certain point, like for example, you can't find any ginseng down here. You have to go up probably half way up that mountain (gesturing w/ hands at mountain) and it'll start there. You may find some there and you'll find maybe more as you go up higher, but it doesn't grow anywhere near half way down that mountain and down. You just can't find it. They understood that it was very delicate if it lived like that, in fact, its name in Cherokee means "mountain climber." (Says Cherokee name – oodilagdilagi) Oodilagdilagi means "mountain climber."

Jesse Litefoot

So they knew just from that that obviously if it was meant for large consumption it would be down lower where there's more light...

Jesse Litefoot

You know, the wild vegetables...we have this issue with the ramps, I'm sure you've heard that about it. They only took what they needed. Of course, it's not becoming extinct where we gather it. It's only becoming extinct where non-Indians gather because they don't know how. You know, they dig up roots and all. We don't dig up the roots. The roots [get left there] for next year. That's how we do the ramps. You know, you cut just right at the bottom of the ramp button and leave the root down in the ground. It's such a world of difference of how it is now and how it was when I was a little girl.

Denise Walker

Flame Length and Heat Intensities for Cherokee Fire Regimes

Analysis of the Cherokee interviews about traditional ecological knowledge, specifically the use of fire, determined that flame lengths would vary significantly from contemporary wildfires. Contemporary wildfires often result in mortality of the numerous tree species in addition to those that occurred in the historic Cherokee forest. This comparison was generated using information about the fire ecology and fire effects of the five dominant and culturally important tree species obtained from the Fire Effects

Information Systems (FEIS). FEIS is an up-to-date database that provides information about fire ecology of plants and animals in the U.S.

Fire intensity values were calculated using the characteristic flame lengths reported for historic Cherokee fire regimes. The most common fires set by the Cherokee had flame lengths that ranged from two to six inches (Figure 1). These values illustrate the low magnitude of the fires the Cherokee elder participants described. I chose to project an increase in heat intensity based on a short range of flame lengths from 0-30 inches to compare the low heat intensities of the Cherokee fire regimes with heat intensity estimates for flame lengths greater than those reported (Figure 2). The typical flame length of Cherokee fires was approximately six inches with an estimated intensity of 5 kWm^{-1} . When this flame length doubles to twelve inches, the heat generated is estimated at 20 kWm^{-1} , approximately four times the amount of heat associated with a six-inch flame. The maximum estimate of heat intensity for a thirty-inch flame length was 150 kWm^{-1} , or about thirty times more intense than the Cherokee set fires.

Modern wildfire intensities estimated from flame length at the fireline are associated with a range of temperatures that can cause severe damage and mortality to mature trees and other vegetation. Agee (1993) distinguishes three categories of wildfire based on fireline flame length and heat intensity. He identifies: 1) surface fires that range in intensity between 0 kWm^{-1} and 258 kWm^{-1} , a category that includes most prescribed fires where hand lines can be effective; 2) understory fires that have heat intensities from 258 kWm^{-1} to 2800 kWm^{-1} , where fires cannot be attacked directly; and 3) crown fires with heat intensities greater than 2800 kWm^{-1} , where erratic behaviors occur that are so intense these fires must be monitored from a remote site (Figure 3). The high heat intensities of understory and crown fires can cause significant mortality to mature trees.

Wildfire Sensitivity for Five Species in the Historic Forest

The FEIS database provides fire ecology and fire effects information related to four of the historically dominant and culturally important tree species (Table 4). Virginia pine and mockernut hickory are most sensitive to wildfire. Virginia pine has shallow roots that are not well adapted to fire, although large trees may be able to survive moderately intense wildfire. Mockernut hickory is listed as “extremely sensitive” to fire. Seedling and sapling survival is extremely low up to the 10 cm d.b.h.-size class. Larger, mature mockernut hickories can tolerate fires of similar intensity. Red oak is classified as fire tolerant. Large trees can withstand “very hot fires” although severe damage to boles can occur. Generally, the larger individuals of this species have a higher survival rate than smaller size classes. White oak exhibits moderate tolerance to wildfire. Fire resistance increases with age and size. Mature trees of this species develop a thickened bark that becomes increasingly fire resistant with age. The American chestnut is moderately tolerant to intense fire. Early photographic and written records concerning this species illustrate that mature individuals were not killed by low intensity fires. Photographs (ca. 1900) show fire scarring of large diameter American chestnuts.

Table 4. Fire tolerance for culturally significant and important tree species

Tree Species	Habitat Range	Forest type	Fire Tolerance	Mature Height
Virginia Pine	VA, NC, SC	Oak-Hickory	Intolerant	50-70 ft
Mockernut Hickory	NC, TN	Oak-Hickory	Intolerant	65-100 ft
American chestnut	NC, TN	Oak-Hickory	Mid-Tolerant	100 ft
White oak	NC, TN	Oak-Hickory	Mid-Tolerant	65-100 ft
Northern red oak	NC, TN	Oak-Hickory	Tolerant	65-98 ft

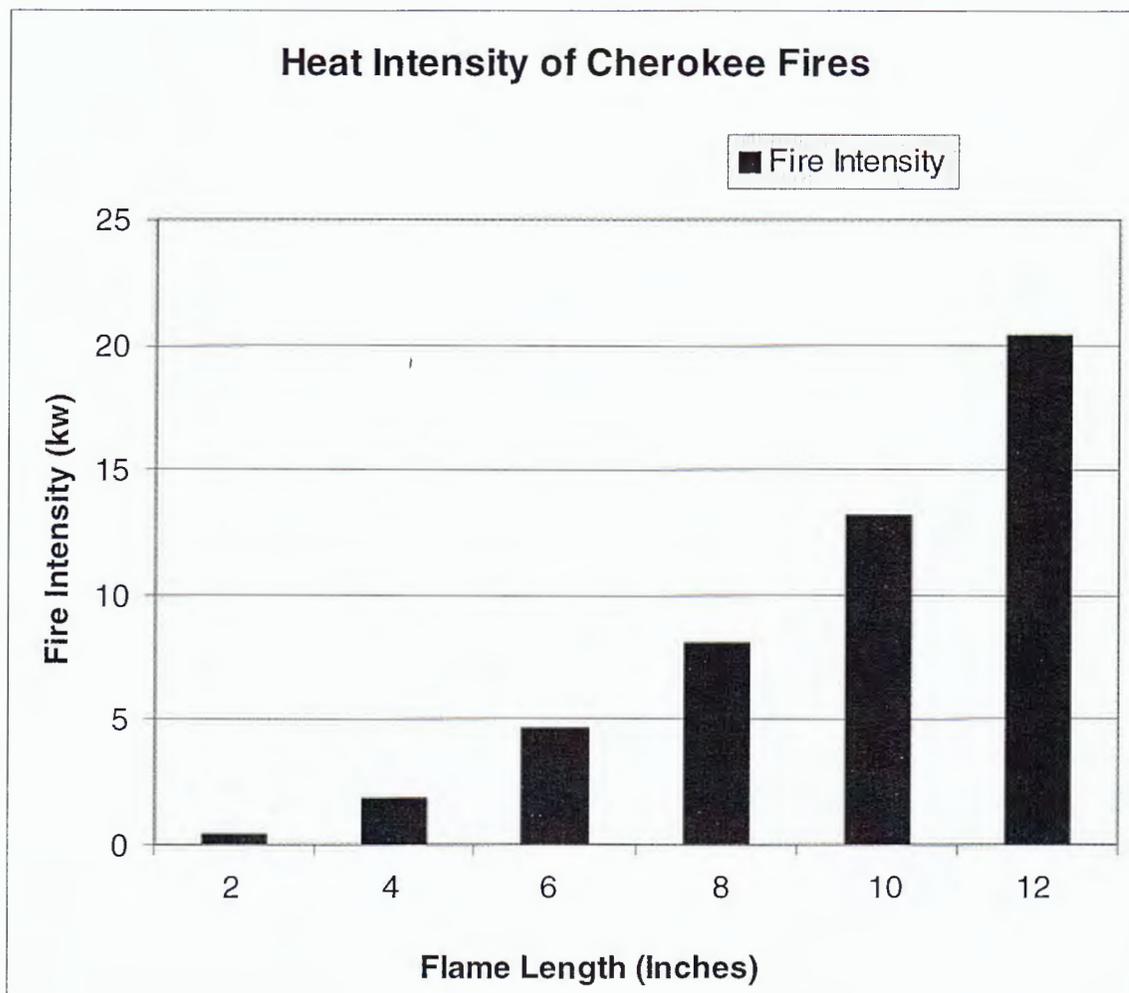


Figure 1. Range of flame length and heat intensity values for Cherokee fires.

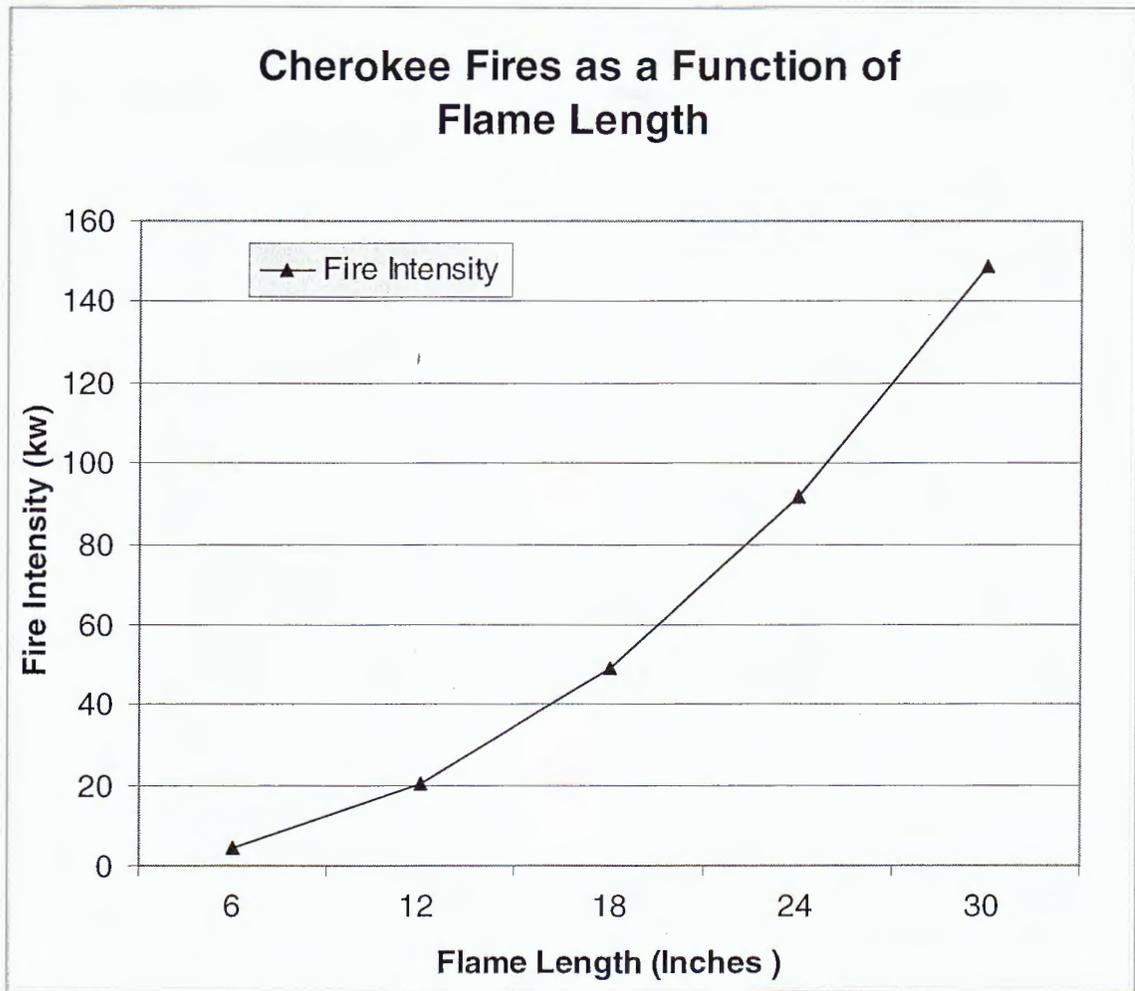


Figure 2. Range of flame length and heat intensity values for fires associated with Cherokee burning practices.

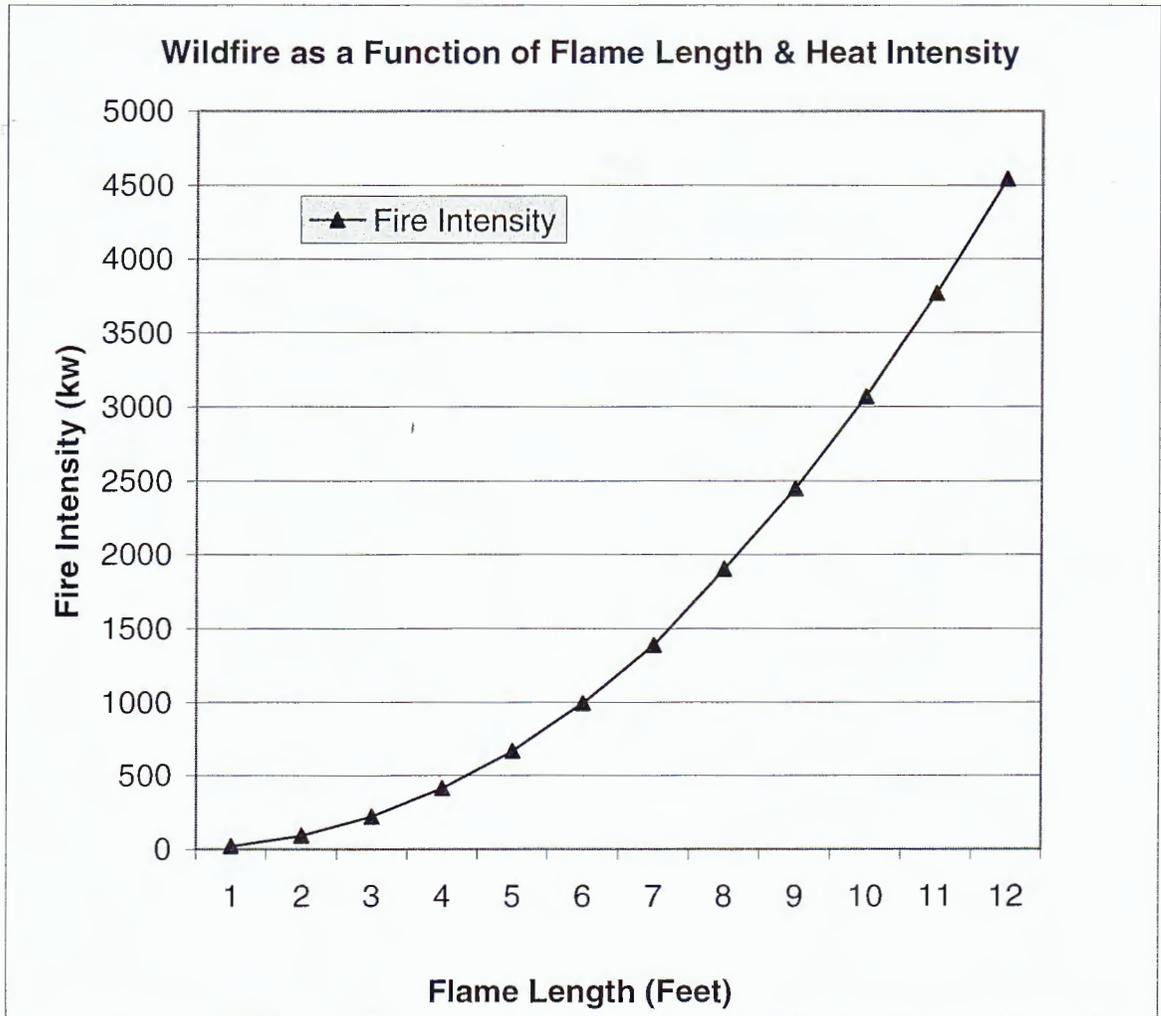


Figure 3. Flame length and heat intensity values of a modern wildfire.

DISCUSSION

Qualitative interviews with Cherokee elders during the summers of 2001-2003 revealed rich descriptions about the condition of the historic forest and provided traditional knowledge of the Cherokee's use of fire as a land management tool. The Cherokee elders spoke of experiences in their youth or stories told them by their elders about specific times of the year when Cherokee people set the woods afire to prepare for the next year's growing season, to harvest the mast of American chestnuts, hickories and oaks or to "let the fire do its work" of keeping the forest clean and healthy. After reporting the preliminary analysis of all interview data to the Cultural Resource Director he presented me with transcripts from previous interviews from tribal elders at Tsali Manor, an elder care service provider on the Qualla Boundary. These interviews were consistent with the findings from my study (Stevens et al. 1999). In addition, Yibarbuk conducted a study in which traditional fire management information documented through interviews with the Aboriginal people of Arnhem land in the Northern Territory of Australia (2001). The outcomes of the study found that burned sites attracted important animal food sources, plant foods remained abundant, vertebrate fauna diversity was high and traditional Aboriginal fire management practices included regular, small fires lit on an annual basis. Yibarbuk concluded that the role of fire was significant socially and spiritually because of an intimate stewardship with the land. Any attempt to restore a regular fire regime to the Australian landscape is rather "premature" without the recognition of the skilled and knowledgeable traditional Aboriginal land owners (2001). The general impression of Native Americans before European settlement is that Native people had no significant influence on the environment except when hunting ungulates and gathering wild plants (Williams 2001). Native people had a system of advanced

technology, “fire, ability to work wood into useful objects, and the bow and arrow” (pg 1) which attributed to their subsistence for thousands of years (Williams 2001). Botkin (1990:169) states “to claim that people with these technologies did not or could not create major changes in natural ecosystems can be taken as Western civilization’s ignorance, chauvinism, and old prejudice against primitivism—the noble but dumb savage”. The effect that Native people had on the environment with fire is substantial enough to create a landscape in which there are remnants of in the 20th and 21st century (Botkin 1990).

The five historically dominant and culturally important tree species present in the historic forest, American chestnut, red oak and white oak, Virginia pine and mockernut hickory, were sustained by Cherokee fire regimes. Elders described fires with managed flame lengths of approximately six inches. Fire intensities resulting from fires with managed flame lengths at .15 m were calculated. I made an assumption that flame length-heat can be used to estimate heat intensity in southern Appalachian forests. These values can be used to evaluate the heat intensity for Cherokee fire regimes. I have concluded that significant mortality from Cherokee fire regimes for historically dominant and culturally important tree species would be unlikely and that high frequency low intensity Cherokee fire regimes sustained forest conditions characterized by (1) low fuel loads, (2) reduced plant competition and (3) limited parasitic insect and disease outbreaks. The heat intensities generated by were less intense by at least one order of magnitude when compared with the lowest wildfire intensity category surface fires. I further conclude that frequent, low-intensity Cherokee fires prevented catastrophic wildfires by keeping fuel loads at a manageable level to avoid high mortality or serious damage to mature mast-producing trees. These conclusions match published accounts of Native burning and

descriptions of forest structure at the time of European settlement in the eastern portion of the U.S. (Bartram 1791, Goodwin 1977, Anderson 1996, Day 1953, Maxwell 1928, Pyne 1983, Van Lear and Waldrop 1989, Noss 1983, Lewis 1991, Burnham 1988, Evergreen 1995).

A new approach by the dominant society, especially ecologists and foresters, towards traditional ecological knowledge would recognize the valuable cultural and ecological contributions of Native people. Two things are clear: 1) Native people lived in eastern North America for thousands of years before the arrival and settlement of Europeans; and 2) Native people's traditional ecological knowledge and practices had a profound effect on the environment long before the arrival of Europeans. The association of fire with negative and destructive forces is a post-European phenomenon that resulted from European settlement patterns and wildfires caused by historic logging methods and other changes in forest management such as fire suppression (Brose et.al. 2001). In reality, the burning practices the Cherokee elders used to care for and sustain their historic landscape match much of what modern-day land managers now advise about fire use as a land management tool. This study provides a way to progress toward understanding and incorporating traditional ecological knowledge, in land management decisions; specifically the use of prescribed fire to reduce the threat of catastrophic wildfires, limit parasitic insects and diseases affecting our forests and promote healthy forest ecosystems. Since Native people have historically used fire and know its effects and value, crediting them with valid, valuable ecological knowledge would substantiate contemporary fire management programs and foster a more complete understanding in the public at large about responsible land management. I have examined the Cherokee traditional ecological knowledge about land care and burning practices using modern

forest ecology principles and concluded that the Cherokee have significant knowledge of historic forest conditions and the benefits of fire as an important component of healthy, sustainable forests.

Further ecological studies concerning Native burning methods need to be conducted, with the assumption that Native peoples who inhabit different bioregions have varied and valuable traditional knowledge for land management in their historic landscapes. Practical ways to improve the conditions of our forests may be slipping from our grasp with the passing of Native elders. Ecological restoration managers specifically can consider: 1) the historic role of Native people and studies that examine their ecological influence; and 2) the implementation of traditional ecological knowledge and practices in ecology and forestry. In these ways, Native American traditional ecological knowledge will give the modern scientific community an opportunity to better understand the role of the human community in the restoration of healthy landscapes and ecosystems.

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Appendix A. Fire Tolerance Estimates for Fire Tolerant and Fire Intolerant Tree species

Tree Species T= Tolerant;I=Intolerant	Tolerant Trees (kw)	Midtolerant Trees (kw)	Intolerant Trees (kw)
Chestnut (T)	1000	-	-
Hickory (I)	-	-	100
Red Oak (T)	-	200	-
White Oak (T)	1000	-	-
Virginia pine (T)	-	40	-

Appendix B. Heat Intensity in Kilowatts of Cherokee Fires as a Function of Flame

Length in inches and meters

Flame Length (inches)	(meters)	Heat intensity (kw)
6	.155	4.644
12	.310	20.382
18	.465	49.020
24	.620	91.409
30	.775	148.389

Appendix C. Heat intensity in kilowatts of wildfires as a function of flame length in measurements of feet and meters.

Flame Length (feet)	(meters)	Heat Intensity (kw)
1	.310	20.382
2	.620	91.409
3	.930	220.332
4	1.24	411.476
5	1.55	667.789
6	1.86	991.888
7	2.17	1385.917
8	2.51	1900.691
9	2.82	2447.148
10	3.13	3068.675
11	3.44	3766.617
12	3.75	4542.213