

DEMOGRAPHIC PROFILE AND SPATIAL ANALYSIS OF SUGARCANE GROWERS IN LOUISIANA

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ABSTRACT

The sugarcane industry is an important agricultural sector in Louisiana with regards to farm gate value and added value. This analysis explores the demographic profile and spatial distribution of sugarcane growers in Louisiana. Results from a survey taken in the fall of 2004 suggest that growers are not optimistic about the economic future of the sugar industry. Spatial analysis shows a high degree of spatial dependency and evidence of clustering. Grower clustering can facilitate investments in new business opportunities, speed-up the adoption of new technologies, and support the emergence of a new value-added industry. These findings can have implications on policy development, potential networking and business cooperation that might take place on a regional cluster basis in the future to enhance industry competitiveness.

INTRODUCTION

Currently, sugarcane production in the U.S. occurs in the states of Florida, Louisiana, Texas, and Hawaii (2003/04 U.S. Sugar Industry Directory). Sugarcane has been produced in Louisiana since 1751 (Louisiana State University Agricultural Center, 2001) and currently produces about 20 percent of the sugar grown in the United States (beets and cane). According to the American Sugar Cane League (ASCL, 2004) approximately 27,000 jobs are directly linked to the sugar industry in Louisiana. Since 1963, the number of farms growing sugarcane has declined from 2,308 to 733 in 2003. However, the total number of acres has increased from 322,029 to 483,000 for the same time period suggesting consolidation of sugarcane farms.

Sugarcane farming and processing is an important segment of the agricultural sector in the State of Louisiana. According to the Louisiana State University Agricultural Center (2004), sugarcane contributed nearly \$496.3 million dollars to the state economy in 2004. This was comprised of gross farm income of \$302,609,016 and value-added of \$193,669,770. Aside from forestry, this exceeds all other agricultural crop commodities grown in Louisiana. Sugarcane production has increased substantially in Louisiana in recent years, largely in response to deteriorating economic conditions for production of other cash crops. LSU AgCenter projections indicate that sugarcane was the only crop providing positive cash returns to Louisiana growers in 2001 (Wu et al., 2005).

Spatial analysis is the process of extracting or creating new information about a set of geographic features. Spatial data consist of measurements taken at specific (known) locations or within a specified area. Spatial data analysis extends and modifies standard statistical techniques so that data point locations and their arrangement are given greater importance in the analysis of results. In the context of this study, we will use spatial statistical tools to locate any clusters of sugarcane growers in Louisiana.

The theory of clusters is premised on the notion that companies tend to spatially concentrate in places where they experience unusual competitive success. A cluster is a critical mass of companies in a particular field in a particular location (Porter, 1998b). Clusters are geographic concentrations of a group or groups of companies encompassing related industries in an industry supply chain (Porter 1998a; Porter 1998b). They may include input suppliers, ancillary service providers, or providers of specialized infrastructure. Clusters can extend horizontally or vertically to take advantage of production and commercialization efficiencies.

The study and identification of clusters can contribute to a better understanding of contemporary patterns, processes of industrial transformation, industry competitiveness and regional development (Hallencreutz and Lundquist, 2003; Peneder, 1995). The current shift in industrial and regional policies towards adopting cluster-based economic development strategies highlights the importance of clustering in current business models (Hallencreutz and Lundquist, 2003).

The objectives were to explore the demographics of Louisiana sugarcane growers and determine their perspectives on the future of the sector, spatial distribution, and possible clustering within the industry.

MATERIALS AND METHODS

This study was conducted in the fall of 2004. Data for the demographics part of the study were collected using a mailed questionnaire to a census of sugarcane processors in Louisiana (U.S. Sugar Industry Directory 2003/2004). The process of questionnaire design followed the Tailored Design Method (Dillman, 2000). Mail questionnaire procedures consisted of one survey mailing accompanied by a cover letter on ASCL letterhead signed by both the Executive Director of the ASCL and the Director of the LSU AgCenter's Louisiana Forest Products Development Center. Key informants were grower principals. The questionnaire instrument tested constructs using measures developed and pre-tested by the authors, as well as measures adapted from previous studies.

Spatial point patterns were studied using geographical location of sugarcane farms. Zip code data for each grower was obtained from the ASCL (2004). The original ASCL database includes 600 growers. The zip codes for these companies were matched against the 5-digit zip code tabulation areas available from the U.S. Census Bureau (2004) for Louisiana. Only those companies for which their five-digit code coincided with the cartographic maps were used in this study. Frequencies aggregated by zip code were calculated. The next step was to geo-reference the centroids (lat-long coordinates of the zip codes) using a map projection for the state of Louisiana (U.S. NADCOM 1983, zone 15).

Spatial analysis consisted of the study of spatial dependency and deviations from complete spatial randomness. Classical variogram is a measure of the continuity of spatial data expressed as an average squared difference between measured quantities at different locations (Bailey and Gatrell, 1995). Typically a variogram estimate is created for a specific distance

interval defined by the number of lags in the model (Cressie, 1993). To identify any clustering patterns for sugarcane farmers, two methods were tested: a binning measure of intensity, and Lhat analysis to estimate deviation of the spatial distribution of sugarcane farms from complete spatial randomness.

RESULTS AND DISCUSSION

Demographics

Of the 600 surveys sent, 143 were returned for a 24 percent response rate. Respondents currently own/lease an average of 1,400 acres of sugarcane farmland but 30 percent expect the number of acres they farm for sugarcane to decrease in the next five years. The greatest source of competition is sugarcane growers in other countries (87 percent of respondents) and 76 percent characterized the future of sugarcane industry in Louisiana as bleak. Seventy-three percent said that they produce less cane in 2004 relative to 2003. With regards to alternatives, 52 percent of respondents said they have considered farming crops besides sugarcane and 31 percent said they have considered growing sugarcane for products other than sugar.

Grower 2003 gross sales are shown in Figure 1. Nearly one-third of respondents had sales between ½ and 1 million dollars. Just over 50 percent of respondents have five or fewer employees while 31 percent had between six and 120 employees (Figure 2).

Growers are primarily represented by family corporations (48 percent of respondents) followed by family non-incorporated operations (33 percent of respondents) (Figure 3). Respondents both own and lease land in Louisiana. On average, respondents own 255 acres with a spread from 0 to 5,000 acres (Table 1). On average, respondents lease significantly more acreage (1,176 acres) ranging from 0 to 6,565 acres.

We also tried to evaluate how growers felt about the future of the sugar industry in Louisiana. The first question was how they perceived the number of acres of cane they think they will grow over the next 5 years might change. Half said they thought the number of acres would remain the same; 31 percent said it would decrease and 19 percent were optimistic and felt that the number of acres planted will increase. The picture is bleaker when we asked about the number of tons of sugar that they anticipated producing in 2004 relative to the previous year. Seventy-three percent of respondents said they would produce less, 17 percent said they would produce about the same and 10 percent said more sugar would be produced. With regard to prices received for sugar in 2003, the majority of growers (58 percent) said they received 20.0-20.9 cents/lb. An additional 27 percent of respondents said they received 19.0-19.9 cents (Figure 4). Just over half of respondents sold their cane in 2003 to privately owned mills while a third sold to cooperative mills. A total of 15 percent of the respondents sold to both privately owned mills and cooperative mills.

The greatest source of competition for growers by far is growers in other countries (87 percent of respondents) followed by growers in Louisiana (6 percent of respondents). Only 4 percent said they do not feel that they have any competition. Another way we looked at competitive pressures was to ask growers what they felt were the greatest challenges in general

to their success as a sugarcane grower in Louisiana. Consistent with the previous question, global competition heads the list of challenges (Table 2). Additional challenges that were found to be significant are volatile pricing, weather-related issues and lack of government support. Least influencing challenges are competition from growers in other states, delivery problems getting to processors, lack of adequate machinery or competition from Louisiana growers.

Spatial Distribution/Clustering

Figure 5 shows a map of Louisiana in which the blocks represent areas corresponding to different zip codes as projected to a lat-long scale using the ArcGIS software package.

Spatial analysis

A classical variogram was produced to model the frequency of sugarcane farms as a function of their spatial location (Figure 6). The variogram indicates that beyond 18.49 kilometers, the frequency of primary companies becomes independent. The nugget effect was “0”. Spatial analysis suggests that the number of sugarcane farms among contiguous zip code blocks varies within a certain perimeter but then tends to fade out. This is clearly seen on Figure 5 where there is a higher concentration and variability in the number of farms, particularly in the South Central part of the State. Note that these frequencies decline as distances get larger. The variogram suggests that at distances above 18.49 kilometers (11.5 miles) the variability in the number of sugarcane farmers is reduced and eventually results in no presence of sugarcane farms.

Cluster patterns

To identify any clustering patterns for sugarcane farmers two methods were tested: a binning measure of intensity and deviation of the spatial distribution of sugarcane farms from Complete Spatial Randomness using a Lhat analysis (Figure 7). The Lhat analysis does not offer strong evidence of clustering as it is denoted by results that do not deviate from a straight 45 degree line. However, a binning method with a 0.1 smoothing parameter better depicts a higher concentration of sugarcane farms in the southern-central part of the state. In Figure 8 a lighter color indicates a higher incidence of farms. Note that the analysis suggests three major clusters of sugarcane growers in Louisiana. The largest concentration occurs around Iberia and St. Martin parishes followed by concentrations in Assumption and Lafourche parishes and then Iberville parish.

Some of the elements that encourage companies to be a part of a cluster include proximity to markets, access to plentiful supply of raw materials and potential customers, and skilled labor (Braden et al. 1998). Clusters enhance competitiveness in three ways according to Porter (2004). First, firms can improve productivity because transaction costs are low. Second, clusters foster innovation by increasing the ability of companies to perceive opportunities for new products, new processes, and meeting new needs due to the sheer concentration of entities in the field. Third, clusters facilitate the commercialization of innovation by lowering the barriers to entry of new firms via startups, spin-offs and new business lines of established firms.

The clusters identified in this study constitute core nuclei that embody fundamental commonalities that can lead to successful agricultural-driven economic development. Although not all growers fit neatly into a cluster with common characteristics, they may have a “reach” or

peripheral interface that can allow them to link to mutual support, develop scale economies through participation, and have better access to market information. By locating close to each other farmers can benefit from better access to information regarding prices for inputs and can also expedite transferring of new technologies within the cluster. Given the nature of the sugarcane industry, plantations have to occur in sufficiently large extensions to supply enough input material to local processing mills. Hence, sugarcane production occurs in specific areas and at a minimum scope to meet scale levels that make sugarcane production and processing financially feasible. There are other factors such as soil quality or just family tradition that may also play an important role in the geographic concentration of farmers but these were not included in this analysis.

The Louisiana Department of Economic Development has adopted a cluster-based development program named “Vision 2020”. Cluster development in Louisiana focuses on establishing a geographic concentration of interrelated companies and institutions that comprise a particular field of linked industries. The Louisiana Department of Economic Development has identified eight clusters of traditional industries in the states, one of which is agriculture and food products. One of the objectives behind the adoption of “Vision 2020” is to retain, modernize, and grow Louisiana’s existing industries and grow emerging technology-based businesses through cluster-based development practices (Louisiana Department of Economic Development 2003).

In the case of the sugarcane sector, it is a well-established industry in the state that already presents a geographic cluster pattern. Such spatial aggregation of farmers can facilitate any efforts aimed toward the development of the sugar production and processing sector. Progress of an industry with a cluster location is easier than in a different scenario because most of the needed inputs are locally available (Porter, 2004). Furthermore, commercialization is eased by the cluster awareness and expertise among industry participants.

Efforts toward the strengthening and development of the sugarcane sector may be focused on the development and adoption of new technologies, product diversification and value added. While growers consider they may not be able to compete in the global market for sugar, they may explore new alternatives such as composite products (Wu et al., 2005), ethanol production, cogeneration of electricity, or further-processed sugar into other valued added products. Close linkages between farmers and processing mills can facilitate investments in new business opportunities and speed-up the adoption of new technologies. A larger producer base can also assure sufficient levels of production to support potential new demands from emerging industries. A sufficient sugarcane supply is a prerequisite to sustain the development of any new industries.

The proximity between farmers and mills may support the development of a new industry structure, which does not target sugar commodity markets, but develops specialty products for niche markets with higher product revenue. The industry is facing tremendous global competition and should seek new markets that can prove to be more profitable than the current commodity market. Future research could build on this analysis to identify geo-spatial locations of supply chain members in the sugar sector, model more complex business relations, and

ultimately identify additional socio-economic factors that may contribute to or hinder supply chain success.

CONCLUSIONS

Aside from forestry, sugarcane exceeds all other agricultural crop commodities in the State of Louisiana. The sugarcane sector in the state currently faces tremendous challenges. Results of this study suggest that growers do not believe that the sugarcane industry has a bright future, many foresee a decline in total acreage planted and the majority of respondents expect total harvest to decrease in the next five years. Sugarcane growers in Louisiana expect these effects as results of competition mainly coming from foreign imports.

The results of this spatial analysis suggest that sugarcane growers conglomerate in clusters. Such spatial aggregation of farms can facilitate any efforts aimed toward the development of the sugarcane production & processing sector and it is a prerequisite for a new industry structure. The clusters identified in this study constitute core nuclei that embody fundamental commonalities that can lead to successful agricultural-driven economic development. Although not all growers fit neatly into a cluster with common characteristics, they may have a “reach” or peripheral interface that can allow them to link to mutual support, develop scale economies through participation, and have better access to market information. Cluster-based economic development can support regional based economic development, industrial recruitment strategies, and downstream value-added manufacturing corporate site location decision-making.

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Table 1. Current land use of owned or leased land of Louisiana sugarcane growers.

	N†	Minimum	Maximum	Mean	Standard Deviation
Owned Acres					
Sugarcane	68	5	3,084	396	585.32
Fallow land	36	6	1,171	148	215.16
Other crops	9	0	2,350	451	749.82
Cattle	5	10	60	28	21.67
Total	143	0	5,000	255	659.47
Leased Acres					
Sugarcane	130	17	4,915	1,014	735.98
Fallow land	91	6	1,650	315	256.73
Other crops	20	0	1,200	319	351.30
Cattle	7	0	400	86	140.78
Total	143	0	6,565	1,176	976.18

† Number of respondent Louisiana sugarcane growers.

Table 2. Survey results on challenges to the success of Louisiana sugarcane growers.

	Strongly Disagree	Somewhat Disagree	Neither Disagree Nor Agree	Somewhat Agree	Strongly Agree
Competition from global producers	4%	2%	1%	12%	82%
Volatile pricing	1%	3%	10%	22%	63%
Weather-related issues	1%	3%	14%	24%	58%
Lack of government support	5%	7%	18%	16%	54%
Getting quality employees	4%	5%	17%	26%	47%
Workman's compensation	4%	4%	27%	26%	40%
Federal taxes	8%	9%	32%	18%	33%
Room for expansion	6%	11%	31%	22%	31%
Labor costs	4%	4%	35%	30%	27%
Productivity of labor	7%	5%	33%	30%	25%
State taxes	10%	10%	38%	17%	24%
Unskilled labor supply	6%	11%	38%	23%	22%
Skilled labor supply	4%	11%	40%	23%	22%
Available capital	11%	10%	35%	23%	22%
Bank financing	13%	14%	31%	20%	20%
Not having enough capacity	8%	9%	44%	19%	20%
Local taxes	12%	11%	41%	17%	18%
Community industrial climate	5%	10%	48%	21%	15%
Inefficient processing capabilities	22%	22%	29%	13%	14%
Competition from producers in other states	10%	15%	45%	18%	13%
Delivery problems in getting cane to a mill	17%	19%	35%	16%	13%
Lack of adequate machinery	23%	20%	37%	9%	12%
Competition from producers in Louisiana	23%	16%	45%	12%	4%
Mean	9%	10%	31%	20%	30%

Figure 1. Gross sales and percent of respondents of Louisiana sugarcane growers in 2003 (n=143).

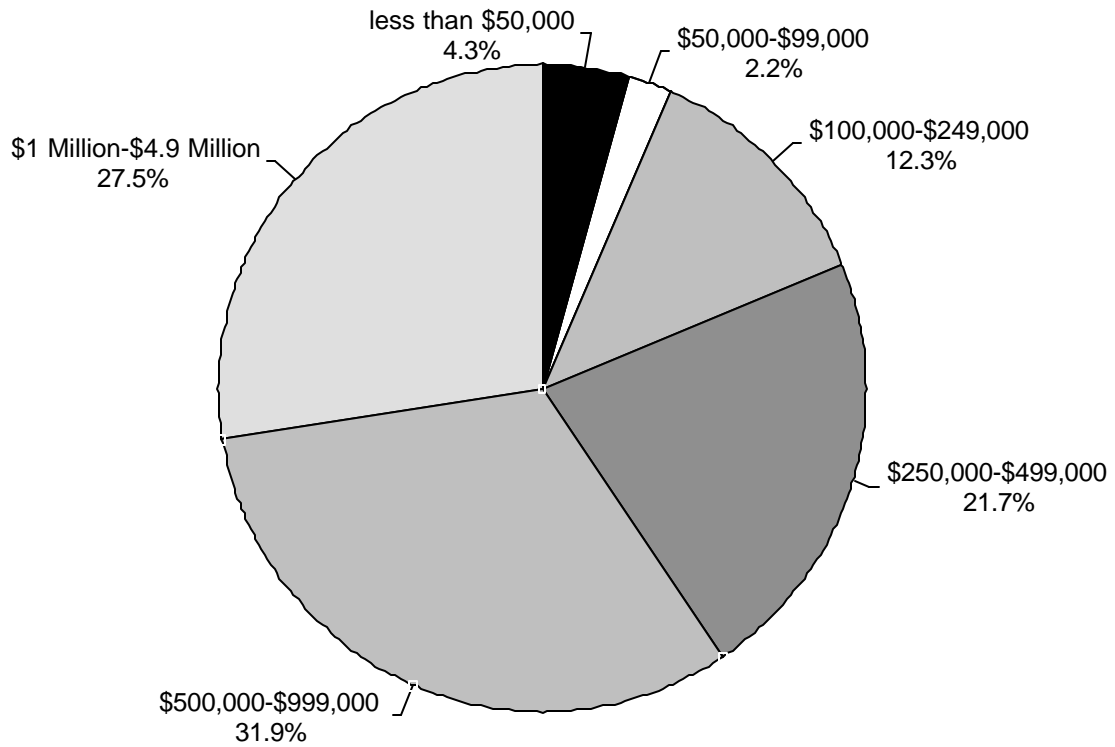


Figure 2. Number of employees and percent of respondents of Louisiana sugarcane growers in 2003 (n=143).

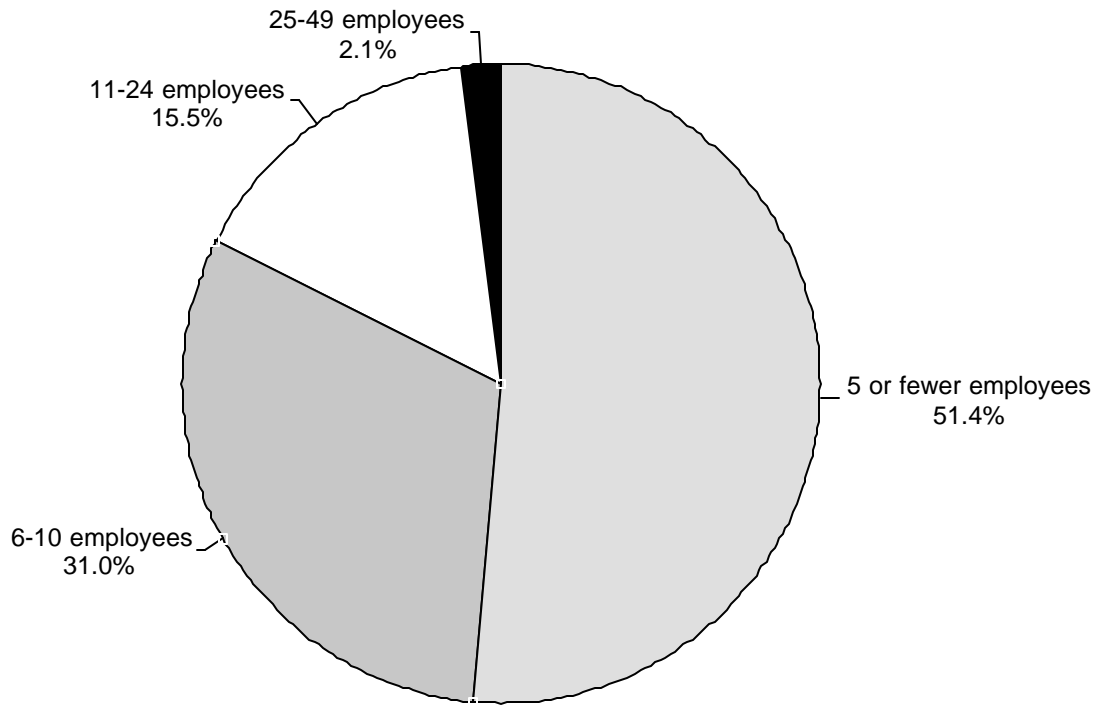


Figure 3. Ownership structure and percent of respondents of Louisiana sugarcane growers (n=141).

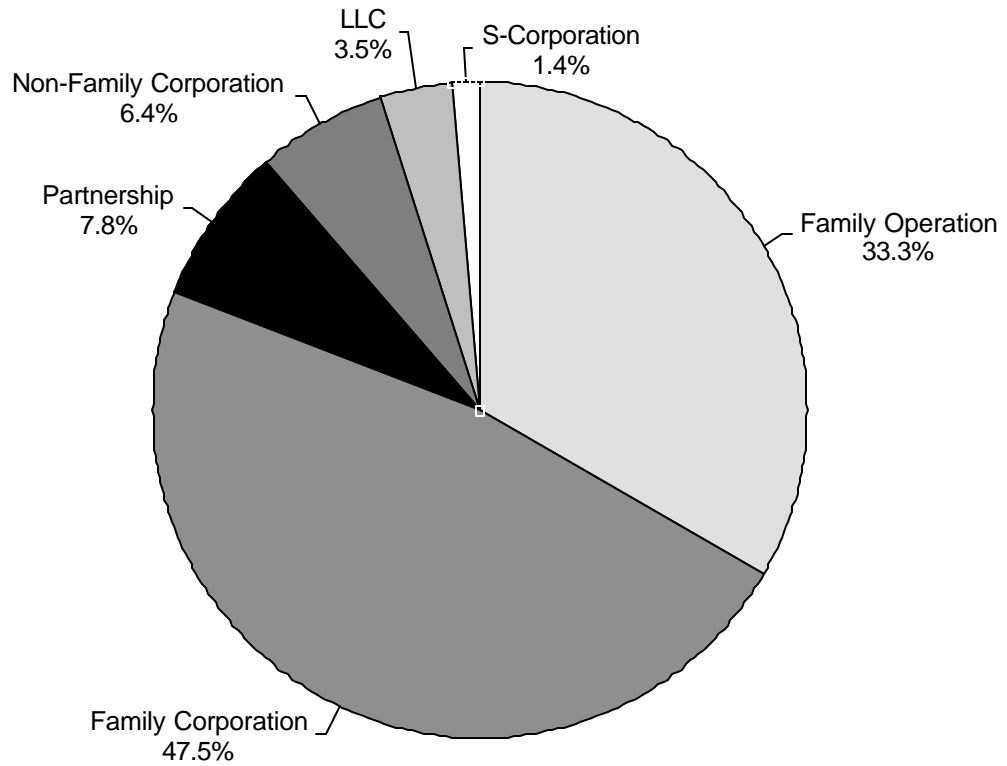


Figure 4. Average price received for sugar and percent of respondents of Louisiana sugarcane growers in 2003 (n=143).

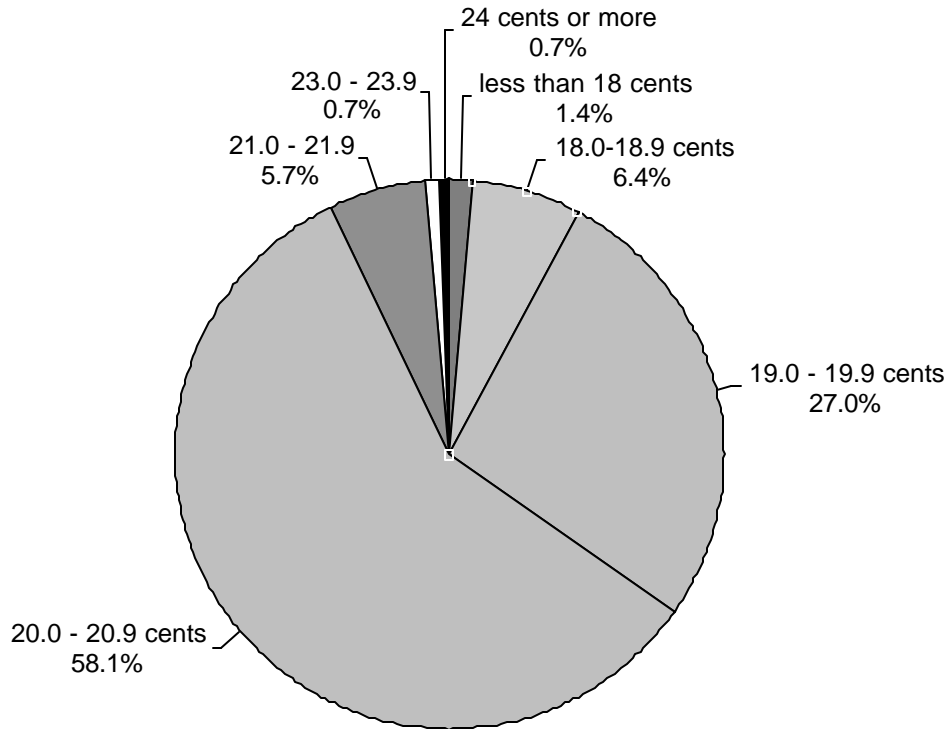


Figure 5. Map lat-long projection of the state of Louisiana showing the frequency of sugarcane farmers aggregated by zip code blocks. Geographic projection US NADCOM 1983, zone 15. Source: US Census Bureau (2004).

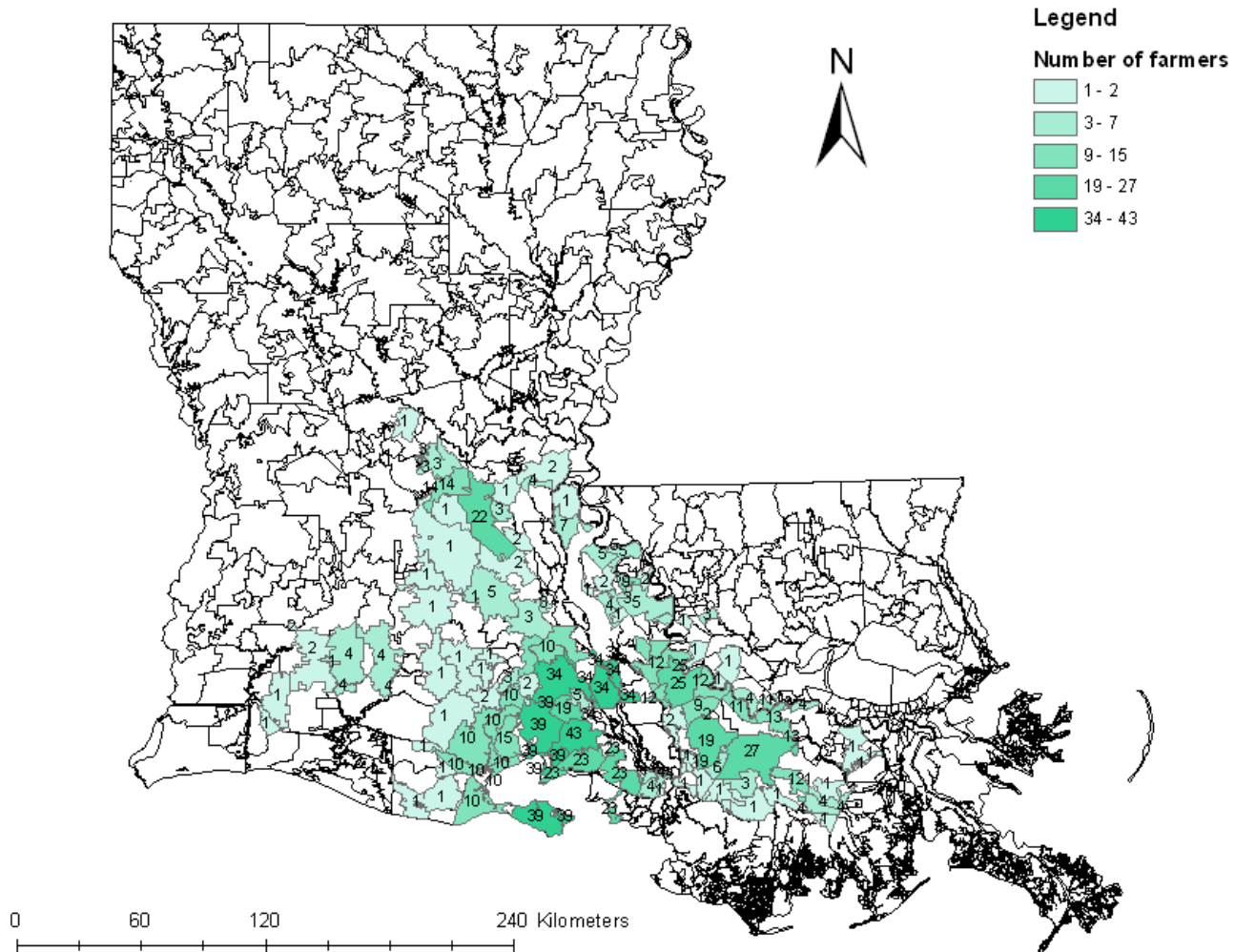


Figure 6. Model variogram for sugarcane farms in the state of Louisiana (Nlag=10). Function: spherical, range: 18.49239, sill: 87.12985, nugget: 0.00000

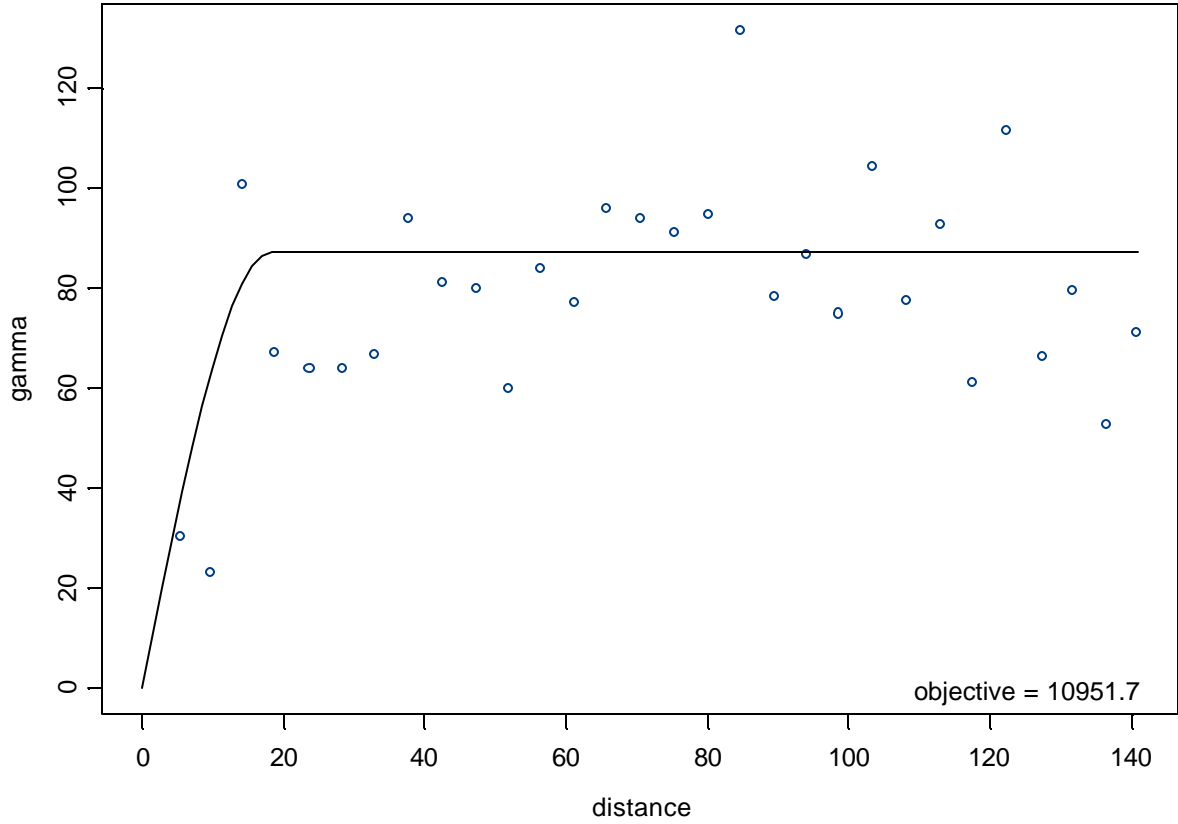


Figure 7. Lhat Plot for the incidence of sugarcane farms versus complete spatial randomness.

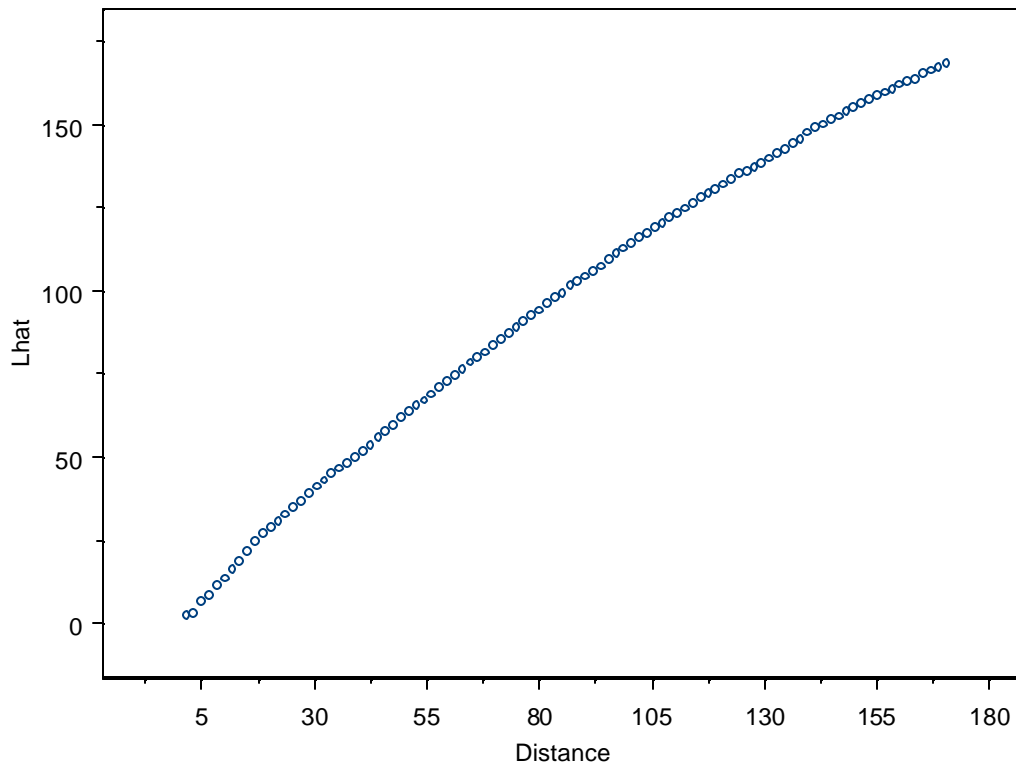


Figure 8. Sugarcane growers measure of cluster intensity (binning) in Louisiana.

