

UNDERSTANDING CENSUS GEOGRAPHY IN THE TIGER DATA BASE: THE CASE OF PUERTO RICO*

Jonathan Sperling
Geography Division
U.S. Bureau of the Census
Washington, DC 20233

ABSTRACT: Critical to the effective utilization and appreciation of census statistics and the 1990 digital geographic data base called TIGER is an understanding of census geography. This paper aims to clarify the unique aspects of Puerto Rico's census geography and to identify changes in terminology as well as content for the 1990 census. The innovations and improvements in the Census Bureau's mapping, combined with the simplification of geographic terms in Puerto Rico, will make census data more accessible, meaningful, and useful to data users.

The development of a digital geographic data base covering the 50 states, the District of Columbia, Puerto Rico, and other outlying areas is one of the major innovations of the 1990 census that will directly benefit data users (Marx 1989). Known formally as the Topologically Integrated Geographic Encoding and Referencing (TIGER) System, this new geographic and mapping data base, combined with published census data and appropriate software, provides data users with an unparalleled opportunity to manipulate, query, and present data not only from the census, but in conjunction with any other spatially referenced data set.¹ Certainly one of its greatest contributions will be its effect on planning more accurate and meaningful maps and data sets for the 2000 census.

Because most census statistics are presented in terms of census geography, the full utilization of census statistics and TIGER products depends on an understanding of census geography and the statistical and legal/administrative hierarchy used to collect, process, and tabulate the data. Although much of the geographic content and terminology for Puerto Rico is similar to their stateside equivalents, the current geographic entities show several unique aspects in terms of their historical origins and development, legal status, technical definitions, and nomenclature.

TERRITORIAL SUBDIVISIONS USED BY THE U.S. BUREAU OF THE CENSUS

The Census Bureau divides the Island's landscape into both legal/administrative and statistical geographic units. Puerto Rico's current legal/administrative entities are the result of historical factors and actions taken by the Commonwealth Legislature, whereas statistical geography is the result, in most cases, of the interaction of geographic and planning staffs in the Census Bureau and the Puerto Rico Planning Board.

LEGAL/ADMINISTRATIVE ENTITIES

The current legal and administrative entities used in Puerto Rico have their origins in 400

* Reprinted, in part, from Caribbean Studies, Vol. 23, 1990.

years of Spanish rule (see Ubeda y Delgado 1878). While the municipio system of government predates the acquisition of Puerto Rico in 1898 by the United States, the Foraker Law of 1900 placed the functional existence of the municipio under the authority of a legislative assembly (Ramos de Santiago 1970). Over the next few decades, municipios underwent various annexations and detachments affecting their boundaries as well as changes in their legal authority, but their territorial limits were not legally described with metes and bounds or delineated on an accurate map base.

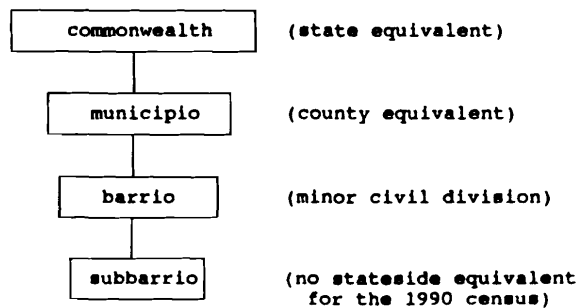
The legal basis for Puerto Rico's current municipio and barrio structure derives from a 1945 statute passed by the legislative assembly authorizing the establishment of legal written descriptions and maps for each of the municipios and their constituent barrios. These legal documents, one for each municipio, are called "memorias." They were published between 1946 and 1955 (Junta de Planificación). Final boundaries were sent to the United States Geological Survey (USGS) for insertion on the first set of topographic quadrangle maps for Puerto Rico.

Approval and funding by the legislative assembly of this massive project to legally define all political/administrative boundaries were based on a number of planning and development issues that arose at the end of the Second World War. The primary reasons for implementing this project were stated generally in each of the municipio memorias: to assist legislative actions, to support research on the general welfare of the population, to facilitate the work of the U.S. Bureau of the Census, to assist the registration and measurement of properties, and to serve as the basis for an Island-wide cadastral map.

The memorias used a number of terms interchangeably, a factor that probably contributed to later confusion relating to the origin and meaning of several geographic entities used for tabulating census statistics.³ For instance, the terms zona urbana and barrio-pueblo were used interchangeably in many of the municipios, as were the terms barrio urbano, pueblo, ciudad, and zona urbana for some of the more urban municipios. Also, the term subbarrio was not used consistently.

Figure 1 outlines the hierarchy of legal geographic entities presented in all recent censuses of Puerto Rico.

Figure 1: Hierarchy of Legal/Administrative Units in Puerto Rico



Commonwealth

For all census programs, the Commonwealth (Estado Libre Asociado) of Puerto Rico is treated as the statistical equivalent of a state. The Puerto Rico Planning Board is the primary Commonwealth agency delegated the responsibility of working with the Census Bureau. The Planning Board delineates census statistical areas according to established Census Bureau guidelines, works with the municipio governments as appropriate, and verifies the political boundaries used in the census (Junta de Planificación 1985).

Municipio

For census purposes, the municipio is referred to as a county equivalent; that is, the Census Bureau treats it as the statistical equivalent of a stateside county. There are 78 municipios of varying size and population on a land surface of approximately 3,427 square miles. The municipio, represented by an elected mayor and a municipio assembly, is the primary legal subdivision of the Commonwealth and the only administrative entity with a functioning government. While the Commonwealth government performs most major public works and services such as public safety, sewer and water, health and land use planning and zoning, the municipio performs, but often shares with the Commonwealth government, more limited functions such as road maintenance, sanitation and recreation.

Although the municipio assembly may present a petition to change its municipio boundary, such a change can be made only by an act of the Commonwealth legislature. Three major changes in the municipio structure have been made since 1950. In July 1951, the San Juan and Río Piedras Municipios were joined by incorporating Río Piedras into San Juan. In June 1969, the Municipio of Loíza was divided into two municipios: Loíza and Canóvanas. A similar Legislative Act in June 1971 split Barceloneta into two municipios: Barceloneta and Florida.

None of these changes led to revisions in the memorias, so that now one must either combine or separate the memorias as they were originally prepared to derive current boundary information. In addition, one must consult the individual legislative acts in conjunction with the memorias to derive the boundaries between the divided municipios and changes in barrio names in the affected municipios. At this date, no new municipios or radical changes in the boundaries of municipio governments are envisioned.

Confusion over the legal limits of municipio boundaries during the past few decades has led to multiple legal, administrative, and operational problems for the municipio governments. This confusion results from several factors. Legal descriptions in the memorias were based on features and landmarks that now seem nostalgic reminders of a past era (e.g., from a mango tree on Doña Ana Perez's farm to an intermittent stream to...). Many of the rivers and streams that formed part of the legal municipio boundaries have either changed course or been channelized since the memorias were written. If the legal boundaries are presumed to follow the original course of rivers and streams, then any natural or man-made changes create a gap between physical reality and the legal descriptions in the memorias.

Increasing urban development on and near the municipio boundaries has led to situations where municipio boundary locations are both difficult to interpret and may split housing units or housing developments. In some cases, municipios provide services to an entire "urbanización" or "comunidad" even though parts of the "urbanización" belong to another municipio. Until

recently, postal ZIP Codes often crossed municipio boundaries, and residents of one municipio sometimes used a delivery address that included the name of the adjacent municipio. Another potential source of confusion in the municipio boundaries is that residents within one municipio may be in different Senatorial and Assembly Districts. Municipio residents may also sometimes vote "by mistake" in another municipio.

These situations undoubtedly lead to confusion not only among politicians and planners but among residents as well. The lack of more-visible or well-known and marked boundaries cause difficulties not only for administrative, electoral, and statistical purposes but also create problems for census operations.

Barrio/Barrio-Pueblo

For census purposes, barrios and barrios-pueblos are referred to as minor civil divisions (MCDs). There are 899 barrios, including 75 barrios-pueblos, which are the primary legal subdivisions of municipios. Although defined by legally established boundaries, these entities do not constitute functioning governmental units; they have no officials of their own, and the Commonwealth and municipio governments provide all basic services. For the 1980 Census, the Census Bureau recognized ciudades, pueblos, and barrios as MCD equivalents. For the 1990 census, with the concurrence of the Commonwealth government, the Census Bureau dropped the use of the ciudad and changed the designation "pueblo" to "barrio-pueblo."

Consistent with the legal name used in the memorias, the use of the term "barrio-pueblo" reinforces the fact that what was called the pueblo for previous censuses was, like all other barrios, a legal subdivision of the municipio. The barrio-pueblo is differentiated from all other barrios because it is the historical center of the municipio where the seat of government, central plaza, and church are located. The barrio-pueblo also forms the core barrio of the zona urbana (place).

All barrios-pueblos have the same name as their municipio except Vieques (Isabela II). Florida, Ponce, and San Juan Municipios do not have barrios-pueblos. Florida Municipio has only one barrio (Florida Adentro), of which only a portion is part of the zona urbana. An approximation of the barrio-pueblo in Ponce and San Juan may comprise the core, urban barrios that existed at the time the memorias were written and that have been reported in previous censuses as comprising the "ciudades".

Although each municipio may legally amend the limits of its barrios as long as these changes are communicated to the Junta de Planificación (Cordova 1964, 44), no municipio has ever done so. While several of the barrios may appear in the 1990 census to be minimally different from 1980, these changes are either cartographic or name corrections rather than changes in the legal boundaries.

When the barrios were first legally established as areas from which members of both the Puerto Rico legislature and the municipio assemblies are elected, Puerto Rico's population was approximately 2.1 million. Most settlements were contained within the barrio boundaries and did not extend to other barrios. Population growth, rapid industrialization, and rural-to-urban migration since the 1960s has led to a large expansion in the transportation and housing infrastructure. New developments increasingly began to disregard barrio boundaries.

Despite continuing growth in the resident population to approximately 3.2 million in 1980 and 3.5 million in 1990, barrio boundaries have not changed. As a result, barrio boundaries now often cross through housing developments and even houses. In some cases, barrio names are identical across municipio boundaries (e.g., Beatriz barrio in Caguas, Cayey, and Cidra Municipios). Road signs or boundary markers between barrios or subbarrios are nonexistent. Combined with such ongoing processes as canalizing of waterways, natural changes in stream channels, and landfill activity, these developments have rendered many of the legal descriptions of these boundaries obsolete, imprecise, and difficult to interpret.

From a sociological perspective, the popular concept or image of a barrio in Puerto Rico today does not coincide with the census statistical version. Most Puerto Ricans view a barrio as an area where poor, mostly rural Puerto Ricans live. Whereas rural Puerto Ricans may be more familiar with their barrio of residence, many urban Puerto Ricans refer to the area where they live as "urbanización ..." or "la ciudad de ..." and do not realize that all Puerto Ricans live in a "barrio."

Subbarrio

Subbarrios are unique entities that have no 1990 census statistical equivalents stateside. For census statistical purposes, they are referred to as sub-MCDs; that is, subdivisions of the barrio/barrio-pueblo. If a barrio has subbarrios, then the entire barrio is divided into subbarrios. Like barrios, they are used for electoral and legislative districting.

There are 145 subbarrios distributed within 23 municipios. Barrios-pueblos are subdivided into subbarrios in 20 municipios. In the other three municipios, barrios (other than the barrios-pueblos) are subdivided into subbarrios (one rural barrio in Salinas, one urban barrio in Ponce and eight urban barrios in San Juan). In some memorias, subbarrios are listed as barrios (or barrios urbanos) in the table of contents but indented under the respective barrio.

Ciudad

In the 1980 census, two ciudades (Ponce and San Juan) were presented on the maps and in the data tabulations as legal political entities (equivalent to the barrios-pueblos). In previous decennial censuses, Mayagüez (until 1980) and Río Piedras (until 1960) were tabulated as ciudades. Because a ciudad comprises a group of barrios, its boundaries are coincident with those of the barrios.

Due to persistent confusion, misinterpretation, and the fact that ciudades have no legal definition and lack any governmental function, the ciudades have been dropped for the 1990 census and accordingly do not appear on the 1990 census maps or in the data products. Ciudad data often have been confused with the data for the "census designated" zona urbana. Ciudades and the "census designated" zonas urbanas refer to different geography within the same municipio. In both Ponce and San Juan, the "central city" requirement for metropolitan areas (MAs) and urbanized areas in Puerto Rico was fulfilled for the 1980 census by the zona urbana (CDP) rather than the ciudad. Unlike the ciudad, the zona urbana (CDP) is subject to change at each census according to the extent of urban development.

Inconsistent usage of the term "ciudad" probably stems from the lack of a rigorous or consistent definition in the memorias. In fact, the word "ciudad" never appears in the memoria

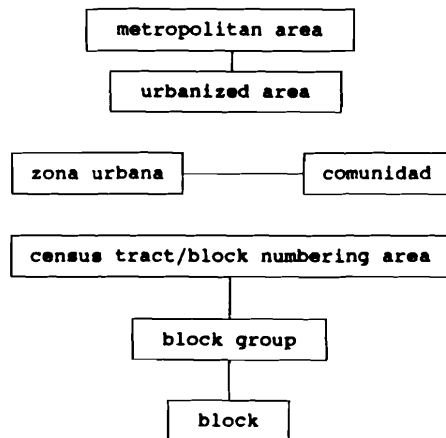
for San Juan Municipio except in historical references where its meaning is synonymous with the municipio. In Ponce, "ciudad" was used interchangeably with zona urbana and pueblo. In Río Piedras, ciudad was used interchangeably with zona urbana but as an entity larger than the barrio-pueblo.

Culturally, Puerto Ricans like to refer to their municipio (particularly the urban portion-the barrio-pueblo) as a ciudad. In fact, throughout Puerto Rico, one can see signs welcoming one to the "ciudad of ..." (Bayamón or Caguas, for example). However, the basis for the use of the term "ciudad" also may be related to more practical concerns such as qualification for Federal funds and the attempts by Federal agencies to adapt stateside criteria to Puerto Rico's unique political geography. Although helpful in discriminating between urban and rural barrios at the time the memorias were written, this classification is no longer meaningful in the current physical, economic, and social reality of today's large metropolitan areas.

STATISTICAL ENTITIES

Figure 2 lists the most important census statistical units for which data have been tabulated in all recent censuses. Statistical areas have been established primarily on the basis of size, shape, contiguity, socio-economic, and demographic criteria as well as transportation and commuting flows. However, physical change in settlement patterns or socio-economic conditions may necessitate changes from census to census. These entities were established to better serve the needs of data users by providing reliable data at a sub-municipio level (census tract, block numbering area, block group, zona urbana), but data also are tabulated for entities on an inter- and multi-municipio level (comunidad, urbanized area, metropolitan area).

Figure 2: Census Statistical Units in Puerto Rico



Census Designated Place (Lugar)

The use of the term "place" or "lugar" in Puerto Rico refers specifically to the unincorporated areas called "zonas urbanas" and "comunidades." Because there are no incorporated places in Puerto Rico as that term is used stateside, there can be no confusion between a place that is incorporated (a legal, political entity) and one that is unincorporated (a statistical entity). Although barrios and subbarrios have legally established limits, they are not incorporated and are recognized for census purposes as legally defined municipio subdivisions rather than places. The two entities serving as places, zona urbana and comunidad, are statistical concepts defined by the Census Bureau and delineated by the Planning Board in cooperation with the municipio governments.

For the 1990 Census, several changes have occurred related to the places recognized in Puerto Rico. These changes are both semantic and substantive. The following descriptions of these two types of places specify the distinctions between the two entities.

Zona Urbana

Until the 1960s, the barrio-pueblo included nearly all the urban population in a municipio. Due to extensive rural-urban migration and other population shifts since the 1960s, the Census Bureau and the Puerto Rico Planning Board decided to produce a new geographic entity (similar to unincorporated communities in the States) to statistically measure changes in rural versus urban population. This census statistical area was called "zona urbana."

As used by the Puerto Rico Planning Board and the Census Bureau, the zona urbana is the area within a municipio that includes the barrio-pueblo (like other barrios, the barrio-pueblo does not change its boundaries even as new development occurs around its periphery and into adjacent barrios) plus additional contiguous land around the barrio-pueblo that has experienced urban growth that is functionally related to the barrio-pueblo. The extent of the zona urbana was designed to show the actual urban area and, therefore, may be redefined for each decennial census. The zona urbana boundary does not have to coincide with barrio or subbarrio boundaries but cannot extend beyond the municipio boundary. Zonas urbanas also are defined by the Planning Board as areas in which specific land use controls may be applied and some government grants designated.

The zona urbana may be one of the most confusing statistical entities used in the census. This confusion probably stems from the fact that the zona urbana was a term used historically to describe a number of different concepts. The term zona urbana often appears in the memorias as synonymous with the barrio-pueblo. In addition, the term "zona urbana" may be confused with the urbanized area (area urbanizada).

For the 1970 census, the legal barrio and subbarrio boundaries were adjusted incorrectly to the "place" boundaries (the pueblo and zona urbana in the memorias refer to barrio boundaries that do not change). The use of the term "pueblo" as an MCD as well as a place and the subsequent boundary changes made on the census maps and in the geographic files led to inaccurate data and map products and rendered many census statistics unusable for electoral redistribution or statistical purposes.

For the 1980 census, the barrio and subbarrio boundaries were revised back to their legal

limits and the term "zona urbana" was introduced for the extended built-up area, but the geographic terminology remained a source of confusion. The 1990 census geographic terminology has been simplified (e.g., elimination of the term "ciudad" as a geographic entity and replacement of the term "pueblo" with "barrio-pueblo") so that census maps and data products are more easily understood by data users.

Each municipio can have only one zona urbana. With the exception of Florida (which does not contain a "true" barrio-pueblo) and San Juan and Ponce (which contain a group of barrios comprising the original urban cores of the municipios), all zonas urbanas contain the whole barrio-pueblo and additional built-up area from adjacent barrios. The zona urbana reflects intra- and not inter- municipio expansion. Cataño zona urbana is coincident with the municipio, indicating that the zona urbana has reached its fullest extension and that the municipio is entirely urban.

No minimum population is required for an area to be defined as a zona urbana. However, a place must have 2,500 or more inhabitants for its population to be defined as urban. While zona urbana is a geographic concept (the name of a type of area), urban population is a demographic concept. In 1980, seven municipios had zonas urbanas whose population was considered rural; that is, in census terms, there were rural zonas urbanas!

Comunidad

The comunidad, on the other hand, is a settlement that often has urban characteristics but is distinct from the barrio-pueblo. Unlike the zona urbana, which has no minimum population threshold, a comunidad must contain a minimum population of 1,000 inhabitants. Similar to the zona urbana, a comunidad must have 2,500 or more inhabitants for its population to be defined as urban. Unlike the zonas urbanas, comunidades can cross municipio boundaries.

Comunidades were called aldeas in the 1960, 1970, and 1980 censuses. Earlier censuses used the term "villages." The use of the term "comunidad" in the 1990 census is broader and less tied to the traditional concept of an "aldea" as a community resulting from land reform programs.

Comunidades have expanded their boundaries, on the whole, at a slower rate than the zonas urbanas. The two major exceptions are Levittown and Roosevelt Roads. Levittown, a housing development that has its origins in the early 1970s, is larger and expanding at a more rapid rate than the Toa Baja zona urbana. Roosevelt Roads is a comunidad identified for the populated portion of a military installation.

Similar to CDPs stateside, but unlike their CDP counterparts, zonas urbanas, there is no limit to the possible number of comunidades. Based on the results of the 1990 census, 14 new comunidades were qualified for publication and six places from 1980 either failed to qualify or were joined with the zona urbana, bringing the total number of comunidades to 142.

Census Tract/Block Numbering Area/Block Group/Block

Similar to barrios in the legal/administrative hierarchy, the entire territory of each municipio is divided into either census tracts or block numbering areas (BNAs) for the 1990 census. These statistical units provide the primary sub-municipio levels of data and probably present the most useful set of statistics for data users. Essentially, census tracts are defined in the more

urban municipios. Stability of boundaries is important for the purpose of intercensal comparability. BNAs, on the other hand, are defined in the more rural municipios. The 1990 census marks the first time that municipios were covered entirely by BNAs. Reflecting the rapid urban expansion in Puerto Rico over the past few decades, the 1990 census shows that 56 of the 78 municipios are covered by census tracts compared with 22 in 1980 and only 8 in 1970.

Census tracts are relatively small geographic areas created for the purpose of providing statistics at the sub-municipio level. Ideally, census tracts contain a population between 2,000 and 8,000 with an overall municipio average of 4,000 per census tract. Census tracts comprise areas of roughly similar socio-economic characteristics at the time of their original delineation. BNAs, on the other hand, occur outside the metropolitan areas and include an area that contains between 1,500 and 3,000 housing units.

All census tracts and BNAs are subdivided into smaller areas of socio-economic homogeneity called block groups (BGs), each of which contains an optimum of 400 housing units. BGs consist of all census blocks in a census tract/BNA whose numbers begin with the same first digit. Due to the field collection requirement of having visible physical features, BGs may deviate somewhat from the ideal housing unit criteria. BGs are the smallest area for which the Census Bureau provides sample data. In the 1980 census, in areas that were not block-numbered, the smallest area for which sample data were available were enumeration districts (EDs).

Because census tracts/BNAs and BGs are both tabulation units and form the basis of enumerator assignment areas or address register areas (ARAs),³ census geographers had to work with planners at the Puerto Rico Planning Board and municipio governments to negotiate between the needs of data users and field collection requirements. The quality of census data is directly dependent on the success of allocating housing units to the correct census block. In order to effectively and efficiently accomplish this task, the boundaries of census collection blocks must adhere to visible, physical features as much as possible.⁴

Concerned with the growing field enumeration problems caused by census tracts and other statistical areas that followed nonvisible barrio boundaries, most newly proposed census tracts for the 1990 census were adjusted to reflect more permanent, stable, and locatable features. Thus, field enumerators would not have to worry about the exact location of the barrio boundary when they took the census and census supervisors would not have to worry that housing units were missed or double-counted by two different enumerators. The primary rationale for adjusting new census tracts to existing physical and locatable features was that (1) housing developments often crossed nonvisible barrio boundaries and (2) barrio boundaries are neither posted in the field nor well-known to local residents.

Those census blocks containing more than one barrio or subbarrio were later split by office and field staff into two or more census blocks in order to allocate housing units to their respective barrio or subbarrio. This Block Split Operation constituted a major advance in collection techniques over the 1980 census. In a few cases, this operation was used to better define statistical areas. The blocks affected are shown on all census maps and data products with alphabetic suffixes after the three-digit block numbers (e.g., block 201 was split into blocks 201A and 201B).

CENSUS GEOGRAPHY OF PUERTO RICO

Urbanized Area

Urbanized areas (UAs) were first established for Puerto Rico in the 1960 census to provide a better separation of the rural and urban population in the vicinity of the larger urban areas when the urban population did not necessarily reside in places of 2,500 inhabitants or more. With minor exceptions, all adjacent land included in the urbanized area must have a minimum population density of 1,000 inhabitants per square mile. Along with this density criterion, urbanized areas must have a total population of 50,000 or more inhabitants. Unlike "census defined" zonas urbanas, urbanized areas do cross municipio boundaries.

Urbanized areas are different from all other census statistical areas in that they are determined solely by the Census Bureau. While some information may be requested from the Planning Board on land use, there is no local input in the delineation of these areas. Boundary delineation is based on technical considerations, primarily minimum population density thresholds.

Based on the 1990 criteria for the designation of urbanized areas, two newly defined UA's were added and the existing seven urbanized areas were revised outward. Results of the 1990 census show that 60.3 percent of Puerto Rico's population, or 2.1 million people, live in an urbanized area. Urbanized areas differ from metropolitan areas (MAs) principally in that urbanized areas include only densely settled areas. MAs, on the other hand, are composed of whole municipios and often contain extensive rural territory.

Metropolitan Area

Although MAs are important statistical units and closely related to the delineation and naming of urbanized areas, they are not defined or designated by the Census Bureau or Planning Board staff. Rather, they are defined and designated by the Federal Office of Management and Budget (OMB) according to standards published in the Federal Register.

MAs consist of a large population nucleus (or nuclei) together with adjacent communities that have a high degree of economic and social interaction with that nucleus (or nuclei). A municipio or group of municipios may qualify as a MA in two ways: (1) a municipio must have a place of 50,000 or more inhabitants or (2) it must contain an urbanized area with 50,000 or more inhabitants and a total metropolitan population of at least 100,000 inhabitants. Similar to the urbanized areas, the zona urbana serves as the "central city" because there are no incorporated places in Puerto Rico.

Adjacent municipios are included in the MA if they are socially and economically integrated with the central municipio. These adjacent municipios must meet published standards regarding metropolitan characteristics, such as population density, urban population and population growth, and a specific percentage of their workforce commuting daily to the central nucleus (or nuclei).

The rapid growth and spatial redistribution of population in Puerto Rico from 1950 to 1983 is reflected in the number of inhabitants and municipios included in the metropolitan areas. In 1950, there were three metropolitan areas comprising six municipios that included 30.75 percent of the population. In 1983, when the OMB revised the MAs in Puerto Rico based on the 1980

PROCEEDINGS - AAG MIDDLE STATES DIVISION - VOL. 24, 1991

census data, there were six metropolitan areas comprising 45 municipios that included 76.4 percent of the population.

OVERVIEW OF CHANGES FOR THE 1990 CENSUS

The following two generic changes for the 1990 census affect Puerto Rico as well as the States and other equivalent areas: (1) the entire land surface of Puerto Rico will be divided into census blocks, block groups, census tracts or BNAs and (2) digital geographic files for the entire Commonwealth will be available on computer tape and CD-ROM on a municipio-by-municipio basis. These are known as the TIGER/Line files, which can be integrated with census data and other information using a Geographic Information System.

Island-wide block numbering for the 1990 census will have several effects on the planning, field collection, and publication aspects of the decennial census in Puerto Rico. The number of census blocks in Puerto Rico has increased from 15.7 thousand in 1980 to 50.3 thousand in 1990, more than a three-fold increase. Increased flexibility resulting from the use of such small-scale geographic units throughout the Island should result in several benefits for the Census Bureau and, most importantly, for the data user.

Several changes specific to Puerto Rico also were made for the 1990 Census. Most of these changes aimed at simplifying and clarifying the vast array of geographic terminology. To summarize these changes quickly: the "ciudad" as a geographic entity was deleted from all 1990 census products, the term "barrio-pueblo" replaced "pueblo," and the term "comunidad" replaced "aldea." In addition, enumeration districts were eliminated with the advance of island-wide block numbering and replaced with block groups as the smallest geographic unit for which sample data are available.

Another major change for the 1990 Census is that all maps will show uniform Spanish terminology. All feature names and landmarks will be labeled consistently in Spanish unless they are part of U.S. military installations or if English names are actually used. In previous censuses, English and Spanish terms often were used interchangeably.

Other significant changes were made in planning, data collection, and data tabulation for the 1990 census of Puerto Rico. In previous censuses, all barrio and subbarrio boundaries were used as field assignment boundaries by the enumerator staff regardless of whether they followed a locatable feature in the field. In order to prevent the undercounting, double-counting, and misallocation problems associated with ambiguous barrio and subbarrio boundaries, boundaries that did not follow physical features were, for the most part, not used during the 1990 field collection process. In an additional office and field operation, collection blocks that contained two or more barrios were split into tabulation blocks after the enumeration was completed so that data could be tabulated by barrio or subbarrio.

CONCLUSION

Critical to the effective utilization of census statistics is an understanding of census geography. Whether one is interested in statistics for all of Puerto Rico or for a particular municipio, barrio, census tract, or comunidad, these data all refer to a particular piece of geography at a specific point in time. All data collected and tabulated by the Census Bureau are based on geography; that is, the allocation of housing units, population, and their

CENSUS GEOGRAPHY OF PUERTO RICO

characteristics to census blocks. These blocks and the data associated with them are then aggregated to form all the other legal and statistical areas discussed in this paper.

The proliferation and diffusion of computer hardware and software from large corporations to small firms and individual households, coupled with the relative low costs of statistical and geographic data on computer-readable media, will have a profound effect on the data user community. In order to take full advantage of the opportunities offered by these new technologies, planners, politicians, local governments, private firms, entrepreneurs, professors, and students will need to comprehend the basics of census geography.

REFERENCES

Arana-Soto, S. *Diccionario Geográfico de Puerto Rico*, San Juan, Puerto Rico, 1978.

Córdova, Efrén. La crisis del municipio y su etiología. *Revista de Administración Pública*, Universidad de Puerto Rico. Vol. 1, Núm 1, 1964.

Junta de Planificación de Puerto Rico. *Mapas de municipios y barrios*. Memorias No. 1-77. 1946-55.

Junta de Planificación de Puerto Rico. *Geografía Censal de Puerto Rico 1980*. San Juan, Puerto Rico, revisado Julio 1985.

Marx, Robert. *GIS, TIGER, and Other Useful Acronyms*. National Conference of Geographic Information Systems. Ottawa, Canada. March 1989.

Ramos de Santiago, Carmen. *El Gobierno de Puerto Rico*. Editorial Universitaria, Universidad de Puerto Rico, 1970.

Ubeda y Delgado, Manuel. *Isla de Puerto Rico, estudio histórico, geográfico y estadístico*. Puerto Rico: Establecimiento tip. del Boletín, 1878.

U.S. Bureau of the Census. *Number of Inhabitants Reports (Puerto Rico). 1950-1980*. Washington, DC: U.S. Government Printing Office.

NOTES

1. The digital cartographic data in the 1990 Census TIGER/Line files for Puerto Rico are based on the United States Geological Survey (USGS) 7 1/2-minute quadrangle maps and enhanced with updates by Census Bureau and Planning Board geographers, municipio officials, and census enumerators through spring 1990. These computer-readable files, available for each of Puerto Rico's 78 municipios, do not contain census statistical data. Data users must purchase software from private vendors in order to read the TIGER/Line files and integrate them with census or other statistical data.
2. Confusion concerning the current legal and statistical entities in Puerto Rico also may originate from errors in the original delineation or description of boundaries and translations between English and Spanish (Arana-Soto, 1978).

3. ARAs are subdivisions of block groups designed to facilitate field collection activities. Similar to the 1980 enumeration districts (EDs), they contain approximately 140-160 housing units. Unlike many of the 1980 EDs, all 1990 ARAs were composed entirely of census blocks. No data will be tabulated for this field collection unit.
4. Ideally, census blocks are fairly small, compact polygons bounded by physical features or legal boundaries, of which at least one side should be bounded by an addressable feature (i.e., a street or road). In many cases, a block may be bounded by nonstandard features such as property lines, ridge lines, and/or imaginary street extensions. The visible-feature criterion is used primarily to assist field collection activities. Census blocks are the building blocks for all the legal and statistical entities discussed in this article.