THE HISTORY AND SURVIVAL OF TRADITIONAL HEIRLOOM VEGETABLE VARIETIES AND STRATEGIES FOR THE CONSERVATION OF CROP BIODIVERSITY IN THE SOUTHERN APPALACHIAN MOUNTAINS OF WESTERN NORTH CAROLINA

A Thesis

by

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ABSTRACT

THE HISTORY AND SURVIVAL OF TRADITIONAL HEIRLOOM VEGETABLE VARIETIES AND STRATEGIES FOR THE CONSERVATION OF CROP BIODIVERSITY IN THE SOUTHERN APPALACHIAN MOUNTAINS OF WESTERN NORTH CAROLINA. (August 2005)

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Southern Appalachia is unique among agroecological regions of the South because of the region's diverse environmental conditions caused by its mountain ecology, the geographic and commercial isolation of the region, and the relative cultural autonomy of the people that live in the region. Those three criteria combined with a rich horticultural history and the continuance of the home gardening tradition make southern Appalachia an area of relative high crop biodiversity in America.

This thesis investigates the history and survival of traditional heirloom vegetable crops in western North Carolina, documents heirloom varieties that are still being grown, and makes recommendations for the conservation of crop biodiversity in the region. I conducted interviews with twenty-six individuals from twelve counties in western North Carolina. I used a snowball sampling method to identify individuals or communities that were maintaining heirloom vegetable varieties, and used the memory banking of farmer's knowledge as a strategy to compliment the gathering of seed specimens in the study.

I documented one hundred and thirty-five variety descriptions of heirloom vegetables that are still being grown in the region. Most of these varieties are being

grown and saved by home gardeners; beans are the most numerous among varieties that are being saved. The results indicate that usually only one or two individuals in a community are maintaining significant numbers of heirloom varieties and that many communities have lost their heirloom vegetable heritage altogether. The decline of the farming population combined with a lack of cultural continuance in family seed saving traditions threatens the ability of communities to maintain crop biodiversity. Some of the cultivars that I have documented probably represent the last small populations of endangered varieties. All of the seeds that I collected in my research are being stored in my own personal seed bank and will in the future be duplicated and donated to the seed bank of the Southern Seed Legacy at The University of Georgia. A comprehensive conservation strategy for western North Carolina's crop biodiversity is proposed in the sixth chapter of this work and calls for a regional seed bank and seed saving network to be established.

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Finally I would like to thank my wife Alena for keeping me fed (among many other things) and my little son Ian for providing much needed comic relief and perspective.

DEDICATION

This work is dedicated to the past, present, and future gardeners and farmers of western North Carolina

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Chapter 1: Introduction

America has lost an estimated 97% of the vegetable varieties that were commercially available in this country in 1903 (Fowler and Mooney 1990). Moreover, the rate of extinction of traditional heirloom vegetable varieties is increasing (McDonald 2001). Several criteria suggest that southern Appalachia is unique for its high level of crop diversity relative to other southern regions. Among these criteria, southern Appalachia's diverse mountainous conditions create the kind of microclimates and isolated environmental niches that are conducive to a rapid differentiation of crop plants (Gray 1999). Another criterion is that areas of high crop biodiversity are more geographically and commercially isolated, less densely populated sub-regions with difficult growing conditions (Smale et al. 2004). Finally, cultural autonomy is also a factor that may impact the crop biodiversity of a region (Smale et al., 2004). Southern Appalachia meets each of these criteria, at least relative to other agroecological regions in the South and the rest of America, suggesting that it could be a region rich in crop biodiversity. Whealey (1998) has noted that, "Heirloom seeds are especially prevalent in isolated mountain areas, such as the Ozarks, Smokies, and Appalachians, and also among traditional peoples such as the Mennonites, Amish and Native Americans" (p.7).

Historical examples have shown the importance of maintaining crop biodiversity. The most cited example is the infamous Irish potato famine. The potato crop of 1846 in

Ireland rotted away in the fields because of a fungal disease called "late blight," *Phytophthora infestans*, which also occurs in southern Appalachia. One reason it was so devastating was because the Irish farmers of that time were only growing two closely related varieties of potatoes, neither of which had genetic resistance to late blight. The result of this lack of agroecological and crop genetic diversity was that over one million Irish people died (Veteto 2001). Late blight is thought to have originated in Central America. In that area of the world late blight is not a common problem. A main reason is that farmers in Central and South America have traditionally cultivated over 3,000 varieties of potatoes. With that much biodiversity in the fields it is highly probable that some of those varieties have genetic resistance to late blight. Late blight has never caused a potato famine in that part of the world, although other factors such as the co-evolution of organisms that are antagonists of the late blight fungus also play a role, alongside crop biodiversity, in controlling the blight.

An example closer to the southern Appalachian region is the corn blight (*Bipolaris maydis*) that occurred in the southern United States in the early 1970's. Over half of the corn crop in the U.S. south was lost in the corn blight. Plant breeders were sent scrambling to Mexico, where a greater crop genetic diversity exists in corn varieties, to find a resistant gene (Rhoades 1991) that has subsequently been bred into post-1970 U.S. corn varieties. Southern Appalachia is not only a region that is potentially high in crop biodiversity relative to other areas in the American South, but, according to Guarino's model for quantifying the threat of genetic erosion (Guarino 1995), southern Appalachia is also a region that is severely threatened with a dramatic loss of crop biodiversity unless steps are taken toward conservation.

Virchow (1999) has noted that, "Aside from the sustainable management of soil, water, and air, it now seems to be accepted that the sustainable management of genetic resources is one of the four indispensable preconditions for a sustainable agriculture" (p.2). Currently, there is no strategy for conserving western North Carolina's crop genetic diversity and no comprehensive data on what traditional vegetable varieties still exist in the region.

This thesis investigates the history and survival of traditional heirloom vegetable crops in western North Carolina, documents heirloom varieties that are still being grown, and makes recommendations for the conservation of crop biodiversity in the region. My objective is to identify as many growers of heirloom vegetable varieties as possible across the region, memory bank the ethnoecological knowledge of each variety they are growing, and collect seed samples to preserve in at least two seed banks.

I will document a range of information about western North Carolina heirloom vegetable varieties to answer the following research questions:

- What species and varieties are most commonly being saved among growers?
- Among what age groups are heirloom vegetable varieties being maintained?
- What kind of grower is most likely to be maintaining heirloom varieties in their fields or gardens?
- How are heirloom vegetable varieties in western North Carolina classified? What varieties are regionally distributed and which varieties are unique to particular individuals or communities?
- Are heirloom varieties being widely maintained in communities or are they just being maintained by a few individuals?

- Where did southern Appalachian heirloom vegetable varieties originate, how were they domesticated, and when did they arrive in the region?
- What is a strategy for the sustainable preservation of western North Carolinas remaining heirloom vegetable varieties?

An Overview of the History of Vegetable Cultivation in Southern Appalachia

There has been no comprehensive effort to document the history of vegetable cultivation in southern Appalachia. Piecemeal accounts of the horticultural history of the region exist in several works about related subjects and from those sources one can get an understanding of the development and origin of vegetable cultivation in southern Appalachia. Donald Davis (2000), in his book on the environmental history of the region *Where There Are Mountains*, has provided perhaps the longest range study of southern Appalachian horticulture to date. He begins his study in 900 A.D. by examining the horticultural practices of the Mississippian period Native Americans. Davis describes the Mississippians as having reached their cultural apex in the southern Appalachians by 1300 A.D. The Mississippians were largely horticultural and kept small garden plots outside their homes and larger fields for growing corn and beans outside of the main village area. These fields were as large as several miles in length (covering perhaps up to 2,000 acres per village) and were usually situated along riverbanks. Although the Mississippians also hunted and gathered a wide range of non-agricultural food items, Davis cites evidence that as much as 79% of the Mississippians' diet came from corn alone (Davis 2000). The next major influence on Southern Appalachia horticultural history cited by Davis was the arrival and influence of the Spanish in the 1500's. Davis credits the Spanish with the destruction of what remained of the Mississippian culture

through a devastating onslaught of introduced cultural patterns, missionary activities, intercultural trade and skirmishes, and above all, disease. The death rate from epidemic diseases carried into the Appalachians by the Spaniards may have been as high as ninety percent. The Spanish settlers also brought several important new crops to the region that influenced the agriculture among the native people including sweet potatoes, peaches, cowpeas, watermelon, castor beans, and okra (Davis 2000).

The Cherokee Indians were the next major influence on southern Appalachian horticulture that Davis cites. Davis (2000) views the genesis of the modern Cherokee as a resulting from the breakdown and resulting decentralization of the post-Spanish Mississippian collapse. However, other scholars and Cherokee historical accounts present the viewpoint that the Cherokee may have a much longer cultural history in the southern Appalachians (Mooney 1992, Whyte 2005). By all accounts, the Cherokee were the dominant native group in the southern Appalachians by the end of the 17th century. Corn was the staple crop of the Cherokees and at least three varieties were grown (Davis 2000). Beans were grown in the cornfields, native squash and gourds continued to be cultivated, and by the late 1700's the Cherokee were growing peaches and potatoes (Mooney 1992, Davis 2000). Increased trade with their Euro-American neighbors continually changed the character of Cherokee horticulture and by the end of the 18th century the Cherokee were also cultivating apples, onions, turnips and cabbages (Davis 2000, Swanton 1979). By 1819, the Cherokee were growing cotton, tobacco, and wheat as well (Mooney 1992). Although apples were originally a European crop introduced by British fur traders, they were made central to regional horticulture by the Cherokees after 1750. When apple growing fell out of favor with Euro-American colonists by the 1830's,

the Cherokee almost single-handedly kept apple cultivation alive in the mountains. In the 1850's and 1860's, southern horticulturists revived the apple industry in the southern Appalachians largely by grafting old varieties of apples from Cherokee orchards that had been left behind following forced removal of the Cherokees from their Appalachian homeland in 1838-9. The contribution of the Cherokee Nation to southern Appalachian apple cultivation is not a widely known part of the region's horticultural history (Davis 2000).

According to Davis, early southern Appalachian pioneers drew their horticultural knowledge from a wide range of cultural traditions. Frontier horticulture was influenced by Cherokee, Scots-Irish, German, and to a lesser extent English and Scandinavian land use patterns (Davis 2000). The dominant form of frontier southern Appalachian horticulture was what is known as "forest fallowing" or alternatively as "slash and burn" (Otto 1987). Forest fallowing was a part of the cultural traditions of all of the above-named cultural influences on southern Appalachian frontier horticulture except for the German (Davis 2000). Forest fallowing was characterized by a practice of clearing the native forest growth for crop fields. Forests would first be "grubbed" by rooting up the forest underbrush with hoes and then piling and burning it. Farmers would then "girdle" the large trees by cutting a ring in the bark with axes in order to "deaden" the forest. Deprived of the rising sap to feed their leaves by girdling, the trees would subsequently drop their leaves and sunlight would penetrate to the forest floor and nourish crops. After a few years of cultivation, settlers would then remove the stumps and "deadenings" by calling on their neighbors to help in what they called a "log-rolling". The most frequent crop planted in fields cleared in the forest fallow system was corn; however, wheat,

barley, rye, and oats were also sometimes planted (Davis 2000, Otto 1987). The forest fallowing system in southern Appalachia remained an important horticultural method until the beginning of the twentieth century, when a combination of population growth, changing land ownership patterns, and the partible inheritance system made southern Appalachian average farm sizes too small to sustain it (Otto 1987).

The German settlers had a different kind of horticultural system. They would clearcut fields instead of creating deadenings, burn all of the trees on site to create potash, and then remove all debris and rock from the fields, creating a parcel of land that was "free and clear" and ready for planting. The Germans also brought with them the practice of spreading animal manure over crop fields in order to maintain fertility. The unique German contributions to southern Appalachian frontier horticulture were less widespread than those of the Scots-Irish and English because they constituted a much smaller percentage of the population than those two groups (Davis 2000). Cherokee contributions to frontier horticulture were numerous and varied. The Cherokee traditionally practiced both tree girdling and forest burning. Frontier settlers cultivated corn, beans, squash and gourds, all of which had been grown by the Cherokees in the region for hundreds or thousands of years. From the Cherokee, the settlers learned about cropping systems such as the "Three Sisters" (growing corn, beans and squash together in the same field) and food processing techniques such as drying squash and pumpkins by hanging them on strings or wooden devices and stringing beans to dry as "shuck beans" or "leather-britches" (two regional names for this drying process). It is also possible that the settlers learned methods of making maple syrup from the Cherokee (Davis 2000).

The Cherokee contribution to Euro-American southern Appalachian horticulture began in the frontier period and continued on into the twentieth century.

The next period of influence on southern Appalachian horticulture was the antebellum (Davis 2000). By 1830, frontier settlement had ceased in much of southern Appalachia and the antebellum period had commenced. Most of the original settlers in the region owned farms that were between 100 and 300 acres, mostly forested (up to two thirds of the land cover), and characterized by major crop cultivation of corn, oats, rye, wheat, and to a lesser extent, buckwheat. Most farmers also grew a diversity of staples including sweet and Irish potatoes, peas, beans, flax, tobacco and sorghum (Davis 2000). Indian corn was the principle mountain crop of the era and fed both humans and animals (Stertzer 2001, Williams 2002, Davis 2000). In western North Carolina, where crop selection was more diversified than other areas in the region, 3.6 million bushels of corn were grown in 1860. In the southern Appalachian region as a whole, by 1860 corn production took up about one tenth of the average farmer's improved land (Davis 2000). However, many western North Carolina counties saw corn production decrease after the civil war (Stertzer 2001). Corn was central to the southern Appalachian subsistence culture. It was processed and made into hominy, hoecakes, grits, corn pone, mush, and whiskey (Stertzer 2001, Davis 2000). The cornhusks and leaves were made into hats, dolls, chair bottoms, and mops. Corncobs were used for bowls, tobacco pipes, fire starters, and toilet paper. Community gatherings known as "cornshuckings" (or frolics) occurred at harvest time (Davis 2000). Though a subject of much debate (see, for example, Dunaway 1996), it appears that southern Appalachia had a higher percentage of subsistence farmers than other regions of the country. Although some well situated

southern Appalachian farms were predominately market oriented, it seems likely that most were subsistence oriented during the antebellum, selling to the market only when home needs had been met (Davis 2000). Historian Martin Crawford (2001) writes that, "Whatever the character and authority of mountain elites or the extent of mountain farmers' integration with the wider regional and national economy, southern Appalachia remained an overwhelmingly small-farm, subsistence-oriented region whose economic development was inhibited by a variety of geographic and cultural factors..." (p. 24). This agrees with Ronald Eller's (1982) observation that, "By 1880, Appalachia contained a greater concentration of noncommercial family farms than any other area of the nation." (p. 16). As mentioned above, the farms of antebellum southern Appalachia were relatively small and highly diversified. The relative lack of interest in large-scale commercial farming allowed for considerable horticultural experimentation by local growers, resulting in a diversity of crop varieties:

> Bean, pea, and corn varieties were hand selected or cross-fertilized in order to produce strains better suited for mountain microclimates. Some particular strains were bred for exceptional flavor, others for a unique color or a particular shape or size. Many antebellum fruits and vegetables would not even be recognizable to modern growers, including Gourdseed corn, a variety whose ears could be easily shelled by flocks of foraging turkeys. Green nutmeg muskmelons known as Rocky Fords were raised in favor of commercial cantaloupe varieties. In eastern Kentucky, a pole bean variety known as Ruth Bible became popular for its resistance to drought, whereas Turkey Craw was grown in northeastern Tennessee, North Carolina, and southwestern Virginia. Of course, all families saved their own vegetable seed every year, giving rise to a cultural tradition that in some mountain areas continues to this day (Davis 2000, p. 144).

John Opie (1980) has made the case that the small-scale, subsistence oriented, family farmer of antebellum southern Appalachia was the model and ideal by which many Americans identified themselves at that time. Whether or not Opie's observation is

accurate or a romanticizing of the region's farmers, after 1850 the southern Appalachian antebellum farmer began to see his fortunes change as a result of the ravages of the Civil War, increasing population pressure, and the continuing depletion of the soils of the region (Davis 2000).

The final stage of southern Appalachian farming that Davis looks at in his study is that of the modern era. Starting in the late 19th century, farming in southern Appalachia began a gradual and dramatic decline. In 1880, the average size of the southern Appalachian farm was 187 acres, and by 1930 it had decreased to only 76 acres (Eller 1982, U.S. Department of Agriculture 1935). Davis (2000) and Eller (1982) noted a diversity of factors contributing to this decline. These include: the increase of ownership of land by outside mineral and timber companies that reduced the commons that had been traditionally used for grazing and gathering activities; further reduction in the commons by the establishment of large national forests and parks in the region; logging activities that increased flooding and decreased soil fertility; increasing population levels and more intensive monocrop farming strategies; and inheritance practices that subdivided family farms among descendants and decreased overall farm size. Despite these changes, Appalachia still had the nation's largest collection of farms that met the government's definition of "self-sufficing" in 1930 (Bureau of Agricultural Economics, et al. 1935). As the 20th century moved forward agriculture in southern Appalachia continued to decline. Between 1969 and 1974 over a million acres of farmland went out of agricultural production in Appalachia and 17,000 farmers (26% of the farming population) left farming occupations (Appalachian Land Ownership Task Force 1981). This decline mirrored the decreases in the farming population in America as a whole, as farming

became increasingly dominated by large corporate farms that applied green revolution technologies and government aid to increasingly larger farms, employed few people, and drove family farmers out of business (Berry 1977; Fisher and Harnish 1980). The decrease of the farming population had a dramatic impact on the horticultural practices of southern Appalachia. The incredibly diverse farms of the antebellum period gave way to monoculture-oriented modern farms. The growing of wheat and rye for flour began to decline. Mountain families became increasingly dependent on outside food sources such as light breads, whole milk, and processed sugars (Davis 2000). Corn production continued but was less important as the grazing of livestock declined and corn was grown less for supplementary animal feed. Bean markets in northwest North Carolina in the 1940's and 50's encouraged bean cash crops and the planting of high-yielding modern varieties in the place of traditional Appalachian beans (Fletcher 1963; Brown, personal communication, February 1, 2005). Tobacco cultivation intensified in the mid-1920's, was standardized across the region with the advent of the federal tobacco program in 1933, and its production as a cash crop steadily replaced diversified subsistence-oriented cropping patterns. By 1978, ninety percent of farms in Madison County, North Carolina, grew tobacco. Wheat, barley, buckwheat and rye (with the exception of a small amount of wheat) had stopped being grown in Madison county prior to 1970 (Algeo 1998). Christmas tree farms and landscape shrubbery are the other two forms of horticultural enterprise that have come to dominate western North Carolina. Christmas tree growing began to be promoted in western North Carolina by extension agents in the 1960's. By 1980, Christmas tree growers in North Carolina harvested 1.5 million trees, which represented 5% of the national supply (Stevens 1987).

In the last fifty years southern Appalachia has become a post-agrarian rural society. For example, between 1967 and 1977, twenty-five percent of land in Madison county was sold to people from out-of-state, mirroring a pattern across western North Carolina. Most of the in-migration has been fueled by retiree and seasonal second home owners. Agriculture has continued to decrease as land values and taxes have increased, forcing natives to seek public work or other jobs in the cities (Algeo 1998). Most farmers in the southern Appalachia of today are part-time farmers who grow either Christmas trees, landscape shrubbery, or tobacco. With the recent tobacco buyout, tobacco farming may decline in the near future. Southern Appalachian farms have become increasingly less diverse in crop species.

Through all of the changes that have characterized southern Appalachian horticulture, the home garden is an institution that has not been completely lost. Each spring thousands of southern Appalachian gardeners plant vegetable gardens that help them provide for their families' food needs. Although home gardening is also an institution that is in decline in southern Appalachia (Brown, personal communication, February 1, 2005; Schuford personal communication, Januaruy 24, 2005; McCoury, personal communication, January 24, 2005), the home garden remains the principal place where a diversity of traditional southern Appalachian heirloom vegetable varieties can be found. The home gardens of southern Appalachia are modern links to the whole horticultural history of the region.

Structure of This Thesis

The second chapter is a review of relevant literature pertaining to this study. The third chapter describes the research methods used and the limitations to this study. The

fourth chapter documents the origin, domestication and diffusion of the southern Appalachian crop diversity in western North Carolina. The fifth chapter documents the results of the nineteen interviews that I conducted. It contains an analysis of results, a discussion of southern Appalachian heirloom vegetable variety classification, and variety descriptions for traditional heirloom crops that are still being grown in western North Carolina. The sixth and final chapter is the conclusion, which provides a summary and proposes a strategy for the conservation of crop biodiversity in western North Carolina.

Chapter Two: Review of the Literature

This chapter will review the literature pertaining to three areas of inquiry important to this thesis. In the first section, the problem and the causes of the global loss of biodiversity will be reviewed. Five main causes will be examined including: the replacement of traditional heirloom varieties with modern hybrids; a decrease in the number of seed companies; loss of farmland; the decline of the farming population; and the erosion of genetic resources in gene banks. The second section will review which of these main causes are behind the loss of crop biodiversity in southern Appalachia. In the third section of this chapter, strategies for the sustainable conservation of crop biodiversity will be reviewed. Strategies reviewed include: *ex situ* conservation; *in situ* conservation; participatory plant breeding; and informal research and development.

Global Loss of Crop Biodiversity: The Problem and Its Causes

The loss of genetic diversity in the world's food crops is a problem that warrants serious attention from plant genetic resource experts around the globe. Over the past century the world has been losing crop biodiversity at an astounding rate. For instance, it has been estimated that America has lost 97% of the vegetable varieties that were commercially available in this country in 1903 (Fowler and Mooney 1990). Statistics from around the world tell a similar story. In China, 10,000 wheat varieties were being grown in 1949; by the 1970's, the number of wheat varieties being grown had decreased to 1,000. Mexico has lost 80% of its traditional corn varieties since the 1970's (Tuxill

1999). In the Republic of Korea, 74% of varieties of 14 crops being grown on particular farms in 1985 had been replaced by 1993. India traditionally had 30,000 local varieties of rice in use, today they get 75% of their production from less than 10 varieties (Virchow 1999). Sri Lanka maintained 2,000 varieties of rice in 1959 and today they grow four. Wheat varieties in Greece have decreased from 60 in 1930 to four in 1970 (Rhoades 1994). All of the rice-area currently sown in China is planted in modern varieties. Worldwide it has been estimated that 75% of crop genetic diversity has been lost and 90% has become commercially unavailable since 1900 (McDonald 2001). This staggering loss of plant crop biodiversity is alarming for various reasons.

In addition to the potential for increased disease problems indicated by case studies such as that of the Irish potato famine, other potential hazards associated with a decrease in crop biodiversity include: a decrease in pest resistance, lack of resistance to environmental conditions, and a loss of potential material for plant breeders. Heirloom vegetable varieties (local, traditional varieties with typically high levels of genetic diversity that are adapted to specific biogeographic conditions) are known to carry genetic information that may not be present in a modern hybrid variety. When many different heirloom varieties are planted together using traditional farming practices, they provide a wide genetic base that may carry genes for resistance to diseases and insects, drought/wet conditions, or any number of other environmental factors which may affect the harvest (Stickland 1998). A single modern hybrid variety planted over thousands of acres is likely to have a much narrower genetic base than a field planted with a diversity of heirloom varieties. This narrow genetic base is what makes the crop more susceptible to epidemics.

The loss of potential genetic material for plant breeders is a consequence of crop biodiversity losses. It is estimated that half of the astounding grain yields that were achieved during the last century have come from improvements that plant breeders have made to crop varieties. Much of the genetic basis for the modern high-yielding crop varieties bred by professional plant breeders can be attributed to traditional heirloom varieties. Because a typical professionally-bred crop variety only has a lifespan of 5-10 years before it succumbs to some environmental calamity, plant breeders must return to heirlooms and their wild relatives for about 6% of the germplasm lines used in breeding new vegetable varieties (other material comes from previous professionally-bred lines that were in turn bred from heirloom material if you go far back enough into its genetic history). One of the many examples of the importance of heirloom varieties to modern professionally-bred varieties is that an heirloom variety from Turkey is a parent of many of the wheat varieties in the northwestern U.S., to which it provides genetic resistance to smuts, rusts, and other fungal diseases affecting wheat. The value of the genetic traits of crop biodiversity to global agriculture is measured in the billions of dollars (Tuxill 1999).

Traditional heirloom varieties still play a prominent role in feeding the people of the world. Small scale agriculture using heirlooms or locally adapted varieties of professionally-bred seed accounts for 15-20% of the world's food supply, providing sustenance for about 1.4 billion indigenous and peasant farmers (Tuxill 1999). It is clear that traditional heirloom varieties are essential for the survival of the world's food supply even as they are disappearing at a rapid rate.

The Replacement of Traditional Heirloom Varieties with Modern Hybrids

Many observers agree that the replacement of traditional heirloom varieties with modern professionally-bred hybrids is the biggest cause of the loss of crop biodiversity. Fowler and Mooney (1990) have stated that, "...clearly *the major force causing the loss of our agricultural heritage is the introduction of new varieties* produced by professional breeders." (p.75). Smale et al. (2004) put it even more succinctly: "We can think of the likelihood that farmers continue to grow landraces as the likelihood that they will not replace them with modern varieties" (p. 125). The motivating factors behind the replacement of heirloom varieties with modern varieties are varied. A main factor is that modern professionally-bred hybrid varieties produce higher yields and, therefore, provide better economic opportunity (Smale et al. 2004). This increase in yield is largely due to a breeding phenomenon called "hybrid vigor." When you take two different varieties of vegetables and cross-pollinate them, the first generation of your cross will typically create a larger, more vigorous, and better yielding variety than either parent. This particularly applies to insect or wind pollinated plants and not so much to self-pollinated ones (Deppe 2000). Farmers will often jump at the chance to increase their yields and profit margins by buying hybrid seeds, oftentimes discontinuing the use of heirloom varieties in the process. Field experience by Pundis (as cited in Virchow, 1999) has demonstrated that farmers will switch to a new crop variety if the yield gains are 15% more than the traditional variety that is being replaced. Case studies have also shown that the closer farmers are to a center of commercial activity, the more likely they are to grow modern varieties. Therefore, areas of high levels of heirloom crop diversity tend to be more geographically and commercially isolated (Small et al. 2004). Human population

density also has a strong impact on the strategy of adopting high-yielding modern hybrid varieties. In general, areas of high population density have transitioned into growing high yielding hybrids. For example, the adoption of modern rice varieties in the developing world has been most complete in densely populated rice-producing areas where traditional mechanisms for enhancing yields have been exhausted (Small et al. 2004). Population densities also interact with agro-ecological conditions in explaining the adoption of modern varieties. More favorable, irrigated agroecological regions are typically planted more uniformly in modern varieties; whereas more marginal ecological areas that have more heterogeneity in environmental variables such as soil type, slope, moisture regime, and associated flora are often planted with heirloom varieties that are adapted to local conditions (Small et al. 2004).

Decrease in the Number of Seed Companies

Interconnected with the replacement of traditional heirlooms with modern hybrid varieties is a decrease in the number of companies in the seed business. Having fewer seed companies in the market has had a negative impact on crop biodiversity, particularly in the developed world. In the U.S. during the past century there was a trend of increasing consolidation within the seed industry. Kent Whealy (1999) has documented that between 1984 and 1987, 54 out of 230 (23.5%) mail order seed companies in the U.S. and Canada either went out of business or were bought out by large transnational agrochemical corporations. This decline continued a trend that had followed on the heels of the advances in industrial agriculture's "green revolution" that had began in the 1950's (Miller 1997). When these typically small mail order companies were bought out, their more regionally adapted collections of seed were replaced with profitable hybrids and

patented varieties. Offsetting this trend has been the creation of more new mail order seed companies than were lost starting about 1990 (Whealy et al. 1999). A growing interest in traditional heirloom vegetable varieties has helped fuel the growth in the small specialized heirloom seed business. By 1998 there were 25 more mail order seed companies in the U.S. and Canada than in 1984. However, most of the vegetable varieties being offered by these companies are common varieties that are being offered by other companies in the study. Whealy found that only 10% of the companies were responsible for 56% of the "total unique varieties" being offered in 1998. This means that the gains in previously unavailable unique varieties of heirloom seeds offered by the current upswing in mail order seed companies is very fragile and could be wiped out by the loss of just a few of those companies (Whealy 1999). Despite this recent upturn following major losses in the number of mail-order seed companies, the overall consolidation of the seed industry has continued and is dominated by transnational agrochemical corporations. In the late 1990's, the top five vegetable seed companies controlled 75% of the global vegetable seed market. In North America, four companies controlled 69% of the maize seed market and at the end of 1998 a single company controlled 71% of the US cotton seed market (Crucible II Group 2000). Such consolidation in the hands of the huge transnational agrochemical corporations is detrimental to crop biodiversity. These corporations are almost exclusively selling modern hybrid seeds that are bred to be grown in a variety of different climates in conjunction with inputs of chemical fertilizers and pesticides. Increasingly, these seeds are not only hybrid, but genetically engineered as well. From 1997 to 1998, the world area planted in genetically engineered crops increased from eleven to 27.8 million

hectares, most of which (20.5 million hectares) were planted in the U.S. (Crucible II Group 2000). As these transnational corporations continue to corner the world market for seed and continue to focus on offering hybrid and genetically engineered varieties, the probability for a continued decline in crop biodiversity is high.

Loss of Farmland

Loss of farmland also contributes heavily to the loss of crop biodiversity. Farmland lost to soil erosion or other forms of environmental degradation is a leading cause of habitat destruction. Only a few countries have tried to actively assess the affects of soil degradation. For example, studies in Kazakstan have found that after reaching a peak area of 25 million hectares of grain sown in the 1980's, the area sown to grain began to decline and had shrunk to 18.6 million hectares by 1995. As marginal, degraded land continues to be abandoned, they expect that figure to continue to decline until stabilizing at 13 million hectares (Brown 1997). Natural disasters, war, and civil strife can also have a negative impact on farmland habitat and lead to the loss of crop biodiversity. Droughts, floods or other natural disasters can wipe out a whole crop population, which results in the loss of specific genetic resources. Violent conflict can contribute to farmland destruction through a variety of means and pressure farmers to abandon fieldwork, consume their seed stock for survival, and leave their seeds in the field behind as they move to safer areas (Virchow 1999). Modern industrialization and population growth can also contribute heavily to the loss of farmland. This cropland loss is particularly accelerated in areas that are already densely populated when industrialization gets under way. Brown (1997) has written about this trend in Asia:

> [These] economic forces have been at work in Japan, South Korea, and Taiwan, which have lost nearly half their grainland area since it peaked

> around 1960. As Asia industrializes, the construction of factories, roads, parking lots, and new cities is eating into the remaining productive cropland. In more affluent regions, land is also being claimed for shopping centers, tennis courts, golf courses, and private villas. In China's rapidly industrializing Guangdong Province, an estimated 40 golf courses have been built in the newly affluent Pearl River Delta region alone. In 1995, concern about the effect on food production of this wholesale loss of cropland led the Guandong Land Bureau to cancel the construction of all golf courses planned but not yet completed (p.21-22).

Decline of the Farming Population

A dramatic decrease in the size of the farming population has also led to the loss of crop biodiversity. This loss of farmers is more acute in the developed nations than it is in the developing world. The United States provides a marked example of this trend. In 1790, farmers made up 90% of the labor force. By 1820, approximately 2.1 of 2.9 million workers, 71.8%, were in farm related work. The percentage of U.S. workers laboring in farm occupations had declined drastically by the turn of the 19th century; by 1950 farmers made up 12.2% of the labor force, in the next decade the farm population had been reduced by almost half to 6.4 % by 1960, and by 1994 only 2.5% of all U.S. workers were employed in farm occupations (USDA Agriculture Economic Research Service 2004). The decline of the farm population in the U.S. closely followed the trend toward greater mechanization and modernization in agriculture. Statistics show that the loss of farmers and the loss of crop biodiversity in America follow a parallel path. It follows that as the U.S. has become increasingly reliant on big machinery, chemical inputs, and hybrid seed monocultures for its farming that it would need less farm laborers to supply work (which is now done largely by machines) and use fewer traditional heirloom vegetable varieties, resulting in diminished genetic diversity in the field. In the developing countries of the world, higher percentages of the population are still involved

in farming. They are also, as a whole, less dependent on modern industrial agricultural methods. It is, therefore, predictable that crop biodiversity would be higher in developing nations. The poverty of the rural population in the developing world encourages the maintenance of traditional varieties as modern agricultural inputs are generally too expensive to acquire. The poor rural people of the developing world are also often situated in marginal areas such as drylands or mountains where modern varieties are not competitive and a diversity of local heirloom varieties have been bred to adapt to challenging environmental niches and microclimates (Virchow 1999).

Erosion of Genetic Resources in Gene Banks

Erosion of crop biodiversity is also occurring in the collected material in gene banks around the world. Factors contributing to this erosion include: mismanagement, lack of financial resources, untrained staff, and deteriorating facilities. For example, at the national genebank located in Fort Collins, Colorado, 50% of the conserved varieties are not viable and only 28% are still healthy enough to be used in the future. In India it was discovered that 5,311 accessions of rice varieties collected in the 1960's had deteriorated or had been lost. The collection could only be restored because it had been duplicated and sent to the International Rice Research Institute (Virchow 1999). These examples show that even if endangered varieties are stored *ex situ* in genebanks their conservation is still at high risk.

Plant genetic resources for agriculture around the world are decreasing at an alarming rate. The replacement of traditional heirloom varieties with modern professionally-bred varieties, a decrease in the number of companies in the seed business, the loss of farmland, decline of the farming population, and the erosion of genetic

resources in gene banks are all major trends affecting the loss of crop biodiversity. Until strategies for reversing these trends begin to achieve their objectives on a large scale it can be assumed that the global loss of crop biodiversity will continue. Given the important, underlying and essential role that crop biodiversity has in the success of world agriculture it is difficult to foresee any achievable plan for sustainable development that does not include the conservation of crop biodiversity as one of its more essential objectives. Later in this chapter, I will review various strategies for crop biodiversity conservation.

Loss of Crop Biodiversity in Southern Appalachia

Several of the causes listed underlying the worldwide decrease of crop biodiversity are present in southern Appalachia. The most prominent causes of crop biodiversity loss in the region are the replacement of traditional heirloom varieties with modern professionally-bred hybrids, the loss of the farming population, and loss of farmland (all causes associated with the spread of industrialization). The decrease in the number of seed companies and the erosion of genetic resources in gene banks are global patterns that probably have little to do with the loss of crop diversity in southern Appalachia directly, but may assert a more indirect influence. A gene bank has never been located in southern Appalachia and it is unlikely that a lot of seed collecting has been done in the region by plant collectors. Although some southern Appalachian traditional heirloom crops may exist in the national gene bank system, it is beyond the scope of this study to search their accessions.

With increased modernization in southern Appalachia after World War II, the region has had increased exposure to modern vegetable varieties through the spread of

commercial feed and seed stores, home and garden centers, and commercial seed catalogs. This has resulted in a situation today where residents in western North Carolina are more likely to get their vegetable seed from Lowe's hardware or Wal-Mart than they are from their parents, friends, or neighbors. I experienced this phenomenon as I was making contacts to interview for this study. Most people I talked to, though I had targeted them as likely sources for information about heirloom crops, told me that they no longer saved the seeds of their forbearers but either purchased their seeds at a local store or ordered them from seed catalogs. This has created a situation where it is likely that there are only one or two (if any) seed savers left in a community. Lucille Shuford (personal communication, January 24, 2005) told me that people in her community always saved their seed until a farmer's hardware store opened in Burnsville from where they began to get seed. Today Mrs. Shuford orders all of her seed from seed catalogs such as Park Seed. Stories such as this point to the likelihood that a proliferation of seed catalogs available in western North Carolina was actually detrimental to crop diversity, instead of being indicative of a high level of crop diversity as described above. In isolated areas such as western North Carolina that depended very heavily on heirloom seeds that were handed down from generation to generation, it must have been true that the availability of non-local seeds (whether heirloom or hybrid) had a detrimental effect on the continuance of local varieties. In other areas of the U.S. that had already become dependent on commercial seed by the 20th century, it would remain true that a decrease in the diversity of regional seed catalogs would indicate a loss in crop biodiversity. Since southern Appalachia is an area of the country that has not historically had very many regional seed

catalogs to begin with, a loss of these catalogs would not have had much effect on the loss of southern Appalachia's traditional heirloom varieties.

The loss of the farming population has also had a detrimental effect on southern Appalachia's crop biodiversity. In 1930, slightly above one-third (35.9%) of the gainfully employed population was employed in agriculture. In addition, 42.6% of the population lived on farms (Bureau of Agricultural Economics et al. 1935). By 1970, only about 3.3% of the population in southern Appalachia was employed in agriculture, forestry, and fisheries combined (Appalachian Regional Commission 1977) and, as noted previously, between 1969 and 1974, 17,000 (26%) of the region's farmers left farming occupations (Appalachian Land Ownership Task Force 1981). In 1989, only 0.24% of the population in Appalachia (including central and northern Appalachia) listed farming as their primary economic activity and that percentage stayed constant through 1999 (Black and Sanders 2004). As the number of farms and farmers in southern Appalachia dramatically decreased during the past century, a significant amount of the region's crop biodiversity must have been lost. Since less than one percent of the population in southern Appalachia still lists farming as their primary activity, the region's remaining crop biodiversity is not likely to exist on full-time commercial farms. The survival of crop biodiversity in southern Appalachia relies upon the contributions of some part-time farmers and, for the most part, the home gardens of the region's farmers, an observation that I have documented in this study. However, untold numbers of traditional heirloom vegetable varieties have been lost as people have left a farming-based lifestyle.

The loss of farmland through habitat destruction or economic factors has also contributed to the loss of crop biodiversity in southern Appalachia. Between 1969 and

1974, 205,056 acres of land (22.2%) in western North Carolina went out of agricultural production, and 3,680 (31.3%) farms were removed from agricultural use (Appalachian Land Ownership Task Force 1983). There are several reasons why so much farmland has gone out of production in southern Appalachia. Recreational development, federal ownership of land, urbanization, and rapid population growth are all contributing factors. Prime agricultural land in southern Appalachia is in short supply because of the region's mountainous environment and much of the land that is suited for agriculture is being used for shopping centers, roads, and subdivisions (Appalachian Land Ownership Task Force 1981). At the beginning of the new millennium, development in southern Appalachia is still on the increase and threatens to wipe out all but a few of the region's farms, taking any crop biodiversity that was still being utilized on those farms along with it.

Exploring Strategies for the Sustainable Conservation of Crop Biodiversity

It has been observed that while the collection of vegetable germplasm has been undertaken at the national level through the national germplasm system, and at the regional level through grassroots groups in the midwest, southwest, and west coast; the American South has been notably absent in the grassroots networks dedicated to preserving local heirlooms and landraces (Southern Seed Legacy 2004). The Southern Seed Legacy was established at The University of Georgia in the mid-1990's to address the problem of the disappearing vegetable heritage of the American South. Appalachia is one of the nine agroecological regions identified as being a target area of the project. However, the Southern Seed Legacy project covers a very large area, from Texas to Florida, and north to Virginia (Southern Seed Legacy 2004). This large range may make it difficult for the project to cover many of its identified agroecological regions

comprehensibly. Because southern Appalachia is probably a region with high levels of biodiversity, I review strategies for undertaking sustainable conservation of crop biodiversity within the region, including *in situ* and *ex situ* methods, participatory plant breeding, and informal research and development strategies. In the concluding chapter of this thesis, I propose a comprehensive approach for the conservation of crop biodiversity in southern Appalachia using the most desirable combination of strategies.

Ex Situ Conservation

Ex situ conservation involves the conservation of genetic resources of plants away from their area of origin or development (IPGRI 2004). Strategies for *ex situ* conservation can usually be grouped into three categories (Virchow 1999). The first is conservation in gene banks that store crops that can be stored as seeds. They are dried to a low moisture content and stored at low temperatures over long periods of time. The second strategy is field gene banks for food crops which cannot be conserved as seeds. The plants are managed in fields (e.g. botanical gardens) as living collections with short to medium term conservation. The third approach is in vitro conservation in which vegetatively-propagated species (e.g. potatoes) and species with recalcitrant (difficult to conserve) seeds are stored as sterile plant tissue, plantlets under slow growth conditions on nutrient gels for short or medium-term conservation, or in liquid nitrogen (cryopreservation) for the long-term conservation (Virchow 1999). The first two strategies allow for distribution to interested parties whereas in vitro storage does not (Holden and Williams, ed. 1984). *Ex situ* was the preferred method of crop biodiversity conservation throughout the twentieth century. The importance of conserving crop biodiversity was fully appreciated by the international community toward the end of the

century. Globally, there were only five adequate gene banks in 1976. By 1983 that number had increased to forty-eight gene banks that met international standards for long-term conservation (Holden and Williams, ed. 1984). *Ex situ* conservation methods have the advantage of being able to conserve very high amounts of crop biodiversity in one location for long periods of time. This was very useful during a century in which most of the crop biodiversity in America was lost and global losses had also accelerated. However, there are several drawbacks to *ex situ* conservation methods. Gene banks may experience a loss of genetic diversity due to insufficient and inappropriate regeneration of seeds, poor seed maintenance, and the aging of seed storage facilities (Virchow 1999). A major drawback is that *ex situ* conservation effectively "freezes" a variety, taking it out of the continuous process of evolution and adaptation that occurs in agroecosystems (Virchow 1999). *Ex situ* conservation sites also have the drawback of being very expensive to maintain (Southern Seed Legacy 2004) and require large expenditures of energy to keep them running. These major limitations, in combination with other factors, led to a paradigm shift in plant genetic conservation articulated by the Global Action Plan of the Food and Agriculture Organization (FAO) in 1996 away from *ex situ* conservation toward *in situ* (on site) methods of maintenance. As a result, any expansion of the global gene bank system seems unlikely today (Hammer 2003).

In Situ Conservation

In situ conservation is the maintenance of agricultural species in the habitats in which they occur. For agricultural crops, these habitats are primarily the fields of farmers where cultivated crops developed their present day properties (IDRC 2004). The concept of on-farm management seeks to enable the processes and ecological conditions which

were responsible for creating the existing genetic variability of heirloom varieties to continue to influence genetic development (Virchow 1999). In this section I will briefly look at four different strategies for conserving crop biodiversity *in situ*: community management, farmer-scientist collaborations, home gardens, and community supported agriculture (CSA).

Community management strategies of *in situ* genetic conservation are numerous. Out of a variety of possibilities, I will look at two that seem the most applicable to southern Appalachia. Community seed banks are one approach. They are often considered to be local *ex situ* forms, but since they are likely to be highly interactive with the fields of the farmers in the community, it would follow that they are much closer to *in situ* strategies than more centralized national gene banks, botanical gardens, or other such *ex situ* projects. Community gene banks can be advantageous because they can provide farmers with more direct access to locally adapted seed than national gene banks can. The limitations to community gene banks include the following: they are typically small in size and can only hold a limited number of accessions and replicates; local crop yields that result in community farmers facing similar seed deficits and surpluses simultaneously; and instances where seeds may be of low quality or may be hoarded by individuals (Smale et al. 2004).

A community biodiversity register is another community management strategy. A community biodiversity register is a record of heirloom varieties being maintained by local farmers. The register may include data about the agronomic and morphological characteristics of heirlooms, special uses, and adaptations to local environmental conditions. Registers can solve the problem of locating and attempting to exchange

materials over long distances but do not solve the problem of scarcity of seed relative to demand (Smale et al. 2004).

Farmer-scientist collaborations are another approach to *in situ* management of landrace varieties. These collaborations can occur in a variety of different forms involving farmers collaborating with university researchers, gene bank scientists, government agencies, NGO's, or non-profit organizations. Historically, links between researchers involved in *ex situ* conservation and farmers have been mainly limited to the one-way traffic of crop germplasm samples from farmer's fields to the *ex situ* collections. This has been recognized by some as a less than optimal utilization of conservation methods that does not facilitate developing *in situ* strategies (Virchow 1999). An interdisciplinary, intersectoral and innovative approach is being utilized by the Southern Seed Legacy (2004). Their website describes the approach they have taken:

> Through a broad-based collaborative effort, the Southern Seed Legacy will strive to reverse the erosion of genetic variation and cultural knowledge by encouraging and supporting local seed saving and exchange networks and *in situ* conservation of plant genetic resources... This project will bring together a wide range of scientific disciplines and user groups to collect, preserve, and multiply the heirloom materials and to record the cultural information which is embedded in the heirlooms themselves. Thus, farmers, gardeners, orchard owners, and community action groups will be joined by a team of ethnobotanists, plant geneticists, horticulturalists, private business, and government officials in a concerted effort to preserve both cultural and genetic diversity.

This type of collaborative effort involving a diversity of participants from both the public and private sector is a good example of farmer-researcher collaboration and is a promising strategy of cooperative *in situ* management of crop biodiversity.

Home gardens are living gene banks where indigenous germplasm in the form of heirloom varieties, obsolete cultivars, and rare species are preserved and thrive side by

side. They are, therefore, a critical conservation resource for *in situ* strategies. Home gardens are productive conservation sites in both developed and developing nations (Maxted et al. 1997). Home garden repositories may prove to be a particularly valuable conservation resource in southern Appalachia. The home garden is a tradition that has not died out in the region and is likely to be the location of the highest level of heirloom vegetable diversity. Since farming is no longer a viable vocation in western North Carolina (0.24% of the population) and throughout much of southern Appalachia, it is unlikely that high levels of crop biodiversity will be found in farmer's fields. Despite the decline of farming as an occupation, the strong agricultural roots, love of good food, and cultural conservatism of southern Appalachia continue to encourage people to maintain family heirloom vegetable varieties in their home gardens (Best, personal communication, April 3, 2005).

A final *in situ* conservation strategy is not commonly mentioned in the literature. It is called community supported agriculture (CSA) and is properly categorized as a farming strategy, but also has great potential for *in situ* genetic conservation. The University of Massachusetts Extension (2004) gives a good description of CSA:

> CSA is a partnership of mutual commitment between a farm and a community of supporters which provides a direct link between the production and consumption of food. Supporters cover a farm's yearly operating budget by purchasing a share of the season's harvest. CSA members make a commitment to support the farm throughout the season, and assume the costs, risks and bounty of growing food along with the farmer or grower. Members help pay for seeds, fertilizer, water, equipment maintenance, labor, etc. In return, the farm provides, to the best of its ability, a healthy supply of seasonal fresh produce throughout the growing season. Becoming a member creates a responsible relationship between people and the food they eat, the land on which it is grown and those who grow it.

CSA farms typically give members a basket of a variety of vegetables once a week throughout the growing season. Since CSA farms aren't focused on producing a large crop of one vegetable variety to be harvested all at once and shipped off to market, they are by nature a more diversified operation than most modern farms. Heirloom vegetable varieties provide the benefit of having a wide range of tastes, colors, shapes, and sizes that may appeal to CSA members. They also typically ripen over longer periods of time than modern hybrids that are bred to ripen uniformly to make them mechanically harvestable and marketable in mass quantities. These characteristics make heirlooms an appealing choice for some CSA farmers. A trend of increasing numbers of CSA farms has been gaining momentum across Japan, Europe and the U.S. There are multiple CSA farms in western North Carolina that are currently growing heirloom vegetable varieties for their members, including Green Toe Ground in Celo, and Homegrown Heritage in Candler (Appalachian Sustainable Agriculture Project 2005).

In summary, there are several advantages and disadvantages to *in situ* genetic conservation strategies. The advantages include (but are not limited to): enabling the process of natural and artificial selection to continue in an agroecological context; facilitating research on species in their natural habitats; potentially conserving a large range of alleles; protecting associated species that possibly contribute to the functioning of ecosystems; favoring desirable crops not receiving attention from the formal sector; and contributing to agricultural development and improvement of farmers' livelihoods (Virchow 1999). Some disadvantages of the *in situ* method may include: loss of allelic diversity if the population and area of a variety to be conserved is limited; the reality that *in situ* conservation projects have a time horizon of at least 50 to 100 years (Virchow

1999); and the challenge of undertaking locally-based conservation of cultivated crops without a return to or preservation of traditional cultural systems and farming practices (Maxted et al. 1997). It has also been noted that because *in situ* strategies are a relatively new paradigm within the agrobiodiversity conservation community, they are in need of further testing and evaluation to assess their success in conserving the diversity of crop genetic resources (Hammer 2003).

Participatory Plant Breeding and Informal Research and Development (IRD)

Although no scholarly consensus exists, theories about the origin of agriculture generally place it sometime between 10,000 and 15,000 years ago, occurring through the efforts of hundreds of thousands of people on different continents. The early agriculturists faced a wide range of social and ecological conditions. Over hundreds and sometimes thousands of years farmers have selected for certain traits that they desire in their crops including: taste, increased harvest, tolerance to diseases and pests, color and shape, cold or drought tolerance, and a variety of other cultural and environmental adaptations (Fowler and Mooney 1990). At different times throughout history farmers have also realized that they could intentionally influence the reproductive processes of plants through breeding. Modern day plant breeders are the current recipients and developers of this long tradition. Selection and plant breeding are the processes by which we arrived at the vast diversity of food crops that exist in the world today. They are also methods that can allow us to continue to develop diversity just as our agricultural ancestors did for thousands of years and plant breeders continue to do today.

Participatory plant breeding methods are an *in situ* strategy that can be used to enhance crop diversity. Modern plant breeding has generally involved professional plant

breeders working for companies or government agencies to develop crop varieties. The companies or agencies then market or introduce them to farmers. However, it is often the case that farmers' criteria for selection or breeding are very different than those used by researchers (Maxted et al. 1997). Using participatory methods can help plant breeders and farmers to work together to identify desirable and undesirable traits of their heirloom materials and develop a strategy for improving selection in local materials, or to transfer a preferred trait from exotic plant material (Smale et al. 2004). Of course, these methods may involve a shift in the gene pool, but breeding strategies can be adopted to maximize genetic diversity while still allowing for productive change (Maxted et al. 1997). Diversity can be enhanced using this method by improving the productivity or other desirable traits of the heirloom variety, thereby creating incentives for the farmer to continue to grow local varieties under economic or ecological pressures (IDRC 2004).

Another strategy which combines the orthodox approach of professional breeders releasing seed to farmers as a finished product, and the methods of participatory plant breeding, is called informal research and development. Smale et al. (2004) describe this strategy as it has been applied in Nepal:

> In Nepal, informal research and development (IRD) has been used to test, select, and multiply seeds (Joshi and Sthapit 1990). A small quantity of seed of recently released and/or nearly finished varieties is distributed to a few farmers in a community to grow under their own conditions with their own practices. First practiced by Lumle Agricultural Research Centre (LARC), this approach has now been adopted by other organizations in Nepal and India for variety testing and dissemination (Joshi et al., 1997). Such approaches incur no substantive additional costs but speed up the time to use varieties since they shortcut release procedure.

It is likely that IRD methods can enhance diversity since farmers receiving seed in the program will exert their own selection pressures according to economic and environmental needs (Smale et al. 2004).

There are also potential disadvantages to these strategies. One disadvantage is that these methods can require substantial time investments from farmers that can take away from other activities. It is also difficult to document the amount of farmer empowerment and public benefit that result from the project. Another disadvantage is that releasing well-adapted varieties or preferred traits from exotic varieties developed with or without the help of farmers may cause a decline in the diversity of genetic resources unless proper precautionary methods of maintaining diversity are applied (Smale et al. 2004). More research probably needs to be done to determine how well participatory plant breeding and IRD strategies work toward the conservation of crop biodiversity.

In the next chapter I will review the methods that I used to research the history and survival of western North Carolina's crop biodiversity.

Chapter Three: Methodology

Field data for this research were collected in order to record and analyze the history and current state of heirloom vegetable crops across the Appalachian region of western North Carolina. The results section of this study is based on interviews with farmers that I conducted. I conducted ten full-length, formal interviews with seventeen individuals (including some interviews conducted with more than one family member) based on the interview questions listed in Appendix A. Full-length interviews were requested when I determined (through phone contact) that the individual to be interviewed was maintaining a significant number of heirloom vegetable varieties, was maintaining particularly unique varieties, or had exceptional knowledge about the history of seed saving in the region. Shorter phone interviews were conducted with nine other individuals who were maintaining only a few varieties or had smaller amounts of information to contribute. The interviews contained questions about the cultural history of each vegetable variety within the farmer's family or community, the biophysical conditions in which the varieties are typically grown, the methods each farmer uses in growing each variety, pest and disease susceptibility and tolerance, and storage and eating qualities (see Appendix A). Areas for interviews were selected based on criteria determining them to be rich in crop biodiversity. Criteria included factors such as: a large population of farmers or gardeners, a significant number of older farmers, and rural character.

I used a snowball sampling method based on contacts that I made in the area to identify individuals to interview. Bernard (2002) defines snowball sampling as follows: "In snowball sampling, you locate one or more key individuals and ask them to name others who would be likely candidates for your research" (p. 185). Since I had already been gardening in western North Carolina using heirloom vegetable varieties for over six years, I first contacted individuals who I already knew to be maintaining heirloom varieties. I also contacted selected county agricultural extension agents to see if they knew of any heirloom growers. Finally, I consulted members of my thesis committee and other individuals at Appalachian State University to see if they knew of any useful contacts. After making my initial contacts with the three categories of individuals listed above, I was then led to other potential interviewees as their suggestions began to "snowball." The snowball sampling method was very effective, as in the end, due to time and funding limitations, I was not able to interview everyone who was suggested to me as a knowledgeable source of information. Detailed histories of every heirloom vegetable variety described in the interviews (along with some varieties that I had collected and have been growing myself prior to this research project) are recorded in Chapter Five so that the history and existence of the varieties are documented and future research in this area of study will be enriched. The variety descriptions contain both cultural and biological information about the vegetables and their history.

Virginia Nazarea (1998) has argued that the "gene bank" strategy of collecting, maintaining, documenting, and evaluating samples of traditional crop germplasm is an incomplete method. She promotes a complimentary "memory banking" system that documents the indigenous practices of local farmers associated with traditional crop

varieties. Without memory banking, Nazarea says, "...the genetic information preserved in gene banks will be decontextualized in the sense that the cultural and ecological forces that shaped their selection will be largely ignored" (Nazarea 1998, p. 5-6). This decontextualization can lead to a situation where accessions in gene banks are underutilized because researchers have very little cultural information about how the varieties are actually grown, in effect creating a "library without readers" (Nazarea 1998). Nazarea sees a parallel relationship between gene banks and memory banks where gene banks contain "germplasm [which] encodes genetic information that has evolved through time as a response to selection pressures" and memory banks record "cultural data in the minds of local farmers who have had considerable experience in growing these crops [and] are repositories of coded, time tested adaptations to the environment." (1998, p.6). I memory banked the interviews that I have recorded while researching this thesis in my own private bank, backed them up at the W.L. Eury Appalachian Collection in the Belk Library at Appalachian State University, and donated copies to the memory banking project of the Southern Seed Legacy at The University of Georgia. All seed samples that I have collected in this study will be filed in my personal seed bank, duplicated where needed, and donated to the Southern Seed Legacy. It will thus be insured that the traditional vegetable varieties and their histories collected in this research will be preserved for the use of future generations and can be utilized in the creation of a western North Carolina seed preservation project in the future (see Chapter Six).

Library research was conducted at the Belk Library at Appalachian State University, the W.L. Eury Appalachian Collection located in the Belk library, and

through interlibrary loan. I also located articles through *Ingenta* and *Jstor*, two online data bases of scholarly journals, and through internet searches.

Limitations to This Study

As is commonly the case, this project was limited by both time constraints and funding resources. To comprehensively document and preserve a majority of western North Carolina's remaining heirloom vegetable varieties would take a research effort spanning several years, involving more than one researcher, and having a significant amount of funding. My strategy was to locate, for documentation and preservation, as many varieties as possible within a period of about six months. The snowball sampling method was very effective for this and kept me busy with interviews during the whole six months. My focus was on the quantity of varieties I could locate, trying to document the highest quality variety descriptions that I could within the limited time frame. However, I decided not to do second interviews with individuals in the interest of spending my remaining time interviewing other growers. Had I decided to do follow-up interviews, I could have perhaps provided more complete variety descriptions, but would have almost certainly documented fewer total varieties. A longer project with more researchers could most likely produce more optimal results in both quantity and quality. Another prospect for better research results occurred to me late in my project. In addition to contacting individuals who I knew, I contacted selected county cooperative extension agents in my research, which did not yield any significant results. However, it was suggested that individuals who go to community senior centers might be maintaining heirloom vegetable varieties or know of family or community members who are. In future

research in this area, I think it would be worthwhile to distribute surveys to senior centers all over western North Carolina.

I also found limitations inherent in the memory banking method during the course of my research. In Third World countries such as Africa, farmers still maintain detailed agroecological knowledge about factors such as soil conditions, plant morphology, and crop associations (Sperling 1992). In First World countries, farmers have often lost traditional agroecological knowledge due to the spread of modern farming practices. The control of nutrients, pests, and diseases through the application of fertilizers and pesticides has almost completely replaced traditional knowledge as the means for successful farming in the First World. Therefore, when trying to access the agroecological knowledge of local farmers, I often found that the "memory bank" was largely empty. This was not true of all farmers but did apply to the majority. In a more comprehensive study, an attempt could be made to recreate agroecological knowledge through detailed soil mapping of grower plots and the recording of other factors such as microclimate information and site aspect and altitude. Had my interviews taken place during the summer growing season, I could have probably gleaned more agroecological knowledge than I was able to (my interviews took place during the winter and early spring). However, in my final analysis, I think that memory banking was still an effective research method. I have been able to document cultural information about each variety that was previously unrecorded, in addition to limited amounts of agroecological and culinary knowledge about the varieties. What I have documented contains far more information than is usually recorded on passport data in gene banks and also compares favorably to the amount of information typically included in the variety descriptions of

successful North American seed conservation organizations such as the Seed Savers Exchange or Native Seeds/Search. It seems that the memory banking method would achieve its optimum utility in Third World settings, but is also an effective method of conserving what is left of the cultural and agroecological knowledge about heirloom varieties in the First World.

The reliance of First World farmers on modern technology, and in particular the adoption of modern methods by southern Appalachian farmers since 1950, also provides a further limitation to this study. Most of the farmers who I gathered heirloom varieties from in western North Carolina rely on modern fertilizers and pesticides to grow their crops. This creates a situation where environmental variables are controlled by external inputs instead of being mitigated by natural selection and adaptation. Therefore, it is likely that many of the heirloom varieties I collected have less regional adaptation than they would if they had been grown with traditional low-input farming practices. However, even though most of the growers I collected seed from do use modern methods, the extent to which they use them and the products that they use vary widely. This makes it likely that there is still genetic adaptation to local conditions taking place within the varieties, but the adaptation is uneven and unpredictable. In addition, the genetic diversity of varieties that have adapted to local conditions over hundreds or even thousands of years and are still being grown *in situ* (albeit with modern methods) is not likely to have been completely lost in the last few decades.

In the next chapter of this work, I will trace the history of western North Carolina's heirloom vegetable varieties by examining the origin, domestication, and diffusion of southern Appalachian crop biodiversity.

Chapter Four: The Origin, Domestication, and Diffusion of Southern Appalachian Crop Biodiversity in Western North Carolina

Southern Appalachia is a region that has been traditionally rich in crop biodiversity. This chapter will examine the origin and dispersal of several of the major crop species that occur in the western North Carolina region of southern Appalachia: maize (*Zea mays*), common beans (*Phaseolus vulgaris*), tomatoes (*Lycopersicon esculentum*), squash (*Cucurbita spp.*), potatoes (*Solanum tuberosum*), brassicas (*Brassica spp.*), and peppers (*Capsicum spp.*).

Each of these seven crop species is currently being grown in western North Carolina and has been grown in the region since historical and (for some) pre-historical times. Research regarding the diversity of southern Appalachian crop species is sparse, so it is hoped that this chapter will contribute to a further understanding of the history of crop biodiversity in the region.

Maize

Maize is thought to have been domesticated around 5000 B.C. in Tehuacan in central Mexico (Eubanks 2001). The Tehuacan area is characterized by marginal mountainous terrain that borders the tropics and has long been populated by agricultural people who were isolated by arid regions, steep terrain, or other natural barriers. Wilkes provides a good summary of the theories regarding the domestication of maize:

> The various theories for the origin of maize run the gamut from simple selection from teosinte (in which case maize would be a domesticated teosinte) to complex hybrid formation between now extinct grasses. All of these theories fit into one of the three evolutionary patterns: (a) direct evolution by domestication from a wild ancestor, whether teosinte, wild maize, or a 'wild grass'; (b) hybrid origin from two dissimilar parents; and (c) origin from a wild ancestor with repeated hybridization from its closest wild relative, teosinte. Theories about the exact role of teosinte in the origin of maize vary depending on how the evidence is interpreted, but most investigators agree that any theory about the origin of maize must, at least, also account for teosinte (Wilkes 1989, p. 449).

Upon domestication, it is likely that maize underwent a genetic bottleneck that reduced the genetic diversity of the species (Brush 2004). This bottleneck would occur because early farmers were likely to only use a small portion of the biological diversity of a species that provided traits (e.g. bigger kernels) that they considered desirable. Most likely it was only a few individual variants of maize that were unique enough to catch the attention of early horticulturists. Therefore, the total genetic diversity of the species was not included in the population that became domesticated. Farmer selection would provide an effective constraint against a wide potential gene flow from wild species, and isolation from ancestral species and maintenance in the artificial environment of a field or garden may have also restricted diversity by reducing selection to a few, anthropocentric criteria (Brush 2004). After the bottleneck of domestication, crop species tend to increase in diversity. Rindos (as cited in Brush, 2004) gives four sources of increased diversity after crop domestication: (1) gradual accumulation of favorable variants, (2) migration into new habitats with distinct selection pressures, (3) growth of the human population, and (4) cultural change.

Maize and other crops historically common to southern Appalachia may have undergone a second bottleneck effect as they diffused outward from their centers of

domestication. Migrants were likely to have only taken a small sample of the diversity found in the original crop populations. Examples of this phenomenon exist throughout history (Brush 2004). Maize left its cradle of domestication and traveled northward into what is now the southwestern United States by around 1000 B.C. By 800 A.D., maize had become an important cultigen in the eastern U.S. (Garbarino and Sasso 1994) and probably arrived in southern Appalachia around that time among the ancestors of the Cherokees and other southern Appalachian tribal groups. The diffusion of maize out of central Mexico and eventual arrival in southern Appalachia almost certainly resulted in a founder effect. The founder effect occurs when a sample of seeds contains a smaller number of alleles that are present in the larger founding population. The resulting changes in allele frequencies is known as the founder effect (Silvertown and Charlesworth 2001). So it is highly probable that maize diversity in southern Appalachia around 800 A.D. was much lower and different than that of central Mexico during the same time period and of southern Appalachia during the subsequent centuries, when diversity would again increase due to the four factors listed above by Rindos. This diversity was passed on through the generations of Cherokee and other southern Appalachian natives. "Cherokee White Flour" and "Cherokee Princess" are two examples of native varieties of southern Appalachian corn that are still in use today. When European settlers first arrived in southern Appalachia during the early 1700's, they likely received some of their original corn varieties from the natives who lived in the area. They also must have brought some varieties from outside the region in their migration south or west. The combination of a thousand years of selection and variation based on environmental niche exploitation by the American Indians of southern Appalachia,

together with the newly added cultural and selective pressures of European immigrants, combined to create a temporary breeding ground for the diversity of maize to flourish. As the natives of the region began to decline in power and numbers by the late 18th century (Beaver 1984), it was increasingly the task of European-descended southern Appalachian peoples to maintain the biological diversity of maize.

Beans

Common new world beans, *Phaseolus vulgaris*, were domesticated separately in Mesoamerica and South America (Sauer 1993). The wild bean population that provided the genetic material for the domesticated *P. vulgaris* in Mexico is called *P. vulgaris* var. *mexicanus*. The wild parent for *P. vulgaris* in South America is thought to be *P. vulgaris* subsp. *aborigineus*. So far, the archaeological record has not provided evidence of a link in domestication between *P. vulgaris* and its wild progenitors, as all the seeds recovered in archeological research are much larger than those found in the wild. *P. vulgaris* has been found in Tehuacan caves in Mesoamerica and dated at 5,000-3,500 B.C.; seeds found in northern Peruvian caves were dated at about 5500 B.C. (Sauer 1993).

About 75% of the *P. vulgaris* cultivars grown in eastern North America today are derived from South America and 25% are derived from Mexico (Sauer 1993). *P. vulgaris* spread into the maize-growing cultures of the American Southwest about 300 B.C. and only became abundant after 1000 A.D. In eastern North America, beans were not grown until 1000 A.D. and became abundant after 1200 A.D. However, before Europeans came to North America, beans had joined maize as one of the native population's staple crops (Sauer 1993). The Cherokee (and probably other mountain native cultures as well) are known to have grown a diversity of bean varieties (Hamel and

Chiltoskey 1975). Cherokee bean diversity is evidenced today by the large number of beans that bear their name, such as the "Cherokee Trail Of Tears", "Cherokee October", and "Cherokee Cornfield" beans (Seed Savers 2003). Native southern Appalachian bean diversity was supplemented by a wide variety of beans that arrived via Europe beginning in the 1800's (Gray 1999). The resulting high level of genetic diversity in the southern Appalachian bean population has been noted by some as being among the highest in the world (Best 1999).

Tomatoes

Tomatoes (*Lycopersicon esculentum*) are perhaps second only to beans in diversity among heirloom vegetable varieties currently being maintained in southern Appalachia. The relative commonality of both old-timey bean and tomato cultivars is more than likely due to the fact that they are both self-pollinated and remain genetically pure. Their seeds are, therefore, easy to save from year to year.

All ten species of *Lycopersicon* are native to a dry zone on the coast of western South America between Ecuador and Chili. However, tomatoes were never domesticated in South America. An endemic South American wild tomato (*L. pimpinellifolium*) is thought to have been diffused to Mexico as a weed or from bird dispersal and then domesticated there. Since there are no archaeological remains of tomato, it is difficult to know at what time domestication occurred and how early they were diffused into North America. It is known that the tomato was a diverse and fully domesticated native crop in Mexico before the Spanish conquest (Sauer 1993).

The first mention of tomatoes in the Carolinas was made by William Salmon in his 1710 book *Botanologia* (Sokolov 1991). However, they weren't grown as more than

a curiosity in eastern North America until the late 18th century (Sauer 1993). Thomas Jefferson was known to have grown tomatoes in his garden at Monticello, Virginia, in the early 1800's (Sokolov 1991). Monticello is not far from the southern Appalachian mountains of Virginia, so it is not hard to imagine that tomatoes would have reached the southern Appalachians sometime in the early 1800's. The current diversity of southern Appalachian tomato varieties indicates a history of at least 150 years for tomatoes in the region. Tomato varieties that are grown today in western North Carolina include "Cherokee Purple," "Clarence's Yellow Tomato," "Beefheart," "Boyd Smith German Yellow," "Stripey," "Heirloom Orange," "Granny Bradley," and "Little Red Pear," to name just a few.

Squash

Squash are divided into four major species: *Cucurbita pepo, C. maxima, C. mixta (C. argyrosperma),* and *C. moschata* (Ashworth 2002) and have three different possible centers of domestication, including North America (southern Texas), Mexico, and South America (Sauer 1993).

C. pepo are squash that have prickly leaves and stems, a hard stem with five sharply angular sides, and cream colored seeds with a white margin. The species includes small decorative gourds and almost all of the commonly grown summer squashes (Ashworth 2002). *C. pepo* is considered the oldest crop to have been domesticated in the Americas (Heiser 1989). Domestication of *C. pepo* is thought to have occurred separately in two different areas from two different closely related wild species. The earliest archaeological remains and site of domestication for *C. pepo* occur in Oaxaca, Mexico between 10,750 and 8000 B.C. from the wild species *C. fraterna*

(Sauer 1993; Heiser 1989). A second, independent site of domestication occurs in southern Texas (5500 B.C) from the wild species *C. texana*. However, it is thought that *C. texana* may have been distributed more widely during an earlier period because *C. pepo* has been found at a site in Illinois dated at 5000 B.C. (Heiser 1989).

C. maxima is a species of squash characterized by very long vines, huge hairy leaves, soft round stems, and thick seeds that are white, tan, or brown with cream-colored margins and thin cellophane coatings (Ashworth 2002). The earliest archaeological remains of *C. maxima* occur in Viru Valley, Peru and have been dated at about 1800 B.C. They are thought to have been domesticated from the wild squash species *C. andreana*. Prehistoric cultivars of *C. maxima* were diverse, including both summer (harvested when immature) and winter squashes. *C. maxima* are currently grown in all temperate areas of the world and include pumpkins that weigh up to 300 kg., which are the world's largest (Sauer 1993).

C. mixta (C. argyrosperma) has spreading vines, large hairy leaves, a hard hairy stem that flares out slightly where it attaches to the fruit, slightly greener leaves than those of *C. moschata*, and white or tan seeds that have a pale margin and cracks in the skin coat on the flat side of the seeds which are covered with a thin cellophane coating. Varieties of *C. mixta* include most Cushaw squashes and some gourds (Ashworth 2002). The wild progenitor of *C. mixta* is thought to be *C. sororia* (incl. *C. kellyana*), which is a bitter-fruited gourd native to the semi-arid riparian lowland regions of much of Mexico and Central America. Archeological remains in the Mexican Tehuacan caves suggest that selection of *C. mixta* had already developed cultivars with larger seeds before 3000

B.C. By 300 A.D., *C. mixta* was already being grown in the American Southwest and was common in that region from 1000 A.D. onward (Sauer 1993).

C. moschata varieties have spreading vines, large hairy leaves; a hard, hairy and slightly angular stem that flares out noticeably where it attaches to the fruit; a flower with large green sepals at its base; and slightly darker leaves than *C. mixta* that have a pointed tip and slight indentations along their sides. The seeds are small, beige and oblong with a dark beige margin. Cultivars of *C. moschata* include the butternut, cheese, and golden cushaw squashes (Ashworth 2002). The oldest remains of *C. moschata* have been discovered in the Peruvian coastal desert and are dated at about 2000 B.C. The species was being grown in Tamualipas, Mexico by 1400 B.C. It is not currently known what wild species was the progenitor of *C. moschata* (Sauer 1993).

The four species of squash mentioned above have probably taken complex routes in their journey to southern Appalachia. *C. pepo* is likely to have had two separate domestications, one in Mexico and one in the south central or eastern United States (Sauer 1993; Heiser 1989). Given the possibility of two separate domestication sites, it seems likely that *C. pepo* would have first reached the southern Appalachians from the south central/eastern U.S. center of domestication. The first archaeological remains from a *C. pepo* cultivar in eastern North America occur about 500 A.D and European explorers described a large diversity of *C. pepo* varieties being grown in the 16th century. Crooknecks and straightnecks, two distinctive *C. pepo* summer squash varieties that are commonly grown in Appalachia, didn't enter the historical record until after 1800 and were thought to have been developed by American Indians in the midwest (Sauer 1993). New varieties of *C. pepo* (and all squash) can easily be bred through crossbreeding,

selection, isolation and inbreeding; so it is likely that after going through the bottleneck of domestication, squash breeding occurred in the many areas into which it diffused, creating a greater diversity than is found in its wild progenitors.

It is unclear how *C. maxima* came to be cultivated in southern Appalachia. According to Heiser (1989), *C. maxima* didn't diffuse out of South America until the 16th century. At least one variety of *C. maxima*, the original hubbard variety, came to the U.S. from the West Indies in the 18th century (Stickland 1998). *C. maxima* must have come to western North Carolina by at least 1900, as the Cherokee had developed their own *C. maxima* variety, the "Candyroaster," by the early part of the 20th century (Hamel and Chiltoskey 1975). The "Cherokee Indian Pumpkin" is another *C. maxima* variety associated with the Cherokee (Ashworth 2002) that indicates an early Appalachian presence for *C. maxima* following its diffusion out of South America in the 16th century.

C. mixta (C. argyrosperma) varieties are likely to have two routes of diffusion into southern Appalachia. The first is a concurrent migration with maize from Mexico via the southwestern U.S. that brought *C. mixta* into the eastern U.S. by 500-300 B.C. and saw its use become widespread by 800 A.D. (Garbarino and Sasso 1994). Another, more recent, diffusion occurred in the 17th century from the West Indies when *C. mixta* (variety Cushaw) arrived in the southeastern U.S. (Stickland 1998). From there, it probably didn't take long for *C. mixta* to reach the southern Appalachians, as it is known that the Cherokee and Appalachian people have grown "Cushaw" varieties for centuries and still do. The "Tennessee Sweet Potato" is another variety of *C. mixta* that has been grown in the southern Appalachian region since the 1800's (Stickland 1998) and could

have arrived from either of the two diffusions of *C. mixta* or may have been bred in the Appalachians.

Like *C. mixta, C. moschata* has two probable sources of diffusion into the southern Appalachians (Sauer 1993; Heiser 1989). The first is the familiar route from Mexico to the Southwestern U.S. and into the eastern U.S. and southern Appalachia from 800 A.D. onward. The second route is also similar to *C. mixta*, as *C. moschata* was introduced into Florida (where it was adopted by the Seminole Indians) by the Spaniards from the West Indies. By the 17th century, *C. moschata* cultivars were being grown all the way up the eastern seaboard into New England (Sauer 1993). It is known that several varieties have been historically grown in the southern Appalachian region including "Old Time Tennessee," "Old-fashioned Tennessee Vining," and "Shumway's Tennessee Sweet Potato" (Ashworth 2002).

Potatoes

Genetic and archaeological evidence indicates that the original hearth of domestication for the potato was the central Andes of Bolivia and Peru (Brush 2004; Zimmerer 1991). Hawkes (1990) proposes that potatoes were first domesticated in Northern Bolivia between 8000 and 5000 B.C. from the wild diploid species *Solanum leptophyes*. The first domesticated potato species, according to Hawkes, was *S. stenotomum.* The common potato, *S. tuberosum*, that is grown around the world was a result of a cross between *S. stenotomum* (after its domestication) and another wild species called *S. sparsipilum* (Hawkes 1990). Following the bottleneck of domestication, the potato and Andean culture have co-evolved for at least 7000 years, which has resulted in the selection of 30,000 potato types (Brush 2004).

The first European encounter with the potato was in 1537 when ransacking Spanish explorers encountered them in the stores of Columbian villagers. It took another forty years for the potato to make the cross-Atlantic journey to Europe in the 1570's. Once in Europe, the potato dwelled in relative obscurity as a garden curiosity until becoming a staple in Ireland in the late 1600's (Sauer 1993). The diffusion of potatoes out of Europe and into colonial North America didn't occur until the late 1600's. They were first reported as being grown by the American colonists in Pennsylvania by William Penn in 1685. By the late 1760s, potatoes were being grown in Virginia and by 1775 they had crossed the Shenandoah Valley into Kentucky (Zuckerman 1998). Although I haven't found documentation, it isn't hard to imagine that potatoes would have traveled down the Great Valley migrations into the northwestern corner of western North Carolina by the early 1800's and may also have been grown by the Cherokee Indians prior to 1600 (Hamel and Chiltoskey 1975). Potatoes, being a favorite crop of Appalachian farmers, probably adapted to the diverse habitats of the mountain environment and resulted in the selection of many new varieties. However, it also seems likely that colonial Appalachian potato cultivation was based on a small number of varieties as they traveled southward, resulting in a founder effect that limited diversity. In the 150 year period between the arrival of potatoes in colonial western North Carolina and the spread of modern agriculture to the region, the selection of new potato varieties could not have come close to producing the kind of potato diversity that exists in the Andes. The diversity that Cherokee potato varieties may have added to the population in western North Carolina is unknown but was probably not as significant as native contributions to maize, bean, and squash diversity. "New York Pide" is one example of a potato variety that has been

grown in northwestern North Carolina continuously since at least 1892 (Jack Banner, personal communication, January 14, 2005).

Brassicas

Brassica oleracea is a species that includes cabbage, collards, kale, broccoli, cauliflower, brussels sprouts, and kohlrabi (Ashworth 2002). Cabbage is the most commonly grown *B. oleracea* in southern Appalachia. I will focus on the domestication, diffusion and importation of cabbage, collards, kale, and broccoli to the region in this section.

Wild kales and nonheading cabbages were probably the first domesticated *B. oleracea*. Present day firm-headed cabbages are descendents of the wild nonheading *B. olereacea* var. *sylvestris* and (along with kale) other wild species such as *B. cretica*, *B. insularis*, and *B. rupestris*. These wild species are found on the rocky coasts of Britain, the Bay of Biscay, and the Spanish and Greek coastal mediterranean regions (Rubatzky and Yamaguchi 1997). *B. oleracea* cultivars are likely to have been domesticated independently in these locations, although no archaeological evidence of this presently exists (Sauer 1993). Cultivated *B. oleracea* were recorded as being used in ancient Greece and Rome. In Moorish Spain and Germany, several varieties of cabbage (including red and white in Germany) are recorded as being used in about 1150 A.D. After 1600, recognizably modern *B. oleracea* are recorded as being grown all across Europe (Sauer 1993).

Cabbage and kale were introduced into Virginia by the English in 1669. By the time of the American Revolution, cabbages had been introduced into the gardens of American Indians in New York and Florida (Sauer 1993). Broccoli has been a much later

introduction and has only gained popularity in America since the 1950's (Rubatzky and Yamaguchi 1997). *B. oleracea* cultivars were therefore likely to have been introduced into southern Appalachia sometime in the late 18th century and were of European origin.

Peppers

Peppers aren't usually associated with the more popular and widely grown Appalachian crop varieties. They are usually associated with warmer growing environments. However, a few Appalachian-adapted heirloom varieties are known to exist in the region, including the "Ashe County Heirloom Pimento" pepper from Ashe County, North Carolina (Danford, personal communication, September 16, 2003). The domestication and diffusion of pepper diversity is equally as complex as that of squash, but since peppers do not figure as prominently in Appalachian crop diversity, I will only give a brief summary of the evolutionary history of domesticated peppers and their probable journey to southern Appalachia.

Peppers, *Capsicum spp.*, are comprised of four domesticated species: *C. pubescens*, *C. baccatum*, *C. frutescens (incl. C. Chinense)*, and *C. annuum*. They were domesticated between 8000 and 2500 B.C. in the Andes of Bolivia, the inter-Andean valley of Callejon de Huaylas in Peru, and in the Puebla area of Mexico. The wild species of *Capsicum* that serve as the progenitors for domesticated peppers are shrubby perennial chili peppers included in each of the four *Capsicum* species. Sweet peppers are produced in domestication by a single recessive mutation that blocks all capsacin (the chemical that causes pungency in peppers) production and belong mainly to the *C. annuum* species (Sauer 1993).

Cultivated peppers did not follow maize and other Mexican and South American crops into North America in pre-Spanish times. The exact origin of peppers in North America is not clear. Sauer (1993) reported that they were imported into Texas and Louisiana in the 19th century, and Weaver (2000) documents their importation from Jamaica in the 19th century, and into Florida via Cuba as early as the 18th century. When and where peppers entered the southern Appalachians remains unclear. Chili peppers are not commonly grown in western North Carolina that I know of, but some old-time sweet pepper varieties do exist (such as the Sweet Pimento Pepper of Ashe County mentioned above). More research will have to be conducted to determine if they migrated into the region, were a result of a purchase from a seed company, or are from other origins.

Conclusion

The origin, domestication, and diffusion of southern Appalachian crop diversity is a complex process that traces the migration of a diversity of crops from their original centers in North America, Mexico, South America, and Europe to their current home in southern Appalachia. This chapter has outlined this process for several of the major vegetable crops of the western North Carolina region. In the next chapter, I will analyze the results of the interviews that I conducted in this research.

Chapter Five: Results

This chapter begins with an analysis and discussion of the results of my field research on heirloom vegetable varieties in western North Carolina that are still being grown today. The second section of the chapter discusses southern Appalachian vegetable variety classification. The third section provides an analysis of varieties that I found to have a regional distribution in western North Carolina and a discussion of varieties that are being maintained by multiple growers. The chapter ends with a list describing heirloom vegetable varieties from the southern Appalachian mountains of western North Carolina that are still being maintained by growers today.

Western North Carolina Heirloom Vegetable Varieties Still Being Grown and Who is Growing Them

In this study I collected a total of 134 descriptions for western North Carolina heirloom vegetable varieties from twenty-six informants. Of those 134, eighty-three (61.9%) are bean varieties, twenty-four (17.9%) are tomato varieties, eight (6.0 %) are squash varieties, seven (5.2%) are corn varieties, and four (3.0%) are potato varieties. (See Table 1 for a complete list of varieties).

The ages of the farmers and gardeners whom I collected variety histories from ranged from twenty to ninety years old. Twenty of the twenty-six individuals (76.9%) are over the age of forty and are maintaining 90.7% of the varieties. Twelve of the twenty-six individuals (46.2%) interviewed are over the age of fifty and are maintaining

Table 1

Western North Carolina Heirloom Vegetable Varieties Still Being Grown Documented in this Study

Variety	Number Collected	% of Total Varieties Documented
Beans	83	61.9%
Tomatoes	24	17.9%
Squash	8	6.0%
Corn	7	5.2%
Potato	4	3.0%
Brassicas	2	1.5%
Sweet Potato	2	1.5%
Cucumber	1	0.75%
Gourd	1	0.75%
Parsnips	1	0.75%
Peppers	1	0.75%

57.4% of the varieties. Only one individual was under the age of thirty (3.8%) and he is maintaining one variety (0.78%). The 40-49 year old age group provided the largest age demographic that was interviewed (8 individuals, 30.8%) and is also maintaining the highest percentage of varieties (33.3%). The 60-69 year old age group is maintaining the

second highest percentage of varieties (29.5%) and is also maintaining the highest number of varieties per grower (9.5). (See Table 2 for a complete list of the age groups of the individuals from whom I obtained seed histories and Table 3 for the percentages of varieties being maintained by each age group).

Most of the individuals I obtained seed histories from were home gardeners (sixteen of twenty-eight, 57.1%; there are two more individuals tallied here because Reem's Creek Valley Nursery and Whitt's Stall are counted but are not included in the age group list). The next largest group of seed savers was farmers (five, 17.9%). (See Table 4 for a complete list of grower categories of individuals who provided seed histories for this study).

I collected varietal histories from twelve counties in western North Carolina. The three counties that I collected most histories from were Yancey (47 varieties or 35.6% of all varietal histories), Watauga (32 or 24.4%), and Ashe (18 or 13.7%). (See Table 5 for complete list of counties and townships from which seed histories were obtained).

The number of heirloom vegetable varieties collected in Yancey, Watauga, and Ashe counties cannot be taken as an indicator of how much heirloom seed diversity has survived in each of the counties or the region as a whole. Since I used a snowball sampling method, I relied on contacts that I established to provide additional sources for seed histories. It is not surprising that Yancey and Watauga Counties would have provided the highest amount of seed histories since those are also the two counties in which I have lived and have the most contacts. Ashe County, with the third highest number of seed histories, is close to and integrated socially enough with Watauga County to have also provided me with a large number of contacts. My analysis indicates that the

Table 2

Ages of the Individuals From Whom Seed Histories Were Collected

Age Group	Number of Individuals	% of Total Individuals
20-29	1	3.8%
30-39	5	19.2%
40-49	8	30.8%
50-59	1	3.8%
60-69	4	15.4%
70-79	4	13.8%
80-89	2	7.7%
90-99	1	3.8%

results for Yancey and Watauga Counties are fairly representative of the amount of seed diversity that still remains in each of those counties, but as I attempted to collect seed histories from counties in which I had fewer contacts and had to travel further, the number of seed histories decline. Further research will need to be done to get a true picture of the overall remaining heirloom vegetable varieties that exist in western North Carolina. This thesis could serve as a foundation and reference for a more comprehensive study.

Two of my contacts had moved from western North Carolina by the time I

Table 3

Percentages of Heirloom Varieties Being Maintained by Each Age Group

Age Group	Number of Varieties	% of Total Varieties
20-29	1	0.78%
30-39	11	8.5%
40-49	43	33.3%
50-59	13	9.4%
60-69	38	29.5%
70-79	14	10.9%
80-89	3	2.3%
90-99	6	4.7%

interviewed them but were still living in southern Appalachia; Bill Best, who collects seeds from all over western North Carolina and grows them out in Kentucky; and Thurin Edwards, who now lives just over the state line in Erwin, Tennessee. For those contacts, I recorded them as giving seed histories from their home counties in western North Carolina or the counties from which they obtained the seed. For these special cases it is likely that the varieties are still being grown in their native counties, but this remains to be verified. In either case, it is useful to know that varieties from those particular counties are still being grown and could be returned to their home counties upon request

Table 4

Grower Categories of Individuals Who Provided Seed Histories for This Study

Category	Number	% of Total Individuals
Home Gardeners	16	57.1%
Farmers	5	17.9%
Business Operators	4	14.3%
Seed Exchange Operators	2	7.1%
School Gardeners	1	3.6%

if they are not currently being grown there. For growers who still live in western North Carolina but obtained their seeds from other counties, I listed their current county of residence as the county from which the seed history was obtained since I am certain that it is still being maintained there. I noted the county and person from whom it was originally obtained in the variety description of each particular vegetable. For one variety that was included in this study ("Coushaw Squash"), the county of origin is uncertain.

Table 5

Counties and Areas From Which Seed Histories Were Collected

County	Area	Number	% of Total Varieties
Yancey		47	35.6%
	Bald Mountain	23	
	Burnsville	11	
	Cane River	11	
	Celo	2	
Watauga		32	24.4%
	Green Valley	18	
	Boone	9	
	Vilas	4	
	Valle Crucis	1	
Ashe		18	13.7%
	Jefferson	12	
	Green Valley	6	
Haywood		10	7.6%
	Upper Crab Tree	3	
	Waynesville	2	
	Hemphill	1	

Table 5 (Cont.)

Counties and Areas From Which Seed Histories Were Collected

County	Area	Number	% of Total Varieties
Buncombe		9	6.9%
	Weaverville	3	
	Asheville	1	
Madison		5	3.8%
	Shelton Laurel	1	
Allegheny		3	2.3%
Clay	Warne	2	1.5%
Rutherford		2	1.5%
	Ellenboro	1	
	Rutherfordton	1	
Cherokee	Brasstown	1	0.76%
Jackson	Cherokee	1	0.76%
Polk		1	0.76%

Southern Appalachian Heirloom Vegetable Variety Classification

Gardeners and farmers in western North Carolina tend to have their own classification system for vegetable types that is fairly widespread throughout the southern Appalachian region. Some of the classification types are also common to other parts of the country, but taken as a whole, southern Appalachian vegetable growers have developed their own unique system.

Beans are the most popular heirloom vegetable grown in western North Carolina and also have the most complex classification system. The following is a characterization of southern Appalachian bean types:

Bunch Beans: Bunch beans are beans that do not send out running vines and set their beans close to the ground. Most commercial seed catalogs and growers refer to "bunch beans" as "bush beans".

Butterbean: This name (as I have encountered it) refers to a different bean than what growers outside of southern Appalachia usually refer to as a "butterbean." Growers in the non-Appalachian South usually call lima-type heat loving beans that don't grow well in the mountains "butterbeans," whereas the growers I have interviewed call runner bean types *(Phaseolus coccineus)* "butterbeans."

Cornfield Beans: These are vining beans that have traditionally been grown in cornfields to allow the beans to use the cornstalks as a trellis. Best (1999a) suggests that all or most pole beans are in fact beans that were once grown in cornfields. This may be true, although significant adaptation may have taken place during the last several hundred years in pole beans that have been grown in full sun that would now make them less successfully grown in a cornfield setting. Den Biggelaar (personal communication, April

21, 2005) has suggested to me that cornfield beans are better adapted to the more shady conditions of a cornfield. It is also possible, based on my own observations and those of others (D. Bradford, personal communication, March 13, 2005), that cornfield beans are less heavy producers that set their beans in characteristic clusters along the vine. Despite this apparent confusion, "cornfield beans" as used by most southern Appalachian growers signifies a bean that is traditionally grown in a mutualistic relationship with corn. Best (1999a) also subdivides the "cornfield" type into "cutshort" and "greasy" categories (and he may be correct in doing so), but I have listed both "cutshort" and "greasy" beans types separately because they are usually not connected with the "cornfield" label in the beans that I have collected.

Crowder Peas: The "crowder pea" is not actually a bean, but is a kind of "cowpea" or "southern pea" (*Vigna unguiculata*) that originated in the Niger River Basin of West Africa and was brought into the American South with the slave trade (Weaver 1997). It is also wholly distinct from the "garden" or "english" pea (*Pisum sativum*). It is a bush type "bean" that requires a long and hot growing season to mature. Most varieties can probably only be grown in the southernmost part of the southern Appalachians. I listed "crowder peas" in the bean section of this chapter because they are in the same botanical family and have similar growing and eating characteristics.

Cutshort Beans: These are beans in which the seeds in the pods are so tightly packed together that it causes them to square off on the ends (as opposed to the typical rounded seed type). Because they do not grow into the completely round shape of most seeds they are considered to be "cut short" (Best 1999a).

Greasy Beans: A bean that doesn't have any hairs on its pods, causing it to have a "greasy" or slick appearance.

Half-runner Beans: A bean that usually produces prolific yields and sends out running vines that are not nearly as long or unwieldy as pole or cornfield beans (Best 1999a). They combine the better taste of pole beans with the easier growing characteristics of bunch beans. These are the usually the preferred type for canning in the southern Appalachian region.

Shelly Beans: Beans that are grown to be eaten when the seeds have grown to maturity but have not yet dried. The (usually) large seed is then removed from the hull and cooked. I have also heard people refer to beans that are grown to be dried as "shell beans" but the general use for the term "shelly bean" is as described above.

It is often the case that a single bean variety can be classified in several of the categories listed above. For example, a bean could be called a "Long Speckled Greasy Cutshort Cornfield Bean" (Best 1999a). Using a combination of the several bean type categories in naming a particular variety allows the southern Appalachian grower to more accurately describe the physical characteristics of the bean to someone who is familiar with their system.

I only came across one other distinct southern Appalachian vegetable type classification in my research; it was a tomato called a "tommytoe": a small and meaty cherry-type tomato that has very few seeds (D. Bradford, personal communication, March 13, 2005). I haven't actually seen a tomato that is called "tommytoe" and this is the best description of it that I was given.

Regional Trends and Varieties That Are Being Maintained by Multiple Growers

During the course of my research it became apparent that some varieties were grown widely across the region, while others seemed to be unique to particular families or communities. For example, I gathered seven different variety descriptions for "Pink Tip" beans. It may seem redundant to gather variety descriptions for the same bean multiple times, but because of southern Appalachia's diverse environmental conditions considerable variation may exist in vegetable varieties that have the same name and may have derived from the same parent plant. A farmer in Ashe County (Anonymous, personal communication, March 17, 2005) told me that the "Pink Tips" he grows have a white hull and can be grown as bush beans. He also told me about a farmer in his county that has some "Pink Tip" beans that "...are purple, they've got a purple hull, they're a wild looking thing." This shows that even growers that are in the same county may have variations of the same variety that show a significant amount of phenotypic diversity. Among "Pink Tip" bean seed that I collected I also noticed a good bit of variation in seed size, shape, and color, although they were all recognizable as Pink Tip-type brownish seeds. It is also likely that one common name is used to name distinct varieties in some cases.

Another bean variety that seems to have diffused throughout the region is the "greasy cutshort." Greasy cutshort beans are beans that share two main characteristics: (1) The pods are hairless and have a "greasy" appearance and (2) the seeds of the bean grow so close to one another in the pod that they have a square-shaped appearance (Best 1999a). Most of the seven "greasy cutshort" beans for which I gathered histories were white colored of various sizes, but some of them were also brown. There is obviously a

lot of genetic variation in the "greasy cutshort," so I documented all of them that I discovered. Another popular bean name is "greasy," and the fifteen different "greasy beans" that I collected had a variety of names ("Bertie Best Greasy," Big Greasy," "Big Greasy Bean," "Big Speckled Greasy," "Cherokee Greasy," "Greasy Bean," "Greasy Stone Bean," "Late Long Greasy," "Little Greasy Cornfield Beans," "Margaret Best Greasy," "Medium Greasy," "North Carolina Long Greasy," "North Carolina Market Greasy," "Small Lazywife Greasy," and "White Greasy Bean") and also numerous shapes, colors, sizes, and patterns on the seed. It is obvious that there is a lot of diversity in beans named "greasy." And to make matters even more confusing, some of the beans that are named "greasy" have cutshort beans, so they should actually be properly named "greasy cutshorts." In addition, some beans are named "greasybacks," a distinction that I haven't quite figured out. As noted above, southern Appalachian seed nomenclature has definitive categories for naming seed types, but it appears that seeds are often either misnamed or parts of the name are left out as they are passed around. This confusion in naming seeds is clearly seen in the "greasy" and "cutshort" types.

There are five other bean varieties I collected that seem to have a more regional distribution. They are the "Turkey Bean," "October Bean," "Goose Bean," "Butterbean," and "Lazywife bean." "Turkey beans" seem to have to most uniformity of the five and generally have a brown seed with a white blush on one side that comes in slightly different sizes and shades. "October beans" are generally late season beans with large seeds. Some "October" beans may also be called "Cherry" beans in northwestern North Carolina. "Goose beans" have a dark, flat, and dull green seed (I didn't collect a variety of goose bean seeds, but Best {personal communication, April 3, 2005} confirmed their

regional distribution). "Butterbeans" are a "runner bean" type (*Phaseolus coccineus*) with a very large seed in a variety of colors; they are also referred to as "Jack Beans" in northwestern North Carolina. The "Lazywife" is a bean variety that is widely distributed but probably didn't originate in western North Carolina, as other food historians have documented it as being introduced into Pennsylvania in 1810 from Germany (Stickland 1998, Weaver 1997, Watson 1996).

Seven other vegetable varieties that I collected seem to have a region-wide distribution. I documented three "Hickory King" corn varieties that have different numbers of rows of seeds on the cob (8-15) and are either white or yellow and white. Several of my informants agreed that Hickory King has traditionally been the standard hominy corn in the region. Two potato varieties, "Early Rose" and "Green Mountain," seem to have historically had a regional distribution but now are grown by select individuals only. Neither of these varieties is uniquely southern Appalachian, as "Green Mountain" was originally introduced in Vermont in 1885 (Stickland 1998, Weaver 1997) and "Early Rose" in New York in 1861 (Weaver 1997). Both varieties are cultivated outside of the region today and are well known to seed savers. I documented them because they have a long history in the region and may have developed particular adaptations to western North Carolina and also because it is very rare to come across someone who has been continuously maintaining traditional potato varieties in the region.

Three squash varieties that I collected are regionally distributed. The "Candyroaster" is thought to have been bred by the Cherokee Indians and is indigenous to western North Carolina; the "Roughbark Candyroaster" is a unique Candyroaster variety that I discovered in my research. The "Coushaw" squash originated in the West Indies

and was introduced into the southeast before 1700 (Stickland 1998). It has historically been grown across western North Carolina and is still grown today, but appears to be rare. "Yellow crookneck" is another squash variety that I collected that has both regional and national distribution.

The final two vegetable varieties I collected that have regional variation are tomatoes. The first has a variety of names. The names that I collected it under include "Boyd Smith German Yellow," "Candystripe," "Mister Stripey," "Striped German," "Stripe," "Striper," and "Stripey." It is known to most long-time gardeners native to the region and is also sometimes called "Hillbilly," "Pineapple," "Georgia Streak," and "Old German." It is a very large beefsteak-type tomato that has characteristic yellow and red stripes and is quite sweet. Many of the different names signify varieties that differ slightly in size and color pattern. It may have originated in Mennonite or Amish communities (Best 1999b), is thought to have been introduced into western North Carolina from Virginia about thirty years ago (T. McCoury, personal communication, January 24, 2005), and is now perhaps the most popular regional cultivar. The other variety that has a wide distribution and a long history in the region is the "Brandywine." The "Brandywine" tomato is a traditional Amish tomato that has an international reputation for excellent eating qualities. (See Table 6 for a complete listing of the number of each regionally distributed vegetable variety).

Table 6

Western North Carolina Heirloom Vegetable Varieties with Region-wide Distribution

Variety	Vegetable	# Collected	% of That Vegetable Variety Collected
Greasy Type	Bean	15	18.5%
Pink Tip	Bean	7	8.6%
Turkey	Bean	3	3.7%
October	Bean	3	3.7%
Butterbean	Bean	2	2.5%
Lazywife	Bean	2	2.5%
Goosebean	Bean	1	1.2%
Striped German Type	Tomato	7	29.2%
Brandywine	Tomato	1	4.2%
Hickory King	Corn	3	42.9%
Candyroaster	Squash	1	14.3%
Coushaw	Squash	1	14.3%
Yellow Crookneck	Squash	1	14.3%
Early Rose	Potato	1	25.0%
Green Mountain	Potato	1	25.0%

Variety Descriptions for Western North Carolina Heirloom Vegetables That Are Still Being Grown Today

Most of the varieties on the following list (starting on page 78) were described to me by individuals who I interviewed in the course of this research, and are still being grown today. A smaller number of varieties listed I collected personally in previous years and have been growing and maintaining myself. The vegetable variety descriptions are listed in alphabetical order with the number of variety descriptions for each vegetable that I collected listed in parentheses. Within each vegetable category I have listed the varieties in alphabetical order, divided into subtypes, with references to the grower and area where the grower is originally from in parentheses. The variety descriptions detail (to the largest extent possible given the information I have) both biological and cultural aspects of the vegetables and their histories.

I was disappointed not to be able to collect more information about the microclimate preferences and special growing requirements of each variety, along with detailed culinary information. For some varieties (e.g. "New York Pide" potato, "Roughbark Candyroaster", "Kentucky White" Sweet Potato, "Cherokee October Bean") more detailed information was gathered. It was clear to me during my research that a lot of the traditional knowledge about these varieties has been lost. My interviews indicated that this is a result of the spread of modern agricultural techniques and the busyness of modern life. Unless otherwise indicated, it can be assumed that for the majority of the varieties standard chemical fertilizers have been used in their growing in recent years, and that popular chemical pesticides have been used to control insects and diseases. One grower did mention that he used epsom salts for fertilizer. The majority of the

microclimate data will have to be gleaned simply from the current location of the seed and where it has traditionally been grown. It was very rare that a grower would give information about such factors as soil type, aspect, elevation, or cultivation methods that differ from modern, scientific methods. It can be assumed, unless otherwise indicated, that the varieties are being grown in flat areas with the most direct sunlight available. As to traditional ways of preparing the vegetables, it can be assumed for bean varieties that do not have any information listed that they are boiled with salt and either bacon meat or fatback until tender, or they are canned. One unique way of cooking beans that was given (Anonymous, personal communication, March 7, 2005), not specific to any particular variety, was to cook them in a pressure cooker with salt and a little bit of vegetable oil for about ten minutes. Beans are also often pickled together with corn, or with corn and cabbage. Tomatoes are often used sliced in sandwiches or cut up and used as most Americans would in standard dishes, and most of the other vegetable varieties are either boiled or fried. Only one grower that I interviewed still ground his corn for cornmeal.

Beans (83)

Bunch Beans (Bush Beans) (Phaseolus vulgaris)

Brown Bunch Bean (1)-- Darick Bradford says this bean has a delicious flavor. It has a dark brown seed with black streaks on it. An early bean, it will mature two weeks earlier than other varieties and you can (during a warm year) plant two crops of it in one year on the same plot. These are originally from the Cullowee area in Jackson County. It is a good green bean to cook fresh but is not good as a canned bean (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Brown Bunch Bean (2)-- The seed of this brown bunch bean looks the same as "Brown Bunch Bean (1)" except that it is light tan with black streaks on it instead of dark brown. The Bradfords say that it has the same eating qualities as "Brown Bunch Bean (1)" (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Brown Pink Tip-- A brown bean with a white/yellow pod. It is pink on the end of the pod and has a string. It does much better if you trellis it, growing 16-18 inches tall. It will get spots if the bean plant touches the ground while growing (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

Cornfield-- "Cornfield" is an odd name for a bush bean since most cornfield beans are pole beans. A tan/light brown seed with a white eye. This bean has strings and short pods that have visible bumps where the beans are. A "rich and nutty" tasting bean. It originated in northern Yancey County where it was given to Laura Ike by a neighbor (T. Galton, personal communication, April 25, 2005; Celo, Yancey County).

Harris Bean-- A bean with a striking burgundy and white mottled design on the medium sized oblong rounded seed. Some of the seeds are almost pure burgundy. It is eaten as a mid-season green bean (C. Johnson, personal communication, March 18, 2004; Allegheny County).

Mama Byrd Shelly-- This is a bean with a very long kidney shaped seed that is very light tan with red streaks and speckles in it. G. Brown got it from Mama Byrd who used to live on Clark's Creek in Valle Crucis. It is a delicious bean that's eaten as a shell bean and is also very good for canning (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

May Jourden Early Bunch Beans-- The seed of this bean is small to medium sized, oblong rounded, and has a pinkish brown color with a small white eye on the top of it. It is good to eat as a green bean. C. Johnson got them from her mother (C. Johnson, personal communication, March 18, 2004; Allegheny County).

Old Timey White Bunch Bean-- The hull of this bean is three and one half to four inches long and the plant will spread out two feet wide in a row. T. McCoury harvests a bushel from about a fifteen foot row. It is a popular bean for drying out and making "shuck beans" or "leather britches" (T. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Pink Tip-- This farmer grows his Pink Tips as a bush bean although he says you can stake them up and they will run. The bean has a white hull. Pink Tips are widely grown in Ashe and Watauga Counties (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Six Week Bean-- This variety has a tan seed with red streaks in it. This is a very early bean (ready to harvest in six weeks) and has a striped hull that turns dark when you cook it. B. Moretz got it from a neighbor in Meat Camp (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

White Shelly-- This is a bean with a very large round white seed and white pod that was given to G. Brown by Mama Byrd of Clark's Creek in Valle Crucis. It is eaten as a shelly bean (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Half-Runner Beans (Phaseolus vulgaris)

Half-Runner-- This bean variety has small to medium sized oblong rounded white seeds. An occasional seed is cutshort. This bean came from the Whitt's stand at the Asheville Farmer's Market in 2005 (Whitt's Stand, Asheville, Buncombe County).

Manning Half-Runner-- This bean variety has a small to medium sized rounded white seed. These beans were originally from Manning Farmer of Gowinsville, South Carolina (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Pole Beans (Phaseolus vulgaris)

Bertie Best Greasy-- The seeds of this bean are medium sized and are mostly white (90%) with a mixture of brown/tan (6%) and black seed (4%) in them. Originally from Bill Best's Aunt Bertie Best of Haywood County. They have been grown in the Best

family for over 130 years (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Betty Bean-- Maude Thompson got these from a lady at her church from eastern Tennessee. They make a big, long green bean that you can either break or string. You can also shell them and use them in vegetable soup. They have a brown seed and are so long that you can carry a bunch of them in your arms like firewood (M. Thompson, personal communication, February 25, 2005; Vilas, Watauga County).

Big Greasy Bean-- This variety is a pole bean with a big white seed and a hairless pod that looks greasy (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Big Laurel Cornfield-- This bean has a mixture of small and medium sized white seeds. It was originally obtained from Clive Whitt at the Asheville Farmers Market (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Big Red-- This bean has a red pod that is about 12 inches long. The red pod turns green when you cook it and has light tan seeds (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Big Snowball-- This bean used to be called "Lazy Wife". It is a big bean that has six to eight big, shiny white seeds to a pod. The vines can grow as tall as sixteen to eighteen feet high. It is a good cornfield bean (T. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Big Speckled Greasy-- This bean has medium oblong rounded seeds that are cream colored and mottled with brown streaks and specks. It was originally obtained from

Madison County by Clive Whitt and offered at the Asheville Farmers Market (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Brannock Triplett Cornfield-- This is a cornfield bean with a lot of variation in it. The seed is a mixture of beans-- some are white, some black, some gray with black speckles, some orangish tan, and some are different shades of gray. It is a good canning bean. Originally maintained by Brannock Triplett on Lower Triplett in Watauga County (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Black Pole-- This is a shelly bean with very large black seed (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Cherokee Cornfield Bean-- The seeds of this bean are a mixture of jet black, light tan, medium tinted tan, and gray in color and are oblong rounded. They are an excellent tasting green bean. The jet black seed types are very similar to the Cherokee Trail of Tears Bean. I received these through Lee Barnes' seed exchange in 1999 (L. Barnes, personal communication, March 11, 1999; Waynesville, Haywood County).

Cherokee Greasy-- This is a bean with medium to small white seed (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Cherokee October Bean-- This is a bean with a large rounded seed. Some of the seeds are solid maroon and some of them are maroon and white mottled. It is ready to harvest very late in the season, usually late September or October. It can grow very tall, 10-15 feet. It is excellent to eat as a shell bean or a dry bean and has a rich meaty flavor to it. This seed was obtained by R. Webb from Michael Red Fox, who originally got them from the Eastern Cherokee Indian Reservation (R. Webb, personal communication, Spring 2000; Shelton Laurel, Madison County).

Cherokee Trail of Tears Bean-- This is a bean with a medium sized jet black seed that is flat. It makes an excellent green bean and can be grown in the corn patch. The pods of this bean turn dark purple when they mature. This bean was originally offered by Dr. Sam Wyche through the Seed Savers Exchange in 1985 and was reputably carried by the Cherokee people from North Carolina to Oklahoma on the Trail of Tears in the winter of 1838-39. I obtained these from Lee Barnes' seed exchange in 1999 (L. Barnes, personal communication, March 11, 2005, Waynesville, Haywood County; Weaver 1997).

Cherry Bean-- This is a bean with a large rounded maroon seed. These beans cook very fast and are also known as the "Breakfast Bean". A. Carson got these from her mother, who loved to grow them (A. Carson, personal communication March 18, 2004; Jefferson, Ashe County).

Cutshort Greasybacks-- The hull of this bean has a greasy look to it (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Don Foxx Family Bean-- This is a bean from Madison County that was given to B. Best by a friend of a colleague (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Doscia Graham Cutshort Greasy Beans-- This bean has a mixture of seed types and colors that include black, brown, white, brown streaked and gray seeds. The seed is originally from Madison County (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Doyce Chambers Cutshort-- The seed of this bean is white, medium sized, and oblong. Some of the seed is round and some cutshort (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Doubleback Beans-- A bean with a small white seed with a little bit of brown in them. The pod of the bean wraps around the seed very tightly so you can see the beans contour (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Frost Bean-- This is a pole bean that bears all season and is a heavy producer. You can pick them early for green beans or later for shell beans. It has a purple and white seed (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Genuine Cornfield-- This is a cornfield bean that has a brown seed with black streaks in it (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Goose Bean-- This bean has a very striking large flat dull green seed. B. Best says that it is meaty and tender to eat. Originally from the Best family who have a story that the bean was discovered in the craw of a wild goose by a great grandmother and then planted out and saved. Goose Beans are grown across the southern Appalachians and have a tendency to cross-pollinate with other beans (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Grady Baily Cutshort-- This is a small to medium white rounded oblong seed that is originally from Polk County (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Greasyback Beans-- This is a bean with a white seed that has brown spots on it. They will continue producing after a dry spell when it looks like they're going to die. When it

rains they will start producing again (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Greasyback Cornfield-- This is a bean with an orangish brown cutshort seed. It was given to I. Hayes by her husband's aunt Janette Hayes. It is good as a canned bean (I. Hayes, personal communication, February 10, 2005; Boone, Watauga County).

Greasy Bean-- This is a bean with medium sized seeds, some of which are oblong rounded and some of which are cutshort. They were given to A. Carson by a neighbor (A. Carson, personal communication March 18, 2004; Jefferson, Ashe County).

Greasy Cutshort-- This bean has mostly a mixture of small to medium white rounded and cutshort seeds. A few of the seeds are brown and brown and black streaked. This is a good green bean that can be cooked fresh, frozen, canned, or dried for "leather britches". J. Wilson's mom referred to it as a "cornfield bean" so it can probably be grown with corn as well (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

Greasy Cutshort-- This is a bean that was given to J. Bunton by her mother (J. Bunton, personal communication, February 16, 2005; Valle Crucis, Watauga County).

Greasy Stone Bean-- This bean has small tan and brown mottled seeds that are mostly oblong rounded with some that are cutshort. C. Johnson originally got this bean from Frank Williams who got it from his family in Virginia (C. Johnson, personal communication, March 18, 2004; Allegheny County).

Hundred Year Bean-- This is a bean that was given its name because it has been grown for a hundred years in the Moretz family (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

John Hovis Cornfield-- This is a cornfield bean with a round white seed. It originally came from John Hovis' family in Burnsville (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Kate Bean-- This is a flat bean with a brown seed that matures in six weeks. It is eaten as a green bean (T. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Late Long Greasy-- This is a pole bean with medium-sized oblong rounded white seeds. It was originally obtained from the Asheville Farmers Market (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Lazy Wife-- This bean has medium to large rounded seeds that are white (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Lazy Wife Bean-- This is a white seeded pole bean that can either be eaten as a green or dry bean. The seed is originally from Madison county and is currently being maintained by Judy Conrad in Yancey County and I obtained it from Gaelen Corozine (G. Corozine, personal communication, January 24, 2005; Celo, Yancey County).

Little Greasy Cornfield Beans-- This is a bean with a small white seed and slick pods that grow to be two and one half to three inches long. The hull doesn't have much meat to it and is wrapped tightly around the bean (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Little Greasy Cutshort-- This is a bean with a five inch long hull and a small to medium sized seeds. The hull is very slick and shiny (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Louise Bean-- This seed of this bean was given to B. Moretz by his neighbor Louise. Louise saved it from a cross that occurred in her garden and it stayed true to type. It has a long, flat white seed and is stringless (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Margaret Best Greasy-- This is a bean with a small, white rounded seed, some of which are cutshort. It was originally from Margaret Best of Haywood County who got it from a neighbor (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Medium Greasy-- This bean has a medium sized white seed, some of which are oblong rounded, and some of which are cutshort. It is a cornfield bean that has a medium sized greasy pod and has been handed down in the Burnsville area for generations (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Mick Cole Cornfield-- This is a cornfield bean that originally came from Mick Cole of Mitchell County. It has a flat white seed (A. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Moody Greasy Cutshort-- This bean has seed that is canvas brown with a dark mottling of spots. It is from the Hemphill area of Haywood County and was traditionally grown and saved along with a specific dent corn variety (L. Barnes, personal communication, March 11, 2005; Waynesville, Haywood County).

North Carolina Long Greasy-- This is a bean with medium sized oblong rounded white seeds (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

North Carolina Market Greasy-- This is a bean with a medium sized, oblong rounded, white seed. It was originally obtained from Clive Whitt at the Asheville Farmers Market (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

October Bean-- This bean has big round seeds that are tan and mottled with specks and streaks of red. It is a runner bean that will run to over eight feet tall. It is eaten as a shell bean with the hull or as a dry bean. It is a very long season bean that isn't ready to harvest until the Fall. These originally came from the Eastern Cherokee Indian Reservation (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Old Betty Bean-- This is a bean with a white seed that is eaten as a green bean. It matures late in the season but will keep producing until the first frost. It was originally obtained from Blueford Dyer of Blairsville and S. Burson now calls it a "Dyer Bean" (S. Burson, personal communication, February 25, 2005; Warne, Clay County).

Old Timey Cornfield Bean-- This is a bean with a white seed that has pods with a greasy look to them. It is a prolific producer that is eaten as a green bean. M. Thompson got this seed from a lady at her church who is from Tennessee (M. Thompson, personal communication, February 25, 2005; Vilas, Watauga County).

Peanut Bean-- The seed of this bean is very small and dark brown and the hull is pale white. It is a multi-purpose bean that can be eaten as a green bean, a dried shell bean, or pickled. F. Turnmire got this seed at a store in town that used to sell it (F. Turnmire, personal communication, February 15, 2005; Jefferson, Ashe County).

Pink Tip-- This is a bean with a brown seed and snow white pods that have a pink end to them. It is a unique and delicious tasting bean with a mealy taste to it (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Pink Tip-- This bean has a brown oblong rounded seed with a white eye on the top of it. It is good eaten as a green bean or pickled bean. It can be prone to a disease called "the spot" so should be grown in a drier microclimate. A neighbor gave him six seeds of this bean one time and F. Turnmire has being growing them out ever since (F. Turnmire, personal communication, February 15, 2005; Jefferson, Ashe County).

Pink Tip Bean-- This is a bean with a brown seed that has a white pod with a pink tip on the end of it. It can be eaten as a green bean or makes a delicious frozen bean. This bean runs and makes a prolific harvest. M. Thompson got this seed from her grandmother (M. Thompson, personal communication, February 25, 2005; Vilas, Watauga County).

Pink Tips-- (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Pink Tip Shelly-- This is a great big shelly bean that cooks really fast and has a really great flavor to it (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Presley Bean-- This is a bean with a small oblong white seed that has some cutshort seeds mixed in. The meat on the hull is twice as thick as other beans. It is a cornfield bean that sets about three to five pods in a "cluster" going up the vine. They produce for a long time over the season and will give you a second crop on the same plant in the Fall during some years. This is D. Bradford's favorite bean for flavor. It is originally from the Cullowee area in Jackson County and used to be called the "Grady Bean" (D.

Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Potter Bean-- This is a bean that a woman gave to G. Brown (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Red Valentine-- This bean has a mottled tan and red seed. B. Moretz prefers it as a shell bean but it can be eaten as a green bean as well (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Seay Cutshort-- This is a bean with small to medium sized white cutshort seeds. It originally comes from the Seay family of Buncombe County (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Small Lazywife Greasy-- This bean has a small to medium sized seed with some seeds that are oblong rounded and some that are cutshort. It is originally from Mrs. Metcalf of Madison County (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Snowball Bean-- This is a bean that was named after the "snowball bush" (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Squirrel Bean-- This is a bean with a tan seed that has some seeds that are streaked and some that are mottled. Some of the seeds are round and some are cutshort. Given to G. Brown by L. Moretz (G. Brown, personal communication, February 1, 2005; Boone, Watauga County).

Sylvia Bean-- This is a cornfield bean that originally came from Sylvia Ledford and has medium to large cutshort and oblong rounded white seeds. It is eaten as a green bean (D.

Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Turkey Bean-- This is a big rounded oblong seed that is half brown and half white blush. It is the same as the "Turkey Craw Bean" except that the seeds are slightly bigger and have a lighter brown color (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

Turkey Bean-- This is a medium sized oblong rounded seed that is half brown and half white blush. It is very similar to the "Turkey Craw Bean" except that it is a little smaller (A. Carson, personal communication March 18, 2004; Jefferson, Ashe County).

Turkey Craw Bean-- This is a big rounded oblong rounded seed that is half brown and half white blush. The story is that these seeds were recovered from a turkey's craw by a hunter and then planted out (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

White and Brown Greasy Cutshort Beans-- This is a pole bean that has a mixture of orangish brown and white seed. It will grow very tall. It is a good tasting green bean that originated in the Green Valley community area (J. Banner, personal communication, January 14, 2005; Green Valley Community, Watauga County).

White Greasy Bean-- This is an oblong rounded white seed that was given to D. Edwards by a neighbor (D. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

White Greasy Cutshort Bean--This bean originally came from Clive Whitt at the Asheville Farmers Market (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Butter Beans (Runner Beans) (Phaseolus coccineus)

Butterbean-- This bean has very large seeds that are a mixture of solid white and brown speckled. It is a good runner with pretty blossoms. It seems similar to a "White Dutch" or "Brown German" runner type (J. Banner, personal communication, January 14, 2005; Green Valley Community, Watauga County).

Old Time Butterbean-- This is a bean with a mixture of seed colors-- some are white, some black and white speckled, and some are red and white speckled. It is a huge bean and they are sometimes locally called "Flat Beans". They have a red-pink flower and are probably a runner bean type (F. Turnmire, personal communication, February 15, 2005; Jefferson, Ashe County).

Southern Peas (Vigna unguiculata)

Crowder Pea-- This pea has a light brown seed with a white eye that has a dark brown outline around the eye. The seed has a round but irregular shape. D. Bradford originally got these from Brian Silvers of Rutherfordton (Rutherford County) but they will only grow in the southernmost areas of western North Carolina (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Brassicas (2)

Mustard Greens (Brassica juncea)

Old Timey Mustard-- J. Banner recovered these mustard greens when he was digging out a hole to build his basement. Some seeds sprouted in the dirt that he removed and he recognized them as the Old Timey Mustard that his mother had grown in her garden since 1892 on Sugar Mountain in Avery County. This mustard green has a leaves that look like an oakleaf and are green with a red/purple outline along the edges of each leaf. It is very spicy raw and loses its spice when you cook it. When it is cooked this green tastes similar to kale. The leaves have hairs on them that are similar to stinging nettles and will irritate your skin (J. Banner, personal communication, January 14, 2005; Green Valley Community, Watauga County).

Rutabagas (Brassica napus)

Old Timey Orange Rutabaga-- This is a rutabaga that has a white bottom and purple top and an orange colored flesh when you cut it open. They can weigh up to ten pounds when fully mature. They will get browner if you cook and reheat them over a period of several days and that makes them taste better. These rutabagas can over winter in a warm year or can be dug up, stored in a hole in the ground, and re-planted in the spring to produce seed. E. Bradford got these seeds from his grandmother (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Corn (7)

Dent Corn (Zea Mays)

Coxx Special-- This is a dent corn with pure white medium-sized seeds. It is a "bread corn" used for making cornmeal. It produces three ears per stalk. D. Bradford obtained this variety from Manning Farmer of Gowinsville, South Carolina (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Field Corn (1)-- This is a twelve-row white dent corn with small kernels and medium sized ears. Some of the kernels are yellowish (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Field Corn (2)-- This is a thirteen-row dent corn with small kernels that are white and yellow with a reddish orange tint to them. The ears are medium sized. It is similar to "Field Corn (1)" except that the color of the kernels is different and they are slightly larger (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Hickory King-- This is an eight-row dent corn with very large white and yellow kernels and large ears. This variety makes good hominy (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Hickory King-- This variety of hickory king has very long ears (approximately 16 inches) and will grow up to twelve feet tall. You have to get it planted early in cold climates because it is a long season corn. It is prone to being blown down in the wind because it is tall, so staking it is a good idea. E. Bradford obtained this variety from an old farmer in Erwin, Tennessee (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

White Hickory King-- This is an old-time variety that S. Burson is trying to breed to have eight rows instead of the 10-14 it currently has. The kernels are as big as thumbnail. S. Burson received this variety from Fred Lunsford of Marble. They were the last five ears that Mr. Lunsford had (S. Burson, personal communication, February 25, 2005; Warne, Clay County).

Wild Goose Corn-- The seed of this corn is a dent type with red and white kernels. It is a "bread corn" that is traditionally ground and used for cornbread and grits. Some yellow "hickory king" corn cross-pollinated with this seed, so to keep it true to it's original type any yellow seeds will need to be removed before planting (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Cucumbers (1)

Cucumis sativus

Grandma's Old Little White Cucumber-- This is a small white cucumber that is best when harvested young and makes a good pickling cucumber. It was originally obtained from Wilbur Wright of Ellenboro in Rutherford County (S. Sorrow, personal communication, March 19, 2005; Boone, Watauga County).

Gourds (1)

Lagenaria siceraria

New Guinea Bean or Snake Gourd-- This is a long, thin, twisting hard-shelled snake-shaped gourd that can be eaten like squash when it is young (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Parsnip (1)

Pastinaca sativa

Bradford Parsnip-- E. Bradford got this parsnip from his grandmother. It has a unique flavor and smell. In the fall he leaves seedlings in the ground to grow over the winter to get big. Then in the spring you can take a root and plant it on its side and a new plant will grow out of each eye on the root. To cook, put them in a bag with a mix of meal, sugar, salt, and pepper. When they are covered with the mixture, you take them and fry them until they are brown (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Peppers (1)

Capsicum annum

Ashe County Heirloom Pimento-- This is a small and sweet pimento pepper that produces early and is well adapted to cold mountain environments. R. Danford obtained this variety at a seed swap from a lady that lived in the Fleetwood area of Ashe County (Danford, personal communication, September 16, 2003).

Potato (4)

Solanum tuberosum

Early Rose-- This is an early season pink potato with a white flower. Early Rose was developed by Albert Brese from a seedling of a potato called Garnet Chile and introduced in 1861 by B.K. Bliss and Sons of New York. It eventually replaced regional cultivars such as Pink-Eye in the Carolinas (J. Banner, personal communication, January 14, 2005, Green Valley Community, Watauga County; Weaver 1997).

Fingerling-- These are small thin potatoes that look like little fingers (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Green Mountain-- This is a mid to late season potato that is round, tan-skinned, and has white flesh. It is an excellent storage potato. It was introduced in Vermont in 1885 (T. Edwards, personal communication, April 10, 2005, Cane River, Yancey County; Weaver 1997; Stickland 1998).

New York Pide-- This potato was first planted by the Banner family on Sugar Mountain in 1892 after they had moved there from Montezuma. A small potato that isn't a prolific producer, it was maintained by the Banner family because of its superior taste. It is a white potato with a pinkish blush to the flesh and it has a lot of blooms that bloom for a long period of time. They weren't widely planted in western North Carolina and J.Banner may be the only person still maintaining this variety (J. Banner, personal communication, January 14, 2005; Green Valley Community, Watauga County).

Squash/Pumpkins (8)

Cucurbita maxima

Candyroaster-- This is a pinkish/cream colored winter squash that has a very sweet flesh and large tan/brown seeds. It may have originally been bred by the Cherokee Indians in western North Carolina and makes excellent pies (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Candyroaster-- This is an orangish/pink smooth skinned candyroaster from the family of Loyal Jones of Brasstown, Cherokee County (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Roughbark Candyroaster-- This is a winter squash that may have originated with the Cherokee Indians and is grown for its particularly sweet flesh. A pinkish/cream colored squash like most candyroasters, the roughbark is distinguished by its rough and hard skin that improves its storing qualities. It has very large tan/brown seeds. This variety is being maintained by the Bradford Family of Bald Mountain in Yancey County and in their opinion it has a much richer flavor than regular slick candyroasters. D. Bradford also believes that the roughbark is a more primitive form of candyroaster and that the slick candyroasters are a more recent cultivar. Traditionally used for pies, candyroaster butter, candyroaster bread and as a winter time compliment to bean dishes (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Sweet Potato Pumpkin-- Based on the description given by to me by B. Moretz, I have listed this as *C. maxima*, but it also may be *C. pepo* or *C. moschata*. It is a hubbard-type winter squash that has a pale orangish/yellow color. They make an excellent pumpkin pie and are resistant to most diseases and pests, including squash vine borers (B. Moretz,

personal communication, December 6, 2003; Green Valley Community, Watauga County).

Cucurbita mixta (C. argyrosperma)

Coushaw-- I obtained this squash from two Sac and Fox nation farmers from the Thakiwa Foundation in Oklahoma. They said this variety was originally from the American Southeast and was carried on the Trail of Tears by American Indian people in the winter of 1838-9. It is very likely an Appalachian variety and grows very well here. Fruits range from 10-70 pounds and are a variety of shapes with green and white stripes. The flesh is mildly flavored and has a texture somewhat like spaghetti squash. It absorbs cooking flavors nicely.

Cucurbita pepo

Field Pumpkin-- This is an orange pumpkin that has an average size of about twelve pounds. Some years it will produce in the cold climate of Ashe county and some years it won't. It makes a nice small jack 'o lantern. It was described as being very similar to a "Connecticut Field Pumpkin" (Anonymous, personal communication, March 3, 2005; Jefferson, Ashe County).

Sugar and Spice Pumpkin-- This is a small orange winter pumpkin that has a very sweet and rich flavor and makes excellent pies (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Yellow Crookneck-- This is a very knotty old-time yellow crookneck squash with a rich taste. It has yellow and blood orange streaks that run through the flesh of it. To save seed let it cure until frost (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Sweet Potato (2)

Ipomoea batatas

Kentucky White-- This is a white sweet potato that can grow as large as six pounds. They've been grown by the McCoury family along Jack's Creek in Burnsville for over a hundred years. In the mountains it is better to grow sweet potatoes in poor clay soil instead of dark loamy soil. When they are grown in good loose soil they run a lot and make vines but no roots (T. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Spanish Red-- A sweet potato with red skin and white flesh (T. Edwards, personal communication, April 10, 2005; Cane River, Yancey County).

Tomatoes (24)

Lycopersicon esculentum

Beefheart-- This is a large tomato that is red on the top half of it and purple on the bottom half and has a very good taste to it. The bottom half of the tomato tapers to a point, which makes it have a "heart" shape. They are a long tomato that is greater in length than it is in width. It is a very rough looking tomato (especially on the blossom end) that will catface. It has been passed down in the Bradford family for over a hundred years and is rumored to have originated with German settlers in the area (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Boyd Smith German Yellow-- This is a yellow tomato with red stripes in it that is very sweet. It is another of the "Mister Stripey" variations. This variety is originally from Cherokee (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Brandywine-- This tomato is smooth and red with a green top. It has a delicious flavor and local families eat the green top of the tomato fried. It has been grown by families in the Green Valley Community of Ashe County for at least a hundred years (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

Brimmers-- This is a pink tomato that J. Banner got from a lady in western Watauga County that is his favorite tomato. Brimmers was introduced in Virginia in 1905 and is a good producer in southern climates (J. Banner, personal communication, January 14, 2005, Green Valley Community, Watauga County; Watson 1996).

Candystripe-- This is a very big yellow tomato that is red in the center (D. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Clarence's Yellow-- This is a small yellow tomato that weighs one and a half to two ounces. It is very sweet and was discovered as a volunteer in B. Moretz' Uncle Clarence's garden (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

German-- This is a tomato that is grown by E. Bradford's cousin Buck (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Granny Bradley-- This is a large pink beefsteak-type tomato. It produces excellent yields and has a sweet old-timey taste. This tomato originally came from Kentucky and has been grown in Buncombe County for decades (Reem's Creek Valley Nursery 2005; Weaverville, Buncombe County).

Heirloom Orange-- This is a very meaty and large sized orange tomato. It has been grown in the Sherman family of Buncombe County for over 100 years and was brought to Reem's Creek Valley Nursery about ten years ago (Reem's Creek Valley Nursery 2005; Weaverville, Buncombe County).

Hillbilly-- This is a red and smooth six to eight ounce tomato. It is different than the yellow and red "hillbilly" varieties and has been grown by the Wilson family for a hundred years (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

June Pink-- This is a pink twelve-ounce tomato that comes in early and has a very good taste (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Little Red Pear-- These are little red tomatoes that are shaped like a pear. E. Bradford got them from Net Flanders' son (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Little Yellow Pear-- These are little yellow tomatoes that are shaped like a pear. E. Bradford got them from Net Flanders' son (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Mister Stripey-- This is a big knotty yellow tomato with a red center. T. McCoury obtained it thirty-five years ago from Selman Hensley and has being growing it ever since. He introduced it to the H.P.S. seed company and they made it commercially available. It originally came to North Carolina from Virginia. It is very similar to other varieties such as Hillbilly, Pineapple, Georgia Streak, Stripey, Candystripe, Old German, etc., but they each have slight variations (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Old Fashioned Orange-- This is an orange tomato that will weigh from a pound and a half to two pounds (W. McCoury, personal communication, January 24, 2005; Burnsville, Yancey County).

Pink Pear Tomato-- This is a pink pear shaped tomato that is from Buncombe county and was given to B. Best by Randy Gardener (B. Best, personal communication, April 3, 2005; Upper Crab Tree Community, Haywood County).

Plum Tomato-- This is a small tomato that is shaped like a tear drop, light bulb, or plum. E. Bradford got the seed from Net Flanders' son (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Red Tommytoe-- This is a small tomato that is pinkish red and has a lot of meat with little seed in it. It is a low acid cherry-type tomato. E. Bradford got these from his Uncle Buck (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Stripe-- This is another yellow and red "Mister Stripey" type. It has large fruits (up to two pounds) that are low in acid. It has striking pink and yellow shades that swirl through the meaty and sparsely seeded fruits (Reem's Creek Valley Nursery 2005; Weaverville, Buncombe County).

Striped German-- This was described as a mixture of a German Pink and a Yellow Tomato that has a smooth texture and is very delicious. It ripens in about 78 days and the plant grows to be three feet tall. J. Wilson's family has grown this variety for 100 years (J. Wilson, personal communication, February 23, 2005; Green Valley, Ashe County).

Striper-- This yellow "Mr. Striper" type tomato with red streaks was obtained by M. Thompson from her aunt. She has grown it for thirty years (M. Thompson, personal communication, February 25, 2005; Vilas, Watauga County).

Stripey-- This is a bi-colored yellow tomato that is red in the middle. It is also known as Old German (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Yellow Tommytoe-- This is a small yellow cherry-type tomato that has a lot of meat with little seed in it. E. Bradford got these from his cousin Buck (E. Bradford 2005, personal communication, March 13, 2005; Bald Mountain, Yancey County).

Yellow Tommytoe-- This is a small cherry-type yellow tomato (B. Moretz, personal communication, December 6, 2003; Green Valley Community, Watauga County).

Chapter 6: Conclusion

Southern Appalachia has a long history as a region that is rich in crop biodiversity. From the Mississippian era native farmers right up until the mid-twentieth century, farmers in western North Carolina have maintained a wide diversity of crop species. Since the 1950's the subsistence orientation and farming population of western North Carolina have declined dramatically, resulting in a threat to the survival of heirloom vegetable varieties.

This study confirmed my assumption that the majority of western North Carolina's heirloom vegetable varieties are being maintained by home gardeners. The propensity of residents of the region to value family culinary traditions (B. Best, personal communication, April 3, 2005) has perhaps motivated western North Carolina gardeners to save heirloom vegetable varieties long after the region became a post-agrarian rural society. However, it became increasingly obvious during the course of my research that most of western North Carolina's heirloom vegetable varieties have been lost. Many individuals that I identified as being likely sources of heirloom seeds no longer keep the varieties of their forefathers. I talked to several individuals who told me that they had saved seeds that had been handed down to them by their parents for many years, but had recently let them die out. It also appeared that many communities had only a few individuals who still saved heirloom seeds, whereas some communities seem to have lost their heirloom vegetable heritage altogether. As farming continues to die out as a way of

life and young people are forced to continue to move out of the region due to increasing land prices and lack of economic opportunities, it seems highly likely that what is left of the cultural tradition of seed saving will continue to disappear.

I was surprised to find that most of the varieties I collected were not being maintained by the older generations. Based on previous experience, I had assumed that most varieties would come from growers sixty years old or older. The observation that individuals between the ages of forty and forty-nine represented my highest percentage of growers (30.8%) and are maintaining the highest percentage of the total varieties collected (33.3%) of any age group was unexpected. Whereas I thought that the majority of growers would have been sixty years old or older, it turned out that 42.3% are over sixty, and they are maintaining 47.3% of the total varieties. I would be interested to see what age group a more comprehensive study would find to be maintaining the highest levels of diversity.

Of the heirloom varieties that I collected in this study, beans were the most numerous, accounting for 61.9% of the total varieties. Tomatoes were the next most numerous at 17.9%. From there the numbers of particular varieties that I collected dropped off considerably. Squash accounted for 6.0%, corn 5.2%, and potatoes 3.0%. It is telling that out of twenty-six individuals that I interviewed, only four are maintaining heirloom corn varieties (of which three are in the same family), and only four are maintaining old-timey potato varieties. I imagine that if you interviewed individuals during the first part of the twentieth century, almost every family would have been growing heirloom corn, beans, squash, and potatoes. What varieties do remain today are

vestiges of an era where crop biodiversity was the very foundation of an agrarian way of life.

Beans and tomatoes were the most numerous among varieties that I collected. Beans are noted for their high levels of diversity and are the easiest among seeds to save because they are self-pollinated and easy to dry. Tomatoes are also self-pollinated but have a more complex seed saving requirement that involves allowing the seed to ferment before drying it, and they are also harder to grow due to their tendency to get late blight (*Phytophthora infestans*). Corn and squash are much harder to maintain as pure varieties because they easily cross-pollinate, and potatoes can be tricky to maintain because they require specific storage conditions and a lot of space. From my results it is clear that farmers in western North Carolina have tended to save the seeds of heirloom varieties that are the easiest to save and also happen to be very important in the culinary traditions of the region.

To comprehensively document all of the remaining heirloom vegetable varieties in western North Carolina would require a research project much larger in scope than this thesis. The two counties that I collected the most varieties in, Yancey and Watauga, are also counties where I have both lived and worked. The seed histories that I collected from Watauga and Yancey counties can be seen as being fairly representative of the diversity that has survived, but other counties will need to be more comprehensively studied to determine what varieties might still remain there. One of my informants (Best, personal communication, April 3, 2005) indicated strongly that Madison County might contain more heirloom beans than any other *state* in America, but I was unable to develop very many useful contacts there.

Many of the 134 varieties that I documented in this study have a high likelihood of being varieties that are unique to particular individuals or families and may be in danger of being lost forever. One example is the "New York Pide" potato variety. "New York Pide" is a white potato that has been maintained by the Banner family, originally in Sugar Mountain, and now in the Green Valley community of Watauga County. The Banners first planted "New York Pide" in 1892 and were the only family who cultivated them in their community. Other farmers didn't grow it because it is not a highly productive variety, but the Banners maintained it for their personal use because they thought it was the best tasting potato that they had ever eaten. Jack Banner (personal communication, January 14, 2005) has tried to grow "New York Pide" in areas of slightly lower elevation (Newland, Marion) but has only had success growing "New York Pide" at elevations close to three thousand feet in northwestern North Carolina. Unlike the few other potato varieties that I have documented, I have not been able to find any other reference to "New York Pide." It could be that Jack Banner is maintaining the last of an endangered potato variety that is uniquely adapted to northwestern North Carolina and has an excellent eating quality.

The "Roughbark Candyroaster" is another rare vegetable variety that I had not been aware of before doing this study. It is being maintained by the Bradford Family of Bald Mountain in Yancey County and in their opinion it has a much richer flavor than regular "slick candyroasters" (which are more numerous), and is distinguished by its rough and hard skin that improves its storing qualities. Darick Bradford also believes that the "Roughbark" is a more primitive form of "Candyroaster" than the regular "slick roasters" (personal communication, March 13, 2005). It is traditionally used for pies,

candyroaster butter, candyroaster bread, and as a wintertime compliment to bean dishes. The "Roughbark Candyroaster" is a unique western North Carolina variety that may only be being maintained by a few families and is in danger of being lost. It is highly likely that other unique vegetable varieties that I have documented in this study are in danger of extinction.

Developing a Strategy for the Conservation of Crop Biodiversity in western North Carolina

Presently there is no known comprehensive conservation strategy or organization for the preservation of crop biodiversity in western North Carolina. The Appalachian Heirloom Seed Conservancy was formed in 2003 and serves as a seed exchange that focuses mainly on central Appalachia (B. Best, personal communication, April 3, 2005). The Carolina Farm Stewardship Association has also initiated the Saving Our Seed Project, which focuses on preserving and improving heirloom open-pollinated crops in the southeast (Carolina Farm Stewardship Association 2005). However, neither of these organizations does much work in western North Carolina. Two issues are relevant when considering the specifics of crop biodiversity conservation in western North Carolina: strategy and location. I will address the question of what a comprehensive strategy to achieve optimal conservation in western North Carolina might entail and then address the issue of where a southern Appalachian center for the conservation of crop biodiversity would be ideally located.

Gray (1999, p.42) has suggested that conservation in Appalachia would be ideally served by a regional seed bank that would serve the following functions:

a. identifying and collecting regional heirlooms
b. sharing heirloom propagation materials with other growers, both inside and outside the region
c. growing and evaluating heirlooms at a central location
d. comparing heirlooms with introduced breeding lines and cultivars
e. making heirloom propagation materials available to public and private plant breeders
f. providing limited seed bank storage
g. sharing diverse materials with other seed banks

My findings are consistent with all of these objectives as listed by Gray, but I would add three more objectives to the list:

h. using participatory plant breeding to improve and enhance Southern Appalachian germplasm
i. actively promote growing and marketing heirlooms to farmers; especially small scale growers, such as community supported agriculture farms, organic growers, and backyard gardeners
j. encouraging local community involvement by supporting smaller community seed banks and biodiversity registers

My suggestions, however, differ from Gray in terms of conservation strategy. His call for a regional seed bank is an accurate assessment of a real need. Creating such a bank would center the strategy for Appalachian germplasm conservation on an *ex situ* method. As noted in Chapter Two, there are several known disadvantages to *ex situ* conservation. To avoid suffering the drawbacks of both *ex situ* and *in situ* conservation, many experts are now recommending a combination of the two strategies. Virchow (1999, p.44) noted that, "...the importance of an efficient combination of *ex situ* and *in situ* conservation is being increasingly recognized." That being the case, a good strategy for preserving Appalachian crop germplasm would probably involve an appropriate combination of the two methods. Gray (1999, p.43) does allude to *in situ* strategies in his proposal as well: "Moreover, continued production under existing cultural conditions

should be encouraged, permitting further heirloom development while maintaining grower involvement and minimizing program costs."

Like Gray, the focal point of my suggested strategy is a regional seed bank. Again following Gray, this seed bank should provide for "limited seed bank storage." Keeping the seed bank at a modest size would have the advantages of being less costly to maintain, being more energy efficient, and having less of an inventory to replicate, thereby shortening the amount of time and energy it takes to grow out and reproduce the collection. However, the seed bank would need to be large enough to maintain a backup seed supply for crops that are endangered, rare, or otherwise important. This regional seed bank could be part of a larger project that would have a more encompassing range of conservation activities than the purely storage-oriented strategies of conventional seed banks. The larger project could be conceptualized as a "Seed Center" or "Center for Southern Appalachian Plant Biodiversity" (this would leave open the possibility for incorporating native non-agricultural plants) or some other such appropriate name. The Seed Center would consist of a variety of different components including (but not limited to) the following:

(1) Regional Seed Bank-- focusing on preserving target crops that are endangered, rare or otherwise important
(2) Seed Exchange-- identifying, supporting and strengthening current seed exchanges while creating an exchange catalog or website using the Seed Savers Exchange (in Decorah, Iowa) as a possible model
(3) Farmland with acreage devoted to trials of local varieties and plant breeding for new or improved varieties but emphasizing the maintenance of a wide genetic base. Involvement of farmers and gardeners in breeding and improvement projects. Connecting with and providing seed to farmers and projects like the Carolina Farm Stewardship Association's Saving Our Seed program
(4) A connected community supported agriculture that would produce heirloom vegetables for local citizens and promote their use as crops to local farmers and growers

(5) A memory banking project to collect and preserve oral histories about traditional vegetable varieties and farming projects that is potentially connected to a history project/public display about the history of southern Appalachian farming and traditional vegetable varieties
(6) Links to professionals and researchers in anthropology, biology, genetics, Appalachian studies, agroecology, sustainable development, plant breeding, agriculture, etc. at a nearby university
(7) Outreach programs to farmers and growers in the region to maintain varieties in fields and home gardens as *in situ* conservation plots
(8) Encouraging and supporting community seed banks, biodiversity registers or other user groups in appropriate localities
(9) Links to other crop biodiversity conservation projects such as the Southern Seed Legacy

This comprehensive Seed Center for the preservation and promotion of traditional Southern Appalachian vegetable varieties would go a long way toward preserving and enhancing western North Carolina's diminishing crop genetic resources.

Gray (1999) made the case for a seed bank located in central Appalachia to serve as a repository for Appalachian germplasm. His reasons for using central Appalachia as the potential site included: a more recent settlement than other areas in the region, the narrow valleys creating isolated pockets of families growing out differentiated varieties, a late industrialization period (the 1950's), a large number of small and part-time farmers that are characterized by independence and self-reliance, and a wide range of environmental conditions. He also mentioned that being located near a college or university (or having its own qualified staff) would provide the seed bank with technical assistance. Central Appalachia does seem to have characteristics that would make it an appealing place for a regional seed bank.

Western North Carolina is also a good candidate for a seed conservation project. It is very similar to central Appalachia in most of the characteristics that Gray mentioned. It also has a few characteristics that central Appalachia lacks. Western North Carolina's

ecology contains arguably the highest, most rugged, and unique mountain ranges in all of Appalachia. Mount Mitchell is the highest peak in the Eastern U.S. (6,684 feet) and is part of the Black Mountain range that has multiple peaks reaching over 6,000 feet. The amphibolite mountain range in Watauga and Ashe Counties supports two community types that exist nowhere else on earth: the high elevation mafic glade and the southern Appalachian fen. The varied microclimates and elevational grades created by these high mountains allow for a large range of adaptation by plant species. Western North Carolina is also inhabited by the cultural group with the oldest agricultural tradition in the region, the Eastern Band of Cherokee Indians. A wide diversity of native crops can still be seen every fall at the Cherokee Fall Festival. The Cherokee are well known for their indigenous vegetable varieties including "Cherokee White Flour" and "Trail Of Tears" corns; "Candyroaster" squash; "Cherokee Purple" tomato; "Cherokee October" and "Trail Of Tears" beans; and "Cherokee Pumpkin." Potential collaborative projects with the Cherokee people could provide excellent opportunities for conservation and learning. Western North Carolina is also home to three state universities including (Western Carolina in Cullowee, UNC-Asheville, and Appalachian State University in Boone), and several private colleges that have agriculture programs, such as Warren Wilson in Swannanoa. Appalachian State has departments in Appalachian Studies, Biology, Sustainable Development and Anthropology. They have masters degrees in all of these fields except for anthropology. Appalachian State's Biology department has the ability to do molecular and genetic studies and the Sustainable Development program houses the Sustainable Development Teaching and Research Farm and also has potential access to other good sites for trialing and propagating vegetable crops. Watauga and nearby Ashe

and Allegheny counties still contain numerous traditional heirloom vegetable varieties that are being maintained by local farmers and gardeners (See Chapter Five). The area including the counties of Watauga and Ashe, which contain and surround Boone, NC and Appalachian State University, is an ideal location for a southern Appalachian heirloom vegetable conservation project. A seed bank and center in this area of western North Carolina could compliment a similar project in central Appalachia and also contribute to the Southern Seed Legacy and the Saving Our Seed project. The Cullowee and Asheville areas are also legitimate alternative sites for the project. A "Center For Southern Appalachian Plant Diversity" would contribute greatly to sustainable agricultural development and the conservation of the region's remaining plant genetic resources for food and agriculture.

This study attempted to contribute toward the task of preserving some of western North Carolina's heirloom vegetable varieties. The fact that the varieties I have documented are now known outside of the families that have grown them for generations is a good start. The varieties for which I was able to obtain seed samples have been deposited in my personal seed bank and I plan to multiply them to donate samples to the seed bank of the Southern Seed Legacy at The University of Georgia. Transcriptions of the interviews that I conducted with growers will be deposited at the W.L. Eury Appalachian Collection of Belk Library at Appalachian State University and donated to the Southern Seed Legacy. I also am planning to make copies of the variety descriptions detailed in Chapter Five to send out to individuals who participated in this study and to other interested growers and organizations. Currently, I am conducting variety and seed grow-out trials on the Sustainable Development Teaching and Research Farm in Valle

Crucis and will be providing seed to anyone interested in growing them. So in the short term, many of the 134 vegetable varieties that I documented and the cultural information that goes along with them are not in danger of going extinct. But what of the hundreds of other heirloom vegetable varieties that must exist in western North Carolina? It is hoped that my preliminary plan for a "Center For Southern Appalachian Plant Diversity" can contribute to a dialogue that will eventually result in a comprehensive conservation strategy for western North Carolina. It is a region that has a rich heirloom vegetable tradition-- a tradition that contains genetic and cultural information may help toward the survival of future generations.

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APPENDIX A

Interview/Survey Questions

(1.) What community did you grow up in?

(2.) What kind of work do/did you and your parents do?

(3.) Does/Did your family farm?

(4.) If so, what kind of farming did/do they do?

(5.) Do/did you own land or did/do you lease it?

(6.) Does/did your family keep a garden?

(7.) Can you name some of the specific vegetable varieties grown in your family that are not now being grown?

(8.) Can you name any of the specific fruit varieties grown in your family that are not now being grown?

(9.) Can you name the specific vegetable and/or fruit varieties that you or your family are still growing?

(10.) [For each specific variety] How long has this been grown in your family?

(11.) [For each specific variety] Does your family have a story about where this seed originated?

(12.) [For each specific variety] Could you describe the methods you use in growing this variety? (e.g. fertilizers, tillage, cropping strategy).

(13.) [For each specific variety] Is this variety susceptible to any specific diseases or pests?

(14.) [For each specific variety] Are their any specific diseases or pests that this variety is resistant to?

(15.) [For each specific variety] What are the conditions (soil, temperature, elevation, slope etc.) that this variety grows well in? Could you describe the environment that you grown this variety in?

(16.) What methods do you use to start this seed? (Greenhouse, direct seed, inoculate, soak, etc.)

(17.) Are any of these methods different that the way you or any of your family members grew this variety in the past? If so, how did you grow them in the past?

(18.) What makes this a variety that you like to grow?

(19.) Describe the taste of this variety.

(20.) Does your family have any special recipes or ways of preparing this variety?

(21.) Does your family prepare any of these varieties on special occasions or holidays?

(22.) Please describe how you save the seed for this variety.

(23.) Please describe how and where you store this variety.

(24.) Do you can or put up this variety in any specific way?

(25.) Please tell me anything else about these varieties that you can think of. Thanks!

VITA

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