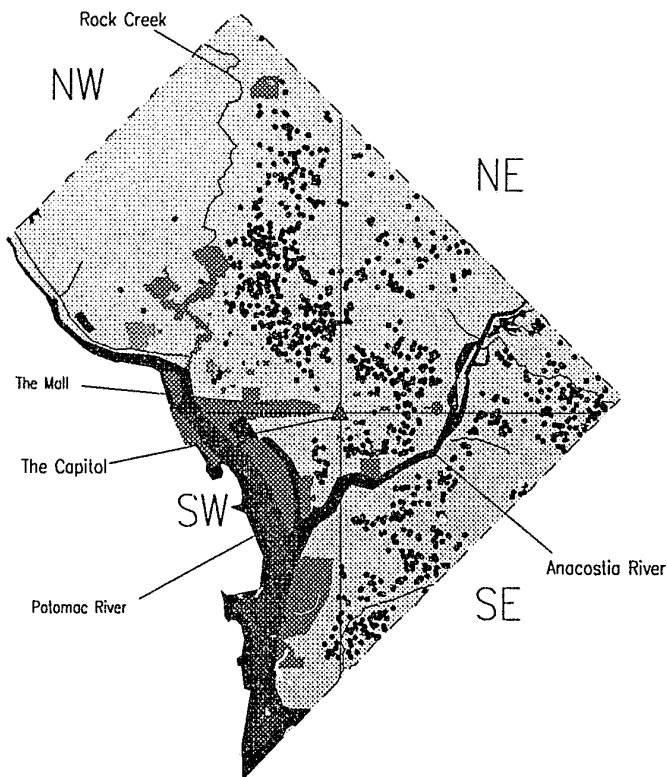


LOCATION OF DRUG-USING ARRESTEES AND TREATMENT CENTERS IN WASHINGTON, D.C.: A GEOCODING DEMONSTRATION PROJECT



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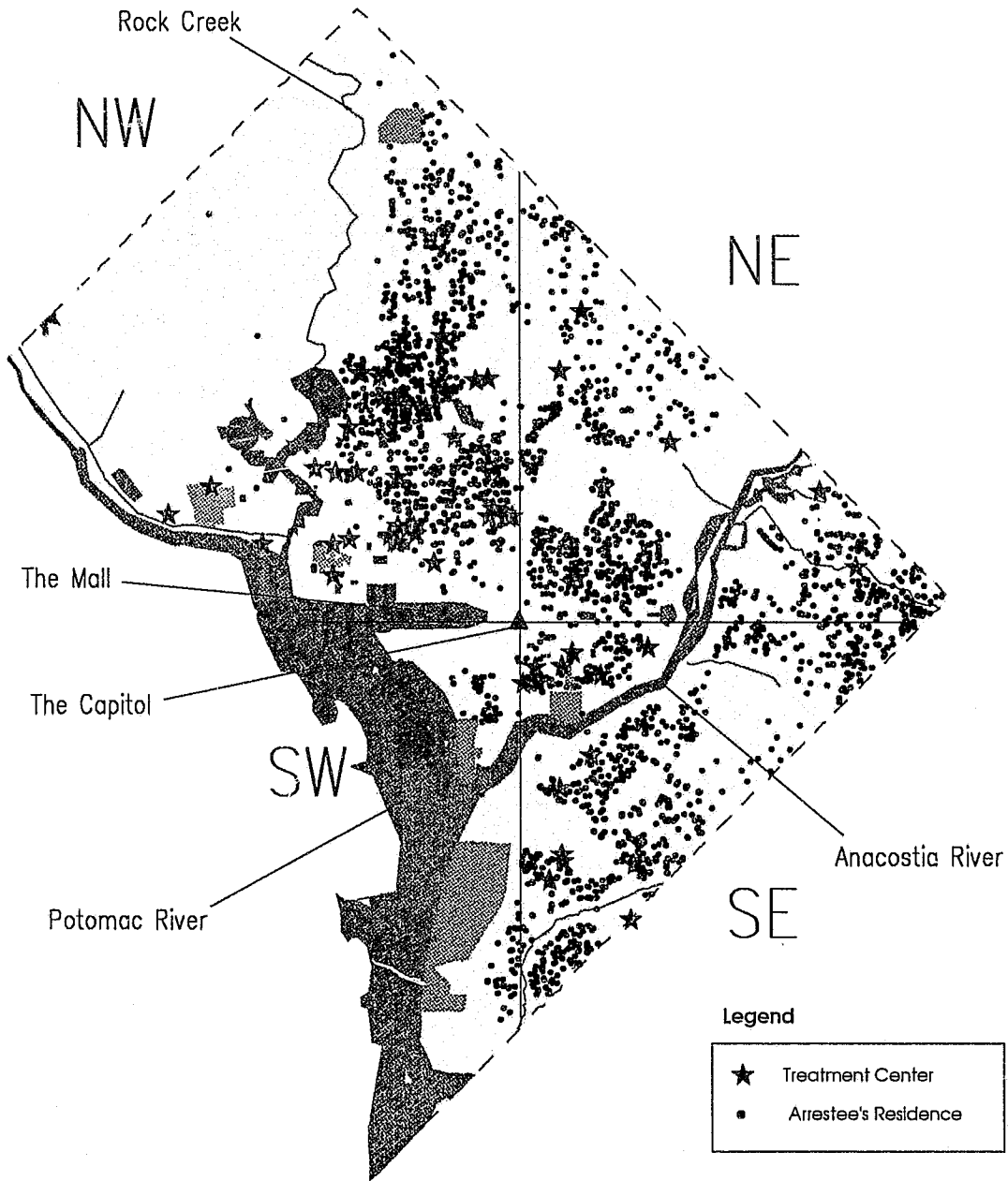
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January 1995

Center for Substance Abuse Research (CESAR)
University of Maryland at College Park

LOCATION OF DRUG-USING ARRESTEES AND TREATMENT CENTERS IN WASHINGTON, D.C.: A GEOCODING DEMONSTRATION PROJECT



NOTE: A color version of this report is available for purchase from CESAR for \$15.00.

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EXECUTIVE SUMMARY

Geographic information system (GIS) technology is relatively new and developing rapidly. It allows geographic patterns, which would not be apparent using conventional statistical methods, to emerge from data and be displayed in the easily understood format of a map. This analysis explores the utility of GIS technology in assessing need for drug treatment.

Data collected during 1985 and 1990 by the District of Columbia Pretrial Services Agency (DCPSA) and treatment center data listed in the 1990 National Drug and Alcoholism Treatment Unit Survey (NDATUS) were used to perform a geocoded drug treatment needs assessment for Washington, DC. The locations of residences of arrestees who tested positive by urinalysis for cocaine, PCP, or heroin in 1990 were examined in relation to the locations of existing drug treatment centers.

The MapInfo geographic information system was used to geocode (assign latitude/longitude coordinates to) the residential addresses reported by the arrestees. Of the Washington, DC addresses reported to DCPSA, 69% were geocoded for this analysis. Treatment center addresses from NDATUS were also geocoded. The NDATUS data, however, did not include all of the treatment centers in Washington, DC. Further, these data do not address capacity for treatment, mode of treatment, or drug-specific treatment.

Because 69% of the arrestee addresses were geocoded and the treatment center data were not exhaustive, the present study should not be considered a definitive description of the need for drug treatment in Washington, DC; rather, it is a demonstration project which examines the utility of GIS technology in the assessment of need for drug treatment.

In general, drug-positive arrestees were concentrated east of Rock Creek during 1985 and 1990. The concentration of cocaine-positive arrestees was greater during 1990 than during 1985. The concentration of PCP- and opiate-positive arrestees, however, was smaller during 1990 than during 1985. In general, geographic areas containing concentrations of arrestees for one drug (e.g., cocaine) also contained concentrations of arrestees who tested positive for other drugs (e.g., PCP). Some of the areas containing concentrations of drug-positive arrestees appear to contain few or no treatment centers.

Future geocoded drug treatment needs assessments should take the following points into consideration:

- * The types of drugs used, and the combinations of drugs used (i.e., polydrug use), should be assessed to

help guide decisions regarding the drugs for which treatment should be provided; knowledge about types of drugs used can be combined with the population's sociodemographic profile (e.g., race/ethnicity, education, income) to inform decisions about the treatment modalities that should be offered.

- * A census of existing drug treatment centers should precede any thorough assessment of unmet need for treatment.

- * Rates of drug use, drug dependence, drug overdose, and other drug-related outcomes, should be calculated by area; the definition of area, however, should be ecologically plausible (e.g., neighborhood rather than census tract).

- * Proxy indicators of drug use that measure the socioeconomic conditions surrounding drug use (e.g., female-headed households, low income) should be examined; their utility in assessing the need for drug treatment across geographic areas should also be investigated.

INTRODUCTION

Assessing the need for drug treatment is a primary concern of the Center for Substance Abuse Treatment (CSAT). How a population's need for drug treatment is assessed is quickly changing due, in part, to improvements in technology. Geographic information system (GIS) technology is relatively new and developing rapidly. GIS software can read geographic information (down to the level of street addresses), turn the information into latitude-longitude coordinates, and display the data as points on a map. This presentation allows geographic patterns, which would not be apparent using conventional statistical methods, to emerge from data and be displayed in an easily understood format.

CSAT contracted with the Center for Substance Abuse Research (CESAR) of the University of Maryland at College Park to examine the utility of GIS technology in assessing the need for drug treatment in a population. Washington, DC was chosen as the site for this demonstration project. Using drug-related data from Washington, DC as an example, the primary goals of this project were to:

- (1) explain the steps involved in performing a geocoded analysis;
- (2) highlight the problems typically encountered in performing a geocoded analysis;
- (3) produce maps which illustrate changes in the geographic distribution of drug-using individuals over time; and
- (4) produce maps which illustrate relationships between the residences of drug-using individuals and the locations of drug treatment centers.

The results presented in this report illustrate how GIS technology can be used to visually present geographic data related to the need for drug treatment. Using data from Washington, DC as an example, the report concludes by discussing patterns that emerge from the maps, limitations of the maps, and future directions to be pursued in the application of GIS technology to drug treatment needs assessment.

METHODS

Two types of data are necessary to examine the relationship between persons in need of drug treatment and treatment centers using GIS. First, geographic data identifying where persons in need of drug treatment reside are needed. Second, geographic data identifying where current treatment centers are located are needed. Ideally, both data sources would contain geographic information at the level of the street address.

Obtaining Geographic Data on Persons Needing Drug Treatment in Washington, DC

The central problem in any study of drug users is finding the drug users. Identifying potential drug users is not an easy task. To perform a geographic analysis, one must also find out where the drug users live -- this is even more difficult.

One possible source of data on the residences of drug users is the criminal justice system. It is sometimes argued that studying drug use among the criminal population provides a glimpse into future drug use trends in the general population. It is also sometimes argued that the criminal population contains the persons with the most severe drug problems and, therefore, the persons most in need of drug treatment.

The District of Columbia Pretrial Services Agency (DCPSA) maintains a database containing information on all persons arrested in Washington, DC for criminal activity. Persons arrested for traffic violations or ordinance violations are not included in the DCPSA data. Among the information collected by DCPSA are the results of urine tests for five substances: cocaine, PCP, opiates, methadone, and amphetamines. (This report does not consider methadone or amphetamines because of the low number of arrestees testing positive for these two drugs.) The residential address of each arrestee is also part of the DCPSA record. The DCPSA data, therefore, present a unique source of information on the geographic location of confirmed drug users in Washington, DC.

CESAR obtained the DCPSA arrestee data for 1984-1990 from The Urban Institute (UI). UI had previously sent the DCPSA records to a professional geocoding firm (Harte-Hanks Data Technologies) to have them geocoded at the census tract level (i.e., census tract numbers were assigned to the records). During the process of geocoding, the database was cleaned -- for example, misspelled addresses were corrected, nonexistent addresses were removed, duplicate records of the same arrest were removed, and multiple arrest records for the same individual were collapsed into a single record. UI, therefore, possessed a cleaned version of the DCPSA addresses. CESAR obtained the cleaned version of

the DCPSA data from UI (with DCPSA's permission) to save time and money on the laborious task of rudimentary data cleaning. To prevent violations of confidentiality, the version of the DCPSA data that CESAR obtained from UI contained no names or personal identifiers.

Records of arrestees who did not report a Washington, DC address were not used in this analysis. Records that Harte-Hanks designated as unable to be geocoded at the census tract level also were not used. The number of records available for each year is presented in Table 1.

Table 1. Total Available DCPSA Addresses and Percent of Washington, DC Addresses That Were Geocodable, 1984-1990.

	Total DCPSA Records Available	Geocodable Washington, DC Addresses	Percent Geocodable Washington, DC Addresses
1984	3,651	2,667	73%
1985	18,864	13,965	74%
1986	21,223	15,716	74%
1987	22,434	16,404	73%
1988	22,200	16,157	73%
1989	21,652	15,795	73%
1990	21,363	15,951	75%
Total	131,387	96,655	74%

The column entitled "Total DCPSA Records Available" counts all records in the DCPSA database, including duplicate records, records for persons who reside outside of Washington, DC, and records that Harte-Hanks deemed unable to be geocoded. The column entitled "Geocodable Washington, DC Addresses" counts only non-duplicate DCPSA records, records that correspond to Washington, DC residents, and records that were previously geocoded at the census tract level.

Obtaining Geographic Data on Treatment Centers in Washington, DC

The National Drug and Alcoholism Treatment Unit Survey (NDATUS) is a national survey of drug abuse and alcoholism treatment facilities in the United States. The 1990 NDATUS (NIDA, 1991) contains the addresses of 63 public and

private treatment facilities operating in Washington, DC during 1990 that voluntarily participated in the 1990 NDATUS survey.

Some of the sites listed in NDATUS do not actually provide treatment services to clients. For example, of the 63 treatment center addresses listed in NDATUS, three were not actual treatment sites but, rather, the location of administrative offices. The 60 remaining treatment center addresses provided some form of service to clients, but the type of services provided varied extremely across treatment centers.

Geocoding the Data

For their analysis, The Urban Institute geocoded the DCPSA data at the census tract level (i.e., assigned census tract numbers to the DCPSA records). The aim of our analysis, however, was to pinpoint locations rather than examine census tracts. Thus, we selected the drug-positive arrestee addresses from the DCPSA database and geocoded them at the street address level (i.e., assigned latitude/longitude coordinates to the DCPSA records) using MapInfo (Windows Version 2.0, 1993) and a digital map of Washington, DC purchased from MapInfo. We also geocoded the treatment center addresses from NDATUS at the street address level.

Geocoding addresses is by far the most time-intensive step in a geocoded analysis. The geocoding procedure must be run numerous times to successfully geocode most (or all) of the addresses in a database. On each pass, the user must instruct the GIS program how it should attempt to locate on the digital map the addresses it failed to geocode during the previous pass.

An address in a database fails to be geocoded when a GIS does not find a corresponding address on the digital map. Some of the reasons an address might not be found on the map are: 1) the address in the database truly may not exist; 2) the digital map may be incomplete and not contain the address; 3) the address in the database could be misspelled; 4) the address in the database may be missing an important piece of information. For example, MapInfo would not geocode the address "56 L Street" because this address does not contain a quadrant (NE, NW, SE, SW), and without specifying a quadrant there are four potential addresses on the map -- one corresponding to each of the four quadrants. As another example, MapInfo could not find the address "1010 N. Capitol Street, NW" on the digital map because it does not contain any addresses on the 1000 block of N. Capitol Street, NW -- there are addresses between 0 and 800, and from 1400 up, but none between 800 and 1400.

As this was a demonstration project with limited resources, only the 1985 and 1990 DCPSA arrestee addresses were geocoded. Table 2 presents the number of geocodable DC addresses for 1985 and 1990 and the number and percentage successfully geocoded for this analysis.

Table 2. Geocodable Washington, DC Addresses Geocoded for this Analysis, By Year.

	Geocodable Washington, DC Addresses	Number of Addresses Geocoded	Percent of Addresses Geocoded
1985	13,965	9,661	69%
1990	15,951	11,042	69%
Total	29,916	20,703	69%

Due to time and budget limitations, about 69% of the geocodable arrestee records with Washington, DC addresses that were available from 1985 and 1990 were geocoded. The remaining 31% of the records from each of these years would require much more time to geocode; many of the addresses present problems that need to be handled on a one-by-one basis. A professional geocoding firm, hired by The Urban Institute, succeeded in assigning census tract numbers to 86% of the DCPSA records for 1984-1990. Hence, the present analysis failed to geocode (at the street address level) 17% of the geocodable (at the census tract level) records.

Table 3 displays, by year and drug test result, the number of drug-positive, geocodable Washington, DC addresses and the number of these that were geocoded in the present analysis. Generally speaking, for every drug in both years, 70% of the drug-positive, geocodable records were geocoded. The only glaring exception was methadone in 1990, for which 91% of the geocodable records were geocoded. The general consistency in the percentage geocoded indicates that the selection of drug-positive records that were geocoded is not obviously biased.

Table 3. Drug-Positive, Geocodable, Washington, DC Addresses Geocoded for this Analysis, By Drug and Year.

	1985		1990	
	Drug-Positive, Geocodable, Washington, DC Addresses	Number and Percent Geocoded	Drug-Positive, Geocodable, Washington, DC Addresses	Number and Percent Geocoded
Cocaine	3,277	2,278 (70%)	6,344	4,420 (70%)
PCP	3,333	2,343 (70%)	913	652 (71%)
Opiates	2,001	1,415 (71%)	1,458	1,050 (72%)
Amphetamines	429	288 (67%)	30	22 (73%)
Methadone	277	197 (71%)	224	203 (91%)
Total	9,317	6,521 (70%)	8,969	6,347 (71%)

7

RESULTS

This section describes the geographic distribution of drug-positive arrestees' residences. Particular attention is given to concentrations of residences of drug-positive arrestees' and whether these concentrations shifted between 1985 and 1990.

The distribution of arrestees in the DCPSA database is depicted for 1985 and 1990. Then the distribution of drug-positive arrestees in 1985 and 1990 is examined.

Data on drug-positive arrestees from the years 1985 and 1990 are compared separately by drug. Maps are examined for changes in concentrations of residences between 1985 and 1990.

For each drug, 1990 data on drug-positive arrestees are examined in relation to the locations of treatment centers in 1990.

The map of 1990 drug-positive arrestees is also subdivided into four quarterly maps in an effort to examine geographic shifts over shorter intervals. In particular, quarterly maps allow one to visually investigate for seasonal effects. The quarterly maps are presented in the Appendix and are not accompanied by any text; they are provided so that the reader can make his or her own decision about the utility of examining these data separately by quarter.

The Geographic Distribution of Arrestees: 1985 and 1990

Of the 13,965 geocodable, Washington, DC arrestee records from 1985, 9,661 (69%) were geocoded for the present analysis. The residential locations of the geocoded arrestees are displayed in Figure 1. Of the 15,951 geocodable, Washington, DC arrestee records from 1990, 11,042 (69%) were geocoded; their residential locations are displayed in Figure 2.

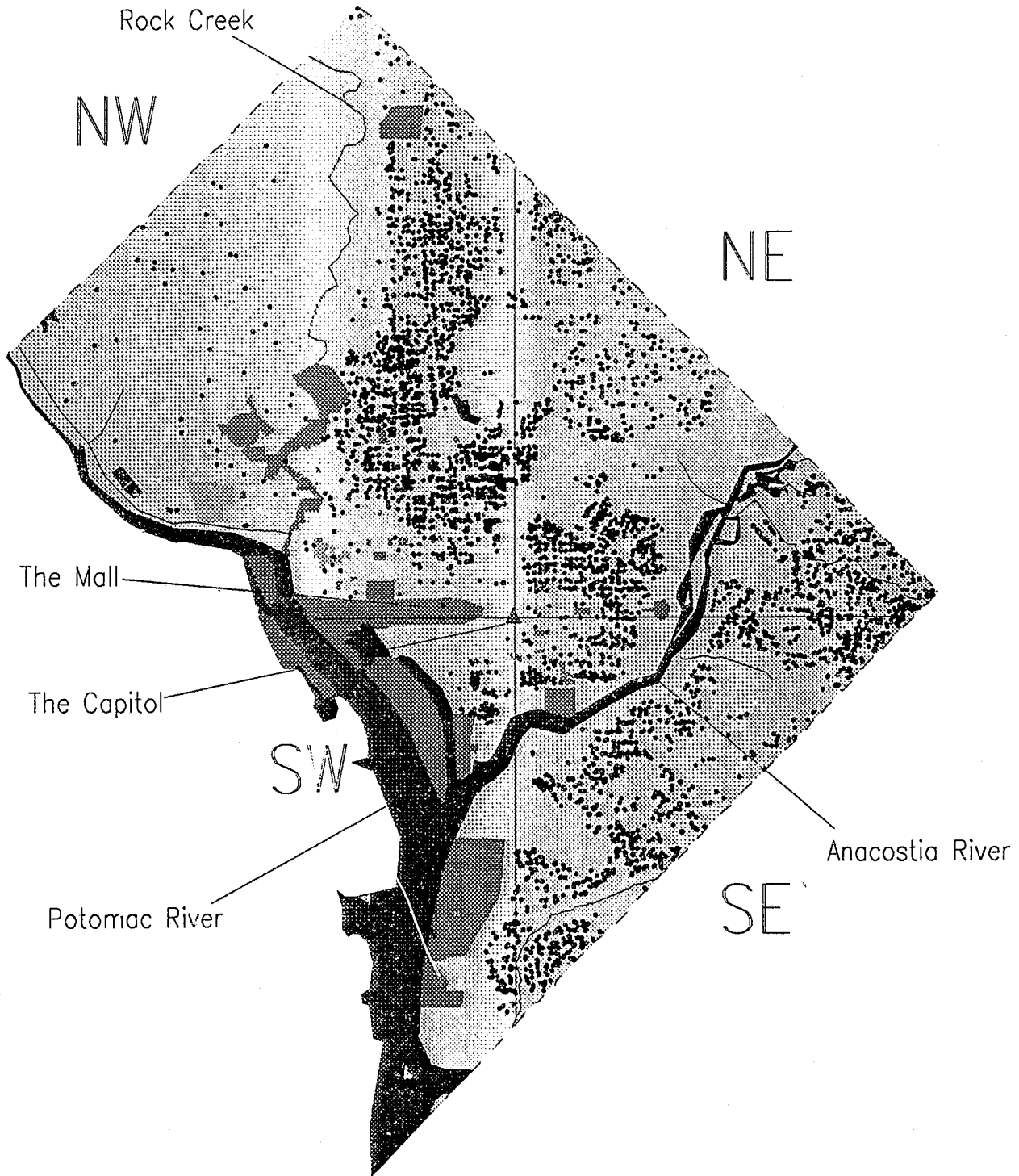
Examining the patterns of 1985 arrestee residences, there appear to be concentrations of arrestees 1) in the southeastern section of NW, 2) at the eastern tip of the "diamond" boundary of Washington, DC, and 3) straddling the northwestern section of SE and the southwestern section of NE. There also appear to be several smaller concentrations throughout SE.

The patterns of 1990 arrestee residences are similar to those described for 1985. Some of the concentrations, such as concentration 1) above, appear to have become more dense.

The concentrations described above were subjectively identified by visual examination of the maps. More objective assessments of concentrations of arrestees could be identified through the use of statistical techniques known as "cluster analysis" (Boots and Getis, 1988), or through the use of geographic techniques known as "point pattern analysis" (Kaufman and Rousseeuw, 1990). These techniques were not employed in the present analysis due to time and budget limitations.

Figure 1

Location of Residences of Arrestees in Washington, D.C., 1985

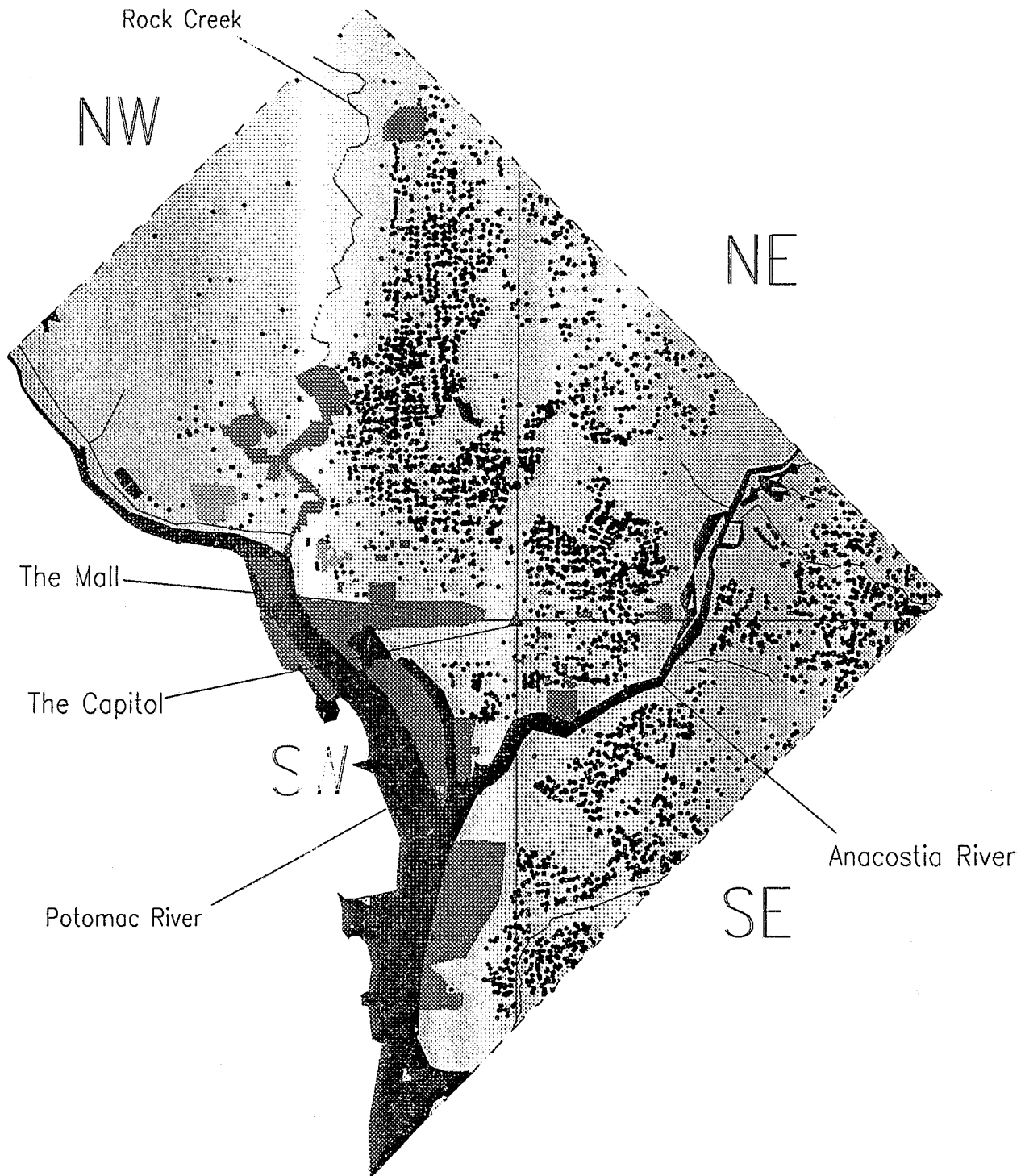


NOTE: There were 13,965 arrestees during 1985 with geocodable D.C. addresses. Of these, 9,661 (69%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure 2

Location of Residences of Arrestees in Washington, D.C., 1990



NOTE: There were 15,951 arrestees during 1990 with geocodable D.C. addresses. Of these, 11,042 (69%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

The Geographic Distribution of Drug-Positive Arrestees: 1985 and 1990

Of the 9,661 geocoded Washington, DC arrestee records from 1985, 6,521 (67%) were drug-positive. The residential locations of the drug-positive, geocoded arrestees are displayed in Figure 3. Of the 11,042 geocoded Washington, DC arrestee records from 1990, 6,347 (57%) were drug-positive; their residential locations are displayed in Figure 4.

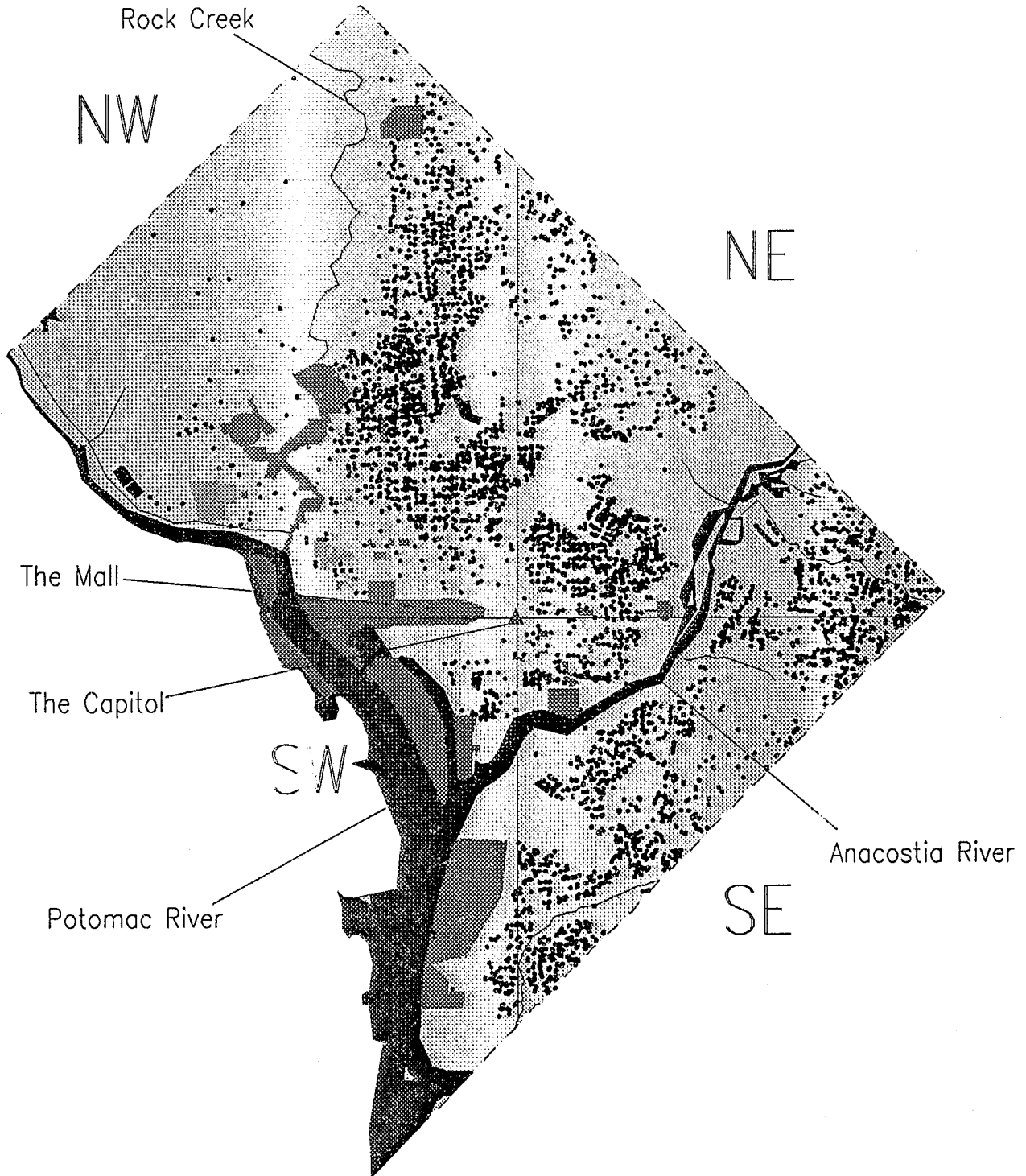
Recall that only 69% of the geocodable Washington, DC arrestee records from 1985 and 1990 were geocoded for the present analysis. These partially geocoded samples indicate that the percentage of arrestees who tested positive for drugs dropped ten percentage points (from 67% to 57%) between 1985 and 1990. If we examine the entire DCPSA database, we find that 60% tested positive in 1985 and 56% tested positive in 1990 (data provided orally by the DCPSA) -- a drop of four percentage points. Although the percentages from the partially geocoded samples are not inconsistent with those from the complete DCPSA database, the former indicate a larger drop in drug-positivity than the latter. The partially geocoded samples may, therefore, constitute a biased sample of the complete DCPSA arrestee population.

Residential patterns of drug-positive arrestees in 1985 and 1990 appear similar to the residential patterns of all arrestees (depicted in Figures 1 and 2). Examining the patterns of 1985 drug-positive arrestee residences, there appear to be concentrations of arrestees 1) in the southeastern section of NW, 2) at the eastern tip of the "diamond" boundary of Washington, DC, and 3) straddling the northwestern section of SE and the southwestern section of NE. There also appear to be several smaller concentrations throughout SE.

The patterns of 1990 drug-positive arrestee residences are similar to those described for 1985. Some of the concentrations, such as concentration 1) above, appear to have become less dense. The decrease in density can be attributed to the previously mentioned decrease in the percentage of arrestees testing positive for drugs in these samples.

Figure 3

Location of Residences of Drug-Positive Arrestees in Washington, D.C., 1985

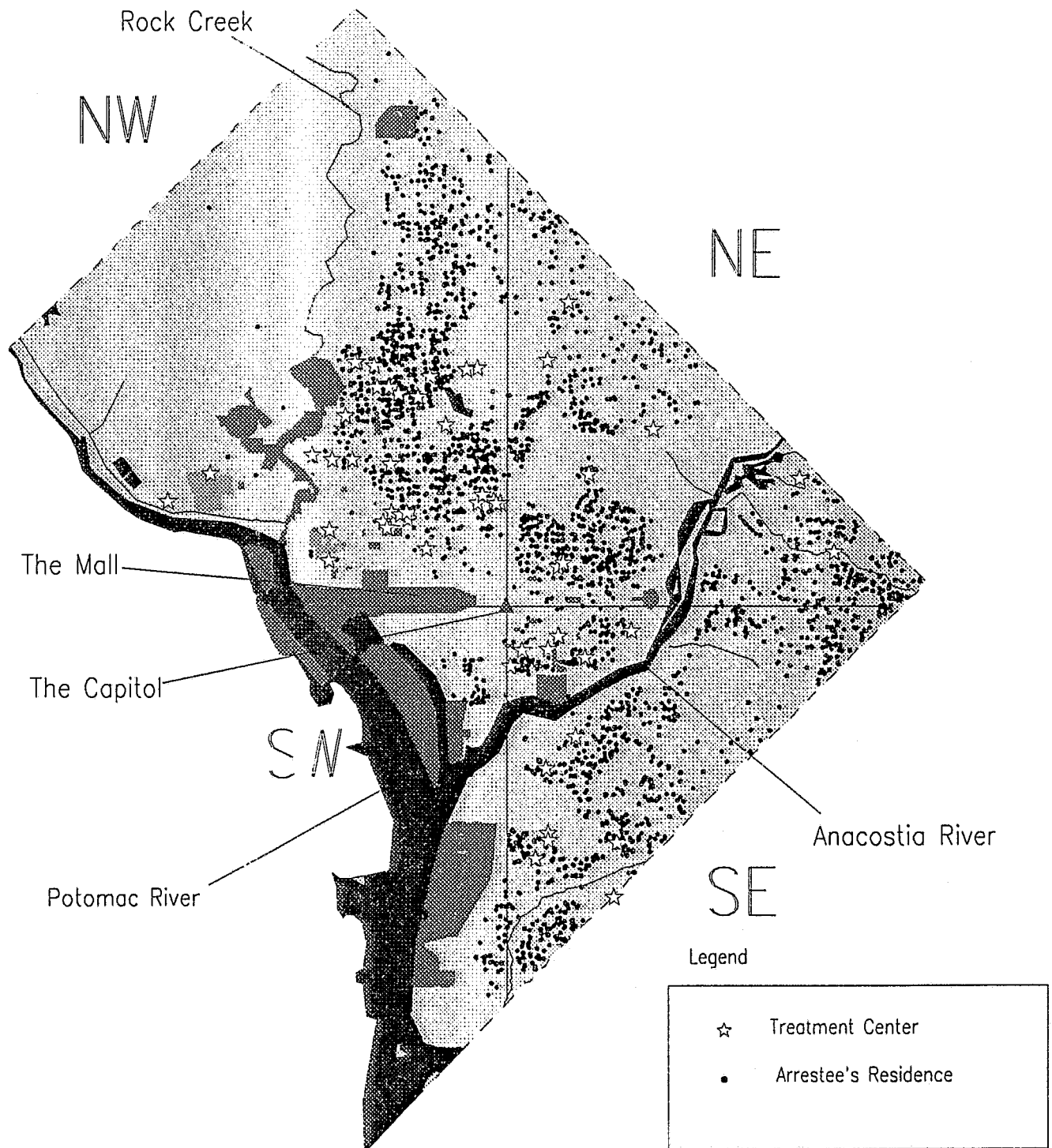


NOTE: Arrestees were urine-tested for the following drugs: Cocaine, PCP, Opiates, Amphetamine, Methadone. There were 9,317 drug-positive arrestees during 1985 with geocodable D.C. addresses. Of these, 6,521 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure 4

Geographic Relationship Between Drug-Positive Arrestees and Drug Treatment Centers in Washington, D.C., 1990



NOTE: Arrestees were urine-tested for the following drugs: Cocaine, PCP, Opiates, Amphetamine, Methadone. There were 8,969 drug-positive arrestees during 1990 with geocodable D.C. addresses. Of these, 6,347 (71%) were geocoded in this analysis. Arrestee data were provided by the District of Columbia Pretrial Services Agency. Treatment center addresses were obtained from the "National Directory of Drug Abuse and Alcoholism Treatment and Prevention Programs-1990 Survey" (DHHS/SAMHSA).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995

The Geographic Relationship Between Drug-Positive Arrestees' Residences and Treatment Centers: 1990

There are treatment centers located near many of the clusters of drug-positive arrestees during 1990 (Figure 4). Coverage during 1990, however, is somewhat uneven. Some areas containing drug-positive arrestees, such as much of SE, do not appear to contain treatment centers. Further, some areas with few drug-positive arrestees' residences, such as the southeastern section of NW and the northwestern section of SE, have several treatment centers.

Northwest (NW) Quadrant

Most of the treatment centers and many of the cocaine-positive arrestees are concentrated in the southwestern section of NW. There are many drug-positive arrestees' residences in the northeastern section of NW but NDATAUS does not list any treatment centers there.

Northeast (NE) Quadrant

The southwestern section of NE, which contains the most dense concentration of drug-positive arrestees, contains few drug treatment centers. The northern section of NE has several treatment centers but drug-positive arrestees' residences are sparse. The southern section of NE also contains several treatment centers.

Southeast (SE) Quadrant

Portions of SE which contain concentrations of drug-positive arrestees have no treatment centers. Most of the treatment centers are located in the northwest corner of SE, where the concentration of drug-positive arrestees is lowest.

Southwest (SW) Quadrant

There are no identified treatment centers in SW and a sparse collection of drug-positive arrestees. Although there are no identified treatment centers in SW, there are several in nearby areas of SE.

Cocaine-Positive Arrestees' Residences: 1985 and 1990

Of the 9,661 geocoded arrestee records from 1985, 2,278 (24%) were cocaine-positive. Of the 11,042 geocoded arrestee records from 1990, 4,420 (40%) were cocaine-positive.

Cocaine-positive arrestees' residences are almost exclusively located east of Rock Creek during 1985 and 1990. Similar concentrations of residences are observed during 1985 and 1990 but they are generally more dense during 1990.

Northwest (NW) Quadrant

1985: Concentrations of cocaine-positive arrestees occur during 1985 in the area of NW between Rock Creek and the NW-NE line (Figure 5). They lay mostly in the southern half of NW. A less dense concentration spreads over a large area in the upper northwest section of NW.

1990: The concentrations present in NW during 1985 are more dense during 1990 (Figure 6).

Northeast (NE) Quadrant

1985: Concentrations in NE during 1985 lay mostly along the southern boundary of NE (Figure 5). A less dense concentration is spread across a large area of upper NE.

1990: The concentrations present in NE during 1985 are more dense during 1990 (Figure 6). Another very dense concentration, oblong in shape and near the NE-NW line, is apparent during 1990.

Southeast (SE) Quadrant

1985: Some of the concentrations identified in southern NE spread into northern SE (Figure 5). Other concentrations can be seen in the area of SE south of the Anacostia River.

1990: The concentrations observed in SE during 1985 are more dense during 1990 (Figure 6).

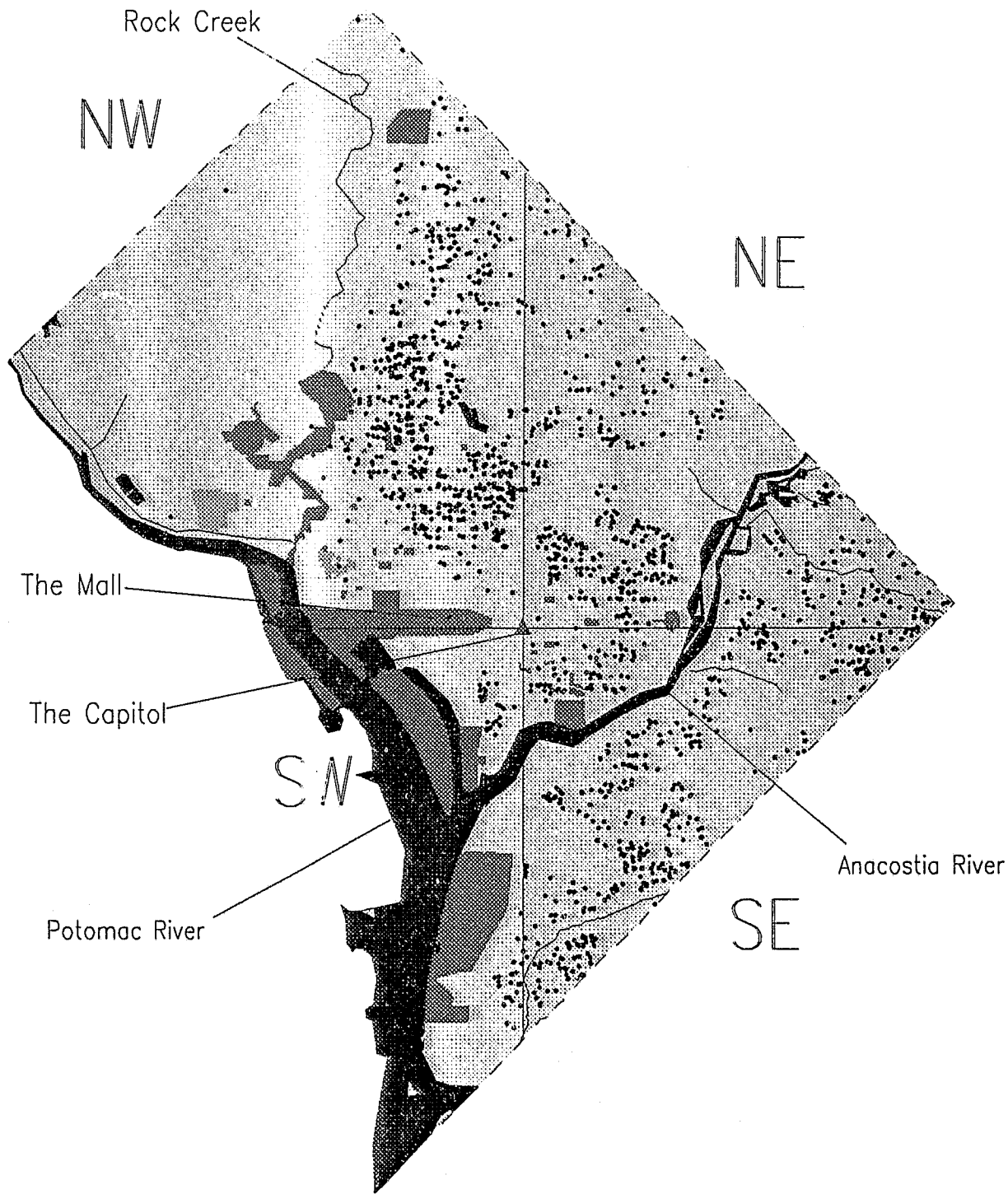
Southwest (SW) Quadrant

1985: A concentration occurs in the portion of SW north of the Anacostia River (Figure 5). Some of the concentrations identified in southwestern SE spread into southern SW.

1990: The concentrations observed in SW during 1985 are more dense during 1990 (Figure 6).

Figure 5

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 1985

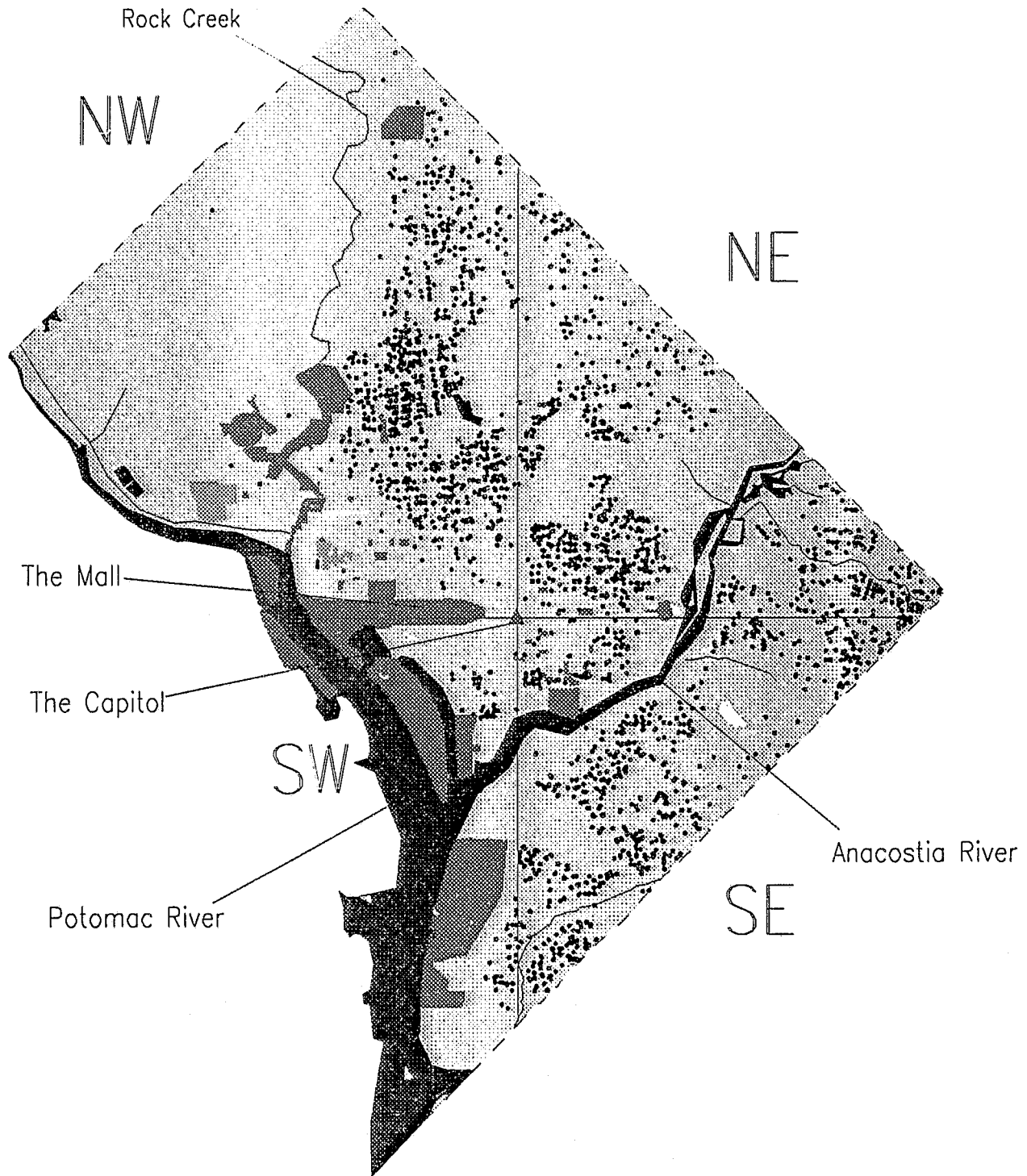


NOTE: There were 3,277 cocaine-positive arrestees during 1985 with geocodable D.C. addresses. Of these, 2,278 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure 6

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 1990



NOTE: There were 6,344 cocaine-positive arrestees during 1990 with geocodable D.C. addresses. Of these, 4,420 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

PCP-Positive Arrestees' Residences: 1985 and 1990

Of the 9,661 geocoded arrestee records from 1985, 2,343 (24%) were PCP-positive. Of the 11,042 geocoded arrestee records from 1990, 652 (6%) were PCP-positive.

Almost all PCP-positive arrestees' residences during 1985 and 1990 are located east of Rock Creek. The concentrations of PCP-positive arrestees' residences did not shift for the most part between 1985 and 1990. The concentrations during 1990 are generally less dense than during 1985.

Northwest (NW) Quadrant

1985: Concentrations of PCP-positive arrestees reside during 1985 in the area of NW between Rock Creek and the NW-NE line (Figure 7). They lay mostly in the southern half of NW. A less dense concentration spreads over a larger area of the upper northeastern section of NW.

1990: The concentrations present in NW during 1985 are less dense during 1990 (Figure 8).

Northeast (NE) Quadrant

1985: Concentrations in NE during 1985 lay mostly along the southern boundary of NE (Figure 7). A less dense concentration is spread across a large area of upper NE.

1990: The concentrations present in NE during 1985 are less dense during 1990 (Figure 8).

Southeast (SE) Quadrant

1985: Some of the concentrations identified in southern NE continue into northern SE (Figure 7). Further concentrations can be seen in the area of SE south of the Anacostia River.

1990: The concentrations observed in SE during 1985 are less dense during 1990 (Figure 8).

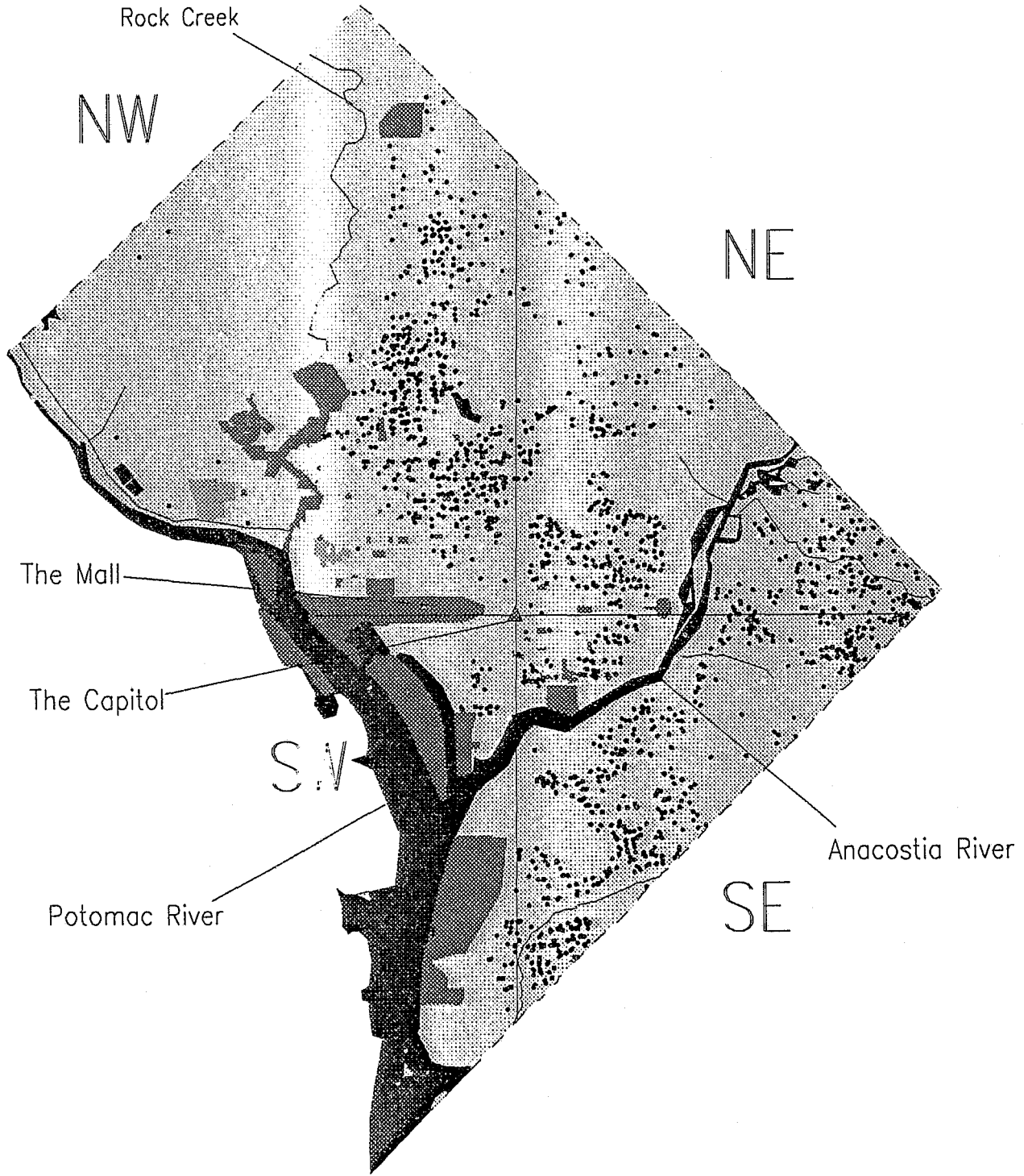
Southwest (SW) Quadrant

1985: A concentration occurs in the portion of SW north of the Anacostia River (Figure 7). Some of the concentrations identified in southwestern SE spread into southern SW.

1990: The concentrations observed in SW during 1985 are less dense during 1990 (Figure 8).

Figure 7

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 1985

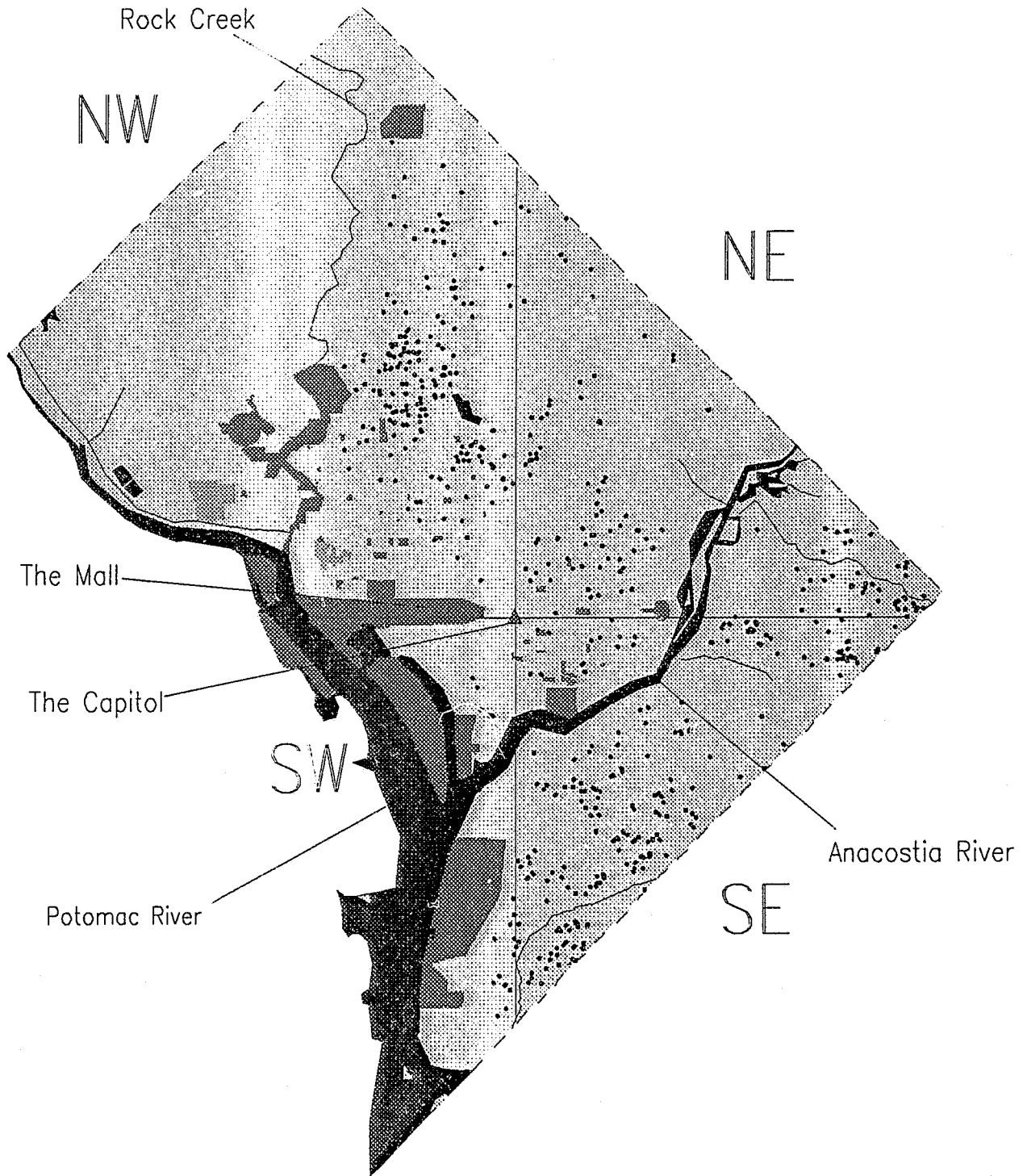


NOTE: There were 3,333 PCP-positive arrestees during 1985 with geocodable D.C. addresses. Of these, 2,343 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure 8

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 1990



NOTE: There were 913 PCP-positive arrestees during 1990 with geocodable D.C. addresses. Of these, 652 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Opiate-Positive Arrestees' Residences: 1985 and 1990

Of the 9,661 geocoded arrestee records from 1985, 1,415 (15%) were opiate-positive. Of the 11,042 geocoded arrestee records from 1990, 1,050 (10%) were opiate-positive.

Opiate-positive arrestees' residences during 1985 and 1990 are almost exclusively located east of Rock Creek. Similar concentrations of residences are observed during 1985 and 1990 but they are generally less dense during 1990.

Northwest (NW) Quadrant

1985: Concentrations of opiate-positive arrestees reside during 1985 in the area of NW between Rock Creek and the NW-NE line (Figure 9). They are spread throughout this area but are somewhat more concentrated in the southern half of NW. A less dense concentration spreads over a large area of the upper northeastern section of NW.

1990: The concentrations present in NW during 1985 are less dense during 1990 (Figure 10).

Northeast (NE) Quadrant

1985: Concentrations in NE during 1985 lay mostly along the southern boundary of NE (Figure 9). A less dense concentration is spread across a large area of upper NE.

1990: The concentrations present in NE during 1985 are less dense during 1990 (Figure 10).

Southeast (SE) Quadrant

1985: Some of the concentrations identified in southern NE spread into northern SE (Figure 9). Other concentrations can be seen in the area of SE south of the Anacostia River.

1990: The concentrations observed in SE during 1985 are less dense during 1990 (Figure 10).

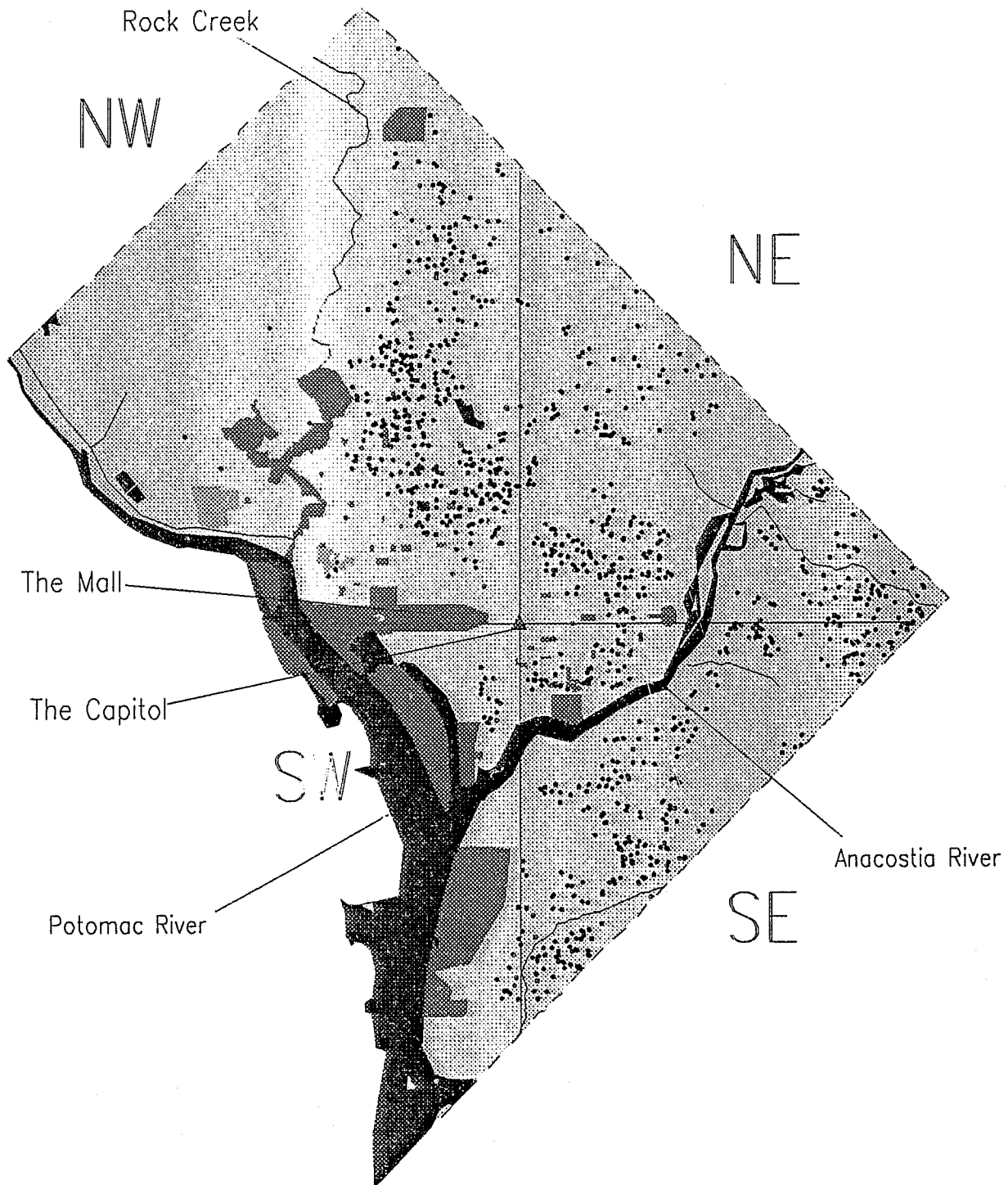
Southwest (SW) Quadrant

1985: There is a concentration in the portion of SW north of the Anacostia River (Figure 9). Some of the concentrations identified in southwestern SE spread into southern SW.

1990: Contrary to the general pattern of lower density, the concentration observed in SW north of the Anacostia River during 1985 is more dense during 1990 (Figure 10). The concentrations observed during 1985 in southern SW are equally dense during 1990.

Figure 9

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 1985

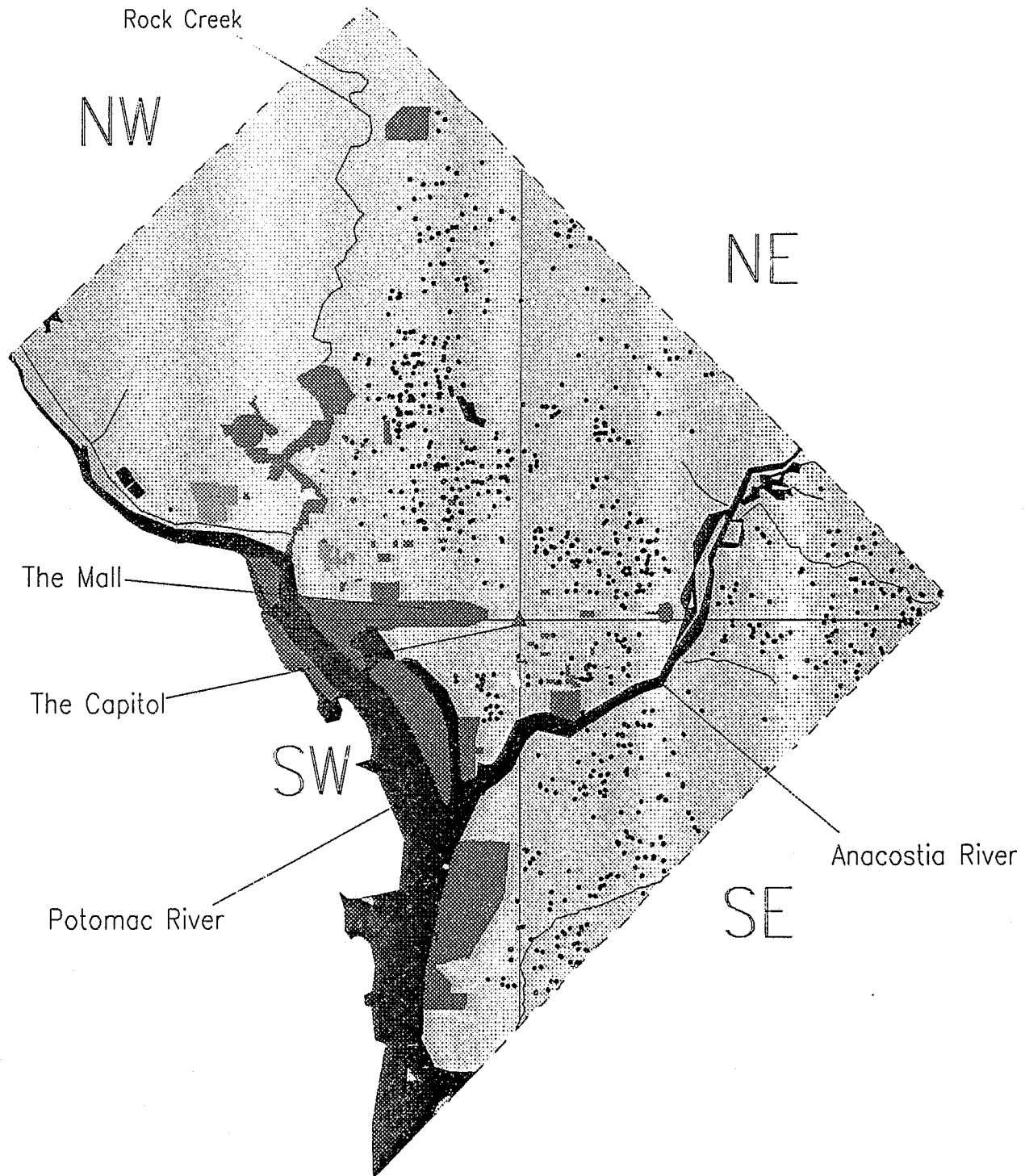


NOTE: There were 2,001 opiate-positive arrestees during 1985 with geocodable D.C. addresses. Of these, 1,415 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure 10

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 1990



NOTE: There were 1,458 opiate-positive arrestees during 1990 with geocodable D.C. addresses. Of these, 1,050 (72%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

DISCUSSION

The purpose of this demonstration project was to investigate the utility of GIS technology for drug treatment needs assessment by performing a geocoded analysis of data from Washington, DC. During the process of performing this analysis, general knowledge was gained regarding how to use GIS technology for drug treatment needs assessment and the pitfalls typically encountered in such an analysis. This knowledge will be highlighted in the course of summarizing the results. First, a few broad patterns discovered in the arrestee data from the District of Columbia Pretrial Services Agency will be summarized. Then the limitations of these data will be discussed. Next, some of the problem areas typically encountered when performing a geocoded analysis will be highlighted. Finally, some general recommendations for future drug treatment needs assessment studies using geocoded analyses will be discussed.

General Patterns in Washington, DC: 1985 and 1990

In general, the concentration of cocaine-positive arrestees in Washington, DC was greater during 1990 than during 1985. The location of the residences of these arrestees was not noticeably different; rather, the density of cocaine-positive arrestees in the same areas was greater during 1990 than during 1985.

Unlike the results for cocaine, the concentration of PCP-positive and opiate-positive arrestees in Washington, DC was smaller during 1990 than during 1985. The decrease in the concentration of PCP-positive arrestees was much greater than the decrease in the concentration of opiate-positive arrestees. The locations of PCP-positive and opiate-positive arrestees did not generally change, but the density of these arrestees in the same areas was lower during 1990 than during 1985.

The same geographic areas often contained concentrations of more than one type of drug-positive arrestees. For example, areas containing large numbers of arrestees positive for cocaine often contained large numbers of PCP-positive arrestees. Examining arrestees who tested positive for multiple drugs is a subject for further analysis and is discussed in the "Recommendations" section that follows.

Some of the areas containing concentrations of drug-positive arrestees appear to contain no or few treatment centers. Although this analysis was not able to examine quantity of services needed or delivered, the "Recommendations" section that follows discusses how this issue might be investigated.

Limitations of the DCPSA Data

The results presented in this report are intended as a demonstration of what GIS technology has to offer drug treatment needs assessment. These results are not meant to be definitive. Recall that the data are incomplete -- only 69% of the geocodable Washington, DC addresses were geocoded. Further, the 69% that were geocoded may constitute a biased sample; among geocodable DCPSA arrestees in 1990, black arrestees were more likely to be geocoded than white arrestees. All maps presented in this report, therefore, must first be viewed as examples of how GIS can be used to visually present data. If any interpretation is made of the maps, it must be made with the caveat that the data presented in the maps are incomplete.

The method of geographic data presentation used in this report does not address quantity/mode of treatment or drug-specific treatment. The maps indicate that a treatment center exists at a geographic location, but they do not indicate how many clients the center is capable of serving, what type of treatment(s) the center provides, or the drugs for which the center provides services. Despite having several treatment centers, therefore, it is possible that a geographic area may still be "underserved" or "overserved." The number of users in the area may not match the capacity of the treatment center(s) in the area, or the type of treatments provided at the local treatment center may not match the needs of the clients in the area of the treatment center. Determining capacity and modes of treatment that are needed in specific areas are subjects for further research. The "Recommendations" section that follows discusses possible approaches to examining these issues.

Problems Encountered When Performing Geocoded Analyses

The first problem that becomes apparent when geocoding at the address level is the issue of confidentiality of data. To prevent potential violations of confidentiality, it is best that names and other personal identifiers be removed from records containing addresses. If necessary, identification numbers may be used to identify individual records. A master list that connects the names to the identification numbers would have to be maintained, but it should preferably be kept by persons other than those doing the geocoding and in a separate environment from where the geocoding is being performed.

Even after removing personal identifiers, issues of confidentiality remain. For example, in this analysis, small areas with few drug-positive

arrestees could inadvertently reveal the identity of the arrestee. The analyst must take care not to present information that could possibly be used to determine the identity of any individual whose data are presented in a geocoded analysis.

The largest part of the time and labor in any geocoding project will be devoted to the actual geocoding process. This would not be the case if the database to be geocoded was perfectly "clean." Cleaning the addresses in a database is an extremely time- and labor-intensive task. For example, the database used in this analysis had previously been used for geocoding purposes (at the census tract level), and it still took a great deal of time to instruct the MapInfo on how to recognize the multitude of abbreviations it contained. For our address-level geocoded analysis, we had to correct mistakes in the database that the census-tract level analysis did not need to correct (e.g., certain address ranges). We also had to work around errors in MapInfo's digital map of Washington, DC, which the vendor advertises as 95% complete. For example, the word "park" was uniformly abbreviated as "PK" everywhere in the map, including places it should not have been, such as "Park Road" (which appeared as "PK RD") and "Park Place" (which appeared as "PK PL").

Recommendations for Future Drug Treatment Needs Assessments

This analysis has provided a basic overview of drug treatment needs in Washington, DC. It attempted to show where drug-positive arrestees live, how densely they are concentrated, how their location and density changed over time, and where they were located relative to treatment centers. A more in-depth treatment needs assessment would have to address more penetrating questions.

Polydrug Use

The extent of polydrug use should be assessed to help guide decisions about treatment modalities. It was not assessed in this analysis due to limitations of time and budget. Further treatment needs assessments could investigate the percentage of drug-positive arrestees testing positive for multiple drugs and what combinations of drugs are most often used by the same person. Geocoding technology is particularly suited to examining if polydrug-positive arrestees more often live in certain areas. A geocoded analysis of polydrug users would be useful in planning and coordinating modes of treatment at treatment centers in a given geographic area.

Census of Existing Treatment Centers

A thorough assessment of unmet need for treatment should answer the questions, "How many more treatment slots do we need?" and "For what drugs do we need to provide treatment?" In order to do this, an accurate census of the capacity and modes of treatment provided by existing treatment centers must first be conducted. This analysis revealed that NDATUS does not provide a complete picture of treatment available in Washington, DC.

Thematic Maps and the Calculation of Rates

The maps presented in this report pinpoint the exact locations of drug-positive arrestees. This approach is a useful first step but does not tell the entire story. One would like to obtain an idea of the rate of various drug-related phenomena in an area relative to the population in that area. For example, the neighborhood with the highest population density may have the largest number of drug-positive arrestees but not the highest rate of drug-positive arrestees. Such rates could be visually displayed using a "thematic map" on which each area's rate is indicated by shading the area accordingly.

In order to calculate the rate of a given outcome in an area, one first needs to define what constitutes an "area." For example, a geocoded analysis of Washington, DC could use areas defined by census tracts or, along more ecologically plausible lines, areas defined by "neighborhood." The rate of occurrence of a defined event, such as rate of cocaine-positive arrestees, could be calculated for each area as follows: divide the number of cocaine-positive arrestees in the area by the number of persons residing in the area according to the Census. The visual presentation of rates using thematic maps would allow areas to be compared on a variety of indicators related to need for drug treatment. The key issue that must be resolved before rates can be calculated is to determine how a geographic region should be divided into "areas."

Alternative Indicators of Drug Use

Because the need for drug treatment is not easily quantifiable, the use of new indicators of an area's need for drug treatment should be investigated. One such source of proxy indicators is sociodemographic and economic data from the Census Bureau.

Previous research has indicated that certain social indicators are usually correlated with need for drug treatment (Gerstein and Harwood, 1990). These proxy indicators for drug use are typically related the concept of "social disorganization" (Byrne and Sampson, 1986). For example, the indicator "percent of households headed by a single parent" in an area is often correlated with higher drug use rates in an area. Using this correlation as a hypothesis, one could examine how the rates of "percent of households headed by a single parent" vary across different areas of a city. More direct measures of need for drug treatment for the same areas, such as rate of drug-positive arrestees or rate of persons currently in treatment, could then be compared with the proxy measures to determine if they are truly correlated. Once geographic correlations between drug use and proxy measures have been established, the proxy measures could be used for more sophisticated research to identify areas with high rates of substance use and need for drug treatment.

Concluding Remarks

The display of quantitative information by geographic area is a powerful tool. GIS technology is developing rapidly and is increasingly being applied in various fields of research. Substance abuse research has yet to take full advantage of GIS technology. Before it can do so, however, appropriate information sources and analytic techniques must be developed. The geocoded analysis of Washington, DC presented in this report is a preliminary step in applying GIS technology to substance abuse research. Future research should explore the potential use of the statistical techniques known as "cluster analysis" and the geographical techniques known as "point pattern analysis" to identify areas in need of drug treatment.

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Kaufman L and Rousseeuw PJ (1990), Finding Groups in Data: An Introduction to Cluster Analysis, Johns Wiley and Sons.

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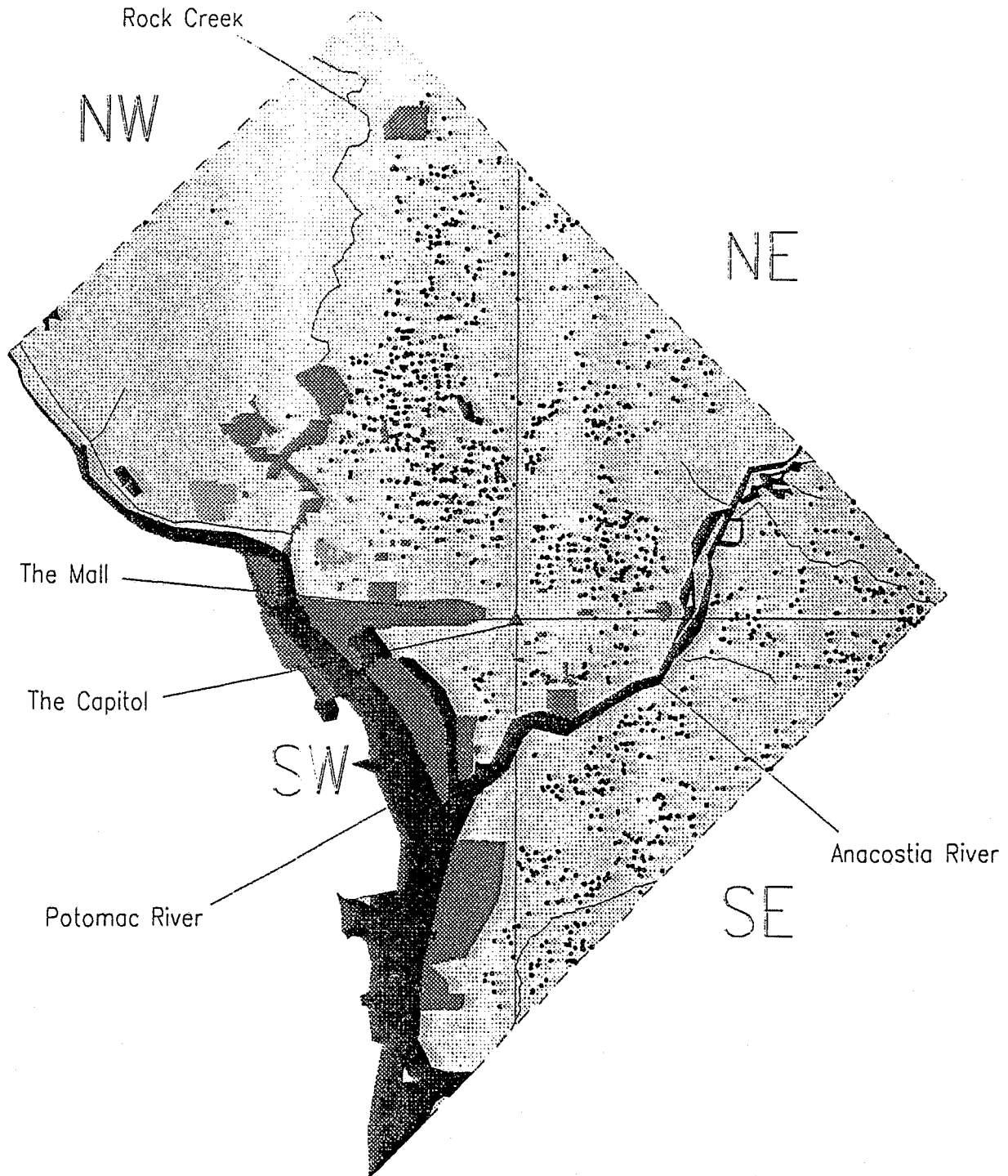
APPENDIX

1990 Cocaine-, PCP-, and Opiate-Positive Arrestees, By Quarter

- Figure A1. Location of Residences of Cocaine-Positive Arrestees in Washington, DC, 1st Quarter 1990.
- Figure A2. Location of Residences of Cocaine-Positive Arrestees in Washington, DC, 2nd Quarter 1990.
- Figure A3. Location of Residences of Cocaine-Positive Arrestees in Washington, DC, 3rd Quarter 1990.
- Figure A4. Location of Residences of Cocaine-Positive Arrestees in Washington, DC, 4th Quarter 1990.
- Figure A5. Location of Residences of PCP-Positive Arrestees in Washington, DC, 1st Quarter 1990.
- Figure A6. Location of Residences of PCP-Positive Arrestees in Washington, DC, 2nd Quarter 1990.
- Figure A7. Location of Residences of PCP-Positive Arrestees in Washington, DC, 3rd Quarter 1990.
- Figure A8. Location of Residences of PCP-Positive Arrestees in Washington, DC, 4th Quarter 1990.
- Figure A9. Location of Residences of Opiate-Positive Arrestees in Washington, DC, 1st Quarter 1990.
- Figure A10. Location of Residences of Opiate-Positive Arrestees in Washington, DC, 2nd Quarter 1990.
- Figure A11. Location of Residences of Opiate-Positive Arrestees in Washington, DC, 3rd Quarter 1990.
- Figure A12. Location of Residences of Opiate-Positive Arrestees in Washington, DC, 4th Quarter 1990.

Figure A1

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 1st Quarter 1990

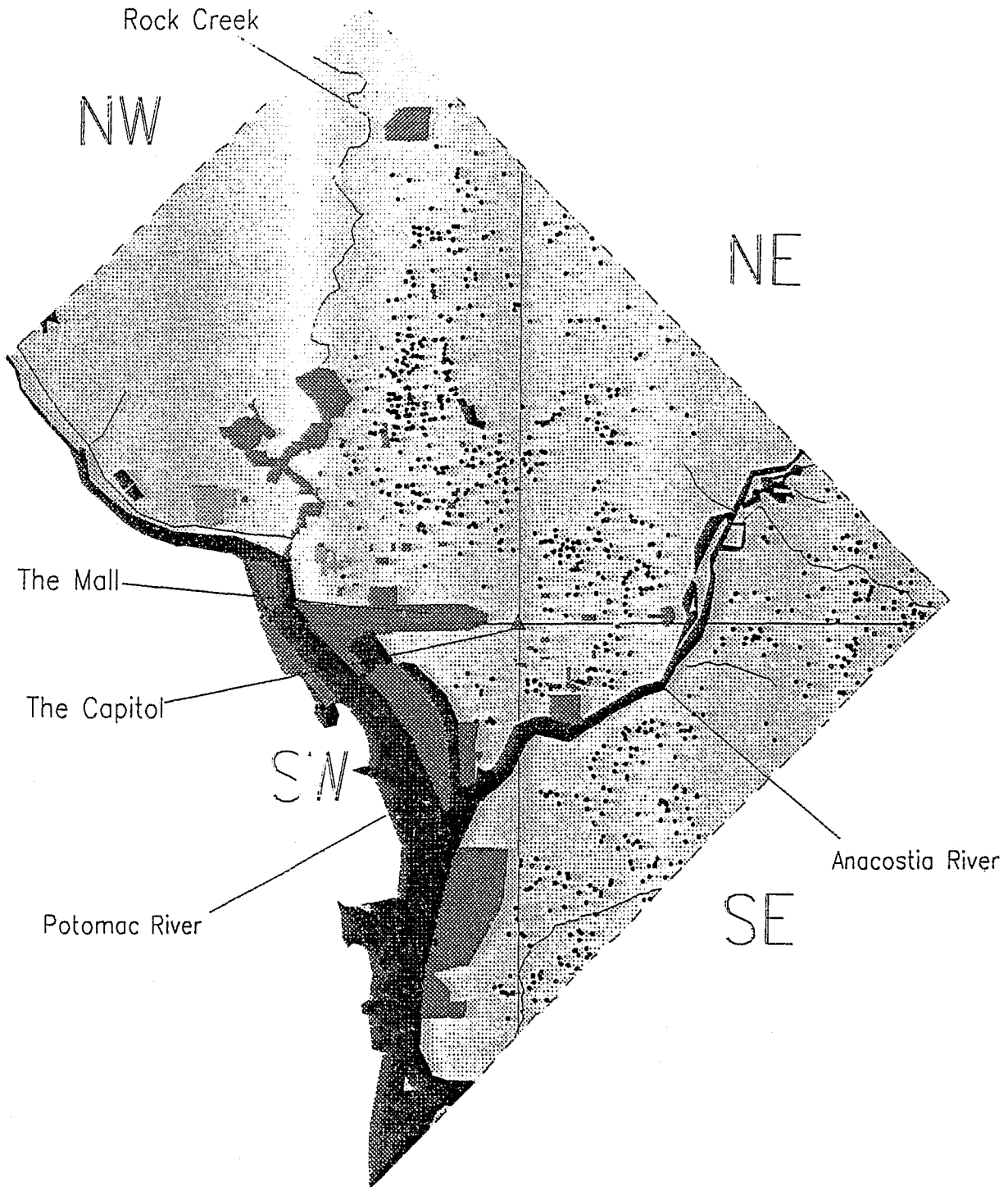


NOTE: There were 1814 cocaine-positive arrestees during 1st quarter 1990 with geocodable D.C. addresses. Of these, 1232 (68%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A2

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 2nd Quarter 1990

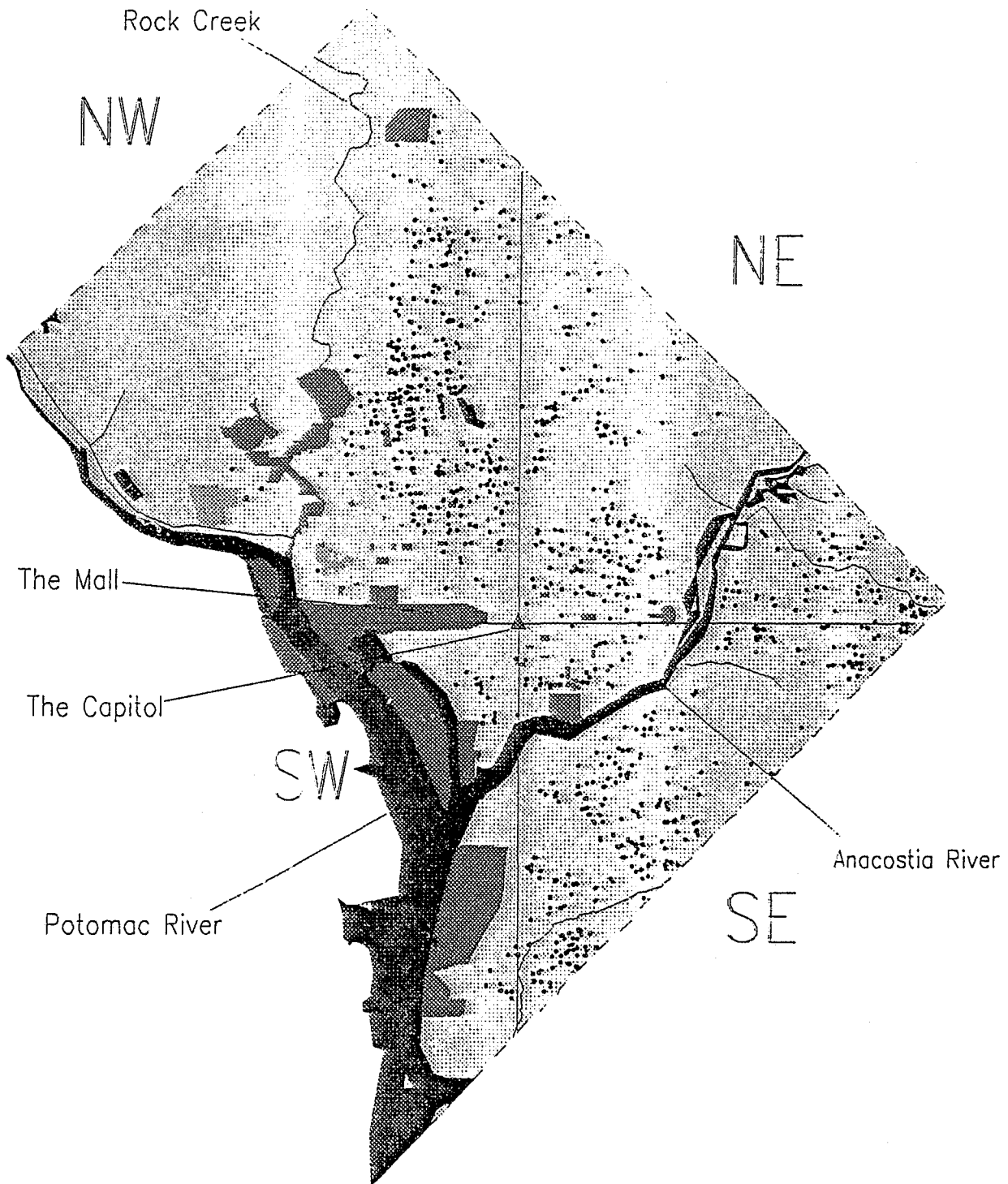


NOTE: There were 1434 cocaine-positive arrestees during 2nd quarter 1990 with geocodable D.C. addresses. Of these, 1016 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A3

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 3rd Quarter 1990

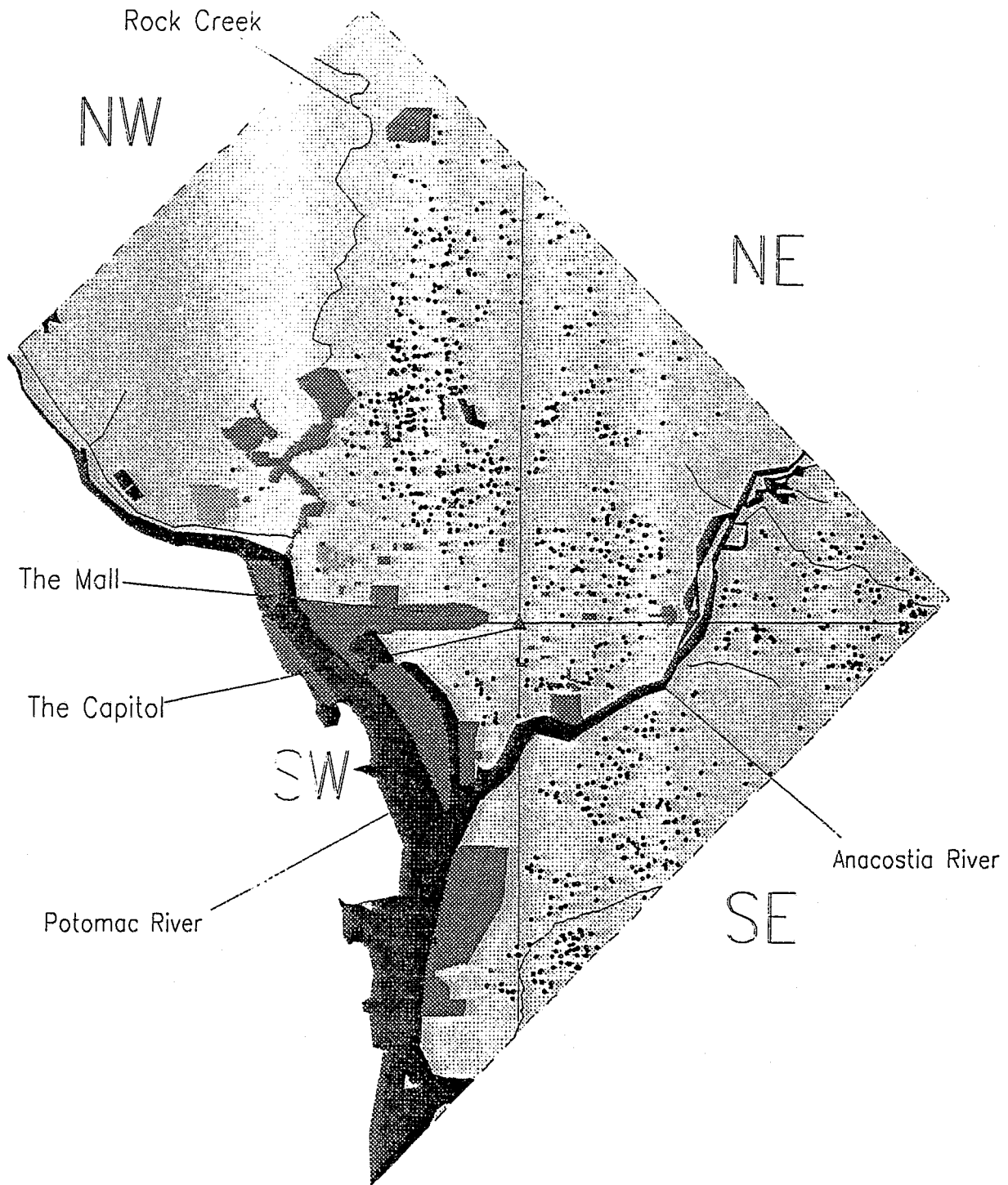


NOTE: There were 1644 cocaine-positive arrestees during 3rd quarter 1990 with geocodable D.C. addresses. Of these, 1138 (69%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A4

Location of Residences of Cocaine-Positive Arrestees in Washington, D.C., 4th Quarter 1990

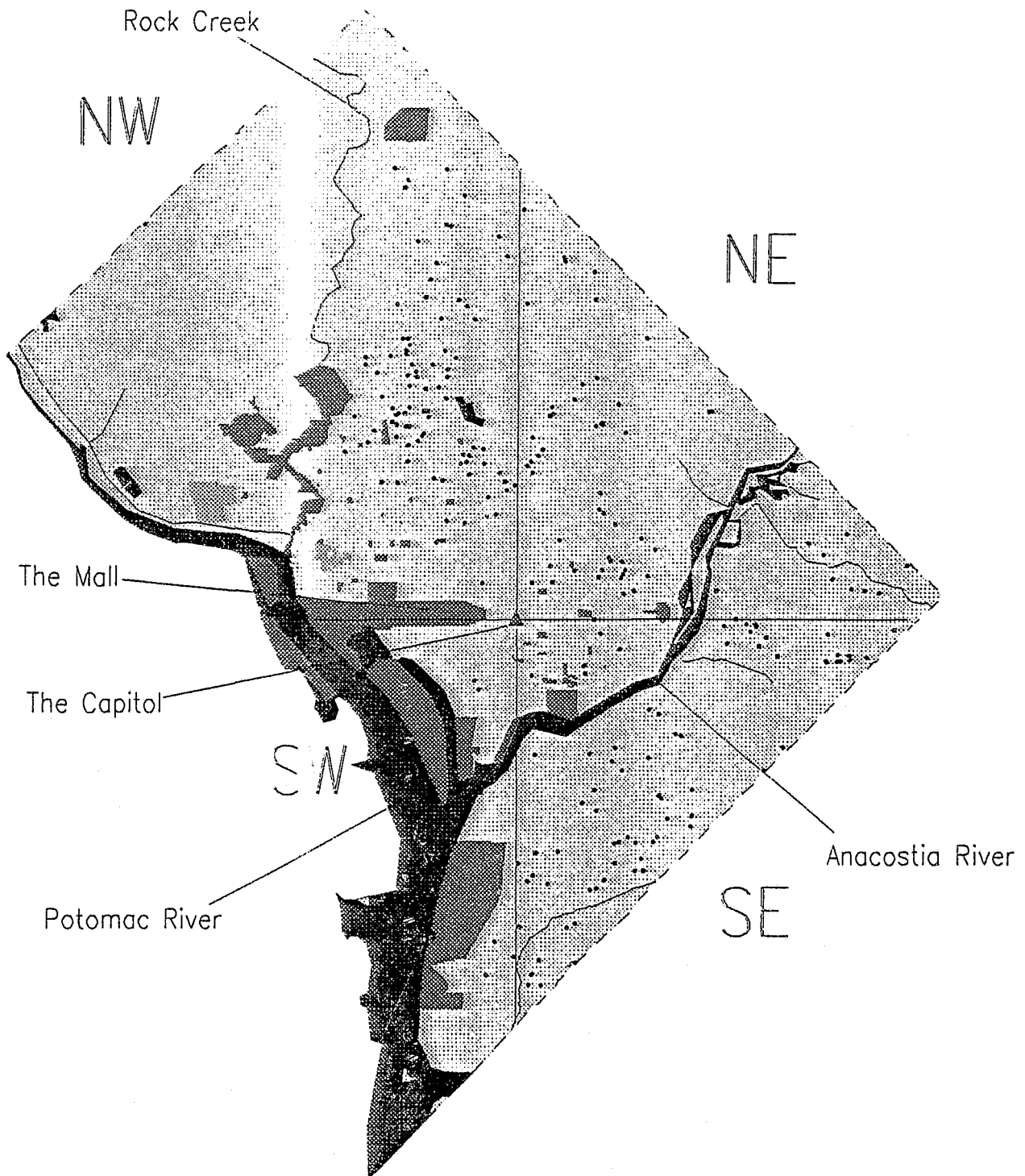


NOTE: There were 1452 cocaine-positive arrestees during 4th quarter 1990 with geocodable D.C. addresses. Of these, 1034 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A5

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 1st Quarter 1990

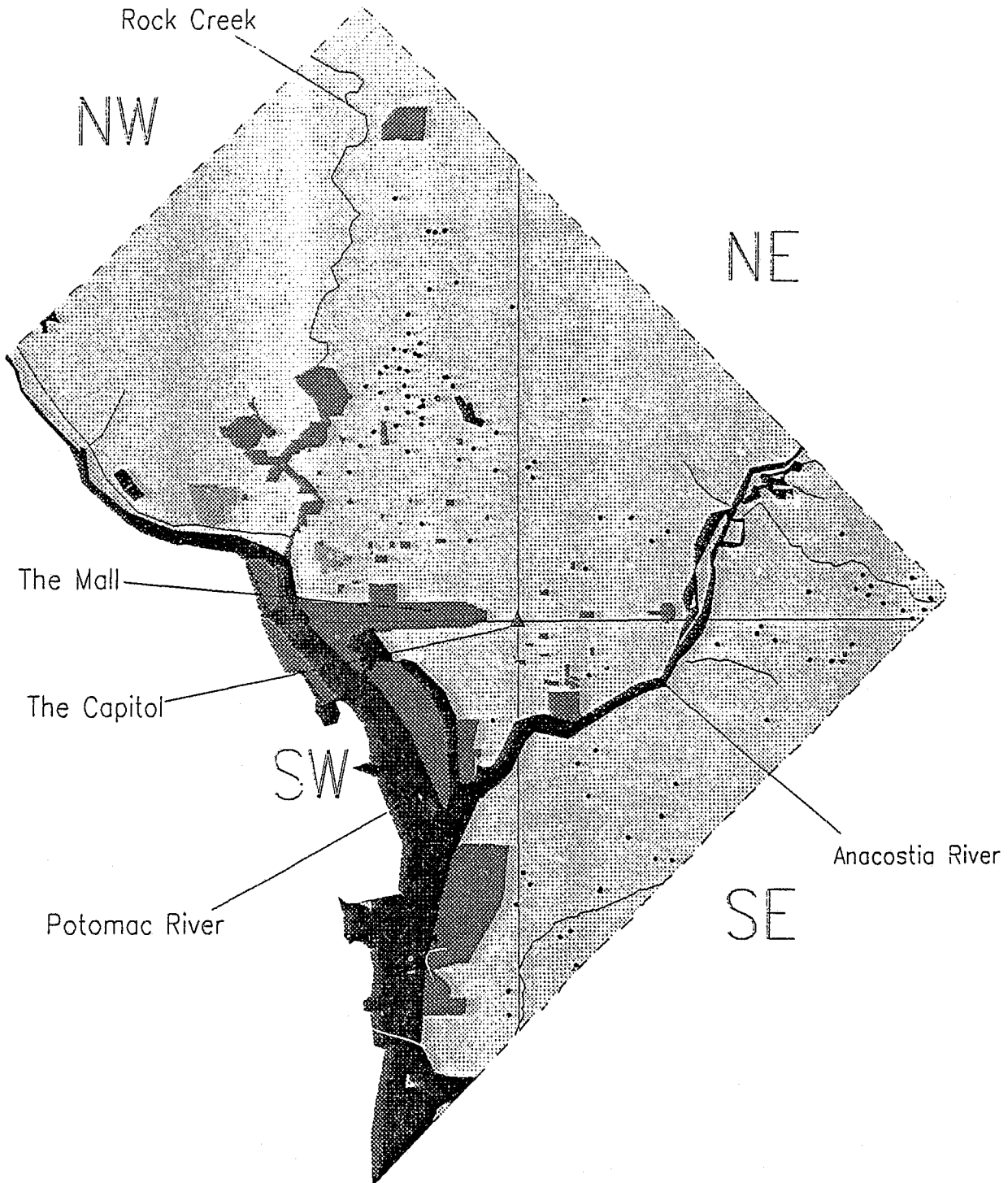


NOTE: There were 277 PCP-positive arrestees during 1st quarter 1990 with geocodable D.C. addresses. Of these, 195 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A6

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 2nd Quarter 1990

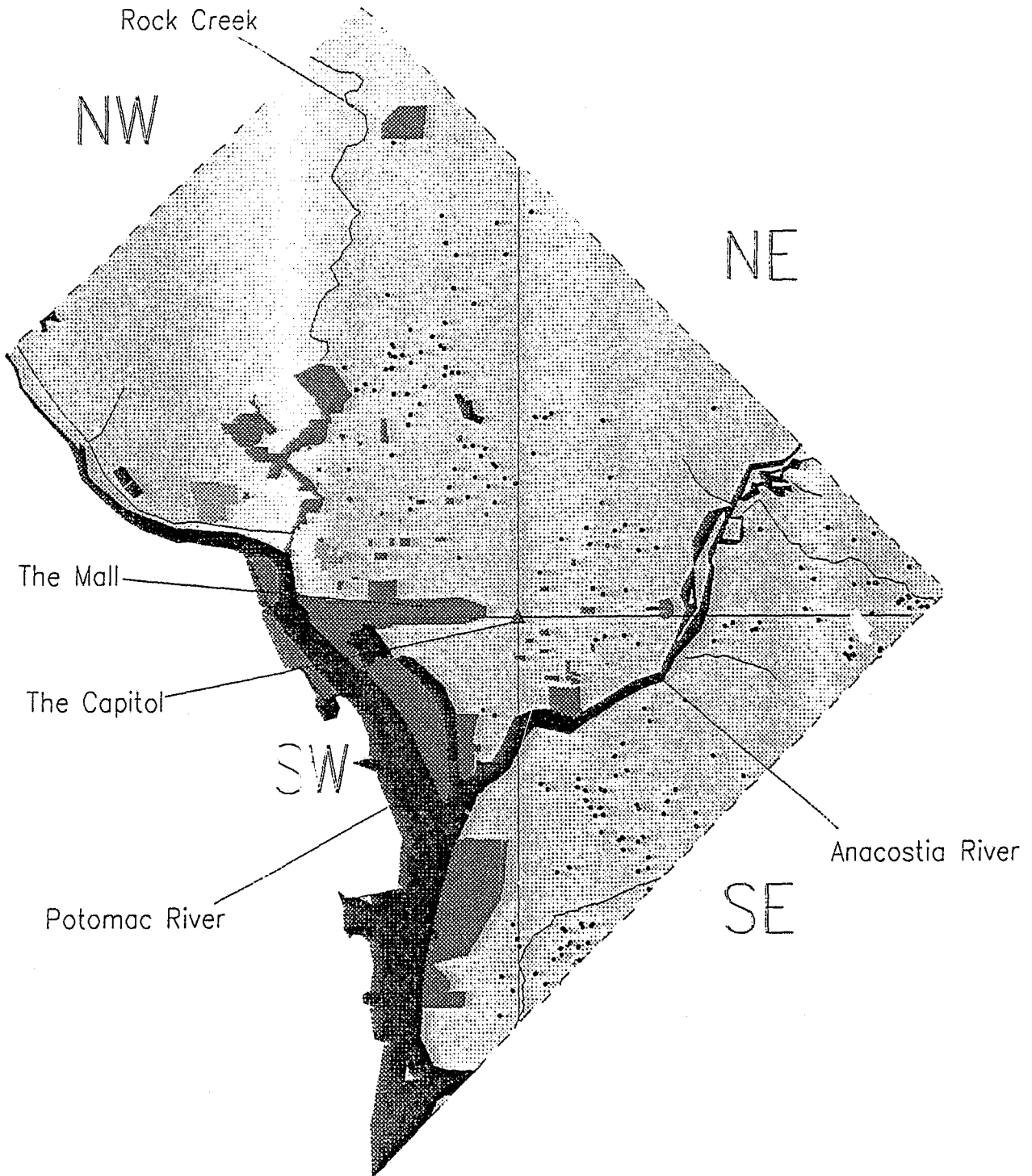


NOTE: There were 159 PCP-positive arrestees during 2nd quarter 1990 with geocodable D.C. addresses. Of these, 107 (67%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A7

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 3rd Quarter 1990

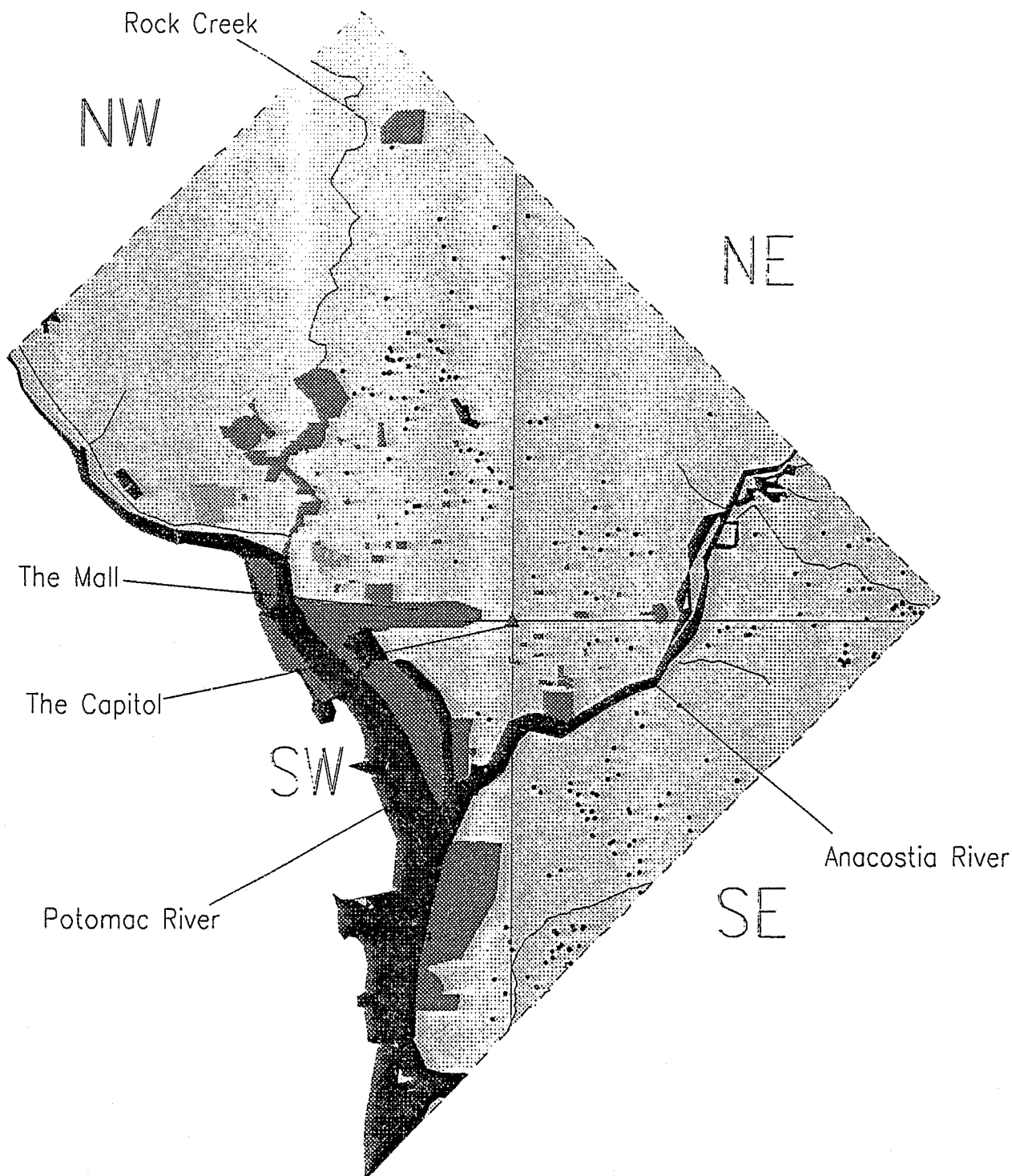


NOTE: There were 269 PCP-positive arrestees during 3rd quarter 1990 with geocodable D.C. addresses. Of these, 201 (75%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A8

Location of Residences of PCP-Positive Arrestees in Washington, D.C., 4th Quarter 1990

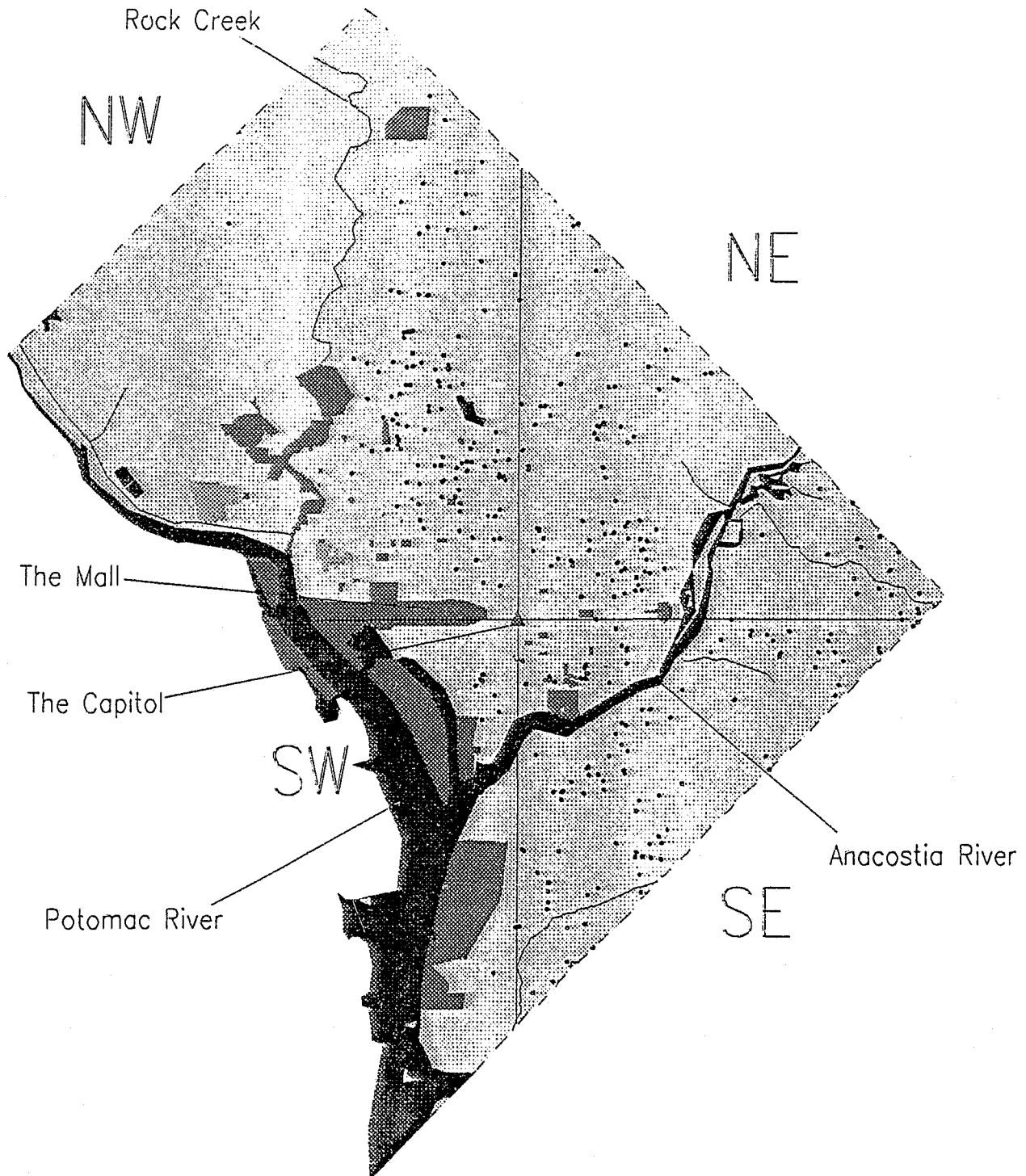


NOTE: There were 208 PCP-positive arrestees during 4th quarter 1990 with geocodable D.C. addresses. Of these, 149 (72%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A9

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 1st Quarter 1990

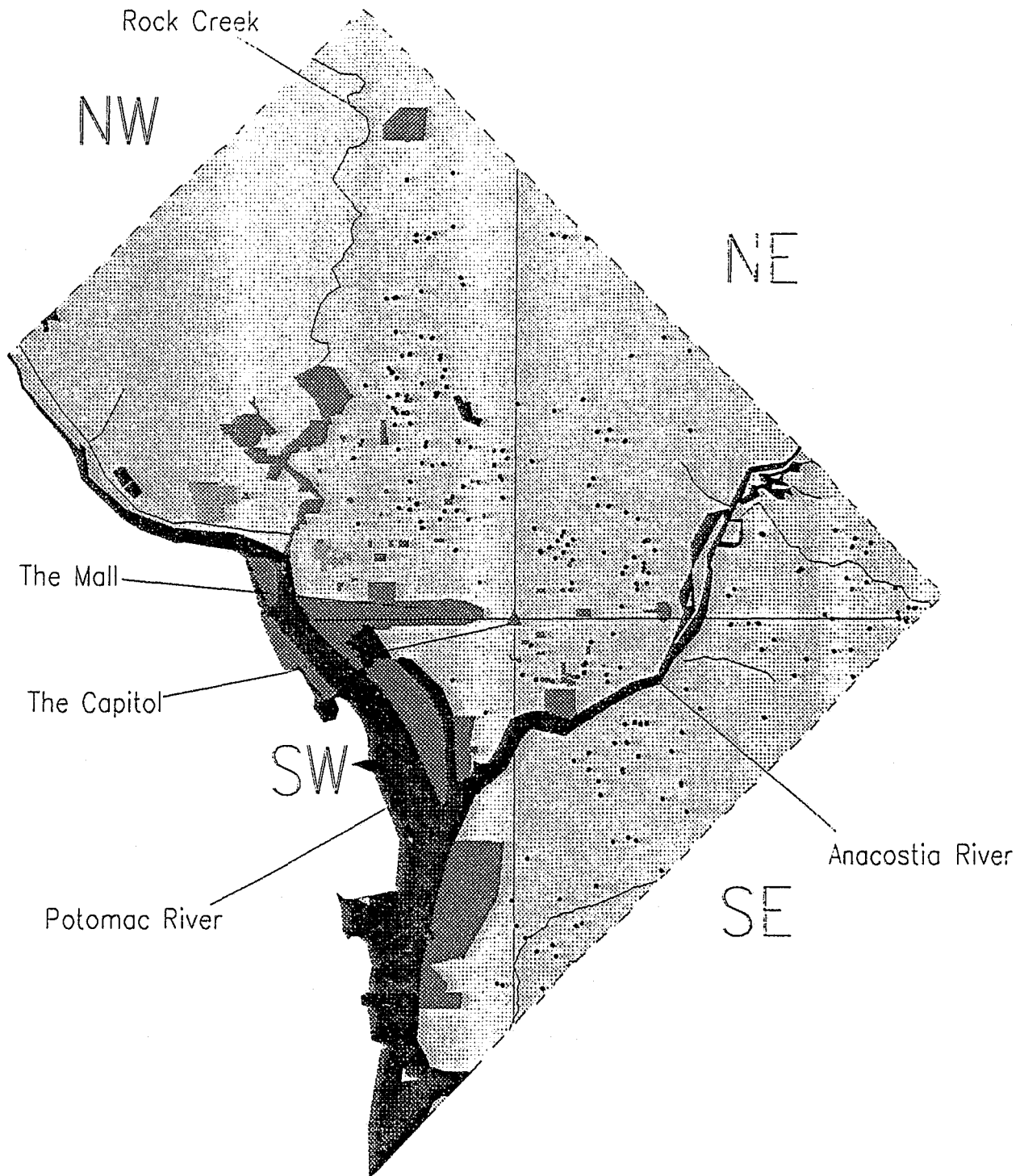


NOTE: There were 417 opiate-positive arrestees during 1st quarter 1990 with geocodable D.C. addresses. Of these, 295 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A10

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 2nd Quarter 1990

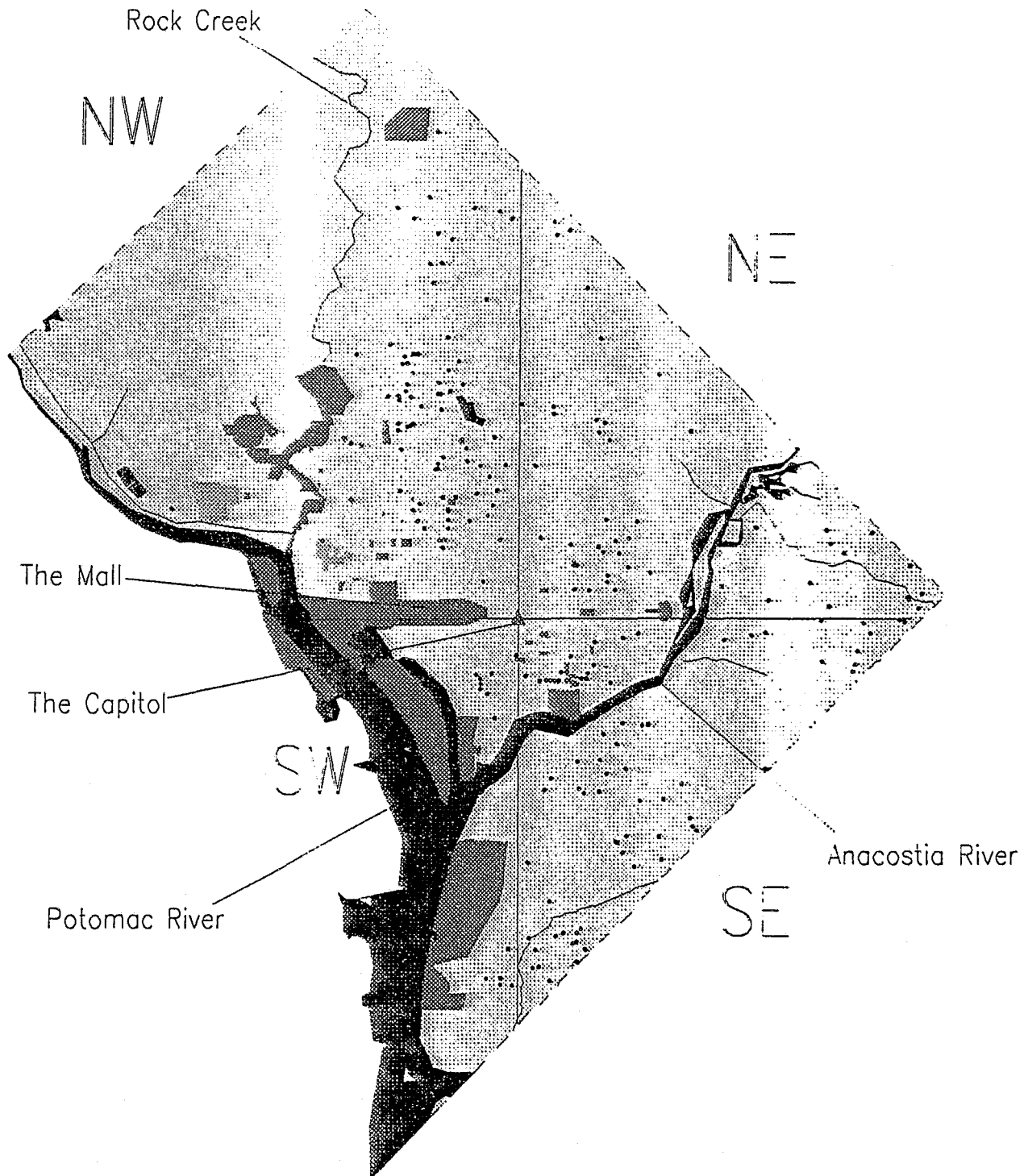


NOTE: There were 349 opiate-positive arrestees during 2nd quarter 1990 with geocodable D.C. addresses. Of these, 268 (77%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A11

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 3rd Quarter 1990

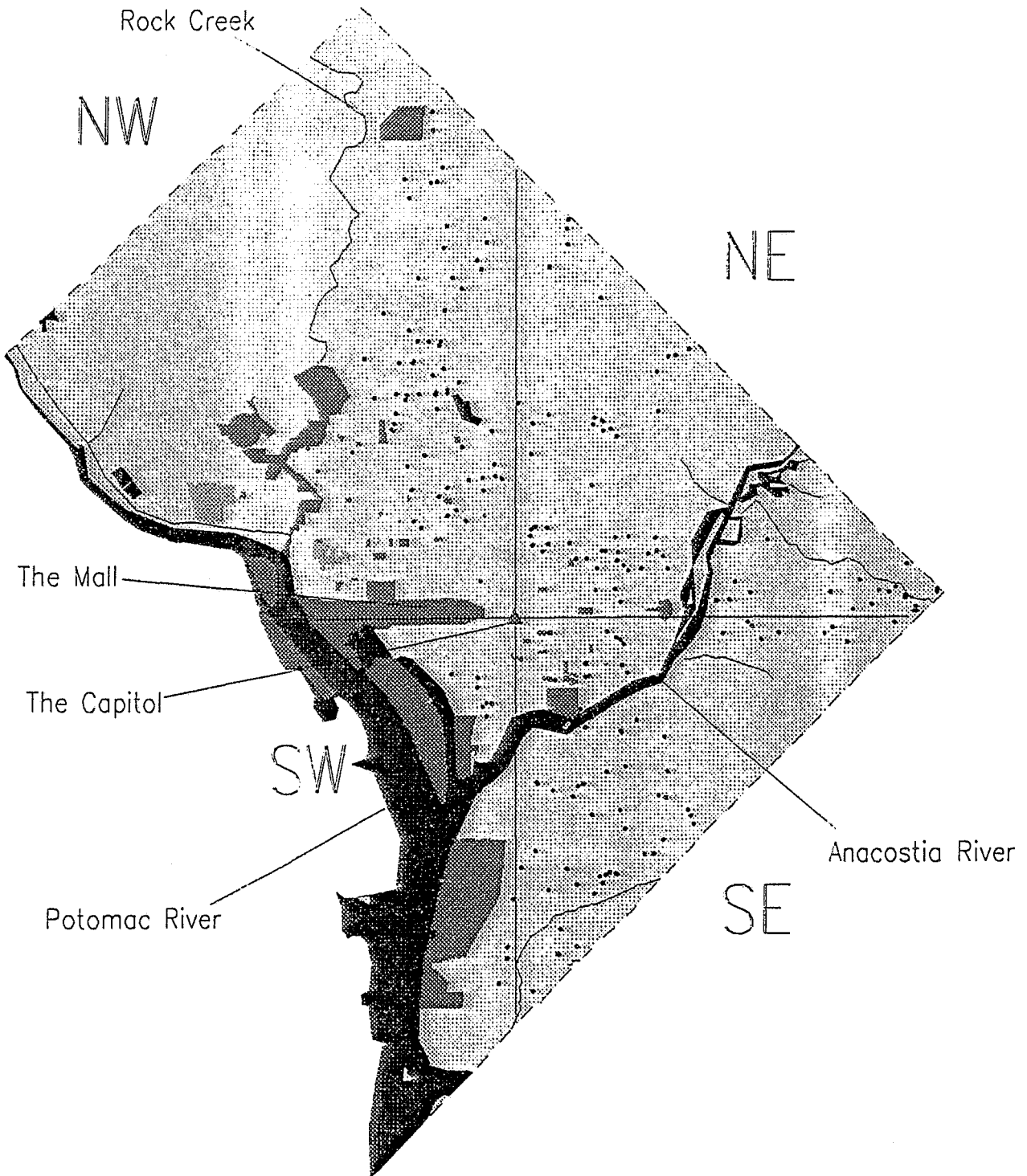


NOTE: There were 347 opiate-positive arrestees during 3rd quarter 1990 with geocodable D.C. addresses. Of these, 242 (70%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.

Figure A12

Location of Residences of Opiate-Positive Arrestees in Washington, D.C., 4th Quarter 1990



NOTE: There were 345 opiate-positive arrestees during 4th quarter 1990 with geocodable D.C. addresses. Of these, 245 (71%) were geocoded in this analysis. Data provided by the District of Columbia Pretrial Services Agency and the Center for Substance Abuse Treatment (DHHS).

SOURCE: Center for Substance Abuse Research (CESAR), University of Maryland at College Park, 1995.