STORAGEWARE AND STATURE IN THE AMERICAN SOUTH:

SOCIOECONOMIC CONDITIONS OF THE SOUTHERN SMALLHOLDER,

1830S-1930S

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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May 2016

Major Subject: Anthropology

ABSTRACT

Small farmers in the 1930s South, particularly those who were not land-owners, are commonly perceived as an impoverished group. Economic, agricultural, and social conditions in the late 19th and early 20th century all played a role in creating this poverty, outside perceptions of regional life and residents, as well as the resulting change in demography of rural areas after the 1930s. In this research, the smallholder framework and multiple scales of analysis provide a general health context for the people of the region and focus on active efforts of small farmers to obtain and store food resources. I juxtapose estimated stature of individuals excavated from southern cemeteries, born between 1770 and 1880, with statures in the United States during that same period. Individuals that comprise the assemblage gathered here are examined by sex, race, and through time to better understand potential differences in group experience. At a smaller scale, food storage materials from 8 archaeological farm sites in the Georgia Piedmont are examined for changes in occurrence prior to 1930. Both data sets are discussed and reflect that southern smallholders carried existing food storage strategies into the early 20th century and general regional health, at least into 1900, likely remained stable because of robust smallholder strategies to maximize opportunities at many levels of economy. Regional stature, and likely general health, by the end of the 19th century does not substantially depart from stature earlier in the century nor are stature patterns notably different from national stature. Likewise, the continued presence of food storageware on farms and the addition of glass containers support the notion that even among Georgia's

poorest residents, farm family foodways continued to encourage food management, storage, and likely home gardening well into the 20th century.

ACKNOWLEDGEMENTS

I want to express my heartfelt thanks to everyone who has made this dissertation a better document and me a better researcher. There are more people who have assisted me than I have thanked by name below. I request forgiveness for my forgetfulness.

I am greatly indebted to my dissertation committee: Alston Thoms, David Carlson, Julia Blackwelder, and Lori Wright. They have sifted through drafts and patiently challenged me. Dr. Thoms has always affably provided theoretical challenges to my own approach; Dr. Carlson came to my rescue—the logic and data herein owe much to his assistance; Dr. Blackwelder has graciously helped me accomplish the balancing act needed of any interdisciplinary work; and Dr. Wright has always worked to keep my biology solid.

I owe gratitude to innumerable people who created the scholarship on which my own work and thoughts have been built. These people have spent countless hours doing good archaeology, bioarchaeology, anthropology, history, medicine, and biology. Specific thanks however is owed to James Wettstaed who graciously shared his research. In addition, I believe the staff at Texas A&M University Interlibrary Loan have expended notable effort over the years fulfilling my requests for obscure gray literature and government documents. Employees and graduate students at several state site files also have my thanks for being easy to reach, quick to respond, and for generally maintaining their state records so well.

I would also like to extend my thanks to many people in the Department of Anthropology and, more recently, in the Department of Hispanic Studies, Department of Sociology, Department of International Studies, and College of Liberal Arts at Texas A&M University. Over the years varying people have kept me employed, helped me navigate paperwork, and done their part to help me figure out how a dissertation and university work. My office mates in particular, Garrett LaPaglia, Erick Armentrout, and Tyler Bright, deserve thanks for creating a supportive place to work and always being ready to listen.

Finally, I owe special thanks to my boosters and writing help for making this document a better read. Neil Puckett, John Albertson, Jacob Baumann, and Thad Bowerman all worked hard to help improve my prose. Patricia Goodson's program taught me that good academic writing is not a secret. Christine Jones has lifted my spirits countless times. Suzanne Eckert treated me as a scholar. She was my friend, encourager, mentor, and fellow theory aficionado, all with admirable professionalism.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

After the Civil War ended in 1865, whites and blacks faced immense economic and social challenges as many fields lay fallow and labor systems evolved for a post-slavery workforce. Federal Reconstruction policies aimed at spurring economic recovery and assuring the civil rights of former slaves largely failed. At the end of reconstruction, the policies had done little to interrupt landownership. A farm tenancy system adopted across the South by the end of reconstruction in 1877 shaped patterns of production and daily life for later generations. In some ways, incremental changes between the 1870s and 1930s altered farm lifeways more than the war. Southerners continued to navigate social and legal changes brought about by emancipation. Many faced economic losses (Ransom and Sutch 1975) and some moved away from the region (Painter 1979). During the decades leading into the 1930s, southern farmers reached an historical peak in cotton production, but agricultural practices began changing too. The boll weevil infestation resulted in significant crop destruction in the 1910s (Lange et al. 2009). World War I and the beginnings of farm mechanization served as both cause and effects of significant demographic and labor out-migration (Higgs 1976). During the Great Depression period of the 1930s these changes became more common. A traditional narrative of economic hardship, agricultural education, and poor health provides the background for my analysis of storageware and stature in the southeastern United States between the 1830s and 1930s.

Cotton production and fluctuating prices have been a central part of the story of Southern agricultural change. The boll weevil entered Texas from Mexico in 1892 and reached Alabama by 1910. Cotton production in Georgia reached an historical high in 1914 with 2.8 million bales produced from the 5.2 million acres under cultivation for the cash crop. The following year, the boll weevil spread to Georgia. Average U.S. market prices for upland cotton between 1902 and 1910 fluctuated from a low of 8.06 cents a pound to a high of 14.69 cents high (Census 1911:17). The Great Migration began in the 1910s as blacks left the region in significant numbers. Some 500,000 individuals left the South by 1920 and even more moved in the next decade (Alexander 1998). Population movement and alternative employment opportunities for all southerners continued with America's involvement in WWI. Participation in cash crop production was prevalent in the region, and the large movement of people out of rural areas strongly suggests that people at the time were seeking better opportunities elsewhere.

During this same period, previously passed federal legislation funded the establishment of agricultural research and education efforts in the United States. In the late 19th century, the First and Second Morrill Acts established public land grant colleges around the nation (Scott 1970). These colleges became home to a variety of public education programs designed to disseminate the latest research related to home and farm life. These programs received formal federal recognition and funding with the Smith Lever Act in 1914 and were collectively known as the Cooperative Extension Program. Instruction ranged widely and included topics designed to improve crop yields, home sanitation, animal husbandry, and food storage practices (Reid 2000). Education programs taught women to use glass storageware, a home activity intended to stretch household finances and improve diets.

Some federal money, non-profit aid organizations, and independent physicians who worked in the South targeted nutritional, infectious, and parasitic disease study and awareness. Perhaps best known was the major roll the Public Health Service (Goldberger et al. 1920; Kunitz 1988; Marks 2003) played in the identification of niacin deficiency. Research conducted in the South determined the etiology of this deficiency in a region where thousands of cases occurred every year (Etheridge 1972:29, 49-50,113). The largely, privately-funded Rockefeller Sanitary Commission educated the public about hookworm infections, other diseases, and preventative measures (Ettling 1981). Estimates of the incidences of any given health problem were broad because of poor diagnosis and documentation, but medical and aid professionals generally agreed that the region's population experienced consistently poor health.

A reading of the medical and agricultural history of the early-20th-century South gives the impression that significant portions of the region's population were 'scraping by'. Many people did not own their farmland and average farm size was small. The 1910 census enumerated that 65.6% of Georgia farms were worked by tenants and calculated a mean 92.6-acre farm size in the state (Census 1913:316-317). Collective evidence suggested that southerners had poor health and finances. The general model is that farm life during this period produced so little for many families that they had less than adequate food and trouble resisting related parasitic and disease insults.

This model obscures important details. Before Agricultural Extension programs taught women how to preserve food in glass canning jars, which were common materials in some homes by the 1930s, potters in the South also produced jars for food storage needs. Historians have documented the resourcefulness of African Americans who actively managed their labor and time under slavery to raise their own gardens, occasional livestock, and supplement their resources and sometimes income (Fogel and Engerman 1974; Otto 1984). Garden foods and food storage could have played an important part in a family's yearly nutrition and finances before the introduction of glass canning jars. Did food production and storage for personal consumption change during the early 1900s? Historical studies of the stature of Americans from war, school, other records suggest that during the 19th-century individuals from farms and rural areas were taller than those from urban areas (Fogel et al. 1983; Margo and Steckel 1983; Sunder 2004). Revolutionary War records show that males from the southeast had a height advantage over those from the Northeast (Margo and Steckel 1983), a pattern than persisted past the 1830s in some areas (Sunder 2004). Why did tall, seemingly healthy, people come to require so much medical aid by the turn of the century?

The primary goal of this study is to develop a robust understanding of small farmers in the southeastern United States by placing detailed information about their foodways and health within an historical and anthropological context. In the late 19th and early 20th century, national narratives characterize the region as a place of poverty and poor health. The research here seeks to more accurately understand the variation of both conditions. Archaeological analysis is used to infer food storage practices and stature estimates are used to evaluate historical patterns of quality of life for Southern farmers during this time.

My research seeks to re-frame the model of small farmer decline in the South within ecology. Doing this allows the existing knowledge of the region and the data analyzed herein to contribute to a cross-cultural perspective of small farmers within state-level societies. My research question aims to better understand the food storage practices of small farmers in the Georgia piedmont between the late 19th and early 20th century and how those practices may have changed over time. I compare and contextualize with bioarchaeological and historical stature data from the southeast in order to use an independent source of information to assess and understand the health and quality of life of small farmers in the region. The material remains of home food preservation from farms sites located in what is now Georgia's Oconee National Forest are examined as a case example. These farms were acquired by the Resettlement Administration program in the early 1940s in an effort to relocate small farmers. The stature estimates utilized come from bioarchaeological examinations of people from cemeteries around the Southeast.

Storageware use on this sample of small farm sites in Georgia is presented in three ways: (1) ceramic and glass artifact counts; (2) relative frequency; and (3) density analysis drawn from the original excavation report. I calculate an abundance index from these data that is designed for the challenge of multi-site comparison, for storageware collectively and by material type. I present all four methods to provide a robust analysis. These data are used to test for changing storageware use in general and by material type.

I use estimated adult stature to infer health during childhood growth and development. I use, in order of preference, the femur, tibia, and humerus length to calculate estimated stature, although a number of osteological measurements can be used. The femur and the tibia have an allometric relation with stature (Jantz et al. 1995). The tibia has a greater reaction to nutritional insults (Jantz and Jantz 1999), while the femur comprises a greater proportion of stature. Both bones have a lower standard of error than other limb bones when estimating maximum living adult stature. The more robust nature of the humerus means it is more often recovered from archaeological contexts than other bones, and it has a relatively low standard of error. Although it is not as responsive to stature change as the femur and tibia, I include it here to ensure a large enough sample size for analysis. I selected skeletal samples cautiously to ensure the most reliable data for comparison with historical studies of stature in both the Southeast and other regions of the Unites States.

The remainder of this dissertation is organized as follows: first, I present the theoretical framework used in guiding my research, some important definitions, and an historical context (Chapter II). I then briefly relate that framework to current archaeological practice, current farming in America, and present the formal hypotheses tested here (Chapter III). As background, the next chapter reviews stature estimation methods, considerations, and previous research (Chapter IV). I continue with stature by outlining my methodology, presenting results of analysis, and comparing those results with previous historical studies (Chapter V). Chapter VI returns to the archaeological sites and presents site excavation, background, and analysis of storageware. The final chapter (Chapter VII) integrates the results of the stature and storageware analysis into a discussion of the changing life of small Southern farmers during this period and reevaluates the original research models presented. I also include suggestions for future research.

CHAPTER II

SMALLHOLDER FOODWAYS, FARMING PRACTICES, AND HEALTH

This study aims to provide a better understanding of small farmer foodways in the southeast after the Civil War and how those practices contributed to regional health. The use of storageware is an indirect indicator of foodways that affected health and influenced stature during development. This chapter places storageware and stature into a general smallholder theoretical framework and illustrates how this twofold analysis serves to provide a more holistic understanding of the quality of life in the South during this time.

I also position Robert Netting's (Netting 1993) smallholder ecology model within the somewhat dichotomic history of the South. Like most model applications, the fit is not perfect. However, I contend it is both suitable and provides a point of common synthesis for the historical context and anthropological study. This chapter defines the smallholder and identifies how farming choices about consumption and subsistence exemplified many southern farmers as smallholders. I examine how Netting's original definition of smallholder eliminated tenants because of post-Civil War patterns of land tenure and ownership. However, the remainder of smallholder attributes were present. This agricultural historical account is important because it was the cultural context that impacted small farmer foodways and regional health patterns. This study identifies all small southern farmers as smallholders, regardless of tenure status.

Consumption, Subsistence, and Smallholder Choice

Archaeologists studying market economies frequently utilize the concept of consumption in their examination of economy, artifact choice, and the formation of the archaeological record (Greene et al. 2008; Stahl et al. 2008; Herva and Nurmi 2009). Those studying cultures with weak or no formal market economy more often utilize the concept of subsistence (Binford 1980; Murty 1981; Richards 2002). The difference between these two is that subsistence involves goods, usually food, obtained directly from the environment and consumption involves goods, food and other items, obtained from the environment and market economy. While this distinction may be useful in some instances, the division potentially obscures the study of agriculturalist subsistence/consumption in a market economy. Farmers' participation in the market is often influenced by and depends upon non-market subsistence strategies, and these strategies inversely depend upon market participation. The smallholder concept combines both market and non-market subsistence and consumption into a single approach.

Robert Netting defined "smallholder" as a small, typically single household unit that concentrated self-sufficient, risk reduction agriculture within a given socio-ecological niche (Netting 1993). His research focused on how smallholders use a variety of diversified crops within social and ecological constraints and opportunities. Smallholders in market economies make socio-ecological decisions about participating in the market economy in varying degrees. In practice, this involves a myriad of choices that balance raising or purchasing stock, fodder, food crops and cash crops, as well as limited hunting and gathering (Murrieta et al. 1999). For example, southern smallholders could grow corn or purchase it. Once obtained it could be eaten, fed to stock, sold for cash, or traded (Hilliard 1972). Livestock and other food crops could be similarly stored, used, or sold depending on the need of the smallholder. Even raising non-edible cash crops required balanced decisions about subsistence; the more cotton grown, the less land planted for food and the more food needed to be purchased. The smallholder model includes methods of food acquisition and production that account for a farmer's ability to produce, hunt, gather, and purchase food. The small, self-sufficient farmer practicing subsistence agriculture and avoiding market participation is an artificial construct. Subsistence is not limited to environmentally obtained food and consumption is not limited to market participation. This study is undertaken with the understanding that smallholder farming strategies vary to take advantage of both the market and other sources of food while making their operations as successful as possible.

Netting's model does not restrict smallholders to a particular socioeconomic class, but in the 19th and early-20th-century South, most with small farms were part of the lower class or the emerging middle class. Douglas and Isherwood's (Douglas 1979) conception of socioeconomic patterns of consumption provides archaeologists an important analytical and interpretive model for site analysis. It identifies a culture's upper class as consumers of ideological products such as artwork and exclusive event participation, the middle class as consumers of material goods, and the lower class as primarily consumers of food. Together they emphasized the importance of understanding economics entirely as a cultural system with different types of participation by different cultural groups. Historical archaeologists have found the three level model of consumption particularly useful. Douglas and Isherwood's model formalized less explicit ideas and methods that some archaeologists previously tested on historical sites (Otto 1977; Klein 1991). Archaeologists studying the upper and middle classes continue to use this model frequently. For example, historic patterns of ceramic purchases by the middle class (Baugher and Venables 1987; Fitts 1999; Wall 1991) and event sponsorship or select opportunities by more elite members of cultures (Emery 2003; van der Veen 2003).

The best way to study Southern smallholders archaeologically is through food remains and related artifacts because they expended most of their resources on these items. Plenty of smallholders owned their own farms, had stable finances, and purchased archaeologically recoverable consumer goods. Others were some of the poorest members of the early-20th-century South. In 1916, Warren and Sydenstricker (Fisher 1997) of the U.S. Public Health Services indicated that a family of five reached a "point of adequate subsistence" at about $800 a year. Census data from 1910 indicated that the mean annual income of black and white sharecroppers in Georgia was $205 and $208 respectively (Alston and Kauffman 2001). Historians and contemporary economists have demonstrated that smallholders in the South spent the majority of their income on food (Morton 1975). Small incomes spending pattern studies both indicate that archaeological focus on food and foodways is a productive way to approach smallholder sites. Zooarchaeology studies are of course well suited for this (Bowen 1975; Lyman 1987; Crabtree 1990), but will fall short of adequate if families did not have meat. Archaeological study of other material types at lower class sites is more challenging. Archaeologists have successfully studied socioeconomic status in the South through material remains, often using tableware ceramics as indicators of purchasing power (Otto 1977; Orser Jr 1987). However, studying socioeconomic status is difficult on the poorest residential sites where income to make those purchases was to limited (Smith 1987). Site occupants were not following middle class consumption patterns, and study of artifacts closer to foodways practices, like ceramics used for food storage and preparation, may be more informative.

Using the smallholder model to study small farmers in the South accounts for interrelated behaviors of market participation and self-sufficiency as well as focusing research on lifeways focused around crop cultivation. Southern smallholder foodways exemplified the flexible, diversified, risk-reducing household production strategy common to many small farming groups and Netting's smallholder ideal. Food was in many ways the primary economic focus of southern smallholders, whether the choice was made to grow or purchase food. In addition to crop sales, wages and barter based income was also acquired in other ways such as off-farm jobs taken by men and domestic jobs taken by women (Jones 2002). Although foodways practices of small farmers in the South before 1940 fit the smallholder model well, patterns of land tenure perhaps do not. Netting allows for sharecropping, other forms of tenancy, and different degrees of land ownership but insists that strong land security is necessary for invested renewable farming (Netting 1993:185-187). Traditional economic history portrays a pattern of southern property tenure that discouraged land stewardship. In the next section, I review land and crop ownership and examine potential problems with the use of the smallholder model in the historic southeast.

General Land and Crop Ownership

All Southern agriculturalists prior to the Civil War, large plantation owners, small slave owners, smallholders, landless laborers both free and enslaved people (Kennedy 1864:594-595), had some opportunity to make cultivation decisions. Smallholders were at liberty to make their own decisions about farm production, but slaves had some opportunity to make cultivation decision as well (Westmacott 1992:16-18). Plantations depended upon slaves to raise profitable cash crops and owners or managers almost exclusively made those decisions (Faust 1985). However, slaves produced food for plantation residents and were sometimes allowed, or even expected, to produce their own food in spaces set aside for them (Morris 1998; Gibbs 1999). In gardens slaves likely made their own decisions about cultivation. It would also be their choice to eat, trade, or sell what they grew and raised.

Antebellum period small farmers reflect the smallholder pattern of crop and land control well. Smallholders, no matter their race, placed primary importance upon food production and raised cash crops when possible for monetary income. Often corn was a preferred cash crop because of the flexibility it offered. Economic anthropologists recognize this as a temporal diversification risk reduction strategy (Marston 2011). Corn could be fed to livestock, sold if the market was good or cash was needed, or eaten by the family. Even post-harvest foliage offered valuable fodder for livestock (Blevins 1998). This economic strategy was particularly common in mountain regions where many smallholders lived as well as among plantation owners who sought to efficiently feed a workforce while attempting to maintain a profitable plantation (Dunaway 2003). Little research has focused on landless agricultural laborers prior to the Civil War, but they also have a place in the smallholder model. These individuals were new residents or the sons of smallholders, both groups sought money and experience for the farms that they hoped to purchase (Kloppenburg Jr and Geisler 1985; Atack 1989). This labor flexibility, both before and after the Civil War, is one-way labor organization in the region also conforms to the smallholder model. Members of an existing landed household could allocate their time to household production when necessary or work for others to acquire additional income.

Many small farmers had less than complete control over cultivation decisions after the Civil War, a departure from Netting's smallholder ideal. Concepts and control of farmland, labor, and crop decisions changed. These changes pushed individuals towards greater production of cash crops on all Southern farms (Ransom and Sutch 1975; Wright and Kunreuther 1975; Reid 1979), potentially at the expense of food crops. Plantations continued as cash crop producing ventures. Despite the family farm appearance, for most farm tenants, crop decisions were still often made by landowners. Varying yearly contracts typically fell into one of three groups. Sharecropper contracts paid the smallholder a percentage of the final crop to the land owner. Sharerenter contracts paid the landowner a set amount of crop and renters paid cash to the landowner at the end of the year. Sharecropper and even share renter contracts often dictated what kind crop was planted. Renters were given the greatest decision making power. They were typically not provided with items needed for farming by the landowner and paid a set cash amount at the end of the year. Renters assumed all the risk of farming but had complete control over what was grown (Bode and Ginter 2008). Renters and share-renters were far fewer in number compared to sharecroppers.

Traditional models suggest that contracts potentially required so much land to be devoted to cash crops that little remained to grow food (Ransom and Sutch 1975). The suggestion is that garden space was sacrificed to plant as much land as possible in cash crops to cover expenses. Marable (1979) proposed this was an intentional move to bind black freedmen and landless whites to landowners. For farmers who could not grow enough food, landowners or other store proprietors offered food sold for a promise of cash or the crop itself at harvest time. If crop expectations fell short, the farmer out of necessity had already purchased more food than he could pay for. If the debt holder was less than honest with prices or account management, the farmer found himself needing to plant more cash crops the next year to cover the debt. With limited land, labor, and resources, this pressure resulted in even less land devoted to food production. Garden spaces were sacrificed and non-edible cash crops were preferred over corn. proposed this was an intentional move to bind black freedmen and landless whites to landowners. For farmers who could not grow enough food, landowners or other store proprietors offered food sold for a promise of cash or the crop itself at harvest time. The farmer out of necessity had already purchased more food than he could pay for out of necessity, even if crop expectations fell short. If the debt holder was less than honest with prices or account management, the farmer found himself needing to plant more cash crops the next year to cover the debt. With limited land, labor, and resources, this pressure resulted in even less land devoted to food production. Garden spaces were sacrificed and non-edible cash crops were preferred over corn.

Smallholders who owned their land after the Civil War faced a similar constraint. Individual farms faced potential labor problems as many farmers died or were disabled during the war. Those who supported the Confederacy, voluntarily or not, lost money and livestock. These farmers often acquired credit with banks and store owners who, in turn, could require a certain amount of cash crops planted (Fite 1979). Cotton was the most frequent crop demanded. As cotton production rose, cotton prices fell. The boll weevil began to destroy crops and compounded the problem by providing farmers with little cash after the harvest. Cotton production in the South gradually increased after the first World War, reaching a peak of production between 1926 and 1930 (Morton 1975:517). The increase is often attributed to previously unfarmed land added to cultivation and farmers replacing other cash crops with cotton, but it is possible that pressured farmers replaced even garden land with cash crops. The financially-weak South faced recessions, fluctuating and cotton prices throughout the late 19th and early 20th century, and insect infestations of cotton crops (Wright 1986).

Historical records of stature indicate favorable heights in the early 19th century South, but late 19th and early-20th-century health officials and social workers, as well as historians, chronicled poor health throughout the South. It is uncertain if health genuinely declined, was a continuation of poor heath from earlier periods, or was a result of changing perceptions of health and the region. Economic conditions of the South were cited as a critical factor contributing to poor health. Inadequate nutrition, parasite, and disease loads were not as pervasive in other areas of the country (Butler 1910; Goldberger, et al. 1920; Kunitz 1988). This recognition likely emerged from several perspectives. At least in part, an increased awareness of disease and social responsibility in the United States at the time could create a perception of poorer health. Alternatively, declining conditions as large numbers of smallholders were unable to maintain farming strategies that provided adequate food quantity and quality may have led to a real decline. Although it is difficult to assess how often cash crops were preferentially panted at the cost of food crops, evidence suggests it may have been frequent and widespread throughout the South. On a regional scale many smallholders, both owners and tenants, had less choice in the early 20th century in how much land they devoted to edible cash crops, non-edible cash crops, as well as gardens. Although, not all historians agree that the constraint to grow non-edible cash crops was significant (DeCanio 1974). Non-farming landowners, creditors, and smallholders all desired cash crops but only farm households had an immediate concern with producing food. This increasing pressure to grow cash crops may have had a major effect on food production and consequently food storage and the health of smallholders.

The loss of control over land and crop decisions precludes small southern farmers from being identified as smallholders. An available alternative model, I could consider southern small farmers as a general class of agrarian peasants (Wolf 1966) within the United States. Wolf's peasantry broadly includes any group living marginally and passing along their surplus to elites or the state. The peasant model would provide an excellent starting point for a concentrated study of class relations and the farmers place within the state in the postbellum South. Use of the smallholder concept, instead allows focus on farmer practices within their social, economic, and ecological condition. I advocate other essential characteristics are present and the term is fitting. Even Netting recognized that the many "characteristics regularly co-occur" and interrelate in dynamic ways (Netting 1993:2).

Two smallholder characteristics that are present in the period include family labor structures and consistent community residence. After the war plantation owners ensured that cash crops were the primary agricultural focus, but former slaves and other farmers who did not own their land restructured plantations into smallholder farms in a number of ways. Actual residency patterns changed; slaves' houses were previously grouped in close proximity to one another (Vlach 1993). In the late 19th and early-20th-century, the houses of plantation residents were dispersed onto individual small farm sized plots. These residences were documented as family farms in the 1880 census (Virts 1987:985) Labor organization on plantations also changed as owners ceased to dictate time management and living arrangements. Former slaves and their children restructured their daily work around the family, a labor system sometimes referenced as the squad system (Shlomowitz 1982; Tolnay 1984), assuming the same agrarian household structure as their neighbors and all smallholder households. Netting's classic definition of smallholders only includes households with strong tenure rights to their land that reinvest in its improvements (Netting 1993:2, 82). It is reasonable to assume that some Southern smallholders lacked strong tenure rights. However, many did own their own farms, tenants frequently reoccupied the same home-site every year with contract renewal (Reid 1979:36), and if they moved almost all tenants remained in the same community (Wright 1986). All maneuvered their jobs, cropland, family roles, and market participation in a manner that makes the smallholder model fitting.

The above economic history model indicates a potential decline in food cultivation by Southern smallholders in the early 20th century, but an alternative narrative that supported and encouraged food production exists. Continuing to structure responsibilities around the family served to encourage food production. Women and children made significant contributions to their household's success and health with food production endeavors that were often exclusively theirs. Their efforts included raising poultry and gardening in addition to their contributions in the field. Gardens would have provided a significant portion of the diet, important micronutrients, and an opportunity for supplemental income. The next section briefly underscores the potential importance of garden foods.

Growing Food and the Importance of Food Storage

Cultivated foods in the South can be divided into two conceptual, but not necessarily strict(Spencer-Wood 1999:164-167), farm areas and gender domains (Stine 1991; 1992; Walker 2000). Edible field crops were grown beyond the immediate yard and outbuildings and typically controlled by men. They received larger plantings than garden foods, could and often were used as animal food, could be sold if needed, and were more likely to be stored in farm outbuildings if they were available. Exceptions existed to planting patterns and gendered labor and control. Fields could extend into yard areas. Field cultivation by women and children, although not a cultural ideal, was common (Stine 1992). Examples of edible field crops in the South include corn, sorghum, sugarcane, and sweet potatoes, but only corn represented a typical dietary staple. These foods were the common carbohydrates in the South as well as the primary supplement to grazing and foraging for farm livestock (Van Willigen and Van Willigen 2006:115, 120). Their larger fields would be the first areas reduced or replaced with non-edible cash crops as smallholders altered crop decisions to meet their needs. In particular, if they needed to maximize the market sales of their crop.

The second domain contains primarily edible foods gown in garden plots typically closer to the residence and most frequently managed by women. Gardens contained a variety of fruits and vegetables and were planted in smaller plots than field crops (Van Willigen and Van Willigen 2006:101). Typical plants included beans, potatoes, tomatoes, onions, and turnips among others. If pressured to increase cash crops, gardens would be one of the last areas to be over-planted. Income increase would be smaller because garden plots were smaller, women many have objected to the displacement of gardens, and even farm owners with tenants recognized the value of family gardens (Van Willigen and Van Willigen 2006:89-90). Garden foods were perishable if not processed correctly, and doing so was almost exclusively the task of women and children (Reid 2000; Van Willigen and Van Willigen 2006).

The loss of edible field crops and garden foods had different impacts upon diet. Field food crops were easier to replace with purchases from stores, landowners, or surplus from family and neighbors. They were less perishable after harvest and could be stored and used through the year, or sold if needed. Without staple field crops diets were potentially inadequate in quantity. If garden crops were removed from the diet, smallholders risked overall energy deficiency as well as micronutrient problems as well (Davidson et al. 2002:247). Garden foods were likely not the bulk of the diet but did provide essential nutrients. They were not available in the winter and early spring if not stored by the family at harvest time and this seasonal period may be when families were most vulnerable. Family case histories collected for dietary studies in the 1920s indicate that, outside of institutions, seasonal shortages affected children most (Etheridge 1972).

Diversified cultivation efforts were a part of the risk-reduction strategy of Southern smallholders, and food storage could also be part of this strategy. Planting a number of food crops both in the field and in the garden provided smallholders multiple options for food, neighbor exchange, as well as cash sales (Van Willigen and Van Willigen 2006). The conceptual structure is successful smallholder had less debt and greater control over planting strategies that, in a recurrent manner, allowed successful flexible management practices that helped the family stay out of debt. Food storage could help stabilize food resources during an annual cycle (Van Willigen and Van Willigen 2006:203). Preservation methods included sugaring, pickling, or fermenting foods in stoneware or glass vessels often kept in or near the home (Van Willigen and Van Willigen 2006:203-220). These foods could be sold or gifted but were primarily for use by the smallholder. A small part of the diet, stored foods could be critical when resources were low.

Historical Stature Studies and the South

Studies of historical stature records provide a different measure of the quality of life in the 19th century and this research, to date has found no clear evidence of a post-Civil War change in final adult heights. The earliest historical data sets considered in the United States included military school cadets (Komlos 1987; Coclanis and Komlos 1995), Union solders (Margo and Steckel 1982; 1983), convicts (Komlos and Coclanis 1997), and antebellum records of free and enslaved blacks (Margo and Steckel 1982; Komlos 1992; Bodenhorn 1999). These sources often provided sample sizes much larger than can be obtained from skeletal sources but were predominantly male and potentially did not represent the general population well. Studies rarely included females and each had project-specific challenges, such as the potential to question how well pre-emancipation freedmen in the South represented the general population. Convict samples likely included greater proportions of individuals with lower socioeconomic status. More recent historical stature studies have sought to broaden analysis to include other groups such as female convicts (Carson 2011), higher status US passport applicants (Sunder 2013), and a larger geographic area of incarceration (Carson 2009).

Some of this previous research did note a decline in stature that reached a minimum around the 1830s. This decline was coined the 'Antebellum Puzzle' (Komlos 1996) and Komlos proposed the timing coincided with lowering wages and an increase in the cost of food that may have resulted in declining nutrition. The data analysis and the proposed explanation was not without criticism (Gallman 1996), and most studies following this observation did not observe this antebellum period decline. However, following detailed analysis from many of the stature studies cited above, I believe it is reasonable to expect future stature analysis to confirm that people, in the 19th century, tended to be taller if they spent their childhood in rural areas, on farms, or in the southeast. This pattern is not universally demonstrated, and when observed the statistically significant difference is small, but it does occur often (Sokoloff and Villaflor 1982; Margo and Steckel 1983; Komlos 1987; Steckel 1995; Carson 2008). Identifying elements of the economy, nutrition, the disease environment, or any other dominate factor that changed stature over a century or more is difficult. Instead, I aim to contribute additional skeletal stature data to the conversation, an effort that needs updating (Steckel and Rose 2002), and to bring together bioarchaeological and archaeological research approaches to indirectly studying diet in the South.

Gardening, Storageware, and Stature

This chapter has presented two potentially conflicting narratives from economic and social history. One focuses on a region in decline with many small farmers stuck in a debt cycle and in poor health during the early 20th century as a result. The other narrative offers small farmers familiar with their environment, growing gardens, and attempting to make the best of cultivation opportunities. Neither perspective is wrong, but presenting one without the other leaves someone's story untold.

Analyzing storageware, both glass and stoneware, from smallholder sites and general stature patterns of the southeast allows evaluation of both perspectives. The storageware recovered from smallholder residential sites provides evidence of garden crop preservation. Gardens themselves are evidence of a smallholder family making at least some decisions about their food production and general crop strategies. These families are potentially in better health overwinter, and in general, than other smallholders who were not growing gardens and storing food. Storageware analysis allows a small-scale look at foodways. In addition, stature patterns across the South serve as a broad measure of health. Health is one way of appraising smallholder success beyond market participation. Statures from the region will reflect if smallholders had poorer health, not just smaller finances, than other regions in the country.

CHAPTER III

SMALLHOLDERS IN AMERICAN ARCHAEOLOGY

A short reflection on family farms in modern American agriculture, American archaeology, and within other subdiciplines of anthropology provides a valuable frame of reference for the research presented in subsequent chapters. I define a family farm as land devoted to raising cultivated plants operated by members of a family. This broad definition includes farms ranging in scale from large agricultural operations to kitchen gardens. All farming efforts can play an important role in sustaining a family. Large agricultural operations can provide sole supportive incomes, and small gardens can provide important dietary additions for families with primary income sources outside of cultivation. Most smallholder farms around the world operate somewhere between those two extreme examples. The research framework for studying these smallholders varies by discipline.

American archaeologists tend to implicitly follow modern federal government guidelines and definitions for historical farms. Two financial elements in particular frame their perspective: ownership and income production from crops. National Agricultural Statistics Service (NASS) and US Department of Agriculture (USDA) publications typically identify family farms as owner-operated even though official NASS terms and definitions do not require ownership (Service 2004:26). For example, the 2014 edition of America's Diverse Family Farms defines family farms as those "where the majority of the business is owned by the operator and individuals related to the operator" (United States Department of Agriculture 2014:2). Historical archaeologists echo this approach to some degree. Owner operated farms, as opposed to tenant-operated farms, tend to have more associated historical records, a greater chance of long-term occupation, and more on-site artifacts. This preference for larger established owner sites is a major factor in archaeology's research bias in favor of farms owned by white families (Barile 2004).

The second important financial element in farms identification is income acquired through crop production. Current USDA guidelines place a $1,000 minimum on gross income to distinguish between a farm and a rural residence. Historically, agricultural census enumerators only considered farm products produced for the market. A prime example of American archaeology's requirement for cash crops is *Tilling the Earth: Georgia's Historic Agricultural Heritage-a Context* (Messick et al. 2001). *Tilling the Earth* provides a framework to federal and state agencies, as well as CRM groups, to assess "agrarian resources for nomination to the National Register of Historic Places" (Messick, et al. 2001:2). Agricultural properties are defined as those "created and maintained primarily for the purpose of cultivating the earth, producing crops, and/or raising livestock (Messick, et al. 2001:49)". The writers further clarify that if "occupants found employment in some sector other than agriculture [it] is not an agricultural property even if it contains a garden to supply vegetables for the family table and livestock pens to provide chicken, pork or beef" (Messick, et al. 2001:49).

In this definition, the authors effectively excluded study of many small farmers, especially those in the early 20th century. Once non-agrarian wage labor opportunities were available in areas like domestic work, tourism, logging, or manufacturing, many farm family members were also employed in other sectors. Work was often limited to project duration, seasonal, or piece-work. Wage labor in the post-war South was dominated by single men 25 years old and younger who held off-farm jobs (Wright 1986). Social scientists have termed this mixed on and off-farm work strategy "occupational pluralism" although most archaeologists would simply refer to these actions as a form of resource diversification. Off-farm contributions to small acre farms probably increased as the United States moved closer to WWII. However, the primary purpose of a farm remained agricultural production for subsistence and even garden crops were an important component of maintaining family well-being.

Cultural anthropologists and agricultural researchers working elsewhere in the world recognize the important role small farms play in family livelihood. The Food and Agricultural Organization (FAO) of the United Nations (UN) notes that small family farms around the world are typically 2 hectares or less and typically just over 50% of family income is acquired off-farm (Food and Agriculture Organization of the United Nations 2015). Cultural studies among different rural peoples have long recognized the variable and often flexible contributions of farming, crafting, and off-farm work to supporting the family (DeWalt 1983). These studies recognize the role of growing crops despite the fact that many are used for subsistence only and never marketed. These smallholder farms with variable sources of income mirror the sites included in the study here. In contrast, folklorists and social historians studying small farmers in the recent past and contemporary America often downplay crop contribution to family income. These studies instead emphasize the culture, values, and identity coupled with rural life and farming. Off-farm employment is interpreted primarily as weakening these qualities rather than providing income that supported the family and farm (Van Willigen and Van Willigen 2006).

American archaeologists' tendency to share farm definitions with modern agricultural policy and to focus on the values and identity of rural farming creates two research problems. First, basing value and identity within the farming role, rather than historically researching perceptions of the smallholders, creates a false ideal that causes researchers to devalue smallholders work outside of agriculture. Second, small farmers of the first half of the 1900s remain understudied. Off-farm wage employment became a lasting part of livelihood efforts of all families who remained in rural areas after the rural-urban migration. During this period off-farm employment became the standard as jobs became more common and modern transportation made daily travel to urban areas possible. In 2010, 91% of family farms had at least one family member who was employed off the farm (Brown and Weber 2013). Much of the American rural population is excluded from study if properties occupied by operators employed off-farm are not included. Failing to study these smallholders at the moment of transition when wage employment became part of traditional farm diversification is a misstep. In contrast, the approach taken in this study includes several rural properties without focus on employment, ownership, and tenancy status. Off-farm employment is a part of varied livelihood efforts by smallholders around the world, including the historic southeast.

Studying American smallholders at this moment of transition is important because the associated changes in lifeways may have large impacts upon a population's health. On a broad, deep time scale anthropology has demonstrated that the adoption of farming often had negative health consequences (Cohen and Armelagos 1984; Larsen 1995). However, when focus shifts to more recent time periods, examples indicate that being a small farmer or living near them offers health advantages. Historically recorded statures in 19th century America suggest farmers reached greater heights and were less effected by income fluctuations than the growing middle class (Komlos 1987; Sunder 2004). Joseph Goldberger's detailed data collection in the early 1900s South consistently indicated that urban residents with gardens, or living near farmers that grew food crops, were typically better protected from micronutrient deficiencies than those without close food resources (Etheridge 1972:124-134).

The smallholder farm potentially has an important role to play in health of contemporary Americans. The contribution small farms around the world make toward maintaining wellbeing for their residents and neighbors is recognized by the World Health Organization (Scialabba et al. 2014). These small farms easily embrace agroecological practices that simultaneously promote productivity and sustainability with low cost and local technology. Farms in the United States today increasingly fall in an inverted bell shape with most farms being large or small. While the mean farm size is 234 acres (94.69 ha.), a midsized U.S. farm, half of all farms are 45 acres (18.21 ha.) or less and the midpoint of farm cropland holding was 1105 acres (447.18 ha.) in 2011 (MacDonald et al. 2013). Understanding the role of smallholder farms in America's past can contribute to the modern dialog about small farms as their numbers increase and small farmers search for their role in 21st century American agriculture. Using the smallholder concept is advantageous for modern small farmers and archaeologists studying them in the past.

My theoretical orientation for this research is primarily rooted with the works of cultural ecologists and researchers in various disciplines that study small farmers, sometimes collectively falling under the agroecology umbrella. My concern with the motivation and mechanisms of crop production (agricultural, horticultural, and garden) have their origins in Boserup's (2005) models of intensification but are not limited to the strict requirement of decreasing labor efficiency with increased production (Stone and Downum 1999; Morgan 2015). Instead, my broad interest is more in line with Netting's (1993) general concern with land productivity and the flexibility of family labor. Like many archaeologists, I am interested in people living within the landscape. I turn to agroecology (Dalgaard et al. 2003) to broaden that research frame to include the ability of humans, especially those in agricultural systems, to create their environment. Ultimately, I am concerned with how this ability to alter and create environments impacts health.

Concluding Comments

The small southern farmer in the late 19th and early 20th century remains wedged between ostensible contradictions. Is it accurate to view these farmers as smallholders, the resilient-poor with diversified efforts to maintain their livelihood, or as the destitute-poor coerced into raising cash crops by an evolving market economy that would soon have no place for them? A more objective history lies somewhere between the two extremes. Analysis can further knowledge about the period and help identify a more holistic and robust history. In the chapters to follow, stature analysis grants a broad cumulative view of health during childhood. Studying the net result avoids the potential error of overemphasizing a particular etiology or period. Archaeological study of farm sites allows direct study of the material results of smallholder choices and actions.

More than half of the residents of all southern states were still living in rural areas in the 1940s. Rural life on a small farm conferred a quality of life advantage to many. Diversified efforts by farm families to maintain their quality of life included cash crops, gardening, and wage labor are common to smallholders across geographic regions and time periods. However, after 1900 southern farmers are marked as a population with poor nutrition and a high disease load. The accompanying economic story features small farmers focused on cash crops that destroy soils, who reduced food production, and frequently turned to wage labor to make ends meet (Wright 1978; 1986). This takes place when agriculture became increasingly science driven and mechanized. Government involvement in agricultural programs and research increased. Concepts and land ownership law changed in favor of large land holders as the open range closed. In many ways the predominant perception marks this period as the end of the smallholder in America. I question if this end was brought about through changing definitions and perceptions as much as it was by changing demographics and mechanized agriculture. My research does not directly address this question but does examine a portion of farmer lifeways during the period of transition.

Intensification, occupational pluralism, and other forms of multitasking are all employed by smallholders attempting to produce more with an unchanging resources base or produce the same amount with a smaller resource base. Here, the historical ecological model is that smallholders were attempting to provide for the needs of a family on smaller farms and potentially on poorer soils (Galang et al. 2007). One intensification method available to smallholders was to increase gardening and food storage efforts. One archaeological indicator of this practice is continued recovery of storageware from early 20th-century farm sites. Artifacts recovered from eight Georgia piedmont farms will be analyzed specifically for changes in storageware.

A common measure of success for modern smallholders is their health. My research uses stature as a non-specific way to evaluate health, similar to other in modern, historical, and archaeological population studies. As a region, if southern farmers successfully intensified and managed food resources this should be reflected in adult statures in the 19th and 20th century. Although adequate nutrition is not the sole factor to influence adult stature, it can be a dominant one. Smallholders in poverty unable to garden would have reduced food resources. Shipping food was just beginning in the early 20th century. Non-farmers were closely dependent upon local farm products or their own gardens. To evaluate health trends in the South, the adult stature trends of people buried in southeastern cemeteries are analyzed here. The net effects of major regional subsistence changes on childhood growth and development should be evident in adult stature changes.

CHAPTER IV

ESTIMATING STATURE

Estimating stature and using it as a crude measure of childhood health is based upon a lot of prior research. Some of this background is presented here to provide an awareness of the many disciplines involved and factors that need to be considered. This chapter will briefly review the power of nutrition to affect stature as well as other factors during growth and development that potentially influence adult stature. Closely related research studies the body's potential for catchup growth, periods of accelerated or prolonged growth that may result in individuals obtaining expected age specific stature following an insult. Drawing conclusions from an individual's maximum stature or from a population's average stature are significant differently scaled exercises. I briefly review both bioarchaeology and economic historian's considerations and approaches to problems of scale. I end the chapter with a roughly chronological history of stature estimation methods from skeletons and related methodological issues as background for my own choice of methods and analysis in the next chapter.

Growth, Development, and Catching Up

The first group of factors to keep in mind is the timing and type of insult upon the body that can create variable effects on growth. Multi-factor studies of large 21st-century cohorts, especially those conducted in countries with newly expanded industrial economies, are furthering efforts to understand these effects and to sort the social and biological factors that impact growth. Emerging patterns in developmental biology indicate that leg and trunk length respond independently to different growth factors

(Gunnell et al. 1998; Bogin et al. 2002; Gunnell 2002; Wadsworth et al. 2002). These early studies indicate nutrition is closer associated with leg length, and childhood illness is closer associated with trunk length. Strong instances of psychological trauma can stunt child growth by disrupting the endocrine system, altering sleep enough to affect growth hormones, and inducing coping behaviors that alter diet (Gilmour and Skuse 1999). Although it is difficult to study, another important factor is the influence of mother's health during an individual's fetal development. Studies to date correlate birth-weight, parental height, socioeconomic status, and other measures of maternal health with stature, both leg and trunk length (Waterlow 1994; Gunnell 2002). Body responses to insults vary in ways that are not agreed upon even in the different research programs dedicated to their study. I cannot account for fetal development in the analysis here, but they are important to keep in mind for analysis of a population. It is worth reiterating that in poor socioeconomic conditions, inadequate nutrition and other poor health factors co-occur so commonly that maximum height measurements serve as a broad indicator of childhood conditions (Bogin, et al. 2002; Webb et al. 2008). Ultimately, the research reviewed here emphasizes the use of adult height as a measure of aggregate level broad group health status during development.

The potential for catchup growth to obscure childhood delays in stature achievement has always been a concern for researchers. The premise is that accelerated growth may occur when an insult is removed allowing an individual to resume growth and reach age appropriate growth standards (Prader et al. 1963; Martorell et al. 1994). If individuals grow faster or grow longer they can potentially attain adult statures that obscure poor childhood conditions. A dominant voice in economic history stature studies, Steckel (Steckel 1986; 1986; 2009) has long maintained that his analysis of height and mortality data for enslaved children in the United States between 1820 and 1860 demonstrates significant catchup growth. Children who reached working age received adequate nutrition and attained final adult heights that were greater than contemporary slave populations and European groups elsewhere in the world (Steckel 1986). Yet, Komlos (Komlos 1992:300) has questioned Steckel's conclusions. He expressed concern that Steckel's data shows very poor growth prior to puberty, that older teens remain much shorter than they should be if catchup growth was adequate, and that the much earlier catchup growth of females remains unexplained. Komlos suggests that the sample contains an unknown bias. Others have confirmed Steckel's results (Pritchett and Freudenberger 1992), but their analysis highlights the common finding of subpopulations with growth patterns that differ from the population at large.

Human biological research into catchup growth indicates that people certainly resume growth after an insult, but that final height is consistently compromised. Studies of growth among contemporary populations indicate that favorable conditions allow resumed growth but stunted individuals do not fully regain lost stature (Reyes and Malina 2001; Vicens-Calvet et al. 2002; Schooling et al. 2008). Age and sex impact how the body responds to an improvement in conditions. For example, studies of modern children in Mexico and Guatemala indicate the body attempts to maintain skeletal maturation at the cost of overall growth (Reyes and Malina 2001), for females in particular (Bogin et al. 1989). Continued maturation can limit catchup growth significant enough to recover from stunting. There is evidence that males from lower socioeconomic groups start the adolescent growth spurt later and continue to grow longer than those from more advantaged groups (Bogin, et al. 1989; Bogin et al. 1992). This seemingly offers potential for catchup, but final adult statures for these groups remain significantly shorter than statures of more advantaged groups. The occurrence of early or late puberty compared to unstunted peers is debated (Vicens-Calvet, et al. 2002; Proos and Gustafsson 2012), but attaining final height earlier or later does not necessitate a particular height attainment. Research on the mechanisms and details of growth and development are ongoing but, studies do agree that above average growth during puberty does not occur for short children. Disadvantaged children may continue to grow longer than their better-off peers. However, they typically do not recover enough height during the pubertal growth spurt to match the final adult heights of their unstunted peers. This is both because of biological limits of growth and because poor growth environments tend to extend throughout an individual's growth period.

An important ongoing question in growth and development studies concerns potential for females to catchup, recover from insult; or to buffer insults, and thereby prevent lasting impact, better than males against bad environmental conditions. It has been noted that female stature may reflect prior childhood insult despite later improved growth opportunities during puberty. Research among middle class women in China suggests that females who experienced growth acceleration, or who continued to mature while their bodies faced insult, reached puberty earlier than their peers or while still stunted. The authors suggest estrogen causes long bone growth to cease, leaving compromised individuals stunted regardless of potential favorable growth during puberty (Schooling, et al. 2008). Counter examples come from Africa where undernourished females, like the Guatemalan boys referenced above, delay adolescent growth and experience a longer period of growth (Cameron et al. 1994; Martorell et al. 1994). These children may reach greater than expected adult heights (Dettwyler 1992). The particular mechanisms and interactions between the endocrine system, skeletal ossification, and final stature is intricate and the question of whether or not females are uniquely resistant to the effects of insult remain unanswered (Stinson 1985; 2012). However, insult strong enough to result in stunting during childhood results in shorter final adult stature for men and women (Gunnell 2002; Wadsworth, et al. 2002; Webb, et al. 2008).

I make a distinction here between potential for catchup growth in the first two years of infancy and the remainder of life. Biological studies indicate that up until age two, children have great potential for catchup growth. Eighty-seven percent of infants born underweight, or small-for-gestational-age, experience extensive catchup growth by age two (Vicens-Calvet, et al. 2002). Individuals without a direct developmental defect that miss this opportune window, however, seldom obtain average height. Analysis of heights of individuals stunted before puberty and at adulthood indicate that even when growth rate during puberty is normal, compared to children of average height, these stunted children grow up to be short adults (Chaussain et al. 1994; Leger et al. 1998; Vicens-Calvet, et al. 2002).

Life during gestation and infancy can impact later growth and health. Generational effects may retard an individual's growth outside of their own direct childhood experiences. Research into the Fetal Origins Hypothesis (Barker 1995; Steckel 2009) concludes that poor health during gestation results in lifelong negative consequences for health. Of greater concern to my research is the Intergenerational Influences Hypothesis (Emanuel et al. 1992). This hypothesis states that a mother with stunted growth will provide a poor uterine environment (Karlberg 1987; Schooling, et al. 2008). This has implications for a child's development creating potentially lifelong growth and health consequences for which the social, dietary, and disease causes ultimately occurred at least a generation prior. Studies since the 1980s have confirmed that maternal health, factors such as mother's weight at birth, mother's length at birth, and mother's diet during pregnancy, has a statistically significant affect upon a child's size at birth (Ramakrishnan et al. 1999). Longitudinal studies of infants suggest that with appropriate growing conditions, most infants can catchup from low birth size in their first year of life (Smith et al. 1976; Mei et al. 2004). However, early environmental conditions and cultural decisions regarding breast feeding, supplemental foods, and disease all potentially cause significant malnutrition or diarrheal disease; the weanling dilemma (Dettwyler and Fishman 1992). The relationship between the gestational environment and the co-occurring tendency of poor socioeconomic conditions to persist from one generation to the next, providing poor conditions for childhood growth, is unclear. What is lacking, but needed to clarify some of the disparate data, are studies that examine birth size, first year growth changes, and final adult stature. In the context of my research, insults to both mother and child during gestation are considered for my research here, part of development prior to adulthood.

Genetic research consistently confirms that stature is a highly heritable polygenic characteristic for individuals. Genetic work has attempted to identify the specific loci linked to height heritability (Palmert and Hirschhorn 2003; Perola et al. 2007). This research has demonstrated that genetics strongly influence individual adult stature. Studies typically cite about 80% height heritability (Silventoinen et al. 2003; Perola, et al. 2007), but the fact that this percentage is often found to be lower in developing countries (Luke et al. 2001; Li et al. 2004) suggests there is still more for researchers to learn. Like environmental factors, it is likely that different genetic loci affect different elements of growth such as trunk, pelvic, and femur length (Soranzo et al. 2009). Additionally, because stature seems to be strongly tied to genetics, observed differences and changes in height are more likely due to environmental impacts (Bogin et al. 2001; Deaton 2007; McEvoy and Visscher 2009). Genetic origins for height differences between populations was traditionally an unexplored problem, but modern research is beginning study genetic causes for human height variation. Notable instances of groups with unusual height averages exist (Bozzola et al. 2009), but research has not demonstrated genetic origins for population height differences to be common.

The Scale of Stature Studies and Implications for Health

Another relevant general research consideration when conducting stature studies revolves around questions of scale and resulting conclusions about health. The concept of health itself is regularly debated (Larson 1999), but all would agree that assessing an individual's health based upon only one attribute is inadequate. Alternatively, using a universal attribute like stature that is broadly sensitive to insult as a general health index serves a different purpose. Stature studies are useful for understanding human variation and identifying possible population and environmental differences on a larger scale. Using limited factors creates strength in comparing differences but makes it more difficult to identify causes on such a large scale. Like most bioarchaeological and health studies, this study aims for some middle ground by using a single comparative factor at a regional scale within a relatively well known historical context.

The Osteological Paradox is a well-known cautionary warning of scale within bioarchaeology. This model was presented by Wood and colleagues (Wood et al. 1992)] as a critique of demographic and health interpretations from skeletons. They posited that a number of factors, including population change and frailty differences, create an ambiguous relationship between insult observed on skeletons and health. This could potentially lead to poor conclusions about a population's general health. Some responses (Wood, et al. 1992; Goodman 1993) to Osteological Paradox concerns were critical, saying it misrepresented both the goals and practice of bioarchaeology. Most paleopathologists agree it is a significant issue, only partly mitigated in studies that take into account multiple indicators of health, interactions of biology and culture, and variable disease processes.

My research here utilizes one indicator of health to draw conclusions about a group that includes people from a multi-state region. Final adult stature is a cumulative measure of experiences that every adult obtains. During a low-stress period, shorter individuals may be more likely to die because factors that resulted in shorter stature often result in greater frailty (Gunnell et al. 2001; Steckel 2009; Wells 2010). However, every adult potentially contributes to the skeletal record. A community that was not present long enough for a representative sample of people to accumulate may have a statistically right-skewed sample (Byers 1994) with a greater number of shorter individuals from the population contributing to the skeletal sample. This population characteristic is readily observable. Conditions could exist that significantly impact the rate at which frail children survive into adulthood. This level could differ by population, would depend on natural and cultural development conditions during childhood, and may leave a left-skewed sample with a greater number of taller adults present in the skeletal sample. However, stature is a characteristic always present for adult remains preserved in the archaeological record, unlike many insults, frailty, and the likelihood of death. The power of short-term events to alter adult stature for a larger group over multiple generations is limited (Floud and National Bureau of Economic Research 2011).

Stature is a cumulative measure of childhood experiences; reduced stature is a non-specific indicator of insult to growth and development. Stature research addresses a plethora of influencing factors that can either aid or hinder explanation of results. One question among researchers who use stature to measure quality of life trends is what factor, if any, is primary in its effect on stature development. Researchers with an economics perspective often point to the availability and quality of food. Their argument has its roots with McKeown and Gibson (Gibson and McKeown 1950; 1951; 1951; McKeown 1976) who argued that the reduction in mortality in the United Kingdom during the 20th century was primarily a result of increased food per capita and a reduction in malnutrition. Later, others applied and addressed a similar model in the United States (Meeker 1972; 1972; Higgs 1973; 1979). Early economics researchers were quick to recognize that adult stature is a net result of factors. They pointed to diseases, physical stress, and workload in addition to diet (Fogel 1986; Steckel 1986; 2009). Current economic work recognizes nutrition, especially the availability of protein, as the primary factor affecting final adult stature (McMahon 1981; Gallman 1996). My own research here takes a similar approach and relies upon the aggregate effect of net nutrition, that available for growth after other biological demands, upon people in the southeast to make a general assessment of health.

The reality of most research, the present work included, is that scale becomes a key factor in stature research. For example, as pointed out by the authors of the Osteological Paradox, a statement about an individual's health based on stature alone is inadequate. At the other end of the scale, affirming that nutrition plays an important role in the general health and final stature of people in regions and countries is rarely disputed (Baten and Baten 2012). Population level research potentially includes many influencing factors (Steckel 2009); I have touched upon the most relevant here.

Brief History of Stature Estimation

Nineteenth and early-20th-century anthropological efforts to calculate stature from human remains did not begin as way to study health. Studies of race and forensic research produced comparisons, indices, and formulas that correlated osteometrics with height. Estimation from long bones received the greatest emphasis (Rollet 1889; Manouvrier 1892; Pearson 1899; Dupertuis and Hadden 1951). Some estimated stature for individuals utilizing a combination of elements that directly contribute to height (Müller 1935; Breitinger 1937). Occasionally, researchers explored elements like the sternum (Dwight 1890), clavicle (Terry 1932; Olivier 1951; Singh and Sohal 1952), and even other elements (Dwight 1894). In 1890, Dwight (1894) concluded that obtaining a stature through anatomical calculation is best and that estimates from long bones are more reliable than estimates obtained from other elements. Osteologists today agree with his conclusion.

In the 1950s, Trotter and Gleser conducted some of the best-known stature studies. They followed previous findings (Pearson 1899; Dupertuis and Hadden 1951) that demonstrated the superiority of regression formulas over ratio calculations for stature estimates and of the femur and tibia over other long bones. More recent work continues to support that regression formulas are more accurate than ratios (Feldesman and Fountain 1996). What distinguished their work is that they directed more of their inquiries towards age and racial differences in stature (Trotter and Gleser 1951; Trotter and Gleser 1951). This direction exemplifies the change in stature research from the late 19th century and early 20th. Specific methodological issues infrequently considered in the first half of the century, were explicit in their research (Rollet 1889; Trotter and Gleser 1951). These included the effects of age on stature (Rollet 1889; Trotter and Gleser 1951)and potential measurement difference between cadavers and living individuals. Three populations provided the primary basis for Trotter and Gleser's regression formulas for American whites and blacks. Their earliest studies utilized the Smithsonian's Terry Collection, an early-20th-century medical school collection from St.

Louis, Missouri, and American World War II dead repatriated by the American Graves Registration Service (Trotter and Gleser 1952; 1977). War casualties were also the base population for regression formulas following the Korean War, and care was taken to evaluate the best use and accuracy of the equations (Trotter and Gleser 1977). Trotter and Gleser's evaluation of these formulas led them to be direct in warnings about the importance of the reference population being similar when utilizing regression equations to estimate stature (Trotter 1970).

In the 1950s Fully developed an anatomical method of reconstructing stature to aid with European efforts to identify and repatriate service members and citizens killed during WWII (Fully 1956). He combined measurements from the cranium, vertebrae, femur, tibia, talus, and calcaneus with an adjustment factor based on the known heights of living adult male Frenchmen. This method is typically considered superior to estimates derived only from long bones (Lundy 1985; Ousley 1995) when the skeletal elements that contribute to height are available and time permits. Fully's method depends only on the individual in question. One does not need to select an appropriate reference population in order to apply it, unlike the Trotter and Gleser regressions (Trotter 1970). This method can also create a reference collection that allows stature estimation from long bone regression formulas for populations with mixed skeletal preservation (Formicola and Franceschi 1996). Although this last point is of particular importance for the study of archaeologically recovered remains, the Fully method is typically not employed because excavated groups are often small and many recovery operations require expediency. Although the Fully method or long bone regression formulas are the best methods for obtaining postmortem stature measurements, they require well-preserved bones.

Analysis of remains from both archaeological and forensic contexts has prompted many tests to examine the suitability of other skeletal elements for stature estimation. In an effort to leverage the advantage of using long bones when preservation is less than ideal, Steele (Steele and McKern 1969; Steele 1970) updated an earlier method (Müller 1935) that utilized long bone landmarks and length percentages to calculate total bone length that could then be used with existing regression formulas. The results are stature estimates with larger standard deviations. Subsequent work on this approach has shown estimation of bone length also requires population specific standards (Jacobs 1992; Wright and Vasquez 2003). Other efforts evaluated regression formulas based on metacarpals (Musgrave and Harneja 1978; Wilbur 1998), metatarsals (Byers et al. 1989; Wilbur 1998; De Groote and Humphrey 2011), individual vertebral bodies and column portions (Tibbetts 1981; Jason and Taylor 1995), and the calcaneus and talus (Bidmos and Asala 2005; Holland 2005), elements that correlate even less strongly with stature. The consensus by researchers is that all these elements provide an estimate with a large standard deviation that may be useful if necessary for forensic applications. Usefulness in archaeological applications depends upon the care of application by the researcher and the quality of existing knowledge about the population under study. Good archaeological application examples include Wilbur's (1998) study of prehistoric skeletons in Illinois and Wright and Vasquez's (2003) study of modern Maya skeleton.

Regression methods for stature estimation that began development in the late 19th century are still the primary methods in use, but they continue to undergo correction and refinement. In a 1985 case study Lundy (1985) highlighted the affect additional vertebrae may have upon the accuracy of the Fully method, but in 2006 Raxter and colleagues (2006) produced a very thorough reexamination of the method with better measurement descriptions and an improved correction factor. Four years later Raxter and Ruff (2010) tested the concern highlighted by Lundy and concluded that individuals with supernumerary vertebrae should follow the standard Fully method and a slight adjustment should be made for individuals with an extra sacral element. Later work (Auerbach 2011) demonstrated that estimation of missing vertebrae and talocalcaneal elements could allow use of this method more extensively.

If skeletal remains are fragmentary, Steele's method of calculating long bone lengths has also proved useful for several populations. In 1990, Simmons and colleagues (Simmons et al. 1990) improved the accuracy of the method by focusing on seven measurements of the femur, providing better measurement descriptions, and new regression formulas based on the Terry Collection. The accuracy of using fragmentary remains is dependent upon variability in bone length and proportions (Jacobs 1992). These factors are a specific demonstration of why it is important to estimate stature with regression formulas calculated from a similar reference population. Wright and Vasquez (2003) demonstrated this well with their use of Steele's method. They examined 23 measurements on the femur, humerus, tibia, and fibula. Overall, these measurements provide good stature estimates, but the authors concluded that it is best that regression equations be population specific and rely primarily upon articular landmarks rather than muscle attachment points. Subsequently, Bidmos (2008) used six femur landmarks to develop regression formulas for estimating stature of South Africans. Paleoanthropological applications sometimes continue to use muscle attachment landmarks for very fragmentary remains (Gidna and Dominguez-Rodrigo 2013).

Regression equations that utilize complete long bone measurements to estimate stature remain the most common. This method strikes the best balance for expediency, accuracy, and precision for well-preserved skeletal remains from many contexts. In 1992 Jantz (Jantz 1992) sought to determine if Trotter and Gleser's regression equations were still applicable to modern individuals. He compared Trotter and Gleser's measurements of female femora and tibiae with measurements from the Forensic Data Bank and estimated stature for modern forensic cases with the Trotter and Gleser stature equations. Jantz noted a 17.52 mm difference in mean tibiae length between these two methods as well as inconsistent stature estimates from the femur versus tibia. Increased secular stature, changes in body proportion, and poor estimation results from Trotter and Gleser's formula led Jantz to recommend use of regression formulas based on the Forensic Data Bank sample for modern individuals. This recognized inconsistency later led Jantz and colleagues (Jantz et al. 1994) to reconsider Trotter and Gleser's original measurements and equations after obtaining their original data. Careful examination and remeasuring demonstrated that, despite method descriptions that indicated measurement of the maximum length of the tibia, Trotter measured tibiae from the Terry collection without including the length of the medial malleolus. They further tested their conclusion by analyzing the 1958 Korean sample and identified a smaller (1.70-3.63 mm) mismeasure of unknown origin (Jantz, et al. 1995) recommend use of the femur for stature estimation when possible. When use of the tibia is necessary, the malleolus should be excluded or an adjustment made for the maximum length (Jantz 1992). The use of Trotter and Gleser's regression formulas are discussed in more detail below.

Maximum Stature Estimation and the Terry Collection

I chose to carry out my analysis on estimates of completed adult stature rather than conduct analysis directly on long bone lengths. A suitable measure of growth and development could be obtained by using long bone length as a proxy for height (DeWitte and Hughes-Morey 2012), but a primary goal of this study is to integrate cemetery populations with existing historical height studies. Not estimating stature could avoid another level of estimation and error, but historical studies use recorded living height. Adult stature allows the current skeletal data set to be easily comparable to historic sets. To estimate stature from skeletal remains, the thoughtful selection of a reference sample is necessary. A good reference sample mirrors the study group as closely as possible, ideally in terms of diet, genetics, and experiences that can ultimately affect final adult height. If preservation is good, a subsample of the group under study may be selected for detailed stature calculations using the Fully method when preservation is good. This approach would allow construction of formulas for faster height estimation of the remaining sample. In the present work, this method was not an option because soil conditions in the Southeast typically result in poor preservation and because all individuals have been reburied.

Instead, I used Trotter and Gleser's (Trotter and Gleser 1952; 1958) regression formulas because the Terry Collection is the best reference population available to approximate my study sample, despite a few sampling problems. The Terry Collection currently contains the skeletal remains of 1,728 people. Robert J. Terry (Hunt and Albanese 2005) amassed the majority of the extant collection between 1920 and 1941. The birthplace of individuals in the collection is not known but, given the birth dates and historically known migration patterns (Lemann 1992; Gregory 2005), it is likely many were born in the southeast. Birth dates range from 1828 to 1943. The mean birthdates are 1880 and 1884 for men and women respectively. A shortcoming of the collection is that few younger individuals are included (Ousley and Jantz 1998). Most of the individuals died between 60 and 64 (Ousley and Jantz 1998; Hunt and Albanese 2005:414). The collection is comprised of lower socioeconomic people who lived in St. Louis and other areas of Missouri. Often these individuals, or their families, could not pay for burial and their bodies were used for anatomy classes. The limited inclusion of higher economic groups is a point of caution when using the Terry Collection as a reference sample and using Trotter's regression formulas for estimations. Terry noted that many people he received exhibited "undernourishment and in many cases the wasting effects of chronic ailment that brought death." (Terry 1940:453). However, any individuals unable to pay for burial at death may have been of average health before a convalescence left them unable to work prior to their death. The presence of older individuals in the collection actually suggests that the group is not a frail subsampling of the St. Louise area poor. Hunt and Albanese (Hunt and Albanese 2005) have noted many people in the collection may not have lived their childhood in poverty. Their poverty during Great Depression, when many people experienced economic instability, may have reflected a socioeconomic change during adulthood. The generally lower social position, probable birth in the southeast, and contemporary birth dates of many people in the Terry Collection make it a good reference sample for my analysis.

To use the Terry Collection as my reference population, I had to contend with the tibia measurement problem associated with the Troter and Gleser regression formulas. One solution for continuing to use the Trotter and Gleser regression formula for the tibia, despite the measurement problem, is to use the physiological tibia length. Cemetery relocation projects are often under numerous constraints that limit the number of measurements collected. Most projects included in this analysis did not record this measurement. As an alternative, I have used an adjustment prior to the regression formulas when the tibia maximum length was used for stature estimation (Jantz, et al. 1995). This adjustment follows Jantz and Jantz's own method (Jantz and Jantz 1999) for accounting for this error and is based on the average difference between Trotter's maximum tibia length and a remeasure of a sample from the Terry Collection.

Concluding Comments

Maximum adult stature is a cumulative outcome of numerous factors, and a thorough understanding of the interrelationships among nutrition, environment, and genetics is important when conducting stature research. Nutrition and environment are intrinsically linked, often covary, and interact with an individual’s genetic height potential in ways scientists have yet to study. Disease, diet, psychological trauma, and uterine growth conditions are examples of environmental impacts on growth. In turn, these conditions further affect nutrition as nutrients are directed away from growth and towards other needs of the body. In social interactions, conditions that create psychological stress that restrict growth also create conditions that restrict access to food. Environmental conditions affect human health, and human health affects individual and group ability to maintain favorable growth conditions in a given environment. Researchers are improving their understanding of the specific impacts of different sources of insult upon individual growth. Height, however, remains a valid collective measure of general growth conditions during childhood. Adult stature has implications for adult health experiences, achieved socioeconomic status, reproductive success, and effective mental and physical work ability. Using methods derived from an appropriate reference population for estimating adult stature ensures as many cultural and environmental factors as possible are shared by both the reference and study group. Stature is an attribute everyone possesses, and it is a reliable broad measure of past health and growth conditions for past populations.

CHAPTER V

STATURE ANALYSIS

I use completed adult stature, with no adjustment for age-related changes, to test for health differences during development between sex and race groups within the South. I also compare my results to previous stature studies. The null hypothesis for my stature analysis is that there is no significant difference in stature between sexes, between racial groups, through time for the cemetery assemblage. I also hypothesize no difference between the assemblage analyzed here and historically documented patterns, although this cannot be statistically tested. I expect to reject the null hypothesis for difference between sexes. Some degree of sexual dimorphism is present in all human populations. Moreover, cultural experiences likely differed, including differential consumption and division of labor, contributing to sex-based stature differences. If analysis indicates no significant stature difference between males and females, this would be unusual and need additional investigation.

I expect maximum adult stature in the region to decline through time based on historical context. Historical research indicates that farming practices, economics, and disease patterns shifted in the southeast after the Civil War. Smallholders were increasingly pressed into riskier farming choices that fostered poorer diets and higher disease incidence. Although Populist movements in the US during the 1890s suggest some degree of shared political pressure among small farmers around the country (Goodwyn 1978), social and economic disadvantage may have been stronger in the southeast, especially for black farm families who had to contend with racism. Stature in the southeast may have stronger, but similar, patterns compared to historically known trends in other regions. For the present study, all economic classes are analyzed together, and a basic division by race is maintained for comparison purposes. Myriad social relationships, opportunities, and stressors experienced by individuals may create broad similarities and differences across racial groups. However, previously discussed historical stature studies indicate blacks were typically shorter than whites at this time. I expect the same pattern to hold true upon analysis here.

Data Collection

This study includes white and black skeletal remains with available sex, race, burial date, and numerical age estimation reported in osteological assessments, historical records, or archaeological analyses. Table 1 lists cemetery locations, interment dates, and number of individuals. I include individuals 18 or older with at least one complete femur, tibia, or humerus. I calculated stature estimates from maximum bone lengths reported by the original researchers when possible. However, a number of reports did not include original measurements, only stature estimates. In these instances (n=220), authors did not report which element was used for the calculation, and I could not adjust for the tibia error noted in the previous chapter. These estimates were typically made using the same Trotter and Gleser formulas I use in this study. Estimations based on equations for fragmentary remains were excluded.

TABLE 1. Cemeteries with individuals included in the study assemblage.

Cemetery Name	State	Type of Cemetery	Racial Affiliation of Included Individuals	Internment Range-Excavated	Interment Range-Included Individuals	Number of Interments Excavated	Interments Included
Allen Parkway Village	Texas	Community/Hospital	black	1859-1910	1895	446	1
Avondale	Georgia	Community	black	1870-1939	1820-1900	101	10
Big Lazer Creek	Georgia	Community	white	1825-1920	1825-1910	6	3
Boothill	Texas	Community	white	1870-1879	1870-1886	4	4
Byrne	Texas	Community	white	1858-1880	1858-1911	20	6
Cedar Grove	Arkansas	Community	black	1890-1927	1890-1927	89	19
Coffey	Texas	Community	white	1871-1930	1870-1874	3	1
Dallas Freedmen	Texas	Community	black	1869-1907	1869-1907	446	165
Eddy	Arkansas	Community	white	1880-1990	1886-1895	16	2
Elko Switch	Alabama	Community	black	1850-1920	Pre1870-1905±10	56	12
Lions Club	Florida	Community	white	500-1949	1875-1899	8	1
Matagorda	Texas	Community	white	1850-1865	1854-1865	5	1
Missionary Colored	Georgia	Community	black	1881-1885	1881-1885	2	1
Mount Gilead	Georgia	Community	white	1837-1849	1837-1857	31	9
Nancy Creek	Georgia	Community	white	1879-1979	1900-1979	56	2
Oakland	Georgia	Community/State	black	1866-1884	1866-1884	17	4
Old Christ Church	Florida	Community	white	1839-1853	1839-1853	3	2

TABLE 1. Continued.

Cemetery Name	State	Type of Cemetery	Racial Affiliation of Included Individuals	Internment Range-Excavated	Interment Range-Included Individuals	Number of Interments Excavated	Interments Included
Oliver Family	Virginia	Community	white	1860-1869	1863-1864	11	2
Phillips Memorial	Texas	Community	black	Late 1800s-1927	1917	44	1
Pioneer	Texas	Community	white	1853-1921	1905-1921	15	1
Potter Field Greenwood	Texas	Community	white	1878-1911	1878-1911	14	1
Prattville	Alabama	Community	black	1800-1850	1880-1850	16	3
Providence	Tennessee	Community	black	1899-1933	1899-1934	65	31
Quad Block	Florida	Fort/Community	white and black	1824-1846	1835-1842	115	15
St. James	Virginia	Community	white	1840-1899	1830-1900	7	1
St. Marks	Florida	Fort	white	1818-1821	1818-1821	20	18
St. Mary’s	Louisiana	Community	white	unreported	1886-1932	14	3
Tate	Virginia	Community	white	1830-1928	1820-1928	25	12
Texas State	Texas	State	white	1907-1951	1907-1951	56	41
Weir	Virginia	Community	white	1830-1907	1870	24	1
West Family	Virginia	Community	white	1754-1806	1754-1785	14	3
Yarbrough	Texas	Community	white	1860-1869	1860-1869	34	3

Assemblage Selection-Sex

In compiling the assemblage, I made decisions based upon analyses by previous researchers and with attention to historical context. Sex assessment was primarily based on skeletal analysis. I classified skeletons as only male or female, collapsing any ‘possible’ or ‘probable’ sex assessment into the most likely sex. Potential problems with this 'lumping' method were noted in previous sections, but my rational for doing this is to ensure an adequate assemblage size. In a few cases, gender of the individual was historically known and original researchers did not do an independent sex assessment for these people. They have been classified in this study as males/females based on their known identity as men/women. Although possible (Eskridge 1999), it is unlikely my assemblage includes anyone whose gender did not correspond with expected biological sex in the 1800s.

Assemblage Selection-Race

In the United States socially constructed racial categories are defined in part by phenotypic traits. These traits can be used to identify the racial group individuals are assigned to within their culture. Physical anthropologists were sometimes part of the original cemetery excavation teams and some made racial affiliation assessments based upon physical attributes of the skull. Individuals without a skull were labeled indeterminate. Some cemetery studies did not include a physical assessment of race. In these studies, researchers assumed the racial identity of everyone in the cemetery was the same as historically know individuals interred in the cemetery or the same race as the associated community or church. Given the historical segregation practices of the South, this is a reasonable approach. Even early municipal cemeteries designated sections to different races, for example Oakland Cemetery in Atlanta had designated pauper sections and black sections within the pauper area (Blakely and Beck 1982). The racial designation reflected by being buried ‘in group’, by family and church members, or ‘out group’, by city officials, reflects a social designation from that historical period. Of course, race is not a static or strict social category but my intent was to retain the racial designation consistent with cemetery use.

When identifying individuals to include in this study I took an approach designed to preference the historical racial designation when possible but was cautious in cases where this designation is potentially less than clear. Individuals interred in cemeteries with a known racial designation, but no physical analysis of race, were included in that racial group. In cases where physical analysis of race was listed as indeterminate or of mixed ancestry by the researcher, I also used the racial designation of the cemetery. Individuals designated as having characteristics of both indigenous and white or black groups were analyzed as white or black respectively. In a few cases, including early forts in Florida (Dailey et al. 1972; Piper et al. 1982) individuals were confidently identified by the researcher as phenotypically indigenous in appearance. These individuals were not included in the assemblage for this study.

Birth Cohort Assignment

I assigned individuals to 10-year birth cohorts to evaluate for stature changes through time. The precise year of birth was used to assign people to a cohort when it was known from historical records. For other individuals, I subtracted the midpoint of estimated age at death, typically a 10-year range, from the midpoint of the interment year range. Individuals assigned by the original researcher to broad categories, such as young adult, were not included in this study. The difficulty associated with aging older individuals frequently resulted in an age estimate of just a minimum value, not an age range. In these instances, I gave individuals with a minimum age in the 40s an age range of 40 to 60. Those with a minimum age in the 50s or greater, I gave an age range of minimum age to 70. The maximum age values are based on the life expectancies for men and women in their 40s and 60s for much of the 1800s (Glover 1921; Haines 1998). Although using life expectancy to assign an age range introduces imprecision, it also aims to mitigate bias against older individuals. These older people may have been among the healthiest and tallest in a given population (Gunnell, et al. 2001; Kemkes-Grottenthalerm 2005). Using this method, my assemblage includes 17 age cohorts with birth years ranging from 1727 to 1905.

I determined interment year ranges from a variety of sources. Historical records and grave markers sometimes provided specific dates. In many cases, it was necessary to derive burial dates from the historically known period of use for the cemetery or from dated funerary objects and coffin hardware. Those interred in the late 19th century and into the 20th century have narrow burial date estimates due to the increased use of datable grave hardware through time. In contrast, earlier-19th-century and 18th-century cemeteries have fewer datable artifacts but were used for shorter historically known periods. I used these short use intervals to make burial date estimates.

Stature Estimation Methods

When possible, I calculated stature estimates from author-reported femur, tibia, and humerus measurements and Trotter and Gleser's regression formulas (Trotter and Gleser 1952). In that respective order, the element with the lowest standard error was used to estimate the stature of 158 individuals in the skeletal assemblage. Preference was given to the left element and the right was substituted when the left was unavailable. Eighty-five percent of the estimates used the femur (n=118) or tibia (n=14); the remaining 15% used the humerus (n=26). I adjusted the author-reported maximum tibia length by 10-13 mm depending on race and sex (Jantz, et al. 1995:258) prior to stature estimation with the regression formulas. Long bone measurements for the remaining 220 people were not reported by the original researchers. In these instances, I used their stature estimations; these authors used the same Trotter and Gleser regression formulas. Calculations by original researchers based on fragmentary remains were not included.

I typically conducted statistical analysis with standard parametric tests, following evaluation for data normality. Occasionally data was not normally distributed and a non-parametric test was used for analysis. These instances are noted below. Tests that do not assume equal variances were used when possible because they are more robust (Ruxton 2006) and consistent use of one statistical test. Differences in stature between sexes, races, and 10-year birth cohorts are my primary focus. I calculated sexual dimorphism as a ratio of male stature and used *t*-tests for statistical comparisons of males and females in the skeletal assemblage. When statistical differences were noted, I calculated a Cohen’s d-value to measure and report effect size (Cohen 1992). The assemblage is divided into pre-1800s, 1800-1860s, and 1861-1899 periods for more detailed analyses by sex and race. Discussion will focus on observations in comparison to historical data, the influence of specific cemetery groups, and individuals from Georgia and Texas because of they comprise a large portion of the assemblage.

Results

The total assemblage includes skeletal remains of 378 people from 32 cemeteries and 8 states. The mean stature for all females is 160.9 cm (n=144, sd=6.0 cm) and for all males is 173.5 cm (n=234, sd=6.9 cm). Table 2 presents the summary statistics for the entire skeletal sample divided by sex and race. Table 3 provides average stature for males and females by cemetery and a sexual dimorphism ratio for the three largest cemetery assemblages. Stature differences between cemeteries are quite variable and differences between males and females in the same cemetery are sometimes substantial. Ratios are greater at the Byrne Cemetery, Elko Switch Cemetery, Oliver Family Cemetery, and

TABLE 2. Skeletal assemblage by sex and race.

	n	Mean (cm)	sd	sample percentage
black females	116	160.6	6.2	30.69
black males	132	172.1	7.5	34.92
white females	28	162.5	5.0	7.41
white males	102	174.8	7.8	26.98

Note: sd=standard deviation

TABLE 3. Mean male and female femur length and estimated stature by cemetery

	Total Sample n		**Mean estimated Stature (cm)±sd**			
Cemetery	**Males**	**Females**	**Males**	**Females**	**Sexual Dimorphism ratio**	**Race**
Allen Parkway Village	-	1	-	155.74	-	black
Avondale	7	3	173.4±4.7	162.58±4.4	-	black
Big Lazer	1	2	179.5	168.29±6.7	-	white
Boothill	4	-	167.0±20.4	-	-	white
Byrne	1	5	183.27	163.0±2.8	-	white
Cedar Grove	8	11	183.5±6.2	169.85±4.4	1.08	black
Coffey	1	-	180.7	-	-	white
Dallas Freedman	87	78	171.9±5.4	159.7±4.9	1.08	black
Eddy	2	-	178.4±0.9	-	-	white
Elko Switch	5	7	173.3±4.1	154.4±10.8	-	black
Lions Club	1	-	173.7	-	-	white
Matagorda	1	-	168.3	-	-	white
Missionary Colored	1	-	170.2	-	-	black
Mount Gilead	5	4	172.2±7.1	161.3±3.3	-	white
Nancy Creek	1	-	174.5	-	-	white
Oakland	2	2	178.9±6.9	169.0±1.9	-	black
Old Christ Church	2	-	180.6±2.0	-	-	white
Oliver Family	1	1	188.0	162.3	-	white

TABLE 3. Continued.

	Total Sample n		**Mean estimated Stature (cm)±sd**			
Cemetery	**Males**	**Females**	**Males**	**Females**	**Sexual Dimorphism ratio**	**Race**
Phillips Memorial	1	-	168.2	-	-	black
Pioneer	1	-	164.7	-	-	white
Potter Field/Greenwood	1	-	167.0	-	-	white
Prattville	3	-	166.3±3.3	-	-	black
Providence	16	15	171.0±5.4	160.0±4.4	1.1	black
Quad Block	15	-	172.2±15.05	-	-	white and black
St. James	-	1	-	164.6	-	white
St. Marks	20	-	172.5±8.9	-	-	white
St. Mary's	-	1	170.5	154.94	-	white
Tate	5	7	174.1±8.0	163.13±5.4	-	white
Texas State	37	4	176.7±6.1	163.1±8.0	-	white
Weir	1		178.8	-	-	white
West Family	2	1	173.1±4.1	154.6	-	white

West Family Cemetery than at other cemeteries. Affluent white families utilized all but the Elko Switch Cemetery. This suggests the difference is a result of greater male stature not shared, to the same degree, by females in the cemetery.

Table 4 presents the initial ANOVA and post hoc Games-Howell multiple comparison test (Games and Howell 1976; Toothaker 1993). Most paired comparisons were significantly different (p=<0.05) from each other with the exception of black and white females.

TABLE 4: ANOVA table and Games-Howell multiple comparison test results, with the skeletal sample divided by sex and race.

	df	Sum of squares	Mean square	F-value	p-value
Among	3	14153.04	4717.68	95.161	<0.0001
Within	374	18541.41	49.58		
Total	377	32694.45			
Games-Howell Post-hoc Test					
	black males	white females	white males		
black females	<0.0001	0.584	<0.0001		
black males		<0.0001	0.037		
white females			<0.001		

Note: df=degrees of freedom.

Comparisons by Gender and Race

To further explore statistically significant stature difference between genders, independent samples unequal variance t-tests were performed. The skeletal assemblage was broken down by broad time period, larger cemeteries, and by the state of Texas and Georgia in the 1800-1859 periods because those individuals are 73% of the assemblage during this period. All sub-samples were sufficiently normal (Schmider et al. 2010 Beyer & Buhner 2010) for parametric tests except for male-female comparisons in the 1800-1859 period. In this instance, the relevant p-value and effect size was calculated with a Mann-Whitney U test.

Results in table 5 demonstrate that males were significantly ($p<0.05$) taller than females as expected. The calculated effect size (Cohen's d) for most comparisons was 1.00, indicating little chance of Type II errors. Although, the risk is higher for comparisons with smaller sample sizes. In all cases the difference between the means was greater than 10 cm. Mean difference between males and females decreases through time from 13.6 cm before 1800, to 12.7 cm between 1800 and 1859, to 11.9 between 1860 and 1900. An analysis of variance was conducted to assess the influence of sex (male and female) and broad time period (pre-1800, 1800-1859, 1860-1900) on stature. The effect for broad time period is not statistically significant ($F(2, 373)=0.123$, $p=0.88$) and the effect for sex is significant ($F(1, 373)=190.630$, $p<0.0001$). The difference between males and females reflect expected sexual dimorphic patterns and the seeming pattern between time periods does not appear to be significant.

TABLE 5. Two-tailed unequal variance t-test comparisons of stature between sexes.

	Female					Male					test statistics		
	n	mean	sd	Skew	Kurtosis	n	mean	sd	Skew	Kurtosis	t-value	p-value	d
Entire sample	144	160.9	6.0	-0.50	2.53	234	173.3	7.7	-0.24	3.16	-17.38	<0.000	1.00
Pre-1800	5	158.0	3.4	-0.07	-2.04	32	172.8	7.8	1.16	2.61	-6.07	0.000	0.98
1800-1859	62	160.9	6.3	-1.28	4.62	135	173.6	8.2	-2.38	12.42*		<0.000*	1.00
1860-1900	76	161.2	6.0	0.16	0.13	67	173.1	6.7	0.09	1.14	-11.11	<0.000	1.00
Cedar Grove	11	169.9	4.4	0.07	-1.55	8	183.5	6.2	-0.32	-1.54	-5.31	0.000	1.00
Dallas Freedman	77	159.7	4.9	-0.48	0.51	88	171.9	5.4	-0.62	0.78	-15.30	<0.000	1.00
Elko Switch	7	154.4	10.8	-0.81	-0.53	5	173.3	4.1	-0.60	-1.48	-4.21	0.000	0.91
Providence	15	160.1	4.4	-0.18	-1.40	16	170.6	5.4	-0.43	-0.25	-5.97	<0.000	1.00
Tate	7	163.1	5.4	0.46	-1.68	5	174.1	8.0	-0.70	-1.35	-2.66	0.035	0.75
Georgia 1800-1859	8	164.0	4.5	-0.31	-1.40	11	173.1	6.0	0.10	-0.92	-3.61	0.002	0.92
Texas 1800-1859	34	160.3	4.6	-0.61	0.48	90	173.9	7.1	-1.26	5.62	-10.40	<0.000	1.00

Note: n=Number. sd=Standard Deviation. d=Cohen's d.
** Calculated with Mann-Whitney U test due to high Kurtosis value.*

In the overall skeletal sample, a 1.9 cm difference exists between black and white females. Table 6 confirms the results of the previous ANOVA test and shows no statistically significant difference between the average statures of black and white females. This comparison holds true both for the combined assemblage, for the Georgia and Texas individuals, and during the 1800-1859 period. No p-values are close to an $\alpha=0.05$ significance level.

Table 7 presents the same assemblage breakdown for black and white males. A 2.7 cm significant difference in mean exists for the entire skeletal sample. When further broken down by period, significance only remains for the 1800-1859 period, but Cohen's effect size value (d=0.838) suggests a strong practical significance. The difference is weaker but remains significant (p=0.080) with a high Cohen's effect size value (d=0.817) when the comparison is made between the two groups just within the state of Texas. The lack of significance for white males in the 1860-1900 period and in Georgia is unsurprising given the very small sample sizes available.

TABLE 6. Two-tailed unequal variance t-test comparisons for black and white females.

	black females					white females					test statistics		
	n	mean	sd	Skew	Kurtosis	n	mean	sd	Skew	Kurtosis	t-value	p-value	d
Entire assemblage	116	160.6	6.2	-0.57	2.58	28	162.5	5.0	0.42	-0.55	-1.687	0.098	-
Pre-1800	1	155.1	-	-	-	4	158.7	3.4	-0.08	-2.04	-	-	-
1800-1859	40	160.1	7.1	-1.22	3.49	22	162.2	4.3	0.19	-0.47	-1.431	0.158	-
1861-1900	74	144.8	5.8	0.14	0.32	2	172.5	0.7	-	-	-	-	-
Georgia	5	165.1	4.8	-0.51	-1.47	6	163.6	5.3	0.60	-1.07	0.495	0.633	-
Texas	78	159.6	4.8	-0.45	0.48	11	162.6	4.9	0.31	-0.66	-1.901	0.080	-

Note: n=Number. sd=Standard Deviation. d=Cohen's d. Bold=significant at α=0.05

TABLE 7. Two-tailed unequal variance t-test comparisons for black and white males.

	black males					white males					test statistics		
	n	mean	sd	Skew	Kurtosis	n	mean	sd	Skew	Kurtosis	t-value	p-value	d
Entire assemblage	132	172.2	7.5	-2.17	14.31	102	174.8	7.8	-0.66	4.33	-	**0.000***	0.708
Pre-1800	3	166.9	3.3	-	-	29	173.4	7.9	1.50	2.85	-	-	-
1800-1859	65	171.3	8.1	-3.46	18.99	70	175.7	7.7	-1.67	6.15	-	**0.000***	0.838
1860-1900	63	173.1	6.8	0.10	1.11	4	172.5	5.6	-0.46	-1.84	0.213	0.843	-
Georgia	10	174.2	5.2	0.46	-1.17	7	173.6	6.4	-0.45	-1.39	0.208	0.839	-
Texas	89	171.8	5.4	-0.60	0.76	56	175.4	8.3	-1.59	5.42	-2.522	**0.014**	0.817

Note: n=Number. sd=Standard Deviation. d=Cohen's d. Bold=significant at α=0.05

** Calculated with Mann-Whitney U test due to high Kurtosis value.*

The majority of Texas males were excavated from two cemeteries; 78.7% of white males were excavated from the Texas State Cemetery and 98.8% of black males were excavated from the Dallas Freedman's Cemetery. As such, the Texas comparison is predominantly a comparison between individuals buried at the Dallas Freedman's Cemetery and the Confederate veterans buried at the Texas State Cemetery. When isolated and compared, males from the Dallas Freedman's Cemetery and the Texas State Cemetery maintain a strong significant difference (t=-3.483, p=0.001) with a high Cohen's effect size (d=0.938). The long-lived Confederate veterans are notably taller than general members of the Dallas Freedman's community cemetery. This select skeletal sample for white males in the Dallas area during this period precludes any conclusions about differences between Dallas area white and black males. However, table 8 below shows that the significant stature difference of the greater assemblage is not a product of the greater number of Texas individuals. Non-Texas males born during the 1800-1859 period also demonstrate a significant stature difference by race (p=0.020). The Cohen's effect size value (d=0.524) is still suggests a moderate practical significance but not as high as the Texans alone. It is tempting to contrast this with the post-Civil War, 1860-1900 period when mean black male stature increased by almost 2 cm and mean white male stature decreased by more than 3 cm. However, the differences between black and white males born during the 1860-1900 period are not statistically significant, and the next section will highlight how difference between the two periods are not significant.

TABLE 8. Comparison test of Texas and Non-Texas males.

	black					white					test statistics		
	n	mean	sd	Skew	Kurtosis	n	mean	sd	Skew	Kurtosis	t-value	p-value	d
1800-1859 Non-Texans	20	169.2	12.5	-2.61	7.422	25	175.6	6.4	-0.52	-0.36	-	**0.020***	0.524
	Dallas Freedman's Cemetery					Texas State Cemetery							
1800-1859 Texans	44	172.3	5.0	-0.15	-0.98	37	176.7	6.1	-0.10	-0.87	-3.483	**0.001**	0.938

Note: n=Number. sd=Standard Deviation. d=Cohen's d. Bold=significant at α=0.05
** Calculated with Mann-Whitney U test due to high skew value.*

Comparisons Through Time

Table 9 presents the descriptive statistics for the entire skeletal assemblage, divided by sex and race, in birth cohort decades from the 1720s through the 1900s. Figure 1 provides a visual graph of the mean estimated stature with at least four people. This graphically represents the statistical analysis above. The strongest difference exists between males and females regardless of race. The period with the greatest representation by all four groups, 1820s-1840s, does indicate stature differences by sex and race. The difference between black males and white males was statistically significant and ranged from 4.3 cm to 5.1 cm in the 1830s and 1840s respectively. An analysis of variance test for white males before 1800, 1800-1859, and 1860-1899 confirms the visual observation in figure 1, there is no statistical difference in mean between the three periods ($F(2, 99)=1.214$, $p=0.301$). Black males and females also maintain a consistent stature before and after 1860, and this is reflected in an analysis of variance test for each. There was no statistical difference between means for pre and post-1860 for black females ($F(1, 112)=0.373$, $p=0.543$) and for black males ($F(1, 126)=1.890$, $p=0.172$). The black male 3.4 cm increase in the 1880s may be due to a change of population. Burial location of individuals in the assemblage shifts from primarily Texas to other states—Arkansas and Tennessee. It is worth noting, however, that this same representation shift occurs for black females without a corresponding shift in stature.

TABLE 9. Descriptive statistics for skeletal assemblage by birth cohort decades.

	black females			black males			white females			white males		
cohort decade	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
1720										2	173.1	4.2
1730							1	154.6				
1740												
1750							1	162.6				
1760												
1770				3	166.9	3.3	1	160.0		8	176.9	10.8
1780										6	169.8	5.9
1790	1	155.1		1	180.0		1	157.6		12	172.4	6.8
1800	1	170.3		2	175.4	11.9	2	161.1	5.1	7	178.1	4.8
1810				3	157.5	31.0	2	162.5	1.6	13	173.5	6.9
1820	4	152.5	13.5	1	173.9		2	162.5	3.7	10	172.8	13.5
1830	4	158.4	6.4	4	171.7	6.1	5	161.6	3.6	19	176.0	5.9
1840	11	162.8	6.1	23	172.5	5.5	8	163.2	6.2	20	177.6	6.5
1850	20	160.0	5.1	32	171.3	4.8	2	160.7	2.6	1	168.3	
1860	38	160.8	5.3	38	172.7	7.1	2	167.7	7.6	2	171.2	9.3
1870	26	160.7	5.6	18	172.8	6.5	1	172.0				
1880	8	161.3	9.2	7	176.2	6.2				1	173.0	
1890	2	164.1	1.8							1	174.5	
1900	1	159.2										

Note: n=number, sd=standard deviation

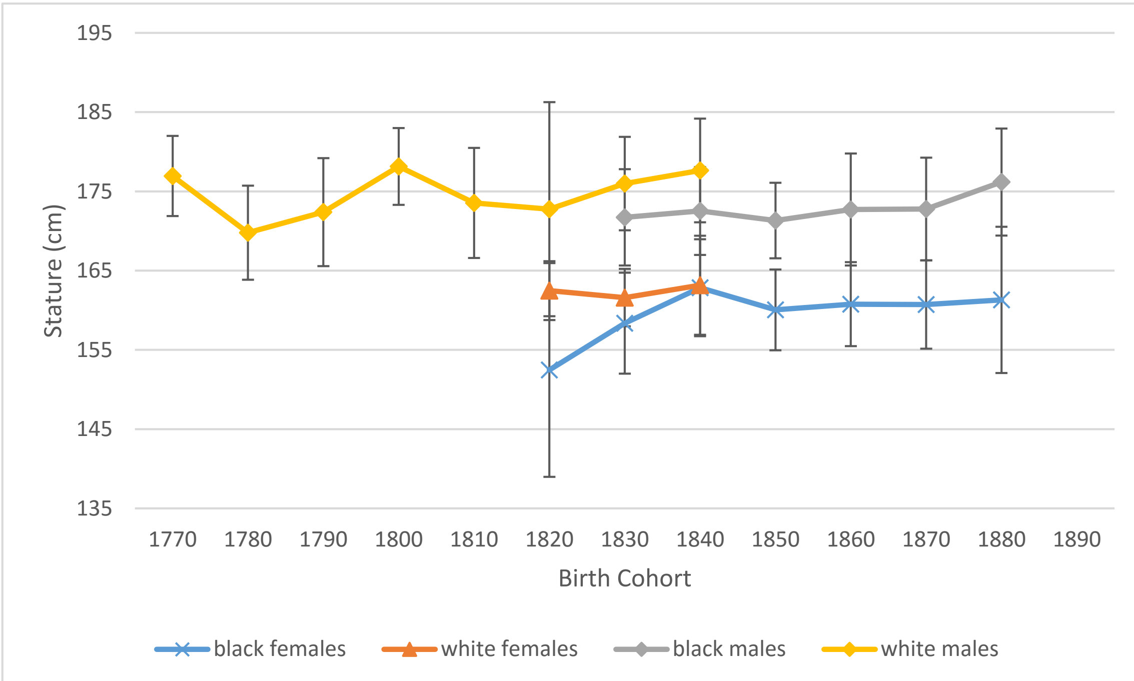

FIGURE 1. Skeletal assemblage birth cohort with a minimum n=4 by race and sex. Error bars represent one standard deviation.

TABLE 10. Descriptive statistics for national convicts.

	black females			black males			white females			white males		
cohort decade	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
1800				195	169.4	6.3				906	172.4	6.5
1810	498	158.2	6.5	647	169.8	7.0	233	159.22	6.8	2467	172.5	6.6
1820	173	157.4	7.2	848	169.3	7.0	68	160.44	7.3	4200	172.4	6.8
1830	125	157.8	7.4	1514	170.2	6.9	144	159.07	6.6	7988	171.8	6.7
1840	136	158.3	7.3	4516	170.2	6.9	258	159.01	6.3	16506	171.5	6.5
1850	350	158.5	7.9	9853	170.7	7.1	488	159.72	6.7	24982	171.3	6.7
1860	516	158.4	8.1	11654	170.6	7.2	482	159.89	7.0	25194	171.7	6.5
1870	612	160.2	6.9	13481	170.5	7.1	353	161.44	6.3	22044	171.6	6.5
1880	965	161.0	7.1	10236	170.3	7.0	359	161.8	6.5	12741	171.7	6.5
1890	829	160.8	6.8	5237	170.3	7.0	264	162.28	6.8	6567	171.9	6.5
1900	345	160.7	6.2	443	169.4	7.3	132	161.04	7.6	406	170.7	6.3

Note: n=number, sd=standard deviation Sources: (Carson 2009; 2011)

Comparisons Between Assemblage and Historical Data

When comparing U.S. historical stature data sets to the four skeletal assemblage divisions, black females, white females, black males, and white males, southeastern statures do not stand out from statures around the country. Detailed comparison is difficult because previous researchers rarely reported standard deviation and sample sizes by birth dates. Table 10 provides an example of an historical data set drawn from Carson's (Carson 2009; 2011) studies of national prison records.

Figure 2 shows a box plot of skeletal assemblage black female cohorts where n>1 and figure 3 shows the same for white female cohorts. Statures by cohort for black females typically have balanced upper and lower quartiles, general agreement between data medians and means, and minimal outliers. The 1820s cohort has an inverted error bar due to the small sample size (n=4) and a minimum value outside the standard lower fence range. The box plots for white females show a good agreement between cohort medians and means but the interquartile ranges are more variable in size and not well balanced in the case of the 1830s and 1840s cohorts.

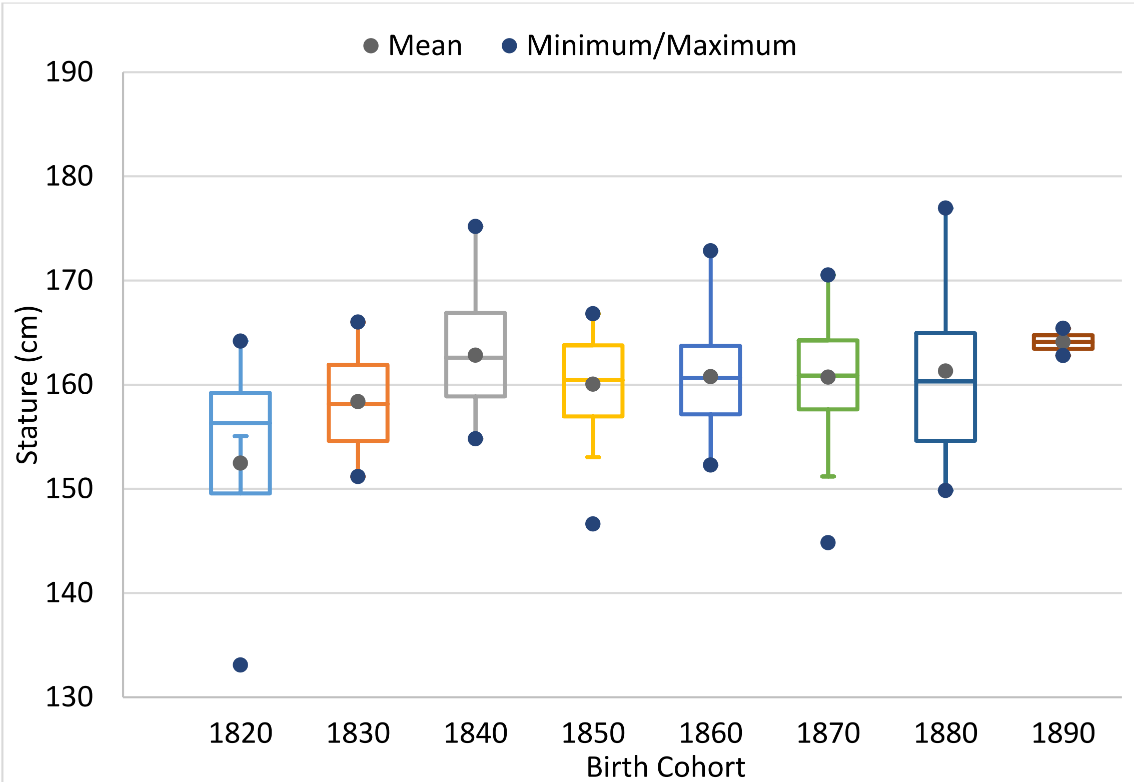

FIGURE 2. Box plot of skeletal assemblage black females for birth cohorts with n>1. Solid line within the box indicates a median value. Boxes represent 25 and 75% of values; error bars indicate the maximum and minimum values within the upper and lower fence (1.5(IQR)).

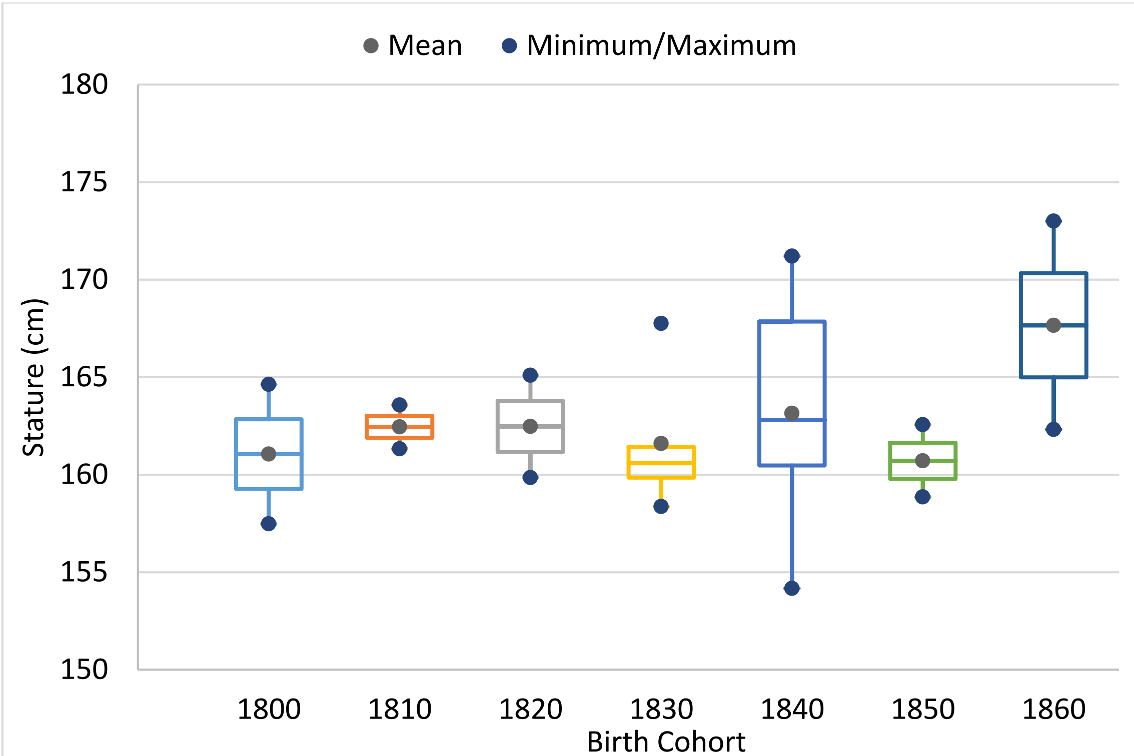

FIGURE 3. Box plot of skeletal assemblage white females for birth cohorts with n>1. Solid line within the box indicates a median value. Boxes represent 25 and 75% of values; error bars indicate the maximum and minimum values within the upper and lower fence (1.5(IQR)).

Figure 4 illustrates the chronological trends in female stature compared to historical stature studies. Female stature estimates from the skeletal assemblage do not differ greatly from other female groups. Skeletal assemblage black present a seemingly very dramatic increase in stature between the 1820s and 1840s. These early females were interred primarily in Elko Switch, Alabama and Avondale, Georgia. At 155.2 and 160.5 cm, the two females buried in Texas during this early period do not stand out from their contemporaries buried in Georgia and Alabama, but they are not enough to suggest a temporal change in stature independent of location. This may be indicative of a shift by birth decade in the skeletal assemblage from individuals predominantly from eastern states to western states. Unfortunately, the sample size is too small to draw any firm conclusions. Black females in the 1830s skeletal cohort are only about 1cm taller than historical samples of Maryland and Virginia freedmen, as well as convicts predominantly from Texas and Tennessee. The 1850s through the 1880s cohort statures are similar to stature means for both the black and white female convict samples gathered by Carson (2009; 2011). Black females in the skeletal assemblage during this forty-year period hail primarily from the Dallas Freedman's Cemetery, Texas; Providence Cemetery, Tennessee; and Cedar Grove Cemetery, Arkansas. The historical convict statures are from states across the country, but those data are also dominated by individuals incarcerated in Texas and Tennessee. The skeletal assemblage mean stature is 1.6 and 2.4 cm greater than the averages for black female convicts in the 1850s and 1860s. Stature difference between these two groups decreases to only 0.3 cm by the

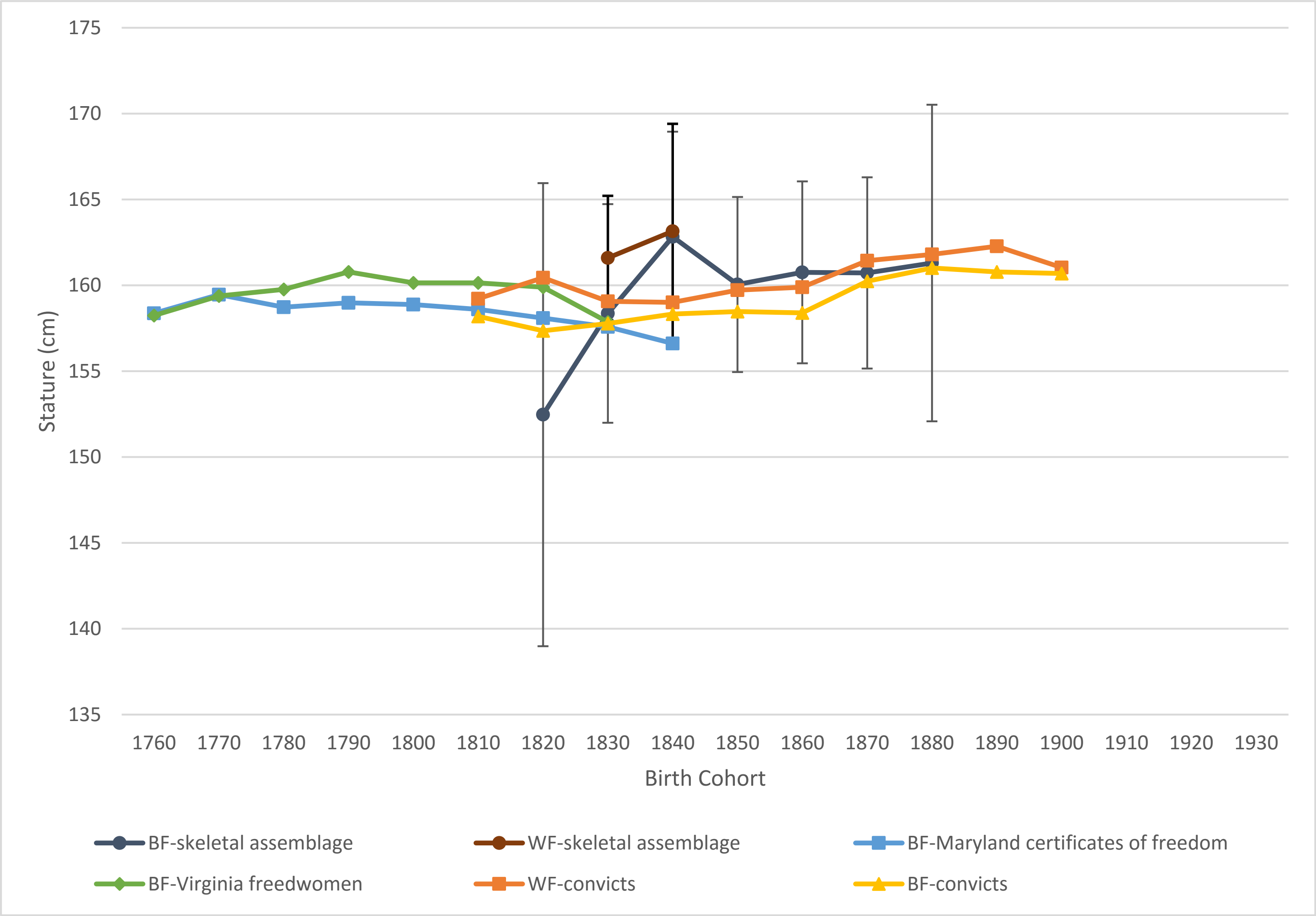

FIGURE 4. Females, skeletal assemblage and historical samples including: black female convicts (Carson 2011), white female convicts (Carson 2011), Virginia freedwomen (Bodenhorn 1999), and Maryland certificates of freedom (Komlos 1992). Error bars represent one standard deviation.

1880s birth cohort. This reduction is due to the taller stature of the black female convicts. Skeletal assemblage black female cohorts in the 1850-1880s appear taller than the black female convicts, however, both are well within the standard deviation of the skeletal assemblage.

Only the 1830s and 1840s birth cohorts contained more than four white females and thus are represented in figure 4 above. White females in the skeletal assemblage are the tallest and have 161.6 and 163.1 cm stature means for the 1830 and 1840 birth cohorts respectively. They come from a range of locations including five cemeteries in Virginia, Texas, and Louisiana. More than half were members of higher socioeconomic families. The only group of white females available for comparison is the convict sample collected from across the United States, which predominantly is comprised of people from Tennessee and Texas. Although the skeletal assemblage white female data set is small, it is not surprising to find these women are from 2.5 to more than 4 cm taller than white female convicts from the same cohorts.

Figure 5 shows a box plot of skeletal assemblage black male cohorts where n>1. Most stature cohorts have balanced upper and lower quartiles, general agreement between data medians and means, and minimal outliers. The 1810 cohort is a notable exception to this; n=3 and one of those is much shorter than the other two at 121.7 cm. Skeletal assemblage black males born between the 1760s and 1870s had stature means that vary by about 4 cm between birth cohorts. Only the 1830s through 1880s black male cohorts, those with a minimum n=4, are graphed in figure 6 in comparison with other historical assemblage means.

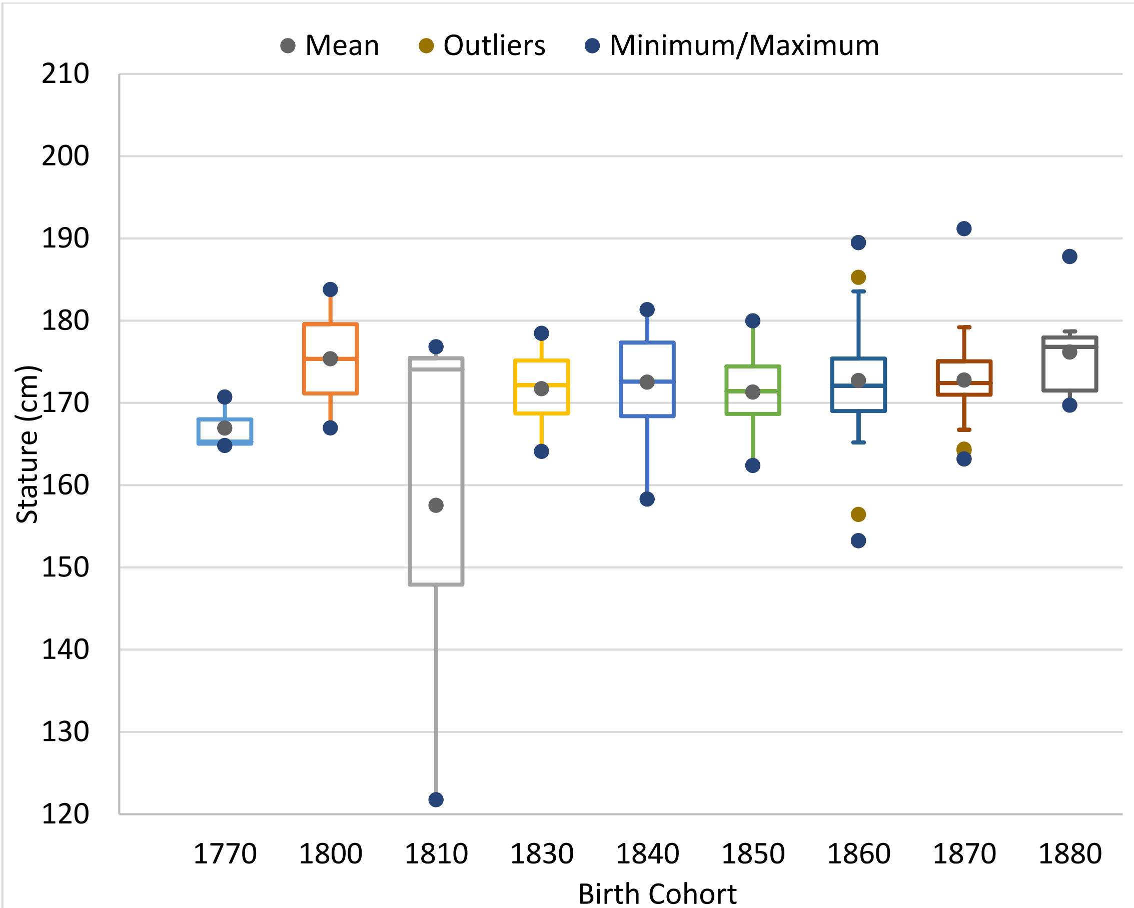

FIGURE 5. Box plot of skeletal assemblage black males for birth cohorts with n>1. Solid line within the box indicates a median value. Boxes represent 25 and 75% of values; error bars indicate the maximum and minimum values within the upper and lower fence (1.5(IQR)).

The historical Virginia Freedmen's assemblage means were consistently greater than all other black male assemblage means through much of the late 1700s and early 1800s, not falling below 170.5 cm. Contemporary Maryland Freedmen did not obtain this height and black union recruits were consistently at least 2 cm shorter. Slaves transported by coastal ships, black male convicts, and the skeletal assemblage of black of male slaves reported on coastal shipping manifests was 172.1 cm. The ships males obtained averages trending near 172 cm in the 1830s. The maximum mean stature transported people from various ports as far north as Baltimore and as far west as New Orleans. One hundred and seventy-two centimeters was also the greatest mean stature for the convict group, comprised of individuals from around the United States but predominantly from Kentucky, Missouri, Georgia, and Texas. Average convict stature gradually declined between 1830 and 1860 birth cohorts. This trend is statistically significant and the author (Carson 2009) attributes it to a changing economy and resources, but it could also reflect changing black prison populations in the South before and after the formal end of slavery. The subset of convicts imprisoned in Texas exemplify this trend but the original investigator did not test for significance. Stature averages of black male Selective Service Registrants born between 1900s and 1920s still conformed to the 172 cm or less stature averages of black males through much of the 19th century. Although notably taller than enslaved black male groups in the 1700 and 1800s, registrants were still consistent with the general stature trend of Virginia Freedmen and the current skeletal assemblage.

Individuals comprising the skeletal assemblage represented in figure 6 are from Texas, Georgia, Tennessee, Alabama, and Arkansas. The majority were interred in the Dallas Freedman's Cemetery, but black males from other cemeteries are well represented in the 1830-1870s cohorts. A shift in the skeletal assemblage is evident in the 1880s cohort when mean stature reached 176.2 cm and Tennessee and Arkansas burial locations become dominate. Tennessee and Arkansas black males in the skeletal assemblage have a greater mean stature. While this suggests an interesting difference between the skeletal assemblage and some of the historical data sources, all are well within the standard deviation range of the skeletal assemblage.

Figure 7 shows a box plot of skeletal assemblage white male cohorts where n>1. There are fewer outliers than for skeletal assemblage black males, generally a product of a smaller sample size. Upper and lower quartile balance and agreement between cohort medians and means are also not as good as for black males.

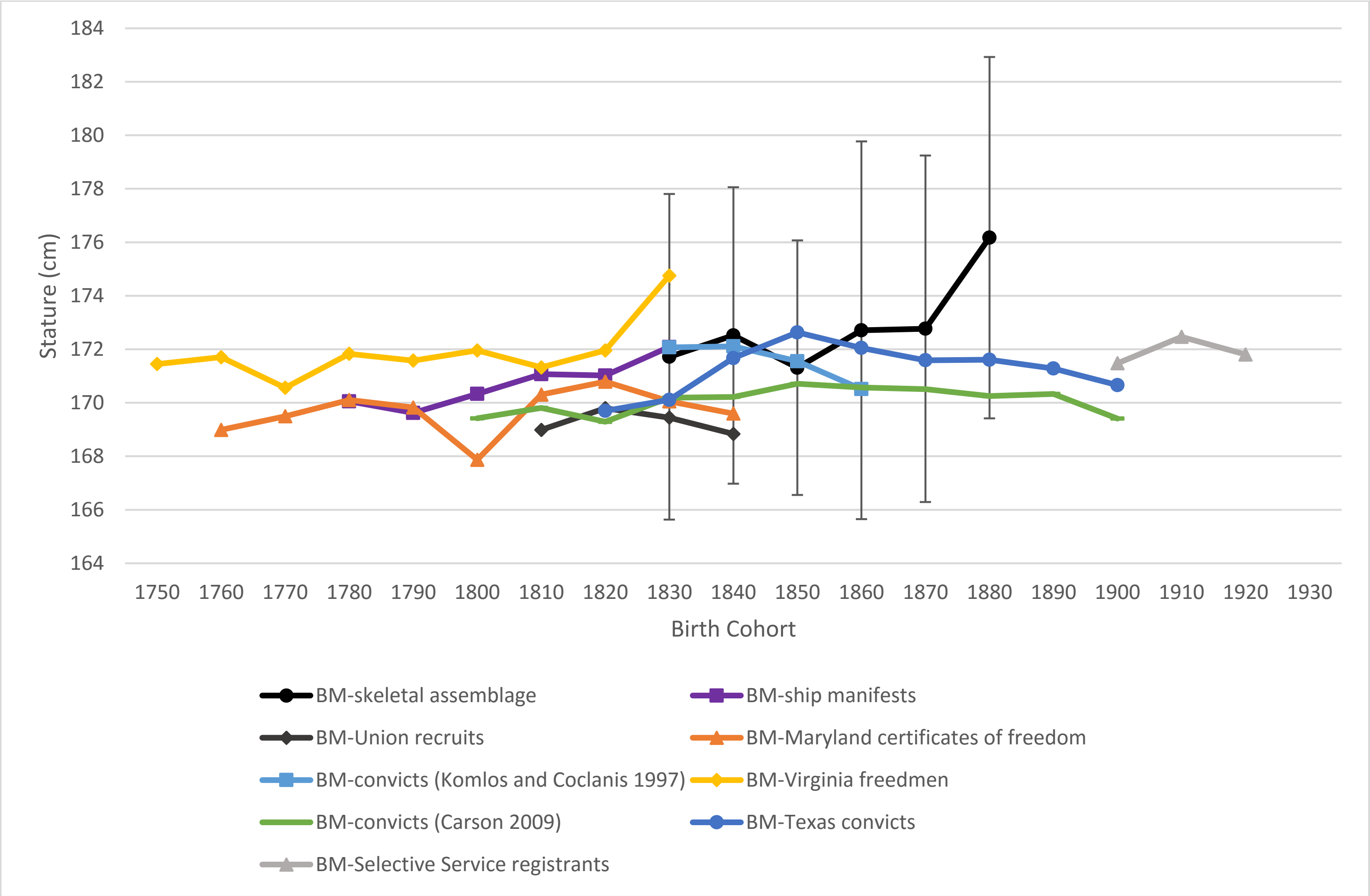

FIGURE 6. Black males, skeletal assemblage and historical samples including: ship manifests (Margo and Steckel 1982), Union recruits (Margo and Steckel 1982), Maryland certificates of freedom (Komlos 1992), convicts (Komlos and Coclanis 1997), Virginia freedmen (Bodenhorn 1999), convicts (Carson 2009), Texas convicts (Carson 2009), and Selective Service registrants (Karpinos 1958). Error bars represent one standard deviation.

Skeletal assemblage white males plotted in figure 8 with historical stature assemblages also reflects the variability seen in the box plots. An analysis of variance test confirms that differences between the pre-1800 and 1800-1859 periods are not significant ($F(2, 99)=1.214$, $p=0.301$). Unlike changes for black females, black males, and white females, the fluctuating changes prior to 1800 are not associated with known geographic changes in the skeletal assemblage and could easily be a product of sampling error. A few individuals from early Texas and Georgia are present but the majority were recovered from the St. Marks Cemetery and Quad Block Cemeteries in Florida. The sites are only 200 miles apart overland, and site occupations are not contemporaneous. St. Marks burials most likely occurred between 1818 and 1819 and Quad Block burials between 1835 and 1842. Adjacent US military forts utilized both cemeteries. It is unlikely many individuals were born in Florida. Instead, they form their own geographically heterogeneous sample much like most of the military samples available here for comparison. The reason for the dramatic stature changes is unknown but one possibility is alterations in US troop deployment as people who grew up in different regions were deployed to Florida. Another possibility is a significant disease event at the forts could have interacted with unknown frailty factors and altered the skeletal population during short periods of cemetery use.

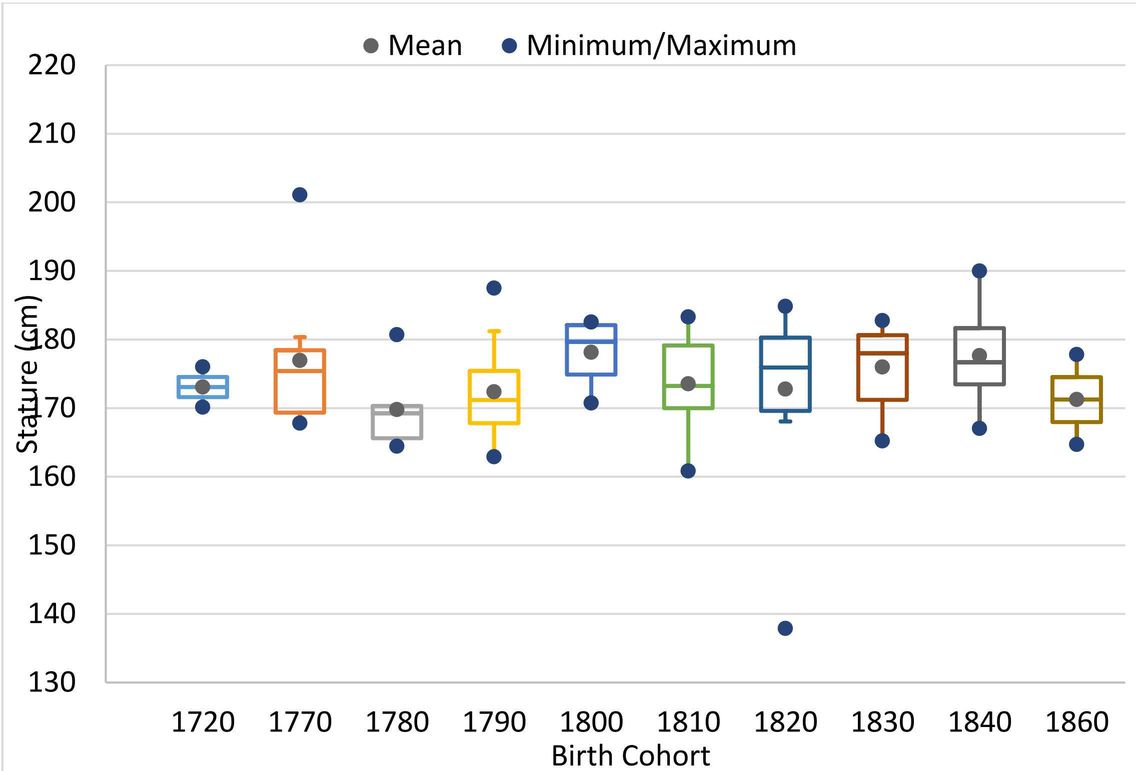

FIGURE 7. Box plot of skeletal assemblage white males for birth cohorts with n>1. Solid line within the box indicates a median value. Boxes represent 25 and 75% of values; error bars indicate the maximum and minimum values within the upper and lower fence (1.5(IQR)).

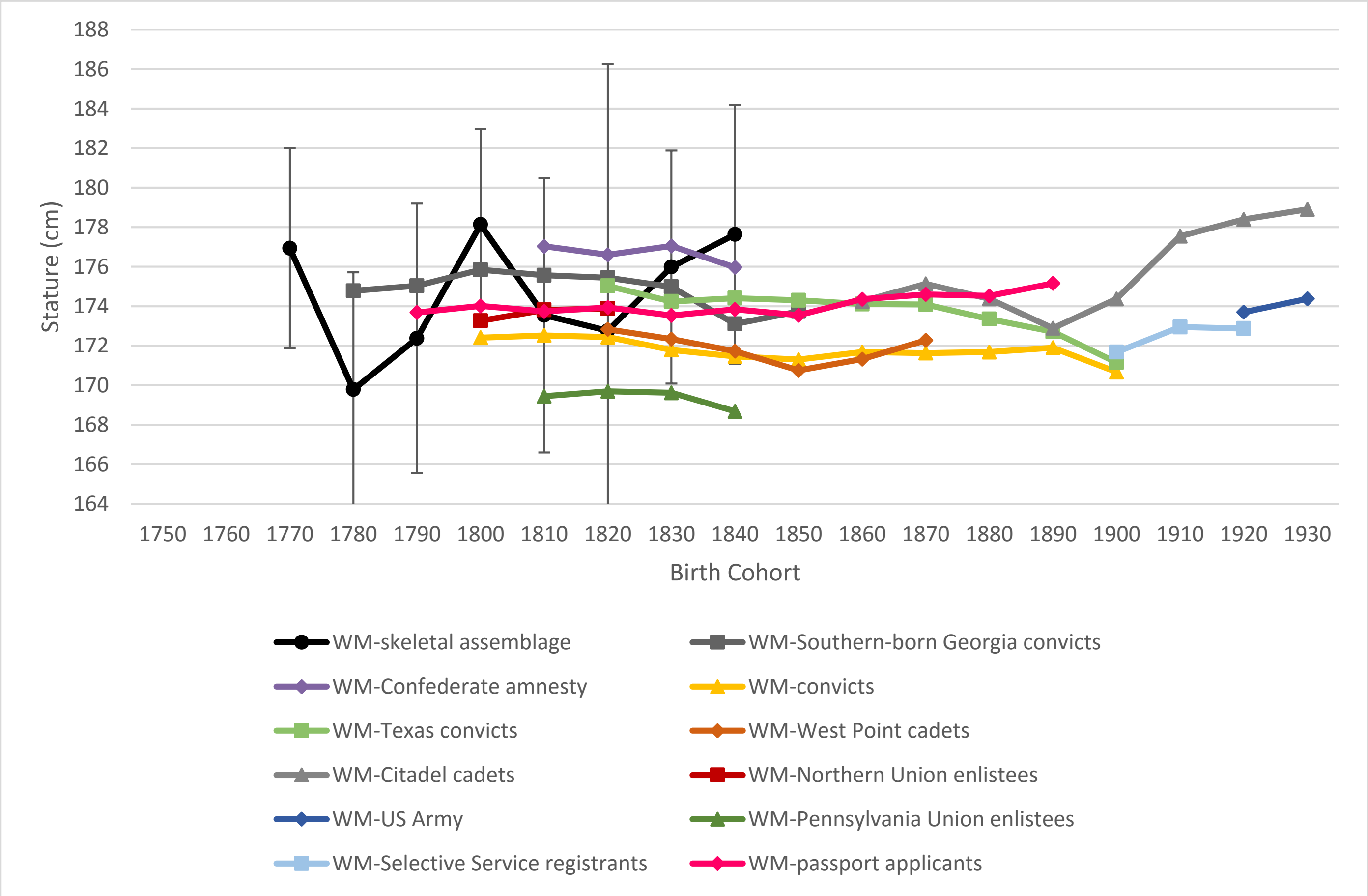

FIGURE 8. White males, skeletal assemblage and historical samples including: Southern-born Georgia convicts (Komlos and Coclanis 1997), Confederate amnesty (Margo and Steckel 1992), convicts (Carson 2009), Texas convicts (Carson 2009), West Point cadets (Komlos 1987), Citadel cadets (Coclanis and Komlos 1995), Northern Union enlistees (Margo and Steckel 1983), US Army (Randall 1949), Pennsylvania Union enlistees (Cuff 1998), Selective service registrants (Karpinos 1958), and passport applicants (Sunder 2013). Error bars represent one standard deviation.

The birth cohorts from 1820 to 1840 are predominantly comprised of Civil War veterans from the Texas State Cemetery and include a few individuals from Arkansas, Virginia, Louisiana, Florida, and Georgia. It is interesting that these three cohorts are the closest to matching the mean stature heights of Confederate amnesty oath takers during the same period. The 1820 cohort average is a similar 176.6 cm when excluding one 137.9 cm outlying male. The skeletal assemblage 1820-1840s group, along with the Confederate oath takers, southern-born Georgia convicts, Texas convicts, and Citadel Cadets remain around 2-3 cm taller than Pennsylvania Union enlistees, West Point Cadets, and the nation-wide convict sample (most from Missouri and Texas). With the exception of Georgia convicts after the 1830s cohort, they were even taller than native born U.S. passport applicants-a generally select and affluent group for the 19th century. US selective service registrants born in the 1900-1920s and U.S. army members born in the 1920-1930s fail to reach these averages. There are no white males from the current skeletal assemblage born in the second half of the 19th century for analysis. Prior to the Civil War southern white men may have been exceptionally taller than men elsewhere in the US and enlisted men in the early 20th century, but the skeletal assemblage data does not strengthen this argument. The skeletal assemblage data is interesting, but the standard deviation is too large to make a clear observation.

Discussion and Conclusions

Calculation and analysis of mean estimated stature and sexual dimorphism ratios demonstrated expected differences in stature between males and females. Sex differences are significant within the five cemeteries with enough males and females for comparison. Sexual dimorphism ratios decline a bit over time, but an analysis of variance test does not indicate the decline was statistically significant.

Statistically significant differences in stature between the races exist for males but not for females. A comparison between white and black women of the entire assemblage, by the three major time periods, and within the Georgia and Texas groups results in p-values below the $\alpha=0.05$ significance level. For males, a statistically significant difference is found only for the assemblage as a whole, for the 1800-1859 period, and for those buried in Texas. Taken together these findings suggest that southeastern white males prior to 1860 may have benefited from growth and development opportunities better than females and black males in the South. However, this conclusion is tentative and needs further investigation.

Stature means trend up within the four groups through time, typically no more than four centimeters. Black females born in the post-Civil War period do trend upwards slightly, steadily increasing in mean stature. The 1880 cohort mean is 1.3 cm greater than those born in the 1850s. Black males follow the same upward trend from a mean of 170.7 cm in the 1850s to 172.8 cm in the 1870s and 176.2 cm in 1880s. These trends were not significantly different. White males and females included here do not span the years before and after the Civil War. They do span the stature decline period sometimes noted in historical stature data (Komlos 1996; Steckel 2009:12). That stature decline, suggested to have occurred beginning in 1810 and reaching a minimum in 1830, is not apparent here for white males and females. No statistical differences existed between time periods for white males.

The skeletal assemblage means of people from the South appear as tall as many other Americans when viewed in comparison to previous historical studies. For white females, this statement is made with particular care because the available number of individuals was small. A larger sample could easily alter that observation. Early cohort black females in the skeletal assemblage are notably shorter and more variable in stature than those in later cohorts. It is not clear if this is due to a change in population from east to west, more related to temporal changes, reflects general population variability, or is simply a sampling error. The 1840-1860's cohorts were taller than other known groups until the 1870s period when white female convict stature increased. This is part of a general increase for all female groups from the 1840s onward.

Cohorts of black males from the skeletal assemblage, 1830-1880s were consistently taller than other black male groups prior to the 1850s. These include Union Civil War recruits, Freedmen groups, and ship manifests from around the South. Skeletal assemblage males were similar to groups of black convicts, both the general sample and the Texas convicts. This is not surprising. Given the common resident states of individuals included, it is possible both samples were drawn from the same population. This similarity appears to diverge with the 1860 cohort suggesting a change with at least one group. As mentioned above one possibility is changing labor and race relations in the post-war South altered the selection of individuals incarcerated in the region.

White males were a less cohesive group. If the large changes between cohort groups prior to 1820 was more than a product of sampling error, it was likely due to changes in population of origin. In-country migration during the late eighteenth and early-19th-century period as well as continued international migration to the U.S. could be one source. A second possibility is advantages that afforded white males their markedly greater stature mean were inconsistent between small population groups and cohorts in the region.

Stature mean increases for each white male cohort from the 1820s to 1840s. These individuals may be taller than other groups because they are select group with a greater age at death than most. The mean age at death for the 1830s and 1840s cohorts are 68.8 years (sd=15.12) and 63.3 years (sd=18.8) respectively. Other studies have successfully demonstrated that longer lived individuals also tend to be taller members of a group, favorable growth and development having conferred upon them both a tendency for a greater stature mean and a longer life (Gunnell, et al. 2001; Kemkes-Grottenthalerm 2005). It is possible the same process is observed here. The population of Confederate amnesty oath takers rivals the means of the skeletal assemblage white males. Georgia and Texas convicts are the next tallest groups with means well above Union enlistees, and even affluent U.S. passport applicants.

Analysis supports rejecting the null hypothesis for no significant difference in the skeletal assemblage by sex, race and through time. Specifically, white males have statistically significant greater mean stature than others. This follows expectations derived from their stronger social position in the early United States and expected sexual dimorphism differences. Comparison with existing historical research suggests a possible difference in the growth and development of Southerners as well. Individuals in the skeletal assemblage as well as previously studied groups from southeastern states typically appear taller than groups from other areas of the country. There is no evidence from the skeletal assemblage that stature declined for the 1830-1840s cohorts as it did in some historical samples (Margo and Steckel 1983; Komlos 1992; 1996). There is also no evidence for mean stature decline after the Civil War.

CHAPTER VI

STORAGEWARE

Focusing on the shared experience of smallholders to broaden knowledge about small historic farms has origins in large multi-site research projects in Texas, South Carolina, and Georgia (Jurney and Moir 1987; Cabak and Inkrot 1997; Wettstaed 2011). These projects sought to address questions such as multi-site variation or adoption of modern materials and lifeways in an area while still utilizing the methods of artifact patterning to compare multiple farm sites. I am concerned with smallholder subsistence in a broad sense. What farmers ate and how they addressed subsistence needs played large roles in creating the health patterns observed in previous chapters, class struggle and resource control, as well as regional economics. In this chapter I use an abundance index to normalize the occurrence of ceramic and glass storageware across a group of Georgia sites. Storageware use serves as a proxy measurement of gardening and food storage activities among farmers in the area.

Previous Approaches to Historic Southeastern Farms

Studying small historical farm sites has always been problematic for archaeologists. In part, this is due to the difficulty of developing meaningful questions readily addressed with archaeological materials. Efforts by archaeologists to develop workable research designs arose in the 1980s in an attempt to identify patterns in Mid-Atlantic and Southeast historical archaeology. The operating model sought to identify differing artifact patterns created by social groups with different practices and beliefs. In historical archaeology this began with South's (1977) Carolina and Frontier patterns.

Other notable examples include Theresa Singleton's Slave Artifact Pattern (Singleton 1980), Otto's (Otto 1977) work at Cannon's Point Plantation, and Drucker's work at Fountainhead Plantation (Drucker 1981). Others (Heitzmann 1980; Mansberger 1987), cautious that pattern detection may not work outside of the South's rigid social classification system, tested this framework's ability in other regions to identify sites occupied historically by upper class and lower class individuals.

There are two reasons that the search for archaeological material patterns became primarily a method for identifying economic groups in southeastern archaeology. The first is that the consumption-based framework makes economic class distinction easier to identify. Douglas and Isherwood's *The World of Goods* (1979) was very influential during the 1980s. Their work helped frame core concepts about material good consumption during a broad 17th to 19th-century rise in income, household social stratification, and material goods. This included a framework for interpreting social purpose and social meaning from material goods adopted by many archaeologists. In some instances this produced significant archaeological studies that have furthered understanding of social relations in history (e.g. Wall 1991). However, in other studies materials have identified only economic differences between sites. A common criticism is that identified differences are often already historically known.

The second reason pattern identification at southeastern historic sites became a method for class identification is by default. It is difficult to identify social purpose and meaning beyond economic differences because small farm sites occupied by poorer people offer archaeologists fewer material goods for analysis. Poorer individuals and families spend the greatest percentage of income on food resources rather than material goods more likely to enter the record (Douglas and Isherwood 1979:178).

The site formation process for many small farms also makes interpretation of identity and meaning difficult. Sites are typically characterized by shallow sheet midden deposits, a factor that makes them easily destroyed. The problem of few material goods purchased by poor farmers is compounded by sometimes brief occupation periods. Frequent resident turnover may have characterized sites with longer occupation periods. Just how ephemeral occupation and material remains are at sites varies by location, but archaeologists who recognize these challenges differ on methods of approach (Anderson et al. 1983; Trinkley 1983; Orser and Holland 1984). My perspective is that too much concern has been placed on resident turnover. Tenants often moved but powerful forces, including family and labor markets, ensured families typically stayed within a community (Wright 1986:87-107). Studying small farms in groups creates a community perspective and potentially provides collective meaning missing from the study of single small sites. The remainder of this chapter is a brief introduction to the agricultural region followed by a consideration of inter-site comparisons and my chosen categories of analysis, the abundance index method, and results of analysis.

The Georgia Piedmont

The archaeological assemblages used here come from two sites in Jones County, one in Oglethorpe County, one in Jasper County, and four in Putnam County Georgia. All eight sites in table 11 were occupied predominately during the late 1800s to the early 1930s. They are located on the central Georgia Piedmont above the Fall Line, the boundary between the crystalline rock and younger Cretaceous and Cenozoic sediments that comprise the coastal plain (Spangler 1950). The Piedmont region in figure 9 was the primary cotton-producing region of the state during the occupation of the archaeological sites. Jones county is located on the Fall Line counties, a noticeable swath of counties along the geographic boundary that only produced between ten and fifteen thousand bales of cotton in 1910 (Census 1911). In the same year Jasper and Oglethorpe counties produced over fifteen thousand bales, on par with other high production counties in the state and elsewhere in the region.

TABLE 11. Archaeological sites included, period of occupation, and county location.

Site	**Site Name**	**1830s-1860**	**1860s-1900**	**1900s-1930s**	**Location**
9JA54		X	X		Jasper County, GA
9JO305/6	Falling Point site		X	X	Jones County, GA
9JO61			X		Jones County, GA
9OG373				X	Oglethorpe County, GA
9PM1072S				X	Putnam County, GA
9PM1894	Journal site		X	X	Putnam County, GA
9PM1905	Resseau site	X	X	X	Putnam County, GA
9PM869			X	X	Putnam County, GA

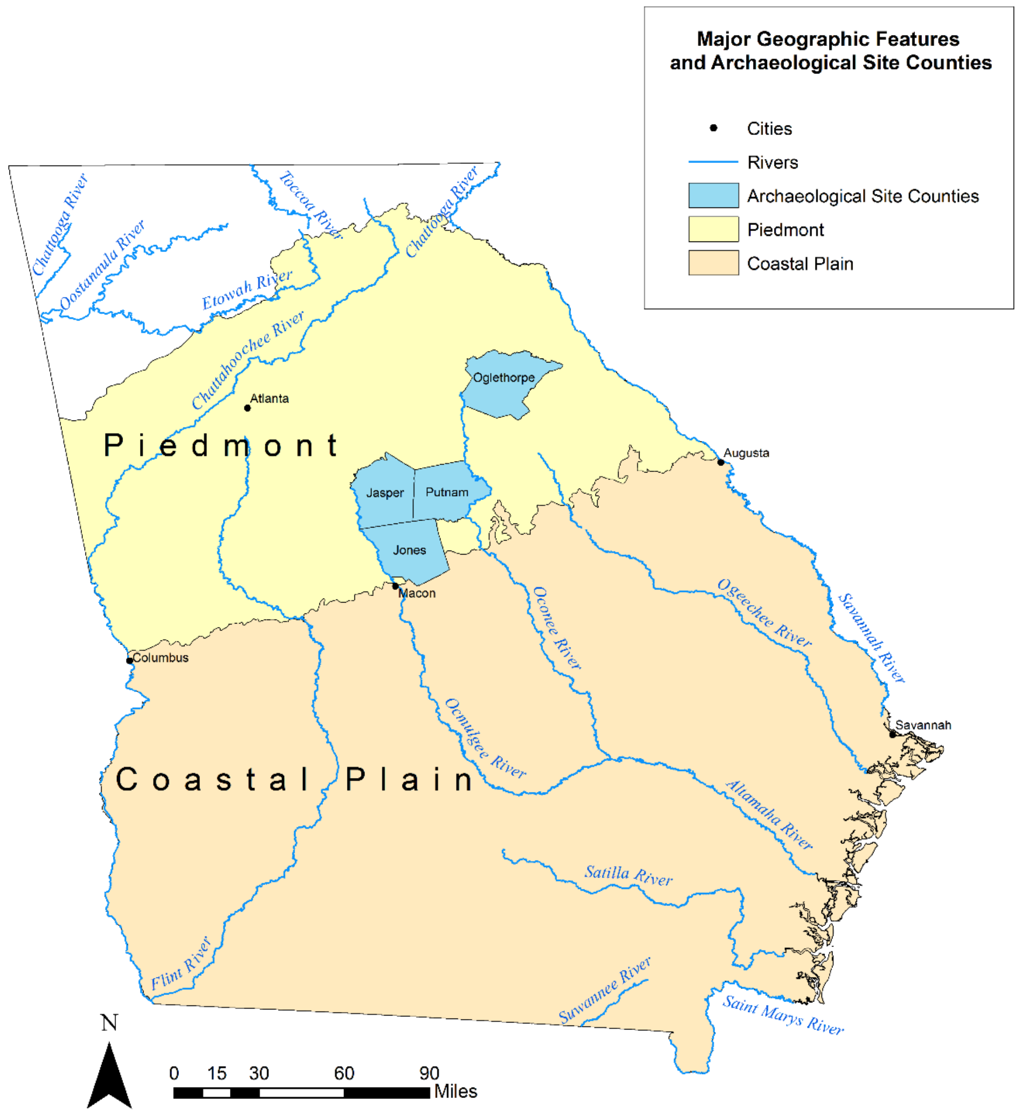

FIGURE 9. Piedmont and Coastal Plain geographic regions. Counties where archaeological farm sites are located. Map data adapted from (US Environmental Protection Agency 2012; National Atlas of the United States 2014a; 2014b; 2014c; 2014d; 2014e).

Historically, residents of counties long the Fall Line dividing the Piedmont and Coastal Plain benefited from the area's geomorphic characteristics and accompanying economic advantages. The high gradient between the two regions offered early industries ready access to water power in the same area that major rivers became unnavigable as people traveled north. The Fall Line was a natural point of commerce for shipping goods to and from the coast on these same rivers, and the area included some of the state's earliest railroads. Deposits of kaolin clays found on the Fall Line were exploited by the state's stoneware potters. Major antebellum cities, including Columbus, Macon, Milledgeville, and Augusta, are located on the Piedmont-Coastal Plain boundary. Late-18th and early-19th-century farmers passed through the immediate coastal interior of Georgia and settled this area first (Messick, et al. 2001:22).

The Georgia Piedmont was a heartland of postbellum cotton monoculture, but by 1910 some farmers were heeding the 19th-century call for reform and crop diversification. Boll weevil infestation did not reach Georgia until 1915, but fluctuating cotton prices, encouragement by agricultural leaders, and assistance by Agricultural Experiment Stations convinced some farmers to grow truck crops. By 1910 a few farmers in all four counties were growing vegetables for the market (Census 1913). Predominately watermelons, cabbages, tomatoes, and potatoes (McCorkle 1988), the diversity of crops increased with further rail company consolidation, refrigerated cars, and other shipping improvements (McCorkle 1992). Although it is unknown what market crops were grown by farmers at the assemblage sites, it is very likely that cotton was the mainstay. It remains to be determined how often food crops were grown for home consumption and how common it was to store these foods for extended use.

The human geography changed rapidly around those who remained on the farm between 1900 and the 1930s. All four counties had marked reductions in population between the 1900 and 1930 census: Jasper County lost 6,439 (43%); Jones County lost 4,366 (33%); Oglethorpe County lost 4,954 (28%); and Putnam County lost 5069 (38%) people (Forstall 1995). As a state, Georgia's rural population dropped from 84% in 1900 to 69% in 1930. Movement away from rural areas and out of the southeast was common.

The sites in table 12 were surveyed in the mid-2000s by Oconee National Forest archaeologist James Wettstaed and colleagues (Wettstaed 2008; Wettstaed and Jurney 2008; Wettstaed 2009; Wettstaed and Wettstaed 2009; Wettstaed 2010). All sites were shovel tested, surveyed with metal detectors, and five included artifacts recovered from excavation units. These sites exhibited sheet middens and sometimes low mound, artifact concentrations. Site occupation dates were determined with a combination of historical documentation and artifact dating. 9PM1894 was initially an owner-occupied farm and became a tenant residence after the owners moved. All other sites were not owner occupied and tenancy type is unknown. A detailed examination of sites 9OG373 and 9PM1072 (Wettstaed 2011) suggested no clear indication from the site and artifacts what type of tenancy the occupants may have been.

TABLE 12. Archaeological sites included in analysis.

Site	Occupation Period	Excavated Area m2			Site Area m2 (Wettstaed 2011)	Shovel Tests (30x40 cm)	Shovel Test Intervals	Test Units	Metal Detector Location Investigations	Noted Features	Report
		total	shovel tests	test units							
9JA54	1850s-1890s	17.5	17.5	-	7200	105	5-10 m	-	Yes	House platform, chimney	(Wettstaed 2009)
9JO306	Late 19th-early 20th	11.16	9.67	1.49	4900	57	5-10 m	3-1.0x0.5 m	Yes	Chimney	(Wettstaed 2008)
9JO61	Late 19th-early 20th century	4.83	2.33	2.50	6300	14	5-10 m	5-1.0x0.5 m	Yes	Rocks and brick foundation, possible cellar feature	(Wettstaed 2008)
9OG373	1900-1910 owner occupied 1910-1937 tenant occupied	19.5	9.33	10.17	4800	56*	5-10 m	11-1.0x1.0, 14-1.0x0.5, 1-1.5x1.0 m	No	Two outbuildings, well, house platform, rock pile	(Wettstaed 2010)
9PM1072	Early 20th century	27.25	3.83	23.42	14300	23	5-10 m	9-1.0x1.0, 3-0.5x0.5 m	Yes	Chimney, well, foundations for outbuilding, low mound midden	(Wettstaed and Wettstaed 2009)
9PM1894	Late 19th to early 20th century	4.5	27	-	4400	27	5-10 m	-	Yes	House platform, chimney	(Wettstaed and Jurney 2008)
9PM1905	1840-1920s	12.83	12.83	-	8800	77	5-10 m	-	Yes	House platform, cellar, chimney, 3 wells, brick structure, outbuilding piers, machine/stove dump	(Wettstaed and Jurney 2008)

TABLE 12. Continued.

Site	Occupation Period	Excavated Area m2			Site Area m2 (Wettstaed 2011)	Shovel Tests (30x40 cm)	Shovel Test Intervals	Test Units	Metal Detector Location Investigations	Noted Features	Report
		total	shovel tests	test units							
9PM869	Late 19th	7.66	5.17	2.49	9000	31	5-10 m	5-1.0x0.5 m	Yes	Building floor	(Wettstaed and Jurney 2008)

**Not available for analysis.*

Inter-site Comparisons

Comparing artifact assemblages between sites comes with challenges. These include differing excavation methods, site preservation, and depositional history. Although the intensity of investigation at each site varied, excavation methods and the project supervisor was the same at all sites. Initial delineation of sites followed Forest Service guidelines (Wynn et al. 1994) and included 10 m shovel test transects. Two negative tests in a row were typically used to determine site boundaries; areas of artifact concentration were sampled at 5 m intervals to more closely determine the nature of the concentration. Site boundaries were confirmed or expanded on the basis of metal detection, which that also occasionally prompted additional shovel tests. Test units were excavated at most sites. 9PM1072 and 9OG373 were excavated more intensively with the Passport in Time Project (Wettstaed and Wettstaed 2009; Wettstaed 2010), eight and 26 test units respectively. Although the unique nature of every archaeological site creates some variability, excavation under the direction of one individual using previously established Forest Service guidelines helps ensure that analysis is as comparable as possible.

Evidence of the primary residential structure and middens were preserved at all site locations, but some sites suffered disturbance. 9JO61 and 9OG373 both were impacted by a bulldozer or fire line activity through the site. 9JO306 was the most disturbed site with bulldozer activity and push piles present. This disturbance altered location provenance but artifacts were still used to identifying site occupation period. The site an artifact was recovered from is the provenance data used in this study. This attribute was not altered; there is no evidence that disturbance removed artifacts from sites.

Concerns about dispositional history are addressed by ensuring site sampling is adequate to include variation and analysis accommodates possible variation. Similar consistent shovel testing at each site helps ensure similar artifact recovery. Common archaeological sampling methods at contemporary small farm sites recovered both an adequate and representative sample of artifacts (Crass and Brooks 1995:218). For example, at small farm sites in Navarro and Freestone Counties, Texas, shovel testing of sheet middens recovered remains from most stoneware vessels later recovered through more intensive investigation. Excavation of specialized features added less than 3-6% of total vessels recovered from a site (Jurney and Moir 1987:128-129). Even at sites with evidence of swept yards, most stoneware was recovered between 4 and 8 m from the dwelling remains.

Representative recovery holds true for broad artifact categories as well. At the Richland Creek and Lewisville Lake areas in Texas, Lebo (1995) noted no differences between artifact category percentages when comparing long and short occupation sites as well as sites occupied before and after 1900. Her analysis suggests that length of occupation should not influence artifact discard in the Oconee Forest multi-county area. Only two of the Oconee Forest sites received intensive excavation, but sampling methods used at all sites provide an appropriate sample for inter-site comparison. Accommodating possible variation in analysis will be discussed with the introduction to artifact indexing. noted no differences between artifact category percentages when comparing long and short occupation sites as well as sites occupied before and after 1900. Her analysis suggests that length of occupation should not influence artifact discard in the Oconee Forest multi-county area. Only two of the Oconee Forest sites received intensive excavation, but sampling methods used at all sites provide an appropriate sample for inter-site comparison. Accommodating possible variation in analysis will be discussed with the introduction to artifact indexing.

Pattern Analysis and Inter-Site Comparisons

Many multi-site analyses utilize ratios of broad artifact classes like kitchen, architecture, and personal items to compare sites. Wettstaed (Wettstaed and Wettstaed 2009; Wettstaed 2011) examined frequency of artifact classes and defined artifact patterns for the sites in included in this analysis as well as others on the Oconee National Forest. These efforts included adjusting and examining artifact categories to address questions specific to Oconee sites, a tactic that has proven fruitful in other areas of historical archaeology (Stine 2014). His artifact category comparisons included relative frequencies of ceramic types sorted by quality. As tends to be the case at 19th-century sites, undecorated whiteware predominated at all sites. Percentages by quality appeared similar to other small farm sites just below the fall line in South Carolina (Crass and Brooks 1995; Cabak and Inkrot 1997). Glass tableware at multiple Oconee Forest sites accounts for a small percentage, but in this time period may better represent family purchasing power or consumer market participation than ceramics that were expensive in the 19th century. Review of artifacts at multiple sites demonstrates no firm relationship between greater percentages of table glass and higher quality ceramics or between greater percentages of table glass and known owner residence. Another category examined by Wettstaed that may also represent a degree of market participation is personal items. In contrast, no correlation was observed between known tenant residence and personal items in the Savannah River Site project area located just below the fall line (Cabak and Inkrot 1997). Oconee Forest site assemblages ranged from less than 1% to 5% personal items with a median of 3% being most common. This was notably higher than 0.2-1.8% at the Richland Creek project area in Texas (Lebo 1987) and 1.6-1.9% on the Savannah River Site in South Carolina (Crass and Brooks 1995).

Wettstaed compared Oconee site artifact categories with previously defined pattern types but concluded that "there do not appear to be distinct differences that reflect more than local variation" (Wettstaed 2011:53-54). He compared kitchen, architecture, furniture, arms, clothing, personal, tobacco, and activities artifact categories. While all Oconee Forest sites are dominated by kitchen and architecture artifacts, frequencies of these categories and others place these sites in several different pattern types including the Tenant Farmer Pattern (high percentage of kitchen artifacts), Carolina Pattern (high percentage of kitchen artifacts and strong percentage of architecture artifacts), and Piedmont Farm Pattern (an almost balanced percentage of kitchen and architecture artifacts) (Wettstaed 2011:66). The kitchen category was reviewed by artifact type, including varying types of ceramics, container and table glass, and thin metal. Thin metal is presumed to often include can remains but can include any otherwise unidentified thin metal. Oconee sites have noticeably greater percentages of ceramics than both the Richland Creek and Savannah River Site; 14% versus 5%.

Wettstaed noted no relation between stoneware and glass vessel percentage across sites. Percentage of glass vessels is 7-12% lower and thin metal is 3-6% lower among Oconee sites when compared to Richland Creek and Savannah River Site (Wettstaed 2011:66). When examining container materials specifically by site and period, Wettstaed notes that occupation period and glass container usage have little correlation. Stoneware continued to be used into the 1920s possibly due to the close proximity to potteries in the piedmont region.

South's (1977) original intent for artifact pattern analysis was to discover cultural differences, but the method faces the same limitations as archaeology at large-cultural differences must manifest in material remains to be observable. Artifact patterns do manifest in certain times and regions but southern smallholder sites are often characterized by a paucity of artifacts in general. There is a recent critique that the standardized categories that archaeologists use to aid in inter-site comparison itself limits the ability to see patterns and changes relevant to understanding culture (Stine 2014). I acknowledge the merits of both standardized categories and research project specific categories, but I have altered Wettstaed's original artifact categories and groups in an attempt to answer specific questions. Specifically, I added to Wettstaed's artifact density analysis an artifact index analysis specifically intended to target storageware usage on the Oconee sites. In the following section I provide background information on previous archaeological use of artifact indexing and elaborate on my aims in using it here.

Artifact Index and Artifact Discard Through Time

Research using Artifact Indexes on historical archaeological sites was previously conducted by Galle in 2006. She correlated Artifact Indexes with site occupation dates to identify trends in the occurrence of costly-signaling artifacts. The slave quarters that comprised her sample were spread across a region, excavated over a long time period, and excavated with a number of differing techniques. Galle used Artifact Indexes to address inter-site comparisons while contending with "discard rates at sites that experienced a range of occupation spans and intensities, excavation methods, and post-depositional processes" (Galle 2006:166). Basic analysis began with calculating volume or area artifact densities. These densities were related to occupation times to identify an artifact with a constant rate of discard. The identified artifact was used to calculate an Abundance Index value for artifacts at numerous Chesapeake region slave quarter sites.

My use of the Abundance Index is not concerned with conspicuous consumption but rather with changes in the use of storageware. Using the Abundance Index in this study contends with the same inter-site comparison challenges noted above. Identification of an index artifact with a constant rate of discard through time is necessary to calculate an Abundance Index. The goal is to improve correlation values and statistical significance because it controls for variation in site use intensity. I examined several artifact categories to identify an appropriate index artifact. An Abundance Index value mathematically builds in an adjustment for sites that had varying numbers of residents, were occupied for different lengths of time, were excavated differently, or had differing degrees of preservation. It is a relative frequency adjusted for discard intensity that provides a better comparison of artifacts between sites than relative frequencies and percentages.

Methods

I began by determining a midpoint occupation date for each site that would be used when preforming rank statistical analysis. Generally, I only estimated site occupation to roughly quarter-century periods, for example the late 19th century. In these instances, I interpreted the site occupation period to be approximately 1876-1900 and the midpoint occupation date to be 1888. Occasionally the presence of specific artifacts or historical records allowed Wettstaed to be more specific with occupation periods and I calculated the midpoint from his estimates accordingly. Table 13 contains site designation, Wettstaed's occupation period assessment, my interpreted date range from his assessment, and the calculated midpoint.

TABLE 13. Archaeological site occupation dates and midpoints used for rank correlation.

Site	Occupation Period	Occupation Estimate	Occupation Midpoint
9JA54	1850s to 1880s or 1890s	1850-1899	1874
9JO306	began mid-19th century but primary early 20th century	1901-1925	1913
9JO61	late 19th century	1876-1900	1888
9OG373	early 20th century	1900-1937	1919
9PM1072	early 20th century	1901-1925	1913
9PM1894	late 19th to early 20th century	1876-1925	1900
9PM1905	1840-1860 to 1930	1850-1930	1890
9PM869	late 19th century	1876-1900	1888

I define and use eight artifact categories for analysis, highlighted in figure 10. I selected container glass, thin metal, stoneware, storageware, and glass tableware because of their potential for frequency change through time. Container glass, thin metal, stoneware, and storageware are the particular indicators here for dietary practices. The remaining three categories are refined earthenware, plain earthenware, and undecorated ware-an aggregate group created from plain earthenware, undecorated porcelain, and plain ironstone. I selected these latter categories because I expected their discard rates, the rate at which artifacts are disposed of on site, to remain relatively static through time and be useful as index artifacts. Artifact counts by site and artifact frequency relative to total site artifact count are listed in table 14. The figure below highlights the analyzed eight artifact categories in squares and other related categories in circles. Arrows indicate group inclusion. For example, plain earthenware represents one analytical category and is combined with undecorated porcelain and plain ironstone into a second analytical category, undecorated ware. The refined earthenware category here includes all site ceramics except stoneware and coarse earthenware. Often this term would also exclude porcelain. I have chosen to included it based on Wettstaed's (2011) previous analysis that concludes porcelain is not a useful socioeconomic marker on these sites.

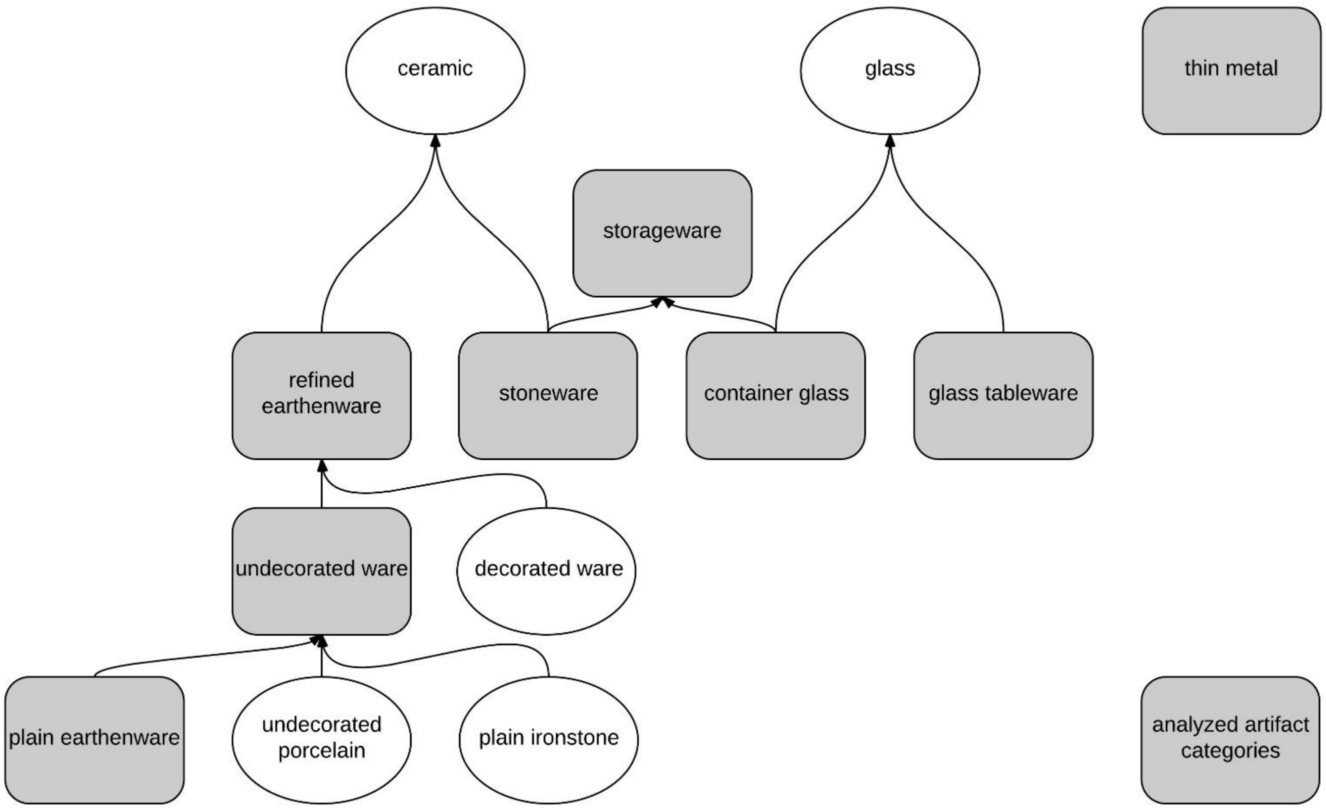

FIGURE 10. Shaded artifact categories included in analysis.

TABLE 14. Artifact counts for each artifact category and frequency relative to total site artifact count.

	9JA54		**9JO306**		**9JO61**		**9OG373**	
	Count	Relative frequency	Count	Relative frequency	Count	Relative frequency	Count	Relative frequency
Container glass	77	0.27	58	0.25	162	0.19	1002	0.36
Thin metal	3	0.01	8	0.03	76	0.09	129	0.05
Stoneware	17	0.59	14	0.13	29	0.04	100	0.04
Refined earthenware	36	0.12	41	0.18	45	0.05	446	0.16
Undecorated ware	25	0.09	31	0.13	34	0.04	382	0.14
Glass tableware	3	0.01	6	0.03	0	0	66	0.02
Plain refined earthenware	25	0.09	31	0.13	34	0.04	369	0.13
Storageware	17	0.06	14	0.06	29	0.03	100	0.04

TABLE 14. Continued.

	9PM1072		9PM1894		9PM1905		9PM869	
	Count	Relative frequency	Count	Relative frequency	Count	Relative frequency	Count	Relative frequency
Container glass	255	0.27	37	0.31	35	0.16	193	0.25
Thin metal	-	-	1	0.00	5	0.02	93	0.12
Stoneware	36	0.03	9	0.08	5	0.02	22	0.03
Refined earthenware	104	0.08	4	0.03	23	0.11	71	0.09
Undecorated ware	-	-	3	0.03	16	0.08	62	0.08
Glass tableware	15	0.01	4	0.03	1	0.00	16	0.02
Plain refined earthenware	-	-	3	0.03	-	-	62	0.08
Storageware	36	0.03	9	0.08	5	0.02	22	0.03

Refined earthenware includes all ceramic tableware recovered from a site, essentially all non-stoneware ceramic. Plain earthenware, a component of refined earthenware, represents an expected purchasing minimum for all families. It collectively includes creamware, pearlware, and whiteware, all of which are inexpensive refined earthenware available in the study area for much of the 19th century. I grouped plain refined earthenware, undecorated porcelain, and plain ironstone as undecorated ware because people in the early 20th century did not prioritize paste and glaze differences. Potters and sellers in the 1800s did not frequently note these differences for earthenware (Miller 1980; 1991) and Wettstaed noted no indication in his analysis that porcelains were favored at owner-occupied farms in the region (Wettstaed 2011). Storageware includes container glass and stoneware, vessels that likely contained home processed foods.

Results

The first step in calculating Artifact Indexes is calculating artifact densities to identify an artifact with a discard rate that did not change through time. Wettstaed (2011) calculated and compared densities for broad artifact categories for many sites in the Oconee Forest area, but it was necessary to generate densities for the more specific categories listed above. Wettstaed noted that shovel tests averaged 30 to 40 cm square and test units varied in size. Table 15 contains the densities for all eight categories by excavated area of a given site, and discard rates calculated from densities divided by the estimated occupation period. See Wettstaed 2011 for site total artifact accumulation on

TABLE 15. Artifact density per meter squared and discard rate over estimated occupation period.

Artifact Category	9JO61		9JO306		9JA54		9PM1072		9OG373	
	density m2	discard rate	density m2	discard rate	density m2	discard rate	density m2	discard rate	density m2	discard rate
Container glass	33.54	1.40	5.20	0.21	4.4	0.09	9.36	0.39	51.38	1.39
Thin metal	15.73	0.66	0.72	0.03	0.17	0.00			6.62	0.18
Stoneware	6.00	0.25	1.25	0.05	0.97	0.02	1.32	0.06	5.13	0.14
Refined earthenware	9.32	0.39	3.67	0.15	2.06	0.04	3.82	0.16	22.87	0.62
Undecoraed ware	7.04	0.29	2.78	0.12	1.43	0.03			19.59	0.53
Glass tableware	0	0	0.54	0.02	0.17	0.00	0.55	0.02	3.38	0.09
Plain refined earthenware	7.04	0.29	2.78	0.12	1.43	0.03			18.92	0.51
Storageware	39.54	1.65	0.25	0.01	5.37	0.11	10.68	0.44	56.51	1.53

TABLE 15. Continued.

Artifact Category	**9PM1905**		**9PM1894**		**9PM869**	
	density m2	discard rate	density m2	discard rate	density m2	discard rate
Container glass	2.73	0.03	8.22	0.17	25.20	1.05
Thin metal	0.39	0.00	0.22	0.00	12.14	0.51
Stoneware	0.39	0.00	2	0.04	2.87	0.12
Refined earthenware	1.79	0.02	0.89	0.02	9.27	0.39
Undecorated ware	1.25	0.02	0.67	0.01	8.09	0.34
Glass tableware	0.08	0.00	0.89	0.02	2.09	0.09
Plain refined earthenware			0.67	0.01	8.09	0.34
Storageware	3.12	0.04	10.22	0.21	28.07	1.17

these sites and others. Excavation depths were typically shallow and not reported for shovel tests. In this instance volume densities likely offer no advantage over area densities given that excavations stopped at the sterile clay B horizon, typically 25 cm or less from the surface. Bioturbation and the shallow depth of artifact recovery create a single occupation period in the soil profile. I calculated the square meters excavated by adding the number of shovel tests divided by six to the number of test units, length multiplied by width. Artifact density by excavated area was calculated by dividing the category artifact count by excavated area.

I calculated Kendall's tau rank correlation coefficient rank (Kendall 1975) for artifacts by time for the eight categories by occupation midpoint at a 10% significance level. This is a nonparametric test used to detect trends in series data. My objective was to identify change, or lack of change, in artifact density over time. In estimating an occupation midpoint two pairs of sites, 9JO61/9PM869 and 9JO306/9PM1072S, had the same midpoint date (table 13), a product of the same occupation period. This was potentially problematic because rank correlation requires unique rank positions. To resolve this for the 9JO306/9PM1072S pair, I decreased site 9JO306's occupation midpoint by a year for the purposes of calculation to ensure unique positions. Preliminary analysis indicated changing the rank order of these two sites did not alter results. However, order of the 9JO61/9PM869 pair potentially does. I performed the test twice; once with site 9PM869's occupation midpoint date decreased by a year and once with site 9JO61's occupation midpoint decreased by a year. If the number of included sites was larger, this necessary alteration would make minimal difference to the overall correlation. Three of the eight categories were unavailable for site 9PM1072 eliminating the concern for order, and the remaining six categories had similar densities for the two sites.

TABLE 16. Kendall's tau rank correlation coefficients for artifact category densities by time at 10% significance.

Artifact Category	**9JO61 earlier***		**9PM869 earlier***	
	r	p	r	p
Container glass	r=0.21	p=0.55	r=0.29	p=0.40
Thin metal	r=0.05	p=1.00	r=0.14	p=0.77
Stoneware	r=0.07	p=0.91	r=0.14	p=0.72
Refined earthenware	r=0.14	p=0.72	r=0.21	p=0.55
Undecorated ware	r=0.14	p=0.77	r=0.05	p=1.00
Glass tableware	r=0.43	p=0.18	r=0.36	p=0.28
Plain refined earthenware	r=0.33	p=0.47	r=0.20	p=0.72
Storageware	r=0.07	p=0.91	r=0.14	p=0.72

*Given an earlier occupation midpoint date.

Table 16 shows low correlation and non-significant p-values for all eight categories when Kendall's tau rank correlation is run. Correlation based on chance was a possibility with only eight sites, but this result was not observed. Ordering site 9JO61 or site 9PM869 first offered no consistent improvement to either correlation or p-values. However, consistent improvement would not necessarily mean 'correct' results because the pattern created by both rank orders is equally valid. Placing site 9JO61 first resulted in the strongest correlation value and best p-values for glass tableware. Placing site 9PM869 first resulted in higher correlation values and better p-values for the categories associated with food storage-container glass, thin metal, stoneware, and storageware. The advantages created by listing either site first are only a matter of degree not kind. In other words, alternating the site order does not change the absence of trend among the categories.

Artifact categories correlation with time both met and countered expectations, depending on the category. Unsurprisingly, glass tableware had correlation values appreciably greater than all other categories and p-values that came closest to 10% significance. These values complement Wettstaed's observation that this artifact category is represented in high percentages (Wettstaed 2011). Plain earthenware had the next highest correlation value. I expected this category to be one with a low value given low cost and common availability. It is possible that in an era when consumption of many materials rose, there was an increase in inexpensive ceramics as well. Compared to other categories, container glass had correlation values that suggested a modest increase in use over time. An increase would be expected as glass containers became mass produced and cheaper to purchase over time. Thin metal and stoneware had very low correlation values in every instance, and undecorated ware did too when a correlation value was calculated from excavated density with site 9PM869 ordered first. This was counter to expectations. Thin metal was expected to increase over time with less gardening and more purchased foods; stoneware as also expected to be abandoned with less food preservation and the adoption of glassware. Thin metal, primarily unidentifiable cans, was expected to rise similar to container glass usage. Stoneware was expected to decline with the increased use of container glass. Undecorated ware was also expected to have a low correlation value, but results were likely influenced by the inclusion of plain earthenware in this group. Values for the storageware category paralleled the container glass and stoneware categories that comprise it.

I used thin metal, stoneware, and refined earthenware to calculate the Abundance Index values in table 17 based upon their low Kendall's tau correlation values on artifact densities. These values are graphically represented in figure 11 through figure 17. These two categories were chosen because this attribute potentially makes them good adjustment artifacts for calculation of the Abundance Index. I also calculated Abundance Index values from refined earthenware in general. Although refined earthenware does not have low correlation values, choosing this artifact category did allow calculation of an Abundance Index for both stoneware and thin metal with an artifact category not tied to food storage. The Abundance Index is calculated (artifact group 1)/(artifact group 1 + artifact group 2); in contrast to a relative frequency, the Artifact Index allows for selection of a specific artifact with constant discard rates (Galle 2006:73). No results from the rank correlation had both minimal correlation value and significant p-value. However, thin metal and stoneware did have very low correlation values suggesting little change in discard rates through time.

TABLE 17. Abundance Index values calculated with refined earthenware, stoneware, and thin metal.

	9JO61			9JO306		
	Refined Earthenware Index	Stoneware Index	Thin Metal Index	Refined Earthenware Index	Stoneware Index	Thin Metal Index
Container glass	0.783	0.848	0.681	0.586	0.806	0.879
Thin metal	0.628	0.724	0.5	0.163	0.364	0.5
Stoneware	0.392	0.500	0.276	0.255	0.5	0.636
Refined earthenware	0.500	0.608	0.372	0.500	0.745	0.837
Undecorated ware	0.430	0.540	0.309	0.431	0.689	0.795
Glass tableware	0.000	0.000	0.000	0.128	0.300	0.428
Plain refined earthenware	0.430	0.540	0.309	0.431	0.689	0.795
Storageware	0.809	0.868	0.715	0.637	0.837	0.900

TABLE 17. Continued

	9JA54			9PM1072		
	Refined Earthenware Index	Stoneware Index	Thin Metal Index	Refined Earthenware Index	Stoneware Index	Thin Metal Index
Container glass	0.681	0.819	0.963	0.710	0.876	not available
Thin metal	0.077	0.150		not available	not available	not available
Stoneware	0.321		0.85	0.257		not available
Refined earthenware		0.679	0.923		0.743	not available
Undecorated ware	0.410	0.595	0.893	not available	not available	not available
Glass tableware	0.077	0.15	0.500	0.126	0.294	not available
Plain refined earthenware	0.410	0.595	0.893	not available	not available	not available
Storageware	0.475	0.847	0.969	0.740	0.890	not available

TABLE 17. Continued.

	9OG373			9PM1905		
	Refined Earthenware Index	Stoneware Index	Thin Metal Index	Refined Earthenware Index	Stoneware Index	Thin Metal Index
Container glass	0.610	0.909	0.886	0.603	0.875	0.875
Thin metal	0.224	0.563		0.179	0.5	
Stoneware	0.183		0.437	0.179		0.5
Refined earthenware		0.817	0.776		0.821	0.821
Undecorated ware	0.461	0.793	0.748	0.410	0.762	0.762
Glass tableware	0.129	0.398	0.338	0.042	0.167	0.167
Plain refined earthenware	0.269	0.787	0.741	not available	not available	not available
Stoneware	0.712	0.917	0.895	0.630	0.890	0.890

TABLE 17. Continued.

	9PM1894			9PM869		
	Refined Earthenware Index	Stoneware Index	Thin Metal Index	Refined Earthenware Index	Stoneware Index	Thin Metal Index
Container glass	0.902	0.804	0.974	0.731	0.898	0.675
Thin metal	0.2	0.1		0.567	0.809	
Stoneware	0.692		0.9	0.237		0.191
Refined earthenware		0.308	0.8		0.763	0.433
Undecorated ware	0.429	0.25	0.75	0.466	0.738	0.4
Glass tableware	0.5	0.308	0.8	0.184	0.421	0.1468
Plain earthenware	0.429	0.25	0.75	0.466	0.738	0.4
Stoneware	0.920	0.840	0.980	0.752	0.907	0.698

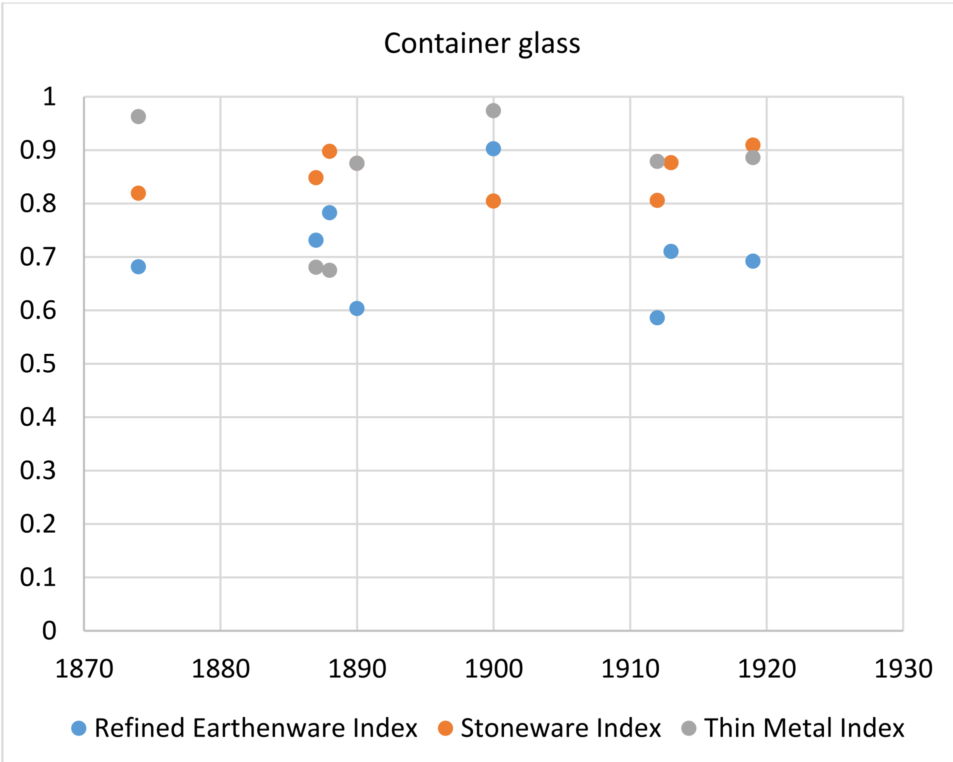

FIGURE 11. Container glass Artifact Index values graphed by site midpoint date.

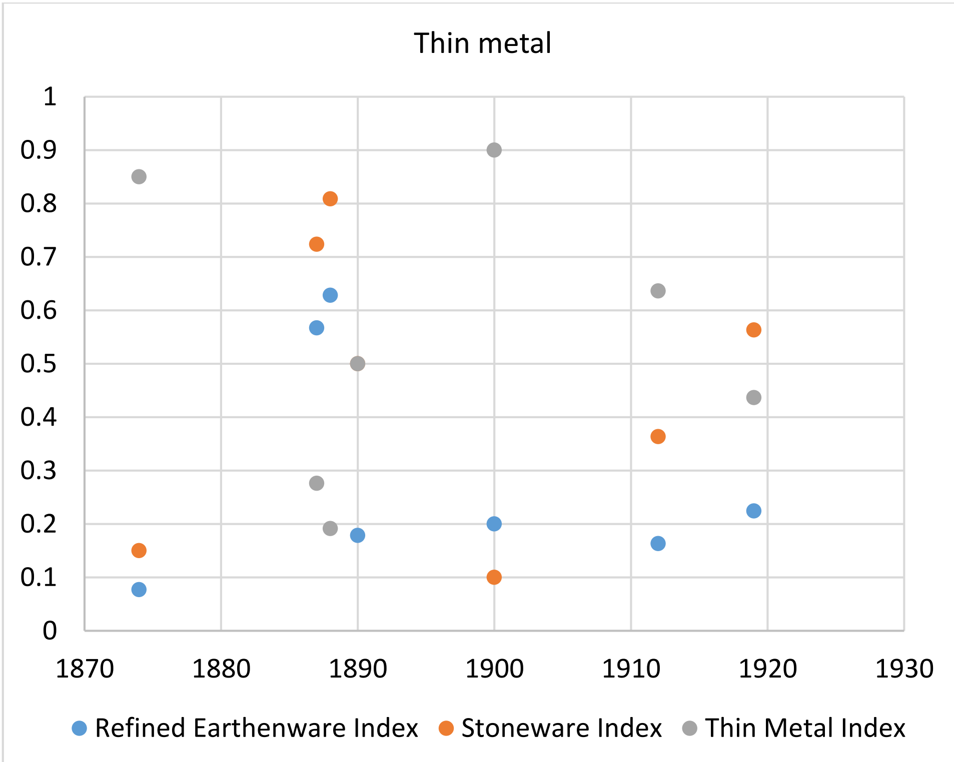

FIGURE 12. Thin metal Artifact Index values graphed by site midpoint date.

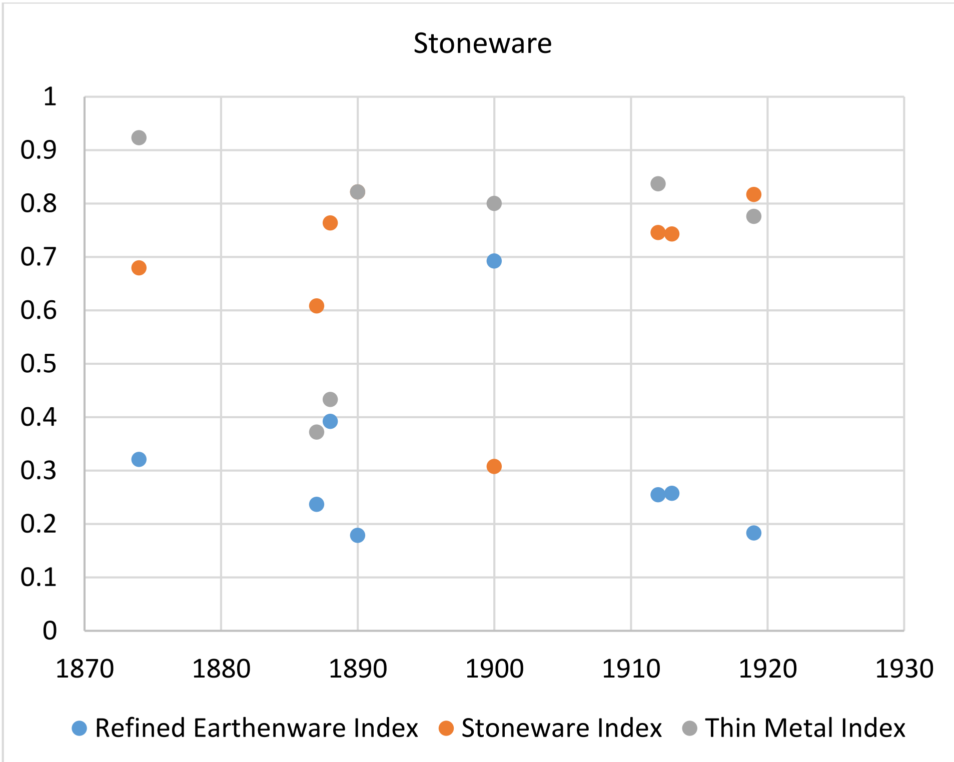

FIGURE 13. Stoneware Artifact Index values graphed by site midpoint date.

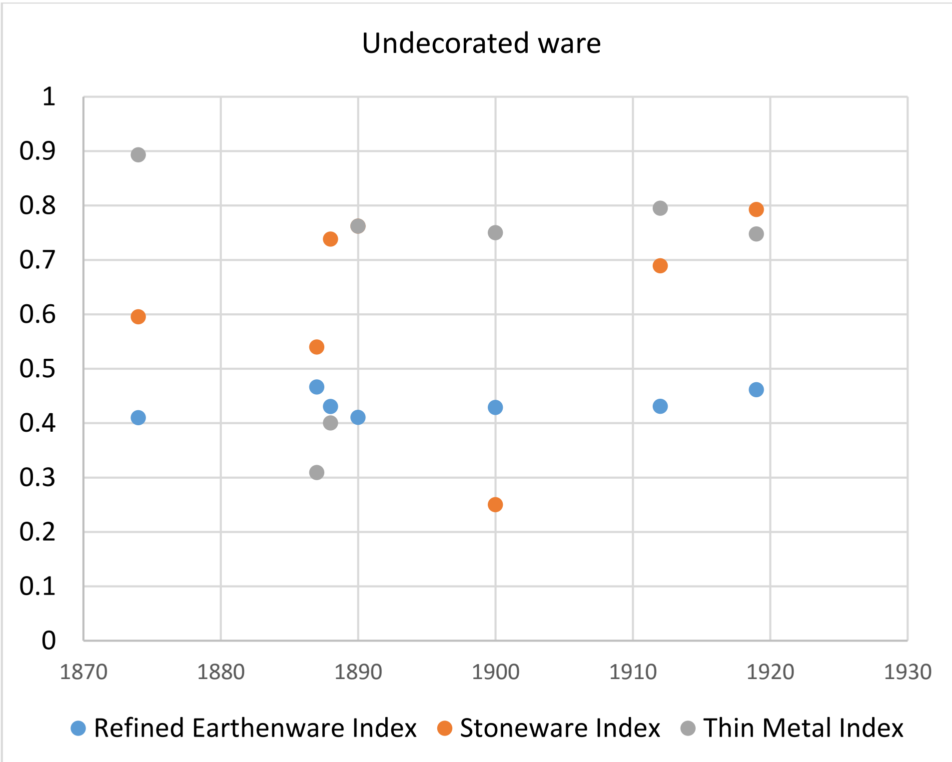

FIGURE 14. Undecorated ware Artifact Index values graphed by site midpoint date.

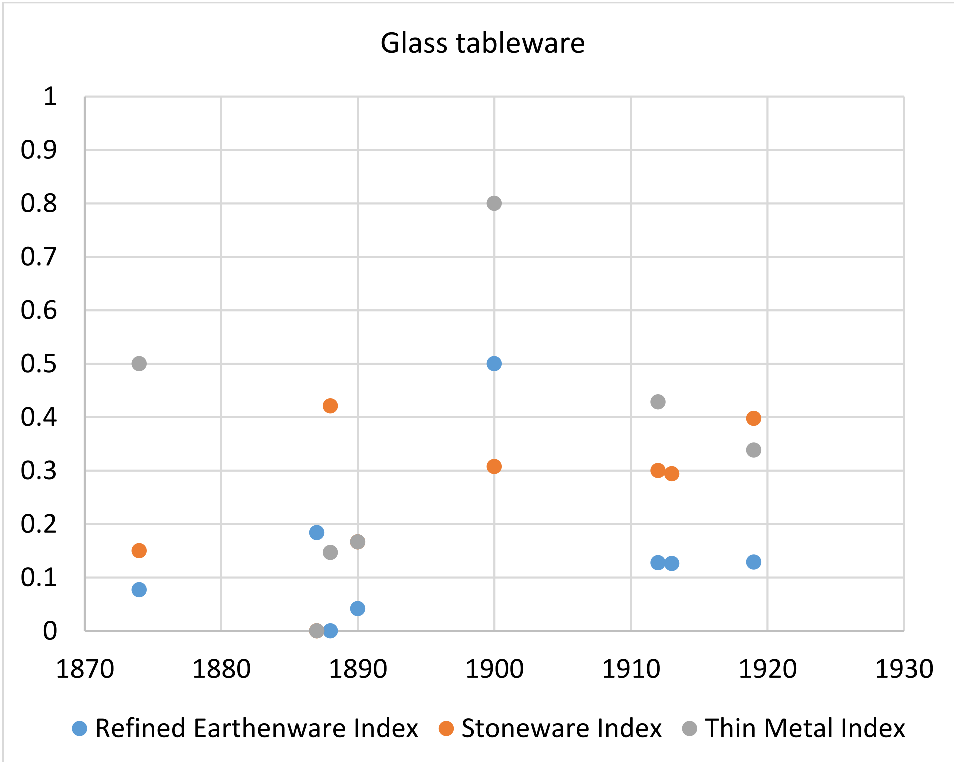

FIGURE 15. Glass tableware Artifact Index values graphed by site midpoint date.

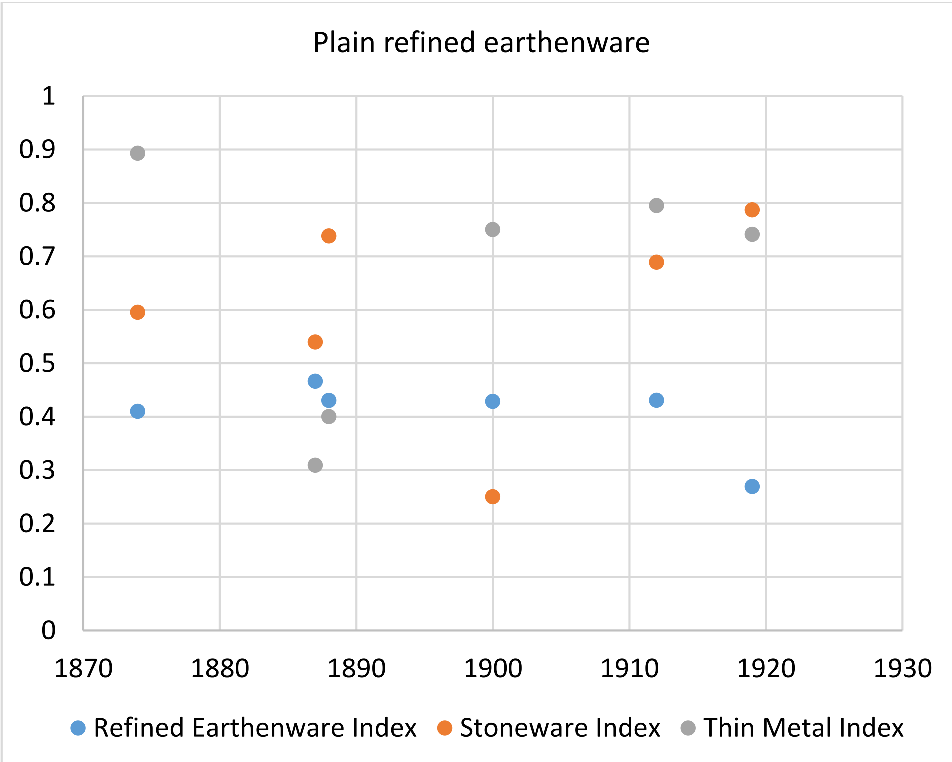

FIGURE 16. Plain refined earthenware Artifact Index values graphed by site midpoint date.

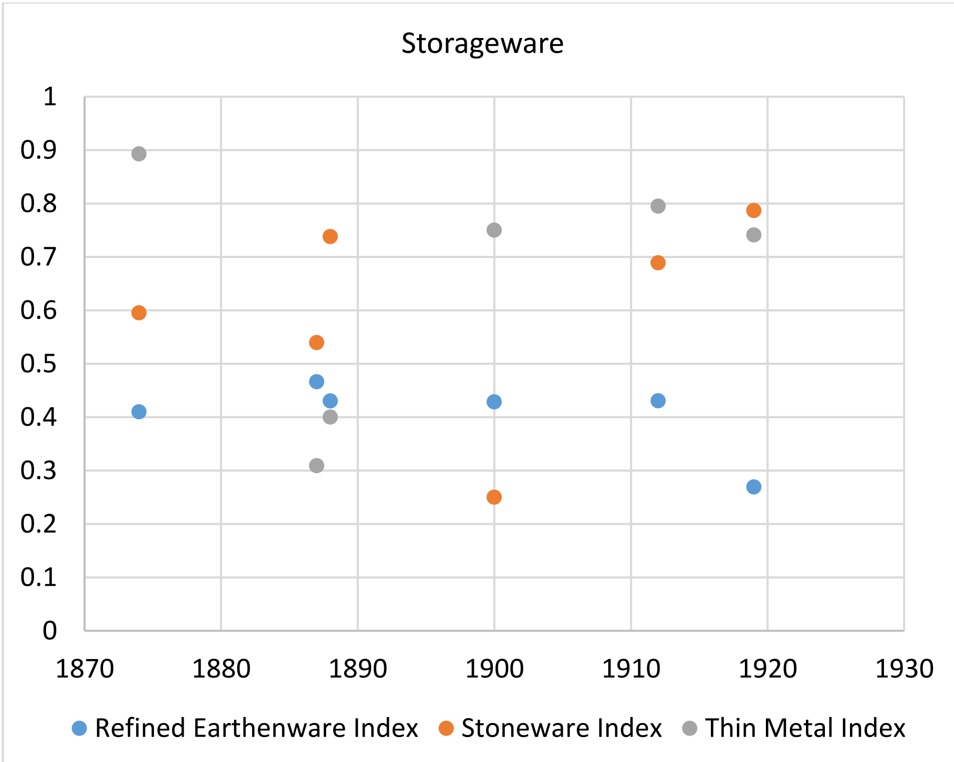

FIGURE 17. Storageware Artifact Index values graphed by site midpoint date.

Kendall's tau was calculated for the Abundance Indexes, like the analysis above on artifact densities. In similar fashion, the calculation was done with both site 9JO61, in table 18, and 9PM869, in table 19, alternately ranked first to explore if the order altered results. The rank correlation value and p-value for a given artifact group improved when calculated from an Abundance Index value that adjusts for site use intensity. The statistical significance of the correlation of artifact categories with time did improve when based upon Abundance Index values, but not consistently and no p-values reached 10% significance. Using the thin metal category for Abundance Index values resulted in no improvement with site 9JO61 ranked earlier and only improved the significance of container glass and stoneware with site 9PM869 ranked earlier, see table 18 and table 19. Refined earthenware Abundance Index values improved statistical significance for stoneware, undecorated ware, and storageware when either site was ranked earlier. Two categories, container glass and undecorated ware, had improved p-values for the stoneware Abundance Index with site 9JO61 ranked earlier (table 19). Correlation calculations on stoneware Abundance Index values resulted in the most improvements to significance with site 9PM869 ranked earlier. P-values are lower for container glass, thin metal, undecorated ware, and storageware strengthening the suggestion that stoneware is the best artifact to calculate the Abundance Index with. Stated differently, stoneware has the most consistent discard rate of the eight artifact categories considered here. In every instance when statistical significance improved, the absolute correlation value increased as well. Although this demonstrates the potential utility of the method, allowing artifact category increases and decreases through time to became both more visible and more likely to be valid observations, there is no relevant meaning here because the low correlation values of the artifacts used to calculate the Abundance Index were not significant.

A few additional observations beyond correlation improvements also merit highlighting. The first observation is that results of every Kendall's tau on the Abundance Index values for glass tableware had lower correlation values and higher p-values than tests on artifact density alone. Glass tableware occurrence on sites did not increase as rapidly through time as artifact density observations suggested when adjusted for site use

TABLE 18. Kendall's tau rank correlation coefficients for each artifact category by time. Site *9PM869* ranked as earlier than site *9JO61*. Evaluated at significance level alpha=0.1. Artifact density calculated for site area in square meters.

	Density		**Refined Earthenware Index**		**Stoneware Index**		**Thin Metal Index**	
	r	p	r	p	r	p	r	p
Container Glass	r=0.14	p=0.72	r=-0.07	p=0.91	r=0.21	p=0.55	r=0.33	p=0.38
Thin Metal	r=-0.05	p=1.00	r=0.05	p=1.00	r=-0.14	p=0.77		
Stoneware	r=0.07	p=0.91	r=-0.14	p=0.72			r=0.14	p=0.77
Refined earthenware	r=0.21	p=0.54			r=0.14	p=0.72	r=-0.05	p=1.00
Undecorated ware	r=0.14	p=0.77	r=0.33	p=0.38	r=0.24	p=0.56	r=-0.05	p=1.00
Glass tableware	r=0.36	p=0.28	r=0.21	p=0.55	r=0.29	p=0.40	r=0.14	p=0.77
Plain earthenware	r=0.20	p=0.72	r=-0.20	p=0.72	r=0.20	p=0.72	r=-0.07	p=1.00
Storageware	r=0.07	p=0.91	r=0.14	p=0.72	r=0.21	p=0.55	r=-0.05	p=1.00

TABLE 19. Kendall's tau rank correlation coefficients for each artifact category by time. Site *9JO61* ranked as earlier than site *9PM869*. Evaluated at significance level alpha=0.1. Artifact density calculated for site area in square meters.

	Density		**Refined Earthenware Index Index**		**Stoneware Index**		**Thin Metal Index**	
	r	p	r	p	r	p	r	p
Container Glass	r=0.21	p=0.55	r=-0.07	p=1.00	r=0.20	p=0.72	r=0.07	p=1.00
Thin Metal	r=0.05	p=1.00	r=-0.07	p=1.00	r=0.07	p=1.00		
Stoneware	r=0.00	p=0.91	r=-0.33	p=0.47			r=-0.07	p=1.00
Refined earthenware	r=0.29	p=0.40			r=0.33	p=0.47	r=0.07	p=1.00
Undecorated ware	r=0.24	p=0.56	r=0.47	p=0.27	r=0.33	p=0.47	r=0.07	p=1.00
Glass tableware	r=0.43	p=0.18	r=0.33	p=0.47	r=0.33	p=0.47	r=0.07	p=1.00
Plain earthenware	r=0.33	p=0.47	r=-0.07	p=1.00	r=0.33	p=0.47	r=0.07	p=1.00
Storageware	r=0.14	p=0.72	r=0.21	p=0.55	r=0.14	p=0.72	r=-0.14	p=0.77

intensity. These results are not significant but do suggest an avenue for further investigation. With a greater sample size, glass tableware should be investigated for a predicable change through time. If present, glass tableware may be the best artifact to calculate the Abundance Index in later research.

The second observation is that thin metal was a poor choice for an Abundance Index. Thin metal densities had very low values for correlation with time (9JO61: r=0.05, p=1.00; 9PM869: r=-0.05, p=1.00). This suggested little change in artifact occurrence and ran counter to the possibility that later sites may have more thin metal simply because preservation of the metal would be better. Rank correlation tests on Abundance Index values calculated with thin metal resulted in little to no improvement in statistical significance. Rank correlation on thin metal Abundance Index values with site 9JO61 ranked earlier resulted in no improved p-values. Only container glass and stoneware categories had improved p-values when I ranked site 9PM869 earlier. The use of thin metal may be muddled by its sometimes fragile and fragmentary condition when recovered archaeologically; artifact handling and care potentially impacts artifact numbers as much as environmental preservation does. Preservation concerns aside it seems that use and discard of thin metal did not increase on these sites and has little to no relationship with the occurrence of the other artifact categories considered here.

Alternatively, stoneware was a good category to create an Abundance Index. Correlation and p-values were improved over those for density for two artifact categories when I ranked site 9JO61 first and for four artifact categories when site 9PM869 was ranked first. Compared to the Kendall’s tau value on Abundance Index values, created using refined earthenware and thin metal, stoneware Abundance Index values consistently provided better p-values for all artifact categories. Although these values still do not reach statistical significance, they are the strongest results

The driver behind the increase in glass tableware could be an unknown factor in artifact recover, an increase in use per capita, or an increase in the number of people. The number of people on a site could increase either because more people were living on sites or because site occupation periods became larger. This later scenario is unlikely. The length of site occupation periods does not increase. A review of the correlation values of the ceramic categories analyzed here indicated possible small increases in the artifact categories through time. Again, this could be tied to a general increase in material goods. Correlation values also indicate a similar small increase in glass containers. Calculating artifact correlation with time based on the stoneware Abundance Index did not alter observations but did strengthen general statistical characteristics. If more people occupied sites over time I would expect to see a general increase in ceramics as well. This did not occur. Ultimately, I was unable to select an artifact to calculate the Abundance Index with that had a significant correlation value. With a better sample size in future research I recommend particular investigation into the possibility that that stoneware use remained consistent through time and people increased their purchases of glass tableware.

Discussion and Conclusions

Archaeological recovery of stoneware remained very stable from site to site. This suggests that use of stoneware also remained very consistent through time. A decline in stoneware use could have two possible archaeological signatures. A sharp increase in recovered artifacts would be seen as people discarded stoneware in bulk. Alternatively, recovered artifacts would gradually decline as people ceased to use or replace broken and discarded stoneware. Neither pattern is observed in these data. Instead, the rank correlation value is low indicating the density of stoneware recovery from sites remains consistent between the 1850s and 1930s. This observation is strengthened the improved values calculated using the stoneware Abundance Index. Stoneware's consistent use makes it a good artifact to calculate an index that adjusts relative frequencies for site use intensity.

Discard rates of container glass increased over time but not enough to suggest a concentrated material replacement of glass jars for stoneware jars. The best correlation and smallest p-values obtained for container glass come from the thin metal Abundance Index (9PM869 ranked earlier, r=0.33, p=0.38) and the stoneware Abundance Index (9JO61 ranked earlier, r=0.29, p=0.40; 9PM869 ranked earlier, r=0.21, p=0.55). However, the correlation values from the stoneware Abundance Index fell generally within the same range as the ceramic categories. This suggested many material goods on sites were slightly increasing through time, but there was no concentrated effort to acquire container glass, either as jars or in the form of purchased items. The artifact data for this area indicate that smallholders added glass jars to their repertoire but did not replace all containers in their inventories with this new product. The consistent recovery of stoneware with the addition of glass containers through time indicates smallholders were using more storageware overall.

My findings about storageware can be conservatively extended to suggestions about behavior. I refrain from making conclusions about changes in food preservation methods. New food storage methods promoted by food scientists often required glass containers and pressure cookers that created higher, safer temperatures for food storage. However, adoption of ostensibly modern glass containers for food storage did not require a change in food storage methods. Traditional methods of pickling, sealing long-cooked hot foods at room pressure, and double boiling in cast iron kettles could be accomplished with glass containers as well as stoneware. Archaeological recovery of glass storageware does not necessarily indicate changing sterilization, processing, and sealing methods. I am confident in the conclusion that an increase in storageware was accompanied by an increase in stored foods. This does not necessarily imply an increase in food availability, although it is possible, but it does imply that food was more managed and availability was extended beyond a growing season. I also suggest that the gardens that supplied this food did not decline and may have even increased as glass storageware was added to older stoneware. Moreover, it is probable that food directed to storageware was surplus available after immediate dietary needs were met or was at risk of spoiling without preservation.

The probable increase in gardening among the smallholders of the Georgia Piedmont does not contradict the economic history model that Southern smallholders were increasingly pressed to replace lower risk field crops with higher risk cotton crops (Wright 1986:87-110). It does affirm that smallholders, even those without strong tenure rights, did not sacrifice garden space for field crops. Food was important. Proper preservation and management of gardened foods, typically tasks allocated to women and children, helped ensure adequate nutrition through the seasons. It also helped buffer the risks associated with growing cash crops.

CHAPTER VII

CONCLUSION AND DISCUSSION

In this dissertation I address two research questions. The first, did smallholders in the South garden less and store less food in the early 20th century than in the late 19th century? A prevailing model examined in the literature review of Chapter II suggested that, over time, many southeastern farmers became increasingly dependent upon cash crops and produced fewer foods on farms with poor soil quality. This change increased market participation and reduced the self-sufficiency of farmers. It also negatively impacted food security and health. My second research question, followed from a contention that declines in nutrition could impact adult stature. How did statures of southeast residents compare to national statures in the 19th century and, if they did decline, did that occur at the end of the 19th and beginning of the 20th century? These two questions center on changes in smallholder lifeways during the post-war South. The first question sought to test one causal element in the story of changing lifeways, and the second question sought to test a related effect element. My broad research goal was to explore the role of smallholder gardening, diet, health, and their resulting effects on stature. All of these elements are interrelated and contribute to the quality of life of lower socioeconomic groups.

To address the first question, I reviewed artifact discard rates at eight sites in the Georgia Piedmont with midpoint occupations ranging between 1874 and 1913. A calculated Abundance Index for eight artifact categories was used to adjust for artifact discard intensity. I also calculated Kendall's tau rank correlation coefficient to evaluate changes in artifact discard through time. Stoneware, the earliest artifact category used for storing food, did not have a discard rate that changed through time. The discard rate of glassware, the newer artifact category, increased modestly through time. I interpreted the consistent use of stoneware with the addition of glassware as an indication of modest gardening intensification among smallholders in this area. Neither activity was in decline over the timeframe of this study, even among these marginal smallholders in Georgia. One contextual explanation for this behavior is that farmers, on exhausted and unproductive soil (Trimble 2008; Wettstaed 2013), increased production and storage to maintain food security. This explanation reflects a strict definition of intensification (Morgan 2015) identified by increased effort needed to maintain returns. Alternatively, traditional foodways were simply being augmented by new glass materials and social interest in their use.

I calculated adult stature for all available individuals excavated from cemeteries in the southeast with reported long bone measurements. To address the second question about possible stature change during the post-Civil War era, I compared that data to historical stature records through time on bases of sex, race, and birth cohort. I was somewhat limited in answering my original question by the non-overlapping cohort periods of my skeletal assemblage and the small number of white females included. White females in my assemblage were born between 1820 and 1849 and predominately from upper-class families. Black females born between 1820 and 1889 in the skeletal assemblage of southern cemeteries did increase in stature. The upward trend of about 3 cm is common to all the black female skeletal assemblages reviewed here in the last half of the 19th century. Black male cohort periods included those born between 1830 and 1889, and the skeletal assemblage does not stand out from other historical assemblages. White male cohort periods included those born between 1770 and 1849. I was not able to evaluate white male stature between the early and late 19th century because of the lack of individuals born in the second half of the 1800s, but statures calculated from my skeletal assemblage resembled those in other historical analyses. My data does not contradict available historical sources that indicate southeastern white men, in the first half of the 19th century, were notably taller than elsewhere in the United States.

My skeletal assemblage and archaeological site dates do not overlap as I intended. White men in the South who lived at the beginning of the 19th century were taller than many in the country. This observation is consistent with the historical observation that farmers and those near agricultural areas had a height advantage during this period (Sokoloff and Villaflor 1982; Steckel 1995). My data lead me to suggest that black women in the South experienced a small improvement in childhood health during the late 19th century, an experience seemingly not shared by black men during their childhood. Future research should continue to test the possibility of differing stature increases and seek possible explanations in differences in childcare.

My storageware analysis supports the claim that smallholders in the late 19th and early 20th centuries took an active role in maintaining their quality of life as farming, markets, and consumerism changed. They readily adopted new glass storage materials alongside existing ceramics. These actions suggest an active role in maintaining nutritional resources for the household. Instead of replacing garden spaces with cash crops as economic pressures increased, poorer families may have depended more on foods grown in gardens. New glass containers offered an additional material tool, perhaps accompanied by the new food storage methods, rather than replacement for older stoneware.

Intensified gardening, along with a diversity of activities including off-farm employment, is a hallmark of smallholder life and reflects how many small farmers live today. Wage labor and employment in other areas, such as community store owners and blacksmiths, was well-known in the 19th-century South. However, the early 20th century was a transitional moment when rural residents became large-scale agriculturalists or remained smallholders who obtained most of their income from sources other than crop sales. Smallholder farms, effectively similar to those in the historic South, are widespread around the world and that has long been the case. Continuation of targeted archaeological research on rural properties in the United States has the potential to place smallholder sites in an anthropological context that considers possible shared farming models in other research areas of the world.

One avenue of continued investigation is to explore whether gardening and food storage intensification occurred elsewhere in the South. Were these efforts common to people across the southeastern United States? A second approach is to use data from the early health departments in Jasper, Jones, Oglethorpe, and Putnam counties, Georgia. Educational, immunization, and other health related documents potentially contain data and offer alternate ways to more closely examine residents' health during the early 20th century. A third research option is to develop a more robust picture of turn-of-the-century dietary patterns in the South. Gardens contributed micro-nutrients, carbohydrates, and food security through the year when produce was properly stored. However, stature studies indicate reliable protein is more important to final adult stature (Sunder 2004; Baten and Baten 2012). The closing of the open range in the South may have negatively impacted smallholder access to animal protein, pork in particular. Future isotopic research on faunal remains could identify if smallholders changed husbandry practices from free-range to penned stock and investigate when smallholders shifted away from local production. These additional lines of inquiry would allow small Southern farmers to be better characterized within a smallholder framework and this in turn may allow for improved archaeological research of less affluent farmers in the early 20th century. The work I have completed here is a small advance in this direction.

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APPENDIX

TABLE 20. Skeletal stature assemblage.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
1	60+	65	F	B	Pre 1870	1860	1795	1790	Pre-1800
2	30-60	45	F	B	1885±10	1885	1840	1840	1800-1860
3	50+	60	M	B	1880±10	1880	1820	1820	1800-1860
4	50+	60	F	B	1885±10	1885	1825	1820	1800-1860
5	40+	50	M	B	1905±10	1905	1855	1850	1800-1860
6	19-24	21.5	F	B	1900±10	1900	1878.5	1870	1860-1899
7	50+	60	F	B	1895±5	1895	1835	1830	1800-1860
8	50+	60	M	B	1900±5	1900	1840	1840	1800-1860
9	60+	65	M	B	1880±10	1880	1815	1810	1800-1860
10	30-60	45	F	B	1895±5	1895	1850	1850	1800-1860
11	40+	50	M	B	1890±5	1890	1840	1840	1800-1860
12	50+	60	F	B	1885±10	1885	1825	1820	1800-1860
13	44+	52	M	B	1800-1850	1825	1773	1770	Pre-1800
14	45-60	52.5	M	B	1800-1850	1825	1772.5	1770	Pre-1800
15	40+	50	M	B	1800-1850	1825	1775	1770	Pre-1800
16	19-20	19.5	M	W	1818-1821	1819.5	1800	1800	1800-1860
17	29	29	M	W	1818-1821	1819.5	1790.5	1790	Pre-1800
18	22	22	M	W	1818-1821	1819.5	1797.5	1790	Pre-1800
19	35	35	M	W	1818-1821	1819.5	1784.5	1780	Pre-1800
20	22	22	M	W	1818-1821	1819.5	1797.5	1790	Pre-1800
21	38	38	M	W	1818-1821	1819.5	1781.5	1780	Pre-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
22	40	40	M	W	1818-1821	1819.5	1779.5	1770	Pre-1800
23	22	22	M	W	1818-1821	1819.5	1797.5	1790	Pre-1800
24	40	40	M	W	1818-1821	1819.5	1779.5	1770	Pre-1800
25	35	35	M	W	1818-1821	1819.5	1784.5	1780	Pre-1800
26	38	38	M	W	1818-1821	1819.5	1781.5	1780	Pre-1860
27	39	39	M	W	1818-1821	1819.5	1780.5	1780	Pre-1860
28	26	26	M	W	1818-1821	1819.5	1793.5	1790	Pre-1800
29	22	22	M	W	1818-1821	1819.5	1797.5	1790	Pre-1800
30	45	45	M	W	1818-1821	1819.5	1774.5	1770	Pre-1860
31	29	29	M	W	1818-1821	1819.5	1790.5	1790	Pre-1800
32	41	41	M	W	1818-1821	1819.5	1778.5	1770	Pre-1800
33	22	22	M	W	1818-1821	1819.5	1797.5	1790	Pre-1860
34	25-35	30	M	W	Late 19th cen.	1875	1845	1840	1800-1860
36	20-30	25	M	B	1835-1842	1838.5	1813.5	1810	1800-1860
37	25-35	30	M	W	1835-1842	1838.5	1808.5	1800	1800-1860
38	25-35	30	M	W	1835-1842	1838.5	1808.5	1800	1800-1860
39	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
40	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
41	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
42	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
43	25-35	30	M	W	1835-1842	1838.5	1808.5	1800	1800-1860
44	25-35	30	M	W	1835-1842	1838.5	1808.5	1800	1800-1860
45	25-35	30	M	W	1835-1842	1838.5	1808.5	1800	1800-1860
46	35-45	40	M	W	1835-1842	1838.5	1798.5	1790	Pre-1800
47	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
48	35-45	40	M	W	1835-1842	1838.5	1798.5	1790	Pre-1800

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
49	17-25	21	M	W	1835-1842	1838.5	1817.5	1810	1800-1860
50	35-45	40	M	W	1835-1842	1838.5	1798.5	1790	Pre-1800
51	31-35	33	M	W	1839-1853	1846	1813	1810	1800-1860
52	36-39	37.5	M	W	1839-1853	1846	1808.5	1800	1800-1860
53	20-40	30	M	W	1886-1895	1890.5	1860.5	1860	1860-1899
54	69	69	M	W	Dec 29, 1893	1893	1824	1820	1800-1860
55	25-29	27	M	B	1903-1927	1913.5	1886.5	1880	1860-1899
56	30-34	64	F	B	1900-1927	1913.5	1849.5	1840	1800-1860
57	35-39	37	M	B	1890s-1927	1908.5	1871.5	1870	1860-1899
58	25-39	32	M	B	1890-1927	1908.5	1876.5	1870	1860-1899
59	30-34	32	F	B	1890-1927	1908.5	1876.5	1870	1860-1899
60	30-39	34.5	F	B	1890-1927	1908.5	1874	1870	1860-1899
61	45-49	47	F	B	1900-1927	1913.5	1866.5	1860	1860-1899
62	30-39	34.5	F	B	1890s-1900s	1900	1865.5	1860	1860-1899
63	40-49	44.5	M	B	1890-1927	1908.5	1864	1860	1860-1899
64	25-29	27	F	B	1890-1927	1908.5	1881.5	1880	1860-1899
65	35-39	37	F	B	1890-1927	1908.5	1871.5	1870	1860-1899
66	40-44	42	F	B	1890-1927	1908.5	1866.5	1860	1860-1899
67	40-49	44.5	M	B	1890-1927	1908.5	1864	1860	1860-1899
68	50+	60	F	B	1900-1927	1913.5	1853.5	1850	1800-1860
69	25-29	27	M	B	1890-1927	1908.5	1881.5	1880	1860-1899
70	20-24	21.5	F	B	1890-1927	1908.5	1887	1880	1860-1899
71	45-49	47	M	B	1890-1927	1908.5	1861.5	1860	1860-1899
72	35-39	37	F	B	1890-1927	1908.5	1871.5	1870	1860-1899
73	45-49	47	M	B	1890-1927	1908.5	1861.5	1860	1860-1899
74	84	84	F	W	1932	1932	1848	1840	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
75	74	74	M	W	1931	1931	1857	1850	1800-1860
76	37	37	M	W	1886	1886	1849	1840	1800-1860
77	31	31	M	W	1870	1870	1839	1830	1800-1860
78	60+	65	F	W	1830-1900	1865	1800	1800	1800-1860
79	25-35	30	F	W	1769	1769	1739	1730	Pre-1800
80	40-45	42.5	M	W	1754-1785	1769.5	1727	1720	Pre-1800
81	40-45	42.5	M	W	1754-1785	1769.5	1727	1720	Pre-1800
82	35-40	37.5	M	B	1885-1900	1892.5	1855	1850	1800-1860
83	50-59	54.5	M	B	1877-1900	1888.5	1834	1830	1800-1860
84	30-50	40	F	B	1846-1900	1870.5	1830.5	1830	1800-1860
85	35-45	40	F	B	1824-1900	1862	1822	1820	1800-1860
86	30-34	64	M	B	1820-1900	1860	1796	1790	Pre-1860
87	39-45	42	M	B	1855-1900	1877.5	1835.5	1830	1800-1860
88	60+	65	M	B	1841-1900	1870.5	1805.5	1800	1800-1860
89	20-30	25	M	B	1846-1900	1870.5	1845.5	1840	1800-1860
90	45-49	47	M	B	1877-1900	1888.5	1841.5	1840	1800-1860
91	38-52	45	F	B	1841-1900	1870.5	1825.5	1820	1800-1860
93	82	82	M	W	1979	1979	1897	1890	1860-1899
94	26	26	F	B	1866-1884	1875	1849	1840	1800-1860
95	50+	60	M	B	1866-1884	1875	1815	1810	1800-1860
96	65-80	72.5	F	B	1866-1884	1875	1802.5	1800	1800-1860
97	65+	67.5	M	B	1866-1884	1875	1807.5	1800	1800-1860
98	36± 9.2	36	M	B	1881-1885	1883	1847	1840	1800-1860
99	83.9±9.2	83.9	F	W	1837-1849	1843.5	1759.6	1750	Pre-1800
100	47.6±9.2	47.6	M	W	1837-1850	1843.5	1795.9	1790	Pre-1860
101	61.4±9.2	61.4	M	W	1837-1851	1844	1782.6	1780	Pre-1800

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
102	73.5 ±9.2	73.5	M	W	1837-1852	1844.5	1771	1770	Pre-1800
103	43.4±9.2	43.4	F	W	1837-1853	1845	1801.6	1800	1800-1860
104	17-21	19	F	W	1837-1854	1845.5	1826.5	1820	1800-1860
105	31.9±9.2	31.9	M	W	1837-1855	1846	1814.1	1810	1800-1860
106	70.1±9.2	70.1	M	W	1837-1856	1846.5	1776.4	1770	Pre-1800
107	67.4±9.2	67.4	F	W	1837-1857	1847	1779.6	1770	Pre-1800
108	48-65	56.5	M	W	1870-1874	1872	1815.5	1810	1800-1860
109	48-55	51.5	M	W	1875-1878~1880	1877.5	1826	1820	1800-1860
110	45-55	50	M	W	1875-1878~1880	1877.5	1827.5	1820	1800-1860
111	45-55	50	M	W	1870<1878-1880	1875	1825	1820	1800-1860
112	58-75	66.5	M	W	1879-1886	1882.5	1816	1810	1800-1860
113	20-25	22.5	M	W	1854-1865	1859.5	1837	1830	1800-1860
114	55-65	60	M	B	1917	1917	1857	1850	1800-1860
115	83	83	M	W	1931	1931	1848	1840	1800-1860
116	73	73	M	W	1908	1908	1835	1830	1800-1860
117	78	78	M	W	1908	1908	1830	1830	1800-1860
118	80	80	M	W	1908	1908	1828	1820	1800-1860
119	68	68	M	W	1908	1908	1840	1840	1800-1860
120	68	68	M	W	1908	1908	1840	1840	1800-1860
121	68	68	M	W	1908	1908	1840	1840	1800-1860
122	89	89	M	W	1908	1908	1819	1810	1800-1860
123	78	78	M	W	1908	1908	1830	1830	1800-1860
124	80	80	M	W	1908	1908	1828	1820	1800-1860
125	73	73	M	W	1908	1908	1835	1830	1800-1860
126	72	72	M	W	1908	1908	1836	1830	1800-1860
127	72	72	M	W	1907	1907	1835	1830	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
128	87	87	M	W	1908	1908	1821	1820	1800-1860
129	90	90	M	W	1908	1908	1818	1810	1800-1860
130	72	72	M	W	1908	1908	1836	1830	1800-1860
131	72	72	M	W	1907	1907	1835	1830	1800-1860
132	60	60	M	W	1907	1907	1847	1840	1800-1860
133	68	68	M	W	1907	1907	1839	1830	1800-1860
134	66	66	M	W	1907	1907	1841	1840	1800-1860
135	77	77	M	W	1907	1907	1830	1830	1800-1860
136	75	75	M	W	1907	1907	1832	1830	1800-1860
137	60	60	M	W	1907	1907	1847	1840	1800-1860
138	75	75	M	W	1907	1907	1832	1830	1800-1860
139	79	79	M	W	1907	1907	1828	1820	1800-1860
140	71	71	M	W	1907	1907	1836	1830	1800-1860
141	67	67	M	W	1907	1907	1840	1840	1800-1860
142	82	82	M	W	1907	1907	1825	1820	1800-1860
143	73	73	M	W	1907	1907	1834	1830	1800-1860
144	63	63	M	W	1907	1907	1844	1840	1800-1860
145	72	72	M	W	1907	1907	1835	1830	1800-1860
146	75	75	M	W	1907	1907	1832	1830	1800-1860
147	75	75	M	W	1920	1920	1845	1840	1800-1860
148	72	72	F	W	1923	1923	1851	1850	1800-1860
149	85	85	M	W	1925	1925	1840	1840	1800-1860
150	79	79	F	W	1951	1951	1872	1870	1860-1899
151	82	82	F	W	1931	1931	1849	1840	1800-1860
152	88	88	M	W	1931	1931	1843	1840	1800-1860
153	78	78	M	W	1917	1917	1839	1830	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
154	89	89	F	W	1932	1932	1843	1840	1800-1860
155	88	88	M	W	1932	1932	1844	1840	1800-1860
156	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
157	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
158	15-19.9	17.45	F	B	1900-1907	1903.5	1886.05	1880	1860-1899
159	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
160	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
161	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
162	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
163	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
164	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
165	15-19.9	17.45	F	B	1900-1907	1903.5	1886.05	1880	1860-1899
166	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
167	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
168	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
169	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
170	50+	60	F	B	1900-1907	1903.5	1843.5	1840	1800-1860
171	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
172	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
173	20-29.9	24.95	M	B	1885-1899	1892	1867.05	1860	1860-1899
174	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
175	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
176	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
177	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
178	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
179	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
180	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
181	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
182	40-49.9	44.95	F	B	1885-1899	1892	1847.05	1840	1800-1860
183	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
184	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
185	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
186	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
187	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
188	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
189	15-19.9	17.45	F	B	1900-1907	1903.5	1886.05	1880	1860-1899
190	30-39.9	34.95	F	B	1869-1884	1875	1840.05	1840	1800-1860
191	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
192	15-19.9	17.45	F	B	1869-1884	1875	1857.55	1850	1800-1860
193	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
194	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
195	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
196	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
197	40-49.9	44.95	F	B	1885-1899	1892	1847.05	1840	1800-1860
198	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
199	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
200	50+	60	F	B	1885-1899	1892	1832	1830	1800-1860
201	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
202	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
203	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
204	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
205	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
206	15-19.9	17.45	F	B	1900-1907	1903.5	1886.05	1880	1860-1899
207	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
208	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
209	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
210	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
211	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
212	20-29.9	24.95	F	B	1885-1899	1892	1867.05	1860	1860-1899
213	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
214	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
215	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
216	15-19.9	17.45	F	B	1900-1907	1903.5	1886.05	1880	1860-1899
217	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
218	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
219	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
220	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
221	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
222	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
223	30-39.9	34.95	M	B	1885-1899	1892	1857.05	1850	1800-1860
224	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
225	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
226	50+	60	M	B	1885-1899	1892	1832	1830	1800-1860
227	15-19.9	17.45	M	B	1885-1899	1892	1874.55	1870	1860-1899
228	30-39.9	34.95	F	B	1869-1884	1875	1840.05	1840	1800-1860
229	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
230	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
231	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
232	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
233	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
234	30-39.9	34.95	F	B	1885-1899	1892	1857.05	1850	1800-1860
235	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
236	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
237	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
238	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
239	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
240	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
241	40-49.9	44.95	F	B	1900-1907	1903.5	1858.55	1850	1800-1860
242	20-29.9	24.95	M	B	1885-1899	1892	1867.05	1860	1860-1899
243	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
244	40-49.9	44.95	M	B	1885-1899	1892	1847.05	1840	1800-1860
245	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
246	30-39.9	34.95	F	B	1869-1899	1884	1849.05	1840	1800-1860
247	30-39.9	34.95	M	B	1869-1899	1884	1849.05	1840	1800-1860
248	30-39.9	34.95	M	B	1885-1899	1892	1857.05	1850	1800-1860
249	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
250	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
251	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
252	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
253	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
254	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
255	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899
256	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
257	30-39.9	34.95	F	B	1900-1907	1903.5	1868.55	1860	1860-1899

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
258	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
259	20-29.9	24.95	F	B	1900-1907	1903.5	1878.55	1870	1860-1899
260	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
261	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
262	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
263	30-39.9	34.95	M	B	1869-1884	1875	1840.05	1840	1800-1860
264	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
265	30-39.9	34.95	M	B	1885-1899	1892	1857.05	1850	1800-1860
266	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
267	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
268	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
269	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
270	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
271	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
272	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
273	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
274	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
275	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
276	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
277	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
278	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
279	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
280	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
281	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
282	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
283	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
284	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
285	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
286	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
287	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
288	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
289	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
290	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
291	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
292	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
293	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
294	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
295	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
296	20-29.9	24.95	M	B	1885-1899	1892	1867.05	1860	1860-1899
297	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
298	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
299	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
300	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
301	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
302	40-49.9	44.95	M	B	1885-1899	1892	1847.05	1840	1800-1860
303	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
304	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
305	40-49.9	44.95	M	B	1885-1899	1892	1847.05	1840	1800-1860
306	15-19.9	17.45	M	B	1900-1907	1903.5	1886.05	1880	1860-1899
307	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
308	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
309	30-39.9	34.95	M	B	1885-1899	1892	1857.05	1850	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
310	40-49.9	44.95	M	B	1869-1884	1875	1830.05	1830	1800-1860
311	30-39.9	34.95	M	B	1869-1884	1875	1840.05	1840	1800-1860
312	40-49.9	44.95	M	B	1885-1899	1892	1847.05	1840	1800-1860
313	20-29.9	24.95	M	B	1900-1907	1903.5	1878.55	1870	1860-1899
314	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
315	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
316	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
317	40-49.9	44.95	M	B	1900-1907	1903.5	1858.55	1850	1800-1860
318	50+	60	M	B	1900-1907	1903.5	1843.5	1840	1800-1860
319	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
320	30-39.9	34.95	M	B	1900-1907	1903.5	1868.55	1860	1860-1899
321	40-50	45	M	W	1878-1911	1894.5	1849.5	1840	1800-1860
322	30-34	64	F	B	1895	1895	1831	1830	1800-1860
323	40-50	45	M	W	1905-1921	1913	1868	1860	1860-1899
324	55	55	F	W	1868	1868	1813	1810	1800-1860
325	88	88	M	W	1862	1862	1774	1770	Pre-1860
326	30-40	35	F	W	1860-1869	1864.5	1829.5	1820	1800-1860
327	81	81	F	W	1911	1911	1830	1830	1800-1860
328	25-35	30	F	W	1867	1867	1837	1830	1800-1860
329	69	69	M	W	1894	1894	1825	1820	1800-1860
330	18-19	18.5	F	W	1858-1880	1869.5	1851	1850	1800-1860
331	21	21	F	W	1858-1880	1869.5	1848.5	1840	1800-1860
332	35-40	37.5	F	W	1858-1880	1869.5	1832	1830	1800-1860
333	35-40	37.5	F	B	1899-1933	1916	1878.5	1870	1860-1899
334	17.5-18.5	18	F	B	1899-1933	1916	1898	1890	1860-1899
335	60+	65	M	B	1899-1915	1907	1842	1840	1800-1860

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
336	60+	65	F	B	1899-1915	1907	1842	1840	1800-1860
337	30-35	32.5	F	B	1915-1933	1924	1891.5	1890	1860-1899
338	55-65	60	F	B	1899-1915	1907	1847	1840	1800-1860
339	45-55	50	M	B	1899-1915	1907	1857	1850	1800-1860
340	35-40	37.5	M	B	1899-1915	1907	1869.5	1860	1860-1899
341	20-30	25	M	B	1915-1933	1924	1899	1880	1860-1899
342	35-45	40	M	B	1915-1933	1924	1884	1880	1860-1899
343	50-60	55	F	B	1899-1915	1907	1852	1850	1800-1860
344	40-50	45	F	B	1915-1933	1924	1879	1870	1860-1899
345	35-45	40	F	B	1899-1915	1907	1867	1860	1860-1899
346	35-45	40	M	B	1899-1934	1916.5	1876.5	1870	1860-1899
347	30-40	35	M	B	1915-1933	1924	1889	1880	1860-1899
348	60+	65	M	B	1899-1915	1907	1842	1840	1800-1860
349	60+	65	M	B	1930	1930	1865	1860	1860-1899
350	60+	65	F	B	1931	1931	1866	1860	1860-1899
351	50-60	55	M	B	1899-1915	1907	1852	1850	1800-1860
352	35-45	40	F	B	1915-1933	1924	1884	1880	1860-1899
353	30-40	35	M	B	1915-1933	1924	1889	1880	1860-1899
354	60+	65	F	B	1930	1930	1865	1860	1860-1899
355	35-45	40	M	B	1899-1915	1907	1867	1860	1860-1899
356	30-40	35	M	B	1899-1915	1907	1872	1870	1860-1899
357	30-40	35	M	B	1899-1915	1907	1872	1870	1860-1899
358	35-45	40	M	B	1899-1934	1916.5	1876.5	1870	1860-1899
359	60+	65	F	B	1915-1933	1924	1859	1850	1800-1860
360	60+	65	M	B	1899-1915	1907	1842	1840	1800-1860
361	35-40	37.5	F	B	1899-1915	1907	1869.5	1860	1860-1899

TABLE 20. Continued.

UID	Reported Age	Estimated Age Point	Sex	Race	Reported Burial Date	Burial Date Midpoint	Birth Date	Cohort	Broad Time Period
362	40-50	45	F	B	1899-1915	1907	1862	1860	1860-1899
363	17-20	18.5	F	B	1920-1933	1924	1905.5	1900	After 1900
364	18.8	18.8	F	W	1825-1850	1837.5	1818.7	1810	1800-1860
365	35-40	37.5	F	W	1900	1900	1862.5	1860	1860-1899
366	55-65	60	M	W	1900-1910	1905	1845	1840	1800-1860
367	21	21	M	W	1864	1864	1843	1840	1800-1860
368	23	23	F	W	1863	1863	1840	1840	1800-1860
369	17-19	18	M	W	1820-1830s	1830	1812	1810	1800-1860
370	40-60	50	M	W	1820-1830s	1830	1780	1770	Pre-1800
371	40-60	45	F	W	1830s	1835	1790	1790	Pre-1800
372	45+	52.5	F	W	1880-1910	1895	1842.5	1840	1800-1860
373	55	55	F	W	1892	1892	1837	1830	1800-1860
374	64	64	F	W	1902	1902	1838	1830	1800-1860
375	40+	50	F	W	1880-1910	1895	1845	1840	1800-1860
376	45-60	52.5	M	W	1890-1910	1900	1847.5	1840	1800-1860
377	40-50	45	F	W	1905	1905	1860	1860	1800-1860
378	81	81	M	W	1928	1928	1847	1840	1800-1860
379	50+	60	F	W	1890-1910	1900	1840	1840	1800-1860
380	31	31	M	W	1918	1918	1887	1880	1860-1899

TABLE 21. Skeletal stature assemblage author reported long bone measurements and statures. Calculated stature estimates used in this dissertation.

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
1						315		155.1
2					362			166.6
3			471	474				173.9
4		214						133.1
5	346							176.7
6			450	444				163.5
7				390				151.2
8			463	468				172.6
9			488					176.8
10				413				156.4
11			440					166.7
12			407		352			155.1
13							164.8 ± 4.1 cm	164.8
14							170.7 ± 4.2 cm	170.7
15							165.3 ±3.8 cm	165.3
16			475					177.3
17			419		336			162.9
18			439					168.1
19			488		407			180.7
20			455		379			172.2
21			448		372			170.4
22			446		365			169.9
23			458		370			173.0
24			463		375			174.2

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
25			426		326			164.7
26			440		349			168.3
27			425		335			164.4
28			468		399			175.5
29			490		395			181.2
30			567		370			201.1
31			435		351			167.0
32			438		362			167.8
33			435		343			167.0
34							68.4 in	173.7
36		326		227		365		121.7
37	362							182.2
38	362	363						182.5
39	328							171.7
40	312		443					169.1
41		353						179.4
42		333						173.2
43	325							170.8
44	336			484				179.7
45	319		456					172.4
46	340							175.4
47	349							178.2
48	379							187.5
49		335	446.5					170.0
50	318							168.6
51				482				179.1

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
52				493				182.0
53							5 ft 9 to 5 ft 11	177.8
54							5 ft 8 to 6 ft 1	179.1
55			550	540	430	433		187.8
56					397			175.2
57			556			493		191.2
58				472		393		173.4
59				453		393		165.5
60				459		386		166.9
61				450		374		164.9
62						386		172.5
63				548		454		189.5
64				503		412		176.9
65						378		170.5
66				485		415		172.8
67				506		416		180.6
68				444		379		163.5
69				488		421		176.8
70				481		395		171.9
71				528		450		185.2
72				462		385		167.6
73				520				183.6
74							61 in (T&G) or 62 in (FORDISC)	154.9
75							63.5 - 69 in	168.3
76							69/70/68 in	172.7
77							178.77 ± 3.6 cm	178.8

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
78	310							164.6
79	280						61.2 in ± 3.0	154.6
80	323						68.2 in ± 3.4	170.1
81		342					70.4 in ± 3.4	176.0
82			461				1.63-1.71 m	171.1
83			457				1.61-1.69 m	170.3
84			455				1.58-1.66 m	166.0
85			447				1.57-1.64 m	164.2
86			503				1.72-1.80 m	180.0
87			475				1.65-1.73 m	174.1
88		317					1.59-1.68 m	166.9
89			498				1.71-1.79 m	178.9
90			468				1.64-1.72 m	172.6
91				418			1.50-1.57 m	157.6
93			467	464				174.5
94		320		462		390	1.67 m	167.6
95		351		475		416	1.75 m	174.1
96				474		364	1.7 m	170.3
97		372		521		425	1.8 m	183.8
98							5 ft 7	170.2
99							5 ft 4	162.6
100							5 ft 7	170.2
101							5 ft 7	170.2
102							5 ft 10	177.8
103							5 ft 2	157.5
104							5 ft 5	165.1

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
105							5 ft 4	162.6
106							5 ft 11	180.3
107							5 ft 3	160.0
108	364	488	489	488	404	408		180.7
109	324	322	463	322	368	361		137.9
110	352	346	503	504	400	399		184.8
111	332	330	461	466	361	363		175.0
112	331	327	456	448	364	371		170.4
113		305		440	364	362		168.3
114	298		447		348			168.2
115						389		182.2
116		355						180.1
117				496		387		182.8
118				473		385		176.8
119		315		440				168.3
120		374		524		414		190.0
121		331		461		372		173.7
122		357				393		183.3
123		347						177.6
124				439		365		168.1
125		319		438		366		167.8
126		360		490		400		181.2
127						359		173.8
128		318		461		368		173.7
129		332		476				177.6
130		323						170.1

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
131		350		496		417		182.8
132		358		510		416		186.4
133		330						172.3
134		359		502		415		184.3
135		362						182.2
136		340		476		395		177.6
137		319		451		342		171.1
138		334				376		178.6
139				488		400		180.7
140		316		432		343		166.2
141		325				382		180.2
142		305				339		168.2
143		359						181.3
144		345		464		381		174.5
145		352						179.1
146		323		428		359		165.2
147		328		465		370		174.8
148		286		414		324		158.9
149		316		465		394		174.8
150		332						172.0
151		286		395		336		154.2
152		336		491		400		181.5
153		334				374		178.0
154		281				345		167.2
155		323						170.1
156							144.8 cm	144.8

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
157							146.6 cm	146.6
158							149.8 cm	149.8
159							151.2 cm	151.2
160							152.3 cm	152.3
161							153.0 cm	153.0
162							153.0 cm	153.0
163							153.2 cm	153.2
164							153.3 cm	153.3
165							153.5 cm	153.5
166							154.1 cm	154.1
167							154.1 cm	154.1
168							154.4 cm	154.4
169							154.6 cm	154.6
170							155.1 cm	155.1
171							155.3 cm	155.3
172							155.4 cm	155.4
173							156.4 cm	156.4
174							156.5 cm	156.5
175							156.8 cm	156.8
176							157.1 cm	157.1
177							157.1 cm	157.1
178							157.2 cm	157.2
179							157.3 cm	157.3
180							157.5 cm	157.5
181							158.1 cm	158.1
182							158.2 cm	158.2

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
183							158.5 cm	158.5
184							158.5 cm	158.5
185							158.6 cm	158.6
186							158.9 cm	158.9
187							159.1 cm	159.1
188							159.5 cm	159.5
189							159.5 cm	159.5
190							159.5 cm	159.5
191							159.6 cm	159.6
192							159.6 cm	159.6
193							159.8 cm	159.8
194							160.1 cm	160.1
195							160.1 cm	160.1
196							160.1 cm	160.1
197							160.1 cm	160.1
198							160.2 cm	160.2
199							160.4 cm	160.4
200							160.5 cm	160.5
201							160.5 cm	160.5
202							160.8 cm	160.8
203							160.8 cm	160.8
204							160.8 cm	160.8
205							161.0 cm	161.0
206							161.1 cm	161.1
207							161.2 cm	161.2
208							161.4 cm	161.4

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
209							161.7 cm	161.7
210							161.7 cm	161.7
211							162.0 cm	162.0
212							162.1 cm	162.1
213							162.4 cm	162.4
214							162.4 cm	162.4
215							162.4 cm	162.4
216							162.6 cm	162.6
217							162.8 cm	162.8
218							162.9 cm	162.9
219							163.2 cm	163.2
220							163.2 cm	163.2
221							163.2 cm	163.2
222							163.4 cm	163.4
223							163.5 cm	163.5
224							163.9 cm	163.9
225							164.1 cm	164.1
226							164.1 cm	164.1
227							164.2 cm	164.2
228							164.2 cm	164.2
229							164.4 cm	164.4
230							164.6 cm	164.6
231							164.6 cm	164.6
232							164.6 cm	164.6
233							165.0 cm	165.0
234							165.5 cm	165.5

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
235							165.9 cm	165.9
236							165.9 cm	165.9
237							166.0 cm	166.0
238							166.1 cm	166.1
239							166.2 cm	166.2
240							166.3 cm	166.3
241							166.5 cm	166.5
242							166.5 cm	166.5
243							166.7 cm	166.7
244							166.8 cm	166.8
245							167.0 cm	167.0
246							167.1 cm	167.1
247							167.4 cm	167.4
248							167.6 cm	167.6
249							167.6 cm	167.6
250							167.9 cm	167.9
251							168.8 cm	168.8
252							168.8 cm	168.8
253							168.9 cm	168.9
254							168.9 cm	168.9
255							169.0 cm	169.0
256							169.5 cm	169.5
257							169.7 cm	169.7
258							169.8 cm	169.8
259							169.8 cm	169.8
260							169.9 cm	169.9

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
261							170.0 cm	170.0
262							170.1 cm	170.1
263							170.5 cm	170.5
264							170.5 cm	170.5
265							170.7 cm	170.7
266							170.9 cm	170.9
267							170.9 cm	170.9
268							171.0 cm	171.0
269							171.1 cm	171.1
270							171.3 cm	171.3
271							171.5 cm	171.5
272							171.6 cm	171.6
273							171.6 cm	171.6
274							171.7 cm	171.7
275							171.7 cm	171.7
276							171.8cm	171.8
277							172.1 cm	172.1
278							172.4 cm	172.4
279							172.7 cm	172.7
280							172.8 cm	172.8
281							173.2 cm	173.2
282							173.2 cm	173.2
283							173.3 cm	173.3
284							173.7 cm	173.7
285							173.9 cm	173.9
286							173.9 cm	173.9

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
287							173.9 cm	173.9
288							174.0 cm	174.0
289							174.0 cm	174.0
290							174.1 cm	174.1
291							174.1 cm	174.1
292							174.2 cm	174.2
293							174.8 cm	174.8
294							175.1 cm	175.1
295							175.1 cm	175.1
296							175.2 cm	175.2
297							175.3 cm	175.3
298							175.3 cm	175.3
299							175.4 cm	175.4
300							175.4 cm	175.4
301							175.4 cm	175.4
302							176.7 cm	176.7
303							176.8 cm	176.8
304							177.2 cm	177.2
305							177.2 cm	177.2
306							177.2 cm	177.2
307							177.3 cm	177.3
308							177.5 cm	177.5
309							177.6 cm	177.6
310							178.5 cm	178.5
311							178.5 cm	178.5
312							178.6 cm	178.6

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
313							178.6 cm	178.6
314							178.8 cm	178.8
315							179.1 cm	179.1
316							179.3 cm	179.3
317							180.0 cm	180.0
318							181.3 cm	181.3
319							181.4 cm	181.4
320							182.7 cm	182.7
321			435			352		167.0
322			410					155.7
323		321		426				164.7
324			424			325		161.3
325			438		375			167.8
326			418		355			159.8
327					325			161.4
328			450			362		167.8
329			498			410	155.2 cm	183.3
330				429	361		162.8 cm	162.6
331			430		352		167.7 cm	162.8
332				421	341		154.8 cm	160.6
333							155.2 cm	155.2
334							162.8 cm	162.8
335							167.7 cm	167.7
336							154.8 cm	154.8
337							165.4 cm	165.4
338							162.6 cm	162.6

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
339							175.9 cm	175.9
340							171.2 cm	171.2
341							171.1 cm	171.1
342							169.7 cm	169.7
343							166.8 cm	166.8
344							164.5 cm	164.5
345							161.9 cm	161.9
346							174.8 cm	174.8
347							178.7 cm	178.7
348							158.3 cm	158.3
349							170.9 cm	170.9
350							157.1 cm	157.1
351							162.9 cm	162.9
352							155.0 cm	155.0
353							171.9 cm	171.9
354							163.2 cm	163.2
355							165.2 cm	165.2
356							179.2 cm	179.2
357							172.1 cm	172.1
358							171.0 cm	171.0
359							161.2 cm	161.2
360							168.9 cm	168.9
361							158.6 cm	158.6
362							152.5 cm	152.5
363							159.2 cm	159.2
364							64.4 in	163.6

TABLE 21. Continued

UID	Max Humerus R	Max Humerus L	Max Femur R	Max Femur L	Max Tibia R	Max Tibia L	Author Reported Stature	Stature
365							173 cm	173.0
366							179.5 cm	179.5
367							187.96±3.81 cm	187.7
368			428				160.02±3.81 cm	162.3
369				411				160.8
370				472				176.6
371				409				157.6
372				458				169.7
373				418				159.8
374				412				158.4
375				464				171.2
376				480				178.6
377				428				162.3
378				491				181.5
379				430				162.8
380				458				173.0