

114
University of Nevada

Reno

Geomorphic Base for Recent Urban Expansion
in the Sacramento Urban Area

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science
in Geology

By

Robert Martin Davis
'''

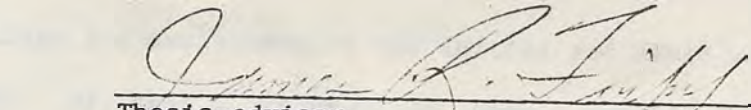
Mines Library
University of Nevada
Reno, Nevada 89507

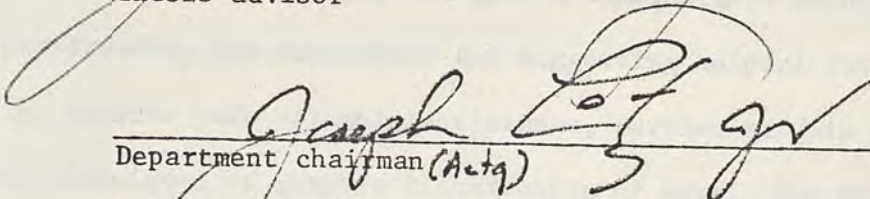
June 1972

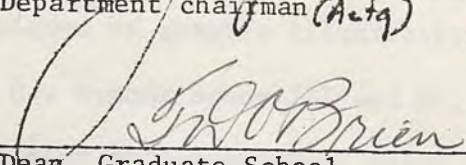
MINES
LIBRARY

Thesis
643
c.2

The thesis of Robert Martin Davis is approved:


Thesis advisor


Department chairman (Actg)


Dean, Graduate School

University of Nevada

Reno

Mines Library
University of Nevada
Reno, Nevada 89507

June 1972

ACKNOWLEDGEMENTS

The work of the author was aided by a graduate assistantship, and a research grant from the Mackay School of Mines, University of Nevada, Reno.

The author is indebted to Dr. Kazuo Z. Ninomiya of Sacramento State College for assistance in the initial and field work stages of this study. Dr. Earl W. Kersten, Jr. gave a considerable amount of his time proofreading the manuscript and suggesting helpful references. Dr. James L. Hendrix gave valuable assistance, particularly in suggesting various techniques of graphic illustration of data. The author is also indebted to Dr. Arthur Baker III and Dr. James R. Firby for their constructive criticism and suggestions which strengthened the thesis.

A final thanks to Mrs. Helen Mossman and Miss Zenna Orr who conscientiously typed the manuscript.

ABSTRACT

Sacramento began its growth in the mid-nineteenth century in the area near the confluence of the Sacramento and American rivers. During the earlier history of the city, growth was strongest toward the northeast, the closest area of higher ground.

This early trend persisted, and has accelerated since World War II. Urban growth in the other directions has been relatively slight or negligible.

This study examines the relationship between elevation and recent population growth, utilizing census statistics from 1950, 1960, and 1970. The relationships between the pattern of urban growth and elevation and relief were studied by means of detailed maps showing population density and 25 foot contours, population-elevation graphs, urban growth theories, and a residential survey.

It is concluded that the northeast has been the preferred area for residential expansion throughout this century. The coming of the automobile and high speed highway transportation has accelerated growth toward the northeast. There are several reasons for this direction of growth, among them the preference for a more pleasant climate, rural surroundings and freedom from pollution and congestion.

TABLE OF CONTENTS

| | Page |
|--|------|
| LIST OF TABLES | vi |
| LIST OF FIGURES | vii |
| CHAPTER | |
| 1. INTRODUCTION | 1 |
| The Problem | 3 |
| Definition of Terms | 4 |
| Sources of Information | 5 |
| Method of Procedure | 5 |
| 2. PHYSICAL FEATURES | 8 |
| Geologic History | 8 |
| Landform Progression | 8 |
| Present Landscape | 9 |
| 3. POPULATION CHARACTERISTICS | 15 |
| Settlement and Historical Urban Growth | 15 |
| Recent Urban Growth | 22 |
| 4. POPULATION GROWTH AND LANDFORMS | 30 |
| Correlation of Population Growth with Elevation .. | 30 |
| Urban Growth Theories | 36 |
| Residential Survey Findings | 43 |
| 5. CONCLUSION | 47 |
| SELECTED BIBLIOGRAPHY | 48 |

LIST OF TABLES

| Table | Page |
|--|------|
| 1. Population Distribution by Census County Division | 23 |
| 2. Population Distribution by Elevation | 34 |
| 3. Location of Recent Home Purchases | 46 |
| 4. The Home Purchase and Rental in 1950 | 46 |
| 5. Part of the Housing and Home Start | 46 |
| 6. Housing Market | 46 |
| 7. Highways, Bridges and Tolls | 46 |
| 8. Census County Division | 46 |
| 9. 1950 Agricultural Production | 46 |
| 10. 1950 Agricultural Production | 46 |
| 11. 1950 Agricultural Production | 46 |
| 12. 1950 Distribution of Families | 46 |
| 13. 1950 Distribution of Families | 46 |
| 14. 1950 Distribution of Families | 46 |
| 15. 1950 Distribution of Families | 46 |
| 16. 1950 Distribution of Families | 46 |
| 17. 1950 Distribution of Families | 46 |
| 18. 1950 Distribution of Families | 46 |
| 19. 1950 Distribution of Families | 46 |
| 20. 1950 Distribution of Families | 46 |
| 21. 1950 Distribution of Families | 46 |
| 22. 1950 Distribution of Families | 46 |
| 23. 1950 Distribution of Families | 46 |
| 24. 1950 Distribution of Families | 46 |
| 25. 1950 Distribution of Families | 46 |
| 26. 1950 Distribution of Families | 46 |
| 27. 1950 Distribution of Families | 46 |
| 28. 1950 Distribution of Families | 46 |
| 29. 1950 Distribution of Families | 46 |
| 30. 1950 Distribution of Families | 46 |

LIST OF FIGURES

| Figure | Page |
|---|-------------|
| 1. Location of Study Area | 6 |
| 2. Sierra Foothills Near Folsom | 11 |
| 3. The Red Lands North of Lake Natomas | 12 |
| 4. The Embarcadero and Sutter's Fort | 16 |
| 5. Part of the Existing Old Town Near Embarcadero | 18 |
| 6. Downtown Basement Complex | 20 |
| 7. Highway Network and Suburbs | 21 |
| 8. Census County Divisions | 24 |
| 9. 1950 Residential Perimeter | 25 |
| 10. 1960 Residential Perimeter | 27 |
| 11. 1970 Residential Perimeter | 28 |
| 12. 1950 Distribution of Population | 31 |
| 13. 1960 Distribution of Population | 32 |
| 14. 1970 Distribution of Population | 33 |
| 15. Number of Persons by Elevation | 37 |
| 16. Percent of Population by Elevation | 38 |
| 17. Concentric Zone Theory | 39 |
| 18. The Sector Theory | 41 |
| 19. Residential Survey Divisions | 44 |
| 20. Physical Features | rear pocket |
| 21. Physiographic Divisions | rear pocket |
| 22. Location of Places | rear pocket |

Chapter I

INTRODUCTION

American cities have been experiencing rapid population growth for many years, and particularly since World War II. By 1970, 68% of America's housing units were in urbanized areas of over 50,000 inhabitants. The development of suburbs around the central cities has been characteristic of urban growth during this century, with especially strong development occurring in the post-World War II period. At the same time, the older interior sections of the cities have generally experienced losses or negligible gains in population because of aging, obsolescence and social and economic changes. The interior parts of the cities have become increasingly oriented to trade and service activities, while the suburbs house the cities' residents.

Recent uneven urban expansion into suburbs can be traced to various cultural, economic, and physical factors. The automobile in conjunction with modern freeways allows city workers to reside at a considerable distance from work. Therefore a suburbanite can work in a city where high-paying jobs are available and reside in the rural or semi-rural environment of the suburbs. Various physical features tend to attract or discourage suburban development. Residential expansion in many cities, has, according to Hoyt (1939, p. 117), proceeded toward high ground or wooded hills, which are free from floods and has tended to spread along water fronts which are not used for industry. Hoyt (Ibid.) also established that open fields, golf courses, country clubs, country estates, and

generally free open land act as a drawing force to high rent residential growth. Hoyt (Ibid.) cites as examples of the influence of physical features on urban growth: St. Louis, Missouri where expansion occurred away from the river bottoms to higher land, and Charleston, West Virginia where one high grade residential area extends along the high bank of the Kanawha River.

An analysis of recent urban growth trends is needed to project areas of future growth. Past urban expansion for the most part has been unplanned, which has resulted in major problems relating to city and county government services, and a deterioration of the urban environment. By plotting urban expansion on maps and analyzing possible factors conducive to urban growth, it may be possible to predict the direction and rate of future urban growth. Well planned subdivisions and other urban developments can provide a more attractive environment and can include more satisfactory amenities and services than small unplanned developments. Such predictions are essential in order to plan for future urban development and to preserve environmental quality as much as is possible.

Sacramento is located at the confluence of the Sacramento and American rivers in the Central Valley of California. The city lies on an alluvial plain which runs in a north-south direction, and is bordered on the west by the Yolo basin, on the east by the lower reaches of the Sierra Nevada, and on the north and south by the American and Sacramento basins respectively (Figure 21 in pocket). At its center, the city has an elevation of about eighteen feet

above sea level. Elevations, however, increase away from the center to the northeast, east, and southeast.

The Problem

The Sacramento Urban Area has recently experienced rapid population expansion, particularly toward the northeast where elevation and local relief increase most rapidly. Lesser urban growth has been experienced southeast and west of Sacramento. The expansion in other areas surrounding Sacramento has been negligible. Urban expansion in Sacramento has resulted in the coalescence of the central city with many suburban centers in the northeast.

This study will examine the possible correlation between recent urban expansion and local relief and elevation, in the Sacramento area since World War II. The greatest urban expansion has been to the northeast, the direction in which both elevation and steepness of slopes increase most rapidly. The problem is to determine to what extent and in what ways the factors of increasing relief and elevation are related to recent patterns of urban expansion.

Definition of Terms

Urban areas for the purpose of this study are defined as in the 1970 census.¹ Major industrial areas are differentiated from urban areas and include only the large employers of military and manufacturing personnel. Such areas include the Sacramento Army depot, Mather and McClellan Air Force bases, the Sacramento Port Facility, and the Aerojet-McDonnell Plant. This distinction was made because each of the above employs many people but houses relatively few, and each utilizes large amounts of land. Besides urban and major industrial areas, rural areas are designated, which also follow the 1970 census definition.²

Census county divisions, as defined by the United States Census Bureau, are used as a common denominator to examine urban growth.³

¹In the 1970 census of population, publication PC(1)-A6 page VII, the United States Bureau of the Census defined urban as follows: An urbanized area consists of a central city of at least 50,000 inhabitants (or twin cities with a combined population of at least 50,000), plus all surrounding closely settled territory. Normally such closely settled territory included all incorporated places of 2,500 inhabitants and more, or incorporated places with fewer than 2,500 inhabitants, provided that each has a closely settled area of 100 housing units or more; small parcels of land normally less than one square mile in area having a population density of 1,000 inhabitants or more per square mile; and other small areas of unincorporated territory with lower population density provided that they serve to eliminate enclaves, or close indentations of the urbanized area.

²In the 1970 census of population, publication PC(1)-A6 page IV, the United States Bureau of the Census defined rural as follows: "In all urban rural definitions the population not classified as urban constitutes the rural population."

³In the 1970 census of population, publication PC(1)-A6 pages V-VI, the United States Bureau of the Census defined Census County Divisions as follows: Census County Divisions (CCD's) were established by the Census Bureau and individual states, to provide permanent boundaries features or the limits of incorporated places for census enumeration.

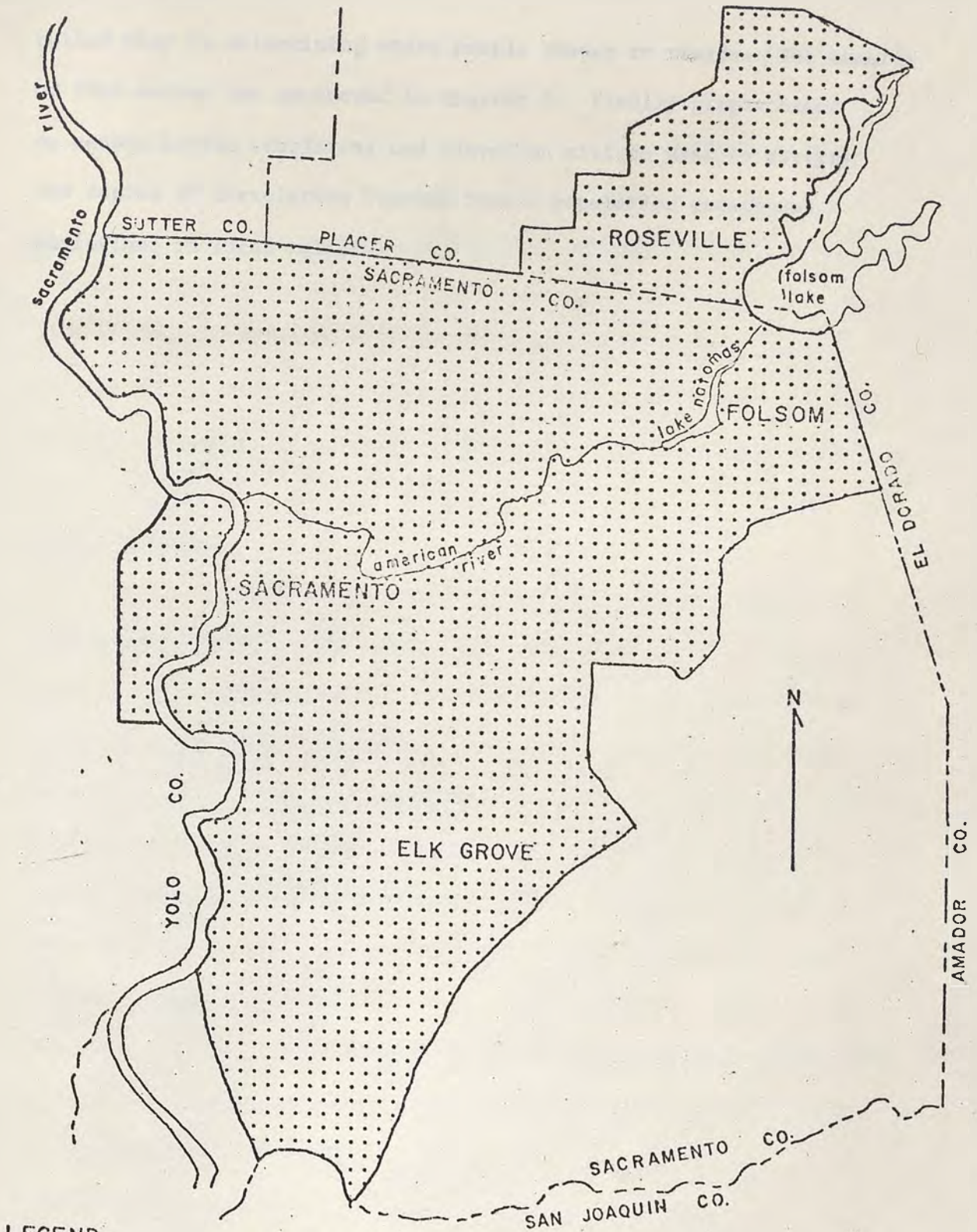
This study will examine population growth in twelve such census divisions within Placer, Sacramento, and Yolo counties, which are designated by the 1970 census bureau as the Sacramento Urbanized Area, (Figure 1). For a more detailed map of location within the study area (see Figure 22 in pocket). All post-World War II population statistics for census county divisions are rounded to the nearest 200 to conform with dot population maps.

Sources of Information

Much of the information used in the study for physical features and population characteristics was obtained from agencies of the federal, state, and local government. Basic population statistics and maps were obtained from the census publications. Additional population statistics and information concerning population distribution were obtained from the Sacramento Regional Area Planning Commission. Supporting information of urban theoretical and historical urban nature are cited in the bibliography.

Method of Procedure

Maps of population distribution for 1950, 1960, and 1970, and maps of elevation and local relief have been studied to determine the extent of the correlation between population, on the one hand, and elevation and relief on the other. Urban growth theories, the Concentric Zone Theory of Burgess (1925,p.47-62), Sector Theory by Hoyt (1939,p.117), and the Multiple Nuclei Theory of Harris and Ullman (1945,p.7), have been applied in order to determine the possible explanation for the growth. In January, 1972 a residential survey was conducted in order to find out what role elevation and

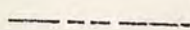


LEGEND -

STUDY AREA

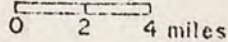


COUNTY BOUNDARY



LOCATION OF STUDY AREA

SCALE



ADAPTED FROM STATE HIGHWAY DEPT. MAP.

Figure 1

relief play in determining where people choose to reside. The results of this survey are presented in Chapter 4. Finally graphs based on census bureau statistics and elevation will be used to portray the degree of correlation between recent population growth and variations in local relief.

The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4.

CONCLUSION

The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4. The results of the survey are presented in Chapter 4.

REFERENCES

References are listed in the following order: books, articles, and maps. The results of the survey are presented in Chapter 4.

Chapter 2

PHYSICAL FEATURES

Geographically the study area lies in a transition zone between the Sierra Nevada and the Sacramento Valley. Geologically the region is complex, with a complicated history of landscape evolution. Since a detailed geologic history of the area is not essential to the study, only a brief description will be given of more recent geological events. The intent of the following paragraphs is to describe the natural environment upon which urbanization occurred in the study area.

Geologic History

The Laramide revolution during the Cretaceous era involved the folding and uplift of the Coast ranges and uplift without significant folding in the Sierra Nevada. Apparently during the Eocene the sea advanced eastward over the Coast Ranges to the base of the Sierra Nevada, where streams were depositing sediments in the shallow sea. The Eocene ended as volcanoes in the Sierra Nevada extruded lavas and other materials down the slopes. Along the borders of what is today the Sacramento Valley uplift and erosion followed continued volcanic eruptions of the Pliocene. Also during the Pliocene the Sierra was uplifted to a height of several thousand feet and acquired a strongly asymmetrical form, which is characteristic of the Sierra today (Matthes, 1956, p.49).

Landform Progression

Alluvium was deposited over the whole valley during Late Pliocene and Pleistocene. Under the weight of these and previous sediments,

the base of the valley slowly sank. As the valley bottom sank and tilted downward the margins were tilted and uplifted. This uplift around the valley margins has exposed the older alluvium to erosion. Older alluvium, uplifted and dissected, is distinct from recent alluvium, which is still being deposited.

Deposition of older alluvium was followed by Pleistocene uplift which resulted in elevation of the Coast Ranges and Sierra Nevada, (Bryan, 1923, p. 12). The shallow sea gradually retreated into San Francisco bay while the rate of sedimentation in the valley exceeded the sinking. Cooler temperatures and increased moisture availability during the Pleistocene resulted in increased stream flow. During the period of excessive run-off associated with interglacial periods in the Sierra Nevada, many shallow lakes formed flood basins where fine sediments were deposited.

Present Landscape

Bryan (1923, p. 9) describes five physiographic subdivisions present in the study area, including: the Sierra Nevada foothills, red lands, low plains, river lands, and flood basins (Figure 21 in pocket).

The Sierra Nevada form the eastern boundary of the southern Sacramento Valley. The foothills have an altitude of 100 to 200 feet above sea level at the edge of the valley, and rise to more than 500 feet in the northeastern part of the study area around Folsom Lake. The Sierras have more active faulting and vertical dislocation, on the steep east front than on the long west slope (Matthes, 1956, p. 50). Streams and rivers issuing from the Sierras have deep incised

canyons running west by southwest into the Sacramento Valley. Besides increasing elevation in the foothills, other environmental differences are present. Climatic and vegetational differences are most pronounced. Woody vegetation increases at higher elevations upwards in the foothills in conjunction with an increase of precipitation, and cooler temperatures (Figure 2).

The red lands, remnants of older alluvium form a discontinuous belt of hilly or gently undulating topography immediately west of the Sierra foothills and sloping westward at an angle of less than 5 degrees. Deposition of volcanic sediments in the study area by the American and Consumnes Rivers has given the older alluvium a distinctly reddish appearance. The red lands sediments, composed of clay, sand, and gravel, have become moderately cemented and indurated, resulting in increased resistance to erosion. Within the study area the red lands grade from a maximum elevation of 300 feet to a minimum of 50 feet above sea level, and are most conspicuous as bluffs on the north bank of the American River east of Sacramento (Figure 3). Originally almost level, the red lands have been dissected by streams and creeks into a hilly plain which slopes westward to the low plains. Climate and vegetation associated with the Sierra foothills extend into the red lands.

Generally the low plains lie between the red lands and the river lands, but occasionally they extend east to the foothills where the red lands are absent, and often grade into the flood basins. The low plains show little relief and the slope is very gentle toward the valley axis. Construction of these plains is still under



The American River issuing from the Sierra foothills below Folsom Lake.



Front Range of the Sierra Nevada along the southeastern margin of the study area.

Figure 2



The Red Lands north of Lake Natomas taken from the northeast



The red lands north of Lake Natomas taken from the south.
Relief increases north of the river and is here represented
by a steep bluff.

Figure 3

way, particularly during floods, which deposit sand and silt. The natural vegetation consists of widely spaced dark oaks and a carpet of short grasses or wild oats. Precipitation is about 5 to 10 inches less than the 30 inch average annual found in the Sierra foothills, and temperatures are about 5° warmer.

The natural levees of the Sacramento River form narrow belts rising five to twenty feet above the valley, and are part of what is called the river lands. Primary tributaries of the Sacramento River have built up natural levees which are also considered river lands (Figure 20 in pocket).

Rising above the surrounding valley floor, the wooded river lands represent the only break in the monotonous, flat topography of the valley lowlands. Deposition by major streams is responsible for these elevated areas. Stream gradients associated with the river lands are extremely gentle and many streams have changed courses frequently.

Between the river lands and the low plains, are wide shallow basins, which are flood basins. They comprise the lowest, flattest areas in the study area. Standing waters during and after floods have deposited silts, resulting in heavy soils, which are well adapted to agriculture. Within the study area there are three flood basins; those of the American, Sacramento, and Yolo. These basins bound the city of Sacramento to the south, west, and north. To the northeastward and eastward are red lands and low plains areas of greater elevation and greater relief.

Another area of notable landscape interest is that of the

dredge tailings, along the course of the American River near Lake Natoma. Piles of cobblestones ten to twenty feet high cover approximately ten square miles. Although it has been nearly one hundred years since the dredging operations occurred, vegetation has only recently begun to reappear. Apparently the area was originally associated with the red lands subdivisions, (Figure 21 in pocket).

Chapter 3

POPULATION CHARACTERISTICS

This chapter outlines the history of urban growth within the Sacramento area, with particular emphasis on the post-World War II period.

Settlement and Historical Urban Growth

In 1817 Padre Narcisco Duran named the Sacramento River while searching for natives to convert (Grudde, 1936, p. 42). The name remained but the region was not explored further until John A. Sutter arrived in 1836. Sutter explored the Sacramento River northward to the junction of the Sacramento and American rivers for settlement. Sutter's settlement, called New Helvetia, was located up the American River as far as navigation permitted. Recognizing the possibility of flooding in the lowlands during heavy run-off, Sutter stated, "I selected the highest ground I could for settlement," (Ibid.). Here Sutter built his fort, the first substantial structure in the region. The landing was moved in 1840 from the American to the Sacramento River and named The Embarcadero. From these two nuclei of activity a city developed (Figure 4).

Sutter proposed and laid out plans for Sutterville, three miles south of the fort where the land was higher and provided access toward the mountains to the east even during floods. Sutter opposed population growth around The Embarcadero and fort because, "the land was so low that a rise of the river above normal would cause a flood in the town." (Ibid., p. 220).

After California was acquired by the United States, Sutter's



Approximate location of Sacramento's old port facility called the Embarcadero, from the I Street Bridge.



Sutter's Fort from the corner of 28 & L Street

Figure 4

Mexican land grant to New Helvetia was not honored by the courts. Consequently, plans for the city of Sutterville were not carried out. In 1848, W. H. Warner laid out the new city between the Embarcadero and Sutter's Fort and named it Sacramento. Initially Sacramento grew along and out from K and L Streets between the Embarcadero and the fort, (Figure 5).

Sacramento grew rapidly during the latter half of the nineteenth century because of its favorable location, with respect to the Mother Lode, which was discovered by James Marshall at Coloma on January 24, 1848. Sacramento became the point of departure for miners bound for the Mother Lode which lies about 30 miles east of Sacramento in the Sierra Nevada. Many miners who struck it rich settled and prospered in Sacramento. With the passing of the gold rush and lower yields in the mines, Sacramento became the agricultural export center and later the food processing center of the Sacramento Valley.

Nineteenth Century urbanization followed an eastward trend until the area between the Embarcadero or Front Street and Sutter's Fort at Twenty-eighth Street was completely urbanized, as far north as A Street, and south through X Street. The 1900 census placed the Sacramento population at 29,282.

Urban development was brought to a halt several times by the mid-1850's due to extensive floods which devastated the city, making Sacramento part of a large temporary lake. Artificial levees were constructed for flood control, but flooding continued almost annually, with considerable loss of lives and property.



Partially restored Historic Sacramento Along Front Street
near the Embarcadero.



Figure 5

Consequently, a program of elevating the city was initiated. According to Fleissig (1960,p.28), in 1863, all of the streets in old Sacramento were raised to a level which was supposedly two feet above high water mark. With the streets raised buildings either lost one story or were slowly elevated to the new street level. Fine examples of this original level have been uncovered by the demolition undertaken by the Redevelopment Agency, (Figure 6). The levee system was also improved and these measures greatly reduced the flooding and flood damage. Less extensive floods continued but with reduced frequency.

Further action was undertaken valley wide in 1917 by the Bureau of Reclamation. First the Yolo bypass was constructed to divert flood waters from the Sacramento Valley to the delta. More recent activities of the Bureau of Reclamation include the construction of many dams along the Sierra streams, which had previously flooded annually. Above Sacramento, Folsom and Nimbus dams built along the American River have eliminated all but minor local flooding.

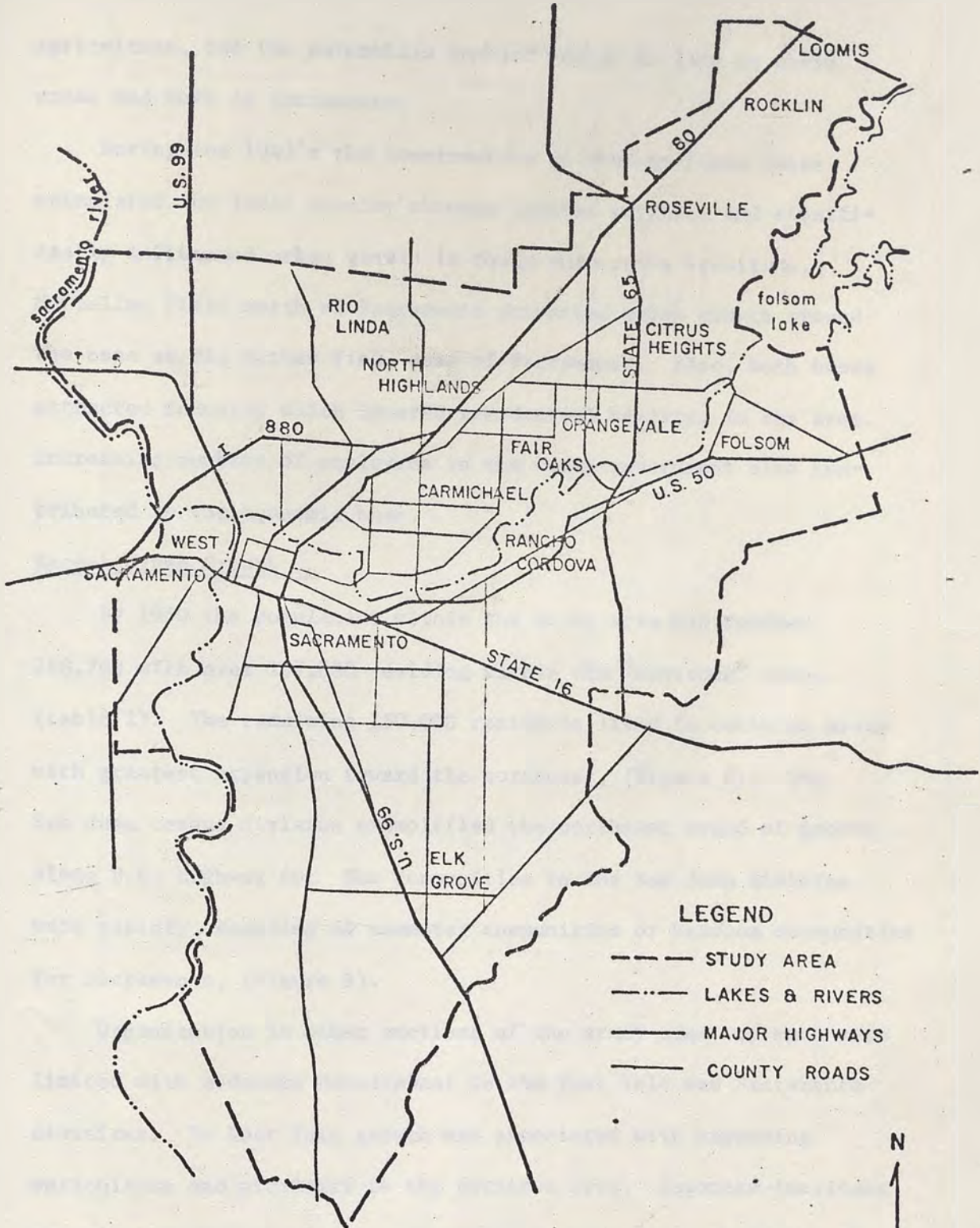
Although floods plagued urban growth in Sacramento, the population continued to increase rapidly. By 1940 Sacramento had a population of 106,000 and urban trends towards outlying areas had begun. Also several small independent communities had developed, particularly in the northeast. They were known as Rio Linda, North Highlands, Carmichael, Fair Oaks, Folsom, and Roseville, and were growing at a moderately rapid rate, (Figure 7). These communities originally served as marketing centers for local



Part of the original ground level under downtown Sacramento near the corner of 10th & H Streets.



Figure 6



HIGHWAY NETWORK & SUBURBS

SCALE
 0 2 4 miles

ADAPTED FROM STATE
 HIGHWAY DEPT. MAP.

Figure 7

agriculture, but the automobile enabled people to live in these areas and work in Sacramento.

During the 1940's the construction of two Air Force bases stimulated the local economy through federal payrolls and significantly influenced urban growth in their respective locations. McClellan Field north of Sacramento attracted urban growth around the base as did Mather Field east of Sacramento. Also, both bases attracted industry which lowered residential quality, in the area. Increasing numbers of employees in the state government also contributed to the economic base.

Recent Urban Growth

By 1950 the population within the study area had reached 288,200 with over 137,000 residing within the "downtown" area, (table 1). The remaining 150,000 residents lived in outlying areas with greatest expansion toward the northeast, (Figure 8). The San Juan census division exemplified the northeast trend of growth along U.S. Highway 40. The communities in the San Juan division were rapidly expanding as commuter communities or bedroom communities for Sacramento, (Figure 9).

Urbanization in other sections of the study area was much more limited with moderate development in the East Yolo and Sacramento divisions. In East Yolo growth was associated with expanding agriculture and proximity to the downtown area. Japanese-Americans returning to Sacramento from detention centers after World War II chose the southern part of the Sacramento division because of the low real estate cost there.

Table 1

POPULATION DISTRIBUTION BY CENSUS COUNTY DIVISION^a

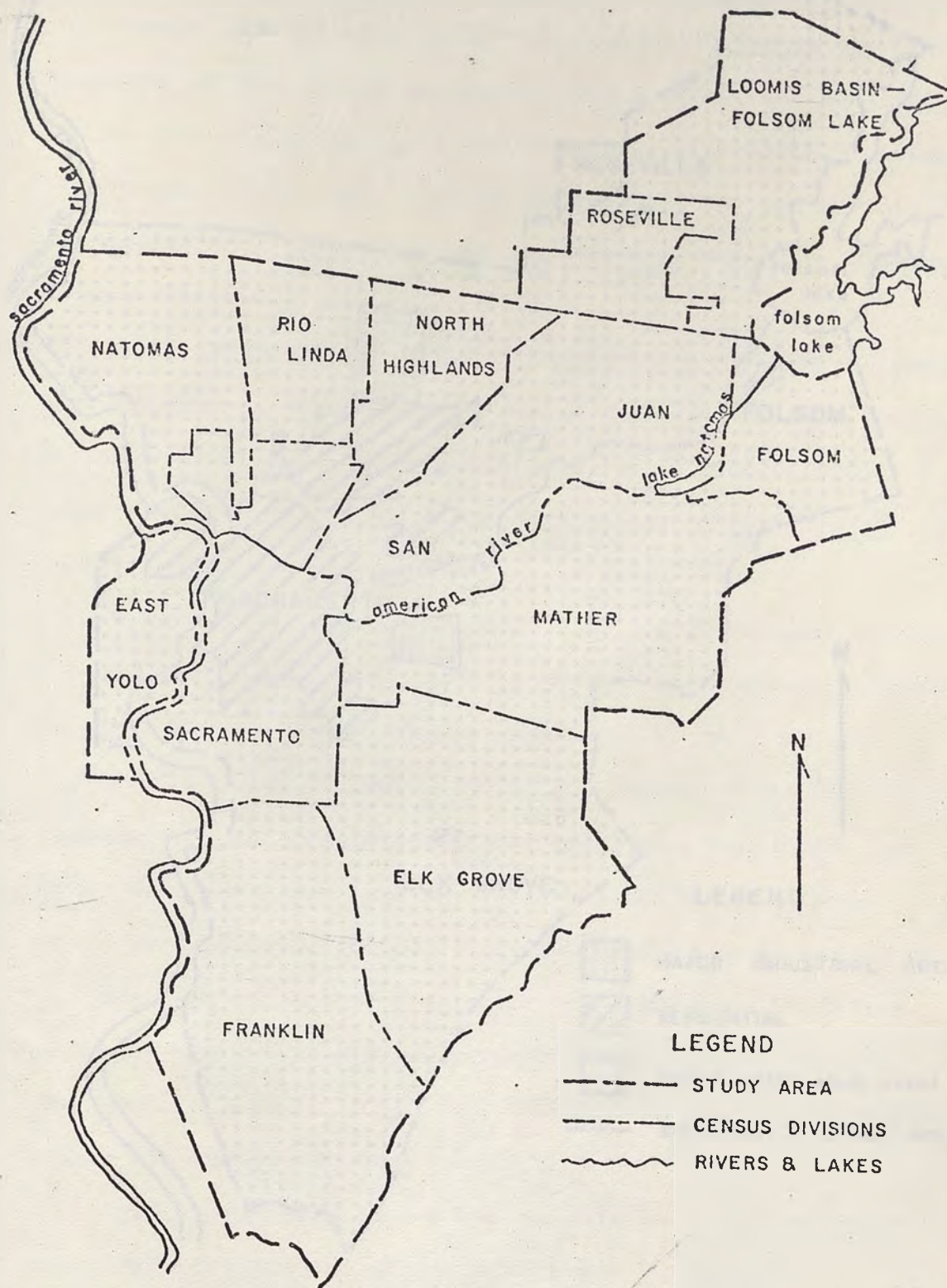
| C.C.D. | 1950 ^b | % CHANGE | 1960 ^c | % CHANGE | 1970 ^d |
|----------------------|-------------------|----------|-------------------|----------|-------------------|
| EAST YOLO DIV. | 11,200 | 123 | 25,000 | 10 | 27,400 |
| ELK GROVE DIV. | 3,000 | 226 | 9,800 | 94 | 19,000 |
| FOLSOM DIV. | 5,200 | 38 | 7,200 | 13 | 8,200 |
| FRANKLIN DIV. | 1,600 | 137 | 3,800 | -16 | 3,200 |
| LOOMIS - FOLSOM DIV. | 5,000 | 64 | 8,200 | 90 | 15,600 |
| MATHER DIV. | 13,000 | 80 | 23,400 | 105 | 48,000 |
| NATOMAS DIV. | 200 | 300 | 800 | 0 | 800 |
| NORTH HIGHLANDS DIV. | 21,800 | 19 | 26,000 | 53 | 39,800 |
| RIO LINDA DIV. | 10,200 | 20 | 12,200 | 3 | 12,600 |
| ROSEVILLE DIV. | 10,000 | 34 | 13,400 | 48 | 19,800 |
| SACRAMENTO DIV. | 164,400 | 36 | 224,600 | 26 | 283,000 |
| SAN JUAN DIV. | 42,600 | 237 | 143,600 | 42 | 203,400 |
| STUDY AREA TOTAL | 288,200 | 73 | 498,000 | 36 | 680,800 |

^a C.C.D. FIGURES ROUNDED TO NEAREST 200

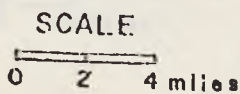
^b STATISTICS FROM 1950 POPULATION CENSUS VOL. 2 PART 5 CALIF. REPORT

^c STATISTICS FROM 1960 POPULATION CENSUS VOL. 1 PART 6 CALIF. REPORT

^d STATISTICS FROM 1970 CENSUS OF POPULATION PC (1) A6 CALIF. REPORT

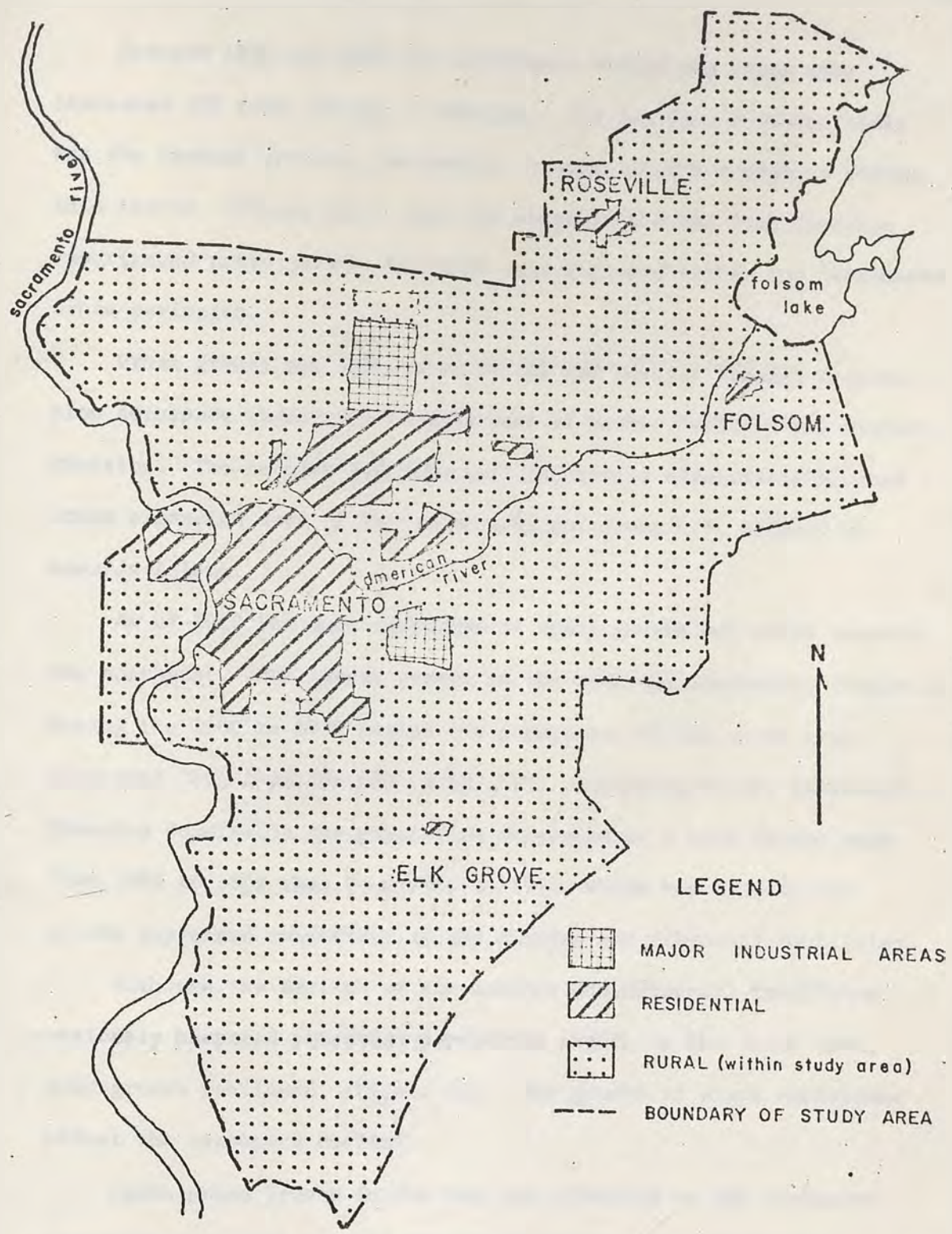


CENSUS COUNTY DIVISIONS



ADAPTED FROM 1970
CENSUS BUREAU MAP.

Figure 8 -



1950 RESIDENTIAL PERIMETER

SCALE
0 2 4 miles

ADAPTED FROM 1950
MAP BY U.S. CENSUS
BUREAU, PAGE 5-34
CALIF. REPORT.

Figure 9

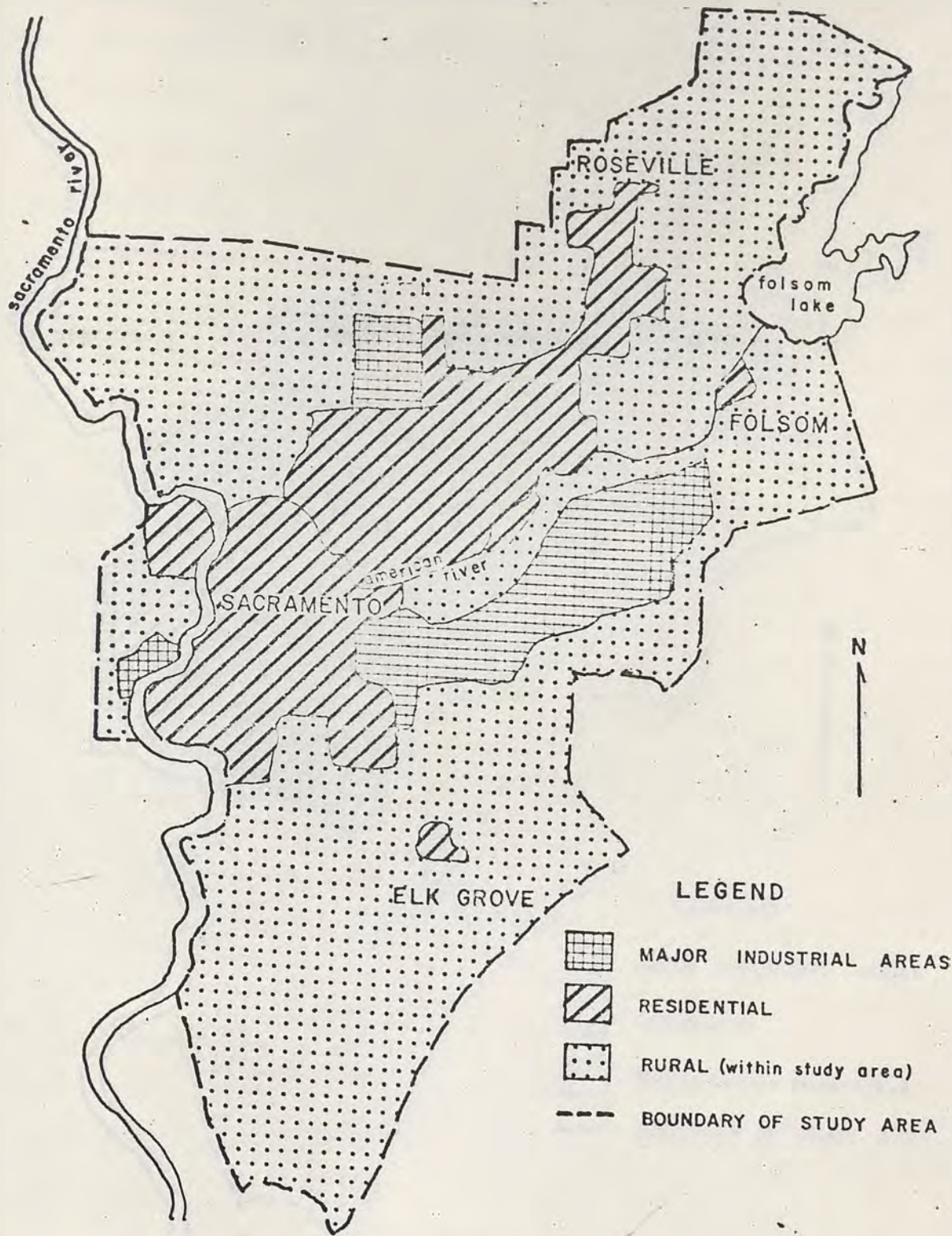
Between 1950 and 1960 the population within the study area increased 73% from 288,200 to 498,000. The San Juan division again was the fastest growing, increasing by over 100,000 residents during this period, (Figure 10). Also the towns in the San Juan division experienced rapid growth, and many were included within the Sacramento urban perimeter.

Urban growth was stimulated by the new Aerojet General Corporation aerospace industries located east of Mather Field in the Mather division. The Aerojet and McDonnell facilities effectively blocked urban expansion east of Sacramento, except along U.S. Highway 50 towards Folsom.

As of 1960 the main direction of urban growth was still towards the northeast, with lesser growth to the west and southeast, (Table 1). During the 1960 to 1970 period the population of the study area increased 36%, from 498,000 to 680,800. According to the Sacramento Planning Commission the population increased at a much faster rate from 1960 to 1965 than from 1965 to 1970, which was largely due to the depressed conditions at the Aerojet and McDonnell facilities.

Although the decline of the Aerojet and McDonnell facilities seriously hampered potential population growth in the study area, some growth continued, (Figure 11). The growth of state employment offset the aerospace decline.

Again urban growth in the San Juan division to the northeast represented a major part of the total growth in the study area. However, other adjacent divisions in the northeast grew substantially continuing the past trend in a broadening sector. Divisions further

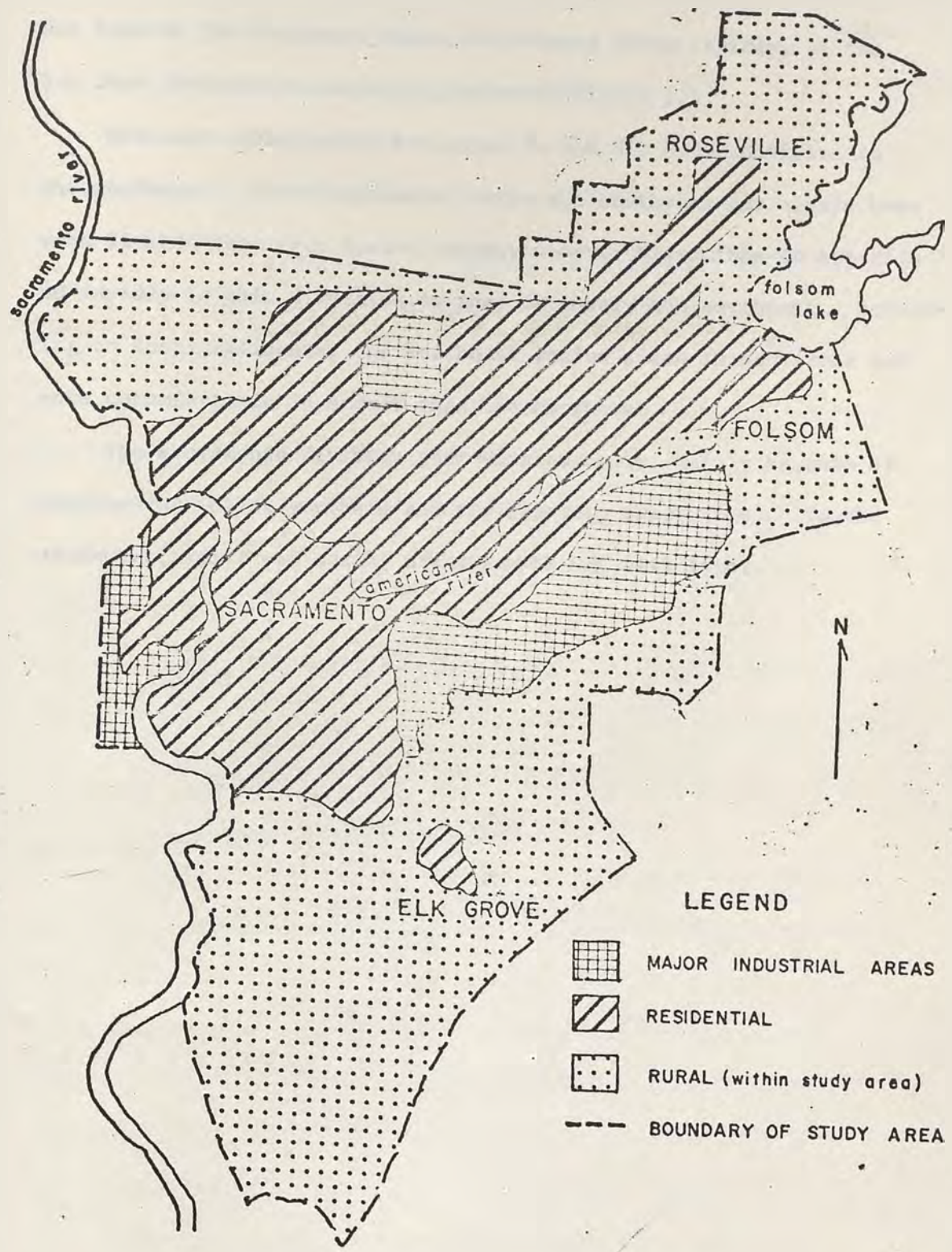


1960 RESIDENTIAL PERIMETER

SCALE
0 2 4 miles

ADAPTED FROM 1960 MAP
BY U.S. CENSUS BUREAU,
PAGE 6-36 CALIF. REPORT.

Figure 10



1970 RESIDENTIAL PERIMETER

SCALE
0 2 4 miles

ADAPTED FROM 1970 MAP
BY U.S. CENSUS BUREAU,
PAGE 6-70 CALIF. REPORT.

Figure 11

out towards the northeast began to increase quite rapidly, as the San Juan division became well populated (Figure 11).

Moderate urban growth was noted in the Elk Grove division to the southeast. Urban expansion toward the southeast has always been more limited than that toward the northeast. Elevations do not rise so rapidly in this direction as they do toward the northeast. According to local residents, the southeast region seems to be warmer and more uncomfortable in summer than the northeast.

The Sacramento division grew substantially, mainly because of development in its southern and northeastern extremities. To the southwest, west, and north, urban growth was very light.

Chapter 4

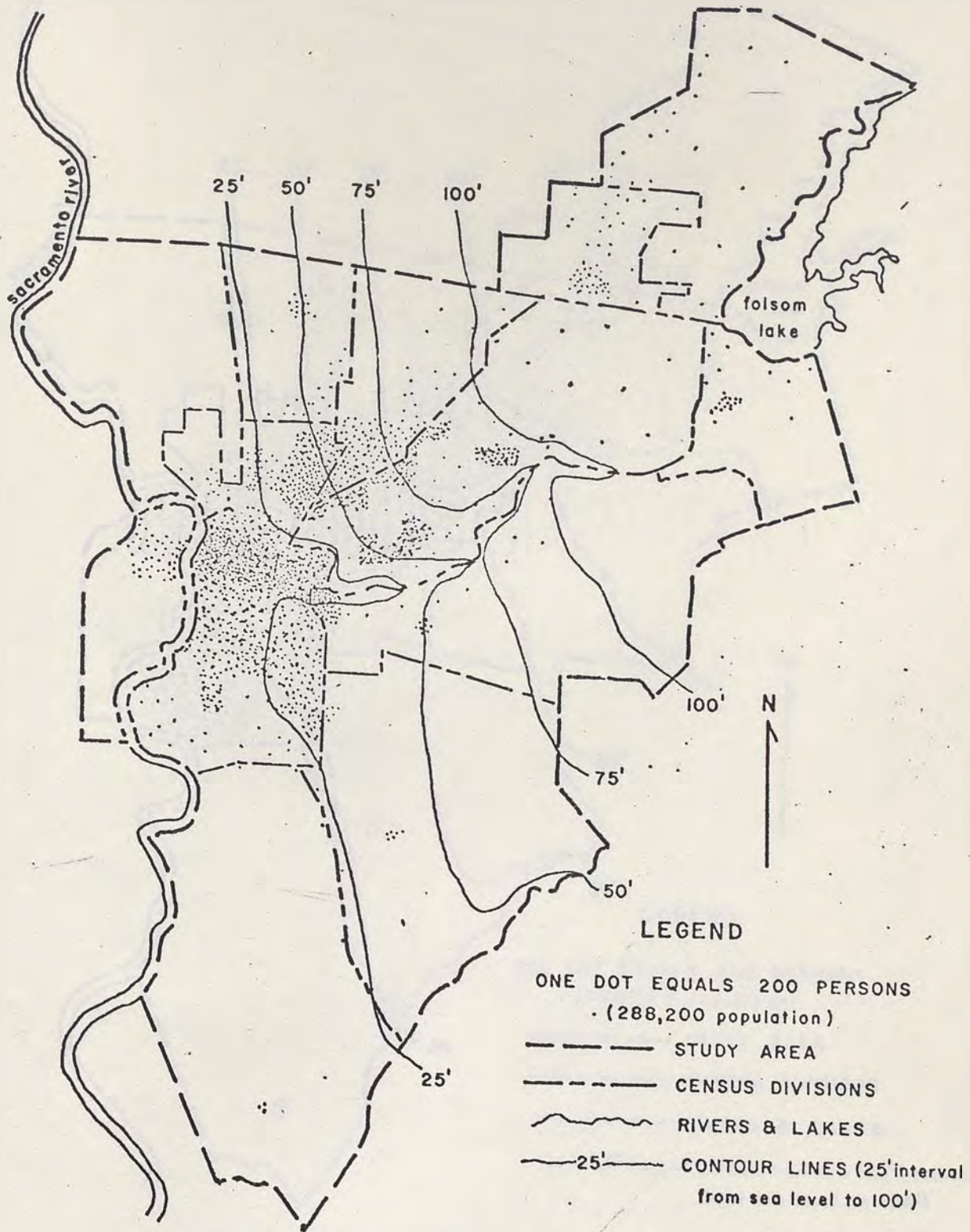
POPULATION GROWTH AND LANDFORMS

This chapter examines the pattern of residential expansion in the Sacramento urban area and considers to what extent landforms, especially slope and elevation, have played a role in the growth. First, population dot maps are used to illustrate population distribution and changes from 1950 to 1960 and 1970. The theories of urban growth are examined to see which may be applicable in helping the pattern of urban growth. The Sector Theory is helpful and the Multiple Nuclei Theory is also of some use. Finally the results of a residential preference survey are used to help explain the pattern of growth. Factors such as the desire for a more pleasant climate, rural surroundings, more open space, and freedom from pollution and congestion appear to be important reasons for the movement of the urban perimeter toward the northeast.

Correlation of Population Growth with Elevation

To determine the degree of correlation between elevation and population growth the study area was divided into five elevational categories: areas below 25 feet, 26-50 feet, 51-75 feet, 76-100 feet, and areas above 100 feet. From the statistics given in Table 1, dot type population distribution maps were constructed for 1950, 1960, and 1970, (Figures 12, 13, and 14). Also plotted on the maps were the 25, 50, 75, and 100 foot contour intervals. From these maps Table 2 was prepared, summarizing population distribution by elevation in 1950, 1960, and 1970.

In the base year of 1950, 75% of the total Sacramento urban

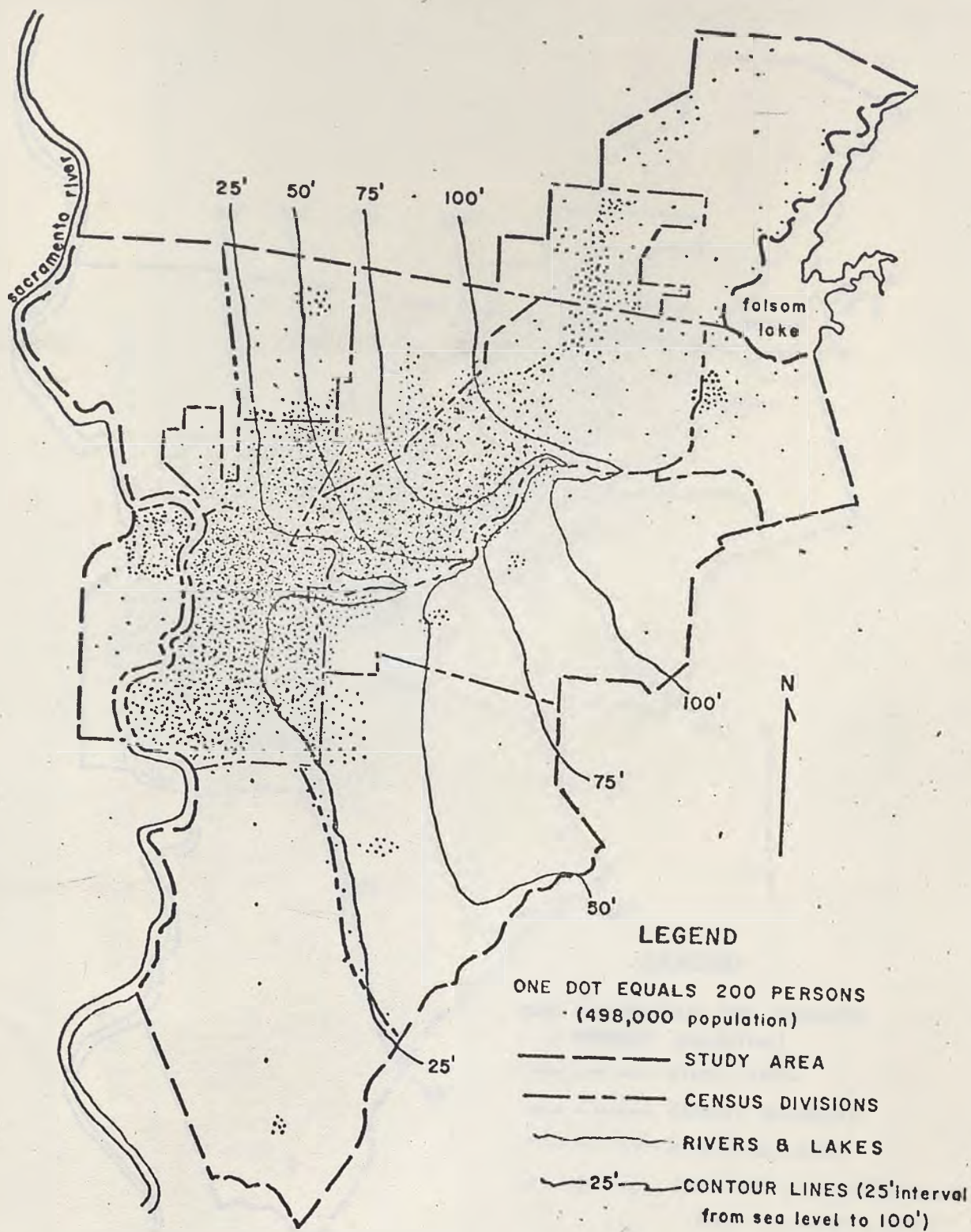


1950 DISTRIBUTION OF POPULATION

SCALE
0 2 4 miles

COMPILED FROM CENSUS
BUREAU STATISTICS.

Figure 12

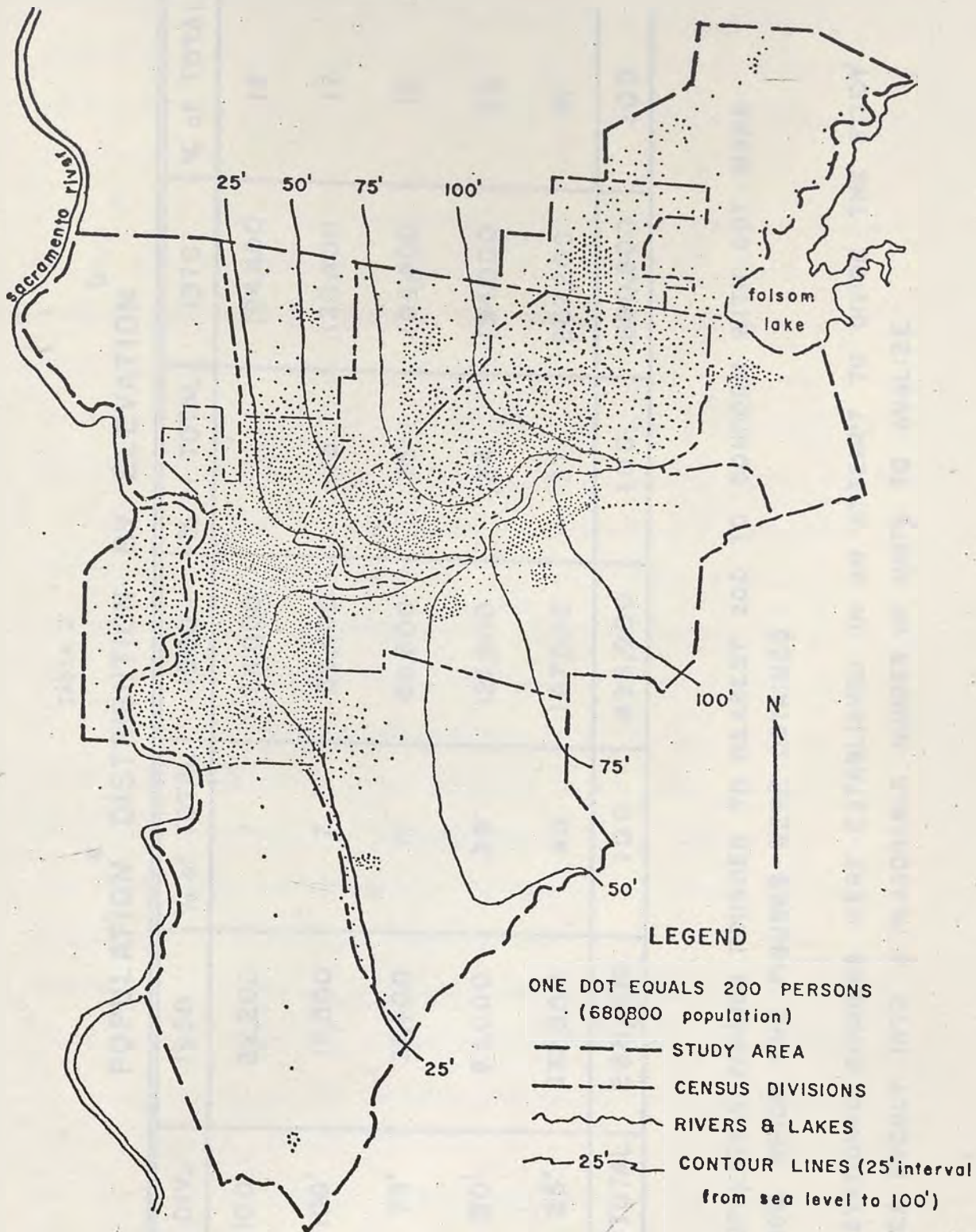


1960 DISTRIBUTION OF POPULATION

SCALE
0 2 4 miles

COMPILED FROM CENSUS
BUREAU STATISTICS.

Figure 13



1970 DISTRIBUTION OF POPULATION

SCALE
0 2 4 miles

Figure 14

COMPILED FROM CENSUS
BUREAU STATISTICS.

Table 2

POPULATION^a DISTRIBUTION BY ELEVATION^b

| ELEV. DIV. | 1950 | % of TOTAL | 1960 | % of TOTAL | 1970 | % of TOTAL |
|------------------|---------|------------|---------|------------|---------|------------|
| ABOVE 100' | 22,200 | 7 | 54,000 | 11 | 94,800 | 14 |
| 76' 100' | 19,000 | 7 | 66,400 | 13 | 120,400 | 17 |
| 51' 75' | 31,400 | 11 | 68,800 | 15 | 104,400 | 15 |
| 26' 50' | 83,000 | 29 | 121,000 | 24 | 154,000 | 23 |
| BELOW 25' | 132,600 | 46 | 187,000 | 37 | 207,200 | 31 |
| Study Area TOTAL | 288,200 | 100 | 498,000 | 100 | 680,800 | 100 |

a. POPULATION FIGURES ROUNDED TO NEAREST 200 TO CONFORM WITH DOT MAPS FROM WHICH THE FIGURES WERE OBTAINED

b. ELEVATIONAL DIVISIONS WERE ESTABLISHED IN AN ATTEMPT TO DIVIDE THE STUDY AREA EVENLY INTO A REASONABLE NUMBER OF UNITS TO ANALYZE

area population resided at elevations below 50 feet, (Table 2, Figure 12). Nearly half, 46% of the total population, lived at elevations below 25 feet, in areas in and around the older sections of Sacramento.

By 1960 the trend of population growth had become well defined up slope particularly into the areas between the 76 and 100 foot contour lines, (Table 2, Figure 13). Notice the decline between 1950 and 1960 in percentage of total population by the areas at or below the 25 foot contour line, from 46% to 37%. A major part of the total population increase for the decade of the fifties, which was over 200,000 in the study area, was registered in the higher elevations, towards the northeast. The main trend of population expansion was clearly headed towards higher elevations between 1950 and 1960, and this trend continued in the period after 1960.

During the decade of the sixties, total population growth exceeded 180,000 and occurred primarily in the higher elevations (Table 2, Figure 14). By 1970, 46% of the population of the Sacramento urban area lived at elevations at or greater than 50 feet, compared to only 25% living at such elevations in 1950. Conversely, only 54% of the population in 1970 lived at elevations of 50 feet or lower as compared to 75% in the same area in 1950.

Although all of the elevation divisions grew continuously in absolute numbers between 1950 and 1970, it is clear that by far the most rapid growth occurred at 50 foot elevations and higher, and that the percentage of total population within the study area increased markedly through the 1950 to 1970 period in the higher

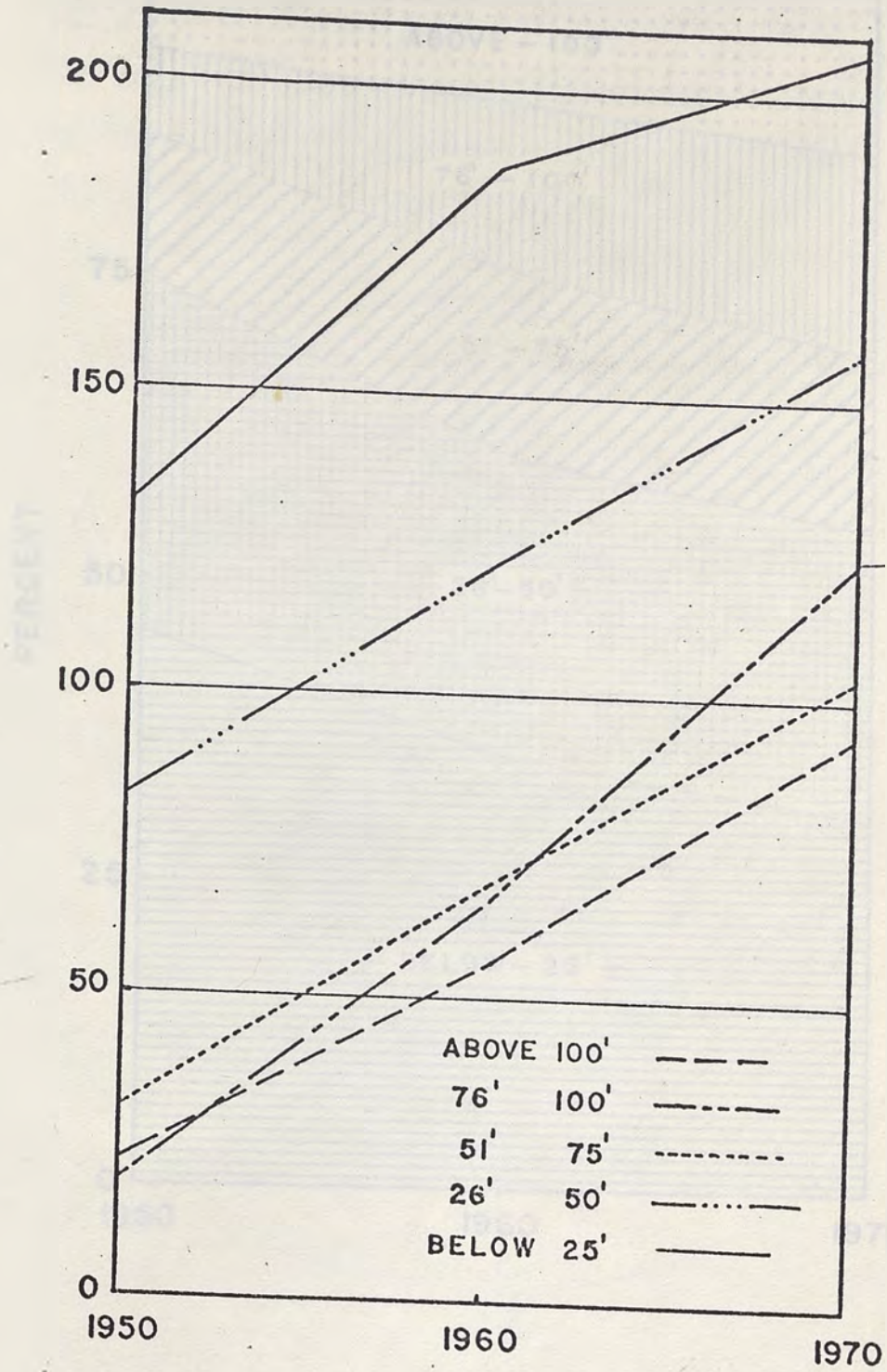
elevations. Figures 15 and 16 illustrate the absolute increase of population in higher elevations and the change in percent of total population over the twenty year period from 1950 to 1970.

Urban Growth Theories

The Concentric Zone Theory presents a land use pattern believed to be generally applicable to all cities. According to Burgess (1925,p.47) the theory suggests that there are five generalized zones of land use in all cities, (Figure 17). The zones from the center outward are as follows: 1. The central business district; 2. zone of transition; 3. zone of independent working men's homes; 4. zone of better residences; 5. commuters zone. Each zone tends to expand outward as the city grows. However in the case of Sacramento, counteracting factors exist, such as natural and artificial barriers, which distort any application of concentric zones to land use.

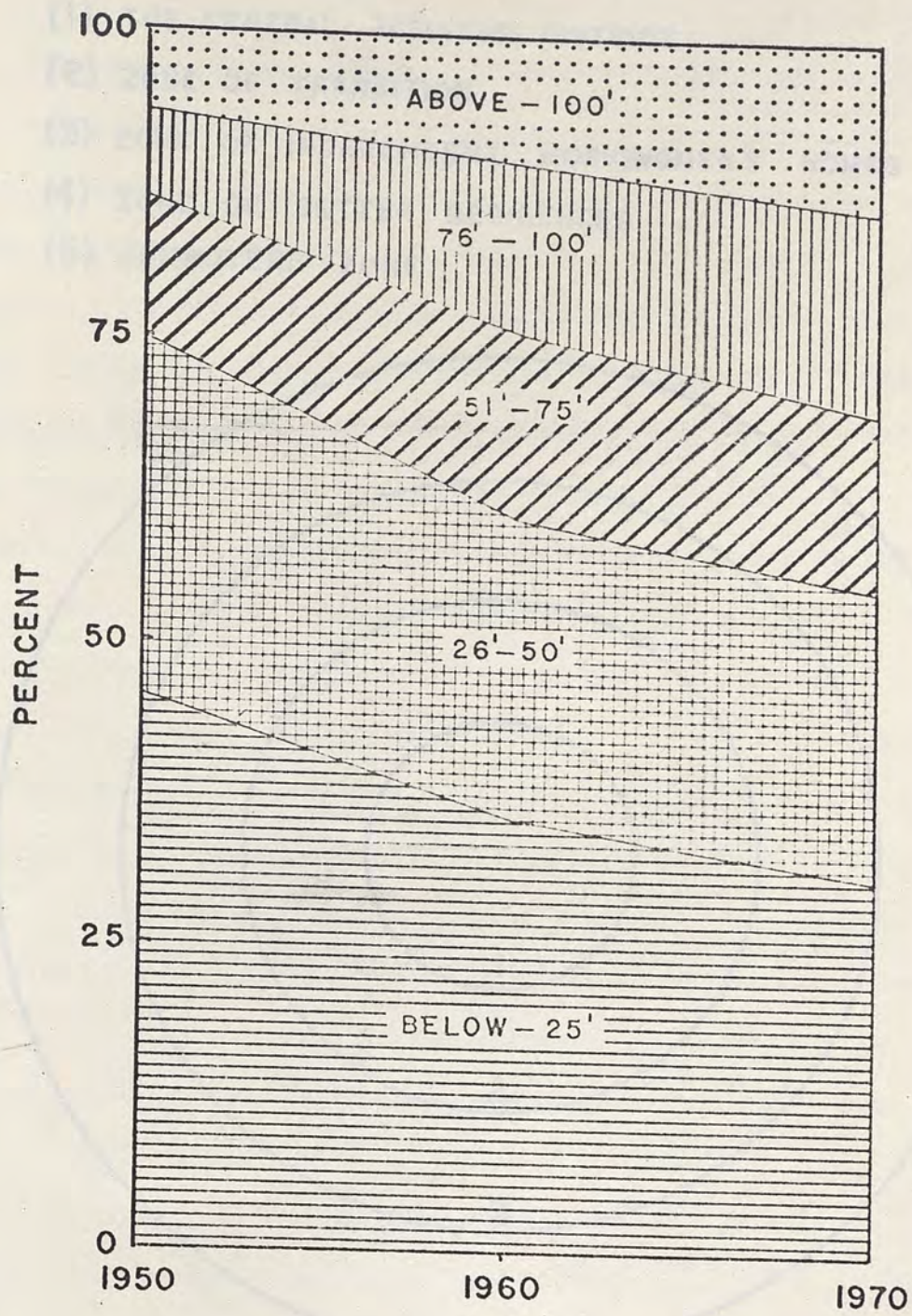
Areas of commercial and residential land use extend out along radial streets from the central business district unevenly, particularly toward the northeast. In Sacramento major industry is located on the periphery near lines of transportation. Differences in the economic status of residential areas are more closely related to a radial pattern than concentric rings in Sacramento. Apparently counteracting factors particularly landforms have altered urbanization in Sacramento enough so as not to conform to concentric zones of land use. Specifically these counteracting factors appear to be transportation lines, land used by industry, and generally the cultural acceptability of different sections of Sacramento.

THOUSAND



NUMBER OF PERSONS BY ELEVATION

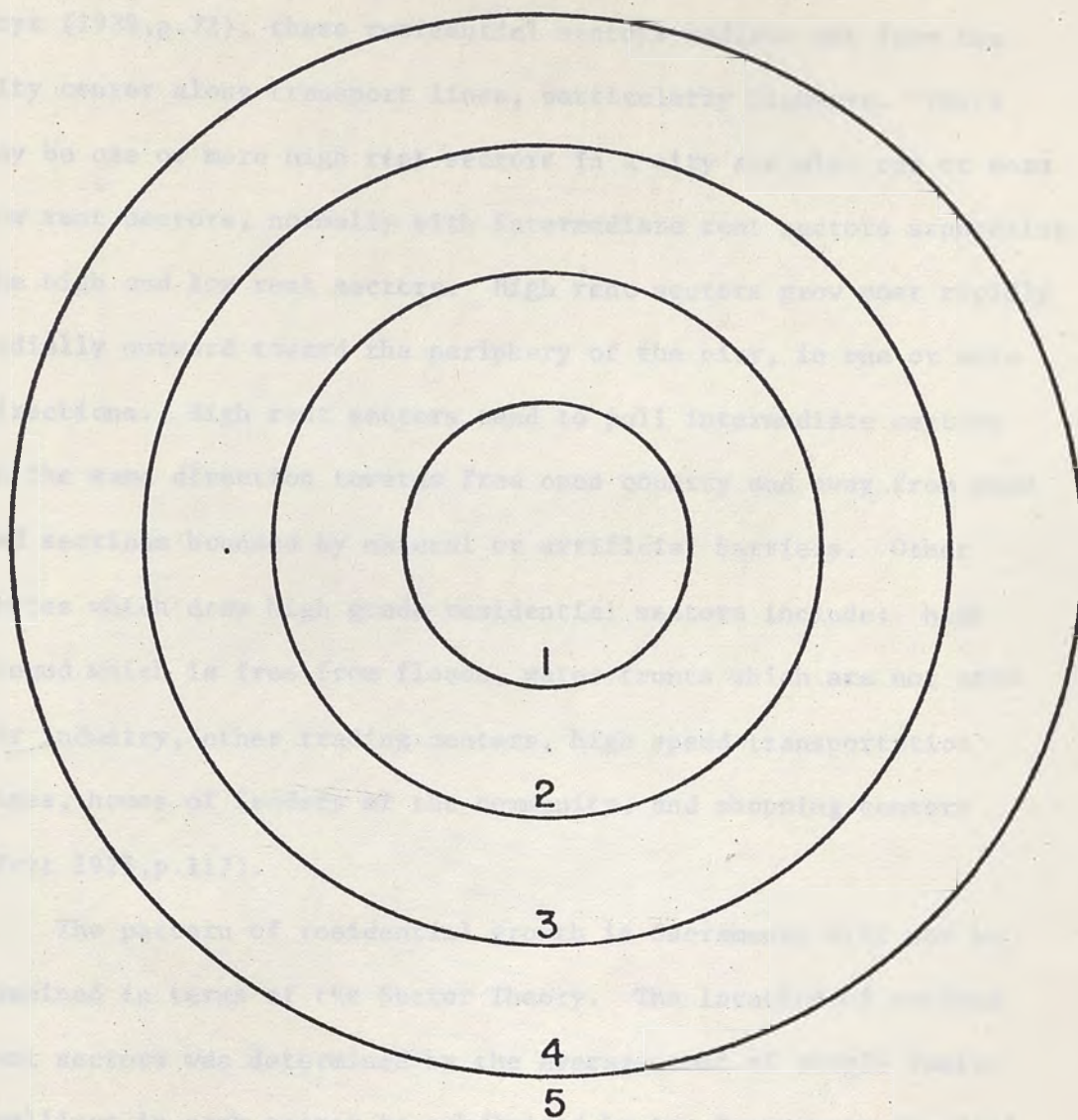
Figure 15



PERCENT OF POPULATION BY ELEVATION

Figure 16

- (1) THE CENTRAL BUSINESS DISTRICT
- (2) ZONE OF TRANSITION
- (3) ZONE OF INDEPENDENT WORKINGMEN'S HOMES
- (4) ZONE OF BETTER RESIDENCES
- (5) COMMUTERS ZONE



CONCENTRIC ZONE THEORY

GENERALIZED ZONES

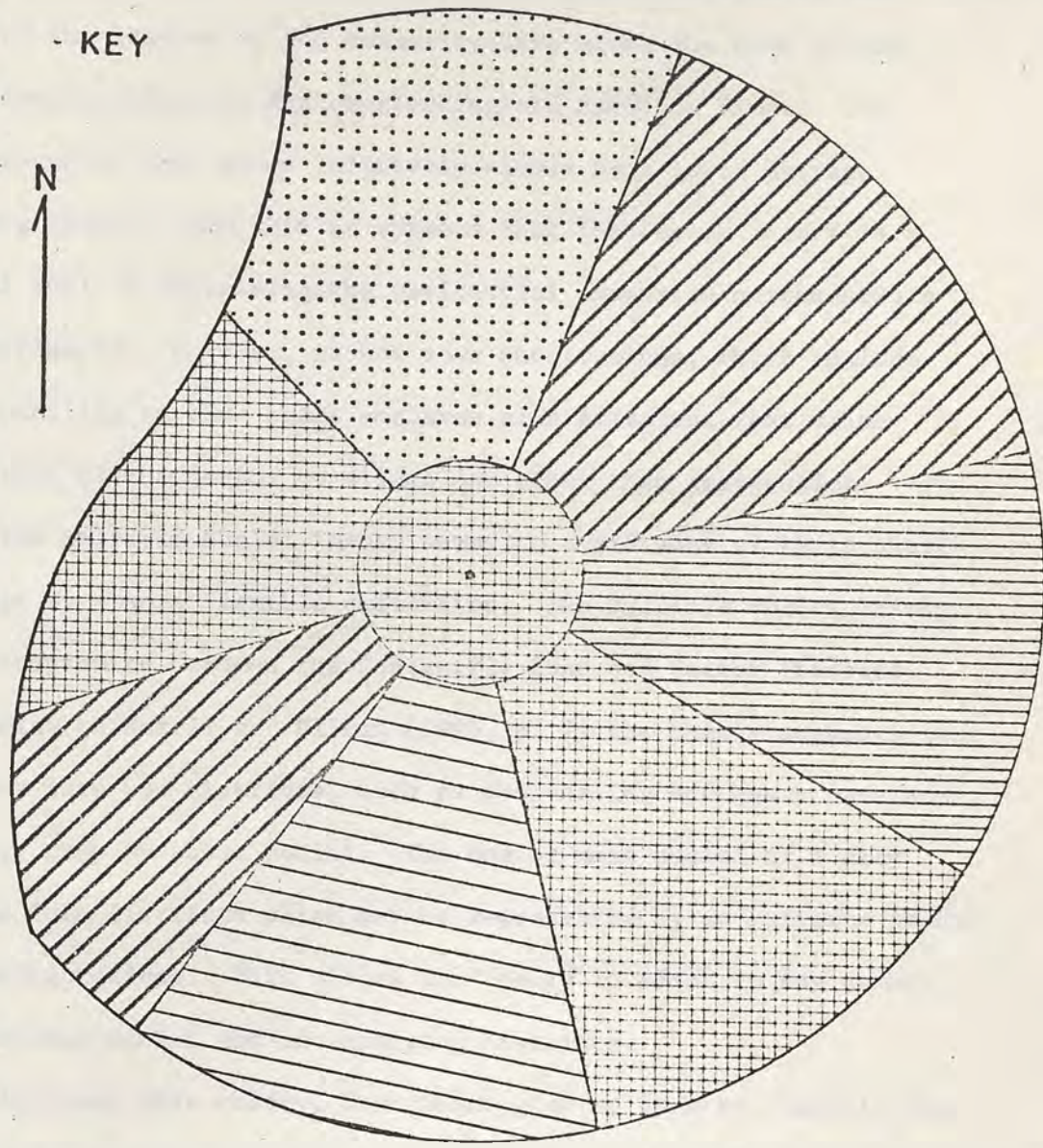
Figure 17

The Sector Theory appears to be more applicable and useful in determining the pattern of urban growth in Sacramento. The Sector Theory sets up a pattern of residential land uses that are believed to exist in different sectors of a city. The value of rentals is used to determine the various sectors. According to Hoyt (1939,p.72), these residential sectors radiate out from the city center along transport lines, particularly highways. There may be one or more high rent sectors in a city and also one or more low rent sectors, normally with intermediate rent sectors separating the high and low rent sectors. High rent sectors grow most rapidly radially outward toward the periphery of the city, in one or more directions. High rent sectors tend to pull intermediate sectors in the same direction towards free open country and away from dead end sections bounded by natural or artificial barriers. Other forces which draw high grade residential sectors include: high ground which is free from floods, water fronts which are not used for industry, other trading centers, high speed transportation lines, homes of leaders of the community, and shopping centers (Hoyt 1925,p.117).

The pattern of residential growth in Sacramento will now be examined in terms of the Sector Theory. The location of various rent sectors was determined by the average cost of single family dwellings in each sector as subdivided by the Sacramento Bee Real Estate Guide, (Figure 18). Of the two highest rent sectors, the one in the southwest is limited by natural boundaries, the Sacramento River and the Yolo bypass. The other high rent sector to the

- LESS THAN-\$15,000. - [Dotted pattern]
- \$15,000-\$17,999. - [Diagonal lines /]
- \$18,000-\$19,999. - [Horizontal lines]
- \$20,000-\$29,999. - [Vertical lines]
- \$30,000 & OVER - [Diagonal lines \]

SOURCE: THE SACRAMENTO BEE
CLASSIFIED REAL ESTATE
DEC. 1970



THE SECTOR THEORY
PATTERN OF RESIDENTIAL SECTORS BY HOUSING COSTS

Figure 18

northeast has all of the forementioned characteristics which draw residential expansion. In the northeast sector higher elevations eliminate the possibility of floods and affords pleasant views because of the gently undulating topography. Also temperatures and climate are more moderate due to the higher elevation, and many of the leaders of the community live along the high ground immediately north of, and overlooking the American River. The sectors which have grown relatively slowly have lower average housing costs. From this it appears that the Sector Theory is a useful tool in explaining the residential expansion northeastward in Sacramento. However, it has some shortcomings, which include the inability to show small enclaves of a different rent value than that of the sector or a land use other than residential.

The Multiple Nuclei Theory seems to avoid some of these shortcomings by a more flexible definition. The Multiple Nuclei Theory is a compromise between the Concentric Zone and Sector Theories. According to Harris and Ullman (1945, p. 7) the theory suggests that various land use districts, such as wholesaling and heavy manufacturing, grow up about nuclei. The one or more nuclei of a city evolve into districts which may be represented by an infinite number of configurations. This allows the theory to adapt to any number of possible nuclei and accompanying districts.

Applying this theory, Sacramento grew up from two nuclei, The Embarcadero, where commerce and business was transacted, and Sutter's Fort, where political decisions were made. Today many more nuclei

exist especially in the northeast, such as the manufacturing nuclei around McClellan Field, and the retail nuclei around Country Club Center.

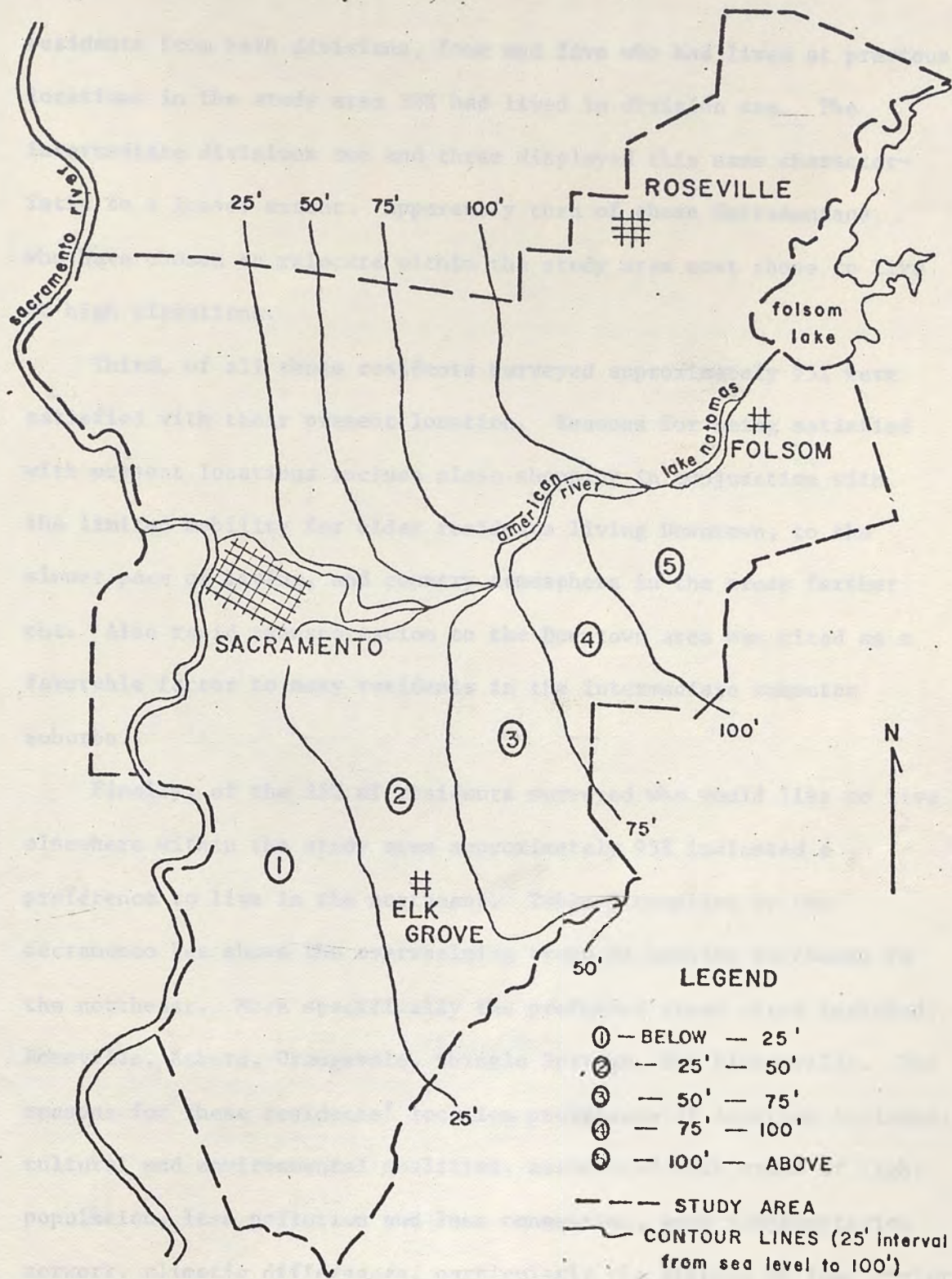
While a more detailed study of the urban structure in Sacramento would use the Multiple Nuclei Concept, the Sector Theory provides a good general explanation of the recent trend of urban expansion. But we are also interested in the causes of this growth.

Although the population trend has been toward higher elevations the reasons for such a trend may be complex rather than simple. To cast light on these reasons, a residential survey was carried out in January, 1972. Five hundred residents responded to the survey, one hundred in each of the five elevation categories, (Figure 19). The Survey questionnaire included the following: 1. How long have you lived at your present residence?, 2. Have you lived elsewhere in the Sacramento area? Where?, 3. Why did you move?, 4. Would you like to live elsewhere in the Sacramento area? Where? Why?

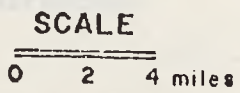
Residential Survey Findings

The following information was obtained from the survey. First, the average length of residency for the study area as a whole was five years. The average length of residency increased with elevation from an average of two years in division one, to over seven years in division five, (Figure 19).

Second, 30% of those surveyed had previously lived in other locations in the study area. Of those residents from division one who had lived in other locations in the study area only 10% had previously lived in divisions four and five. Conversely, of those



RESIDENTIAL SURVEY DIVISIONS



ADAPTED FROM U.S.G.S.
 WATER SUPPLY PAPER
 495- PLATE 4.

Figure 19

residents from both divisions, four and five who had lived at previous locations in the study area 30% had lived in division one. The intermediate divisions two and three displayed this same characteristic to a lesser extent. Apparently then of those Sacramentans who have chosen to relocate within the study area most chose to live at high elevations.

Third, of all those residents surveyed approximately 75% were satisfied with their present location. Reasons for being satisfied with present locations include close shopping in conjunction with the limited mobility for older residents living Downtown, to the slower pace of living, and country atmosphere in the areas farther out. Also rapid transportation to the Downtown area was cited as a favorable factor to many residents in the intermediate commuter suburbs.

Finally, of the 25% of residents surveyed who would like to live elsewhere within the study area approximately 95% indicated a preference to live in the northeast. Table 3 compiled by the Sacramento Bee shows the overwhelming trend of housing purchases in the northeast. More specifically the preferred areas cited included; Roseville, Auburn, Orangevale, Shingle Springs, and Placerville. The reasons for these residents' location preference of location included: cultural and environmental qualities, associated with areas of light population, less pollution and less congestion, good transportation network, climatic differences, particularly the absence of fog, cooler summers, virgin land with natural environment, and the proximity to recreation.

Table 3

LOCATION OF RECENT HOME PURCHASES

SACRAMENTO AREA

APRIL 1968

| NEW HOUSES | DISTRICT | USED HOUSES |
|------------|-----------------|-------------|
| 51% | Northeast | 47% |
| 17 | South | 27 |
| 18 | East Sacramento | 11 |
| 1 | Central | 3 |
| 1 | North | 4 |
| 12 | Outlying | 8 |
| 248 | SAMPLE SIZE | 231 |

SOURCE: SACRAMENTO BEE, MARCH 1, 1968

Chapter 5

CONCLUSION

In Sacramento the long term trend of urban growth, particularly toward the higher elevations, has accelerated during the post-World War II period. This trend of urban growth toward higher elevations in the northeast began in the 19th Century before effective flood control existed. Later in the early 20th Century, when the danger of floods had been eliminated, the pattern of urban growth had already been established.

The automobile, together with a continually improving transportation network, accelerated population growth in the suburbs even before World War II. The current urban expansion into the higher elevations of the northeast seems to be associated with the desire for cultural and environmental qualities. The residential preference survey showed that the sector of the population who are economically able to choose their living environments prefer to live in the northeast, where they find a more favorable climate, more open land, less congestion, and often "a view", as well as other amenities. It is expected that the recent and current expansion of the urban perimeter toward the northeast will continue and will eventually encompass El Dorado Hills, Auburn, Lincoln, and other urban centers, now outside of the Sacramento urbanized area. Conversely, it is expected that the expansion will be much more limited in other directions.

SELECTED BIBLIOGRAPHY

- Bryan, Kirk, Geol. & Grnd. Water Res. of Sacramento Valley, Calif., U.S.G.S., Water Supply Paper 495., pp. 1-285, 1923.
- Bryan, K., U.S.G.S., Water Supply Paper, 495., 1923.
- Burgess, Ernest W., "Growth of the City", The City, University of Chicago Press, Chicago 1925, pp.47-62.
- Campbell, T. G., Flood Control and Storm Drainage, Dept. of Public Works, Sacramento County, 1966.
- County Planning Dept., Commercial Areas Land Use Plan., 1970.
- Demko, G. J., Population Geography: A Reader., New York: McGraw-Hill Book Co., 1970.
- Fenneman, N. M., Physiography of Western U.S., New York: McGraw-Hill Book Co., 1970.
- Harris, C. D. & E. L. Ullman, "The Nature of Cities", The Annals of the American Academy of Political and Social Science, Vol. 242, pp. 7-17, Nov., 1945.
- Hauser, Phillip M., The Study of Urbanization., John Wiley & Sons, Inc., New York, 1966.
- Hinds, N. E. A., Evolution of The Calif. Landscape., Calif. Div. of Mines, Bull. 158, pp. 143-154, 1952.
- Hoyt, Homer, The Structure and Growth of Residential Neighborhoods in American Cities., Washington D.C.: U.S. Govt. print. office, 1939.
- Hudson, F. S., Post-Pliocene Uplift of the Sierra Nevada., Geol. Soc. Am. Bull. 71, pp. 1547-1574.
- Hunt, C. B., Physiography of the U.S. San Francisco: W. H. Freeman & Co., 1967.
- Isard, Walter, Methods of Regional Analysis, the M.I.T. Press, Cambridge
- Jenkins, O. P., Geologic Guidebook of the San Francisco Bay Counties, Calif. Div. of Mines, Bull. 154, pp. 76-106, 1951.
- Jenkins, O. P., Geomorphic Provinces of California. Calif. Div. of Mines, Bull. 118, pp. 82-88, 1943.
- Lindgren, W., U.S.G.S. Geol. Atlas Sacramento Folio (No. 5) pp. 1-3, 3 maps, 1894.

SELECTED BIBLIOGRAPHY (cont.)

Matthes, F. E., The Incomparable Valley. University Calif. Press,
pp. 33-67, 1950.

Murphy, R. E., The American City. New York: McGraw-Hill Book Co.,
1966.

S.R.A.P.C., Regional General Plan. May, 1971.

Thornbury, W. D., Regional Geomorphology of the U.S. New York:
John Wiley & Sons, 1965.

U.S. Dept. of Commerce, Housing & Census Reports for 50-60-70.