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UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

UNDERGRADUATE PROGRAM: The undergraduate geography major may choose a concentration in Urban Planning or Earth Science/Environmental Science. Currently there are about 120 majors in the geography department.

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GEOGRAPHY
at
UNC-WILMINGTON

Geography at the University of North Carolina at Wilmington is housed in the Department of Earth Sciences. There are five full-time geography faculty. Research interests and specialties include cultural-historical geography, material culture studies, environmental planning, and fluvial geomorphology. Equipment available for teaching and research includes modern PC-based cartographic and image-processing lab, and photographic and darkroom facilities. The university library contains a strong geography collection including all major journals, and is a repository for government documents and maps. About 40 majors are working towards a B.A. in geography.

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The North Carolina Geographer
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COUSIN JACKS AND THE TARHEEL GOLD BOOM: CORNISH MINERS IN NORTH CAROLINA, 1830-1880

Elizabeth Hines

Introduction

In the early 19th century, North Carolina experienced the first gold mining boom in North America. By the 1830s a federal branch mint had been built in Charlotte and occupations in gold production were second only to agriculture. North Carolina's mines received a great deal of attention from northern and foreign venture capitalists, who brought not only investment but skilled labor and management to the deep mines of the Piedmont. Many of these skilled miners were Cornishmen, who brought their mining heritage, refined over centuries of experience, into this new field of opportunity.

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This research examines the diffusion of mining technology from Cornwall to the Carolina gold fields. Two results of the initial technological transfer were the beginnings of industrialization in the Piedmont and the subsequent diffusion of Cornish mining expertise and machinery to many other North American mining areas. The first steam engines in North Carolina, almost certainly manufactured in Cornwall, were used in the Piedmont's gold industry. Steam technology was not used in North Carolina's textile industry until 1833 at the Mount Hecla plant in Greensboro (Hines, 1995). And, just as early American coal and iron mining was strongly influenced by the diffusion of technology from Britain, much of the mining and processing of precious and other economic metals was accomplished by Cornish miners and engineers. Today in some places, although not in North Carolina's Piedmont, Cornish culture thrives. Descendants of the Cornish miners who labored in the late 19th and early 20th centuries remain in Wisconsin (home of the University of Wisconsin Badgers, so named for the ubiquitous Cornish mines or "badger holes"), Michigan's Upper Peninsula, South Dakota's Black Hills and California's Grass Valley. There Cornish food, the lovely meat pie called a pasty and saffron buns are commonplace, and Celtic music is sometimes still heard (Jolliffe,1997). While these and other regions drew miners from the depressed copper areas of Cornwall (Figure 1) in the 1880s and after, the earliest Cousin Jacks came to work the Reed, Gold Hill and other gold mines of North Carolina's Piedmont.

With their interest in gold mining the Cornish brought to North Carolina many industrial inventions, including steam technology and the steam engine

Cornish Mining History

Cornwall, unlike much of the rest of northern Europe, provided the possibility for primary occupations in the extraction of minerals, especially copper and tin, although some gold was also mined. Cornish copper and tin deposits have been

mined at and near the surface since ancient times. Archeologists have determined that Cornwall's tin industry was established in the early Bronze Age (~2,100-1,500 BC) and was widespread from Dartmoor to Land's End in the Middle Bronze Age (1,500-800 BC), continuing without serious interruption into the 20th century (Buckley, 1988, 3).

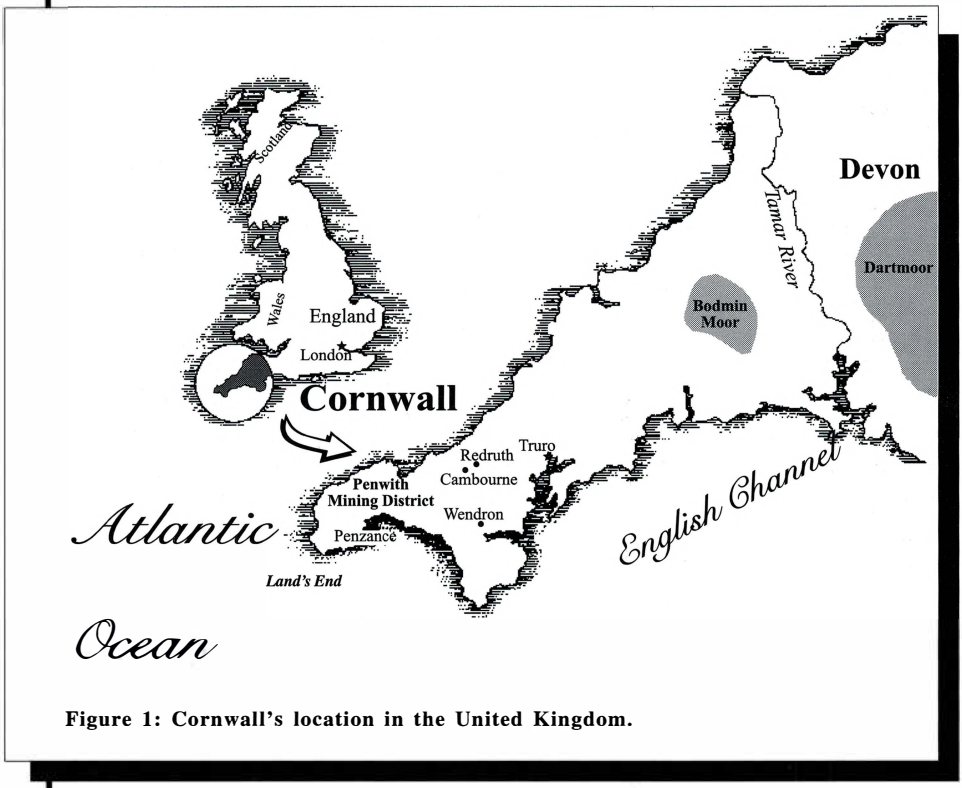

Figure 1: Cornwall's location in the United Kingdom.

Fishing and other maritime activities dominated the Cornish economy for centuries. One Cornish wife explained that "A Cornishman was either out in a boat, building a boat, repairing a boat, or standing about with his hands in his pockets looking at and talking about boats" (Falmouth Maritime Museum, 1996). In the seventeenth century, however, many Cornishmen abandoned the vagaries of the sea, although beloved, for the certainty of the meager mining wage as the industrial age moved into full swing. In the 17th, 18th and 19th centuries, deep reinforced shaft mines provided vast wealth for a few "Mineral Lords," such as the Bassetts and the Falmouths, who held the mineral rights to the whole of Cornwall among them. They provided steady, if terrible, work for thousands of miners and their families. The work was dangerous, seldom rewarding, childhoods ended quickly as children and mothers, the 'bal maidens' (mining maidens) were needed

to break ore with mallets 'at grass,' and the miner's life was generally difficult and short. The "Mineral Lords" were of Norman-English, rather than Cornish nobility—a factor that further limited the miners' loyalty to them and their dedication to profits. Traditionally, the Prince of Wales has also been the Duke of Cornwall, and thus received and receives a royalty, known as an 'override,' on all mineral revenues from Cornwall.

Conflicting stories of the erection of the Charles Bassett monument at Carn Brea (a granite outcrop that has been inhabited and mined since the stone age) in the late 18th century illustrates the uneasy relationship between the Cornish miners and the Mineral Lords. When Charles Bassett died in the 1780s, Bassett family legend relates that he had been so popular with the miners that 30,000 of them marched in his funeral procession; then they quarried the granite and erected a 150 foot monument in the form of a huge Celtic cross to his memory. The miners' version claims that the Bassetts withheld the miners' wages until after the funeral and collected a payment to finance the monument. Miners who failed to contribute, or didn't come to the funeral, lost their jobs (Ball, 1996).

Despite a copper boom, miners were pushed from Cornwall by harsh economic conditions. Tin had been the most important mineral mined in Cornwall for centuries. However, for a relatively brief period, 1750 to about 1850, copper surpassed tin as an export commodity. This development, in large measure, brought about Cornwall's rapid industrial development, which was underway by 1740 (Rule, 1971, 1-2).

Copper occurs at greater depth than tin, therefore extracting it is more expensive and technologically demanding. Not only must deeper and safer shafts be dug, they must be pumped free of water. The development of steam technology, first in the form of low pressure Newcomen pumping engines, of which there were more than 40 in Cornwall in 1776, and later Boulton and Watt's high pressure engines, of which there were 52 in Cornwall by 1800, allowed the boom in Cornish copper to occur (Rule, 1971; and Rowe, 1953, 51).

Depression in the Cornwall mining industries brought mining engineers and miners to the state, especially to the gold mines of the Piedmont

Steam technology required greater capital investments and meant reorganization into larger-scale enterprises. This also meant more mining jobs, which, because a greater level of skill was required, were more difficult to obtain and more rigidly controlled. The copper boom increased the number of mining laborers, from 6,000 in 1800 to 28,000 in 1838 (Rule, 1971, 2 and 10), but not the number of farmers. When the agricultural sector failed to keep up with the burgeoning industrial sector, the number of people dependent on the barley and potato crops in western Cornwall soon exceeded the harvest (Rule, 1971, 121-22). Furthermore, farmers were accustomed to the higher prices and convenience of single bulk sales to exporters over the inconvenience and reduced profits inherent in storing food for frequent small quantity sales to local markets. Therefore, many farmers refused to reserve grain for domestic consumption, often hoarding it. The angry miners rioted repeatedly

throughout the late 1700s and early 1800s. A crop failure and subsequent famine in 1812 exacerbated the distress (Rule, 1971, 126).

Mining opportunities soon pulled miners to the United States. The Cornish copper boom continued until about 1850. Its demise coincided with new discoveries on Lake Superior and in Chilé (Todd, 1967, 19). Tin production continued until the 1880s, when Bolivian and Malayan discoveries flooded, then crashed the market (Todd, 1967, 19). First a trickle, then a flood of miners and their families, left for other parts of the world as Cornish metal reserves were either exhausted or rendered worthless by the global market. The earliest were pushed by food shortages and unfair labor controls and pulled by the usual stories of quick riches, although, many more were drawn by real opportunities for steady employment by owners who needed and would reward skilled miners. Thus, the Cornish Diaspora commenced decades before its late 19th century peak.

Cornish Miners in North Carolina

One of the earliest opportunities arose in North Carolina's Piedmont. In 1799, an 18 pound gold nugget was discovered in Cabarrus County by a boy shooting fish with a bow in Little Meadow Creek. A few years later, his father finally discovered what the flat iron-sized lump of metal was and began to dig in and around the creek with his neighbors and their slaves. John Reed and his partners went on to discover the greatest number of large nuggets on record until the California rush and became very wealthy. Word spread far and wide. People flocked to Cabarrus and surrounding counties. They placered the streams until no more nuggets could be found, then they dug up the hillsides. Veins of gold ore were discovered as the hillsides were denuded and exhausted. The resulting pits often collapsed. When they shored up the pits and hit hard rock, they used explosives to drive further. Deaths and maimings resulted (Glass, 1980). The gold was there, but the techniques needed improvement (Figure 2).

Chevalier Vincent de Rivifanoli brought in Cousin Jacks to help mine the Mecklenburg gold fields

The arrival date and identity of the first Cornish miners and engineers in North Carolina are lost in the mists of time (time being mistier in North Carolina at that time than in Britain in antiquity). They were certainly here by the late 1820s and in 1825, gold mining in North Carolina boomed (Knapp, 1975, 7-8). Hardrock mines were drilled throughout the Piedmont and into the eastern slope of the Blue Ridge. Northern and foreign investors capitalized mines and, significantly, brought in skilled miners, engineers and masons from around the world, many Cornishmen among them. Several rich veins were discovered beneath Charlotte, in Mecklenburg county, which were soon excavated by Cornish miners working for Chevalier Vincent de Rivifanoli, the envoy of a London mining company. Rivifanoli had supervised silver mines in Mexico and brought many skilled men to North Carolina (Figure 3).

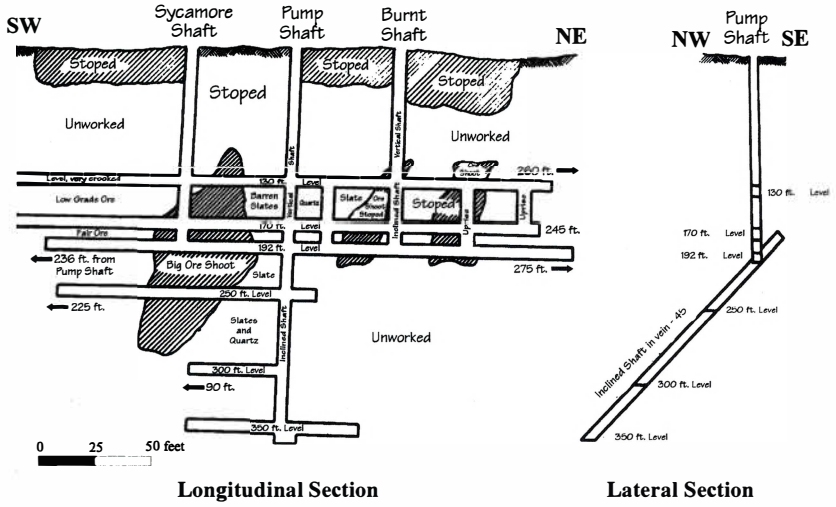

Figure 2: The Rudisil Mine was begun in the 1820's. It is similar to, yet simpler than, tin mines developed in Cornwall in the late 1770's.

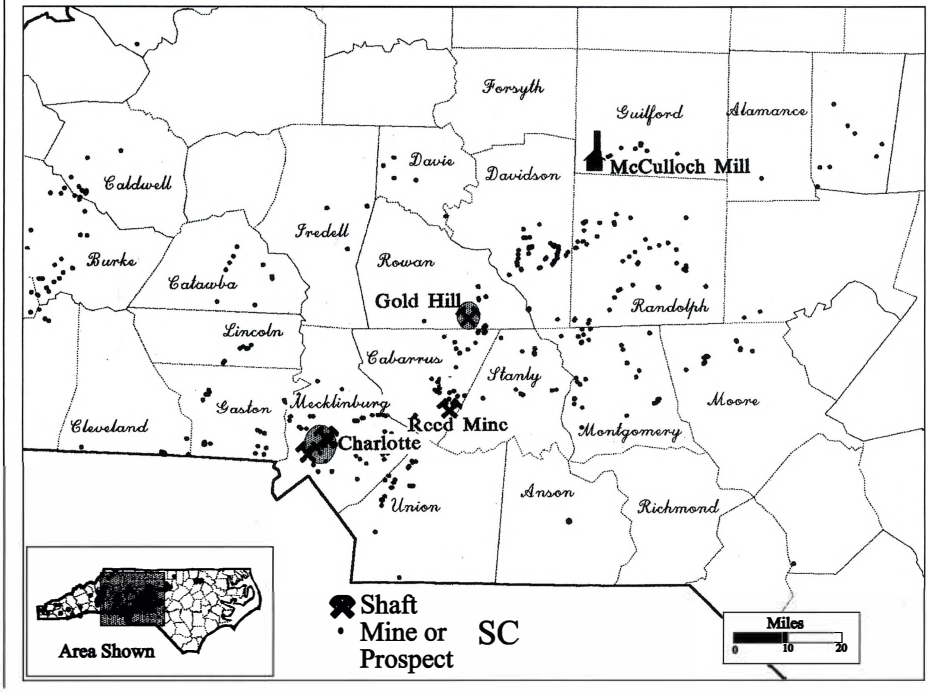

Figure 3: The major gold mining areas of Piedmont North Carolina. Source: USGS Minerals Management Survey, Permitted Gold Mines and Propects Database, 1994.

Gold had been mined by locals in Guilford County for at least a decade when a South Carolina planter, Charles McCulloch, bought land that was centrally located among several profitable mines. There, on a granite outcrop, he had built a dry-laid stone gold ore milling plant to service the local mines (Figure 4). The building was designed, and its construction supervised, by Elizier Kersey, a Cornish engineer, in 1831. The mill building bears a striking resemblance to the hundreds of pump houses that dot the Cornish landscape. McCulloch imported a

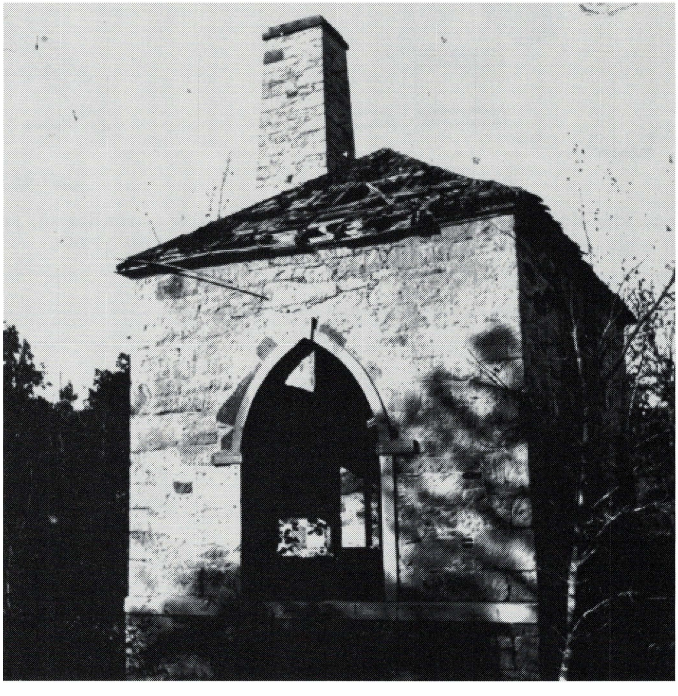

Figure 4: McCulloch's Gold Ore Mill Building, circa 1920. McCulloch's Engine House, or Castle McCulloch, as it is known locally, is of typical Cornish dry-laid stone construction.
Source: North Carolina Department of Archives and History.

steam engine, most likely a walking beam engine from Harveys of Hayle in Cornwall, and used it not to pump water, but to drive Chilean ore crushers in circular beds carved in the bedrock foundation of the mill building. McCulloch ran the mill until 1848 (Hines, 1995, 23), when he sold it to John Gluyas, another Cornish mining engineer.

Very little information about the Cornishmen who came to North Carolina has survived. A few letters in the Gluyas papers indicate the conditions that drove other Cornish miners from Cornwall. The potato blight affected the Cornish in

much the same way as the Irish. One Gluyas relative wrote in 1843..."Wages are low, poverty is intense and taxes exorbitant...operative resistances, political commotions, and gubernatorial coercion reign with insecant fury in the country of 'crown heads'" (Glass, 1984, 1), an obvious reference to lingering animosity toward the English.

Gluyas was born in the Cornish Parish of Wendron in 1796. He and his wife and family emigrated to the United States in 1834, spending their first year in New York City. In 1835, they moved to North Carolina, where they remained until he died in 1858. Trained as a civil engineer, Gluyas was first employed at the Capps mine near Charlotte as steam engineer and machinist (John Gluyas Papers). He subsequently supervised deep gold mines in Mecklenburg, Cabarrus, Davidson, and Montgomery Counties, before arriving at Gold Hill in Rowan County in 1847 (Glass, 1984). He and another Cornishman, William Trealoar, leased land near Gold Hill to work loads of gold, silver and copper. In 1848, he purchased McCulloch's mill, but it is not clear that he ever operated it.

John Gluyas's movements around North Carolina are fairly typical of those of other Cornish miners during those and later years. Many Cornishmen came with their families to the copper and gold areas of the Appalachians in the mid-19th century (Abbott, 1973, 170). Even after the discovery of gold in California and lead in the Great Lakes region, many of the Cornishmen who had lived in New England, Pennsylvania and the southern Appalachians remained in the region, if not in a specific community. Often they turned from mining to farming or became merchants. In Gold Hill, several Cornishmen who had come in the 1840s and 1850s to mine, were listed in the 1860 census as farmers, grocers and tavern keepers (Glass, 1980, 159). One can speculate on the reasons for this. Perhaps the Piedmont and Appalachian landscapes reminded them of Cornwall and the proximity to the Atlantic made the possibility of returning to Cornwall more real. Indeed, many did return in their later years.

John Wesley converted many on his trips to Cornwall in the 1740's; so the methodist church frequently marks the node of Cornish settlement in North Carolina, though little otherwise remains of its distinctive culture

An alternative explanation is, unlike other more mobile immigrants, the Cornish often brought their families and established communities, complete with a Methodist church, in which they had worshipped in Cornwall, having rejected Anglicanism for Methodism after John Wesley's proselytizing trips to Cornwall in the 1740s (Shaw, 1967, 12). Furthermore, although the West boomed, steady mining employment opportunities remained in the gold areas of North Carolina and North Georgia and the copper areas of Tennessee, near Ducktown, up to during and after the Civil War.

By the 1850s, Northern investors employed Cornish miners at the Reed mine and at Gold Hill. Nearly one half of all the gold miners in Rowan County in 1850 had been born in England (*Seventh Census of the United States*, 1850, Rowan County Population Schedule). Two Cornishmen, John Peters and David Martin, settled in

Gold Hill in 1846. Shortly thereafter they built a horse-powered whim and an ore shaft on the Heilig property on contract with George Barnhardt's company. Under their agreement they were to "mine in a mining like manner" and haul their ore to Barnhardt's mill, paying one fourth to the mill and one seventh to Heilig. By 1850 they had invested $4,000 and employed eighteen workers, many of them Cornish, and were grossing more that $5,000 in gold each year. In 1852, they joined forces with Holmes, Earnhardt and Company to finance a large-scale deep-mining and milling operation run by steam-powered equipment, including a Cornish pump to allow mining below the water table, and became the most prosperous of Gold Hill's mining companies (Glass, 1984, 18-19). In 1857, David Hunter Strother, writing and illustrating for *Harper's Magazine* under the pen name "Porte Crayon" (Glass, 1980, 407) published drawings of Cornish miners at Gold Hill (Figure 5) and described their skills and culture (Crayon, 1857).

Figure 5: Porte Crayon's (David Hunter Strother) drawings of Cornish miners at Gold Hill in Rowan county North Carolina in 1857.
Source: *Harper's Magazine*, 1857, pp. 289-300.

Cornish terminology and technology was used in the mines of North Carolina and, later, those of north Georgia and, still later, throughout the West and Great Lakes mining country. They had solved the practical problems of blasting, timbering, hoisting, pumping dry and ventilating mines in Cornwall, where many of the tin mines reached depths of thousands of feet. Indeed, the mines on the north coast known as the Crown Mines of Botallack had horizontal tunnels, known as levels, that reached thousands of feet beneath the North Atlantic. Descendants of miners there still recall stories from mining grandfathers and uncles of the noise made by the boulders rolling on the sea floor above their heads during storms.

Cornish miners made a significant contribution to North Carolina's nearly forgotten gold industry (Figure 6). They arrived after the easy gold had been harvested, when the remaining reserves were bound in hard 'bull quartz' at great

depth. They operated the machinery and provided much of the muscle to drill the shafts and raise the ore, which they and their wives and children processed 'at grass,' as they had for centuries in Cornwall. Their skills and tenacity maintained the gold industry in North Carolina into the 1880s, providing capital where little existed, especially after the Civil War.

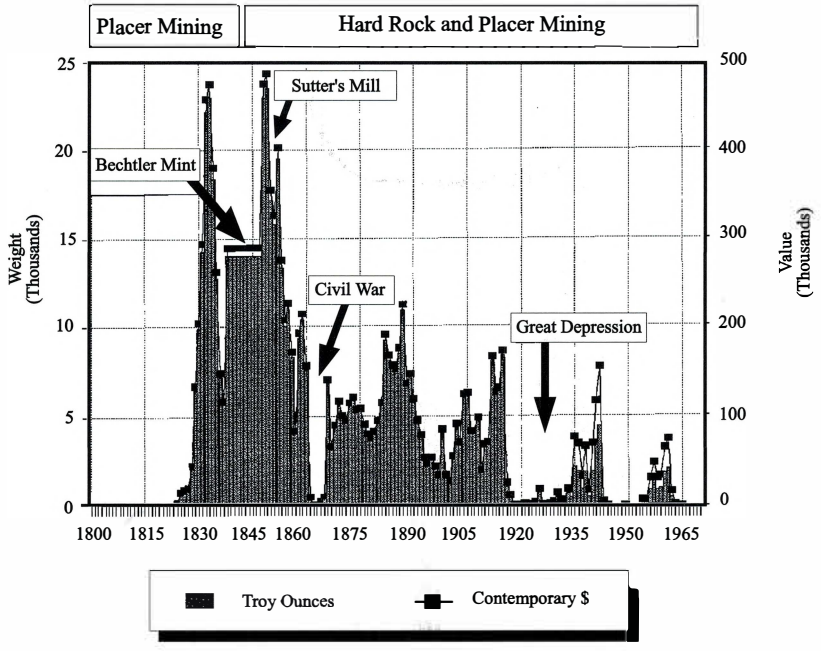

Figure 6: Gold Production in North Carolina, 1804-1965
Source: Pardee and Park1948; Carpenter 1993.

A sad post-script to this story is that very little of the distinctive Cornish culture, which predates Roman Britain, remains among North Carolina's Cornish descendants. Only McCulloch's Engine House, the old Methodist church at Gold Hill, and a few mining artifacts at the Reed and Gold Hill sites are left. Within a few generations, the Cornish in North Carolina were so completely assimilated that only their surnames identify them. As an old saw states: *By Tre-, Pol- or Pen-, shall ye know Cornishmen*—and indeed surnames listed in Charlotte and Salisbury telephone books include Trefethen, Treloar, Trethewey, Trevillian, Pendarvis, Pendrake among other obviously Cornish names, such as Moyle and Gluyas.

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A VIEW OF WESTERN NORTH CAROLINA'S CLIMATE

Peter J. Robinson

Introduction

While weather is one of the most pervasive and obvious aspects of the human environment, climate is much less easy to see. It is thus a challenge to devise a geographical field trip for climate and climatology. Nevertheless, such a trip is possible, and in fact can reveal a great deal about many aspects of the geography of a region. One such trip, a climatological transect across western North Carolina, is considered here (Fig. 1). A trip at any time of the year reveals the same climatic regions and features, but not necessarily in the same way. In the spring the most apparent differences are likely to involve the stage of development of the vegetation, possibly from full flower in the lowlands at the start of the traverse to just breaking dormancy at the higher elevations. In fall, if the time of the trip is scheduled correctly, the color of the foliage indicates the climatic regions. Similarly, with good forecasting or luck, snow depth should be a clear indication of differences in winter, while, less rigorously, it is possible to suggest that summer climatic differences are reflected in tourist density. For a climatologist, a major attraction of the region is the presence in downtown Asheville of the National Climatic Data Center (NCDC), a branch of the National Oceanic and Atmospheric Administration and part of the National Archives, where copies of all official U.S. weather observations are received, quality-controlled, stored and made available. NCDC also holds many non-federal, and thus unofficial, U.S. observations in addition to many foreign data. Most of the data used hereafter originally came from this facility.

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The author explores climate differences between the Piedmont and Mountain regions of North Carolina

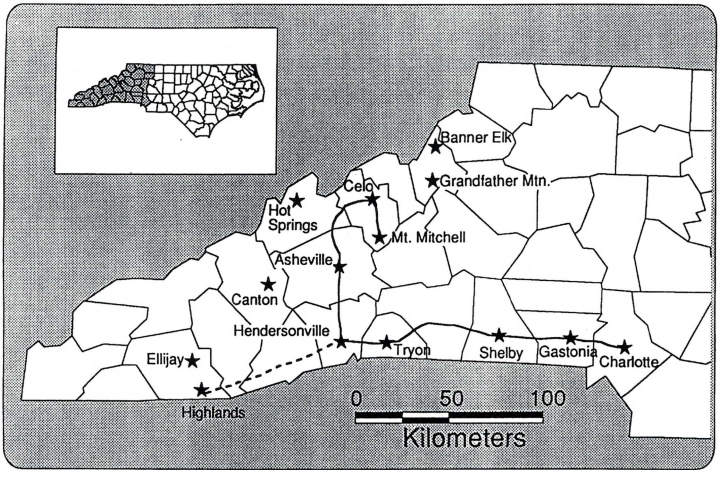

Figure 1: Climatological field trip across Western North Carolina.

The General Climatological Setting

The whole of our traverse is within the warm and humid southeast USA, but local climatic differences in the areas are controlled by elevation and topography. There are four major regions along our transect: the Upper Piedmont around Charlotte, the mountain foothill region known as the Thermal Belt, the French Broad River Valley, and the Blue Ridge Mountains. These can, in general terms. be represented by individual stations. Average temperatures directly reflect elevation (Fig. 2A). All stations have a similar annual temperature regime, but Charlotte and Tryon, at similar elevations (213m, 700ft and 329m, 1080ft respectively), have similar temperatures, while Asheville (686m, 2250ft) and Mt. Mitchell (2023m, 6640ft) get successively colder. Precipitation is influenced less by elevation than by topography, although throughout the region monthly totals are generally lowest in the Fall (Fig. 2B). Tryon, close to the foot of the mountains, often has upslope flow and orographic effects when the wind is from the southeast, which gives it a regime similar to that of the Mt. Mitchell summit. Both have annual totals higher than those of the relatively flat region of the Upper Piedmont as represented by Charlotte. Asheville is in a basin which promotes descending and warming air, opposite to the orographic effect, whatever the airflow direction, leading to lower precipitation totals. Indeed, because of the location, Asheville and the surrounding area is one of the driest regions in the state.

Monthly averages may have a major impact on features such as vegetation and water supply but they conceal major day-to-day differences, which are often the more pertinent climatological facts to be considered when taking a trip. When temperature at two places on the same day are compared, the temperature-altitude relationship is reinforced (Fig. 3). Just occasionally Mt. Mitchell is warmer than Charlotte, but it is safer to assume that it will be about 10-12°C (18-22°F) cooler. Similarly, Asheville is usually cooler than Charlotte. In both cases, it is in summer that the differences are most persistent and least variable. This is, in general terms, a result of the lack of frontal passages in summer. As a front crosses the region is it not uncommon for one station to be on the cold side, another on the warm side. The resultant temperature differences may override those caused by altitude, and Mt. Mitchell may be warmer than Charlotte. The lack of summer frontal passage also means that the same maritime tropical air mass dominates the region for most of summer, leading to small day-to-day temperature changes in this season (Table 1). In the other seasons it is not uncommon for temperatures to change by 10°C or more, in either direction, as a front passes and maritime tropical air is replaced by that of polar continental origin, or vice versa. Certainly the result is an average day-to-day temperature change that is more than double the summer value. These changes, being dependent on the

	Jan	Apr	Jul	Oct
CLT	3.4	2.8	1.0	2.2
AVL	3.3	3.8	1.1	2.3
MIT	3.5	3.0	1.1	2.4

Table 1: Average Day-to-Day Temperature Difference (C)

CLT-Charlotte; AVL- Asheville;
MIT- Mt. Mitchell

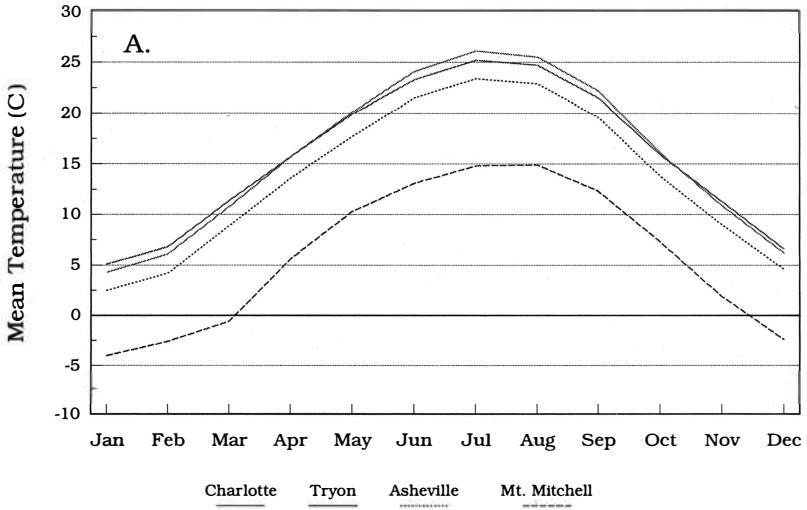

Figure 2a: Relationship between average monthly temperature and elevation.

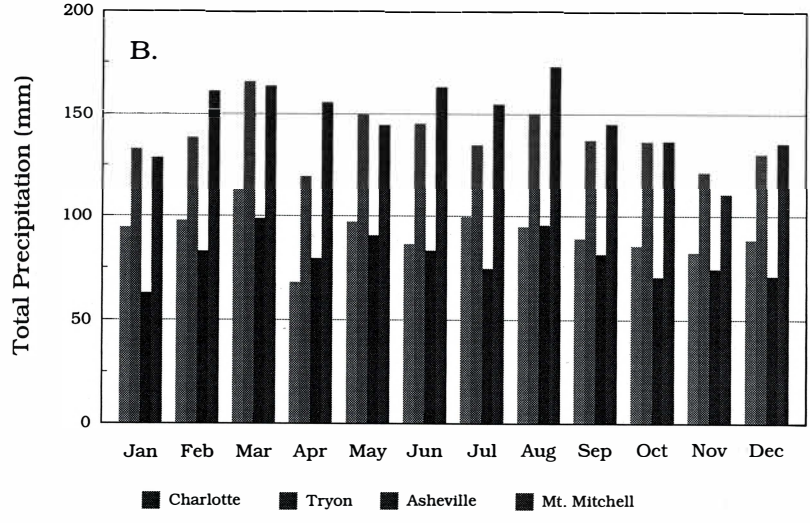

Figure 2b: Average monthly precipitation.

general circulation of the atmosphere, are not really influenced by the local altitude differences in our region.

Turning to precipitation, the major travel related concern is whether it will rain or not. For Charlotte long term averages show that it will rain one day in three in winter and spring, slightly more frequently in summer, and about one day in four in fall.

Seasonal patterns persist, but the number of raindays increases, with altitude, so that in summer on Mt. Mitchell there is a one in two chance of rain. Winter rain usually comes from depressions and is widespread and persistent. If it does rain the chances are high that it is wet for the whole area. Short, sharp, and localized showers are much more common in summer, so it may rain for part of the trip but is unlikely to be wet throughout.

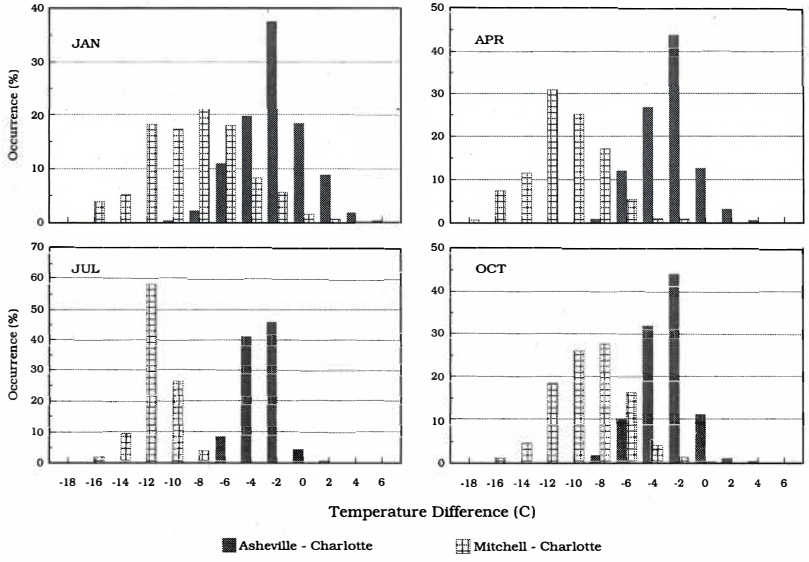

Figure 3: Relative seasonal temperature differences.

The Upper Piedmont Climate Region

Leaving Charlotte westward along I-85 or US 74 the landscape of the Upper Piedmont is a series of rolling ridges and valleys with streams which drain southeast to the Atlantic. Altitude and relative relief slowly increase. Using the length of the frost-free season as a measure of local temperature conditions at numerous western Carolina stations, there is a general linear relationship between season length and altitude in the upper Piedmont (Fig. 4). Charlotte, at the lowest elevation, has the longest season (218 days), and there is a marked and rapid decrease to Morganton at 354m (1160 ft) with 178 days. These small climatological differences appear to have an influence on the agricultural activity of the area. East of Shelby agriculture occurs on any portion of the landscape including ridge crests and valley bottoms. As altitude and relative relief continues to increase westward of Shelby, however, agriculture becomes more restricted to valley sides. This heralds the onset of the thermal belt region centered on the city of Tryon.

The Thermal Belts

Silas McDowell, an horticulturalist in the far west of North Carolina, noted that the frost of April 28, 1858 blackened vegetation as far as 350 feet (105 m) up the valley sides. Higher vegetation was unaffected. McDowell, seeking an explanation, made further observations, initiated correspondence with fellow horticulturalists, and developed the notion that the valley sides were the warmest sites in the region, calling them the "thermal belt". The first published analysis was by LeConte (1883), and interest grew until the state of North Carolina invited the U.S. Weather Bureau to run a field experiment. Observations were made during 1913-1916 at 16 sites in horticultural areas throughout western North Carolina from Ellijay to Banner Elk. Each site had at least four stations arrayed over a slope. The results suggested that mountain tops were commonly somewhat warmer than slope bases, with the valley sides often being the warmest locations (Cox, 1920). These results were eventually linked with the similar phenomena being observed in Europe (see, e.g. Geiger, 1965) and led to the development of the theories of cold air drainage, katabatic and anabatic winds, and frost hollows which we now take for granted. Indeed, these North Carolina data remain one of the major sources of information about thermal belts.

The concentration of apple orchards in the Tryon area led to the discovery of the Thermal Belt

Residents of the Tryon area are proud of their thermal belts, even if they are not sure what they are or do (Dunbar, 1966). The name and concept survives locally, since Tryon is home to the Thermal Belt Chamber of Commerce, with Isothermal Community College at Spindale a few kilometers to the east and Thermal City a short distance to the north. Despite economic changes throughout the region, the original reason for their detection, horticulture, still survives and on many slopes in the area apple orchards persist, albeit surrounded by kudzu.

Kudzu itself is but one example of the relations between climate and vegetation. On the macroscale, it dominates vegetation over much of the southeast, being limited in the north, in northern Virginia, by winter severity and in the west, along the Texas-Louisiana border, by increasing aridity (Winberry, 1996). On the mesoscale in our region, it flourishes in the upper Piedmont. However, the increasing severity of the winter with altitude confines it to elevations below about 600 m. Hence once west of Tryon and into the valley of the French Broad, the plant does not appear.

Kudzu flourishes in the Upper Piedmont though generally below 600 meters (2000 feet) in elevation

The Climate of the French Broad Valley

West of Tryon the Eastern Continental Divide is crossed into the valley of a tributary of the French Broad River. This river system, part of the Mississippi drainage, here flows northward with a slack gradient. At Hendersonville the main stem of the river arrives from the west, and the valley broadens considerably, forming the Asheville basin at an elevation of about 600 m. The valley region is an

agricultural area. This is not limited to the valley sides, although the old temperature observations clearly indicated that Hendersonville is part of the climatological thermal belt. The current local observation sites are on a mixture of floor, slope and low ridge situations within the generally subdued topography of the valley. Since the floor slopes very gently towards Asheville the stations have a very narrow elevation range (Fig. 4).

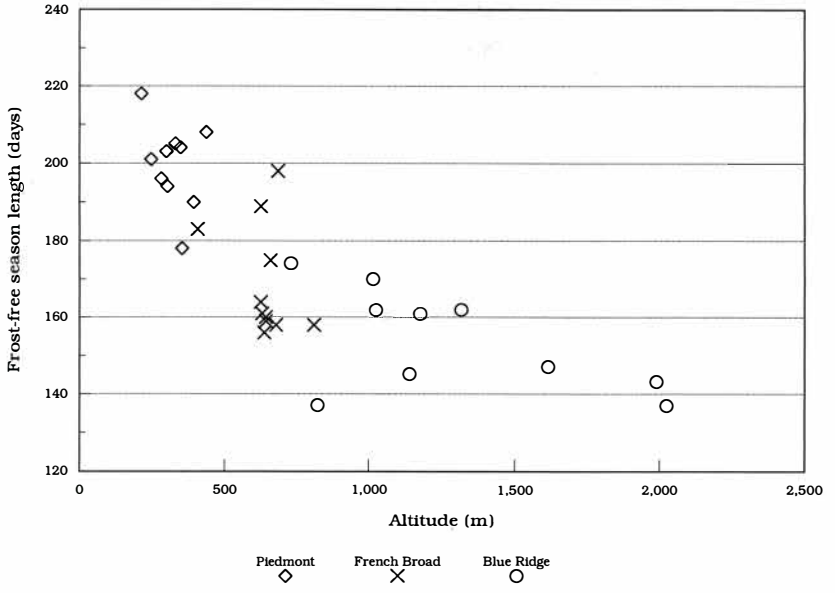

Figure 4: Relationship between altitude and number of frost-free days.

Minor variations in topography play a great climatic role. The current stations indicate, in general, a frost-free season ranging in length from 160 to 200 days within an altitude range of about 70 m (210 ft) (Fig. 5). The low altitude outlier is at Hot Springs (405 m, 1330 ft) with a 183 day season. This station, almost at the Tennessee border north of Asheville, is right on the river. Although low-lying, this spot is open to any winds blowing along the French Broad Valley, so that there is little chance of a build-up of a pool of stagnant cold air. Consequently conditions are akin to those of the Piedmont. At the other extreme, the high altitude outlier is at Canton (811 m, 2660 ft), in the upper reaches of a western tributary valley. Here there is relatively poor air drainage, and the station is in a frost hollow. Thus conditions, with a 158 day season, are akin to those on the Blue Ridge. Indeed, the whole Canton area has become notorious for stagnant conditions giving cold air, fog and pollution drifting over I-40.

Year-round drier conditions, cool summers, and scenic attributes contribute to the Hendersonville-Asheville tourism-retirement attractiveness

While agriculture is a major response to climate in this region, there is another climate impact in the valley and surrounding hills. Climate, combined with scenery, has long encouraged tourists and retirees. Hendersonville became a resort in the early 1800s, and Asheville was a summer retreat long before the Vanderbilts constructed Biltmore House in 1895. Now the relatively dry conditions year-round, combined with cool summers, seems to encourage retirees to congregate in the valley. Resort areas, primarily summer retreats but with winter sports at the higher elevations, are common in the surrounding hills.

A westward detour from Hendersonville to the Highlands area includes several areas of climatological interest. North of Brevard is the "Cradle of Forestry in America" the site of much pioneer work in forest management, including consideration of climate and micro-climate in the growth of trees. Farther west, the town of Highlands, with more than 1,500 mm (60 inches) of rain annually, claims to be the wettest place in the state. Since it is one of the few locations in North Carolina with a 100 year record of daily weather observations, this is no idle boast. Some local resorts have replaced the native tree vegetation with golf course grasses, which has increased runoff and forced them to install irrigation systems to maintain the grass through the wet summer. A series of similar deforestation experiments were run in the 1930's by Coweeta Hydrological Laboratory, west of Highlands (Swank and Crossley, 1987). The results, which became world famous, were the same as those experiences by the modern resorts.

The Blue Ridge Region

The final stage of the climatological traverse leads through the Blue Ridge Mountains from Asheville to Mt. Mitchell. The direct route, via the Blue Ridge Parkway, is frequently closed in winter by snow on the roads, or ice in the tunnels. The longer route, using US 19 through Burnsville and then NC 80 and a short Parkway section to the spur road to Mt. Mitchell, is open more frequently and is climatically more interesting. It passes through the small settlement of Celo, in an almost blind valley northeast of Mt. Mitchell. Celo has the distinction of having exactly the same length of frost-free season, 137 days, as the Mt. Mitchell summit, almost 1,200 m (4,000 ft) above it (Fig. 5). It is obviously in a frost hollow. However, in general the linear decrease in growing season length with elevation found in the Piedmont is re-established in the mountains.

The Blue Ridge is at the margin of a true "snowy" climate so ski resorts rely on artificial snowmaking

Snow on the ground is a key concern for resorts and skiers. The number of days with natural snow on the ground is loosely related to altitude (Fig. 5A), and it seems that at our latitudes an elevation of at least 1100 m (3500 ft) is needed to guarantee some snow every year. The whole area is at the margin of a true "snowy" climate, and as with most marginal climate situations, there is a great deal of year-to-year variability in the number of snow days. An annual time series smoothed using a 5- year running mean shows the snowy period during the 1960s, the time when the state's ski resorts were beginning to be developed. Relatively low amounts

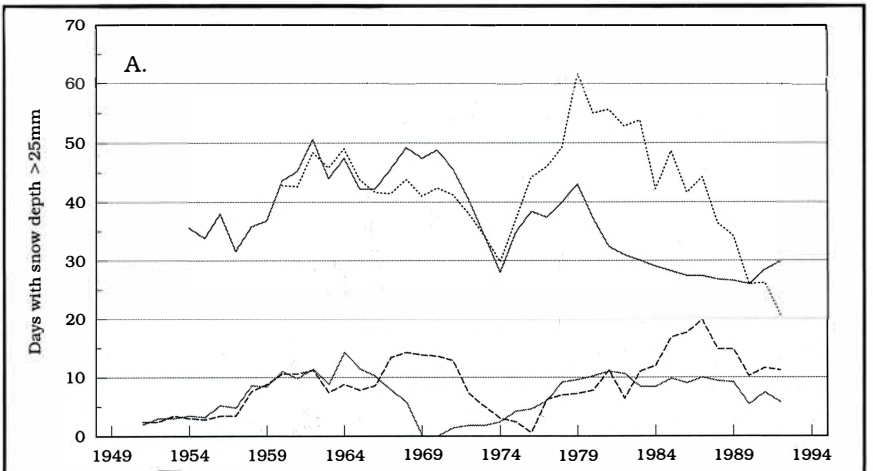

Figure 5a: Snow depth trends.

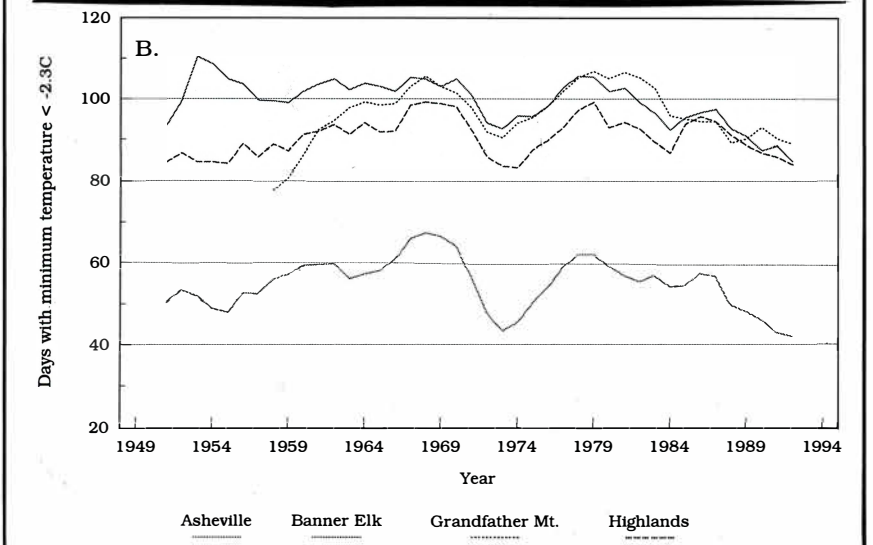

Figure 5b: Minimum temperature trends.

at high elevations in the mid-1970s caused some economic problems, partly alleviated by the advent of efficient snow-making. The increase in the number of days with snow lying during the late 1970s proved to be rather brief and there has been an almost continuous decline since the early 1980s.

In the absence of natural snow, an option for ski resort owners is snow-making. This is economically feasible in this area when minimum temperatures are at or below -2.3°C (28°F) (Robinson and Rehder, 1995). The mid 1970s were a period with few snow-making days, coincident with the short season for natural snow (Fig. 5B). A brief cooling trend, and more snow-making days, followed, but the current

trend is towards warming and fewer snow-making days. Since current trends also suggest less natural snow, it is tempting to forecast problems for skiing in North Carolina. It is also tempting to extrapolate this trend and attribute it to global warming. We must, however, resist any such forecast ideas since the data set is much too localized and short for us to expect it to mimic global fluctuations. Further, even with the short record we do have, that record itself demonstrates that short- and long-term fluctuations were all too common in the past.

The summit of Mt. Mitchell, at 2025m (6,642 ft) the tallest peak in the eastern United States, is in a climatic zone associated with boreal habitats, and the current ecosystem reflects past events and actions. Climatically, the lower temperatures associated with the latest great ice age 18,000 years ago allowed establishment of a spruce-fir forest over a broad area of the southern Appalachians. As the climate warmed, this specific ecosystem was slowly restricted to the highest altitudes. More recent and more rapid changes have been associated with human activity. Until early this century lower elevations were farmed, and higher ones logged. The advent of the State and National Parks stopped this and left the vegetation relatively undisturbed. Now, except on the highest summits, the vegetation is secondary succession, and the regeneration which started 70 years ago is just coming full cycle. A major generation of trees, at a whole range of elevations, are visibly dying, and a new generation is developing. On the highest peaks, however, other factors are at work. Defoliation started in the late 1970's. Initially woolly balsam aphids were blamed. Indeed, they were responsible for much damage throughout the region, and the balsam is now a rare species. However, defoliation progressed downslope until all species of tree above 1600 m (5,250 ft) were affected. Acid rain then became implicated. An atmospheric, soil and vegetation observational program was established, and now various meteorological towers, intermixed with those of public safety agencies, can be seen scattered over the Black Mountain Range. Although none of these towers provide long-term climatic information, their observations, along with meteorological analyses, indicated that the low cloud which so frequently envelopes the range commonly involved air from the Ohio valley and had an acidity akin to vinegar. The moisture precipitated from it was entering the soil and influencing the vegetation. Experience in Europe suggests that pollution abatement will reduce acidity and restoration should slowly work through the soil and into the vegetation. Whether this will lead to a re-establishment of the forest as known early last century remains a mute point. Even if the biological succession were unchanged, the perpetually, and naturally, changing climate will be different.

Though all seasons have their special attractions, Fall is preferred for those who wish to enjoy the clearest evidence of climate differences in Western North Carolina

Conclusions

Western North Carolina displays a variety of climates in a small area, largely because of the presence of the mountains. Both altitudinal and topographic ef-

fects play a role, and it is possible to see the influence of the climate and its spatial variation, if not the climate itself, on the landscape. In order to investigate changes over time, however, data analysis is needed. Our analysis, like most in the United States and many throughout the world, depends on using data obtained from the national archive in the region. Indeed, Asheville is a major center in the climatological universe, known in name and location, if not always in climate, by most climatologists. However, no matter how many data we have, or how much we analyze the climatic record, no climatological treatise can provide the main ingredient of a successful field trip, good weather. To avoid precipitation, to have the highest chance of good visibility in the mountains, to sample the fruits of the thermal belts, and to see the climatic zones when they are most clearly differentiated by the vegetation, climatological probabilities say that fall must be the preferred season for a visit. Since many people obviously know their climatology, it is also the most crowded time. However, all seasons have their special attractions and their climatological signatures ready to be detected.

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NORTH CAROLINA COMMUNITIES IN TRANSITION: AN OVERVIEW OF HISPANIC IN-MIGRATION

Karen D. Johnson-Webb
and James H. Johnson

Introduction

Our nation is in the midst of a dramatic demographic transformation. It is characterized by radical changes in the size, composition, and distribution of the United States population. Owing to continued high rates of immigration—both documented and undocumented —and high rates of natural increase among both the recently arrived immigrants and the native, non-Hispanic Black populations, the Bureau of Census now predicts that the U.S. population will continue to grow well into the 21st Century, reaching 350-400 million by the year 2050 (U.S. Department of Commerce, 1995).

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Over the next five decades, according to Bureau of Census projections, the non-Hispanic Black population will increase by 94%, the Asian and Pacific Islander population by 412%, the Native American population by 109%, and the Hispanic population by 238%. By contrast, the non-Hispanic White population, largely due to low rates of natural population increase, is projected to increase by only 29% over the next 50 years. As a consequence of these disparities in growth, people of color—Asians, Blacks and Hispanics—are projected to surpass non-Hispanic Whites to become, numerically, the "majority" population of the U.S. by the mid-point of the next century. The new "minority-majority" will radically transform the complexion of U.S. society. We refer to this unfolding demographic transition as the "browning of America" (Johnson, Farrell and Guinn, 1997).

North Carolina, with its mild climate, relatively low cost of living, strong employment growth poles (especially in the I-85 corridor communities), and a host of other social and cultural amenities, has attracted a diverse group of "newcomers" in recent years (Foust and Mallory, 1993). The newcomers include non-Hispanic Whites from all regions of the country; non-Hispanic Blacks —both first time movers and return migrants— who are entering the state mainly from cities in the Northeast and Midwest; and a host of other non-White ethnic minority groups who are either interstate or international migrants (Cromartie and Stack, 1989; Johnson and Grant, 1997). The impact of these newcomers on the size and composition of North Carolina's population can be seen in Table 1, which highlights total, non-Hispanic White, non-Hispanic Black, Hispanic and Asian population change for the 1980-1995 period.

The 'browning of America' will result in rendering the non-Hispanic White population a minority in the country by mid-21st Century

Absolute Change

Year	Total	White	Black	Asian	Hispanic
1980	5881766	4457507	1319054	23084	56039
1990	6628637	5011248	1455340	50395	69020
1995*	7179473	5284383	1682999	82334	105333

Percent Change

Year	Total	White	Black	Asian	Hispanic
1980-90	12.7%	12.4%	10.3%	118.0%	25.7%
1990-95*	8.3%	5.4%	15.6%	57.0%	37.3%
1980-95*	22.1%	18.5%	27.6%	256.0%	88.0%

Table1: North Carolina population change, 1980-1995.
Sources: U.S. Bureau of Census, 1980, 1990; *CACI Marketing, 1996, projected figures.

In general, over the past 15 years, North Carolina's non-Hispanic Black, Hispanic, and Asian populations have grown more rapidly than its total and non-Hispanic White populations. Between 1980 and 1995, the state's total population increased from 5.8 million to 7.1 million, or by 22%; the non-Hispanic White population increased from 4.4 million to 5.2 million, or by 19%; the non-Hispanic Black population increased from 1.3 million to 1.6 million, or by 28%; the Asian population grew from 23,000 to 82,000, or by 256%; and the Hispanic population grew from 56,000 to 105,000, or by 88%. Of the 1.2 million people added to the state's population during this period, non-White ethnic minority groups —that is Blacks, Asians and Hispanics— accounted for 36% of the total.

Previous research has focused primarily on the influx of non-Hispanic Whites and non-Hispanic Blacks into North Carolina (Cromartie and Stack, 1989; Johnson and Roseman, 1990; Johnson and Grant, 1997; Newbold, 1997). Little systematic attention has been devoted to the influx of Asians or Hispanics into the state. In this study, we begin to fill this void in the existing literature on North Carolina's changing demography and population geography. We focus here on the growing presence of Hispanics in the state.

Five questions guide our exploratory analysis of the Hispanic influx into North Carolina. Where are they settling? Where are they coming from? Who are they? What kinds of jobs are they finding? How are long term residents of North Carolina responding to the recent influx of Hispanics?

To answer these questions, we utilize data from the 1990 Public Use Microdata Sample (PUMS), a machine readable data file which provides a wide array of demographic information for 1% and 5% samples of the U.S. population. The PUMS file is ideal for migration and immigration research because it contains information on the place of birth of all individuals, on the origin and destination of all recent movers, and on the social and economic characteristics of all members of destination households.

We extracted data from the 1990 PUMS 5% sample on Hispanics residing in North Carolina in 1990, and their place of origin in 1985. The sample included those who classified themselves in one of the specific Hispanic origin categories listed in the census questionnaire—"Mexican," "Central American," "South American," "Domi-nican," "Puerto Rican," or "Cuban"—as well as those who indicated that they were of "other Spanish/Hispanic": those who came from Spain, or those who identified themselves generally as Spanish, Spanish-American, Hispanic, Hispanic, Latino, and so on (U.S. Department of Commerce, 1993).

In attempting to answer our fifth research question, we also utilized data from the 1996 spring Carolina Poll, which contained four questions designed to assess public attitudes about the influx of Hispanics and Northerners into the state. The poll is jointly sponsored by the School of Journalism and Mass Communications, and the Institute for Research in the Social Sciences at the University of North Carolina at Chapel Hill.

In this research we focus on the growing presence of Hispanics in North Carolina

Critical Background and Research Context

Over the past 15 years, the US Hispanic population has grown rapidly—in both absolute and relative terms—far outpacing total U.S. population growth

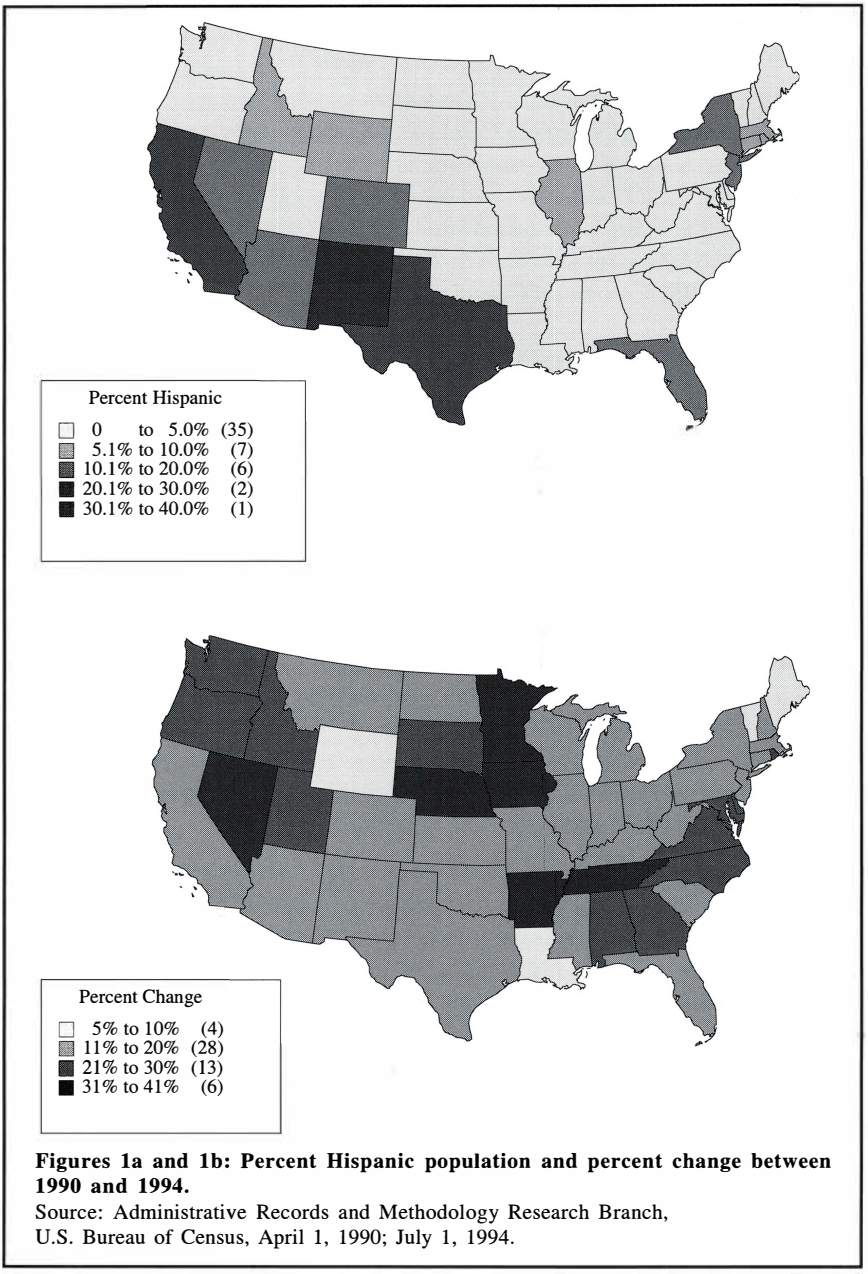
During the 1980s, the Hispanic population increased by more than one half—from 14.6 million to 22.3 million. During the early 1990s, the Hispanic population grew by 28%, reaching 27 million in 1994. By comparison, the total U.S. population increased by only 6% between 1990 and 1994.

Past research indicates that Hispanics have become an increasingly metropolitan population since W.W.II (Bean and Tienda, 1987). Frey (1993b) has pointed out that the Hispanic population began moving to U.S. metropolitan areas at approximately the same time that the percentage of the U.S. population living in urban areas was declining. As a consequence, by 1980, the various Hispanic groups had a higher percentage of their population living in large metropolitan areas than its non-Hispanic White counterparts did.

Today, one in ten Americans are Hispanic and over 30% of the U.S. Hispanic population is foreign-born. Research shows that much of the Hispanic population growth in U.S. metropolitan areas is driven by immigration from abroad and Hispanic immigrants are more highly concentrated in large metropolitan areas than native born Hispanics (Bean and Tienda, 1987; Frey, 1993a; 1993b).

Post-1990 U.S. Bureau of the Census population estimates show that in the states in the West and Southwest, Hispanics comprise very high proportions of the population (Figure 1a). The states containing the traditional port of entry communities (CA, TX, NY, FL) stand out as well as those that border Mexico. However, Figure 1b, which shows 1990-1994 percent change in Hispanic population by state, depicts a very different distribution. The states with the highest rates of change during this period are found in the Upper Midwest, in the South-

east, and in the Pacific Northwest. Nevada also experienced a very high percent change in its Hispanic population during this period. The rate of Hispanic population change for North Carolina between 1990-1994 was estimated to be 25% (US Department of Commerce, 1990; 1994).



Figures 1a and 1b: Percent Hispanic population and percent change between 1990 and 1994.
Source: Administrative Records and Methodology Research Branch, U.S. Bureau of Census, April 1, 1990; July 1, 1994.

Little research has been devoted to the Hispanic population redistribution trends within the U.S., especially to states like North Carolina, which traditionally have not been magnets of Hispanic population growth (Johnson and Roseman, 1990; Barringer, 1993; Frey et al, 1995; Newbold, 1977).

Analysis and Findings

North Carolina's Hispanic population has grown dramatically since 1980, and especially within the last 5-6 years. Like Hispanics nationally, the Hispanic population of North Carolina increased at a rate that was double the rate of total population growth and more than double the rate of non-Hispanic White and non-Hispanic Black population growth (Table 1).

More specifically, North Carolina's Hispanic population increased by 20,687 between 1980 and 1990, from 56,039 to 76,726. Between 1990 and 1995, the Hispanic population increased to 105,325, a net increase of 36,309 (CACI Marketing Systems, Inc., 1995). More recent estimates place the state's Hispanic population at 300,000 (Howard, 1996a).

Where have Hispanics Settled?

Figures 2 and 3 depict the evolving settlement patterns of the state's Hispanic population over the last 15 years. These maps reveal an increasing Hispanic presence or concentration in Cumberland and Onslow Counties and along the I-85 corridor in the counties comprising the Research Triangle (Wake, Durham, Orange and Chatham), the Piedmont Triad (Guilford and Forsyth), and the Charlotte MSA (Mecklenburg, Cabarrus and Gaston). The enumerated Hispanic population, as these figures show, is relatively sparse in the extreme western part of the state and in the northern coastal areas.

These data show that Hispanics are settling in two types of North Carolina communities: (1) the metropolitan or "urban crescent" communities along the I-85 corridor, where most of the state's employment growth has occurred over the last 15 years; and (2) the military complexes in Onslow County (Camp Lejeune) and Cumberland County (Ft. Bragg and Pope AFB). Together, these communities were home to almost half of the state's Hispanic population in 1995 (Table 2).

Where are Hispanics Coming From?

Figure 4 identifies those states that sent the largest numbers of Hispanic in-migrants to North Carolina between 1985 and 1990. California, Texas, Florida, and New York contributed the largest number of interstate Hispanic migrants—each of these sent between 2,600 and 15,000 Hispanics to North Carolina. New Jersey, Virginia and Georgia sent the next largest numbers, between 700 and 2,600 Hispanics each. Another 12 states each sent between 200 and 700 Hispanics to North Carolina, and 8,873 moved to the state from abroad.

To further identify the specific origins of Hispanic migrants to North Carolina, we employed the concept of an in-migration field (Roseman, 1977), which is defined here as any place sending 100 or more Hispanics to any one of the five target communities which served as the primary destinations for North Carolina Hispanics between 1985 and 1990: Research Triangle; Piedmont Triad; Charlotte/ Mecklenburg County; Onslow County; and Fayetteville/Ft. Bragg/ Cumberland County (Figure 5). The results are presented in Figure 6.

The largest flows, as indicated, originated in major Hispanic immigrant port-of-entry communities: New York City, Chicago, and Los Angeles. New York City sent

County	Total 1990 County Pop.	Total 1980 County Pop.	1990 County Hispanic Pop.	1980 County Hispanic Pop.	Percent Hispanic 1980	Percent of 1980 State Hispanic Pop.	Percent Hispanic 1990	Percent of 1990 State Hispanic Pop.
Durham	181835	152785	2054	1395	1%	2%	1%	3%
Forsyth	265878	243683	2102	1616	1%	3%	1%	3%
Guilford	347420	317154	2887	2202	1%	4%	1%	4%
Wake	423380	301327	5396	2262	1%	4%	1%	7%
Mecklenberg	511433	404270	6693	3767	1%	7%	1%	9%
Onslow	149838	112784	8035	4206	4%	8%	5%	10%
Cumberland	274566	247160	13298	8923	4%	16%	5%	17%

City	Total 1990 City Pop.	Total 1980 City Pop.	1990 City Hispanic Pop.	1980 City Hispanic Pop.	Percent Hispanic 1980	Percent of 1980 County Hispanic Pop.	Percent Hispanic 1990	Percent of 1990 County Hispanic Pop.
Durham	136611	100847	1610	867	1%	62%	1%	78%
Wins-Salem	143485	131895	1236	1060	1%	66%	1%	59%
Greensboro	183521	155684	1765	1201	1%	55%	1%	61%
Raleigh	207951	150255	2940	1382	1%	61%	1%	54%
Charlotte	395934	314447	5571	3418	1%	91%	1%	83%
Jacks'ville	30013	17056	1571	482	3%	11%	5%	20%
Camp Lejeune	36716	30764	3072	2198	7%	52%	8%	38%
Fayetteville	75695	59507	2381	1077	2%	12%	3%	18%
Ft.Bragg	34744	37834	3587	3495	9%	83%	10%	45%
Pope AFB	2857	NA	144	NA	NA	NA	5%	2%

Table 2: Urban concentration of NC Hispanics, 1980 and 1990.
Source: U.S. Bureau of Census, 1990.

significant numbers of Hispanic migrants to four of the five communities which served as North Carolina Hispanic migration magnets between 1985 and 1990. In addition, there were also salient flows into these communities from small- to medium-sized cities in the Southwest. Brownsville and Texarkana, TX and Albuquerque, NM are examples.

One other noteworthy salient stream of interstate/interjurisdictional Hispanic migration into our targeted North Carolina communities exists. That flow or stream

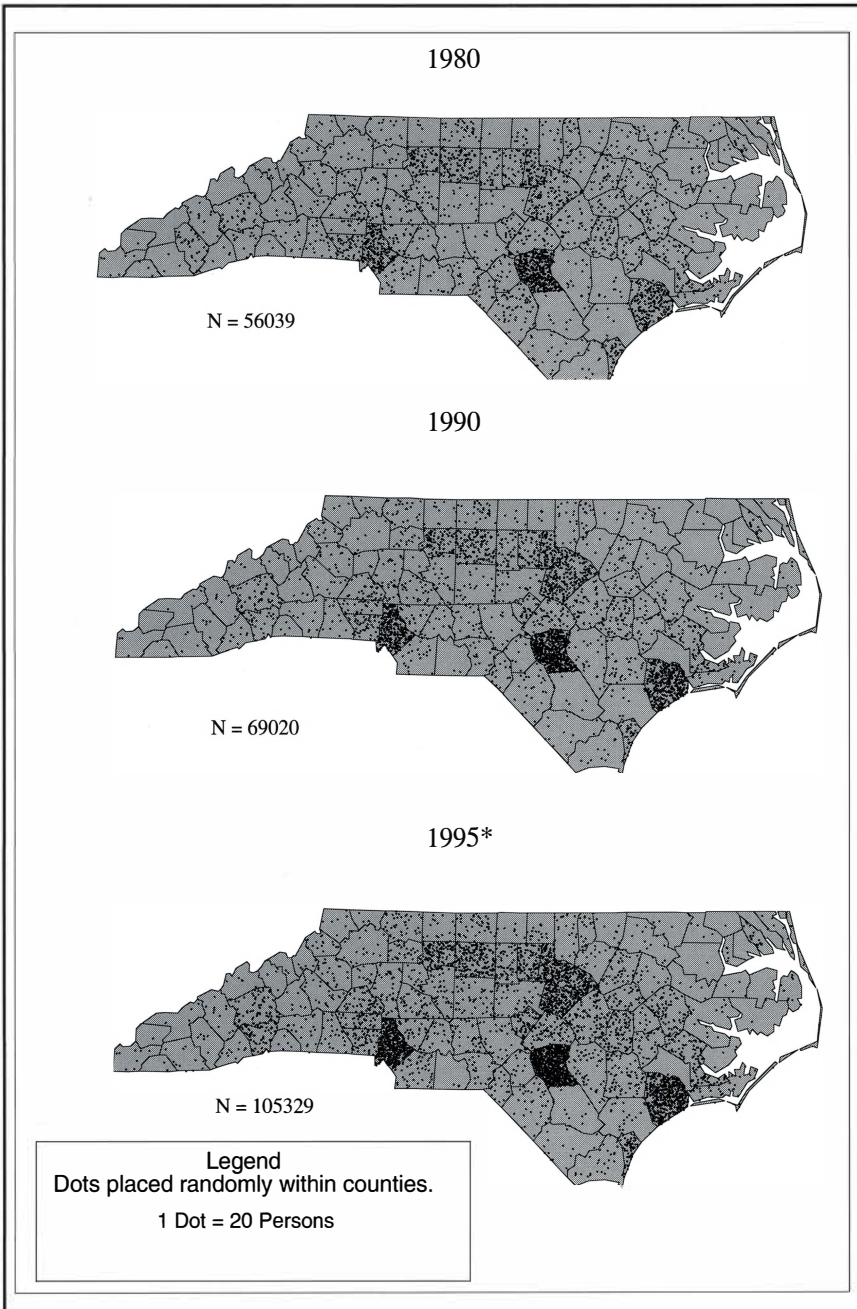


Figure 2: Distribution of total state Hispanic population, 1980-1995.
Source: U.S. Bureau of Census, 1980 and 1990;
*1995 projected figures, CACI Marketing Systems, 1996.

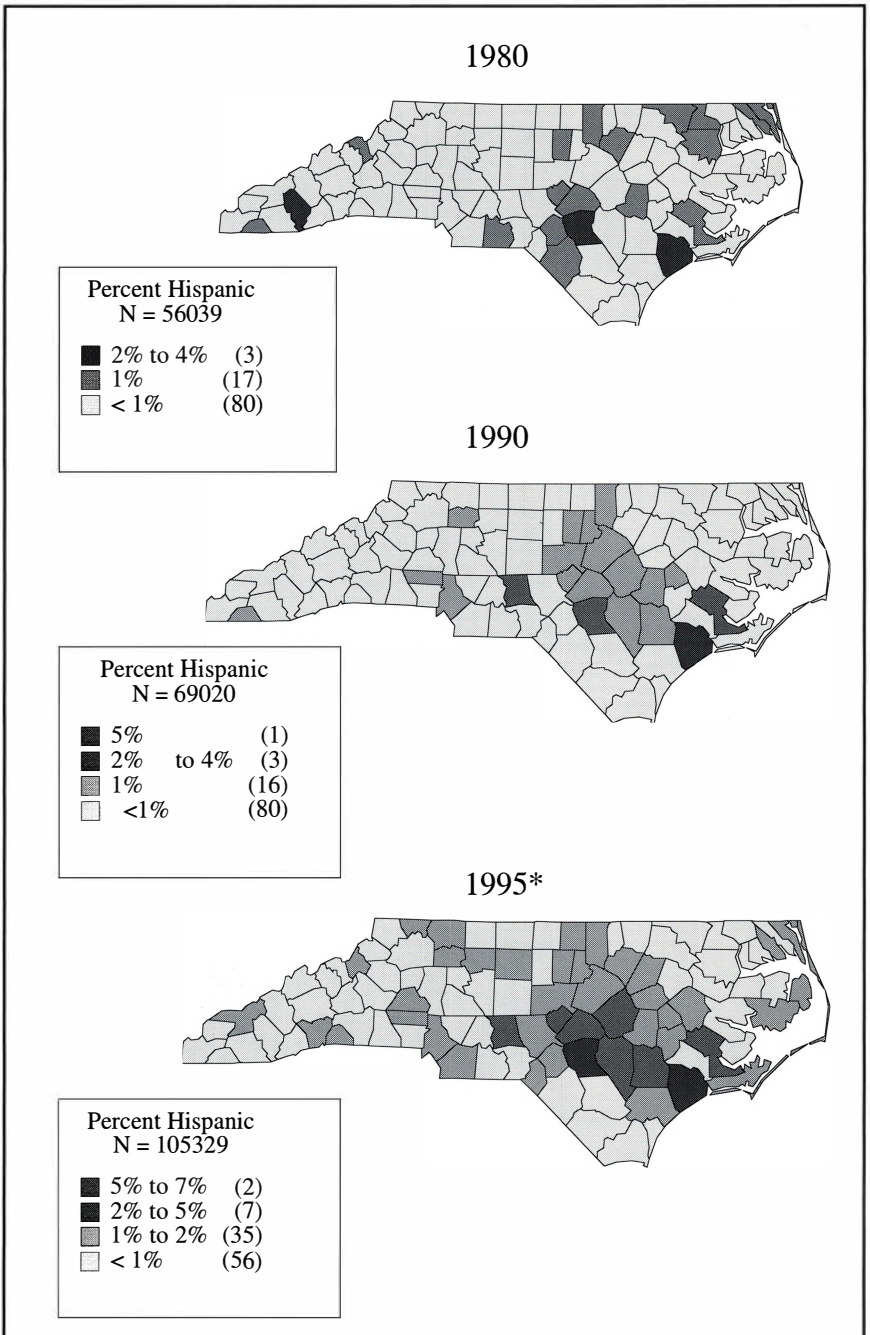
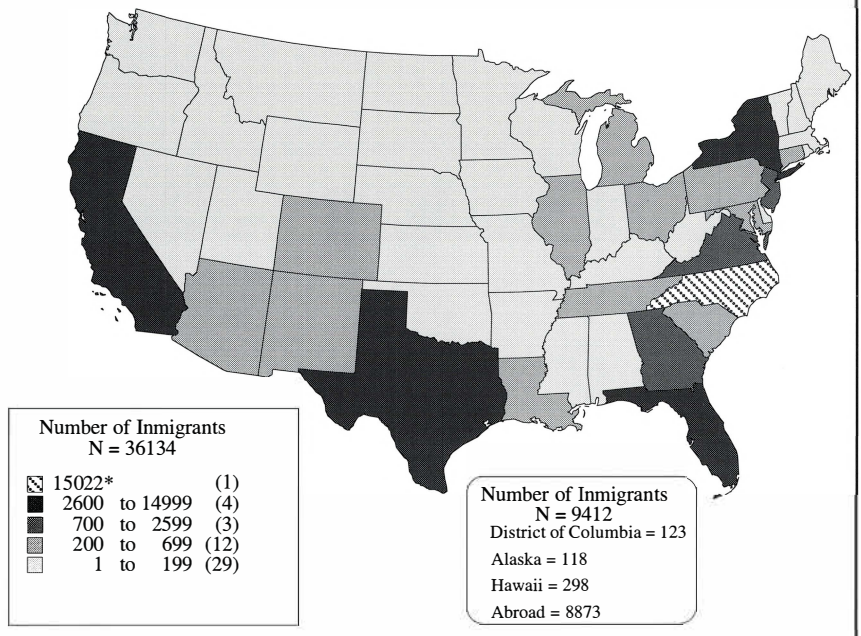


Figure 3: Percent Hispanic population, 1980-1995.
Source: U.S. Bureau of Census, 1980 and 1990;
*1995 projected figures, CACI Marketing Systems, 1996.



*Number of Hispanics migrating within NC

Figure 4: State of origin for North Carolina Hispanic immigrants, 1990.
Source: U.S. Bureau of Census, 1990.

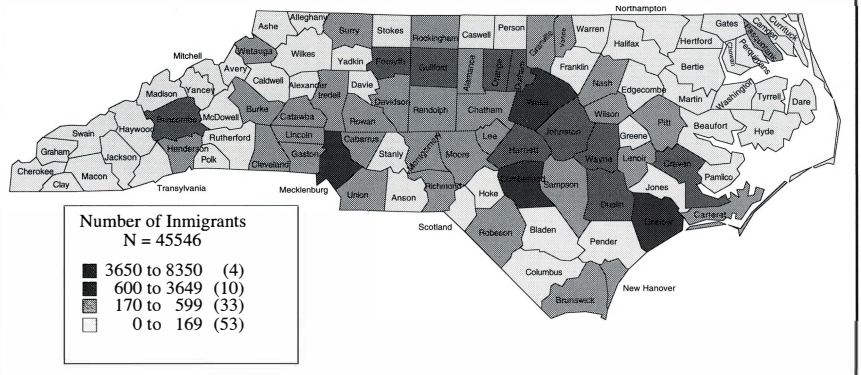


Figure 5: Number of Hispanic immigrants to North Carolina counties, 1990.
Note: Inmigrants are Hispanics who are > 5 years old and who indicated a different county of residence in 1985. This includes Hispanics migrating within NC. Additionally, 23,474 Hispanics were non-movers or < 5 years old.
Source: U.S. Bureau of Census, 1990.

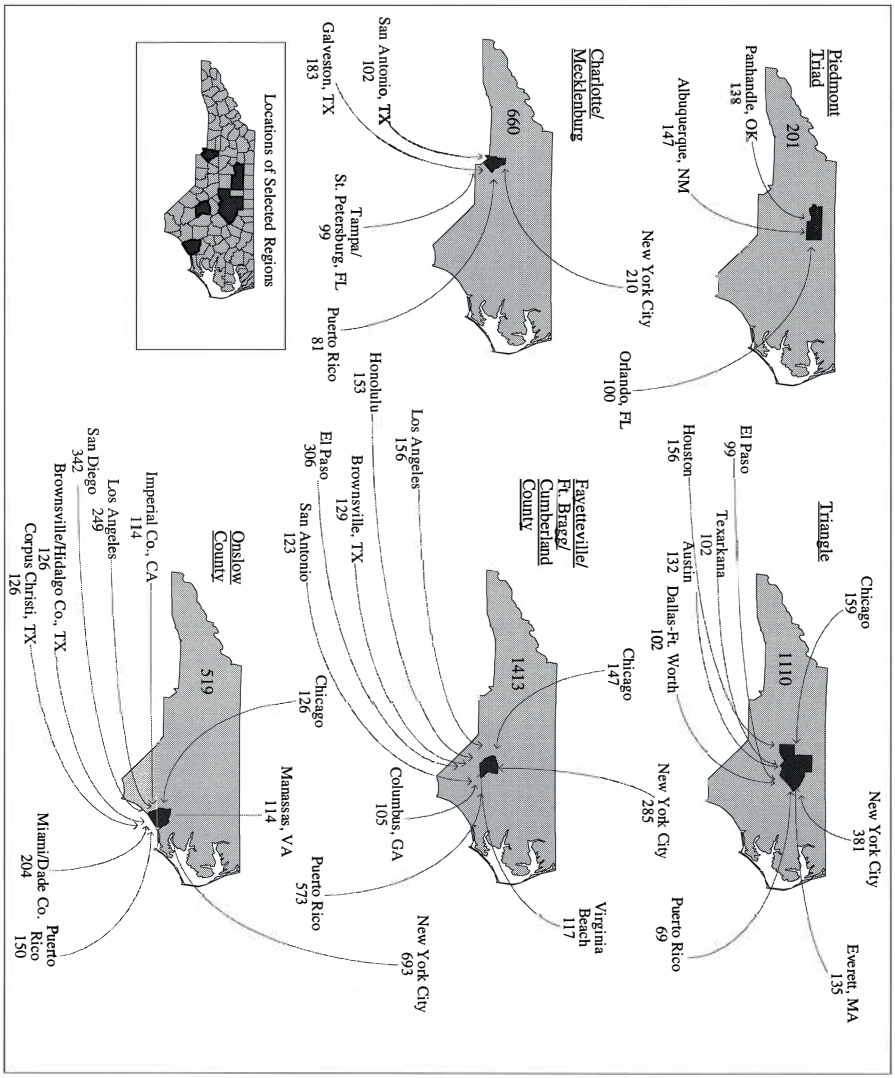


Figure 6: Specific origins of Hispanic migrants to North Carolina.
Source: U.S. Bureau of Census, 1990.

is from Puerto Rico, which is official U.S. territory. Between 1985 and 1990, 150 Hispanics from Puerto Rico settled in Onslow County and 573 settled in Cumberland County.

With respect to Hispanic immigration from abroad, we are unable to identify the specific points of origin, but we do know that there were salient international flows into the Triangle area (1,110 Hispanics from abroad) and into the Fayetteville/ Ft. Bragg/ Cumberland County (1,413 Hispanics from abroad) area between 1985 and 1990.

We should note here that these data are consistent with the findings of earlier studies, which revealed that Hispanics, not unlike their non-Hispanic White and non-Hispanic Black counterparts, are moving down the urban hierarchy to small- and medium-sized urban centers. What our research adds is that some of these small- and medium-sized Hispanic migration magnets have a distinct character—in the case of North Carolina destinations, several are military towns.

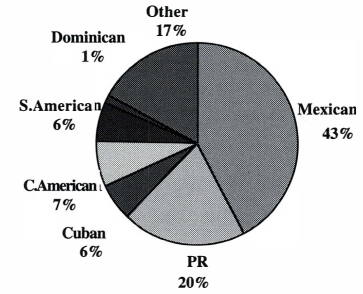
Who are the Hispanics?

From the 1990 PUMS data, we were able to develop a socio-economic and demographic profile of North Carolina Hispanics (Figure 7a). In terms of ethnic origins, Hispanics of Mexican descent constituted the largest group — 43% of the total. Puerto Ricans made up the second largest group, accounting for 20% of total Hispanic inmigration. The influx consisted of smaller percentages of Cubans, Central Americans, South Americans, Dominicans and the "Other" category of Hispanics. Geographically speaking, Puerto Ricans appeared to be over-represented in the military towns.

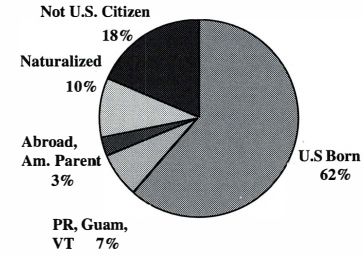
Nearly two thirds of North Carolina Hispanics were born in the U.S., Puerto Rico, or some other U.S. territory (Figure 7b). Ten percent were naturalized citizens. Only 16% were not U.S. citizens. Onslow County and the Piedmont Triad had the highest proportions of Hispanics who were born in the U.S. (74.8% and 64.1%, respectively). Charlotte/ Mecklenburg and the Triangle had the greatest concentrations of Hispanics who were not U.S. citizens at the time the 1990 Census was taken (25.3% and 27.2%, respectively).

As is typical of most migrants, irrespective of whether they are interstate or international movers, a majority of the Hispanic migrants to North Carolina are young (Figure 8a). Over half are between

7a. Ethnicity



7b. Citizenship



Figures 7a and 7b: Socio-economic and demographic profile of North Carolina's Hispanics.
Source: U.S. Bureau of Census, 1990.

the ages of 18 and 35. Undoubtedly due to their active involvement in the military, the highest concentration of Hispanics in this age range can be found in the Onslow County and the Fayetteville/Ft. Bragg/Cumberland County areas.

With respect to gender, males slightly out number females, which is usually the case in migration (Figure 8b). Males constituted 56% of North Carolina Hispanics. However the proportions of males did vary significantly among the primary destination communities. Not surprisingly, males dominated the flow into Onslow County—one of North Carolina's military installations—while the flow into Charlotte/Mecklenburg was more balanced (51.5% were male).

In terms of years of school completed, North Carolina Hispanics (43% of whom had less than a high school diploma) are generally less well-educated than the state's population as a whole (33% with less than a high school diploma) (Figure 8c). However, the Hispanics who settled in the Triangle area are generally better educated than the statewide Hispanic population. One quarter of the Hispanics settling in the Triangle area had completed college. The highest percentage of those with a high school diploma or some college settled in Onslow County and the Fayetteville/Ft. Bragg/Cumberland County areas.

With regard to marital status, North Carolina Hispanics were either married (41.2%) or never married (48.8%). Among those who were married, 36% reported that their spouse was present in the home at the time the Census was taken.

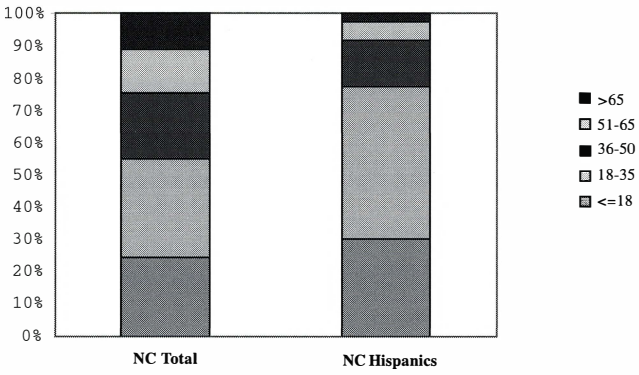
In short, most of the Hispanics who resided in North Carolina in 1990 were of Mexican or Puerto Rican ancestry. Most were U.S. born or naturalized U.S. citizens. They tended to be young and married or young and never married. While collectively their education levels were below the state-wide average, in selected regions, they ranked high on the education dimension, especially in the Triangle area.

What Kinds of Jobs are the Hispanics Getting?

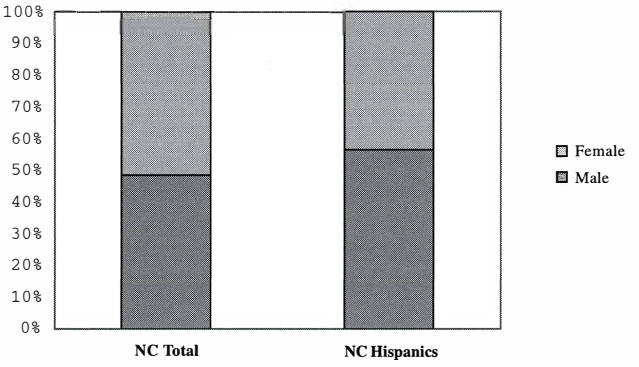
Most of what we know about Hispanic employment patterns in North Carolina (outside of agricultural work) comes from studies of specific industries (e.g. poultry and hog processing) or of local communities that have experienced a significant influx of Hispanics in recent years, like Siler City in Chatham County and Charlotte in Mecklenburg County (Griffith, 1993; Levin et al, 1995; United Way, 1995). However, no systematic efforts have been undertaken to assess the overall employment impacts of Hispanic in-migration to North Carolina.

In an effort to address this issue, we created an employment profile of the Hispanic population of North Carolina using occupational data from the 1990 PUMS. While these data are a bit dated, they are, nevertheless, the best and most reliable source of information on the statewide employment impacts of North Carolina's Hispanic population.

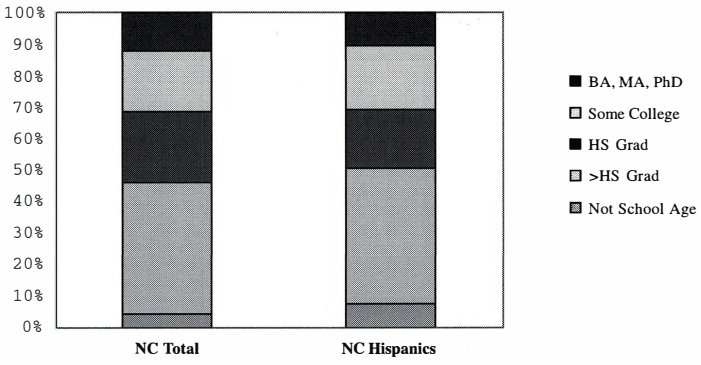
8a: Age distribution.



8b: Percent male and female population.



8c: Level of education.



Figures 8a, 8b, and 8c: Demographic characteristics.
Source: U.S. Bureau of Census, 1990.

For the purposes of this research, we grouped Hispanic occupations, as defined by the U.S. Bureau of Census (U.S. Department of Commerce, 1993), into the following categories:

- •Primary Activities include agriculture, forestry and fisheries;
- •Transformative Activities include manufacturing and construction;
- •Distributive Services include transportation, communication, whole sale and retail trade;
- •Producer Services include finance, insurance, real estate (FIRE) and business services;
- •Personal Services include entertainment, repairs, eating and drinking;
- •Social Services include medical, education and government;
- •Active Military includes active status in a branch of the U.S. military.

Figure 9 shows the distribution of Hispanic employment across our typology of occupations for the statewide Hispanic workforce, for those Hispanics who resided in the two military communities, and for those Hispanics who resided in the I-85 corridor communities. For the sake of comparison, we also include in the figure, the state distribution of total employment in North Carolina across our typology of occupations. Several important findings are apparent in these data.

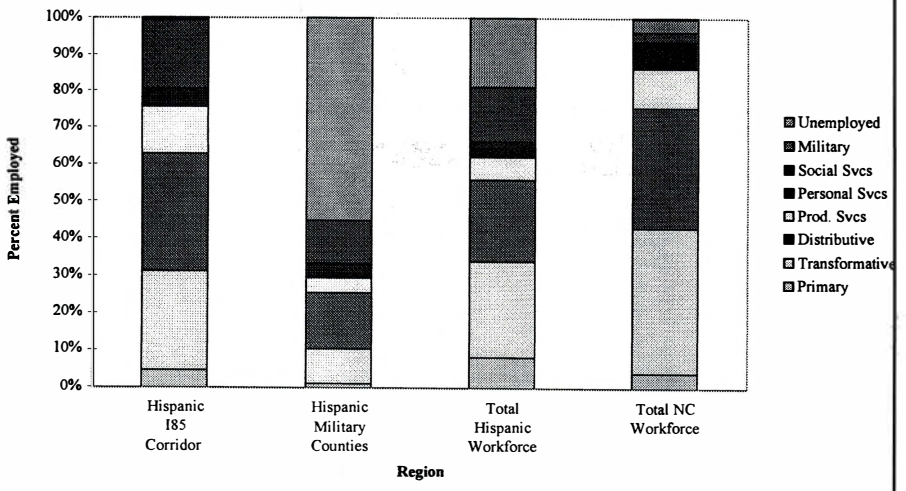


Figure 9: Employment concentration by region.

First, contrary to the popular or stereotypical views of Hispanic workers, they are widely dispersed throughout the North Carolina economy. Using the statewide distribution of occupations as a bench-mark, North Carolina Hispanics are over-represented in what are typically considered to be low-wage occupations— primary activities and personal services— as they are in other communities outside in North Carolina which have a substantial Hispanic presence. But unlike many other such communities, they are also over-represented in social services and the military, occupations that pay better wages. In addition, although they are under-represented by statewide standards, there is substantial representation or presence of Hispanics in transformative activities, especially construction, where the wages are fairly high— reportedly as high as $22.00 per hour for a journeyman stonemason and 65% of this wage for an apprentice.

Contrary to the stereotypical view Hispanics are well dispersed throughout the state's economy

The occupational distributions in the communities that served as Hispanic migration magnets between 1985 and 1990, which have been combined into two groups for the ease of presentation here, show a radically different pattern between these two settings— that is, the military communities and the I-85 corridor communities. In the military communities, Hispanics are grossly over-represented in the military service occupations and under-represented in all other occupational categories. In the I-85 corridor communities, as Figure 9 shows, Hispanics are over-represented in social services and are either at parity or only slightly under-represented in the other occupational categories. Thus, the typical image of a seasonal migrant farm worker or gardener no longer applies to the North Carolina Hispanic population. They are distributed throughout the North Carolina economy– in both high-wage and low-wage occupations.

How are Long-Term Residents of North Carolina Responding to the Recent Influx of Hispanics Into the State?

We know that considerable tensions and conflict over jobs, housing, schools and other goods and services have accompanied the influx of Hispanic newcomers into port-of-entry communities (Oliver and Johnson, 1984; Johnson and Farrell, 1993; Johnson, Farrell and Guinn, 1997). Anecdotal evidence and media accounts exist which suggest these same types of tensions and conflicts may be arising here in North Carolina, as the state's Hispanic population grows and expands.

In an effort to systematically gauge public attitudes toward Hispanic newcomers, we analyzed data from the 1996 spring Carolina Poll, which posed, among others, the following four questions to a sample of 655 North Carolinians:

1. How comfortable are you with the influx of Hispanics into the state?

2. How would your neighbors feel about Hispanics moving into your neighborhood?

3. How comfortable are you around people who are not speaking English?

4. How comfortable are you with the influx of Northerners into the state?

Table 3 summarizes the answers to these questions for all respondents and cross-tabulates responses with selected socio-economic and demographic characteristics of the survey respondents.

Category	(1)	(2)	(3)	(4)	Category	(1)	(2)	(3)	(4)
Total Sample	42%	67%	55%	26%	Race				
Age					Black	38%	54%@	51%	23%
<35 years	41%	70%	56%	31%	White	44%	69%	57%	26%
≥35 years	42%	66%	55%	24%	Other	26%	55%	44%	27%
HS Grad					Gender				
yes	35%	64%	50%	22%	Male	44%	70%	59%	29%
no	49% @	71%	59% *	28% **	Female	40%***	65%	52%	24%
Yrs. Educ.					Metropol.				
<12 years	49%	69%	55%	29%	Metro	39%@	66%	55%	26%
≥12 years	41%	67%	55%	24%***	Nonmetro	45%	69%	55%	27%
Marital Stat.					Region				
Married	44%	68%	58%	29%	Coastal	35%@	65%@	46%	30%
Not Married	37%	65%	50%	21%	Piedmont	45%	66%	33%	22%
Polit. Affil.					Mountain	37%	67%	42%	37%
Democrat	43%	67%	46%	50%	Reg. to vote				
Republican	45%	69%	66%	32%	Yes	42%	65%	56%***	27%
Indep./Other	40%	68%	53%@	40%	No	40%	76%	52%	24%
Employment					Res/16yrs				
Full-time	44%@	70%	41%@	27%@	NC	49%@	70%**	58%*	30%***
Part-time	29%	71%	50%	35%	Other	26%	59%	47%	13%
Unemployed	60%	60%	33%	13%	Southern				
Other	39%	63%	42%	16%	Yes	46%*	68%@	58%*	28%**
					No	28%	62%	46%	17%

Category	Attitude toward Latino Influx (1)	Neighbor's Attitude about Latino Influx (2)	Attitude about Non-English Speaking (3)	Attitude about Northerners Influx (4)
Mountain	37%	67%	42%	37%
Registered to Vote				
Yes	42%	65%	56%***	27%
No	40%	76%	52%	24%
State of residence at age 16				
North Carolina	49%****	70%**	58%*	30%***
Other	26%	59%	47%	13%
Southern				
Yes	46%*	68%****	58%*	28%**
No	28%	62%	46%	17%

(1)Is Respondent comfortable with the influx of Hispanics into the state?

(2)How would Respondent's neighbors feel about Hispanics moving into neighborhood?

(3)Is Respondent comfortable around people who are not speaking English?

(4)Is Respondent comfortable with the influx of Northerners into the state?

Percentages show the proportion of persons in each indicator group that had negative responses to the questions (e.g.% of those <35 years were uncomfortable).

Significance of Fisher's Exact Test:

***< .05**
****< .01**
*****< .001**
******< .000**

Table 3: Results of survey guaging public attitudes towards Hispanics.
Source: Carolina Poll, Spring, 1992, Institute for Research in Social Science, University of North Carolina at Chapel Hill.

In general, North Carolinians harbor negative feelings about the influx of Hispanics into the state. Nearly half said they were uncomfortable with the increasing presence of Hispanics, 67% said they thought their neighbors would not approve of Hispanics moving into their neighborhood, and over half (55%) said they do not feel comfortable around people who do not speak English. Such sentiments were not expressed at such high levels, however, against Northerners. Only 26% of the respondents said the influx of Northerners made them uncomfortable.

As Table 3 shows, North Carolinians who have no high school diploma are significantly more negative than their more educated counterparts in their responses to the influx of Hispanics. In comparison to North Carolinians who live in the state's metropolitan areas, those who live in nonmetropolitan areas are also more negative about the Hispanic influx. Those who consider themselves to be Southerners and those who lived in the state at age 16, compared to the new comers to the region, harbor significantly more negative attitudes about Hispanics and Northerners. However, the levels of opposition to the influx of Northerners are not as high as the levels of concern about the influx of Hispanics.

Responses vary significantly by region; however, the pattern is not clear cut across responses. Those living in the Coastal region appear more negative about non-English speaking. Those who live in the Mountain (western part of the state) region feel their neighbors would be uncomfortable with Hispanic neighbors. Those in the Piedmont are more uncomfortable with the Hispanic influx.

Those who are unemployed expressed significantly more negative attitudes toward the Hispanic influx into North Carolina than their employed counterparts. When questioned about how their neighbors would feel about Hispanics moving into their neighborhoods, whites expressed more negative attitudes than Blacks did. Those who are registered to vote have significantly more negative attitudes toward non-English speaking, than those who are not registered to vote. Males have significantly more negative attitudes toward the Hispanic influx than females. Among the survey respondents, Republicans harbored more negative feelings about non-English speaking than did Democrats or Independents.

If you are white, male, rural and/ or Republican you are apt to have more negative views about the Hispanic influx

These responses and attitudes do not bode well for North Carolina Hispanics. As we have shown above, nearly one-half of North Carolina Hispanics live within the migration magnet communities. The I-85 Corridor communities lie within the Piedmont Region of North Carolina. Significantly negative attitudes were expressed by residents of this region. Nonmetropolitan respondents had more negative attitudes toward Hispanics than did metropolitan respondents. This may be fortunate for a majority of the Hispanics included in this study, who are concentrated in metropolitan areas within North Carolina (Table 2). The fact that unemployed North Carolinians are so negative about Hispanic influx suggests that ethnic tensions surrounding the labor market may be festering in North Carolina.

The range of groups that expressed negative feelings about Hispanics is very broad. What is alarming about this is how openly these views were expressed. Respondents tend to temper their responses when similar questions are posed about Blacks, in order, in all probability, to avoid appearing racist (Stocking, 1996b). Apparently these concerns are not present when discussing immigrants and, in this case, Hispanics.

Conclusions

We have shown that North Carolina Hispanics have settled in defined geographical areas within the state. They come to the state from mostly port-of entry communities and U.S. metropolitan communities, although some have entered the state from small- and medium-sized urban areas.

Because they arrive with a diverse set of skills and experiences, Hispanics can be found in a wide array of occupations in the North Carolina economy. In addition to filling low-wage occupations, we find that Hispanic newcomers to North Carolina are also making their way into other better-paid occupations, such as social services and the construction industry.

We also evaluated North Carolinians' attitudes toward the massive and dynamic Hispanic influx. Tensions and conflicts seem to be building among long term residents of the state. Locally, newspapers are reporting similar attitudes and tensions. Future research should address media reports of job competition between non-Hispanic blacks and Hispanics (Stocking, 1996a; Stocking, 1996c). Also reported in the media are images of over-utilized social and public services and the strain on housing in many communities due to the influx of Hispanics (Stocking, 1996d; Howard, 1996b). Anecdotal evidence exists that employers are bringing workers in from the Mexican border.

Future research should focus on whether Hispanics are primarily recruited from elsewhere or are leaving agriculture for manufacturing and service jobs.

Further research should also seek to answer the questions: Are North Carolina Hispanics being recruited to come here and work or are they settling out of agricultural work and moving into industrial and service sector jobs? How do North Carolina employers make their hiring decisions? How do North Carolina employers gain access to information about prospective Hispanic

employees? What influences their hiring decisions? How do they recruit their hires? These are the types of questions we will investigate in our future research on the increasing diversity of North Carolina's population.

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LOCATIONAL ANALYSIS OF NORTH CAROLINA PHYSICIANS' PRIMARY, SECONDARY, AND TERTIARY PRACTICES

Don P. Albert and Wilbert M. Gesler

Introduction

As physicians reorient toward a changing health care system, they increasingly establish secondary and tertiary practice locations. Sixteen percent of North Carolina's physicians had multiple locations during 1992. The expansion into multiple sites has clear implications for the geographic distribution of physicians and therefore for the availability of and access to physicians. One can view multiple-site practices as a two-edged sword; they might increase or decrease physician-to-population ratios in an area, depending on the geographic distribution of physicians' primary, secondary, and tertiary practices.

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Studies that only consider physicians anchored to a single location are rapidly becoming out-of-date. To deal adequately with current realities, locational analyses of physician practices must recognize more complex patterns that include primary, secondary, or tertiary practices. Further complicating analysis are the linkages between financing and service delivery (i.e., managed care) that are revolutionizing the health care industry. In this paper our focus is on describing spatial patterns of practices with multiple sites. This is done using the standard locational concepts of low vs. high order goods and services, threshold, range, population size and central function relationship, and trade areas to compare multiple practice sites. Such an approach demonstrates the usefulness of geographic concepts in "real-world" applications.

The authors deal with the increasing tendency of individual primary health physicians to open offices in different locations and the resulting complexities of patient access to medical services

Background

Why do physicians have multiple locations? The expansion of physician services into secondary and tertiary practices, additional locations to where they commute to provide services, is primarily a function of economics. The goal of course is to maintain and increase profits to insure a stable and secure practice or health care organization. Some measures to maintain and increase profits include increasing the geographic patient (population) base, increasing the referral volume from other collaborating physicians, and discouraging competition from other physicians. However, if physicians (or organizations which employ them) cannot increase their medical service or population base/demand to reach a profitable threshold in only one location, their options are either to relocate to larger markets or branch out with secondary and tertiary practices.

In spite of the importance of economic considerations, there may be other motivating factors which spur the establishment of multiple practices. Is it just a matter of branching out to acquire additional patients or is there a conscious effort to provide care to particular population subgroups with "preferable" (e.g., underserved) characteristics? Other motives directing physicians to secondary and tertiary practices include contract obligations (e.g., managed care) and historic precedent (Albert and Gesler, forthcoming).

Studies of multiple-site practices, especially those with a geographic orientation, are rare.One recent exception is a study which found that multiple-site.practices for urologists (n=35) were common in the Hartford Medical Service Area. Inclusion of secondary practices increased appointment capacity 23 percent and the number of towns with urologists from 6 to 19 of the 38 towns within region. Interestingly, secondary practices were "in communities with higher than average elderly populations and incomes and lower than average minority populations" (Cromley and Albertsen, 1993). This seminal research affirms the importance of multiple-site practices within physician location analyses and concludes by recommending "further research to document the functioning of multiple-site practices across other specialties and geographic areas" (Cromley and Albertsen, 1993).

Data Source

Our physician data originate from a self-report questionnaire subsumed within a registration application for a medical license that is accessible through the North Carolina Board of Medical Examiners (NCBME, 1992) via the North Carolina Health Professions Data System (Sheps Center for Health Services Research, 1992). This statewide database consists of 18,253 records with twenty-two fields that include one field each for gender, race, specialty, and an in-/out-of state code and three fields each for the city, state, county, ZIP Code, hours per week in medicine, and employment setting for the primary, secondary, and tertiary practices.While gender, race, specialty, in-/out-of state code, city, state, and county fields were 98 to 100% complete, the Zip Code fields were far less complete with 97, 66 and 54% respectively for primary, secondary, and tertiary practices. Some of the other fields such as hours/week in medicine and location setting suffer from missing observations. These fields ranged from a low of 70% for tertiary practice setting to a high of 86% for secondary hours/week in medicine. Dealing with missing observations attenuates the power of interpretation for some of the analyses; however, 11 of the 22 fields were over 90% complete (most 98 or 99%). It is important here to recognize data concerns (e.g., self-reported data, completeness, accuracy) up front so that analyses are evaluated in terms of data limitations.

General Description

There were 11,632 primary practices during 1992 which tended to cluster within counties having medical schools, regional hospital complexes, and large urban populations (Figure 1). Supplementing these primary practices were 2,221 second-

ary and tertiary practices with similar spatial patterns (Figure 2); however, without factoring in a denominator (population) the contribution of secondary and tertiary practices to a health care system is difficult to assess (Albert, 1995).

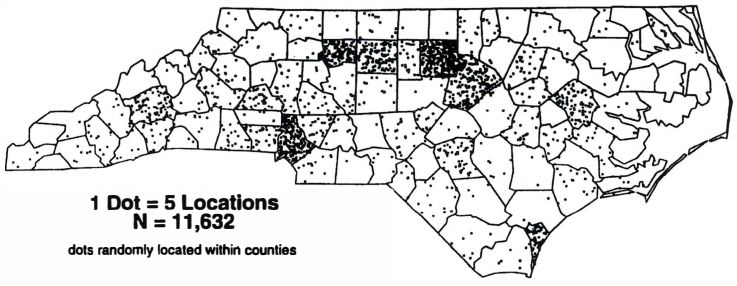

Figure 1: Primary practices, 1992.

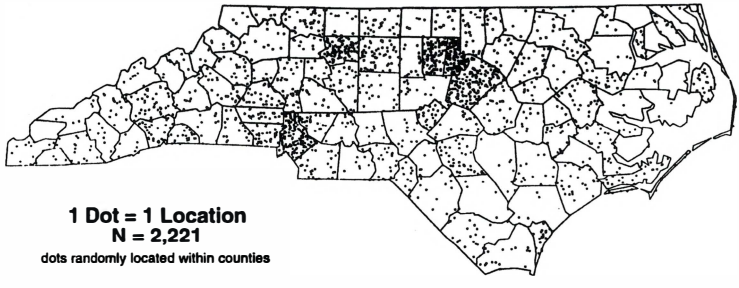

Figure 2: Secondary and tertiary practices, 1992.

The effect of physicians crossing state lines to establish secondary and tertiary practices is minimal with 41 more practices entering North Carolina than leaving the state. In other words, the North Carolina multiple-site system is almost entirely a closed one. The ratios of secondary and tertiary to primary practices provide insight into counties benefiting dramatically from multiple practices. There were 15 counties having ratios of ≥ 1 (i.e., more secondary and tertiary practices than primary practices), including Martin, Washington, Hyde, Dare, Currituck, and Camden which formed a cluster of adjacent counties in northeastern North Carolina. Simple examination found these counties to be nonmetropolitan and health professional shortage areas. Designation as a health professional shortage areas

(HPSA) is dependent on population-to-primary care physician ratios and other criteria such as poverty status, infant mortality, and birth rates for females aged 15-44 (NC Office of Rural Health and Resource Development, 1993). These factors, nonmetropolitan status and HPSA status, were significant in a multiple regression analysis using the ratio of secondary and tertiary to primary practices as a dependent variable (Albert, 1996). Such findings suggest that some physicians were locating with respect to underserved populations.

Physicians with multiple practices work on average 45 hours per week at primary practices, 11 hours at secondary practices, and six hours at tertiary practices. These physicians' secondary practices tend to be much less office based (35% vs. 55%), more hospital based (34% vs. 24%), less university based (6% vs. 9%), and more based in other settings such as clinics or nursing homes (24% vs. 13%) than their primary practices. Tertiary practices of multiple-site physicians were less office based (35% vs. 55%), less university based (6% vs. 9%), and more other based (34% vs. 13%) than their primary practices. Second practices tend to mirror the county type of the primary practice (e.g., if primary practice is metropolitan then secondary practice is apt to be metropolitan). Eighty-two and sixty-two percent, respectively, of physicians cross municipal and county limits to secondary and tertiary practices, indicating a movement out of the immediate area to serve other markets. Secondary and tertiary practices were in smaller sized settlements than primary practices. Forty percent of secondary and 50% of tertiary practices were in settlements under 10,000 as compared with 20% of primary practices. The average distance between primary and secondary practices is 24 miles with 90% under 50 miles (Albert and Gesler, 1997).

Multiple locations of a physician's office are especially concentrated in counties that have a shortage of primary health services to begin with

Locational Analysis

There are a number of geographic concepts that can provide structure to an analysis of physician practice locations; these are the central place elements of 1) low and high order goods and services, 2) threshold, 3) range 4) population size and central function (specialties) relationship, and 5) trade area (deSouza and Stutz, 1994). These concepts will highlight locational differences existing between primary, secondary, and tertiary practices of multiple-site physicians.

Low and High Order Goods and Services

One of the fundamental concepts of central place locational analysis is order of goods and services. There are lower order (small cost and more frequent purchase) and higher order (large cost and less frequent purchase) goods and services. Physicians, according to their individual specialties, were aggregated into a four group classification that included general practitioners and family practitioners (GP&FP), medical specialties (MS), surgical specialties (SS), and other specialties (OS). The GP&FP, MS, and SS groups were considered low order and the

OS group high order. This dichotomy is based on the hours per week each group spends in the office versus a hospital setting. More hours per week are spent in an office setting than hospital setting for lower order specialties; the reverse is true for higher order specialists (Gonzalez, 1993). From among the physicians (N=2,000) with multiple practices, 68% offered lower order specialties (GP&FP = 16%, MS = 27%, SS = 25%), and 32% offered high order specialties (OS).

Threshold

Threshold is the minimum population base (or demand) that supports primary, secondary, and tertiary practices. Notice that 57% of secondary and 65% of tertiary practices were in settlements under 20,000 compared to just 35% of primary practices (Table 1). This means that secondary and tertiary practices operate at lower population thresholds (smaller-sized settlements) than do primary locations. Greatest threshold differences were among the specialties at primary locations with the lowest order specialties, GP&FP, standing apart from the other physician groups with lower thresholds (Figure 3). Threshold differences among the specialties (GP&FP, MS, SS, OS) at secondary and tertiary practices were minimal.

Secondary and tertiary office locations are in the smaller towns and more rural counties which therefore see their physician(s) less frequently

Settlement Size	Primary	Secondary (cumulative percentage)	Tertiary
< 2,500	8	13	15
2,500 - 4,999	15	24	35
5,000 - 9,999	22	38	52
10,000 - 19,999	35	57	65
20,000 - 49,999	54	72	80
50,000 - 124,999	65	79	84
125,000 - 199,999	82	90	94
200,000+	100	100	100

Notes: significant using K-S test at $p < 0.001$; primary locations (N=1,984), secondary locations (N=1,934), tertiary locations (N=342); includes out-of-state locations when physicians have at least one in-state location; data sources, NCBME, 1992 and U.S. Bureau of the Census, 1994.

Table 1: Primary, secondary, and tertiary practices and settlement size.

Range

Range is defined here as the maximum distance physicians traveled between their primary, secondary and tertiary practices. The average distances were least from primary to secondary (24 miles) and greatest from secondary to tertiary practices (35 miles) (Table 2). General practitioners and family practitioners, medical

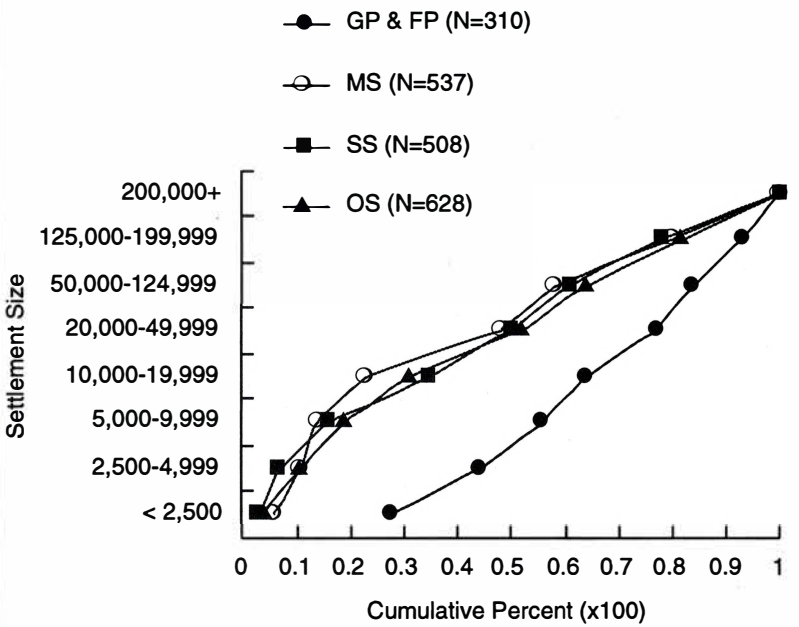

Figure 3: Primary Practices of GP & FP,MS, SS, and OS.

specialties, and surgical specialties (lower order specialties) travel on average less distance than the other specialties (higher order specialties) between primary, secondary, and tertiary practices.

	P to S	P to T	S to T
GP&FP	23	30	32
MS	22	26	34
SS	21	26	30
OS	27	36	40
Total	24	30	35

Data Source: NCBME, 1992; out-of-state locations excluded.
Note: P = Primary, S = Secondary. and T = Tertiary; P to S (N = 1,741), P to T (N = 292), and S to T (N = 286).

Table 2: Mean miles between practices.

Population Size and Central Function Relationship

There is a positive relationship between a settlement's population size and the number of different central functions (goods and services). Here we compare the

number of different specialties offered among aggregates of large, moderate, and small settlements for physicians having just a single practice (N = 9,754) and for physicians having multiple practice locations. The number of individual specialties offered by physicians decrease from primary, secondary, and tertiary practices at the large (I), moderate (II), and small (III) settlement sizes (Table 3)[1]. One should note, however, that the ratio of the specialties between small (III) and large (I) settlements increase from 1.1 among primary, to 1.6 among secondary, and then to 2.5 among tertiary practices. This is a positive indication that a wide spectrum of specialties, rather than just a select group of specialties such as GP&FP that customarily favor smaller sized settlements, were located in smaller sized settlements.

	Specialties (Number)		
Settlement Size (I. large, II. medium, III. small)	Primary Practices	Secondary Practices	Tertiary Practices
I. ≥ 125,000	78	47	22
II. 20,000 - 124,999	75	46	19
III. ≤ 19,999	86	74	56
Ratio III/I	1.1	1.6	2.5

Table 3: Number of specialties and settlement size.

Trade Areas

Mean distances between primary and secondary and primary and tertiary practices for GP&FP, MS, SS, and OS delimit surrogate trade or market areas for those physicians with three practice locations. Trade areas are depicted graphically in Figure 4. The x-axis is the mean distance from primary to secondary and the y-axis is the mean distance from primary to tertiary practices. For low-order specialties' (GP&FP, MS, SS) the trade area is less than or equal to 690 square miles; whereas, the higher order specialties' (OS) trade area is 972 square miles.

Health Care Policy Implications

There are five potential health care policy implications of multiple locations. These include implications related to data quality, monitoring health care providers, geographic access to and availability of physicians, calculating health professional shortage indices, and physician recruitment. For example (Albert and Gesler, 1997):

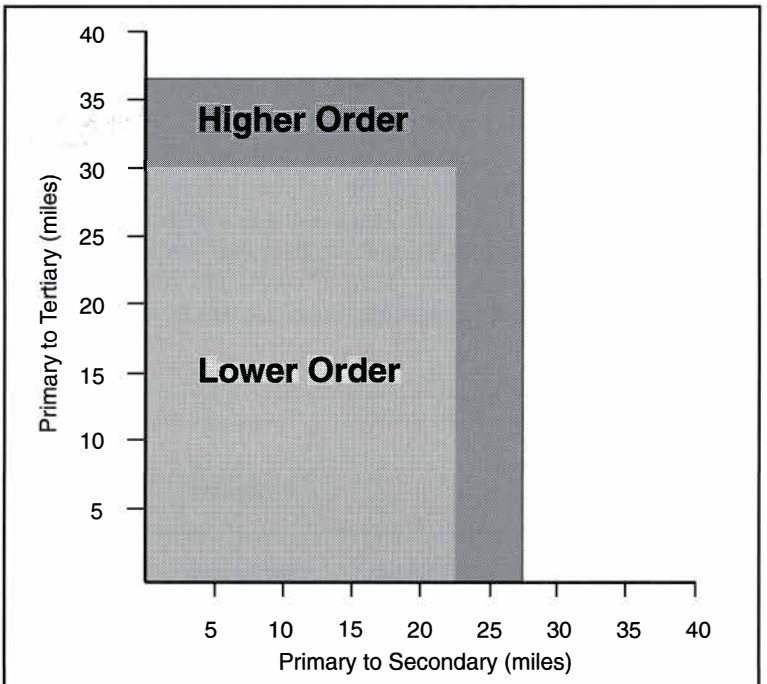

Figure 4: Trade Areas of Higher and Lower Order Specialties.

•missing observations, inaccuracies, and poor definition of terms taint the usefulness of the physician database;

•ignoring second and tertiary locations might cause an under or over estimation of physician-to-population ratios;

•multiple practice patterns redistribute physicians within and between counties to alter access for or against certain population groups;

•precise accounting of physicians' hours spent in secondary and tertiary locations might cause counties to gain, lose, or maintain federal shortage designation (i.e., health professional shortage areas and medically underserved areas) and change potential to compete for various program funding; and

•data on secondary and tertiary locations might be useful to target physicians within some specified radius (e.g., 30 to 60 miles) of shortage communities for full-time recruitment.

Summary and Discussion

Basic concepts of locational analysis provide a useful approach to differentiate between the lower (68%) and higher order (32%) specialties and among the primary, secondary, and tertiary practices of physicians (Table 4). In general, the

results confirm the expectations geographers derive from their knowledge of central place locational theory. This analysis, however, is particularly useful because it shows that concepts such as threshold and range differ for different physician groups as well as for multiple- versus single-site practices. Threshold populations decrease with multiple practices; a larger percent of secondary (57%) and tertiary (65%) compared to primary practices (35%) were in settlements under 20,000. Distances (range) separating primary, secondary, and tertiary practices were less for lower order specialties (GP&FP, MS, SS) than higher order specialties (OS). More individual specialties were among the aggregation of small rather than large settlements; however, the ratios (individual specialties at small/individual specialties at large settlements) were greatest for secondary (1.6) and for tertiary (2.5) practices. Trade areas of the lower order specialties (GP&FP, MS, SS) were less than trade areas for higher order specialties (OS). Results such as these indicate that clear geographic differences exist both among specialty groups and among primary, secondary, and tertiary locations.

Results indicate that clear differences exist within North Carolina in service availability provided by specialist as well as primary health physicians

The dynamics of multiple practice locations are fascinating. The phenomenon of multiple practice locations raises concerns over data quality of physician databases, effective geographic monitoring of health care personnel, access and availability of physician services, health professional shortage area determination, and physician recruitment (Albert and Gesler, 1997). Further investigations of secondary and tertiary practices might reinvigorate the languishing topic of physician location analysis. One immediate need is to continue to document the percent of physicians with multiple practices since 1992. Future research must recognize that locational patterns of physicians have become more complex given the phenomenon of multiple practices and overarching changes occurring (i.e., managed care) within the health care sector.

Endnote

[1]**General Practice & Family Practice (N=2):** General Practice; Family Practice; **Medical Specialties (N=33):** Allergy; Cardiovascular Disease; Dermatology; Diabetes; Endocrinology; Gastroenterology; Geriatrics; Hematology; Infectious Disease; Internal Medicine; Neoplastic Disease; Nephrology; Nutrition; Pediatrics; Pediatrics, Allergy; Pediatrics, Cardiology; Pulmonary Disease; Rheumatology; Adolescent Medicine; Allergy and Immunology; Immunology; Neonatal - Perinatal; Pediatric Endocrinology; Pediatric Hematology-Oncology; Pediatric Nephrology; Gynecological Oncology; Maternal and Fetal Medicine; Medicine/ Pedicatrics; Pediatric Gastroenterology; Pediatric Rheumatology; Pediatric Pulmonology; Pediatric Infectious Disease; **Surgical Specialties (N=29):** Bronchoesophagology; Gynecology; Laryngology; Obstetrics; Obstetrics/Gynecology; Opthalmology; Otology; Otorhinolaryngology; Rhinology; Surgery, Abdominal; Surgery, Cardiovascular; Surgery, Colon and Rectal; Surgery, General; Surgery, Hand; Surgery, Head and Neck; Surgery, Neurological; Surgery, Orthopedic; Sur-

gery, Pediatric; Surgery, Plastic; Surgery, Thoracic; Surgery, Traumatic; Surgery, Urological; Maxillofacial Surgery; Reproductive Endocrinology; Vascular Surgery; Facial Plactic Surgery; Hand Surgery, Plastic; Surgery, Oncology; **Other Specialties (N=41):** Aerospace Medicine; Anesthesiology; Emergency Medicine; General Preventive Medicine; Hypnosis; Legal Medicine; Neurology; Neurology, Child; Neuropathology; Nuclear Medicine; Occupational Medicine; Pathology; Pathology, Clinical; Pathology, Forensic; Pharmacology; Physical Medicine & Rehabilitation; Psychiatry; Psychiatry, Child; Psychoanalysis; Psychosomatic Medicine; Public Health; Radiology; Radiology, Diagnostic; Radiology, Pediatric; Radiology, Therapeutic; Roentgenology, Diagnostic; Other Specialty; Blood Banking; Dermatopathology; Nuclear Radiology; Radioisotopic Pathology; Child Development; Addiction/Chemical Dependency; Critical Care Medicine; Epidemiology; Radiation Oncology; Sports Medicine; Anatomic Pathology; Administrative Medicine; Neuro-Radiology; Medical Microbiology/Genetics

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GREENHOUSE GAS EMISSIONS: METHANE RELEASED IN NORTH CAROLINA, 1990

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Brian D. Witcher
and Phillip T. Dellinger

Introduction

Earth's atmosphere is heated by the sun, but most of that energy comes to the atmosphere via indirect routes. Being transparent to most forms of direct solar energy, much of the sun's electromagnetic energy passes through the atmosphere and heats the surface of the Earth. Energy is then re-emitted as longwave energy. Compounds in the atmosphere known as "greenhouse gases" readily absorb that longwave radiation. Greenhouse gases include water vapor, carbon dioxide, methane, chlorofluorocarbons (CFCs), and other gases. Energy is temporarily "trapped" resulting in additional warming of the atmosphere. This natural greenhouse effect is what makes Earth habitable; without it, the average temperature of the planet would be 55 F° (30 C°) colder than it is today (U.S. EPA, 1995a).

Michael Mayfield is Associate Professor while Brian Witcher and Taylor Dellinger are graduate students at the Department of Geography and Planning, Appalachian State University

Human activities have profoundly influenced the atmosphere of Earth since the beginning of the Industrial Age, leading many prominent scholars to warn of significant global change (Santer, 1995; Schneider, 1990). While skeptics remain in the scientific community, there is an increasingly strong consensus among climatologists that global warming has begun and that it will accelerate over the next century (Michaels, 1990; Kerr, 1995; Schneider, 1994). Global warming is one major category of change that is being critically evaluated by climatologists and other scientists. The concern is that greenhouse gases will continue to accumulate in the troposphere at rates that could lead to significant warming over the next century and beyond. One prominent group of scientists has predicted a warming of approximately 4.5 F° (2.5 C°) over the next century (Bolin, et al., 1995). Impacts from such warming could include rapidly rising sea level, major shifts in crop production, geographic displacement of species and entire ecosystems, and increased costs for climate control in houses and other structures.

Without the natural greenhouse effect the Earth's average temperature would be 55° F cooler

With its barrier island coast and vast areas of estuaries, North Carolina is particularly vulnerable to global warming (Daniels, 1996). Coastal regions are likely to experience more significant and immediate impacts from global warming than interior locations. Agriculture, of great importance to the economy of the state, is also highly susceptible to impact from changes in temperature and precipitation (Easterling, et al., 1992). In addition, urban areas are more vulnerable to

summer heat waves and associated human discomfort and mortality than other areas.

While considerable uncertainty surrounds most specific projections of climate change, the probability of change and the consequences of such change are serious enough that international bodies have determined the need for a global assessment of sources of radiatively active gases. The Intergovernmental Panel on Climate Change (IPCC) has been charged with completing inventories of all greenhouses gases for the nations of the world. In the United States, the U.S. Environmental Protection Agency (EPA) is responsible for estimating greenhouse gas emissions. It has completed a national survey (U.S. EPA, 1995a; 1995b) and has recently commissioned more detailed state level surveys.

Human activities have initiated a global warming trend that will accelerate over the next century

At Appalachian State University, the Department of Geography and Planning contracted with the North Carolina Department of Commerce, Energy Division to produce the state inventory (ASU, 1996). Funded jointly by the N.C Energy Division and the U.S. Environmental Protection Agency's Office of Policy, Planning and Evaluation, Climate Change Division, State and Local Outreach Program, this recently completed inventory is one of only three to have been completed at the county level. Only state totals have been provided by the other 22 states which have completed inventories. The North Carolina inventory followed IPCC and EPA protocols for accounting, supplemented by internally developed procedures to produce county level emission estimates (IPCC, 1995; EPA, 1995b; ASU, 1996). A total of 120 linked spreadsheet files with a combined size of approximately 210 megabytes of disk space were required to complete the work. Detailed descriptions of the inventory procedures are contained within the inventory manuals (IPCC, 1995; EPA, 1995b; ASU, 1996).

In order to compare different gases with different atmospheric impacts, all gases were converted to global warming potential (GWP) values, which are expressed in tons of carbon dioxide equivalent. By converting emissions for all gases to GWP values, the impacts of emissions of different gases can be compared directly (U.S. EPA, 1995a). Greenhouse gases inventoried in this study included methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O), ozone depleting compounds (ODCs), carbon monoxide (CO), oxides of nitrogen (NO_x), and nonmethane volatile organic compounds (NMVOCs). This report focuses on releases of methane during 1990, the last year for which a full data set exists. The combined total of all greenhouse gas emissions for the State of North Carolina in 1990 was almost 152,000,000 tons of CO_2 equivalent. That amount equals approximately 23 tons of CO_2 for each person in the state (Table 1).

This study is near unique among a multitude of global warming research in its emphasis on the county level of data evaluation

Emission Source Category	Actual Emissions and Global Warming Potential (tons/yr)					
	CH_4	CH_4 as CO_2 equiv.	CO_2	N_2O as CO_2 equiv.	% of CO_2 equiv.	Total CO_2 equiv.
Fossil Fuel Consumption	**9,266**	**203,841**	**120,847,628**	**992,883**	**80.46%**	**122,044,351**
Commercial/Institutional	7	145	3,731,586	1,324	2.46%	3,733,054
Industrial/Manufacturing	33	718	23,372,681	67,304	15.45%	23,440,702
Residential	42	927	5,591,119	95,113	3.75%	5,687,159
Utilities	269	5,928	46,231,048	106,391	30.55%	46,343,367
Transportation	8,915	196,123	41,921,195	722,751	28.24%	42,840,070
Biomass Fuel Consumption	**26,596**	**585,110**	**16,578,428**	**198,491**	**11.45%**	**17,362,029**
Production Processes	**0**	**0**	**426,097**	**366,849**	**0.52%**	**792,946**
Agriculture and Livestock Production	**377,606**	**8,307,332**	**340,548**	**1,007,854**	**6.37%**	**9,655,734**
Domestic Animals	37,912	834,064	0	0	0.55%	834,064
Animal Manure Management	339,694	7,473,268	0	0	4.93%	7,473,268
Fertilizer Use/Agricultural Liming	0	0	340,548	1,007,854	0.89%	1,348,402
Waste Disposal, Treatment, & Recovery	**266,825**	**5,870,151**	**506,614**	**18,851**	**4.22%**	**6,395,615**
Landfills	260,355	5,727,817	0	0	3.78%	5,727,817
Waste Incineration	1,056	23,241	506,614	18,851	0.36%	548,706
Sewage Treatment	5,413	119,092	0	0	0.08%	119,092
ODC					**2.54%**	**3,859,270**
Human Emissions	**49,183**	**1,082,015**	**57,965**	**0**	**0.75%**	**1,139,980**
Land Use Changes	**-108**	**-2,372**	**-9,611,812**	**53,955**	**-6.30%**	**-9,560,229**
Total Emissions	**729,367**	**16,046,077**	**129,145,468**	**2,638,883**	**100%**	**151,689,698**
%Global Warming Potential		11%	84%	2%		100%

Table 1: Summary of North Carolina 1990 Greenhouse Gas Emissions: Primary Gases (tons/year)
Source: ASU, 1996.

Methane Emissions in North Carolina

One of the most significant greenhouse gases produced by human activity is methane (Smith, 1995). Methane is a greenhouse gas of special concern because every ton of methane released to the atmosphere produces 24.5 times as much warming as a ton of CO_2. Roughly 17,000,000 tons (11%) of the total CO_2 equivalent for the state in 1990 resulted from methane emissions. Methane is emitted from a wide variety of sources, both "natural" and from human activities. The methane is generated by direct emissions such as cattle flatulence and from secondary processes such as the decomposition of hog manure in anaerobic waste lagoons. Emissions associated with human activity are increasing significantly through time in North Carolina

Agriculture is the most important source of methane emissions in North Carolina, with almost half the state total (Figure 1). Animal manure management accounted for 44% of N.C. methane emissions and domesticated animals produced 5% of the total. Following agriculture are landfills (36%), human emissions (7%), biomass fuels (4%), and fossil fuel combustion (1%).

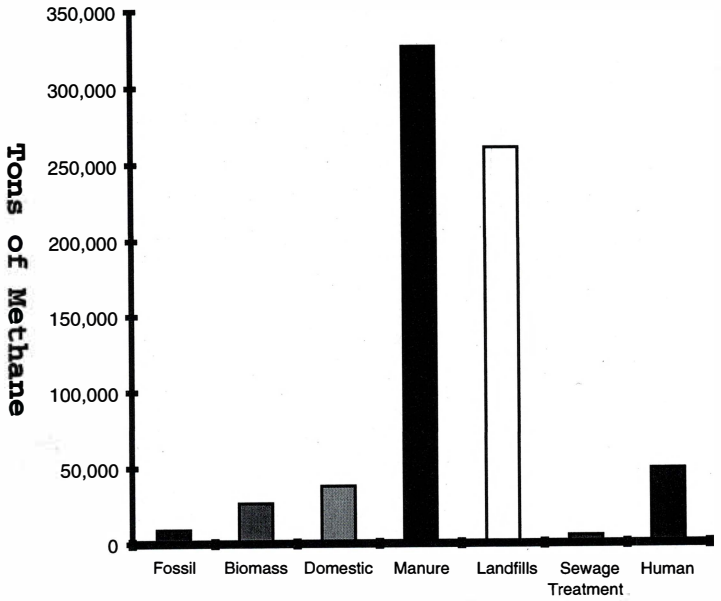

Figure 1: State Methane Emissions (tons/yr.).

Agricultural activity produces large amounts of methane from a variety of sources. For the entire Earth, agriculture contributes 65% of all anthropogenic methane emissions (Duxbury, 1994). Domesticated animals are one important source. Cows and other ruminants chew their cud and regurgitate the food between multiple stomachs. During that activity, anaerobic bacteria convert some of the food into methane in the digestive tract of the animal. The result is the emission of methane through belching and flatulence. An 800 lb. steer fed on grains will emit approximately 150 pounds of methane per year. Other feed types result in lesser amounts of methane released to the atmosphere (U.S. EPA, 1995b). Statewide, about 38,000 tons of methane are released to the atmosphere each year from domesticated animals, which is the equivalent of over 830,000 tons of CO_2 (Table 1). On the other hand, the 6.6 million persons living in North Carolina in 1990 directly emitted over 49,000 tons of methane as a result of digestion and respiration. Finally, game animals released another 13,000 tons of methane that year.

By far the most important source of agricultural methane is the anaerobic digestion of animal waste products by bacteria. So when hog wastes are collected and decomposed in waste lagoons, enormous amounts of methane are generated. Thus, hog operations contribute more methane to the atmosphere than any other activity in North Carolina. Animal manure management, comprised of hogs, cattle, and chickens, systems in North Carolina released approximately 7,200,000 tons of CO_2 equivalent in methane in 1990, or nearly nine times the direct emissions of domesticated animals in the state.

Waste products from homes, industry, and commerce are primarily disposed of in sanitary landfills. These are largely anaerobic environments, so significant amounts of methane are generated as the organic components of the waste stream are broken down by microbes (U.S. EPA, 1995a). Approximately 260,000 tons of methane were generated in landfills in 1990, equivalent to over 5.8 million tons of carbon dioxide.

Agriculture, especially animal manure management practices, is the most important source of methane emission

Combustion of biomass fuels such as firewood contributed over 26,000 tons of methane in 1990, with a GWP of 585,000 tons of carbon dioxide. Almost all of that biomass related methane came from residences. Although the relative contribution of domestic wood burning to methane production in North Carolina is small, it is accompanied by significant releases of carbon dioxide, air pollutants, and reduced carbon stores in forests.

When we account for the greenhouse gas emissions associated with the out of state production of fuels that are ultimately used in North Carolina, the total methane emissions increases significantly. Here coal mining figures prominently. Large amounts of methane contained within the coal are released to the atmosphere when coal is mined. Following a protocol established by the State of Wisconsin, we have estimated that fuel production for North Carolina released 1.8 million tons of CO_2 equivalent and that transportation and distribution of fuels released another 15.1 million tons of CO_2 in 1990 (WDNR, 1993).

Geographic Patterns Within North Carolina

While the state totals of methane production are substantial, it is necessary to examine emissions of greenhouse gases at the local level in order to understand the driving forces which lead to those releases. Once those driving forces are understood, remediation and mitigation may be effectively addressed (Dietz and Rosa, 1997). For the North Carolina Greenhouse Gas Inventory, we used the county as our smallest level of spatial analysis a level of precision not before attempted. Estimating greenhouse gas emissions at the county level is especially challenging because data on rates of fuel consumption and other critical activities are often compiled at the state level. For each sector of activity, the research team had to find ways to estimate greenhouse gas production using available data. For example, in order to calculate CO_2 emissions from automobiles, it was necessary to use vehicle miles traveled in each county, enter that into a sophisticated carbon monoxide emissions model, then estimate the emissions of CO_2 based upon fuel consumption rates and established ratios between CO and CO_2 emissions.

Total methane emissions in North Carolina in 1990 are shown in Figure 2. Counties range from a low of less than 1000 tons of GWP in most of the mountain counties to over 100,000 tons in Duplin and Sampson Counties; those two counties alone generate one-fifth of the state total. Both the Piedmont and Coastal Plain regions showed significant levels of methane emissions, but the activities responsible for those emissions are quite different for the two regions.

Coastal Plain counties which produce large amounts of methane are concentrated in the inner part of that region, with highest totals coming from Duplin, Sampson, Greene, and Wayne Counties. Most of that methane is associated with domesticated animals with the majority coming from hog waste management. While environmental problems such as waste spills, nitrification of groundwater, and odor problems associated with swine operations have been in the news frequently, little mention has been made of the contribution of those operations to greenhouse warming. Figure 3 illustrates the growth of the swine population in the state from 1978 to 1992 and the methane generated by their waste. The great concentration of swine populations in Duplin and Sampson Counties is especially notable.

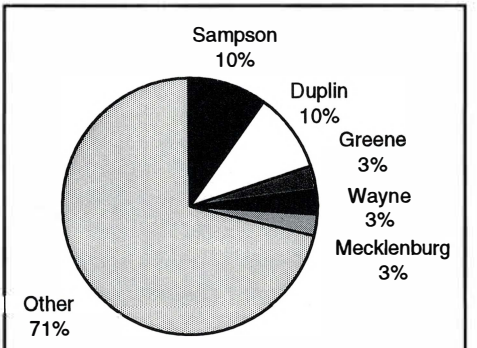

Figure 2: Total State Methane (tons/yr.).

North Carolinians generate large amounts of garbage in their everyday work and home environments. That waste is disposed of in a variety of ways, but by far the most common method of disposal is the sanitary landfill. Emissions of methane in the Piedmont are directly tied to decomposition of waste in landfills. Piedmont counties which produce high concentrations of methane include Mecklenburg, Guilford, Wake, and Forsyth, revealing a clear pattern of emissions rates being tied directly to population concentrations (Figure 4). Because of persistent problems with groundwater contamination from landfill leachate, the EPA has recently imposed stringent regulations on the construction and operation of landfills. As small landfills are decommissioned and more waste is shipped to large landfills, the spatial patterns of methane releases from landfills will change significantly. For example, the Watauga County landfill was closed in 1995 and waste is now trucked 100 miles to a private landfill in Forsyth County (Payne, 1997).

Methane generated by swine producers contributes significantly to greenhouse warming

Opportunities to Reduce Methane Emissions

While it is clear that human actions have substantially altered Earth's atmospheric chemistry, there are a number of steps that can be taken to reduce the volume of greenhouse gases added to the atmosphere each year (Thompson, et al., 1992). Greenhouse gases mix readily in the atmosphere, so all such emissions have impacts on the global atmosphere and climates worldwide will be affected by emissions regardless of their source. Nonetheless, actions to stabilize or reduce emissions must take place at the local level.

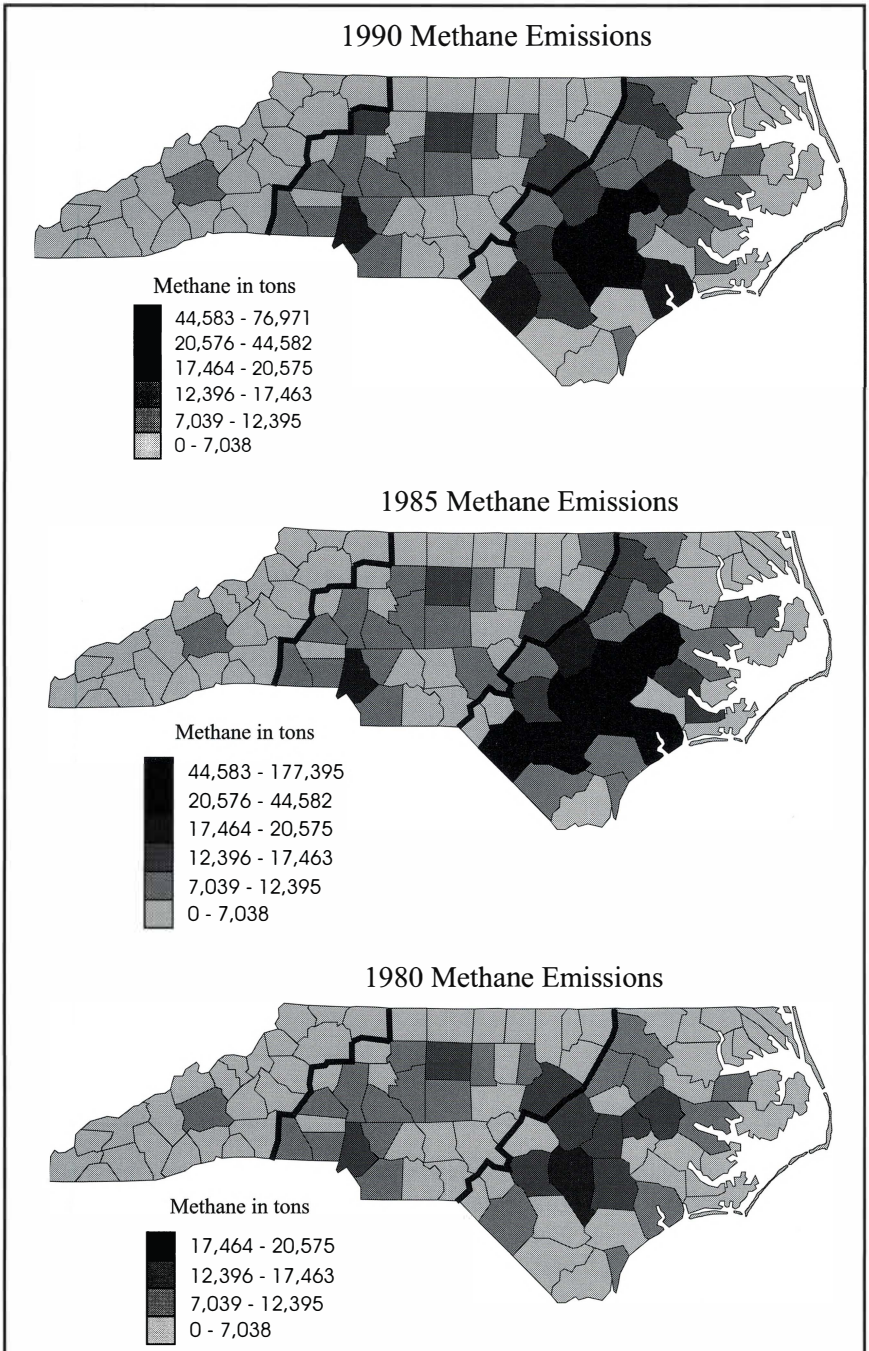

Figure 3: Methane Emissions for North Carolina 1980-1990.

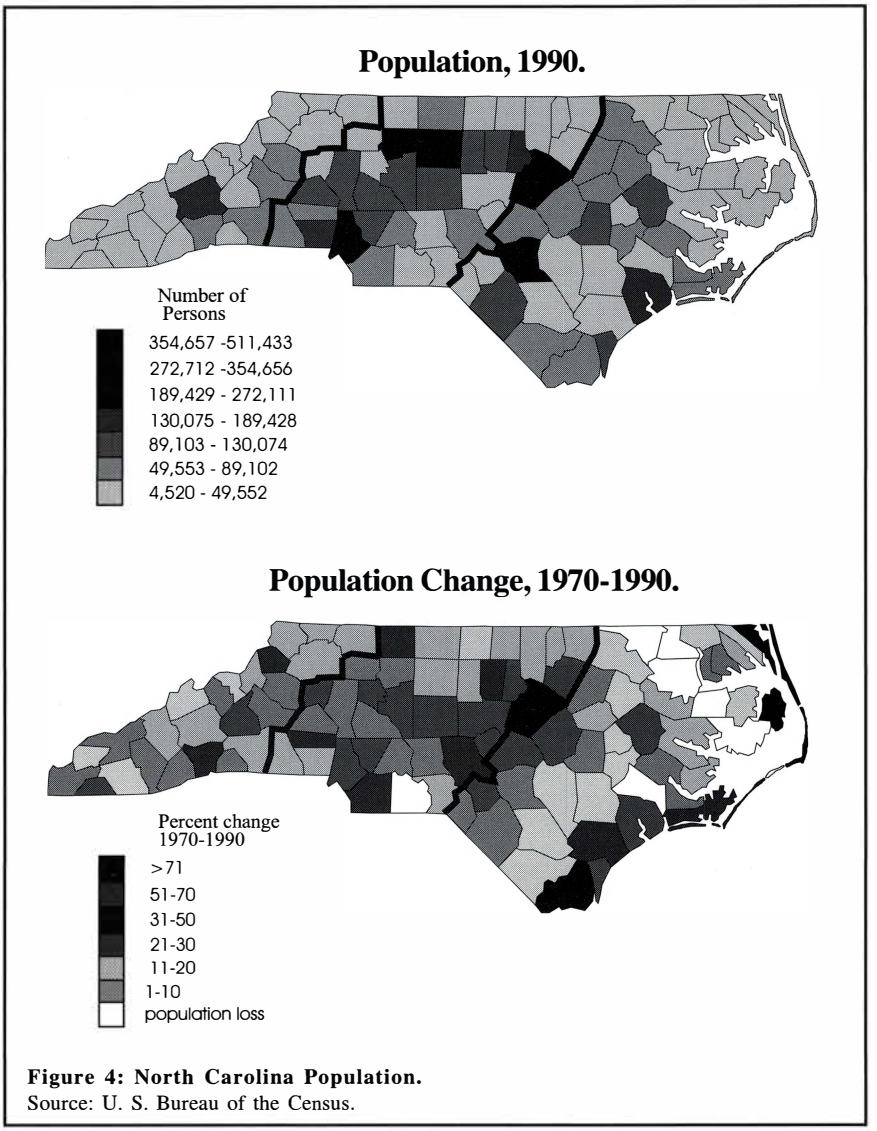

Figure 4: North Carolina Population.
Source: U. S. Bureau of the Census.

The steps that can be taken at the household level can be quite significant, as households account for approximately 36% of the greenhouse gases emitted in North Carolina. Any action that results in a reduction in fossil fuel use will reduce greenhouse gas emissions and generally save the household money at the same time. Simple, cost effective steps include driving fewer miles, using public transportation, driving a more fuel efficient automobile, and adding insulation to the home (Swisher, 1996). Corporate reductions in carbon dioxide emissions must focus on reducing coal consumption at power plants through more efficient com

bustion, co-generation, or by switching to natural gas, which releases less carbon dioxide per BTU of energy generated than coal.

Efforts are underway to stabilize and eventually reduce greenhouse gas emissions. The United States recently committed to participating in an international effort to reduce emissions in order to delay and minimize global warming. Some of the approaches recommended for achieving those goals are top-down in nature, meaning that they will be mandated by federal action and involve mandatory compliance. More recently, bottom-up approaches to greenhouse gas reductions have been recommended. A bottom-up approach means that decisions concerning greenhouse gas emissions and actions to mitigate production of those gases are made at the local level. The North Carolina Greenhouse Gas Inventory can contribute significantly to such a bottom-up approach because it identifies the geographic pattern of emissions within the state.

Methane production in North Carolina can be reduced in a variety of ways. In examining Figure 1, it is clear that the largest emissions of methane are associated with manure management from domesticated animals. The largest potential mitigation comes from that source category as well. By changing the manner in which swine, cattle, and poultry waste are collected and disposed of, methane emissions could be significantly reduced while also reducing offensive odors. One way to achieve this reduction in methane emissions is to capture the gas as it rises from waste ponds and to burn the methane for process heat on site. This heat can then be converted to steam to provide for the co-generation of electricity. The N.C. Division of Energy is currently experimenting with such systems (Soderberg, 1996).

Existing technology can aid in converting harmful methane gasses from landfills and animal waste management to usable forms of energy

Landfills are a significant source of methane. As new landfills are completed, it will become easier to capture fugitive methane than in the past, as most of the newer systems collect and burn or compress methane gases. Even if the gases are simply flared on site, a significant reduction in GWP is achieved as the methane is converted to CO_2 because CO_2 has a much lower GWP value than that of methane. If the gases are captured, compressed, and used as an energy source, even greater savings are achieved by having the energy content of the waste stream displace fossil fuel energy otherwise used. Either option will have the added benefit of reducing odors.

Remaining source categories account for only one fifth of the total emissions of methane in North Carolina, so savings potentials are much lower in the remaining categories. As with the previous source categories, however, additional benefits can also be gained at the same time that greenhouse emissions are reduced. Some categories, such as human emissions, are nearly impossible to reduce, while biomass fuel use and sewage treatment plants offer opportunities for substantial reductions.

Conclusions

Methane generated by residential, commercial, and industrial activities in North Carolina represent a significant proportion of the bundle of greenhouse gases emitted within the State each year. Geographic patterns of those emissions are directly related to the population patterns of people and domesticated animals. Counties such as Mecklenburg and Wake with large human populations emit large amounts of methane from solid waste disposal in landfills. But the largest methane emissions in North Carolina are in counties with large swine populations, with most of the emissions coming from waste lagoons.

The climate research community has succeeded in convincing governments and intergovernmental units that global warming is a very real concern. While predicted amounts and patterns of warming vary significantly, the impacts of even the least severe of those predictions will require extensive adaptation by most people on Earth (Henderson-Sellers, 1996). Impacts of warming will be unevenly distributed geographically and socially, with the poorest counties being least capable of adapting. Mitigation strategies that reduce greenhouse gas production could significantly reduce the amount of eventual warming, thus reducing adaptation costs and impacts substantially.

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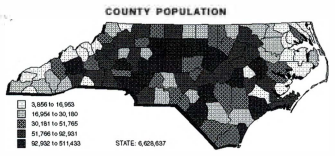

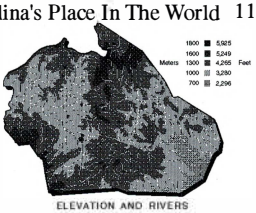

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The North Carolina Geographer
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RURAL GEOGRAPHY AND POLITICAL ECONOMY: A RESEARCH AGENDA FOR NORTH CAROLINA

Deborah Dixon

Introduction: Bringing Theory into the Picture

Rural geography has a long and worthy tradition within Geography, focusing on the emergence of particular rural-based regional complexes, and the trials and tribulations of agricultural industries (Gilig, 1985, 1991; Hart, 1977, 1978, 1980, 1986, 1991; Hart and Chestang, 1978; Napton, 1989). There has also been a tendency, however, to privilege empirics at the expense of theory. Such empirical analyses often fail to consider the complex of social processes that are at work in the transformation of the social landscape, as well as the interrelation between them. Explanation has tended to consist of the in-depth description of a few phenomena, categorized according to observable criteria, or an outright voluntarism.

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I would suggest that it is through a theoretically informed rural geography that the diversity of problems associated with rural areas can be addressed. As a whole, rural communities suffer not only from high levels of outmigration and illiteracy, but also low levels of affordable housing, institutional and organizational infrastructure, and credit. Thirteen percent of rural Americans have incomes below the poverty line, while persistent poverty is concentrated in particular areas such as Appalachia, the Atlantic Coastal Plain, the lower Mississippi Delta, and the US-Mexico border. It has become clear that such poverty is not the inherent quality of such places and their inhabitants, but is rather the culmination of various economic, political and social processes — it is very much a (re)produced complex of diverse social relations of power reaching well beyond the confines of locale to the halls of Washington D.C., the headquarters of multinational corporations, and the film and TV production stations of California.

The author argues in favor of a firm theoretical foundation for much needed North Carolina rural research

The complexity of crises facing many rural communities has provided an impetus to those research initiatives that provide theoretically and empirically-informed analyses of the economic and political processes transforming these communities. Within the last few years rural geographers have begun to specifically address issues of economic and political restructuring in rural areas (Cloke, 1980, 1985, 1989, 1996; Cloke and Little, 1995; Gilig, 1991; Harvey, 1993; Lowe, Marsden and Whatmore, 1990; Marsden, Lowe and Whatmore, 1990a, 1990b). In view of the volume and importance of this work and the rapid rate at which it is being produced, the time has come to take stock of progress in research on the transformation of ruralities.

The Relevancy of Research on Rural Transformation

The question arises, however, as to whether the "rural" constitutes a distinct area of study for geographers? While the definition of "rural" as an economic system has been much transformed over recent decades I would suggest, however, that the term still captures a distinct mode of living and, as such, remains a legitimate site of study. "Rural" is no longer synonymous with "agricultural," as family farms continue to disappear off the map and manufacturing, services and retirement centers gain in economic significance as well visibility (Swanson, 1990). Defining rural geography on the basis of a distinctly agricultural mode of production is clearly inappropriate. While new industries offer employment opportunities in areas previously dominated by tobacco, for example, the repercussions of this shift for labor, residential and public services, must be considered. Indeed, it is this same transformation of the meaning of the term "rural" that becomes an extremely relevant avenue for research. Within recent years we have witnessed a proliferation of programs and initiatives designed at all levels of the state to ameliorate economic decline and/or promote economic development in "rural" areas (Farrington and Babbington, 1995; Galston, 1992; Radin et al, 1996; Sears and Reid, 1992). We must consider not only how ruralities are being *reshaped* by these initiatives, but also the reasons why the term "rural" continues to evoke a high level of concern and debate within the political realm. Furthermore, even though agriculture is no longer the primary determinant of what is to be considered "rural" this particular economic sector continues to provide challenging research avenues. The increasing significance of the poultry and hog industries to regional economies, for example, is an area ripe for research. With the addition of a new layer of female and Hispanic workers into rural labor markets, questions arise as to the social transformation of rural communities (Cravey, 1996). Similarly, with the decline of the family farm questions arise as to the place of this economic unit within particular agricultural industries. While the fate of such farms has become something of a *cause celebre*, we need much more careful assessments of the specific geography and history of this "crisis."

Theorizing Place, Structure and Process

Economic transformations of rural areas are fed by the decline of the family farm, the rise of corporate agriculture, and the global marketplace

It is largely through the work of Harvey (1985a, 1985b) that theorizations associated with political economy have entered, and tranformed, the Geographic discipline. While Harvey's work focuses primarily on urban areas as the locus of production, his theorization of the space produced by capitalism has had a tremendous impact on rural research (Kelli and Dixon, 1996). The current problems associated with rural areas can be divided into two categories, namely economic and political restructuring. Economic problems have usually been contextualized within a broad political economic framework that link economic recession in particular locales to shifts within the national and international political economy (Cloke, 1989; Harvey, 1993; Marsden, Lowe and

Whatmore, 1990a, 1990b). Particular places are not conceived of as independent entities, but are caught up in universal processes of financial flows, international divisions of labor, and the operation of global financial markets. This global system, and thereby the places which constitute it, is undergoing constant economic restructuring, as capital is dis-invested and reinvested from sector to sector, firm to firm, and place to place in an attempt to maintain profitability. The plight of rural manufacturing, for example, can be laid at the door of wider economic restructuring processes, as industry relocates to areas with cheaper, less unionized labor, frequently overseas. The service industries coming into rural areas tend to offer less skilled, lower wage, jobs than their predecessors. As capital moves out of one place and into another the impacts upon local communities, especially those dependent on one industrial sector, can be tremendous — impacts which exacerbate the uneven development of the social landscape. As a consequence of falling state and local tax revenues, for example, the social and physical infrastructure of rural areas becomes increasingly obsolete. Banks continue to avoid high risk agricultural ventures, while canals, irrigation streams and sewers slowly deteriorate. Rural schools remain chronically underfunded, while interstate highways and local routes await repairs.

The state has usually been conceptualized as an agent of capital, in that government plays a key role in both facilitating the process of economic restructuring noted above. Political programs and subsidies for agricultural industry have facilitated the transition from family farm enterprises to contract farming or conglomerate farming. Part and parcel of this 'transformation' is a reconfiguration of the image of an area and its inhabitants, as associations with the 'old', "traditional," "backward looking" family farms are put aside, and "progress" revolves around the "high-tech," "profitable" agribusinesses and their accompanying consumption-based life styles. The state ensures the accumulation of profit, but also ameliorates its impacts, thereby ensuring some measure of social welfare. As a whole, federal spending in rural areas has been a matter of transfer payments, such as welfare payments and pensions, rather than investments — a form of funding that does not usually increase income generating capacity.

Social transformations of rural areas are conditioned by a changing labor market increasingly attractive to female and Hispanic workers

So far, the overwhelming opinion of rural geographers has been that these economic and political restructuring processes have proven detrimental to the local communities within which they are embedded. While corporate farming, for example, has been much touted within the private sector as the potential "savior" of rural jobs, and indeed has been facilitated by the emergent "new governance' state apparatus" (Meadows, 1995; Radin et al, 1996), the prevailing opinion on behalf of rural geographers is that increasing vertical integration in the economic and political arenas has exacerbated economic inequalities in rural areas, and has led to a democratic deficit (Cloke, 1989; 1996; Harvey, 1993; Marsden, Lowe and Whatmore, 1990b). This vertical integration, for example, may consist of the grow-

ing dominance of a small number of firms over all aspects of hog farming, and the establishment of new agencies (combining state personnel from all levels of government and members of the private sector) concerned solely with issues of rural development.

A broadly conceived of political economic framework, then, allows for a consideration of the underlying social processes at work in the reconfiguration of places such as rural North Carolina. Economic restructuring has certainly been a major factor in the recent shifts in capital investment away from manufacturing and toward more postindustrial industries and services, as well as the changing relationship between capital and labor (Oakey and Cooper, 1989). Case study research has identified the historical and geographical emergence of corporate and contract farming within agri-business as well as the increasing significance of *non*-agricultural employment in rural areas (Marsden, Lowe, and Whatmore, 1990a). Researchers have also undertaken: an analysis of the comparative success rate of corporate as opposed to family farm enterprises in the region (Meadows, 1995); a comparison of the economic effects generated by corporate and family farm enterprises; and an evaluation of the pros and cons of the shift toward large-scale agricultural industrialization within particular regions (Furuseth, 1996; Lands and Leigh, 1996). Furthermore, in the face of rising unemployment and decreasing income, local governments have indeed joined with centrally funded development agencies in aiding this transfer. More often than not, the local state has proven willing to enter into partnerships with local business to attract capital through the aggressive promotion of place (Mackenzie, 1992; Sprouse, 1996).

The theoretical framework thus presented has not gone unchallenged, however. One of the most prevalent critiques of political economy has been that it is too deterministic in its conception of social relations (Jackson, 1989, 1991; Williams, 1973, 1980). In response, researchers working within this approach have explored the contributions that can be made from the incorporation of cultural materialism. Such an approach differs from a more rigid political economic perspective in the belief that change in this socio-cultural matrix cannot be simply read off from changes in the economic organization of society. Rather, economic processes are themselves constituted from cultural meanings. For Jackson (1991), the goal of academic research should be:

> ... to explore specific intersections between the ideological and the material, the cultural and the political, regarding these terms not as separate domains but as a single field in which, to varying degrees in different times and places, the cultural is political (p. 200).

It is through the cultural materialist approach that this criticism has been most strongly articulated. The use of the term "materialism" denotes the retention of the idea that beliefs are constructed out of the social world,[1] while the term "culture" denotes the assertion of the significance of socially determined meanings and beliefs. Within this reformulation of the scope and goals of academic research the theorization of "place" has changed. Rather than view place as the residual effect

of capitalist accumulation, it is perceived to be actively constructed and invested with meaning. This reconceptualization of place can be most clearly seen in Williams' (1973) work on the city and the countryside (1973), wherein the shifting views and beliefs pertaining to these two types of places are assessed in the light of the actual material relations between them. The gradually decreasing role of agricultural labor, for example, has repercussions in the gradual emergence of a view of the countryside as a place for recreation rather than work.

The impact of cultural materialism on rural geography has become more manifest in the 1990s — this impact has, however, been limited to the work of British rural geographers (Milbourne, 1996; Murdoch and Pratt, 1993; Philo, 1992, 1993), who have drawn attention to the ways in which social relations of power constitute meanings such as "rural" itself. In particular, attention has been paid to the attempt to mandate, or codify, the meaning of "place" (in regard to its "past," "present" and "future") and the "place" of inhabitants within it, such that those meanings in turn serve, or maintain, social relations of power. This is the "framing" of a discursive site, and is reliant on the institutional complex from which various positions are articulated. Research, then, becomes a matter not of "exposing" the original intent behind various messages, but rather of deconstructing the ways in which the message itself articulates particular notions of the "real." As Philo notes:

The decreasing role of agricultural labor is leading to the perception of rural areas as places of recreation rather than work

> ... the rural is not some stable, pre-given even natural phenomena awaiting insertion in academic rural studies, but is actually something constructed in varying ways and with varying emphases in a variety of settings (1993, p. 434).

Establishing A Research Agenda

If we turn our attention to one particular area, North Carolina, as an arena within which rural geographers work, then we can identify numerous opportunities for theoretically and empirically informed analyses, including, but certainly not limited to, an assessment of::

(1) The relative decline of cash crops such as tobacco, and the increasing significance of livestock, particularly poultry and hogs, within the regional economy. As these two latter industries diffuse across the state from west to east, dramatic transformations have been wrought in regard to numbers of farm workers, number and size of farms, farm income and so on. Rather than be content to track this diffusion, rural geographers should examine the causal processes behind this transformation, noting the embeddedness of these industries within wider social structures such as capitalism. How is this transformation being financed? How are labor relations within these industries being reworked? What is the role of the state? The manifold repercussions of the shift from tobacco to poultry and hogs must be assessed. What accompanying changes have occurred in rural labor markets? What has been the impact on residential and service sectors?

(2) Current debates on the need to peel back governmental subsidies for various agricultural industries.With the proposed revival of a free market economy, what are the potential effects of this on farm-based industries such as peanut production? Why has this move towards free trade conditions arisen at this point in time? How would the proposed changes impact the US' international trade in farm products? and,

(3) Current debates on the need to maintain "rural community" initiated by the federal Farm Bills and maintained by the Rural Development Initiatives and Councils. How is the "rural" being defined within this political context? How will the state's resources be deployed in order to achieve this aim? What particular types of development strategies are being suggested and funded? How do these strategies support some social relations of power and undermine others?

All of the above research avenues are relevant in and of themselves to rural transformation in North Carolina, focusing as they do on economic, political and social changes currently underway, but they are also generative of *other* research questions. This is so because they are written from within a particular theoretical framework, namely political economy. For rural geography to continue as a vibrant sub-field within the discipline, its researchers must be committed to theoretically and empirically informed analyses. In formulating actual research questions, and establishing a mode of inquiry through which answers can be ascertained, the importance of theory cannot be understated, for it is theory that informs our understanding of how the events and processes we examine are constituted, maintained or transformed. Whether that theory is derived from political economy, cultural materialism, or other strands of thought within and beyond Geography, it provides a context wherein epistemological inquiry can be formulated, carried through and evaluated. If North Carolina Geographers are to continue to make a contribution to the wider discipline, we must take advantage of cutting-edge developments in our various sub-fields, noting what is informative, what is faciliatory and, most importantly, what gives us pause for thought.

Three aspects are here suggested as important for new research, the relative decline of cash crops; the decline of agricultural subsidies, and the "need" to maintain the concept of the rural community

Ideas, or attitudes/beliefs are not presumed to be immanent categories of the mind but are viewed, rather, as ensuant from the input of sensory data from a knowable world. This is the material world of experience. Social knowledge and action, then, depend on the particular socio-cultural matrix surrounding the individual. Such a matrix is composed of intersubjective meanings, consisting of inherited values, institutionalized roles and social norms. Social action depends on the agent's "definition of the situation."

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THE MASTER OF ARTS IN GEOGRAPHY
THE UNIVERSITY OF NORTH CAROLINA CHARLOTTE

The MA in Geography at UNC Charlotte emphasizes the application of skills, methods and theory to problem solving in contemporary society. Students are offered a solid foundation in research methods, problem formulation, quantitative methods and computer and GIS skills. Many UNCC graduates have gone directly into jobs working as professional geographers using skills acquired in their MA program. Jobs include research and/or marketing specialists, location analysts, planners, transportation specialists and private consultants. About 15 percent of the more than 100 graduates have gone on to study in Ph.D. programs.

CHARACTERISTICS.

- About 55-60 students are in residence; 25% are part-time.
- There are 23 faculty teaching in the Department.
- Class sizes; are small; student and faculty contact are close; community involvement in class projects.
- The 36 hour program normally requires 4 semesters or 2 years for a full-time student to complete.
- Funding is available on a competitive basis; about one-half of all full-time, current students have funding.
- Excellent Spatial Analysis Laboratory with ARC/INFO GIS (workstation and PC) and ERDAS image processing system (workstations).
- The Department manages the Center for Transportation Studies which contains a research laboratory.

THE INTERNSHIP. As a program which emphasizes applied geography, the Internship is an especially important element and normally replaces the traditional thesis as the capstone project of a graduate program. Projects normally involve the students in the execution of a substantive research task for private or public sector clients where the student is the primary investigator in a specific "real world" research task.

PROGRAM CONCENTRATIONS

ENVIRONMENTAL ANALYSIS AND ASSESSMENT

The environmental concentration draws upon the expertise of practitioners and professionals and a diverse earth science and geography faculty. There are three main courses of study: hydrologic processes; atmospheric studies; and an interdisciplinary focus which includes environmental assessment and planning.

URBAN-REGIONAL ANALYSIS AND PLANNING

Students in the urban-regional analysis and planning concentration normally pursue course work in one of the following areas:

planning theory public facility siting regional development impact analysis
urban planning environmental planning site feasibility analysis urban theory

Students normally become planners in public sector planning agencies.

LOCATION ANALYSIS

The location analysis concentration offers course work in:

retail location trade area analysis facility siting
office and industrial location real estate development applied population analysis

This concentration prepares students for jobs in location research with retail companies, real estate developers, consulting firms, commercial banks, and economic development agencies or for continued academic training in economic geography and location analysis.

TRANSPORTATION STUDIES

Students in transportation studies can pursue course work in transportation systems analysis, policy formulation, impact analysis, and planning. This concentration prepares students for jobs in the public sector as planners and the private sector, usually as analysts for transportation providers and private consulting companies.

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