

The North Carolina Geographer
Volume 18, 2011

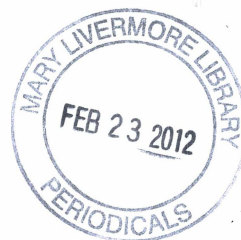


From the Editor

Dear fellow Geographers:

The 18th volume of *The North Carolina Geographer* includes a variety of articles, reviews, and reports. Susan Walcott analyzes the dynamic influx of southeast Asian migrants to the state. Tim Mulrooney examines the potential for wind power. Cheryl Hegevik and Chris Badurek present a temporal analysis of drought. Nathan Phillippi considers the roll of topography and tactics in one of the final military exchanges of the Civil War. And Gordana Valhovic and Rakesh Malhotra review their experience with teaching GIS using an Esri site license. In the reports sections, Jeff Patton was named North Carolina Geographer of the Year at the North Carolina Geographical Society meeting in Greensboro, and Jim Young provides an update on activities of the North Carolina Geographical Alliance.

Michael E. Lewis
Editor



On the cover: The Grove Park Inn and Resort in Asheville, North Carolina has been attracting tourism to the Asheville area since 1913. Image: Michael E. Lewis



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Southeast Asians in North Carolina: Settlement Patterns and Socioeconomic Outcomes

Susan M. Walcott

University of North Carolina- Greensboro

The relevance of place characteristics of both sending and receiving regions on the socio-economic success of immigrants constitutes an under examined yet potentially highly important factor explaining differential adjustment outcomes of groups from a similar geographic region. This research looks at major Southeast Asian refugee groups in North Carolina to compare them with each other in the same state and with the success of the same groups in other states. Census figures from PUMA and SF3 files are used to trace education attainment, income levels, and clustering in five demographic divisions from 1990 – 2007, depending on data availability. Interviews with community leaders supplement quantitative sources. Cultural factors, proclivity to settle in an urban or rural location, and the role of leadership are all found to play important explanatory roles.

Keywords: Southeast Asia, refugees, North Carolina, education, occupation

Population patterns in the United States display a highly varied diversity of demographic groups characteristic of a history of receiving immigrants and refugees from around the world. Responding to the enhanced mobility typical in the U.S., different groups spread over time to different locations from their initial settlement assignment. Does that movement differentially impact adjustment strategies? To test that hypothesis I examined patterns of settlement by major Southeast Asian ethnic groups from 1990 to 2007, comparing their educational and economic attainment and assessing the relationship of those factors in a case study of North Carolina. The case study illustrates differences between major receiving areas and concentrations in secondary locations.

By the year 2000 census, major settlement states for Southeast Asians were California (705,381), Texas (163,625), and Minnesota (84,062) (Bureaus of the Census 2000). A Southern regional counterpart to studies done in the West Coast and upper Midwest is missing, but could enhance

understanding of the adaptation of these groups to different cultural and geographic settings. More widespread studies are desirable for improving the applicability of models and policies (Potocky and McDonald 1995). The degree to which their varied historical experiences and demographic make-up impact socioeconomic outcomes is often obscured by an overly general treatment of refugee populations as “Asian” or “Southeast Asian” (Andrews and Stopp 1985). The experience of refugees like the Lao, for example, is qualitatively different from immigrants such as the Thai, with whom they are grouped by the census. Immigrants respond more to an economic “pull” than a fear of persecution “push”, and are more likely to embody higher levels of skill and education that ease their readjustment.

On a national scale, the 750,000 Southeast Asian refugees counted in the 1980 census grew to 1.6 million by the year 2000. At the beginning of the 21st century, North Carolina contained the 12th largest population of Southeast Asians (34,087) in the U.S.,

ranked fourth in Hmong (7,982), fifth in Laotians (6,282), 13th in Vietnamese (17,142) and 17th in Cambodians (2,681) among states in the U.S. Major features attracting this largely secondary relocation population included the availability of basic skill level manufacturing jobs, available farm land, a variety of topography reminiscent of their homeland, and an affordable cost of living. The presence of major volunteer agencies aiding immigration adjustment to new populations also helped. Those agencies were found among religious organizations, and the Center for New North Carolinians (Brown, Mott and Malecki 2007). Public Use Microdata Sample (PUMS) data from 1990, 2000, and American Community Survey (ACS) data from 2005-2007 as well as qualitative evidence are used to test the hypothesis that spatial concentration has a positive effect on successful settlement. A second hypothesis is that the rural or urban sending region setting also impacts socioeconomic outcome and settlement pattern. These factors influence aspirations for attainment of different education levels and occupations, which are reflected in settlement location over time as demonstrated in the following sections.

Qualitative interviews explore reasons for the impact of clustering on two paired groups in particular: the Lao and Hmong from the country of Laos, and the Vietnamese and Montagnard (also known as the Dega) from the country of Vietnam. Upland tribal groups (Hmong and Montagnard) tended to live in related kinship or tribal units, while the lowland Lao and Vietnamese tended to come as individuals and family units. Commonalities include the experience of all groups who initially settled in areas where they were directed by settlement agencies, then subsequently moved to locations of their own choosing (Bailey 2002). Differences include the relatively lower numbers and initially lower educational level of the upland groups, so measurement of subsequent

attainment will be on a percentage basis to compare across ethnic groups of different sizes. By applying a geographic examination of the effect of clustering on differential attainment rates of regionally similar ethnic groups, this study provides a new angle for understanding refugee adjustment success. Results could have significant policy application for improving refugee adaptation by heightening understanding of the intertwined roles of location, culture and leadership.

Southeast Asian Refugee Patterns

Refugee populations can be differentiated by origin and migration paths within their homeland, through camps (largely Thai) in Asia, among states in the U.S. and within their current state. Discrimination continues to occur in Southeast Asian populations on many levels: from the white majority population, among other Asians, and among different national sending areas based on upland or lowland, political wartime affiliation, wealth status, rural or urban home setting (Bonus and Vo 2002). It is therefore important to take a wide set of factors into consideration when evaluating refugee adjustment experiences. Emigration out of Southeast Asia generally came in two waves. The first period of movement out of refugee camps and entry into the U.S. took place from 1976 to 1993, when Thailand stopped accepting people into the camps. The second wave began in 1988 with refugee secondary relocation to areas with better jobs and/or newly located family networks, and accelerated in 1996 when the welfare reform act provided even greater motivation to move to areas of economic opportunity. This spurred many refugees who were former agriculturalists, for example, to acquire less expensive available land to start their own farms, becoming capitalist entrepreneurs in non-urban settings.

Several models describe the socioeconomic experience of refugees and immigrants. One of the most commonly used

is segmented assimilation, which highlights movement through different steps in the adjustment process (Portes and Zhou 1993, Portes 1995, Fu and Hatfield 2008), economic advancement reflecting social capital stock as seen in economic attainment which is frequently linked to education level completed (Zhou 1997), and a migration chain perspective linking initial placement by agencies with secondary migration based on communication concerning job, education and other factors (Brown, et.al., 2007). Southeast Asian identities are portrayed as “fluid, multilayered, and situational” (Jeung 2002, 60), frequently reconstructed to reflect changing circumstances across time and space. Identities are maintained by language and reenacted customs of a group, especially when an older generation is present and practices are culturally distinctive. A “we, therefore me” identity of self is characteristic of these Asian origin societies, emanating from the importance of the link with an associated group to a far greater degree than is the case in the U.S. host culture (personal communications). The following study contributes a more nuanced examination of how a process of gradual adjustment – rather than assimilation – varies by cultures of origin (including within a country, such as the Hmong within Laos) and locations of resettlement within the host country, culminating in the realization of different American dreams.

Many studies from the West Coast involve urban settings, which shape the types of behaviors depicted. Pan-ethnic largely Southeast Asian urban underclasses of immigrant neighborhood youth (Khmer, Hmong, Lao, Chinese, and Filipino) are portrayed as associating largely with each other. They demonstrate largely symbolic sub-ethnic identities in a racialized, impoverished commonality (anti-Khmer Rouge Cambodians among other Asians) and relate to stories of marginalization told in school as part of Black culture. Asians in these circumstances banded

together as protection from the violent antagonism of African Americans, seeing themselves as pan-Asian, non-majority American whites (Jeung 2002). Nationally, linguistic isolation among Southeast Asians decreased from sixty percent in 1990 to 34.8% in 2000. Educational attainment rose from a 1990 average of 11% with a high school degree and 3% with a BA, to year 2000 levels of 27.2% high school graduates, 11.7% with a BA, and 1.5% with a Masters degree. Income levels reflected the trend, from a median in 1990 of just over \$14,000 to a year 2000 median income of \$32,074, but with wide variations by state.

In the 1990 U.S. census, the highest poverty rates were found among Cambodians, Hmong and Laotians. The Southeast Asian median age was 30 years of age, with an important “Generation 1.5” emerging as the bicultural/bilingual transition group (Potocky and McDonald 1995). By the year 2000 census the Vietnamese were doing the best on a national scale. They came with the highest social capital in a first wave (pre-1975) that represented individuals with ties to power and wealth, and built on cultural values for a second generation whose attainments reflected those of an underlying Chinese ethnic: Confucian, hierarchic, Mahayana Buddhism group centered, valuing educational attainment and parental involvement. With a higher level start, they lived in better areas, went to better schools, were already more urban and westernized, and tended to be small business owners. They also contained a number of Catholics and individuals who had long worked with and were familiar with Americans (Zhou and Bankston 1998; Wood 2006).

Cambodians in the year 2000 census were faring the worst of the Southeast Asian settlement groups, largely attributable to their highly disruptive pre-refugee experience under the murderous, anti-elite Pol Pot regime. Refugees therefore tended to be rural farmers or families of fishermen. Their

poverty in the U.S. led them to reside in areas with low achieving schools, in which their performance was most like that of their majority African American classmates (R. Kim 2002, W. Kim 2006). Nationally, the Hmong were doing the best of the second tier refugees. They demonstrated the biggest improvement and best psychological adjustment, lived in tight communities, and frequently maintained traditional practices (Kim 2006). In the 2000 census, fully 75% of the Hmong were still in only three states (CA, MN, WI), with North Carolina fourth. Secondary migration frequently involves targeted destinations to reunite extended family/ clan members (Faruque 2002). Ethnic enclaves were traditional in Hmong sending areas, the isolated rural parts of three Laotian provinces. Many came as pre-literate refugees of the U.S.'s "Secret War" preceding and continuing through the main Vietnam conflict, with 300,000 arriving by the 2000 census. In 1975 Hmong General Vang Pao sought to create an educated elite by sending a few young men to the US to study. They were supposed to return to Laos, but this did not happen due to the civil war in Laos. Educational challenges of low attainment are a large concern of the Hmong community, averaging the lowest of Asians in U.S., with almost half of their population lacking schooling (Miyares 1998, K. Yang 2003). Some interesting gender observations: though males started off doing the best, over the decade females closed the gap even while becoming young mothers and males drifted into extra-curricular activities that depressed their educational attainments (Pfeifer and Lee 2001). Overall, Hmong assimilation inevitably increased over the generations, but maintenance of customs is enhanced by maintenance of social networks with which they came (Her and Buley-Meissner 2010). Living within a half day commuting range of other Hmong enables participation in community events, continuation of social

network bonds, and communication bridging various generational experiences.

Laotians had the lowest wages of the Southeast Asians. Laotian parents tended to be less likely to push education attainment than in Hmong families. A Southern California-based study found that Laotians were also the most likely (more than half) to live in an enclave setting (Allen and Turner 2002), in part due to the affordability of housing in locations experiencing successive waves of low income new occupants. The function of enclaves in retarding or hastening the transition of immigrants remains an open question, beyond preference for access to familiar products in retail clusters. Movement into higher priced housing, usually indicating better adjustment and ability to integrate with the majority society, usually signifies the lessening of enclave dependence and increasing socioeconomic progress. This is particularly the case in terms of access to better education. The size of California enclaves, however, permits a stability that is not present in the South for all Southeast Asian ethnic groups.

In national level studies, education was the factor most closely correlated to an improved economic standing. Thai immigrants tend to come from a wealthier, more educated background, and like the Vietnamese they pass these on to the socioeconomic aspirations of the next generation. Also similar to the Vietnamese, they tend to have a much higher proportion of ethnic Chinese in the refugee population. Due to their relative success, this segment was the first to be exterminated in Pol Pot's Cambodia, rather than targeted for discriminatory expulsion as occurred in other Southeast Asian countries. The Montagnard (also known as the Dega), the upland Vietnamese group who is highly represented in North Carolina's Southeast Asian refugee population but not in separate census statistics, fall into five different dialect subgroups. Almost all were settled in North

Carolina by State Department design. Originally arriving in 1986 as a very isolated group of 30 among thousands of other immigrants, keeping them as a cluster seemed to be the best way to assist their adjustment (CNNC 2010). An upland group on the geographic periphery of Vietnam, they were heavily converted to Christianity in order to benefit from increased education opportunities provided by access to Western missionaries. This also enabled the socially disfavored group to transcend their impoverished status. Their upland rural counterparts the Hmong were much less inclined to conversion, combining basic Shamanic beliefs with Buddhism instead. Modern Christian Hmong are seen as similar to what was known in mid-19th century China as the “rice Christian” effect of “fill the bowl, save the soul”. Conversion of young professionals to Christianity is in part a response to the encroaching time demands of complex traditional practices, thus accelerating their assimilation to mainstream American society. The overly simplistic attribution of causality for observed ethnic differences in resettlement outcomes underlines the often cited need for qualitative data to provide locally valid explanations for statistically observed ethnic differences. Observations concerning the impact of the type of Buddhism practiced by various groups – a more group oriented Mahayana for the Vietnamese, a more individualistic Theravada for Thai, Laotian and Cambodians – was less likely to impact refugee adjustment patterns than the relative percentage of ethnic Chinese in the refugee population, with their cultural emphasis on education attainment as the route to wealth accumulation (Zhou and Gatewood 2000).

Data and Methodology

This study uses a multimethods approach to more fully address underlying questions in the proposed hypotheses as to the relationship of spatial clustering, cultural frameworks, and socioeconomic performance in education and/or income as proxies for desirable

adjustment outcomes of refugees in a new setting. Although much of the literature on ethnicity in the U.S. utilizes broad census categories, such an approach can blur important distinctions reflecting place-based cultural frameworks from the sending area. Census data provides the most accurate comparable statistics over time, but still hampers analysis by frequently acknowledged shortcomings such as ethnic categories that reflect incomplete understandings of within group relationships, size of groups, and political visibility. Within-country distinctions can be captured at a finer level of PUMS SF3 data, such as upland Hmong contrasted with lowland Lao, but only in the American FactFinder series (Brod 2004). These distinctions are unfortunately not available for a similar geographic-cultural distinction in Vietnam involving the upland Montagnard who also immigrated in notable numbers to the U.S., though it is hoped that this will be partially rectified in the 2010 census. Speculation exists within immigrant communities that census figures represent a large under count, largely due to the marginalized situation (poverty, suspicion of government based on previous alienating experiences) of reluctant refugees. While supplemental funds were apportioned in the 2010 census for outreach to reportedly under-represented groups within the Southeast Asian community, not all groups chose to be involved.

This research draws on census data in three basic areas. The “language” variable is used for ethnic identity in order to separate out better immigration effects, avoiding the “blurring” of ethnicity effects due to generational remove and intermarriage (Perez and Hirschman 2009). Location maps of ethnic Southeast Asian groups in North Carolina are based on county areas tied to the census data. This research explores strategies for economic advancement of Southeast Asian immigrants to North Carolina using educational attainment and income proxy

measures (Jeung 2002). Education levels by last finished for each of the four census grouped Southeast Asian ethnicities (at a 5% sample, representing a 1-in-20 census response representation) were divided into nine categories: none, lower elementary (K-4), upper elementary/ middle school (5-8), high school (9-12), some college, and the three degree levels. Income levels for 1990 and 2000 were divided into ten levels, corresponding to their proportional natural divides in the range. Particular focus fell on the poverty line cutoff, as set based on a family of four (it should be noted that refugee families tend to have larger households, as the family of six Hmong average size, including a larger number of children and elders) in the year of census enumeration. In 1989 this was \$5,980, and in 1999 it was \$8,240. Comparative results are displayed in Table 2, discussed further in the North Carolina section.

Qualitative evidence was accumulated through a dozen interviews with members and leaders of various refugee communities, volunteer agency representatives, and religious figures. Although distribution was necessarily random rather than strictly representative, given constraints of availability, narrative evidence was sufficiently overlapping and reinforcing to supplement the primarily quantitative data upon which this study is built.

Southeast Asian Refugee Adjustment Patterns in North Carolina

The composition and behavior of the five ethnic groups previously discussed varied in North Carolina by group and in some cases from settings in other states, reflecting both the segment of the sending country's population and the circumstances in the receiving region and counties. The next section discusses the cluster maps for each group based on the census data enumeration county areas, using language to identify the refugee population. The second section

discusses the socio-economic measures of education attainment and income level for each ethnic group. The order in which each group is treated follows the census category order: Hmong (4420), Thai (4710), Lao (4720), Vietnamese (5000), and Cambodian (5120).

Cluster maps

Legal entry requirements for the United States favored family reunification, a factor that largely determined initial refugee settlement locations along with a match with a sponsoring organization. Much secondary shifting subsequently occurred to areas with relatively high public assistance, low unemployment in low skill jobs, mild winters, and a large Asian community, resulting in a pattern of increasing spatial concentration (Desbartes 1985). Clustering was also a sign of community reconnection through contacts with a same- ethnic sponsor in the U.S. who was able to locate relatives initially settled elsewhere.

North Carolina's Hmong continue their cluster location in the western Appalachian mountain range in the foothills east of Asheville (Figure 1), which was anchored by the patriarchal leadership of the late Gen. Vang Pao. The extended clan found congenial jobs in the furniture related industry of the nearby Hickory-Lenoir area, enabling members to easily gather for frequent ceremonies. More far-flung secondary clusters noted in later census maps were an outcome of two considerations. The 1994 welfare reform act motivated Hmong agriculturalists to separate to buy land for poultry farming in the southern tip of the state. Clusters in Guilford County in central North Carolina reflect a higher concentration than in surrounding areas due to the education opportunities and relatively high paying jobs available there. A second clan leader also settled with his network in North Carolina, but both locations attracted skill sets that led to different

occupational outcomes than in the upper Midwest or west coast states.

North Carolina served as a relocation site particularly for the less skilled and less literate Laotians (Figure 2) who left the West Coast for factory jobs and services as secondary relocatees. The Piedmont Triad's Laotian cluster, for example, found employment in a variety of small entrepreneurial businesses catering to the ethnic community such as grocery stores and restaurants that functioned as community gathering place with videos and other entertainment in Thai/Lao language. Other businesses also drew upon a market in the larger community with laundromats, sandwich and auto shops. A new predominantly Lao Theravada Buddhist temple in High Point provides a community gathering place as well, branching out from the Thai-Cambodian temple in nearby Greensboro, also in central Guilford County. Thai/Lao Theravada Buddhist temples are located in North Carolina's main three cities. Kings Mountain, on the southwestern border of North Carolina has a large Lao community, as does Spartanburg, SC across the border to its south, but cluster sites are split by affiliation to parties in the civil war of the home country. Southern Lao congregate close

to each other, as do the Northern Lao, representing two parts of the traditional Laotian three-headed elephant. Tennessee, to the immediate west of North Carolina, contains another community of Laotians. With more than 60 ethnic groups in Laos, it is not unexpected that the immigrant population would be less cohesive and more readily assimilated than other groups such as the Hmong and Montagnard Dega that transferred in as more tightly integrated clan groupings. Thai immigrants overwhelmingly concentrate in the three largest cities in the state, as do the next group.

The Vietnamese (Figure 3) reconcentrated in the state's three major urban areas of Charlotte (in the southwest), the Piedmont Triad (Greensboro, High Point and Winston-Salem in the center of the state) and the Triangle (Chapel Hill, Durham, and Raleigh, several counties to the east of the Triad). These university-anchored sprawling city regions served as home bases suitable for business and education. The level of human capital brought by the Vietnamese most closely approximated that of the Thai, and also reflected their shared higher proportion of ethnic Chinese population.

Figure 1. Hmong Settlement Pattern, 1990-2007

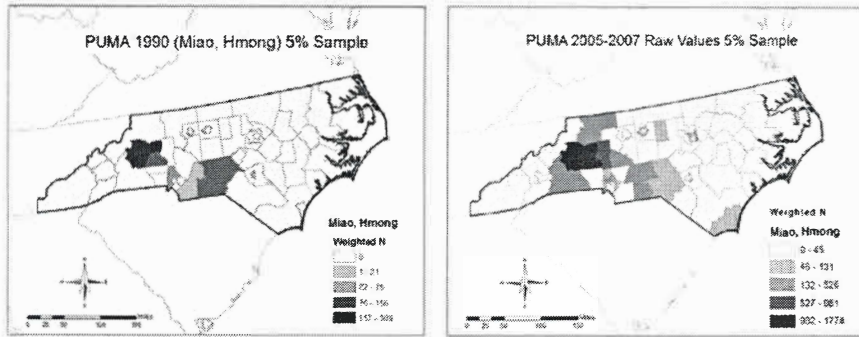


Figure 2. Vietnamese Settlement Pattern, 1990-2007

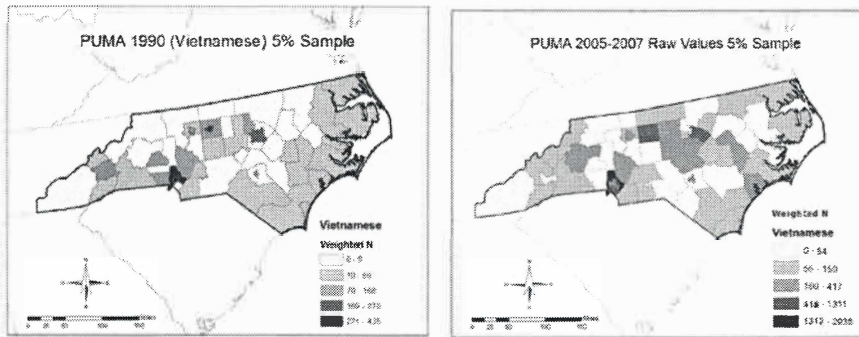
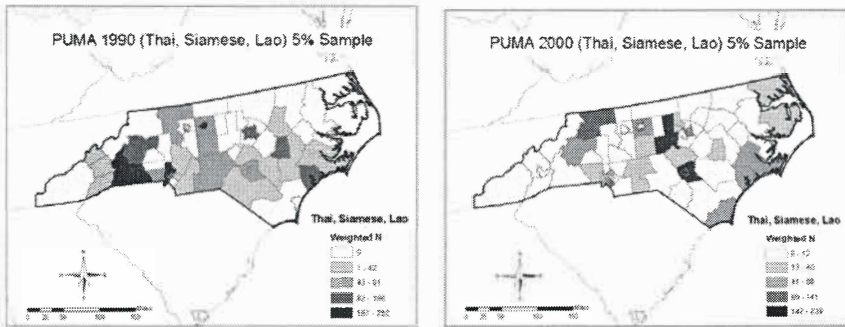


Figure 3. Thai-Lao Settlement Pattern, 1990-2000



Initially settled in a continuous belt, the Cambodian population increased slowly (Figures 4, 5), unlike other Southeast Asians. Remaining Cambodians shifted and spread out to different counties, responding in large part to two developments: the targeted enticement of hardworking, low cost and low skill workers by several individual factories, and construction of Buddhist temples. Despite efforts to encourage customs such as traditional dance groups, attendance at culture classes rapidly diminished as the youth downplayed their differences and blended into the majority practices. Southeast Asian groups (except for the Thai-Lao), increased in North Carolina over the 18 year period measured. This development reflected the availability of appropriate skill-level jobs, affordable land and educational opportunities for those who sought them, though with different adaptive dynamics functioning in various groups.

Socio-economic indicators

By the first census of the 21st century the strongest growth in Hmong population had occurred in the South and Midwest. This occurred largely as a result of tendencies for clan re-unification in areas of higher job opportunities. The proportion of the U.S. Hmong population in the South increased from 1.3% in 1990 to 6%, with particularly strong gains in the Carolinas (544 to 7,093) (Yang 2003). Hmong population in the Hickory-Morganton-Lenoir census area jumped from 433 in 1990 to 4,207 in the year 2000. Hospitals in the Hickory area provided jobs in a suitable skill level, and migrants found an abundance of military contacts in North Carolina (important for groups with ties to the U.S. as former anti-Communist fighters).

An important emerging trend is the movement out of ethnic enclaves and toward areas of employment opportunities. The Hmong population is young, the only ethnic population with a median age under 20, reflecting the perceived role of females as

child-bearers and a paucity of elders who survived the rigors of relocation. In North Carolina, 83% of the Hmong population came from other states by the year 2000. The average household size was a large 6.28 compared to the US average of 2.59 individuals.

Regional attitudes among host states and their resident Southeast Asian communities differ. Southeast Asians wield more political clout in the Midwest since the population size is large enough for a block vote and they coordinate a cluster response. The Southeast Asian population is spread out, so they are less able to exercise a block vote on behalf of lifting discrimination barriers or increasing access to education opportunities such as for adult learners. The Hmong community's attitude in regard to female education changed markedly over time, demonstrating the impact of leadership arising from within the community in response to new opportunities in the larger society. Hmong feminist leaders promoted education to elders on the basis that their skill acquisition could benefit the larger group. Several graduates found prestigious jobs in Washington, DC that proved helpful as path-breaking models. A Hmong leader advocates education by lecturing to students that having a high school degree brings honor to one's family, a BA elevates the clan, a Master's degree brings distinction to the ethnic group, and a PhD provides the opportunity for making a global contribution.

Figure 6 compares the four groups for which census figures were available across education levels in North Carolina in the 1990 and 2000 census years. The relatively young Hmong and Cambodian population is reflected in the "none" education category, but their priority on education as a path to improvement appears in the year 2000 MA and PhD categories. The much larger Vietnamese population is featured in the high school completion and college through the BA level. All figures are shown as percentages of the affiliated population, since absolute

numbers vary greatly reflecting the size of the group's population in the state. A comparison of the upland Hmong with the lowland Lao refugees from the same country yields some interesting shades of difference (Table 1). American FactFinder data proves useful in separating the Lao from the less similar Thai with whom they are associated in U.S. Census data. Although the Lao population is smaller by one-fourth than the Hmong, they are slightly older with a higher percentage of foreign born and lower percentage of college graduates, but have a slightly higher median income and lower percent of individuals living below the poverty line. This pattern would seem to contradict national trends, but reference to the longitudinally extended Table 2, which compares progress of groups over a

decade, conforms more to national trends and particularly demonstrates how much the Hmong improved. Table 1 also demonstrates the choice of the Lao to focus on income attainment while the Hmong are more represented in higher education levels.

While increasing their state population by an astounding 910%, the Hmong brought 31% of their population out of poverty, compared to the Cambodians at 22% and the Thai/Lao by 7%. Vietnamese in the South are seen as more business minded, less focused on education than those on the West Coast, and began at a higher income level overall leading to only a 3% change in poverty level. The strong upward movement in all groups testifies to their overall economic success.

Table 1. Comparison of Hmong and Laotians in North Carolina: Census 2000

	Population	% age 65+	College graduate	Foreign born	Median HH income	Individuals in poverty
Hmong	7,093	2%	3.5%	50%	\$42,544	14%
Laotian	5,313	3%	2.3%	62%	\$44,354	10%

Table 2. Change in Southeast Asian Socio-Economic Measures: Census 1990, 2000

	ΔCollege graduate	ΔPoverty	Clustering	ΔPopulation
Hmong	+5%	-31%	Reconcentrate	910%
Thai/Lao	+7%	-7%	More	436%
Vietnamese	-2%	-3%	Similar, shift	308%
Cambodian	+1%	-22%	Less	82%

Figure 4. Cambodian Settlement Pattern, 1990-2007

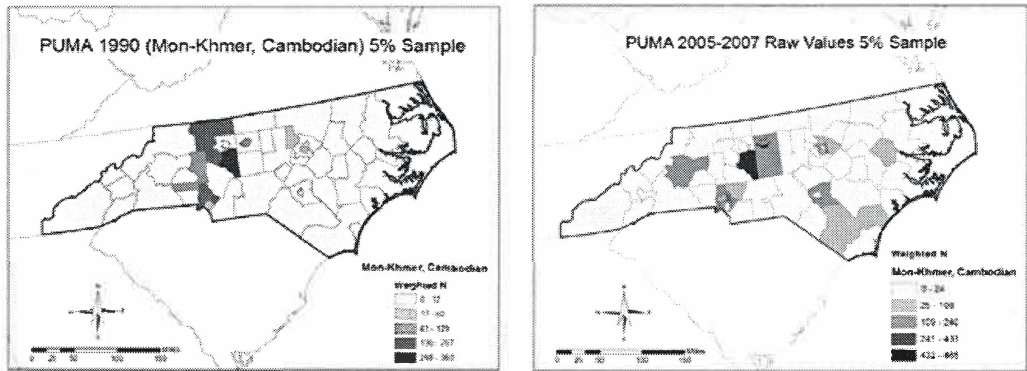


Figure 5. Population shift in North Carolina Southeast Asians, 1990-2008

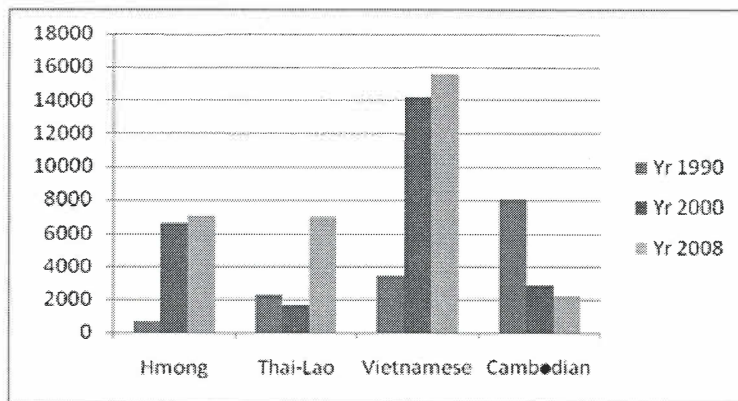


Figure 6. 1990 Education Levels

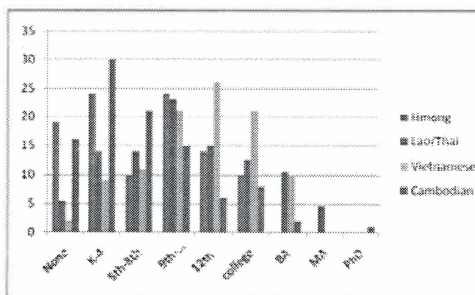
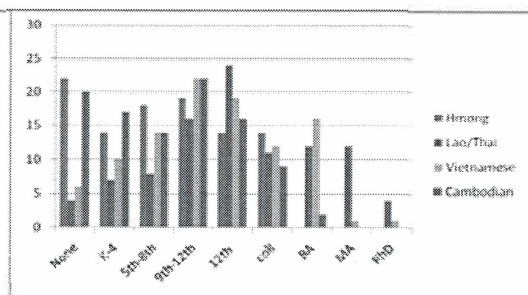


Figure 7. 2000 Education Levels



Source: U.S. Census Bureau, SF 3 files

Conclusion and Discussion

The children of the 1975 First Wave joined the post-1987 Second Wave immigrants in a largely second stop migration to North Carolina. They were drawn to the Tarheel State by employment and education opportunities and followed community leaders to less urban settings than those that characterize the larger refugee concentrations in the West Coast or Upper Midwest. Three generations are now involved in cultural change, simplifying and streamlining traditional practices in an adjustment transition to the U.S., through a process that displays a great deal of flexibility, adaptive ingenuity and drive to succeed.

A variety of factors affect the demonstrated differences in spatial, educational, and economic outcomes of Southeast Asian ethnic groups in North Carolina over the 18 years studied. The most important considerations appear to be whether the original settlement was in an urban or rural area (which the final settlement location tends to replicate), the educational or economic attainments and aspirations of the group that initially came to the state, and the tightness or looseness of the community network. The direction of adaptive adjustment taken by a particular group often depends on local leadership within the Southeast Asian community, with the most successful leaders utilizing basic traditional values to transition to successful positions within the new host society. As an area peripheral to the main body of early refugee settlement, the southeast has less elite population representation than does the West Coast community which garnered more of the literate and higher skilled refugees.

Policies that recognize and appreciate these differences and work with local leadership can improve the accommodation outcomes of both the host and the immigrant society, creating contributing citizens who are assets to all. Education remains a prime route to economic achievement, but good schools

are often tied to the economic standing of the immediate location so tend to perpetuate the local geographically concentrated culture. The beginning socio-economic position does not determine the success of subsequent generations, as demonstrated by the Hmong. It just means that more ground needs to be covered. So community networks are even more important, as shown in the cluster maps. While data are indispensable for tracing the numerical movement of these groups, interview evidence is also indispensable for making sense of the complex interactions involved in cultural adaptation. Many of the insights used in this research reflect the input of numerous community members and leaders who contributed their time, experience, and stories to construct the preceding picture of their adjustment to a new society so different in many ways to their society of origin. Their success benefits sending and receiving areas, as well as extending frameworks for theory and policy application.

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Temporal Analysis of Climatological Drought in Watauga County, 1940 to 2009

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Prolonged water deficit periods have caused many environmental, social, and economic problems in North Carolina and across the southeast. In order to protect water resources and the communities they support, it is essential to understand complex interactions that lead to water shortages. Climatological drought is monitored through various measurements of water resources, including precipitation, stream flow, and soil moisture. In this study, precipitation, stream flow, and soil moisture data from April 1940 to September 2009 in Watauga County were analyzed to help in understanding this complex relationship. Weak to moderate positive relationships were seen between the different variables. When the time span of collected data was increased the relationships were showed to be stronger. The strongest relationship was seen between stream flow and soil moisture. No significant relationships were seen on a monthly basis after creating a time lag. These relationships can help in understanding different types of drought, enabling water resources in North Carolina to be better protected and managed.

Keywords: drought, precipitation, climate, temporal analysis, North Carolina.

Variations in precipitation patterns across regions have increased with climate change. Although this variation makes it difficult to deduce general statements about overall precipitation patterns, some long-term trends have been noted. According to the IPCC (2007), significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia, while drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Further understanding of changing hydrologic cycles and their relationship to drought on a regional basis has become essential.

In addition to climate change, there are other social and political factors that have contributed to the depletion of water resources. According to Sun et al. (2008), growing world population, aging urban water infrastructure, environmental water rights claims, and increased competition for available water add stress to water resources. Progress in understanding how climate is changing

through space and time has been gained through improvements in data analyses, broader geographical coverage, better understanding of uncertainties, and a wider variety of measurements, but data coverage remains limited in some areas. Many areas are expected to see and have already seen more frequent and longer lasting drought and flood conditions.

Previous Work

Even though drought can last for very long periods of time, it is considered a temporary event. According to the IPCC (2007) report, climatic factors such as low relative humidity, high winds, and high temperatures can contribute to changes in droughts. A climatological drought refers to a prolonged shortage in rainfall leading to low river flows and possible crop damage. The classification of drought based on a disciplinary perspective can be found in Dracup et al. (1980) where droughts are related to precipitation (meteorological), stream flow (hydrological),

and soil moisture (agricultural). According to Beniston (2003), changes in precipitation can affect physical mechanisms such as soil moisture, groundwater reserves and the frequency of flood or drought episodes. Meteorological drought can be triggered by many natural factors, such as volcanic activity, solar variations, and changing ocean currents, and anthropogenic factors, such as fossil fuel use, land use change, and agriculture.

Hydrological drought conditions are reflected through deficiencies in water supplies above and below ground level. According to Hisdal and Tallaksen (2003), this type of drought is observed through monitoring water levels in stream flow and levels of ground water reserves, lakes, and reservoirs. Declining levels in these surface and subsurface water resources can be seen following a lack in precipitation or meteorological drought. The frequency and severity of hydrologic drought is studied on a watershed or river basin scale. There is a time lag between lack of precipitation and lower water levels in surface and subsurface sources.

Similar to hydrological drought, agricultural drought reflects changes in precipitation and evapotranspiration that are the result of meteorological drought. According to Wang (2005), soil moisture changes are impacted and then reflected through changes in agricultural water availability and crop productivity. Soil moisture climatology depends largely on precipitation and the atmosphere's evaporative demand. Cubasch et al. (2001) noted that when temperatures increase, the atmosphere's evaporative demand will increase. When there is a lack of soil moisture during critical periods of growth cycles, the growth of crops can be stunted or even halted leading to a loss in food production.

Any departure from what are considered to be normal measurements in a particular water resource is a sign of climatological drought. A comparison must be made to an amount that is considered normal for any particular region in terms of water indices using a predetermined amount of time to determine if a drought has occurred, as

pointed out by Hisdal and Tallaksen (2003). Several drought indices have been developed in order to bring large sets of data into perspective, such as the Standardized Precipitation Index (SPI). The National Drought Mitigation Center (2006) describes SPI as a versatile index based on the probability of precipitation for any time scale at a particular location. The SPI can provide early warning of drought and help assess drought severity. Because the SPI is normalized, wetter and drier climates can be represented in the same way. McKee et al. (1993), defined a drought event as a period that begins with the SPI being continuously negative or reaching a value of -1.0 or less, and ending when the SPI becomes positive (Table 1). According to McKee et al. (1993), in addition to precipitation data, this method can be used to evaluate variations in any of the five usable water sources, which include stream flow and soil moisture.

Monitoring stream flow and understanding its relationship to meteorological drought can provide insight into water resource planning. Hisdal and Tallaksen (2003) conducted a case study in Denmark to compare hydrological and meteorological drought characteristics. The study area consisted of a homogenous space divided into grid cells representing 14x17 km areas where kriging was used to interpolate the areas between data collection stations. The precipitation and stream flow amounts were calculated for each grid cell for the time scale of 1961 to 1990. The results revealed that stream flow droughts were less homogenous over the region. Large differences were seen between meteorological and hydrological droughts in the study area, illustrating an expected time lag. According to the National Drought Mitigation Center (2006), water in these hydrologic storage systems is used by a range of groups for a number of purposes, often creating competition for their resources. The southeastern United States is expected to experience water resource stress in coming years due to recent fluctuation in precipitation patterns, increases in population, climate change, and land use changes.

SPI Values	Drought Category/ Condition
0 to -0.99	Mild Drought/ Near Normal
-1.00 to -1.49	Moderate Drought/Moderately Dry
-1.50 to -1.99	Severe Drought/ Severely Dry
≥ -2.00	Extreme Drought/ Extremely Dry

Table 1: Drought categories based on standardized precipitation indices (SPI).
(McKee et al 1993; National Drought Mitigation Center, 2009)

According to Sun et al. (2008), the southeastern states have the fastest population growth rate in the United States and many states have already foreseen local water shortages. The spatial and temporal distribution of water stress is difficult to project due to many changing factors contributing to the rise and fall of water levels. A study conducted by Sun (2008) attempted to assess the impacts of multiple stresses on water resources in the southeastern United States by examining an annual water yield model combined with climate, land use/land cover, and population change projections. A modeling system was used to predict future water supply stresses in 2020. The study found that across the southeastern states, climate change had the greatest impacts on water stress, followed by population growth and then land use change. As water demands increase and supplies decrease, monitoring water supplies becomes a necessary priority.

North Carolina experienced a severe drought during a period lasting from 1998 to 2002. A U.S. Geological Survey Scientific Investigations Report (Weaver 2004) summarized the effects of this drought on North Carolina's water resources and economy. This drought caused widespread hardship and economic loss throughout the state. Widespread record low stream flows and ground water levels were recorded in

some areas during the summer of 2002. Drought conditions first began in the western part of the state, while tropical storms prevented continuous drought in the eastern part of North Carolina. Over the five-year period, the drought was continuous in parts of western North Carolina. Water level deficits in the western piedmont were some of the lowest ever recorded. The study concluded the greatest deficits were in the streams of the Blue Ridge and the western Piedmont. However, above normal rainfall returned in August of 2002 and by January 2003, most areas of the state were no longer operating under water conservation restrictions.

Methods

Drought in Watauga County, North Carolina will be examined through an onsite disciplinary approach in order to understand the hydrologic cycle in an eastern United States mountain environment. By analyzing data collected from 1940 to 2009, patterns and relationships between different types of drought were investigated. Precipitation amounts were used to show meteorological drought and were measured in inches. Stream flow discharge rates were used to show hydrological drought and were measured in cubic meters per second. Agricultural drought was shown through soil moisture, which was measured in cubic meters per cubic meters.

Data was obtained through the State Climate Office of North Carolina and the USGS National Water Information System. Four

different stations were used to compile the necessary data (Figures 1 and 2).

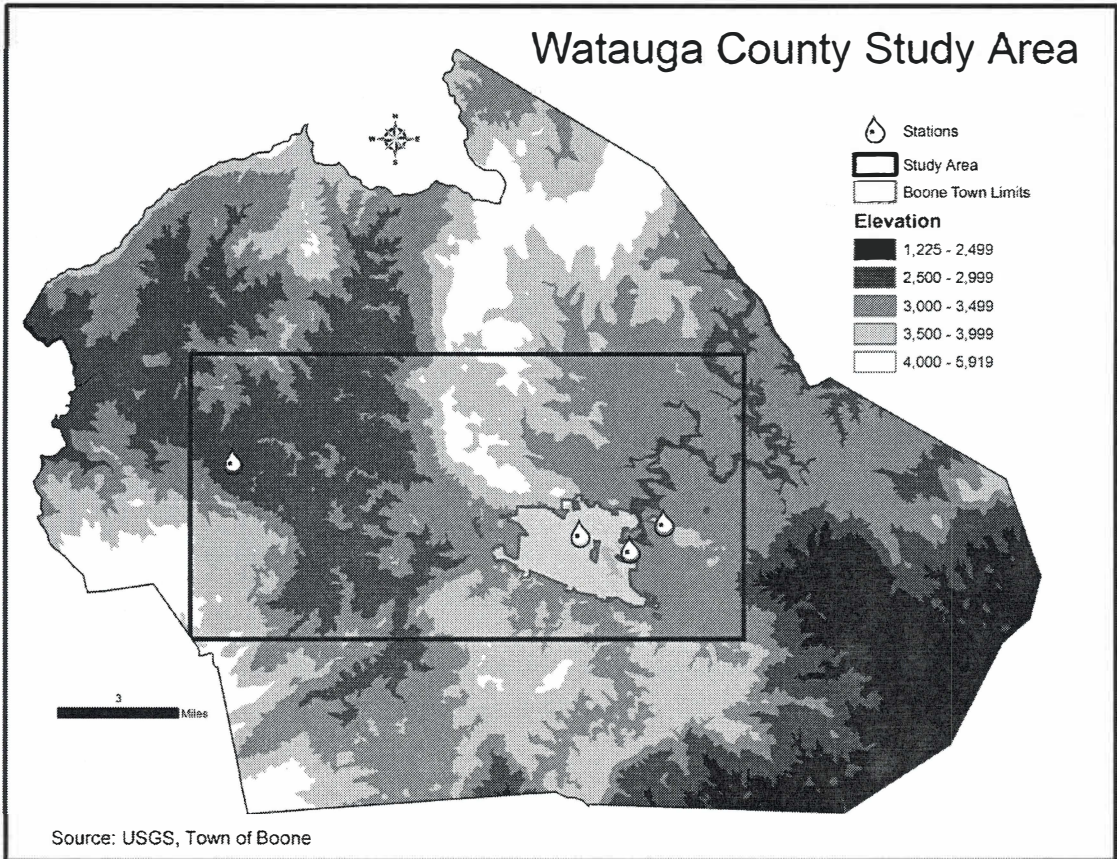


Figure 1: Study area, Watauga County, NC.

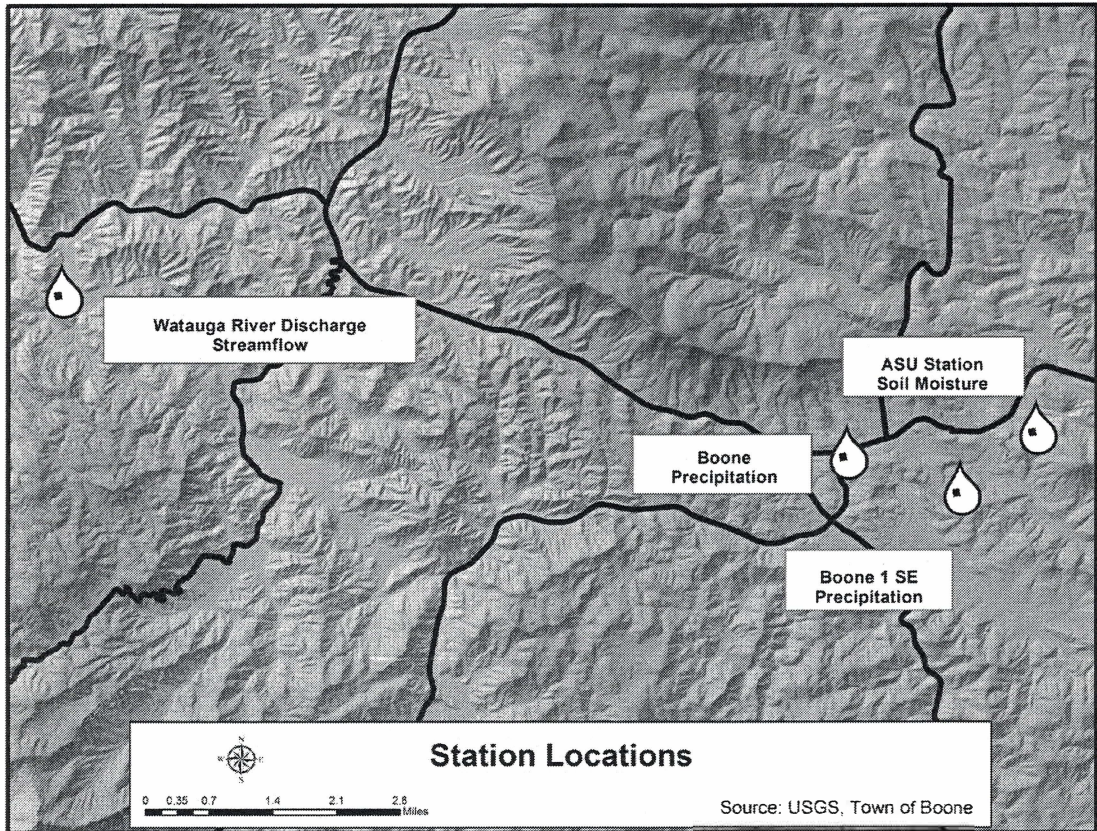


Figure 2: Station locations, Watauga County, NC.

An indication scale must be applied to the data representing different types of drought in order to bring perspective and identify patterns. The definition of drought used was based on standardized precipitation. The standard precipitation index (SPI) was calculated for each variable indicating drought (precipitation, stream flow, and soil moisture) from October 2005 to September 2009 for Watauga County. From April 1940 to September 2009 the SPI was calculated for precipitation and stream flow. SPI is the difference of precipitation from the mean for a specified time period divided by the standard deviation, where the mean and standard deviation are determined from past records of

monthly data. This long-term record was fitted to a probability distribution, which was then transformed into a normal distribution so that the mean SPI for the location and desired period is zero (Edwards and McKee 1997). Tables 2 and 3 present descriptive statistics used to calculate SPI values.

A linear regression examined possible relationships between the different drought indicators. Variations in precipitation, or meteorological drought, can affect the water levels in streams and soil. Therefore, precipitation is the independent variable that can affect stream flow discharge rate and soil moisture, the dependent variables. The values used for analysis were computed from the raw

data collected. The SPI values become an ordinal measurement that ranks the original values based on their departure from normal. Both the Pearson's Correlation Coefficient and Spearman Rank Correlation Coefficient tests were used to examine the correlation between the independent and dependent variables (Tables 4-7).

To further analyze these variables, regression curves were fitted to the data (Figures 3-5). A multiple regression model examined the effects of precipitation and soil moisture on stream flow (Table 8). Two different time periods were examined. Soil

moisture data was only available for October 2005 to September 2009, so this time period was studied separately from the overall time period of April 1940 to September 2009. Precipitation and stream flow were analyzed over the historic time period for comparison. Studies have shown a time lag exists between meteorological drought and affected water sources. Therefore, time lags between precipitation drought and stream flow and soil moisture drought were analyzed within both time periods (Tables 9-10).

Variable	Number of months	Minimum	Maximum	Mean	Std. Deviation
Precipitation (inches)	48	.52	8.56	4.6150	2.04033
Stream flow (m ³ /sec)	48	31.00	316.20	127.5398	70.95331
Soil moisture (m ³ /m ³)	48	.26	.44	.3713	.04595

Table 2: Descriptive statistics for monthly data, October 2005 to September 2009.

Variable	Number of observations	Minimum	Maximum	Mean	Std. Deviation
Precipitation (inches)	833	.16	23.01	4.4287	2.48594
Stream flow (m ³ /sec)	833	18.10	1169.00	176.2129	131.18024

Table 3: Descriptive statistics for monthly data, April 1940 through September 2009.

Variable		Precipitation SPI	Stream Flow SPI	Soil Moisture SPI
Precipitation SPI	Pearson Correlation	1	.341*	.118
	Sig. (2-tailed)		.018	.426
	N	48	48	48
Stream Flow SPI	Pearson Correlation	.341*	1	.635**
	Sig. (2-tailed)	.018		.000
	N	48	48	48
Soil Moisture SPI	Pearson Correlation	.118	.635**	1
	Sig. (2-tailed)	.426	.000	
	N	48	48	48

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4: Pearson Correlation for monthly SPI values, October 2005 to September 2009.

Variable		Precipitation SPI	Stream Flow SPI
Precipitation SPI	Pearson Correlation	1	.664**
	Sig. (2-tailed)		.000
	N	833	833
Stream Flow SPI	Pearson Correlation	.664**	1
	Sig. (2-tailed)	.000	
	N	833	833

** . Correlation is significant at the 0.01 level (2-tailed)

Table 5: Pearson Correlation for monthly SPI values, April 1940 to September 2009.

Variable		Precipitation SPI	Stream Flow SPI	Soil Moisture SPI
Precipitation SPI	Correlation Coefficient	1.000	.346*	.157
	Sig. (2-tailed)	.	.016	.286
	N	48	48	48
Stream Flow SPI	Correlation Coefficient	.346*	1.000	.678**
	Sig. (2-tailed)	.016	.	.000
	N	48	48	48
SPI Soil Moisture	Correlation Coefficient	.157	.678**	1.000
	Sig. (2-tailed)	.286	.000	.
	N	48	48	48

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6. Spearman Rank Correlation for monthly SPI values, Oct. 2005 to Sept. 2009.

		Precipitation SPI	Stream Flow SPI
Precipitation SPI	Correlation Coefficient	1.000	.568**
	Sig. (2-tailed)	.	.000
	N	833	833
Stream Flow SPI	Correlation Coefficient	.568**	1.000
	Sig. (2-tailed)	.000	.
	N	833	833

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7: Spearman's Rank Correlation for monthly SPI values, April 1940 to September 2009.

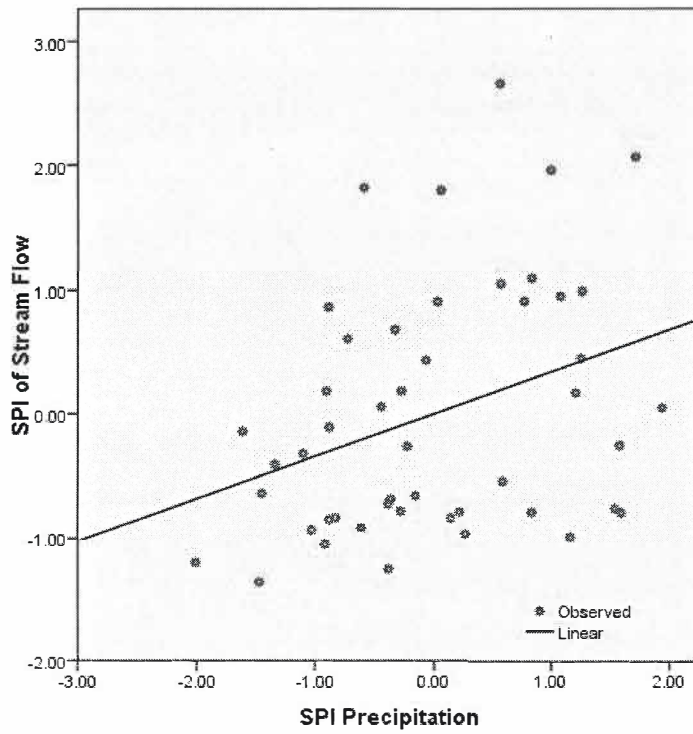


Figure 3: Regression curve estimation of precipitation and stream flow, October 2005 to September 2009.

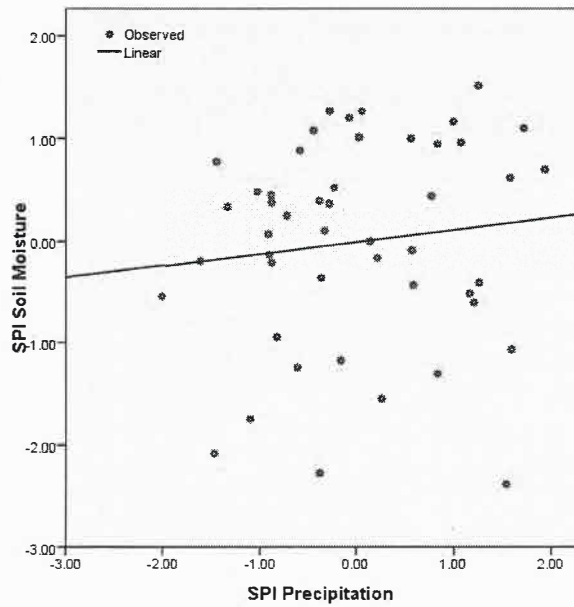


Figure 4: Regression curve estimation of precipitation and soil moisture, October 2005 to September 2009.

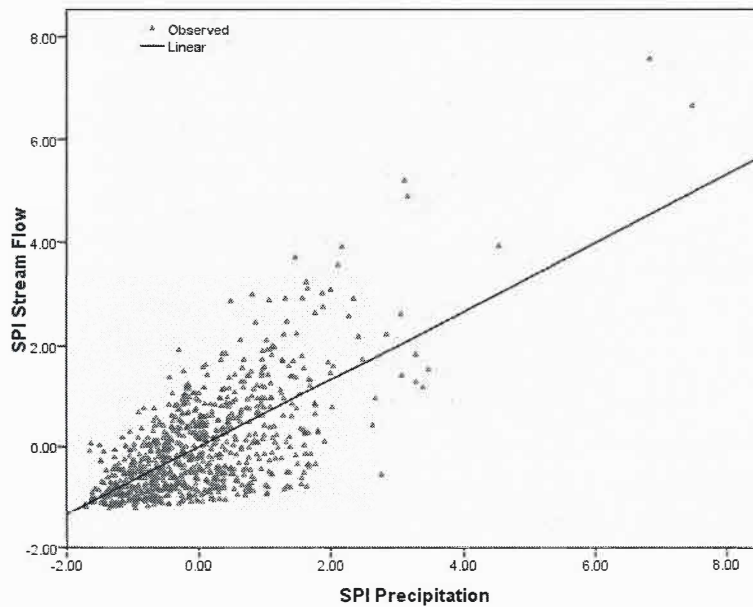


Figure 5: Regression curve estimation of precipitation and stream flow, April 1940 to September 2009.

<i>Model</i>	<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Std. Error of the Estimate</i>
1	.341 ^a	.116	.097	.95036

Predictors		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.000	.107		.002	.998
	Precipitation SPI	.270	.109	.270	2.479	.017
	Soil Moisture SPI	.603	.109	.603	5.547	.000

a. Dependent Variable: Stream Flow SPI

Table 8: Multiple regression model of variables affecting Stream Flow, October 2005 to September 2009

Time Lag	Pearson's Coefficient		Spearman's Coefficient	
	Stream Flow SPI	Soil Moisture SPI	Stream Flow SPI	Soil Moisture SPI
1 month	0.024	0.094	0.041	0.053
3 months	0.062	0.151	0.060	0.188
6 months	-0.040	-0.076	0.055	-0.095
1 year	-0.174	-0.176	-0.251	-0.108

Table 9: Correlation of Precipitation SPI to dependent variables with increasing time lags, October 2005 to September 2009.

Time Lag	Pearson's Coefficient	Spearman's Coefficient
1 year	-0.003	0.027
5 years	-0.040	-0.018
10 years	0.039	0.064
15 years	0.004	0.035
25 years	-0.004	0.053

Table 10: Correlation of Precipitation SPI to Stream Flow SPI with increasing time lags, April 1940 to September 2009.

Results

The Pearson's Correlation Coefficient measured the covariation between variables through strength and direction of relationship. The Pearson's coefficients representing relationships between the variables are seen in Tables 4-5. For the time period of October 2005 to September 2009, precipitation and stream flow had a weak to moderate positive correlation ($R = 0.341$) at a significance of .018. Precipitation and soil moisture had a weak positive correlation ($R = 0.118$) but not significant at .426. Stream flow and soil moisture had a much higher R value ($R = 0.635$) and a moderate positive correlation with significance of .000. The Pearson correlation was much stronger when the longer time period of April 1940 to September 2009 was examined. Precipitation and stream flow had a stronger moderate positive correlation ($R = 0.664$) and significance of .000.

The Spearman Rank Correlation Coefficient test showed little difference from the Pearson's test. The Spearman's coefficients representing relationships between the variables are seen in Tables 6 and 7. For the time period of October 2005 to September 2009, precipitation and stream flow had a weak to moderate positive correlation ($r_s = .346$, significance of .016). Precipitation and soil moisture had a weak positive correlation ($r_s = .157$, significance of .286). Stream flow and soil moisture had a moderate positive correlation ($r_s = .678$,

significance of .000). Just as in the Pearson's test, the longer time period had a stronger correlation. Precipitation and stream flow from April 1940 to September 2009 had a moderate positive correlation ($r_s = 0.568$, significance of .000).

Results of the regression models reflected the correlation coefficients with similar relationships between the variables. For the time period of October 2005 to September 2009, precipitation explains only 12% of the variability of stream flow with a positive relationship (Table 8). This weak positive relationship can be seen in Figure 3. Precipitation had an insignificant affect on soil moisture with 1% of variability explained with a very low significance (Figure 4). The longer time period again had a stronger relationship than the shorter time period. From April 1940 to September 2009, precipitation explained 44% of the variability of stream flow (Table 10). This moderate positive relationship can be seen in Figure 5.

The multiple regression analysis of the effects of precipitation and soil moisture on stream flow was completed within the time period of October 2005 to September 2009 (see Table 8). Precipitation and soil moisture are related to stream flow with an R of .689. Precipitation and soil moisture explain 48% of the variability of stream flow with $r^2 = .475$. The beta values seen in Table 8 suggested that soil moisture ($\beta = .603$) has a greater impact on stream flow than precipitation ($\beta = .270$).

Overall, this model fits the data moderately well.

To analyze the delay that is known to exist between precipitation amounts and water resources, data were staggered to create various time lags. The shorter time period, small time lags of 1, 3, 6, and 12 months were used. As the time lag increased, the correlations among variables grew weaker and crossed from a positive relationship to a negative relationship (Table 10). The strongest relationship was seen in the 3-month time lag, with a Spearman's coefficient of .188, representing a weak positive correlation. Time lags of 1, 5, 10, 15, and 25 years were created with the longer time period. The results yielded very weak positive and negative correlations.

Discussion

Overall, a stronger correlation was seen between precipitation and stream flow when the time period was longer. This suggested that the relationship is more significant with an increased in time span. As the time span increased, the covariation and variance between precipitation and stream flow moved from a weak positive to moderate positive relationship. All of the relationships observed between variables in the Pearson's, Spearman's and regression tests were positive. The shorter time period consisted of three variables: precipitation, stream flow and soil moisture. The correlation between precipitation and stream flow was stronger than that of precipitation and soil moisture. The significance level was much higher for the covariation between precipitation and stream flow than it was for precipitation and soil moisture. There was a moderate relationship between stream flow and soil moisture, suggesting that both dependent variables are affected together.

The effect of multiple independent variables on stream flow was examined through multiple regressions. Precipitation and soil moisture related to stream flow

moderately well overall. According to the multiple regression model, soil moisture affected stream flow more strongly than precipitation. When taking time lag into consideration, the correlation grew weaker. The time lag that existed between precipitation and water sources could have had more of a cumulative affect that cannot be seen when examining data on a monthly basis.

This study based precipitation trends in Watauga County on measurements taken near Boone. The stations were spread across an area of 11 miles. There can be variability among the different locations of the stations due to their distance from each other. This variability can contribute to error when establishing relationships among the different types of drought. The topography of the mountains can intensify this variability due to runoff patterns and steep slopes. Even the global climate models based on an analysis of multiple climate averages, while being highly consistent in predicting the magnitude of precipitation changes; poorly predict changes in soil moisture (Wang 2005).

Conclusions

With increasing population and demand for high quality fresh water resources, there will be less available water for human use, even without changes to the current hydrologic system. The IPCC (2007) noted that it is necessary to understand the possible effects of a warming climate in order to preserve the high quality water resources that will be needed for an ever increasing number of people. Through studying the relationships between different types of climatological drought, a better understanding can be reached about the effect of precipitation on stream flow and soil moisture.

There are many additional factors that can contribute to drought in addition to changes in the natural water cycle. With increasing population and demand for high quality fresh water resources, it is possible that even without changes to the current

hydrologic system there will be less available water for human use. This includes an increase in the need for water resources for greater food production. This increased need can affect the water levels seen in streams and soil. In addition, regional variability is important. This may necessitate increasing the number of monitoring stations especially in areas such as the mountains in which topography plays a greater role. Careful regional monitoring of rainfall, soil moisture, and stream flow in the mountains is even more critical since the mountains are sources of water for the cities and towns below. The mountains themselves are constantly being changed, not only by natural occurrences such as landslides, but by human activities such as recreation and development. This along with a changing climate makes careful drought monitoring of the mountainous regions of our country a necessity for sustainable high quality fresh water resources of the future.

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An Assessment of Wind Power as an Alternative Energy Source in North Carolina: A GIS Approach

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With the exponential price increases and costs associated with conventional forms of energy, one must seriously consider the advantages of integrating alternative forms of energy with those already in existence. This energy comes from many different sources and their predominance within geographic regions relies on a variety of physical factors. These alternative resources include solar energy, wind power, biomass and tidal forces. However, ancillary issues associated with harnessing this energy include the transportation of this energy to populated areas, aesthetics, the degradation of wildlife and the socio-political dynamics required to implement these practices. Wind has proven to be an inexpensive alternative energy source in the United States. This paper will use GIS to study the feasibility of using wind as a viable energy source in North Carolina.

Keywords: North Carolina; Alternative energy; Wind energy; Wind potential; GIS

Introduction

By the end of 2010, the electrical needs for about 2% of the United States were met by wind energy. Wind farms exist in 36 states, producing about 40,181 Mw (Megawatts) of energy (American Wind Energy Association 2011a). While these numbers pale in comparison to countries such as Denmark (21%), Portugal (15%), Spain (16%), and Germany (9%), the United States has seen positive growth in wind energy production in each of the last 10 years (World Wind Energy Association 2011). The use of wind energy is limited in North Carolina, but there are potential areas for wind-energy development. This study focuses on two questions: where in North Carolina is wind potential greatest, and what urban areas in North Carolina can benefit from wind energy initiatives?

Literature Review

Any paper exploring the spatial distribution of available wind energy in the United States

would be remiss in not mentioning the landmark study in the field. "An Assessment of the Available Windy Land Area and Wind Potential in the Contiguous United States" was published in 1991 by the Pacific Northwest Laboratory in Richland, Washington (Elliot et al. 1991). While the assessment was done before the large-scale proliferation of GIS, it still was able to evaluate areas that have the highest wind energy potential. It uses physical factors such as relief and land cover combined with anthropological restrictions such as national parks and urban areas in order to rate windy states.

Elliot's (1991) paper uses a rating scale from 1 (lowest) to 7 (highest) that is still in use today. These classes are based on both the persistent wind speed and the height of this wind. As the wind classification decreases on the ground, one must go higher in elevation to experience the same amount of wind energy. While Class 5 winds may have been able to

adequately support wind energy operations in the past, the increasing heights of wind turbines can now convert Class 3 winds to usable energy as wind turbines in Pennsylvania can reach over 200 ft (61 m) in height (PA Department of Environmental Protection 2007).

States have used Eliot's analyses as a precursor to further evaluate wind energy potential in their state. For example, Acker et. al. (2007) used GIS to assess wind energy potential in Arizona, incorporating criteria such as proximity to existing power lines and property ownership to determine a best costs analysis for serving the citizens of Arizona. Gray-Searles (2007) further expounds on the restrictions of turbine construction in Arizona by assessing environmental impacts, archaeological, sites and even potential bird activity near wind turbines.

Wind energy does have its deterrents. A citizens group in Maine claims that wind turbines are visual eyesores and the flickering shadows provide an unwanted disruption (Karkos 2008). Even proponents of wind energy admit that wind turbines produce both broadband and tonal noise, but consider the decibel values to be negligible (American Wind Energy Association 2011b). From an environmental standpoint, wind turbines do place wildlife such as birds in danger. However, this danger is statistically insignificant compared to other dangers such as electrical lines, tall buildings, cars and pesticides (National Wind Coordinating Committee 2001). An ephemeral analysis of the human, environmental and safety consequences of wind energy as a viable domestic energy solution over conventional forms of energy should show the merits of wind energy. For example, in 2010 48 U.S. coal miners lost their lives in a single accident in West Virginia that highlighted the dangers of conventional coal mining and the lack of safety regulation enforcement (U.S. Department of Labor 2011). While our use of conventional forms of energy will probably

continue, the incorporation of alternative energy source such as wind hold the promise of reducing risks to health and safety.

Data and Methods

I converted data from Eliot's 1991 study to digital format, including both total area and the percentage of area based on wind class. I quantified wind classes based on wind speeds, converting them to kilowatt hours of potential electrical energy from wind. The top five states are shown in Table 1.

Table 1: Top 5 States for Wind Energy Potential (Eliot et. al. 1991)

State	Billions of Kilowatts
North Dakota	1,210
Texas	1,190
Kansas	1,070
South Dakota	1,030
Montana	1,020

North Carolina ranks 31st in wind energy potential with 8.35 billion kilowatts, but there are no active large scale wind energy projects in North Carolina so the figure remains a potential resource. However, there are 7 states that have implemented wind energy turbine projects that have less wind energy potential than North Carolina. They are Tennessee, Vermont, New Hampshire, Rhode Island, Maryland, Ohio and West Virginia (American Wind Energy Association 2011c).

The National Renewable Energy Laboratory (NREL) has updated Eliot's (1991) report to include GIS data representing the wind classes as polygons at various resolutions. Coarse resolution data (1/3° latitude by 1/4° longitude) exists for the entire United States, and high resolution data (200 meters) exist for North Carolina (NREL 2008). The complete state level assessment of class three wind potential (the highest wind class) includes land areas and littoral areas not previously included in Eliot's original analysis (Map 1).

The data were created as raster data and were then converted to polygons, a process called vectorization. As a result, the areas supporting a particular wind class take on a 'blocky' appearance and are often multiples of the smallest resolution unit. This must be taken into consideration when computing the areas of these regions. In order to assess and map wind classes for the United States, a *Clip* function was performed on the high resolution NREL Mid-Atlantic Region data to create wind classes for North Carolina. Once clipped, the classes were consolidated using the *Summarize* function.

The results for North Carolina are summarized in Table 2. Class 3 winds or higher can be expected to occur over 10.3% of North Carolina (z score = -0.674), representing $5,669 \text{ mi}^2$ of land (an area equal to Delaware and Connecticut combined).

Table 2: Summary of Class Designations for Winds Derived from NREL GIS Data in North Carolina

Class	Area (Miles ²)	Percent of Total Land Studied
1	47,498	85.97
2	2,079	3.76
3	1,818	3.29
4	2,412	4.37
5	1,290	2.33
6	122	0.22
7	27	0.05

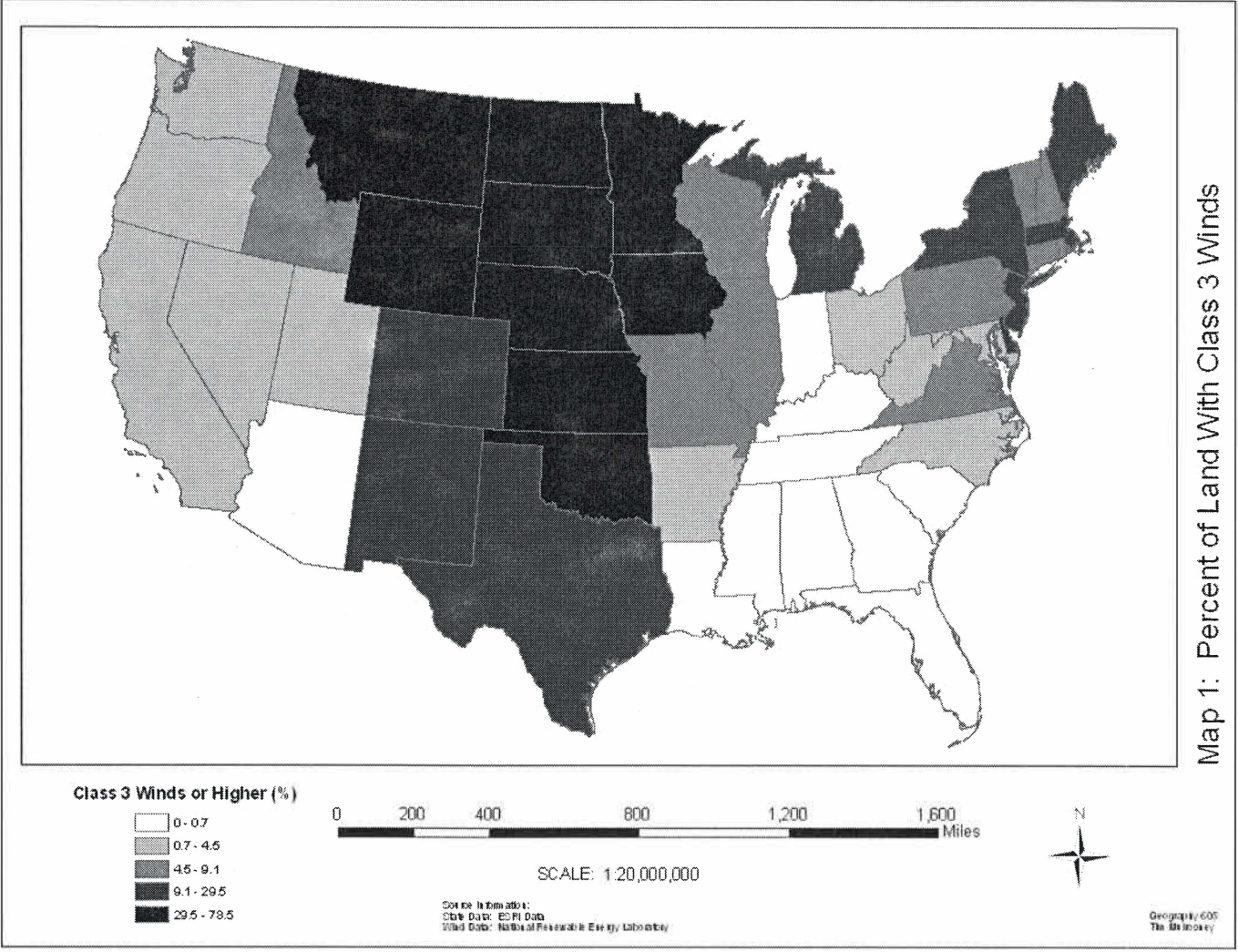
After *dissolving* lands of Class 3 and higher into land parcels, it was found that 1,121 independent pieces of land satisfied these criteria. However, these areas could be larger so that the combined wind potential highlighted in Table 1 would be maximized. Areas were calculated using the *calculate* function. The area of each polygon in square miles and a centroid was then calculated. Of those polygons, 89 were larger than 1 square mile and 22 of those were larger than 5 square miles. All other polygons were deleted.

From a visual inspection, the spatial distribution of these wind classes is varied. It is evident that high and sustained winds that can support wind farming occur in either the mountains or along the coasts (Map 2). However, metrics can quantitatively measure the geographic distribution of these using GIS and statistical tools.

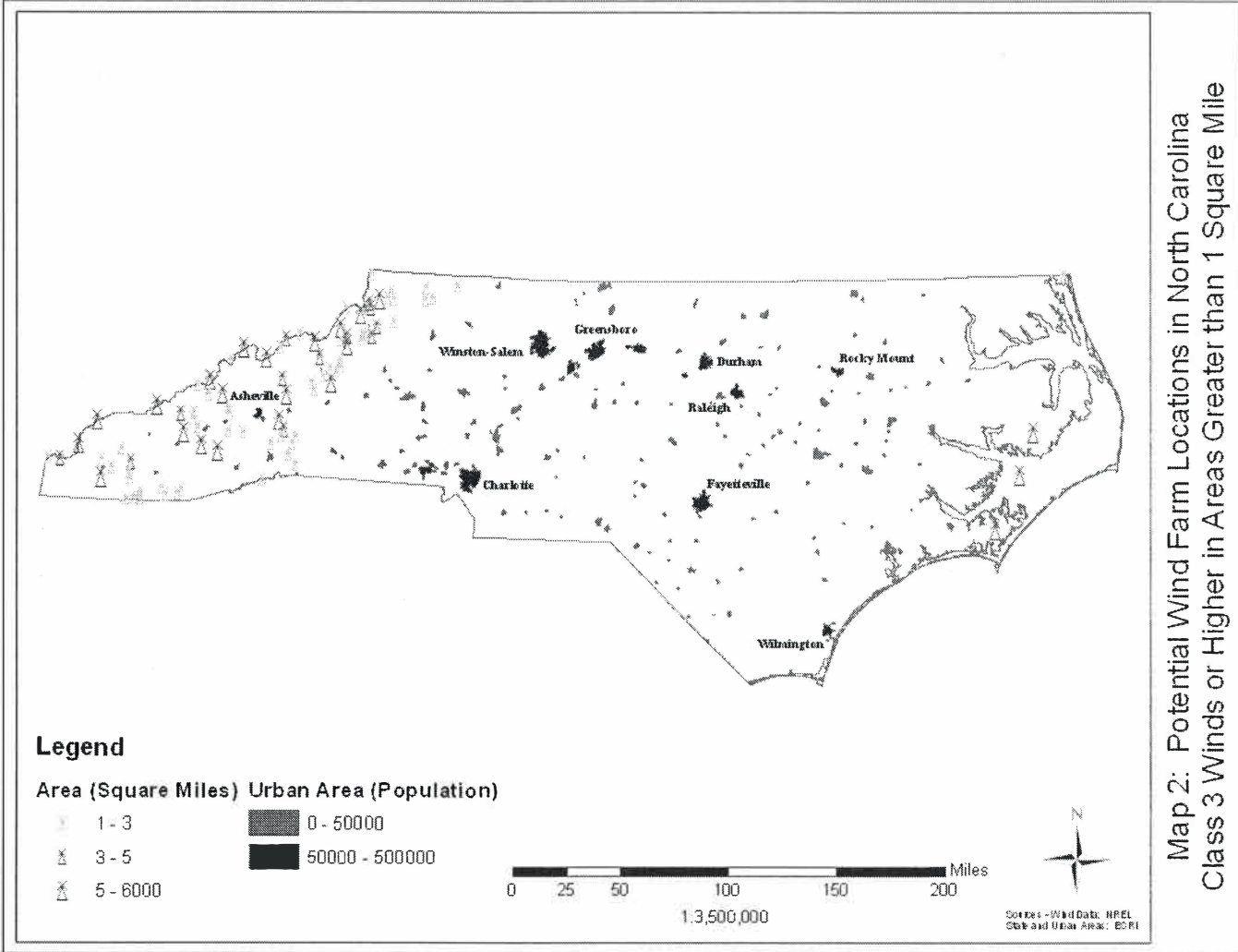
The Standard Deviation Ellipse

GIS analysts have a number of metrics to express geographic distribution. Two of these are the standard distance circle and the standard deviation ellipse. The standard distance circle measures compactness by inspecting the distribution of points about a mean center. The mean center represents a single point that is the average of all x -values and y -values of a feature's physical location. It is a graphical manifestation of standard deviation, where the radius of the circle represents the z -score specified by the user in the settings (Mitchell 2005).

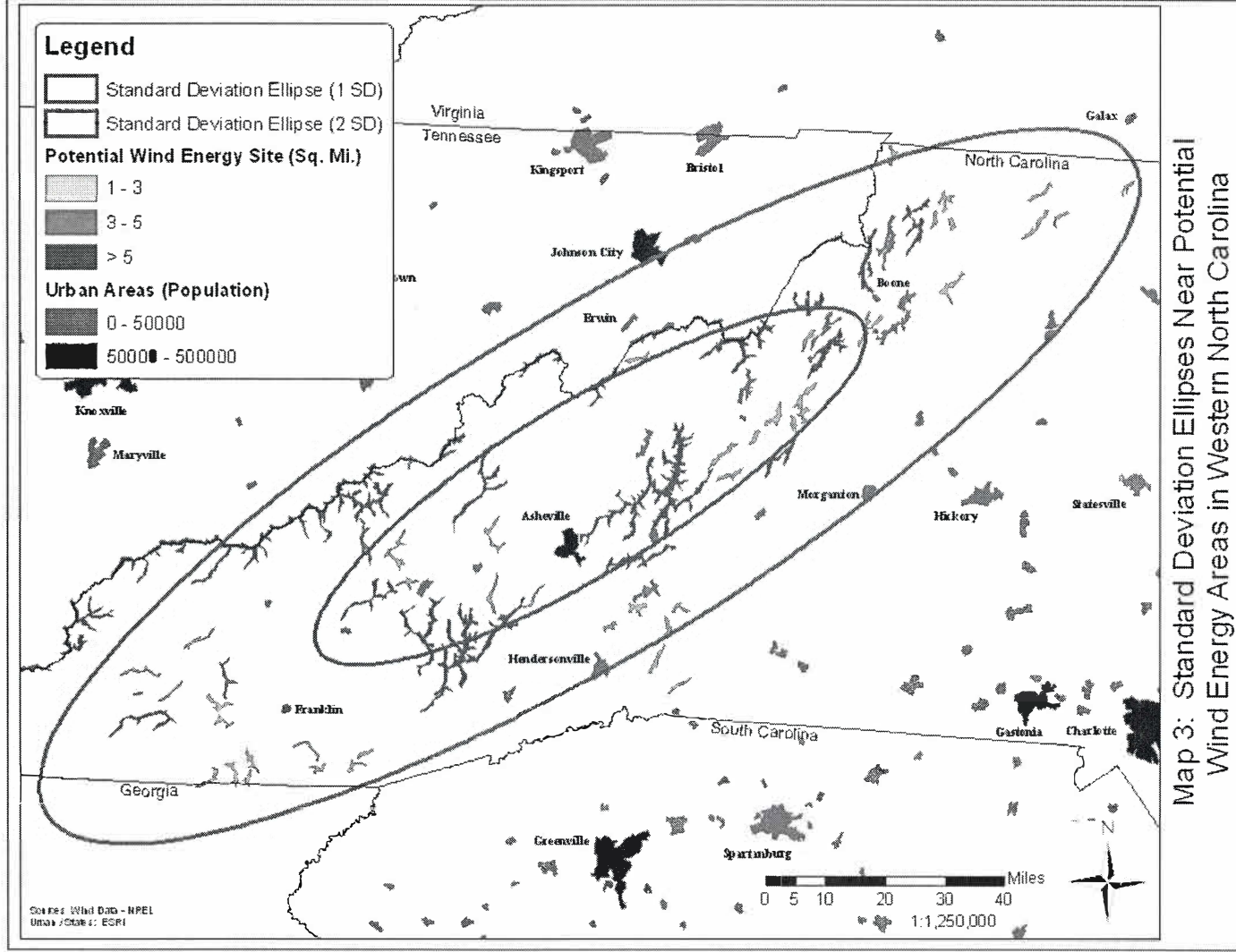
If the points display a directional trend (like they do in this case), the standard deviation ellipse is used. For the ellipse, separate x and y standard distances are derived to the coordinates from the mean center. The orientation of the ellipse is computed using a minimum distance function so that the sum of the squares of the distance between each point and axis is minimized (Mitchell 2005). The standard deviation ellipse with a threshold of 1 and 2 standard deviations (1 SD and 2 SD, respectively) in the mountainous portion of North Carolina is shown in Map 3. This represents a proverbial service area or area of greatest concentration for high wind locations using the centroid of these areas as the basis for the computation. This 2 SD ellipse has an x -distance of 27.7 miles, a y -distance of 105.4 miles and a rotation of 300.9° . It is important to note the location of nearby urban areas to which this electricity from potential wind farms can be



Map 1: Percent of Land With Class 3 Winds



Map 2: Potential Wind Farm Locations in North Carolina
Class 3 Winds or Higher in Areas Greater than 1 Square Mile



distributed. For the 2 SD ellipse, 17 areas that satisfy the census definition of an urban area or urban cluster fall within this ellipse. This includes two cities of population 50,000 or greater (Asheville, North Carolina and Johnson City, Tennessee).

Buffering Analysis

Because of their larger size and the almost north-south orientation of the few centroids near the coasts, a directional ellipsoid would not be best to capture the proximity of potential winds in coastal areas. A buffer creates a polygon a specified distance around an input feature. In this case, a 15 mile buffer was created around the high wind areas (Map 4). Within this buffer area, there are 12 census defined urban areas and clusters within this buffer zone. Two of these areas (Wilmington, NC and Jacksonville, NC) have a population greater than 25,000.

Average Distance Analysis

One of the major concerns of wind energy is the costs associated with the transmission of this energy to populated areas. Population centers that are closest to high wind areas would most likely be the recipients of wind energy initiatives. While the buffering and standard deviation ellipse could be computed using the Spatial Statistics Extension using ArcGIS 9.3, CrimeStat is a statistical GIS software package catered to algorithms used to map crime. CrimetStat has the ability to compute the distance from every point in one file (potential wind sites) to another file (urban areas). In this case, urban areas of population 25,000 in North Carolina were selected. A matrix composed of distances

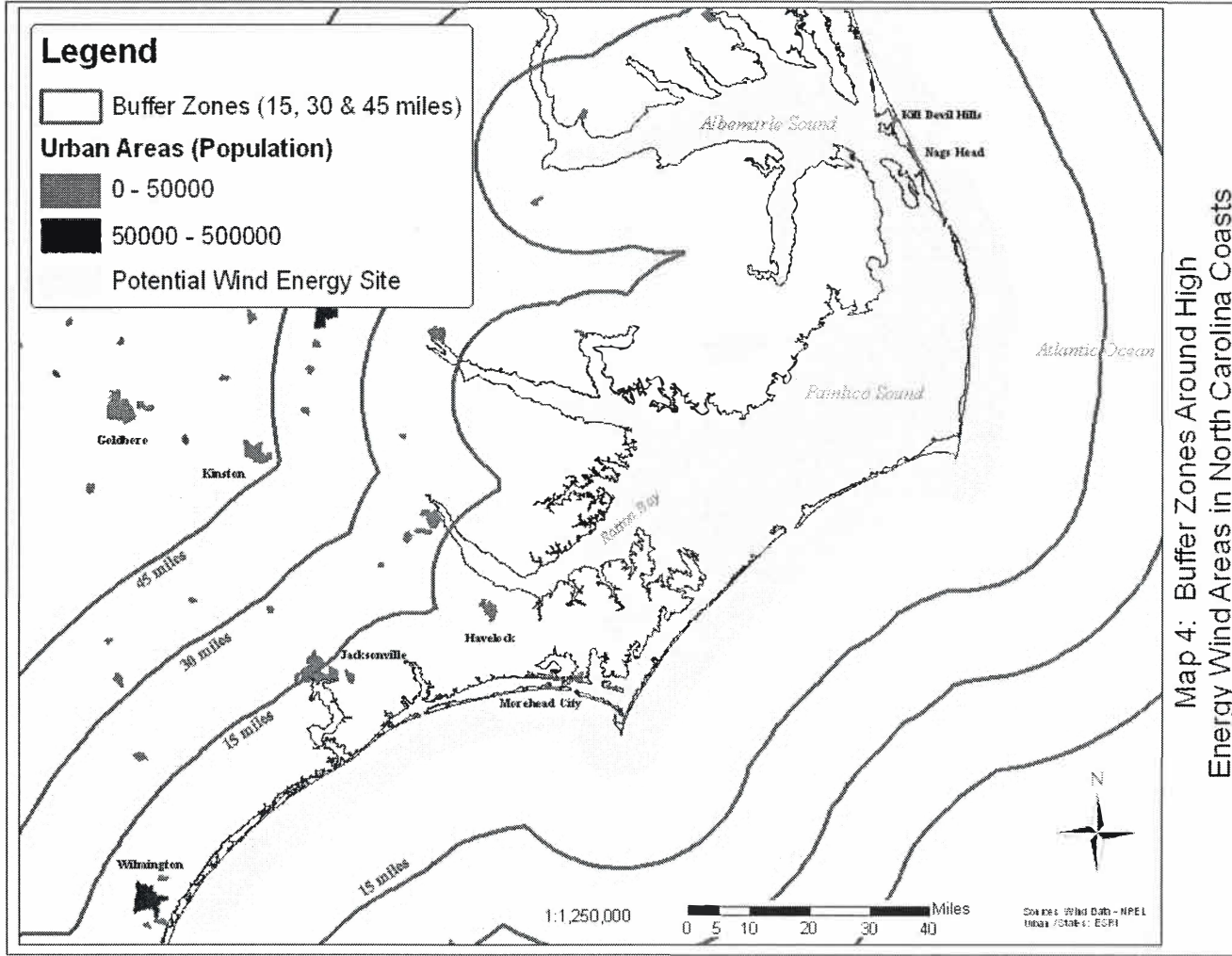
between each urban area and all potential wind sites was created using CrimeStat.

This matrix was exported to Microsoft Excel and an average distance was calculated using functionality within Excel. These results are shown in Table 3. Of the urban areas used in this computation, Asheville rated the highest, with an average distance of 63 miles to all potential wind energy sites in the state of North Carolina. In addition, the greater Charlotte metropolitan region scored high in its proximity to these high wind areas with an average distance of 118 miles. However, analysis regarding the cost of transmitting electricity over this distance or its proximity to high wind areas that may be closer in South Carolina would be the basis for future research. High resolution GIS data were not available for the state of South Carolina so comparable analysis could not be done.

Conclusion

On average, the cost of wind energy is about 6 to 10 cents per kilowatt-hour while the cost of a kilo-watt hour for the average North Carolina consumer is 10.2 cents (Carolina County 2007). These numbers are promising. Many wind energy projects are relatively small in nature, while larger projects are being planned by large electric utility companies. Further analysis could contribute to the scale of potential wind energy projects in North Carolina.

While states such as South Dakota and North Dakota have tremendous wind energy potential, North Carolina has absolutely no harnessing infrastructure in place for this requisite potential. Other states with less wind



Map 4: Buffer Zones Around High Energy Wind Areas in North Carolina Coasts

energy potential have already begun harnessing the wind for electrical energy. Why has North Carolina not followed suit?

High wind areas occur in the mountains and near the coasts within the state of North Carolina. Cities such as Asheville, Boone, Hickory and Brevard are found in high wind areas with a high degree of spatial significance via the standard deviation ellipse. These areas in the Western part of the state may be problematic because of the close proximity to many state parks and national forests in the area. However, cities such as Wilmington, Jacksonville and Morehead City in the eastern part of the state have shown the wind energy potential because of their proximity to high wind areas near the coasts.

Discussion

This analysis represents a pilot study regarding *where* potential wind energy harvesting sites are situated in the state of North Carolina. I took a physical geography approach to assessing potential wind locations using existing data with a variety of GIS metrics. However, other issues must be addressed in order to make wind energy a viable option in North Carolina. These include proximity to existing electrical infrastructure, zoning allocations, parks and changing the attitudes resistant to putting these wind turbines in their towns. One such practical issue is the proximity of these windy areas to Great Smoky Mountains National Park.

While harnessing wind energy is environmentally friendly, harvesting conventional energies such as oil and coal occurs out of sight, and therefore out of mind for most consumers. Why is this fervent NIMBY (Not in My Backyard) attitude so prevalent with wind turbines? Can these attitudes be quantified at the regional level? These attitudes need to be addressed before constructive dialog can be had before making this migration to wind power.

It is implausible to think that wind energy is a cure-all panacea or replacement to the rising demand for energy in the near future. However integrating domestic wind energy with other forms of energy will decrease our reliance on foreign governments in this fickle economic and political climate. It is impossible to predict how the price of oil and coal will be affected with increased competition for these resources. However, we do know the costs associated with domestic wind energy now and in the future. The use of wind energy is possible in North Carolina. Scientists, politicians and consumers need to take a hard look at the economic, political and environmental pains taken to supply energy to the typical North Carolinian. Another form of energy exists in all of our backyards. A thoughtful and pragmatic approach needs to be taken so we, our children and grandchildren can reap from its benefits.

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The Confederates Last Victory: The Battle at Averagesboro, North Carolina

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In commemoration of the 150th anniversary of the American Civil War, the little known battle of Averagesboro is reviewed. Though this battle is often referenced as a skirmish before the Battle of Bentonville, it was an important victory for the Confederates and would prove to be their last. The battle of Averagesboro is interesting because it was an effective use of terrain by a smaller force to stop the advance of a much larger army. Situated between the Cape Fear and Black rivers in the Cape Fear River basin it was an area that was full of long needle pines and wetlands. General Hardee's placement of his troops in a deep defense is reminiscent of General Andrew Jackson's troop placement during the battle of New Orleans. Though largely outnumbered, Hardee's small force was able to delay General Sherman's troops within the area for two days, allowing General Johnston the time to gather his forces at Bentonville.

Key words: Averagesboro, Cape Fear River Basin, Civil War, Military Geography.

Introduction

It is the last year of the American Civil War. General Robert E. Lee is bottled up inside Petersburg by Ulysses S. Grant's army; Sherman has concluded his march to the sea, and has turned northwards to conduct his Carolina campaign. Fort Fisher, NC had finally fallen to the Union on January 15, 1865 severing the last eastern supply route to Lee's army in Virginia. The Confederate army was on its last legs and being strangled in an ever tightening noose.

Sherman entered North Carolina with roughly 60,000 troops and equipment on March 8th 1865. His intention was to march through this state destroying any valuable material for the Confederates; he marched from Cheraw, SC through the Southeast portion of the state; which at this time consisted largely of long needle pine forests interspersed with cotton fields. The pine forests were used in created navel stores for ships in the form of resin, tar, pitch, and turpentine. His other objective was the destruction of the armory at Fayetteville. His ultimate objective was to enter Virginia from the south and meet up with Grant's army and completely encircle Lee's Army.

At this point of his march Sherman had met with little determined resistance. The last real battle he had was at Kennesaw Mountain in Georgia when he fought General Joseph Johnston and actually lost. It was because of the lack of troops that Johnston had to withdraw from the area of Kennesaw Mountain towards Atlanta which, along with political infighting with CSA President Davis, resulted in his removal from command. He was reinstated at the request of General Lee on February 22nd and ordered to try to stop Sherman's advance into Virginia.

Physical Geography and Military Considerations

North Carolina can be separated into four distinctive regions. The Western quarter of the state is comprised of the Blue Ridge Mountains and has the highest point east of the Mississippi, Mt. Mitchell at 6,684 feet. The Piedmont, or the foothill region, is hilly and was once heavily forested, today it has a number of farms and the majority of the state's largest cities are found in this region. The Coastal Plain takes up forty-five percent of the state and gradually "falls" to the

coast. It can be separated into two regions, the inner coastal plain which rises 300 feet above sea level extends to the “fall line”, an area where the rivers fall towards the coast and become rapids. This area extends from Raleigh to Fayetteville and it was because of the rapids that these two cities were created as foraging points. The outer coastal plain is no more than thirty feet above sea level and consists of sandy flat lands also occupied by long needle pine. There are seventeen river basins that flow through or from

the state. The river basin that the Battle of Averasboro took place in is the Cape Fear River basin. It is entirely found within the state, and is the largest watershed (Gabe, Rex, Young, and Perry, 2002). Within this watershed, the rivers flow slowly in a south easterly direction and are fairly navigable, converging just above the coastal town of Wilmington (Figure 1).



Figure 1. The Cape Fear watershed and key locations mentioned in the text.

Drainage systems are shaped like asymmetrical trees that have numerous branches that attach to the main river, or the trunk. These trunks form different types of rivers or streams, for example, if the hydrology is flowing from a mountain range a radial pattern emerges, if it flows over flat ground, but the ground has a lot of fractures consisting of solid hard material, it will create a rectangular pattern, and if there are hills, lower than mountains, that feed into a valley, a trellis river basin will be created. The Cape Fear River basin is a dendritic river type where the water flows down on a slight gradient and the land that it flows through is made up of light sandy mineral deposits that do not impede its flow. Another important river within this basin is the Black River. The area between the Cape Fear and the Black River are poorly drained and suffused with oblong shaped lakes, shrub lands, forests, and wetlands (Gabe, Rex, Young, and Perry 2002). The area that the Battle of Averasboro took place, between the Cape Fear and Black River, was a very effective choke point because it is where both rivers narrow and are filled with marshy wetlands and dense woods. There are some examples of using rivers as choke points for a defense such as the Battle of Wagram, 1809, where the Austrians placed their army between the Russbach and Danube Rivers and the Battle of Blenheim, 1704, where Franco-Bavarian positions were between the Danube and Nebel Rivers (Macdonald, 1984) and the Battle for New Orleans, 1815.

Confederate General Hardee used the area between the Cape Fear and Black Rivers very effectively in a form of a deep defense where he set his defenses at areas where the forest, wetlands or the rivers, were at their closest. These lines in turn were than close enough to support each other. According to Von Clausewitz in his book *On War*, a defensive battle is one where a defender uses the terrain effectively, between rivers, mountains, or in a valley, to draw an attacker into an area where the main army is in the back and behind strong entrenchments, with one or two smaller lines of defense placed in the front at weaker

entrenchments. As the battle progresses, these first lines give way slowly and fall back to the main line where a decisive battle can then take place and the route for retreat is open and clear for a tactful withdrawal (Von Clausewitz, 1966).

Before the Battle

After capturing the city of Fayetteville practically without a fight and destroying the Arsenal there, Sherman needed to resupply his army before heading into Virginia. To do this, he needed to make his way eastward towards Goldsboro, the rail hub of North Carolina, to get supplies and troops from New Bern and Wilmington. To cover his movements, Sherman separated his force into two columns of roughly 30,000 troops apiece. He sent General H.W. Slocum to the north with the left wing towards Raleigh on the Fayetteville - Raleigh road while he moved to the east, with the right wing, towards Goldsboro.

During this time General Johnston was assembling his army in order to face Sherman and delay his forward momentum. Not knowing if Sherman was going to march towards the railhead at Goldsboro, or on the capital in Raleigh, Johnston chose a central point as his rendezvous area. This turned out to be the small town of Smithfield between the Cape Fear and Black Rivers (Figure 2). General Hardee was leaving Fayetteville and was ordered by Johnston to maintain contact with Sherman's forces on the Fayetteville-Raleigh road. As he approached the small town of Averasboro, he rationalized that Sherman's troops would have to pass through this area no matter which direction his army was going to move. This was an excellent position to establish a defensive line because the two rivers come close together forming a natural choke point (Smith and Sokolosky, 2005). This defensive position was made even more tenable because it had been raining for most of the month, swelling rivers, flooding marshes, and creating roads that, after being traveled on, were virtual quagmires (Barrett, 1956).



Figure 2. Topography in the vicinity of Avera'sboro between the Cape Fear and Black Rivers.

Summary of the Battle

First line of Defense

The weather on March 15, 1865 was terrible; it was rainy and miserable wet. It was an abnormally rainy winter and it turned all of the dirt roads into swamps (Smith and Sokolosky, 2005). On this morning at 6:00 am, Union cavalry, lead by Kilpatrick, made contact with Rhett's South Carolinian's. This small force, because it was entrenched and had its flanks anchored by dense forest and wetlands, (Figure. 4) was able to hold off the Union army for the whole day and for most of the following day. At noon of the 16th Union Captain Case forced his troops through the dense woods and swamps in a flanking maneuver on the confederates right, with a combined attack on the front, this forced Rhett's command to fall back to the second line commanded by Elliott.

Second line of Defense

This line was 300 yards to the north of the first line (Smith and Sokolosky, 2005) and was also flanked by forests and wetlands (Figure 5). Unfortunately, on seeing the retreat of the first line, it broke quickly after Cases' flanking maneuver, many soldiers in the second line took Rhett's troops falling back as a sign of a mass route, and ran back to the third line of defense. Because this was the widest point between the rivers, the flanks did not extend to them. Elliott's command was able to fend off two frontal attacks, but was overwhelmed by the Unions superior numbers that threatened both of his exposed flanks. This line held out only for an hour before it was pulled back into the final line.

The Third Line of Defense

This final line with earthworks, stretched between the two rivers with the right flank anchored by a ravine running from the Cape Fear River and the left flank being anchored by the Black River (Figure 6). As this line is approached from the south there is a slight rise to the land of about 2 feet, the third line of defense and earthworks were placed about 100 feet from this rise. This rise would have exposed the Union troops to direct fire as they reached the top, almost silhouetting them against the sky. Behind the third line earthworks, the ground rises again to a few feet where the cannon were placed to fire over the line at the advancing troops. Also, in the front of this position was an area of marshy ground that worked to slow the Union advance. All of these factors worked together to discourage any real direct assaults on the position. Sherman was reduced to repeated flanking assaults through the dense woods to try and turn this line which he was not able to do.

Hardee's position was also in danger of being flanked as well as overrun by superior numbers. Scouts had informed him that Sherman's right wing had crossed the South River further east and was prepared to attack from the rear. During the night of the 16th, following Johnston's orders to preserve the army, Hardee lit campfires and moved his men under the cover of darkness out of the area. He led what was left of his army to Smithfield to join with General Johnston and take part in the final battle of the Atlanta campaign at Bentonville.

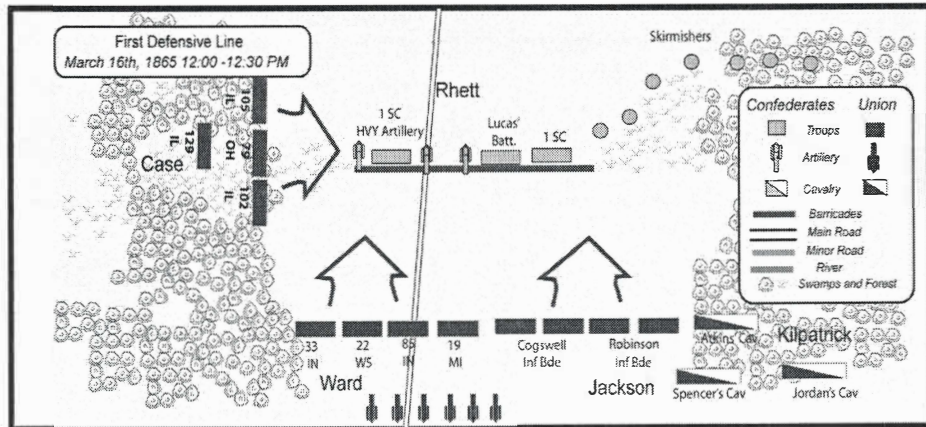


Figure 4

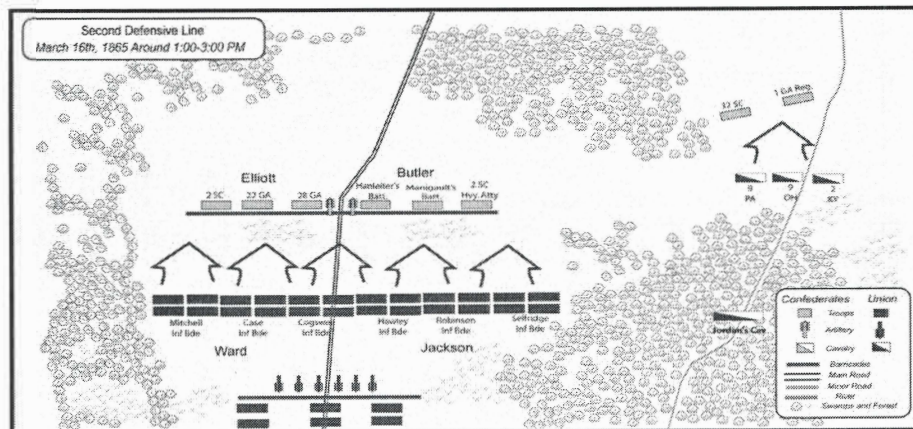


Figure 5

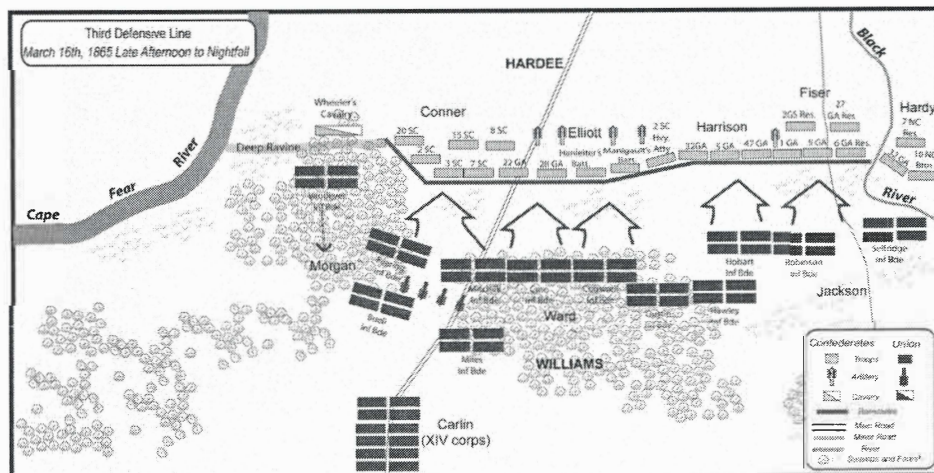


Figure 6

Conclusion

Hardee had more than exceeded the objectives put before him by Johnston. He was able to hold the Union armies advance for two days and bloody them enough to slow their forward advance. After this battle Sherman did not move towards a decisive engagement until the Battle of Bentonville on March 18th. In his *Memoirs*, Sherman writes that Hardee was able to put up a very stubborn resistance. This was due to Hardees excellent choice in land for setting his defense. Forcing the Union army into a small area that was difficult to traverse, and impossible for them to reconnoiter, was effective for reducing the numbers of troops that could be brought forward and deceive Sherman as to the effectiveness and placement of the confederate defenses. It was when the area could not be anchored by impassible terrain that the lines were flanked. It was also beneficial to Hardee that the weather had been exceptionally wet during this period which forced Sherman to utilize the roads and not move across country meaning that the only corridor towards Goldsboro and Raleigh was the Fayetteville - Raleigh road. If the weather would have been warmer and dryer this battle may not have taken place in this area and may have occurred at Smithfield.

The battle of Averasboro is often referenced as a holding action or short skirmish by historians, a skirmish that the Confederates lost. In number of dead and wounded, they lost 865 killed, wounded, and missing (Smith and Sokolosky, 2005) compared to Federal loses of 682 killed, wounded, and captured (Barrett, 1956). But on closer examination a much smaller force of roughly 6,455, succeeded in holding off an attacking force of roughly 29,000 for two days and was still able to leave the field of battle largely intact and in marching order. On that basis it was clearly a tactical victory for the Confederates.

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The Esri Site License Program: Enhancing Geospatial Education at North Carolina Central University

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North Carolina Central University, as one of the seventeen constituent educational institutions of the University of North Carolina system, participates in the annual system wide Esri Site License Program (SLP). This program is jointly funded by participating universities. Students, staff and faculty gain access to cutting edge geospatial software and allied benefits such as online courses and conference participation. The availability of these programs helps students from a variety of disciplines such as Geography, Environmental Science, Public Administration and Social Work, to name a few. This article describes the impact of participating in this program on the curriculum and learning of geospatial techniques as well as on the future employability of our graduates. Specific examples of benefits of SLP are provided, including student testimonials and course development ideas. The popularity of the Esri SLP is also discussed with the emphasis on the presence of the SLP at Historically Black Colleges and Universities (HBCUs). Institutional benefits of the SLP are weighted against the cost of deployment and suggestions for lobbying for the SLP at other HBCUs are provided.

Keywords: GIS, education, curriculum development, diversity

There are many firsts associated with North Carolina Central University (NCCU). It was the first state funded liberal arts college for African Americans (1910); it was one of the first Historically Black Colleges/Universities (HBCUs) to offer courses in Geographic Information Systems (GIS) (1990s); and the first HBCU to become part of the University Consortium for Geographic Information Science (2006). Moreover, NCCU is one of only two HBCUs in the southeast that offer a degree in geography (McKee and Dixon 2004) and it is nationally one of the top institutions of baccalaureate origin for geography doctorate recipients who are African-American (NSF 1996). These 'firsts' add value to the education received by current and future students and the NCCU Department of Environmental, Earth and Geospatial Sciences has continued the tradition by being one of the first HBCUs to incorporate the leading geospatial software (ArcGIS) and its allied

systems through the Esri Site License Program (SLP) into the curriculum (the company recently changed its name from ESRI to Esri). The SLP not only facilitates the use and learning of geospatial techniques but also provides opportunities for students to hone their skills by using real world tools in classroom exercises, projects and internships. This article reviews the 'Site License Program' and its application at NCCU to promote geospatial education. The main issues considered are how this program supports students, faculty, and allied administrative applications. This information is presented as a template for current and future implementations of the program at other small and mid-sized educational institutions that have or are in the process of investing in a site license. Such an association would particularly apply to Minority Serving Institutions (MSIs) that have or are interested in developing a geospatial sciences program.

Based on information provided by Esri (current as of February 2010), 20 of the 105 institutions of higher education classified at HBCUs in the United States participate in the site license program. Only 20% (4) participate in this program as stand alone institutions and 80% (16) are part of the program under state wide or multi campus agreements. HBCUs are more likely to participate in a Site License program under an agreement that covers more than one educational institution, probably due to the cost savings that result from such banding. The only private HBCU that participates in the program is Wilberforce University, Wilberforce, OH – the nation's oldest private HCBU. North Carolina Central University has participated in the Esri SLP since 2005 as part of the University of North Carolina system-wide site license program. Prior to this NCCU used to use the Lab Kit licensing option to bring Esri software to the classroom.

Esri's Academic GIS Licensing has undergone considerable changes with the latest release (ArcGIS 10) and this paper reflects most of these changes. The SLP is the highest level of the four options available to educational institutions (for a single campus, multiple campuses, districts, or statewide system). The other three options under the new ArcGIS 10 version are the Teaching and Research Lab Kit Licenses (for teaching and research use in computer labs or classrooms at educational institutions); the Teaching Lab Pak Licenses (for instructional use in a single computer lab or classroom at educational institutions); and the Educational Edition (Student/Faculty) and Individual Licenses (for students, instructors, faculty, staff, and other educators). Information about these options is provided in the "Higher Education Licensing Details" document that can be found on the Esri website (Esri 2010a, 2010b).

Site License Program – The Student Advantage

The most popular advantage of the SLP, by far, is the 1-year Student License (Education Use Only) that lets students from universities under the SLP umbrella install and use a full version of ArcGIS (ArcInfo) on their personal

computers. These days, most students start their college education with a laptop and expect to have resources available at their fingertips. In fact, most buildings on the NCCU campus are WI-FI enabled which gives the students ready access to information. It is widely accepted that the three main components of GIS are hardware, software, and data with software usually being the limiting factor. By providing software access to students, the SLP takes geospatial learning to a whole new level. Students can literally learn GIS anytime, anywhere. Everything – hardware, software and data – are at their disposal.

Most students enrolled in GIS classes at NCCU opt to install ArcGIS on their computers and use this capability to complete homework and class assignments. Being able to work on the assignments and explore GIS software without constraints of campus location and laboratory hours is even more important for many non-traditional NCCU students who balance commute, work, family obligations and academic schedules. As in most other MSIs, they form a larger percentage of the student body at NCCU than at research oriented institutions. For example, close to 25 percent of the undergraduate students at NCCU are older than 25 and half of the undergraduate students commute or live off campus (NCCU Common Data Set 2008-2009).

Another advantage of the SLP is that it offers an abundance of opportunities for students to hone their geospatial skills via the Esri Virtual Campus (Esri 2010c). This is because universities under the SLP program have unlimited access to these courses. Various free courses and almost 35 for fee courses are available at not cost to our students. Students can either take courses to buttress their existing knowledge or expand into areas such as programming, geospatial analyses, scripting, etc. The courses are easy to follow and have exercises and exams that can be used to turn theoretical learning into practical knowledge. Several NCCU students have taken basic and advanced courses via the Virtual Campus. Undergraduate students often

take these courses either as part of class requirements or to add to their repertoire prior to internships. Graduate students from other departments as well as graduate students entering the Earth Science graduate program with limited GIS training often take these courses to get up to speed with GIS concepts before incorporating geospatial analysis in their research. For example, two current Earth Science graduate students used a free Virtual Campus course “Creating, Editing, and Managing Geodatabases for ArcGIS” as preparation for their thesis research to create geodatabases for two central and southeast U.S. intraplate seismic zones (Esri 2010d). Starting with ArcGIS 10, in addition to Virtual Campus training (self paced) Esri has launched Instructor-Led Virtual Classroom courses. While the traditional Instructor led courses have mostly been out of reach of students due to high course fees and associated travel, it will now be possible for students to take these courses without traveling, thereby putting some of these course within students’ reach. Academic institutions not participating in the SLP can still take advantage of the Virtual Campus courses as long as they participate in one of the other educational licenses offered by Esri.

Under faculty guidance students often couple these direct SLP advantages to other avenues offered by Esri such as the User Conference Student Volunteer program or the Esri Summer Student Internship program. Both of these programs are highly sought after and the SLP gives students an edge as they are likely to be more familiar with the Esri software suite than students who do not have access to the SLP. This advantage also carries over to other internships and job opportunities as students, due to access to the software and Esri courses, invariably show conceptual familiarity to real world applications such as heads-up digitizing, data access, geodatabases, Toolbox, ArcGIS Extensions and scripts. At NCCU students have taken advantage of most of these programs to enhance their geospatial skills. Over the past five years four NCCU students have applied for and become student volunteers at the Esri User Conference in San

Diego, their applications in part made stronger by knowledge of Esri products. GIS related internships and successful completion of GIS Certification (Malhotra and Vlahovic 2009) are also evidence of important albeit intangible benefits of the SLP at NCCU.

The success of this program can also be gauged by comments made by students about the popularity of this program. Gerrikka Taylor, a senior in the Bachelor of Business Administration program at NCCU, states:

“I actually gained a lot by having access to ArcGIS outside of class. At times I was able to run through maps and complete them faster outside the 50-minute class and without the MANY distractions and questions of other students. Outside of class I was able to repeat assignments as many times as I wanted which was a major plus. Studying for the test was easier too because I could refresh my memory at any time. Overall, having the program on my personal computer was beneficial in many ways and it added to my success in the course”.

Another student, Kelsey McCleave, a Junior working towards a Bachelors Degree in Social Work wrote:

“It was very beneficial because once I have learned the information it is a lot easier for me to go home and repeat it than in the class room because I find myself more worried about helping friends and then completing my own work. Being able to access the software at home has helped me a lot because I am able to take more time out and repeat the maps and go through the steps and memorize them.”

Faculty Options

At most HBCUs and MSIs, the primary responsibility for most faculty members is teaching. Resources such as complimentary registrations to the Esri User Conferences (UC), both the Education UC and the International UC, online courses, networking with others educators via online Esri Education Community and the HIGHERED-L listserv, and faculty and staff discounts on Esri

training courses not only help with the teaching load but also provide avenues to broaden their research horizons. Most small institutions host one or at most two faculty who specialize in geospatial technologies and the SLP helps bridge these islands within the state and across the nation. The complimentary conference registration gives instructors and researchers the opportunity to interact with other teachers, potential students, and vendors who might be able to further enhance their geosciences program. It also gives faculty members the option of showcasing their program, research and student work through paper and poster presentations. The ability to interact with over 10,000 users is an important learning and professional experience – especially for students and faculty from small programs. Providing the one year ArcEditor license for educational use and unlimited access to the Virtual Campus courses frees the faculty from the task of “looking” for resources and lets them concentrate on “using” the resources. Moreover, help is just a click away; the Esri Education Community website and the HIGHERED-L listserv are full of ideas, lessons, data, and information. The website is not limited to teachers from institutions that are part of the SLP but having this in conjunction with the other software tools enhances the instructors’ ability to leverage them all. Real world examples and case studies using ArcGIS software can be ported to the classroom. Students get the advantage of learning and using software that they will use in their future jobs. Moreover, because students and faculty have access to the ArcGIS suite, they can take advantage of free extensions such as ArcHydro and examples from Esri TV. The HIGHERED-L listserv *“provides an opportunity to post information and questions related to teaching and research at colleges and universities. This includes questions about the use of all of ESRI’s software products, curriculum, pedagogy, lab set up and program development and support. Use HIGHERED-L to receive expertise/advice from other users of our software and discuss related GIS*

procedures and data in education” (Esri 2010e).

In addition to being a valuable resource for faculty in geography and allied fields, the SLP is a door for inter-disciplinary professional education for other faculty. As the use of geospatial technology is becoming mainstream in fields other than geography, courses offered through the Virtual Campus allow faculty from other disciplines to enter the geospatial arena and incorporate geospatial analysis into their teaching and research. At NCCU, ArcGIS software was showcased to faculty from other departments through series of workshops and is now used in six departments, in addition to the home department of Environmental, Earth and Geospatial Sciences. Faculty exposure and enthusiasm for geospatial technology usually translates into students in other disciplines learning about GIS from their professors and deciding to take GIS courses. For example, one such course specifically developed for non-geography majors, “GIS for Social Sciences”, was added to the curriculum in Fall of 2008 and has waitlisted every semester since. Students increasingly recognize that the job market prizes combination of competence in their particular discipline and geospatial skills. In fact, the most recent Occupational Outlook Handbook (2010-2011) issued by the U.S. Department of Labor (<http://www.bls.gov/oco/oco20016.htm>) predicts faster than average employment growth and favorable job prospects for bachelor's degree holders with strong geospatial skills.

Institutional Benefits

Having the SLP has important campus wide implications. The SLP facilitates inter-departmental collaboration, supports curriculum development, enhances research projects, helps run geospatial training in classroom and laboratory settings, and is a way for allied services such as police, facilities, health and safety to ‘map’ the campus. One such example of the strong interest in GIS across the campus community

is the attendance by staff from eight supporting administrative units at a GIS workshop hosted on campus (Vlahovic and Malhotra 2010). The Esri SLP program is unique, comprehensive and useful in any educational setting. It is unique because no other geospatial site license program offers comparable depth, diversity and expansiveness of materials and services. It is comprehensive because almost everything Esri has to offer is included in the SLP. It is useful because it impacts all aspects of geospatial learning and teaching at a university/college.

Having access to all the tools included in the SLP facilitates curriculum development and integration. The students and faculty have access to the latest developments in geospatial technology, online courses, and software. All these can be easily incorporated into the curriculum. For example, lectures can be buttressed by online exercises and class projects can be more realistically implemented because they are conducted in an environment widely used in the outside world. At NCCU, at least four GIS courses take significant support from the online suite of courses. For example, Geohazards Analysis with GIS course (open to geography upperclassman and other students interested in geohazards) is organized around the “Spatial Analysis of Geohazards Using ArcGIS” Esri Virtual Campus course. The online course consists of six modules covering earthquakes, volcanoes, floods, coastal hazards and landslides. The course schedule alternates between professor-led lectures introducing concepts of natural systems and students working independently on data analysis using ArcGIS modules. Similarly the “GIS for Social Sciences” course introduces GIS to the students through the free course “Getting Started with GIS” and the advanced course “Applied GIS” relies heavily on a series of Virtual Campus courses dealing with geodatabases.

Allied courses in remote sensing and physical geography all include a few exercises that are conducted in Esri software due to ease of access to the software. All this learning could easily be conducted in a vendor neutral

and open source environment but the experience gained by working under the SLP environment helps students develop familiarity with operations and work flows. Furthermore, having access to the SLP enhances theses and senior projects conducted in partnership with local organizations that use the Esri suite of software in their work. This integrated learning that starts with the curriculum is critical in internship and employment opportunities. One current example is work that several geography majors are completing for the City of Durham Stormwater Division using ArcGIS software to verify parcels and address point data in order to improve accuracy of stormwater billing. These internships are realized through the NCCU – City of Durham partnership. The partnership was the result of showcasing faculty and student capabilities during ArcGIS training provided by NCCU faculty on NCCU campus for the City of Durham employees – an indirect result of participating in the SLP.

The benefits of giving software to universities at a reduced cost are well established. From Esri’s point of view the SLP can be viewed as similar to the desk copy program which is the hallmark of the educational publishing business. However it is not one or two things that make the program strong – the fact that everything is available is what makes it work. The multifaceted approach with something for everything (teaching, learning, research, mapping, and development) is what sets the Site License Program apart.

Deployment and Cost Options

There are considerable benefits of deploying an SLP to students, faculty and the educational institution. These benefits, however, are accrued at a cost and it is important from an institutional standpoint to consider the deployment and cost options. As stated earlier, the SLP is the highest and logically the most expensive level of the four license options that are available to educational institutions. Therefore, institutions with limited budgets allocated to GIS or institutions with smaller GIS programs such

as community colleges with a couple of GIS courses offered, or institutions that cannot participate in a state wide program should consider the Teaching or the Teaching and Research Lab packs.

While the exact cost of the SLP or the other licensing options are not publically provided by Esri (Buckely and Pheonix 2000), it can be assumed with some confidence that the costs of an SLP run into thousands of dollars annually. This high cost gives educational institutions access to a collection of software (Desktop GIS, Server GIS, Business GIS, and other programs) and opens the possibilities of collaboration, research, and development. But the multitude of software options coupled with the fact that Esri software can be set as Single Use or Concurrent Use add complexity to SLP management which can lead to underutilization of the program which in turn translate into diminished value to the institution. Therefore, it is important to team the SLP setup with knowledgeable personnel. This adds to the cost of running the program to the extent that even some of the larger universities look to recuperate some or all associated costs and overhead. A review of the list of "Universities with ESRI Campus Wide Licenses" provided by Esri that was current as of February 2010 combined with an internet search, shows that public educational institutions in 37 of the 50 states partnered together to participate collectively in the SLP. In three of these 37 states (California, Connecticut, and Washington), community colleges formed a separate group independent of universities. A web search of these statewide site licenses was conducted at the educational institution level to find costs if any recuperated from students, teachers, or laboratories that utilize the SLP. It was found that institutions in 14 of the 37 system wide programs listed specific and detailed charges for end users (laboratories, faculty, and students). Pricing information could not be located for programs in the remaining 23 states either because this information could only be accessed via a login; this information was not available on the internet; or no direct

evidence was found that the institutions charged to recover costs of the SLP. The distribution of the SLP benefits such as software and virtual campus courses was also very varied. This ranged from a set of automation tools developed at University of Washington (Hurvitz 2001) to the NCCU model where the site license administrator relied on faculty and student emails, primarily due to limited resources allocated to the running of the program. Almost universally, however, if any kind of automatic system was developed it would include some functionality for end users to request Virtual Campus courses and these courses were offered at no charge. Wherever available and advertized, the one year "ESRI Software Promotion for GIS Students at Institutions with a Campus-Wide Site License" was also provided at no cost. So, even with cost considerations, the two important student focused components of the SLP were kept cost free and the cost recovery was generally focused on individual departments, laboratories, and faculty/staff computers. It is important to note that resident students and students enrolled in distant learning programs are both considered at par and have access to and are encouraged to use the virtual campus courses as well as the one year promotion.

With ArcGIS 10, Esri has implemented a new license management technology and various deployment options are discussed in the licensing white paper (Esri 2010b). Some key changes to streamline the process include the elimination of hardware keys that used to be standard for Single Use licenses, and borrowing of licenses from the Concurrent Use pool for a specific period. Another significant change that has occurred is that the one year student promotion software is now shipped at the ArcInfo (highest) level. This gives students access to the complete functionality found in organizations that use Esri software in their business environment. In addition to unlimited seats of ArcGIS Desktop, the SLP come with a suite of Esri extensions, ArcGIS Server, access to the Esri Development Network (EDN), Telephone Technical Support, and Passes to the Esri

International User Conference and the Education User Conference. While the technical support and the conference passes are standard in the SLP, their quantities vary and are governed by contract specifications. Only two restrictions are placed on the administrative use of software. ArcPad 8.0 and data included with ArcLogistics can be used for teaching and research but not for administrative purposes. Also starting with ArcGIS 10, Esri is moving away from the disk (CD/DVD) mailing model to a "Software Download" model. Through the Esri Customer Care website, site license managers can access, download, and manage the site license. At present the download option does not allow direct student access but Esri plans to change this in the near future.

Conclusions

This article presented the advantages of the Site License Program for NCCU students, faculty and wider university community. They include university wide access to ArcGIS software, one year education license for students' personal computers, free access to Virtual Campus courses and other Esri developed educational materials, support for faculty through Esri Education Community forum, free Esri conference registration and student volunteer opportunities. Furthermore, as the cost of the complete Site License Program can be prohibitive for smaller institutions, Esri has created a layered approach where institutions can use the a-la-carte model to gain access to the SLP. Before the current arrangement of distributing SLP cost among 17 campuses of UNC-system, practice that started in 2005, NCCU had to cover the cost of the license. The process involved not only justifying, on a yearly basis, rational for use of the software, but in lean budget years also finding funds to cover the cost. In NCCU's case funding varied from year to year from departmental funds to support from academic offices such as the Office of the Vice-Chancellor for Academic Affairs and the Office of the Provost. Faculty considering lobbying their administration to cover the cost of SLP, especially at HBCUs

and other MSIs that have been hit harder by the recent economic downturn due to traditionally smaller endowments and high number of economically disadvantaged students (Shaila 2010), are admittedly facing a challenge. They have to overcome the lack of vision of the transformational power of the SLP, not just for few professors and geospatial programs, but for all the students and university as a whole. At many major educational institutions, the Esri SLP is at par with Microsoft, Adobe and other software site licenses that facilitate education and learning. Thus, popularizing the use of GIS on campus and developing alliances with other academic units is a must. Faculty championing GIS at traditionally non-research campuses must also be prepared to volunteer their time extensively until number of GIS users and cumulative GIS competence grows to the critical level necessary to ensure long term survival of the program. In addition, faculty trying to establish the SLP at HBCUs and other MSIs should consider connecting to thriving programs at other similar institutions and inviting speakers to their campuses who can testify to the benefits of the SLP on their campus. Past success stories of how the cost of SLP returned many times over through external funding for collaborative geospatial research and educational endeavors, paid student internships, improved graduation rates and job placements, partnerships with business, government and non-profits, may turn out to be the deciding factor in favor of investing in such programs.

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The North Carolina Educator of the Year -- 2011

For over 30 years Professor Jeffrey C. (Jeff) Patton has been an advocate and exemplar of geographic teaching, research, and service. He arrived at the University of North Carolina--Greensboro in 1980 as a visiting assistant professor, fresh from the Ph.D. program at the University of Kansas where he focused on classic issues of cartographic theory and communication. He was appointed to the tenure track at UNCG the following year, rising to the rank of Full Professor and serving as Head of the Department of Geography for the past nine years, a period of considerable growth and restructuring in the department.

Jeff's impressive storehouse of work in cartography and geography is wide ranging and eclectic. His early work focused on research into the role of cartography in children's learning styles. Later efforts involved the historical development of maps in educational curriculums. Along the way he branched out into surveying and mapping Bronze Age settlements on the island of Crete.

Jeff's explorer's instincts and secondary interest in physical geography were manifest in 20 summer field courses throughout the United States and Canada. One such course included 30 students in an extensive road trip into the intermountain West. In Great Basin National Park the students were invited to join Jeff in a climb up Wheeler Peak where glacial topography and panoramic views of the basin and range country would be available. Many started, but only four reached the summit. Along the way Jeff took a misstep in a boulder field and green-stick fractured his leg. With undaunted courage he continued with the few remaining students on to the summit and then turned to face the steep five mile decent to the trailhead.

Students, colleagues, and the people of North Carolina have always found Jeff a willing mentor and contributor, one who is generous with his time and cartographic skills. Some 500 of his maps and other artwork have been contributed to scholarly articles and books, as well as public and private brochures and pamphlets scattered around the state. His textbook on the geography of the United States and Canada (co-authored with Gordon Bennett at UNCG and James Leonard at Marshall University) is now in its 5th edition, and continues to feature artwork hand drawn by Jeff. His artistic talents extend to the classroom, where he often shuns computer technology in favor of carefully drawing out concepts with chalk, on a chalkboard, face-to-face in a classroom. For the past nine years, while maintaining a busy administrative schedule as Department Head, he has continued to teach introductory earth science, cartography, and graduate seminars, while advising M.A. and Ph.D. students through to completion of their degrees. He recently joined with other UNCG science professors to co-sponsor the Science Technology and Mathematics Preparation Scholarships (STAMPS). Initially funded by the National Science Foundation at \$32K/AY, the fund is slated to grow to \$600,000 in four years. In these times of shrinking sources of financial aid, STAMPS will support undergraduates pursuing majors in the sciences, including geography. At the graduate level, Jeff is also a co-director on an NSF funded grant to place research scientists in the K-12 public schools. The program funds Ph.D. level graduate students from geography and other sciences, who gain teaching experience while supporting professional teachers in local classrooms.

Jeff's additional service to organization's devoted to geographic education is also extensive. He is a past president of the North Carolina Geographical Society (2005), twice past president of the North American Cartographic Information Society (1987, 1993), and a member of the Editorial Board of *Cartographic Perspectives*.

The North Carolina Geographical Society is please to recognize the distinguished record of Dr. Jeffrey C. Patton with the North Carolina Educator of the Year Award for 2011.

-- Michael E. Lewis

2011 Annual Meeting of the North Carolina Geographical Society

This year our Annual Meeting was hosted by the University of North Carolina-Greensboro on October 1-2, 2011. The meeting followed the North Carolina Geography Bowl, which was also held at UNCG. A reception and social hour was held that evening, with President Tom Crawford welcoming attendees. Presentation of The North Carolina Educator of the Year Award to Jeff Patton (UNCG) was made by Michael Lewis. Following the social hour we moved on to dinner at a local restaurant.

The Business Meeting was held Saturday morning. Chris Badurek (ASU) was elected President of the Society for a two year term, and Roy Stine (UNCG) was acclaimed Secretary-Treasurer. Michael Lewis, editor, noted that submissions to The North Carolina Geographer may include Carolina Landscapes, Teaching Plans and Strategies, and Book Reviews, in addition to Research Articles. Jeff Neff announced the end of his phased retirement from Western Carolina University. Jeff has been a friend and supporter of the North Carolina Geographical Society since its beginnings and we wished him an active and enjoyable retirement. Jim Young has completed his term as chair at ASU and the new chair is Kathy Schroeder.

A field trip to The Guilford Courthouse National Military Battlefield followed the business meeting. Non-historians were reminded that the Battle of Guilford Courthouse took place in 1781 during the War for Independence and not during that later conflict over state's rights. A walking tour from the visitor's center ended with Roy Stine demonstrating the use of ground penetrating radar to reconstruct the battlefield landscape and determine the precise location of Guilford Courthouse.

-- Chris Badurek and Michael Lewis

Report on Activities of the North Carolina Geographic Alliance

In 2012, the North Carolina Geographic Alliance (NCGA) will celebrate 25 years of efforts to improve geographic education in the state. The NCGA was founded in 1987 under the leadership of Dr. Doug Wilms (East Carolina University) and Dr. Bill Imperatore (Appalachian State University). The National Geographic Society provided financial support and training to develop a cadre of Teacher Consultants who served as the foundation for NCGA activities across the state. With the support of geographers from university programs in the state, the NCGA provided professional development opportunities for teachers, developed classroom materials, and helped shape geography curriculum and standards in the state. Over the past decade, NCGA funding, programming, and leadership have experienced significant shifts, but the Alliance members continue to carry out the mission of improving geography education and increasing awareness of how a geographic perspective can help us better understand our world.

Over the past few years, the NCGA has continued many of the programs that have been successful for more than two decades: summer institutes, workshops, development and distribution of materials, connecting teachers with National Geographic programs (e.g., My Wonderful World and Geography Awareness Week), and consulting with state educators regarding curriculum changes. The NCGA has built strong relationships with education organizations in the state, particularly the North Carolina Council for the Social Studies (NCCSS). Several NCGA Teacher Consultants have served in leadership roles with the NCCSS and a number of teacher outreach activities have been conducted at the NCCSS annual meeting. For example, at the 2011 NCCSS meeting in Greensboro the NCGA sponsored the giant traveling map of Africa (provided by the National Geographic Society), and featured sessions with David Smith (author of *If the world Were a Village*), and Phil Gersmehl (Michigan Geographic Alliance and the New York Center for Geographic Learning). One of the workshops focused on use of the GeoHistoGram, a graphic device that helps teachers integrate geography and history learning. Several NCGA Teacher Consultants also presented at NCCSS sessions. The giant traveling map of Africa traveled to school districts across the state in the weeks before and after the NCCSS meeting with support from the North Carolina Geographic Alliance; more than 3,000 students and several hundred teachers and parents had the opportunity to work with the giant map of Africa during its time in North Carolina.

A major focus over the next couple of years will be providing workshops to help teachers teach the geography components of the new Essential Standards in social studies adopted by the state DPI. Due to a lack of lesson plans and textbooks, the new standards present significant challenges for social studies teachers, but an opportunity for the NCGA to help teachers incorporate geo-literacy concepts and tools into their teaching. Steve Pierce, NCGA Coordinator, is working with NCGA Teacher Consultants to provide training for teachers in several school districts. NCGA Teacher Consultants will offer several sessions at the 2012 NCCSS meeting to provide further assistance to social studies teachers developing curriculum to incorporate the new standards.

The NCGA currently is involved in a strategic planning process, part of an effort by the National Geographic Society to examine the successes of the alliance network and identify goals, objectives, and processes for enhancing geographic education efforts. A Strategic Planning Committee has been established and is working with the NCGA Steering Committee and Kallan Strategic Partners (a private consulting firm) to develop a strategic plan for future NCGA programming. The NCGA Strategic Planning Committee has been working to shape a mission statement, establish goals and objectives for alliance programs, identify possible partners across the state, and develop a funding plan to support NCGA programs. The North Carolina Geographical Society (NCGS), university geography departments, and professional geographers are possible partners in the NCGA efforts to enhance geographic awareness and understanding. Several NCGS members have been interviewed and provided valuable insights and ideas about NCGA efforts to build partnerships. The members of the NCGA Strategic Planning Committee and Steering Committee are looking forward to the opportunity to meet with professional geographers, teachers, parents, school administrators, and private business personnel to gather additional information that can help shape the future of geographic education in North Carolina.

-- Submitted by James Young, Appalachian State University

Guidelines for Authors

The North Carolina Geographer is an annual peer reviewed journal published by the North Carolina Geographical Society. It serves as an outlet for the dissemination of research concerning topics of regional interest. The journal publishes research articles, a section on Carolina Landscapes that includes descriptions of emerging and interesting features of the region, book reviews, and conference reports. Contributions from faculty, students, professional practitioners, and independent scholars are welcome.

All manuscripts submitted to *The North Carolina Geographer* should adhere to the following guidelines and be in acceptable format ready for peer-review.

- ❖ Only original, unpublished material will be accepted. Submission by electronic means is encouraged. Paper copies may also be submitted through the mail. A separate title page should include the authors name(s) and affiliation(s). An abstract giving the key purpose and findings of the article should follow on a separate page. The first page of text should begin with the title, but not include authorship.
- ❖ All manuscripts should be ready to print single sided on standard 8.5 X 11 inch paper, double spaced, with 1.25 inch margins, using 10 point type. Times Roman type font is preferred.
- ❖ References are to be listed on separate pages, double spaced, and follow the Publication Manual of the American Psychological Association (APA style guide) as used in journals published by the Association of American Geographers (*Annals*, or *The Professional Geographer*).
- ❖ Figures and tables should be submitted on separate pages at the end of the manuscript. Electronic versions or figures or maps should be in .TIFF format to provide for the best reproduction in the journal. Also provide a list of figures and tables on a page separate from the main text of the manuscript.
- ❖ High quality black and white images may be included. Original digital images are preferred to paper photographs.

Submit manuscripts to:

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Department of Geography

PROGRAMS AND RESEARCH FACILITIES

Undergraduate tracks include the B.A. in Geography and the B.S. in Applied Geography. The former is a broadly-based geography program, drawing courses from human and physical geography, as well as techniques. The latter has a strong emphasis on spatial analysis, and requires an internship in a state agency or private firm.

At the graduate level the Department specializes in human geography, physical geography and spatial information technologies, and supports a variety of philosophical and methodological approaches within each of these areas. Students are encouraged to develop their research in conjunction with faculty, and to disseminate their findings via professional meetings and journals. Faculty expertise is clustered around the following:

Economic Geography: development policies, practices, and impacts; urban and rural restructuring; and geographic thought (political economy, feminist theory, critical geopolitics).

Cultural Geography: community development; tourist landscapes; cultural ecology; and field methods.

Coastal Plain Geomorphology: coastal geomorphology (aeolian processes and dune formation); drainage basin hydrology; fluvial geomorphology; soil geomorphology; and environmental management (natural hazards research, land and water use planning).

Spatial Information Technologies: geographic information systems (watershed/ environmental modeling, topographic effects on digital data); remote sensing and image processing, computer cartography (global databases and map projections), and spatial quantitative methods.

Regional Specializations: Africa-East; Africa-South; Asia-South; Caribbean; Middle East; North Carolina; Western Europe.

Faculty are actively engaged in research in all four clusters, and have received multiple-year grants from, amongst others, the U.S. Department of Agriculture, the National Science Foundation, the New Jersey Sea Grant Program, N.A.S.A. and the U.S. Forest Service.

The department maintains both a fully equipped physical geography laboratory and a Unix-based Spatial Data Analysis Laboratory. The physical geography laboratory is designed for mechanical analyses of soil and sediment, but also includes state-of-the-art GPS, electronic surveying equipment, and instrumentation for monitoring hydrologic and aeolian processes and responses. The spatial laboratory consists of ten Sun workstations, a large format digitizer, and an Esize DesignJet plotter for teaching and research. Primary software includes Arc/Info, ArcView, and Imagine. A PC-based cartography laboratory was recently established. Students also have access to a wide variety of university facilities including the Institute for Coastal and Marine Resources, the Regional Development Institute, International Programs, and the Y.H. Kim Social Sciences Computer Laboratory. The Kim laboratory provides access to PC-based software such as Adobe Illustrator, ArcView, Atlas*GIS, IDRISI, SAS, SPSS, and Surfer.

FOR CATALOG AND FURTHER INFORMATION WRITE TO:

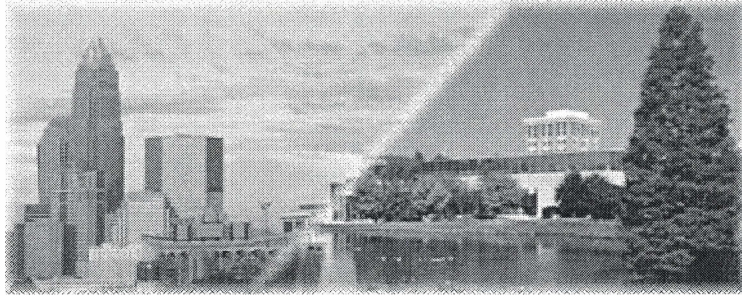
Undergraduate Catalog: Director of Admissions, Office of Undergraduate Admissions, East Carolina University, Greenville, North Carolina 27858-4353.

Tel.: (919) 328-6640. World Wide Web: <http://www.ecu.edu/geog>

Graduate Catalog: Graduate School, East Carolina University, Greenville, North Carolina 27858-4353.

Tel.: (919) 328-6012. Fax: (919) 328-6054.

Graduate Programs at The University of North Carolina at Charlotte



Ph.D. Program in Geography and Urban and Regional Analysis

The Ph.D. program focuses on two interconnected research themes: multi-scalar analysis and GIScience. Pairing technology and theory in the core curriculum, the doctoral program is designed to prepare graduates for research positions in the public and private sectors, as well as academic careers. Doctoral assistantships carry stipends of \$13,000 plus healthcare insurance, and a tuition waiver.

For further information contact Dr. Owen J. Furuseth, Director Geography Ph.D. Program at: ojfuruse@uncc.edu or via telephone at 704-687-4253.

Master of Arts in Geography Program Concentrations

Community Planning Track students are awarded the M.A. in Geography and complete a formally structured multi-disciplinary core curriculum with course work in Geography, Architecture, Economics and Public Administration. The Track has an excellent placement record.

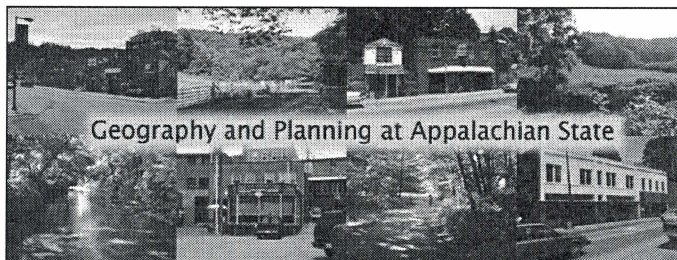
Location Analysis Concentration students prepare for careers with retailers, real estate developers, consulting firms, commercial banks, and economic development agencies. Course work is offered by practicing professionals and focuses in: Retail Location, Market Area Analysis, Real Estate Development, Applied Population Analysis, Real Estate Development, and Industrial Location.

Urban-Regional Analysis Concentration trains students for public and private sector planning economic development and Geographic Information Science. Course work may be concentrated in one of the following areas: Economic and Regional Development, Site Feasibility Analysis, Urban Development, and Geographic Information Science.

Transportation Studies Concentration is affiliated with the University's Center for Transportation Policy Studies. Students pursue course work in Transportation Systems Analysis, Transportation Modeling, and Transportation Policy Analysis. Careers are available in public and private sector agencies and in consulting firms.

The M.A. program has a limited number of out-of-state tuition waivers and a significant number of graduate teaching or research assistantships. Typical stipends include awards of \$10,000 for the academic year. Current full-time students receive financial support via assistantships or via contract work.

For further information, visit our website at <http://www.geoeath.uncc.edu/> or contact Dr. Tyrel G. Moore, Graduate Coordinator, Geography M.A. Program at tgmoore@uncc.edu, or via telephone at 704-687-5975.



APPALACHIAN STATE UNIVERSITY
Department of Geography & Planning
www.geo.appstate.edu

DEGREES OFFERED

- B.A in Geography
- B.S. in Geography (teaching)
- B.S. in Geography (general concentration)
- B.S. in Geography (geographic information systems)
- B.S. in Community and Regional Planning
- M.A. in Geography with thesis or non-thesis (general geography or planning concentrations) options

RESEARCH FACILITIES

The Department occupies the third and fourth floors of a soon-to-be renovated science facility and contains three computer laboratories for work in computer cartography, GIS, and image processing. The laboratories have numerous microcomputers networked to each other and to the campus mainframe cluster. Appropriate peripherals include digitizers, scanners, printers, and plotters. The Department maintains a full suite of professional GIS, image processing, graphic design and statistical software applications in its laboratories. The Department is a USGS repository, and its map library presently possesses over 100,000 maps and 5,000 volumes of atlases, journals, and periodicals; and is also a repository for census material available on CD-ROM including TIGER files, DLGs, and other digital data..

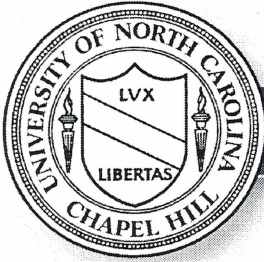
GRADUATE PROGRAM

The Masters program in geography is designed to provide students with a relatively broad range of academic and professional options, preparing them for Ph.D. work in geography and planning, professional applications in GIS, or opportunities in teaching at all educational levels. Accordingly, thesis or non-thesis options are offered with the non-thesis option requiring an internship in regional, urban, or environmental analysis and planning. In addition, the Department participates in a program leading to the Master of Arts degree in Social Science with preparation in geographic education.

For further information, please contact:

- Department Chair: Dr. Jim Young (youngje@appstate.edu)
- Graduate Program Coordinator: Dr. Kathleen Schroeder (schroederk@appstate.edu)
- Program Inquiries: Kathy Brown (brownkv@appstate.edu)

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DEPARTMENT of GEOGRAPHY

<http://www.unc.edu/depts/geog>

The University of North Carolina at Chapel Hill is the oldest state university in the country and is one of the nation's premiere public institutions, with extensive and state-of-the-art resources and a range of nationally and internationally recognized academic programs. Set within this environment is Geography, a collegial, dynamic, and highly productive department of 16 faculty, including national and international leaders in areas of human geography, earth systems science and geographic information science. Geography offers the B.A., M.A., and Ph.D. degrees, with most graduate students pursuing the doctorate. The department enjoys excellent collaboration with a set of leading interdisciplinary programs on campus, including the Carolina Population Center, Carolina Environment Program, Shep Center for Health Services Research, Center for Urban and Regional Science, International Studies and Latin American Studies.

Undergraduate Program. UNC's Department of Geography offers a broadly based B.A. degree with concentration in three areas—the geography of human activity, earth systems science, and geographic information sciences. A well-equipped teaching lab directly supports undergraduate teaching and research in Geography, while a range of state-of-the-art facilities can be found at several venues on campus. Students are urged to participate in the University's superior undergraduate programs and resources, undergraduate research, and internships. The department has a student exchange program with Kings College London.

Graduate Program. Our graduate program reflects our ongoing commitment to the highest quality research and our intention to continue to direct resources toward our primary research strengths: Earth Systems Science, Geographical Information Sciences, Globalization, Social Spaces, and Human-Nature Studies. These areas are integrated in individual and group research projects, while interdisciplinary cooperation is also highly valued. Reciprocal agreements with other universities in the Triangle allow graduate students to take courses at Duke University and North Carolina State. Funding is available through fellowship, research assistantships and teaching assistantships. Current graduate research is carried out both locally and globally on six continents with funding from a range of agencies including NSF, NASA, USDA, HUD, NIH and EPA as well as a set of private endowments. Recent graduates have regularly found positions in leading universities, government agencies and private enterprise.

For more information, contact Dr. Larry Band, Chair, Department of Geography, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-3220. Telephone: (919) 962-8901. Email: lband@email.unc.edu



The Department of Geography and Geology at the University of North Carolina Wilmington offers a Bachelor of Arts degree in Geography. Students who pursue the B.A. degree in geography may choose from a broad, flexible program that meets personal educational goals and interests, including careers and graduate study in physical, human or applied geography. The Department of Geography and Geology also offers a minor in Geospatial Technologies. The minor enables students to achieve a documented expertise in geographic techniques which can then be leveraged to gain employment in the expanding GIS job market. UNCW Geography also supports a vibrant internship program that places students in a wide variety of professional agencies in southeastern North Carolina.

There are three options of concentration for students in the Geography Program at UNCW:

The **applied geography** option is designed for students who are interested in careers as planners, GIS specialists, and historic preservationists.

The **human geography** option is designed for students who wish to pursue a career as regional specialists, international business officials, and social scientists.

The **physical geography** option is designed for students planning careers as meteorologists, climatologists, geomorphologists, and hydrologists.

Faculty research interests include settlement geography of the South, fluvial systems of the Coastal Plain, applied climatology of islands and coasts, GIS applications in watershed management, and the racial landscape of the South. Students are encouraged to participate with faculty in their research and also pursue individual research projects. The geography program makes extensive use of computers for both laboratory and classroom instruction. The department maintains state-of-the-art Spatial Analysis Laboratory (SAL), Cartography Laboratory, the Laboratory for Applied Climate Research (LACR), and a Sediment Analysis Laboratory.

For more information, contact
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Articles

Southeast Asians in North Carolina: Settlement Patterns and Socioeconomic Outcomes
Susan M. Walcott, University of North Carolina- Greensboro

An Assessment of Wind Power as an Alternative Energy Source in North Carolina: A GIS Approach
Timothy Mulrooney, North Carolina Central University

Temporal Analysis of Climatological Drought in Watauga County, 1940 to 2009
Cheryl Hagevik and Christopher A. Badurek, Appalachian State University

Carolina Landscapes

The Confederates Last Victory: The Battle at Averasboro, North Carolina
Nathan Phillippi, University of North Carolina Pembroke

Carolina Teaching Strategies

The Esri Site License Program – Enhancing Geospatial Education at North Carolina Central University
Gordana Vlahovic, North Carolina Central University; Rakesh Malhotra, Fayetteville State University

North Carolina Educator of the Year

Jeffrey C. Patton, University of North Carolina-Greensboro

2011 Meeting of The North Carolina Geographical Society

Report from the North Carolina Geographical Alliance

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