REPORT FOR CONSULTATION ON THE METROPOLITAN DAYTON INTRASTATE AIR QUALITY CONTROL REGION

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service

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PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE
NATIONAL AIR POLLUTION CONTROL ADMINISTRATION
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PREFACE

The Secretary, Department of Health, Education, and Welfare is directed by the Clean Air Act, as amended, to designate "air quality control regions" as an initial step toward the adoption of regional air quality standards and the establishment of plans to implement those standards. In addition to listing the major factors to be considered in the development of region boundaries, the Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities.

The National Air Pollution Control Administration, DHEW, has conducted a study of the greater Dayton area, the results of which are presented in this report. The Region* boundaries proposed reflect consideration of available and pertinent data; however, the boundaries remain subject to revision suggested by consultation with State and local authorities. Formal designation will be withheld pending the outcome of this formal consultation. This report is intended to serve as the starting point for the consultation.

The Administration is appreciative of assistance received either directly during the course of this study or indirectly during previous studies from the official air pollution agencies of the affected state and counties and the Miami Valley Regional Planning Commission.

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*For the purposes of this report, the word "region," when capitalized, will refer to the proposed Metropolitan Dayton Intrastate Air Quality Control Region. When not capitalized, unless otherwise noted, it will refer to air quality control regions in general.

INTRODUCTION

> "For the purpose of establishing ambient air quality standards pursuant to section 108, and for administrative and other purposes, the Secretary, after consultation with appropriate State and local authorities, shall, to the extent feasible, within 18 months after the date of enactment of the Air Quality Act of 1967 designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including implementation of air quality standards. The Secretary may from time to time thereafter, as he determines necessary to protect the public health and welfare and after consultation with appropriate State and local authorities, revise the designation of such regions and designate additional air quality control regions. The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."
>
> Section 107(a)(2), Clean Air Act, as amended.

THE AIR QUALITY ACT

Air pollution, because of its direct relationship to people and their activities, is an urban problem. Urban sprawls often cover thousands of square miles; they quite often include parts of more than one State and almost always are made up of several counties and an even greater number of cities. Air pollution, therefore, is a regional problem. The collaboration of several governmental jurisdictions is prerequisite to the solution of the problem in any given area. Air quality control regions called for in the above-quoted section of the Clean Air Act are meant to define the geographical extent of air pollution problem areas and the combination of jurisdictions that must contribute to the solution in each area.

The regional approach set forth by the Clean Air Act is illustrated in Figure 1. The approach involves a series of steps to be taken by Federal, State, and local governments. This mechanism begins with the designation of regions, the publication of air quality criteria, and the publication of information on available control techniques by the Federal Government. Following the completion of these three steps, the Governors of the States involved in a region designation must file with the Secretary within 90 days a letter of intent, indicating that the States will adopt within 180 days air quality standards and within another 180 days plans for the implementation and enforcement of those air quality standards in the designated air quality control regions.

The Federal legislation provides for a regional attack on air pollution and, at the same time, allows latitude in the form which regional efforts may take. While the Secretary reserves approval authority, the States involved in a designated region assume the primary responsibility for developing air quality standards and an implementation plan including administrative procedures for abatement and control.

THE SIZE OF A REGION

Several objectives are important in determining how large an air quality control region should be. Basically, these objectives can be divided into three separate categories. First, a region should be self-contained with respect to air pollution sources and receptors. In other words, a region should include most of

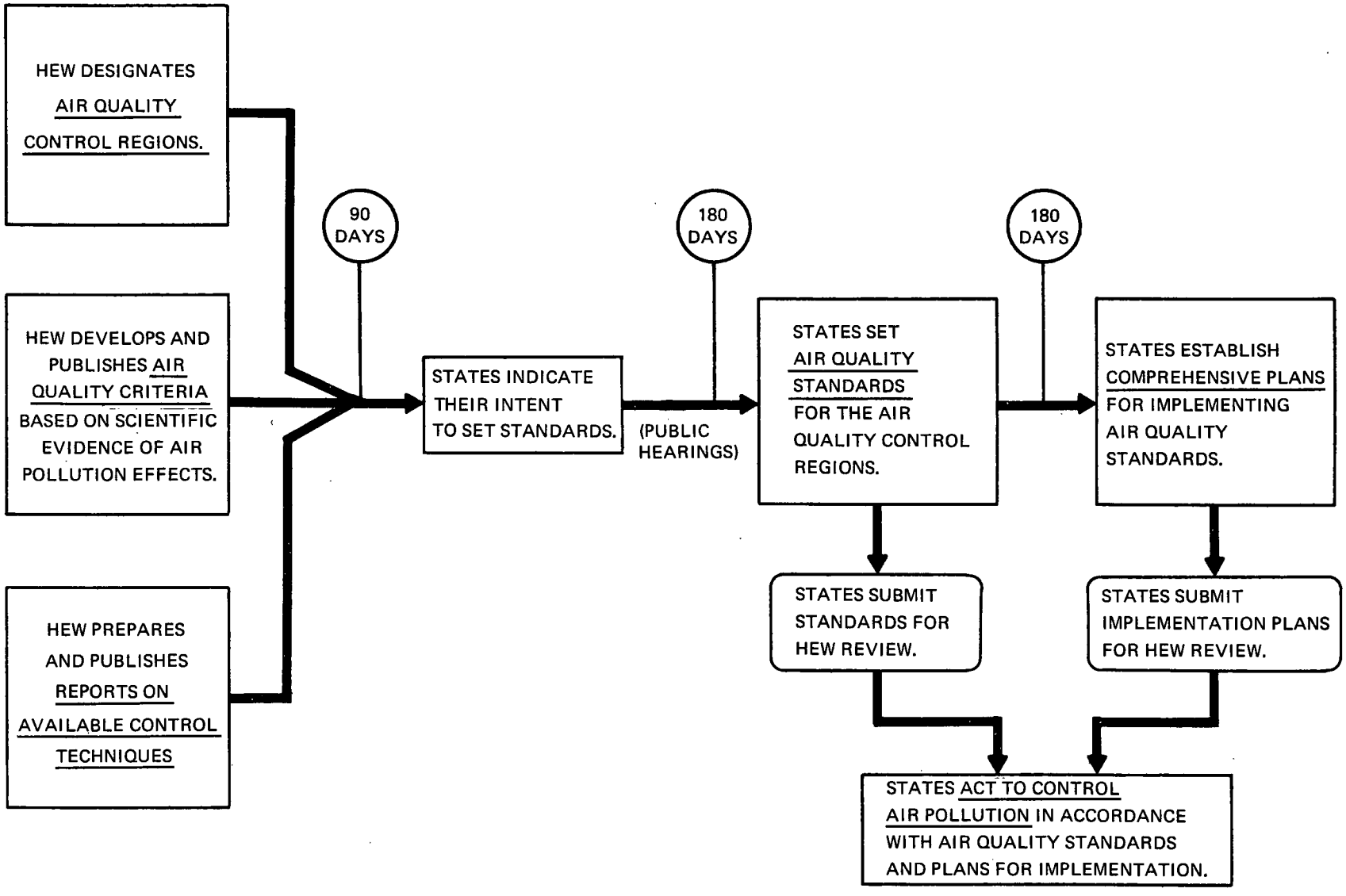

FIGURE 1 **FLOW DIAGRAM FOR ACTION TO CONTROL AIR POLLUTION ON A REGIONAL BASIS, UNDER THE AIR QUALITY ACT.**

the important sources in the area as well as most of the people and property affected by air over a region will usually have at least trace amounts of pollutants from external sources. During episodic conditions, such contributions from external sources may even reach significant levels. Conversely, air pollution generated within a region and transported out of it can affect external receptors to some degree. It would be impractical and inefficient to make all air quality control regions large enough to encompass these low-level trace effects. The geographic extent of trace effects over-estimates the true problem area which should be the focus of air pollution control efforts. Thus, the first objective, that a region be self-contained, becomes a question of relative magnitude and frequency. The dividing line between "important influence" and "trace effect" will be a matter of judgment. The judgment should be based on estimates of the impact a source has upon a region, and the level of pollution to which receptors are subjected. In this respect, annual and seasonal data on pollutant emissions and ambient air concentrations are a better measure of relative influence than short-term data on episodic conditions.

The second general objective requires that region boundaries be designed to meet not only present conditions but also future conditions. In other words, the region should include areas where industrial and residential expansion are likely to create air pollution problems in the foreseeable future. This objective

requires careful consideration of existing metropolitan development plans, expected population growth, and projected industrial expansion. Such considerations should result in the designation of regions which will contain the sources and receptors of regional air pollution for a number of years to come. Of course, region boundaries need not be permanently fixed, once designated. Boundaries should be reviewed periodically and altered when changing conditions warrant readjustment.

The third objective is that region boundaries should be compatible with and even foster unified and cooperative governmental administration of the air resource throughout the region. Air pollution is a regional problem which often extends across several municipal, county, and even State boundaries. Clearly, the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem. Therefore, the region should be delineated in a way which encourages regional cooperation among the various governmental bodies involved in air pollution control. In this regard, the existing pattern of governmental cooperation on the whole range of urban problems may become an important consideration. Certainly the pattern of cooperation among existing air pollution control programs is a relevant factor. In general, administrative considerations dictate that governmental jurisdictions should not be divided. Although it would be impractical to preserve State jurisdictions undivided, usually it is possible to preserve the unity of county governments by including or excluding them in their entirety.

To the extent that any two of the above three objectives lead to incompatible conclusions concerning region boundaries, the region must represent a reasonable compromise. A region should represent the best way of satisfying the three objectives simultaneously.

PROCEDURE FOR DESIGNATION OF REGIONS

Figure 2 summarizes the procedure used by the National Air Pollution Control Administration for designating air quality control regions. A preliminary delineation of the region is developed by bringing together two essentially separate studies--the "Evaluation of Engineering Factors" and the "Evaluation of Urban Factors."

The study of "Engineering Factors" indicates the location of pollution sources and the geographic extent of significant pollutant concentrations in the ambient air. Pollutant sources are located by an inventory of emissions from automobiles, industrial activities, space heating, waste disposal, and other pollution generators. Pollutant concentrations in the ambient air are estimated by a theoretical diffusion model. Air quality sampling data is more reliable than the theoretical diffusion model results since the data is directly recorded by pollutant measuring instruments. Unfortunately, in many cases extensive air quality sampling data is unavailable in the rural areas surrounding an urban complex.

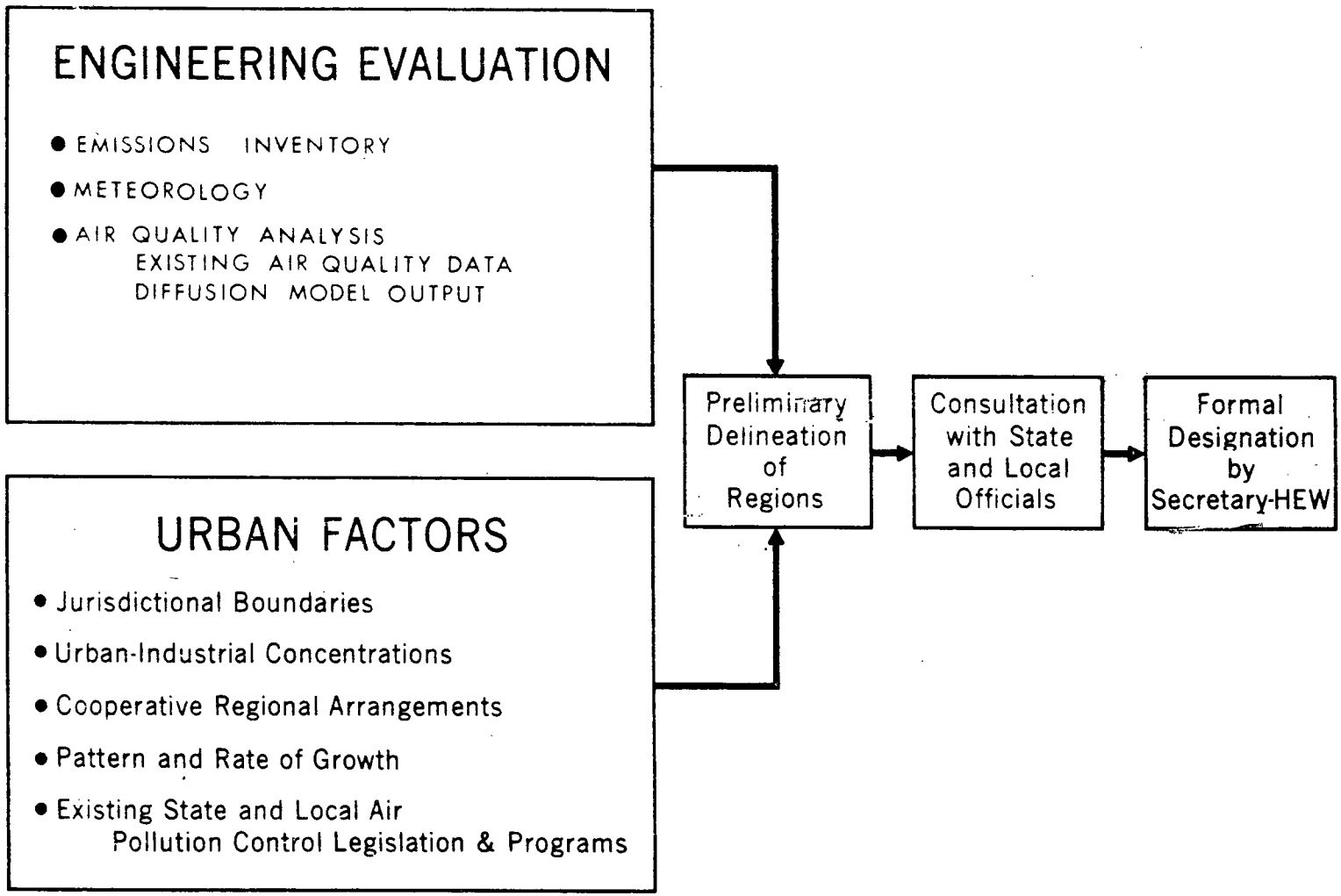

FIGURE 2. FLOW DIAGRAM FOR THE DESIGNATION OF AIR QUALITY CONTROL REGIONS.

The study of "Urban Factors" encompasses non-engineering considerations. It reviews existing governmental jurisdictions, current air pollution control programs, present concentrations of population and industry, and expected patterns of urban growth. Other non-engineering factors are discussed when they are relevant. As a whole, the study of urban factors indicates how large an air quality control region must be in order to encompass expected growth of pollution sources in the future. It also considers which group of governmental jurisdictions will most effectively administer a strong regional air quality control program.

The conclusions of the engineering study are combined with the results of the urban factors study to form the basis of an initial proposal for an air quality control region. As shown in Figure 2, the proposal is then submitted for consultation with State and local officials. After reviewing the suggestions raised during the consultation, the Secretary formally designates the region with a notice in the Federal Register and notifies the Governors of the States affected by the designation.

The body of this report contains a proposal for the boundaries of the Metropolitan Dayton Intrastate Air Quality Control Region along with supporting studies on engineering and urban factors. The report itself is intended to serve as the background document for the formal consultation with appropriate State and local authorities.

REGIONAL SETTING

The Dayton metropolitan area is located in the southwestern portion of Ohio on the Miami River, 47 miles north of Cincinnati. The area contains eight per cent of the State's total population and its central city, Dayton, is the sixth largest city in Ohio. Several Standard Metropolitan Statistical Areas* (S.M.S.A.) are located within the area under study -- Dayton, Cincinnati, Springfield, and Hamilton-Middletown. Figure 3 shows the counties that are included within the study area portions of these S.M.S.A.'s.

The Dayton region's strategic location between the agricultural Midwest Corn Belt and the Manufacturing Belt of the East has made it an extremely prosperous area. An important manufacturing center for such diversified products as business machines, rubber products, and refrigerators, Dayton is also well-known as the first large city in the nation to adopt the commission-manager form of government.

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*The term Standard Metropolitan Statistical Area refers to politically defined regions as established by the U. S. Bureau of Census. The most basic requirement is that the area be a county or a contiguous group of counties containing at least one city of 50,000 or more inhabitants.

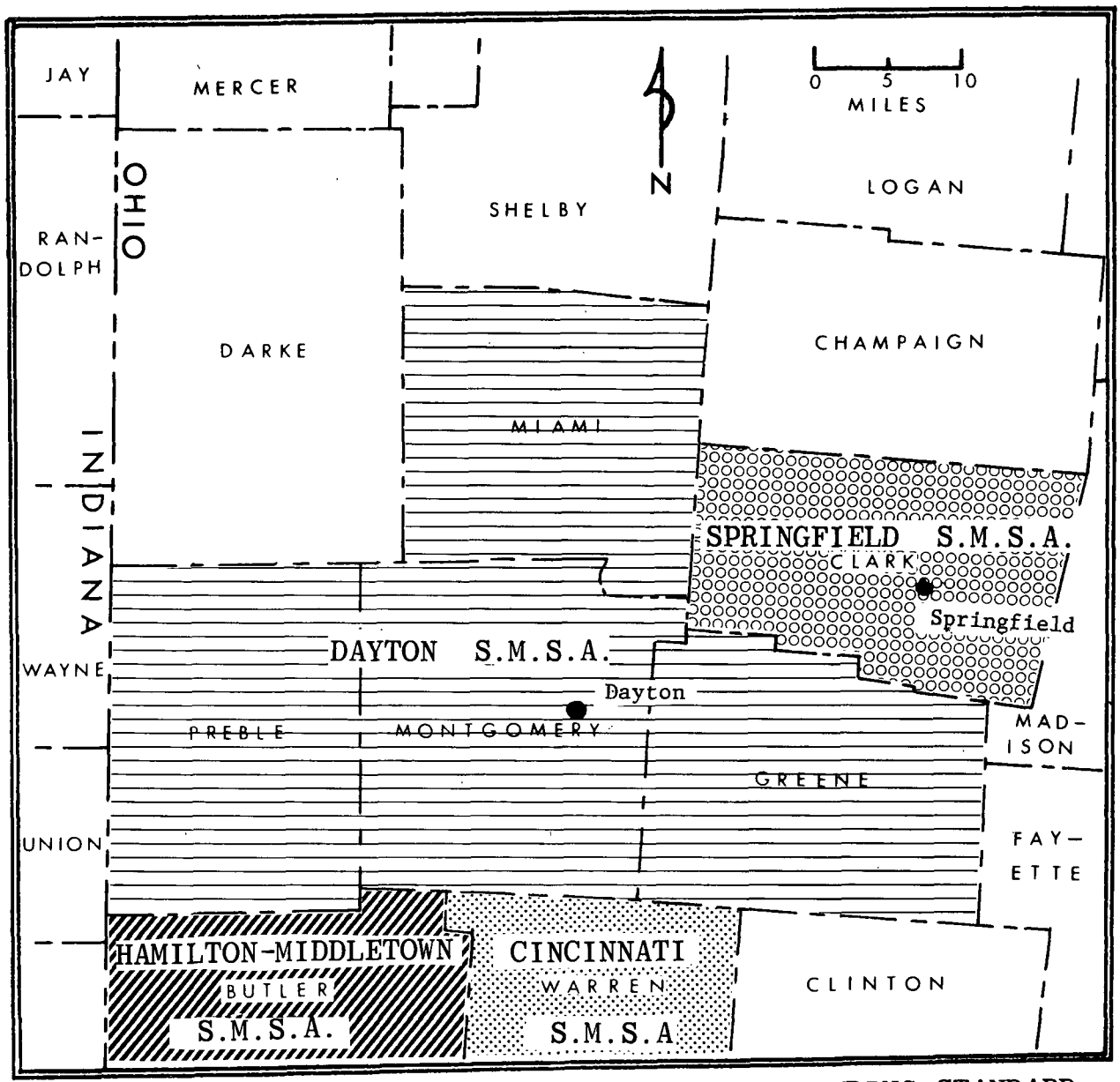


FIGURE 3. BOUNDARIES OF DAYTON AND SURROUNDING STANDARD METROPOLITAN STATISTICAL AREAS

STATE BOUNDARY COUNTY BOUNDARIES

EVALUATION OF ENGINEERING FACTORS

Five major engineering factors were evaluated in the Dayton area to assist in determining the geographical extent of the proposed air quality control region. They were meteorology, topography, air pollutant emissions, measured ambient air quality data, and theoretical air quality levels as determined by a diffusion model. The examination of these factors, discussed in detail in the following subsections, led to basic conclusions on the size of the Region.

TOPOGRAPHY

Most of the Dayton metropolitan area lies within the Miami River Valley, a nearly flat plain, generally 50 to 200 feet below the elevation of the surrounding countryside. Tributaries, chiefly the Mad River and the Stillwater River, converge on the Miami River at Dayton and extend the river plain to the northwest and northeast. All waterways in the Dayton area drain southward into the Ohio River. The elevation of the Miami River at Dayton is about 750 feet and the surrounding countryside in the form of rolling hills rises to little more than 1,000 feet above sea level. The topography of the Dayton metropolitan area, shown by the map in Figure 4, does not tend to intentify the air pollution problem in greater Dayton.

METEOROLOGY

Precipitation in the study area is rather evenly distributed throughout the year and temperatures are usually moderate.

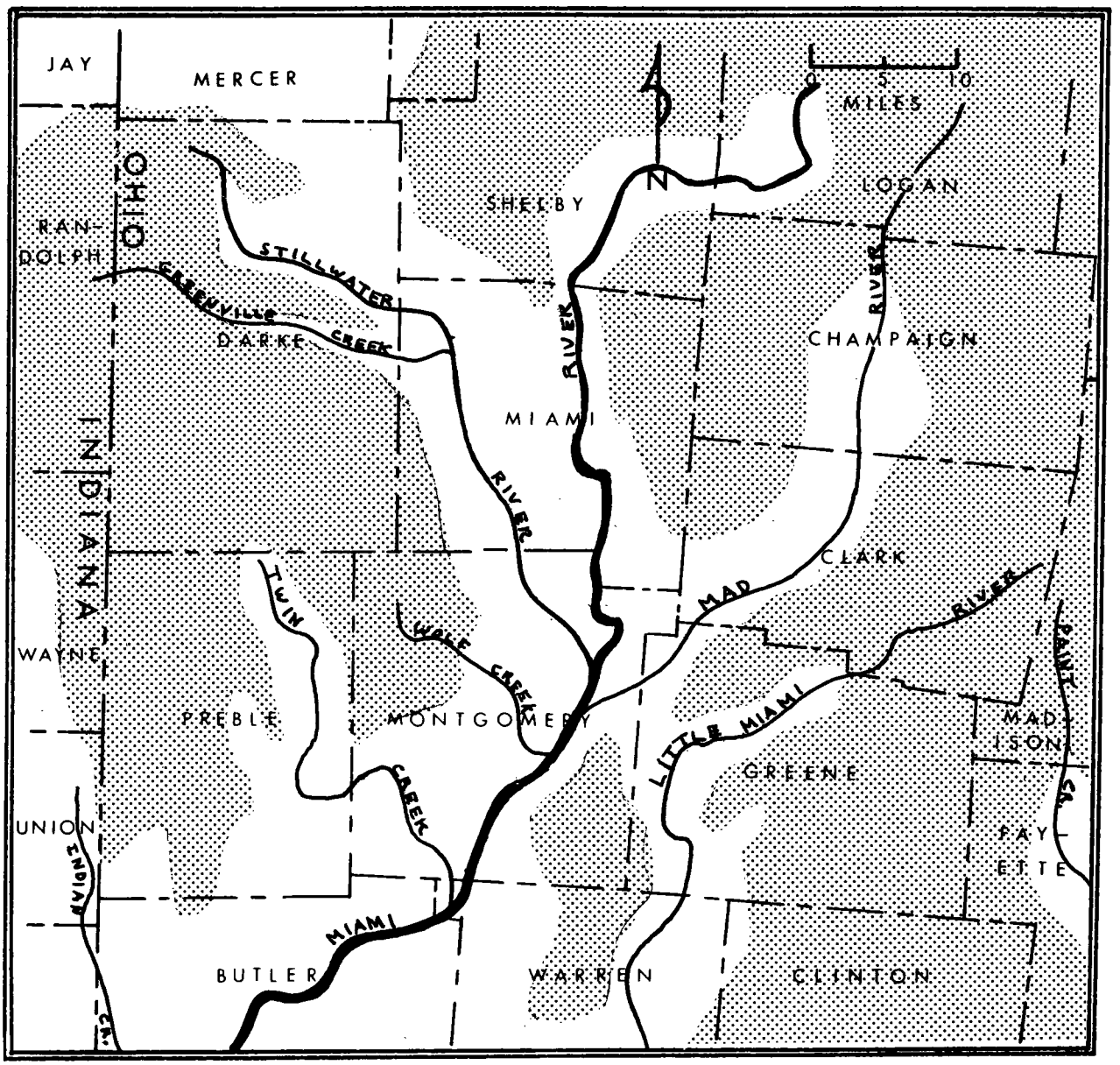


FIGURE 4. TOPOGRAPHY OF THE MIAMI RIVER VALLEY

STATE BOUNDARY

COUNTY BOUNDARIES

Over 1,000 feet Elevation

Temperatures of zero or below will occur four out of every five years, whereas temperatures of 100 degrees or more will occur only once in every five years. Furthermore, extremes in temperature are usually of short duration. Cold, polar air flowing across the Great Lakes causes much cloudiness in the winter and is accompanied by frequent light snow flurries.

The wind is predominantly out of the south-southwest except in February and March, when west-northwest winds prevail. The wind speed averages about eight miles per hour in the summer and about twelve miles per hour in the winter. Annual, summer, and winter wind roses are shown in Figure 5. The Dayton area appears to be much more affected by stagnant air masses extending over large areas of the Midwest than by localized climatological conditions.

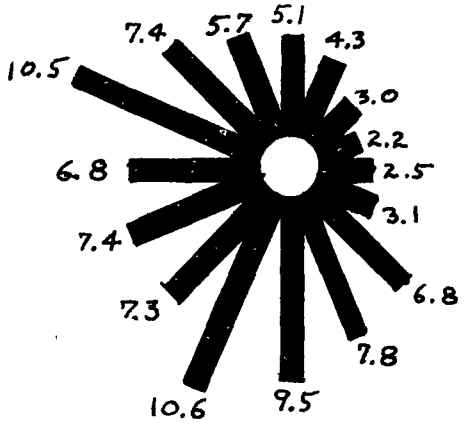
EMISSION INVENTORY

The National Air Pollution Control Administration conducted two emission inventories within the Dayton area. Based upon 1967 data, the Dayton survey included the counties of Darke, Greene, Miami, Montgomery, and Preble; and the Springfield survey was inclusive of Clark County. These areas are shown in Figure 6. Five pollutants were inventoried through the use of the PHS rapid survey technique[1] -- total particulates, sulfur dioxides,* carbon monoxides, hydrocarbons, and nitrogen oxides. Only particulate matter, sulfur dioxides, and carbon monoxide are

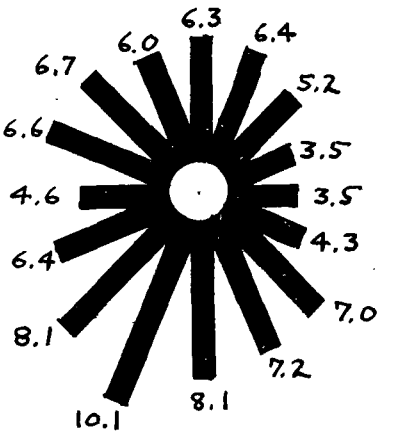
* Estimates are based on all oxides of sulfur, of which the vast majority is composed of sulfur dioxide.

FIGURE 5

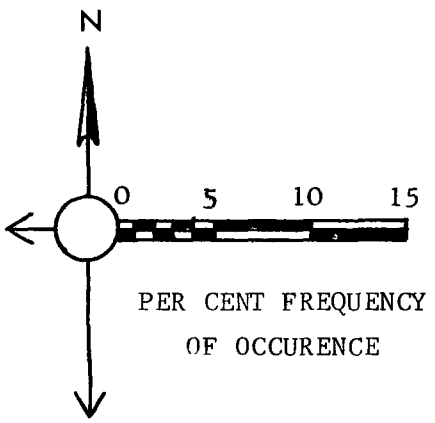
PER CENT FREQUENCY OF WIND DIRECTION

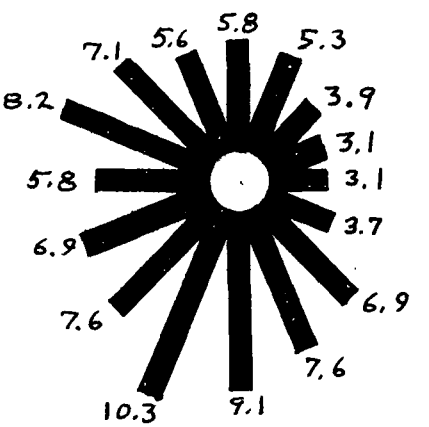


WINTER



SUMMER





ANNUAL

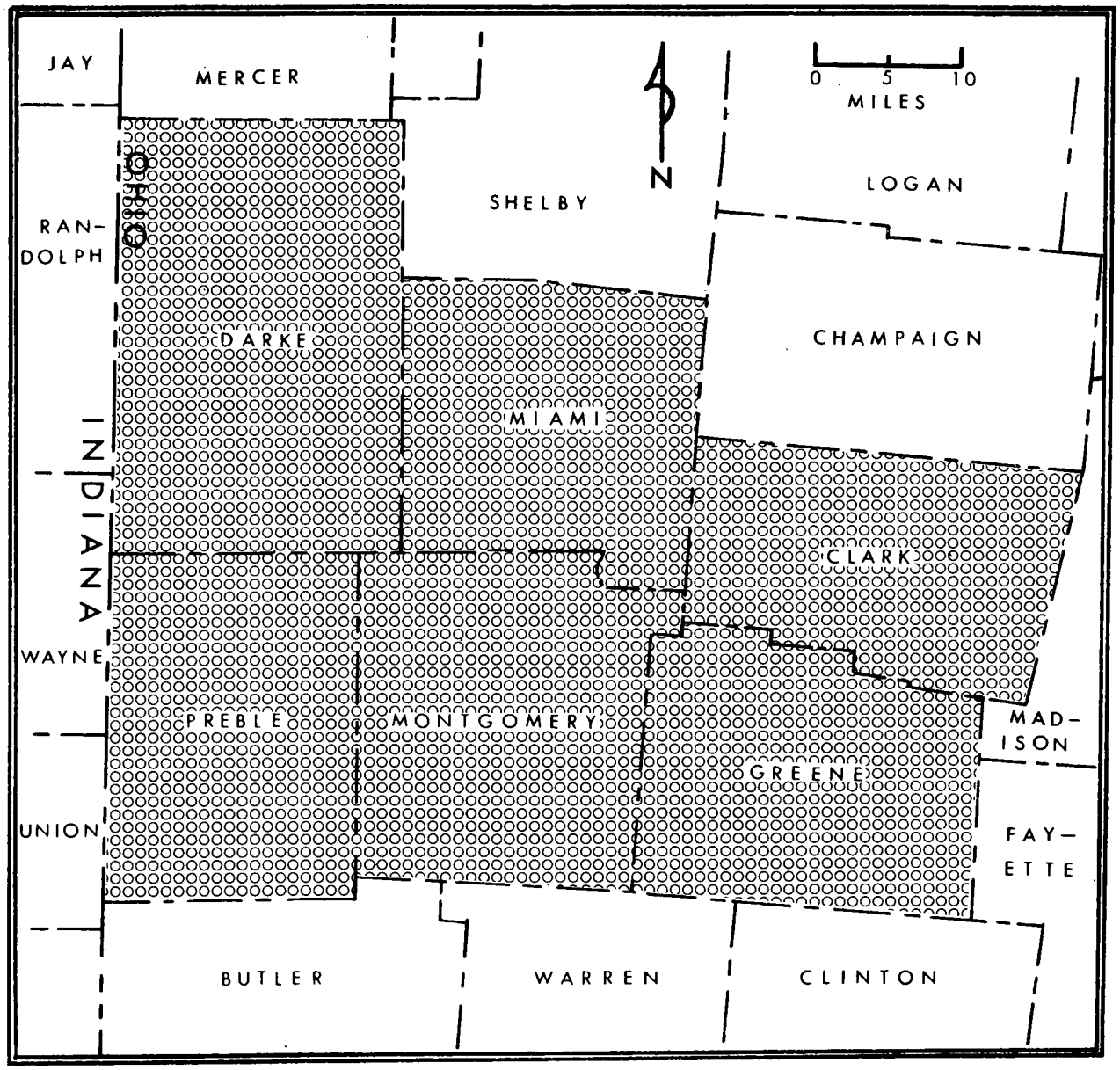


FIGURE 6. JURISDICTIONS INCLUDED IN THE DAYTON-SPRINGFIELD AIR POLLUTANT EMISSION INVENTORY

STATE BOUNDARY

COUNTY BOUNDARIES

considered, since it is believed that they provide an index of the geographic extent of the pollution problem.

Total particulate emissions show the extent of industrial, waste incineration, domestic heating, and steam-electric power plant emissions. Sulfur dioxide emissions describe the effect of fuel combustion from stationary sources. Finally, carbon monoxide emissions directly portray the influence of gasoline-powered motor vehicles upon the survey area.

Emission inventory results portray the geographic distribution of pollutant emissions, whether stationary or mobile, for particular areas. Although additional counties outside the two emission inventory survey areas were considered as candidates for inclusion within the proposed Region, the six counties surveyed were felt to represent the heart of such a region. The results of the inventory were evaluated by the diffusion model to systematically predict the spatial and temporal distribution of the emitted pollutants.

EMISSIONS BY LOCATION

The results of the emission inventory of the Dayton-Springfield area are tabulated by source category, pollutant-type, and political jurisdiction in Table I. Montgomery County, because of its population size and industrial concentration, leads in total emissions for all three pollutant-types. Second highest

TABLE I
POLLUTANT EMISSIONS BY SOURCE CATEGORY AND POLITICAL JURISDICTION
IN THE DAYTON AREA, 1967 (TONS/YEAR)

Pollutant	COUNTY	Emissions from Fuel Consumption					Transportation	Solid Waste Disposal	Total Emissions (All Sources)
		Industrial	Residential	Commercial & Institutional	Steam-Electric Power Plants	Total Fuel			
Sulfur Dioxides	Clark	---	1,380	---	2,470	3,850	130	20	4,000
	Drake	390	420	220	0	1,030	90	Neg.	1,120
	Greene	18,050	400	300	0	18,750	165	10	18,925
	Miami	2,300	350	400	4,080	7,130	150	25	7,305
	Montgomery	18,340	1,510	980	57,270	78,100	1,160	45	79,305
	Preble	570	300	210	0	1,080	60	Neg.	1,140
	TOTAL	39,650	4,360	2,110	63,820	109,940	1,755	100	111,795
Particulates	Clark	10	2,470	10	7,160	9,650	160	260	10,070
	Darke	1,010	380	520	0	1,910	155	210	2,275
	Greene	9,950	320	770	0	11,040	300	505	11,845
	Miami	4,800	330	1,020	7,770	13,920	260	240	14,420
	Montgomery	28,360	1,450	2,400	25,890	58,100	2,020	3,090	62,210
	Preble	1,500	280	510	0	2,290	110	160	2,560
	TOTAL	45,630	5,230	5,230	40,820	96,910	3,005	3,465	103,380
Carbon Monoxide	Clark	---	2,600	---	260	2,860	34,700	1,290	38,850
	Darke	30	440	250	0	720	17,740	1,120	19,580
	Greene	3,450	330	380	0	4,160	34,170	2,555	40,885
	Miami	140	370	500	40	1,050	29,660	840	31,550
	Montgomery	13,390	1,520	1,140	490	16,540	229,900	9,065	255,505
	Preble	50	320	250	0	620	12,530	830	13,980
	TOTAL	17,060	5,580	2,520	790	25,950	358,700	15,700	400,350

for sulfur dioxide and carbon monoxide is Greene County, while Miami County has the second highest emission of total particulates.

EMISSION BY SOURCE CATEGORY

Figure 7 graphically portrays the total study area emissions by the percent contribution of the various source categories. A brief summary of such emissions is as follows:

1. Coal combustion accounted for more than 74 percent of the total particulate emission of almost 103,400 tons per year. Transportation sources contributed 3.4 percent; industrial processes, 15 percent; and refuse burning, 3.4 percent.

2. Sulfur dioxide (111,800 tons per year) are emitted primarily from fuel combustion in stationary sources. Steam-electric power plants contributed 57 percent, almost solely from coal combustion; industry accounted for 38 percent; residential, commercial and institutional establishments added another 4.5 percent.

3. The major source of carbon monoxide (400,400 tons per year) was gasoline-powered motor vehicles which emitted 91 percent of the total emissions. Coal combustion in stationary sources accounted for 3.4 percent; and industrial processes, 3.1 percent.

GEOGRAPHICAL DISTRIBUTION OF EMISSIONS

A grid coordinate system, shown in Figure 8, was used to define the geographical distribution of air pollutant emissions. The grid coordinate system used was the Universal Transverse Mercator (UTM) System. Grid squares are 5, 10, and 20 kilometers on a side, depending on the intensity of urban development in an area.

The estimated emissions of each of the three pollutants (by grid zone) were expressed as average daily emissions for three different time periods -- annual, winter, and summer.

FIGURE 7. TOTAL STUDY AREA EMISSIONS BY PERCENT CONTRIBUTION OF VARIOUS SOURCE CATEGORIES

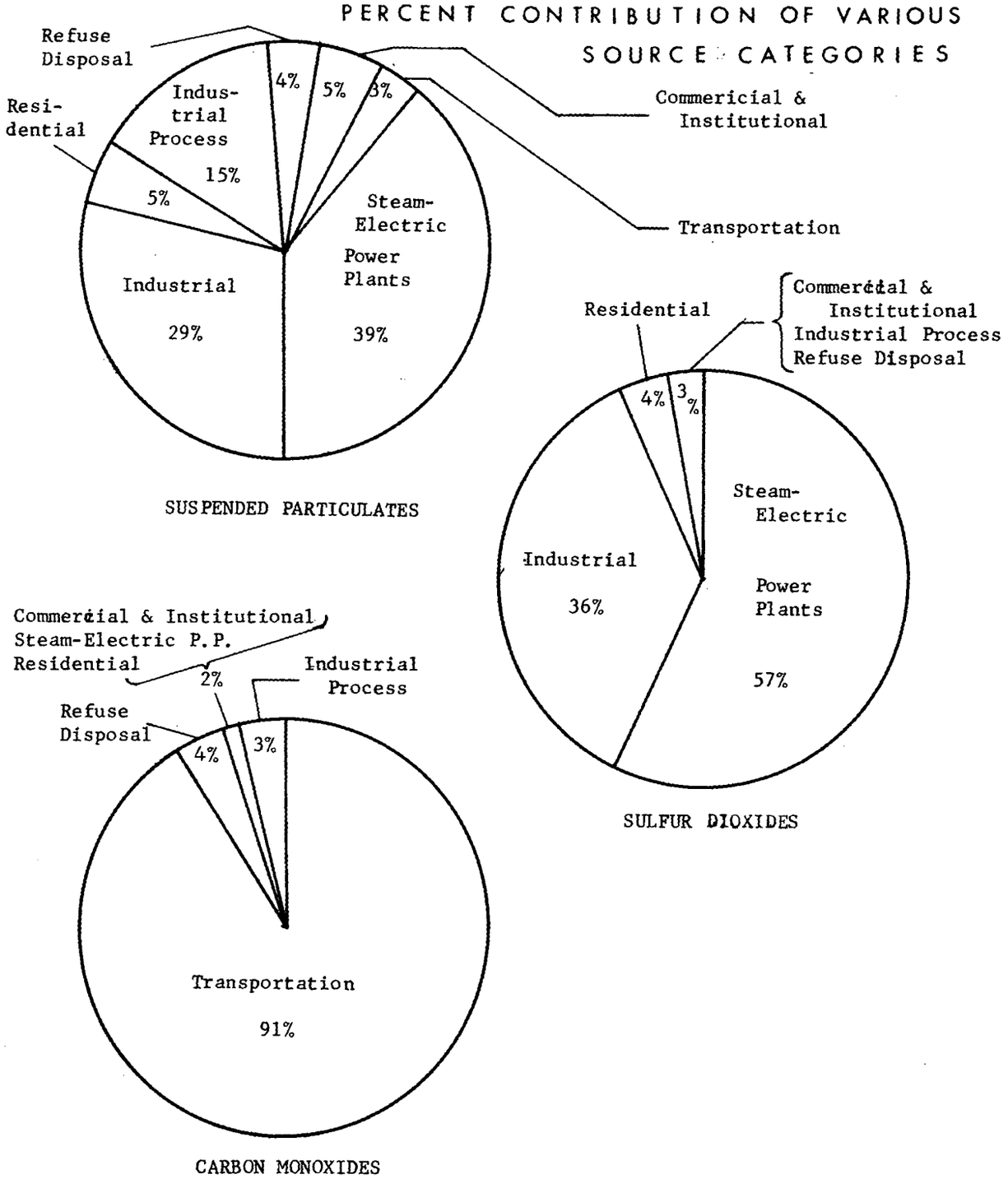
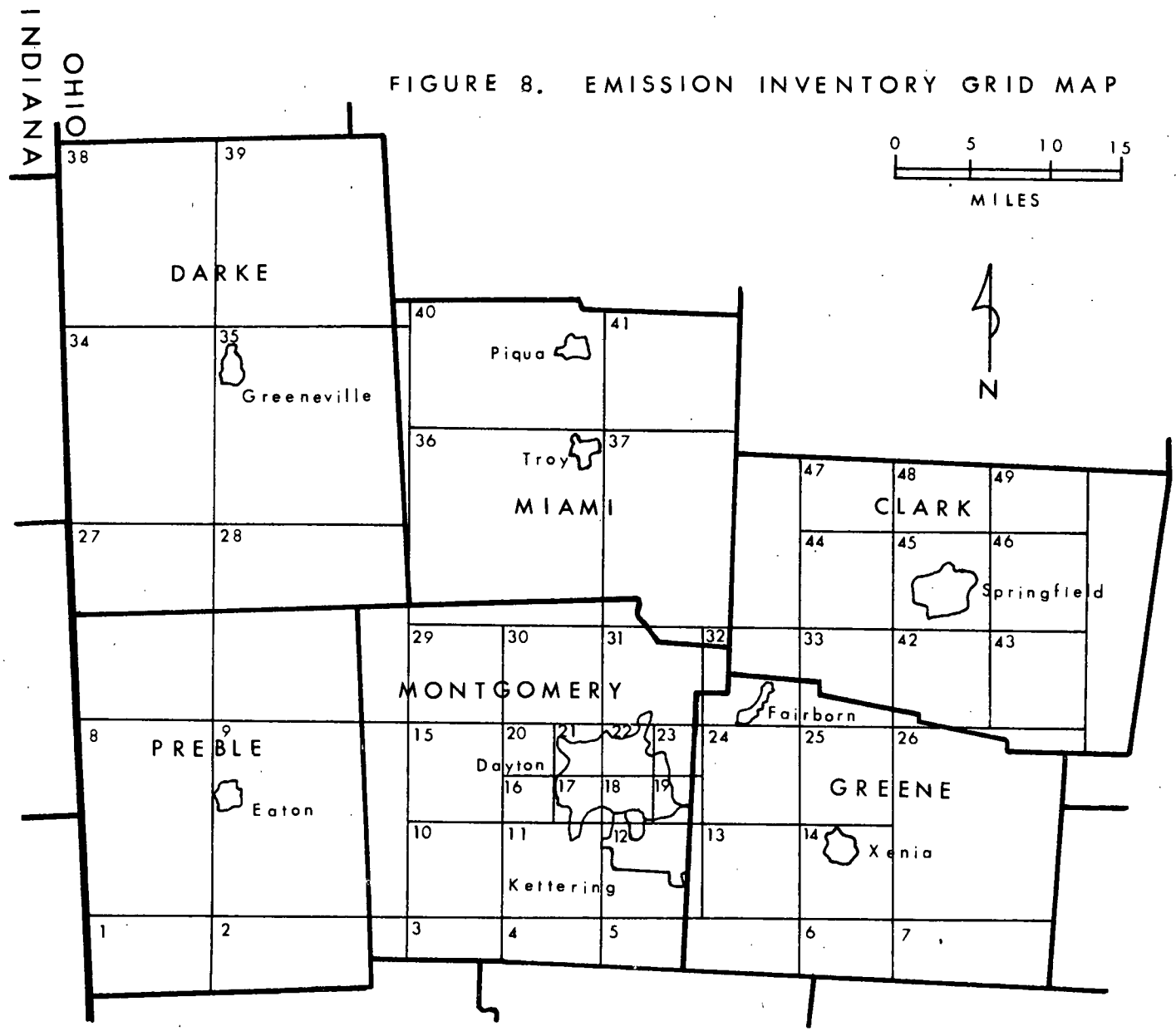


FIGURE 8. EMISSION INVENTORY GRID MAP



Annual average emission densities were calculated by dividing the total quantity of pollutants emitted in each of the grid zones by the total land area of the zone. Table 2 tabulates the resulting emission densities by grid zone. If greater than 50 per cent of the grid zone emissions result from major point sources, an asterisk is shown in the table.*

Figure 9 shows the mean daily emission density of particulates by study area grid zone. The highest densities are found in the City of Dayton and in outlying areas that contain major steam-electric power plants. Nearly all of Montgomery County is affected by emission levels of greater than 0.02 tons per square mile. Miami and Clark counties also have relatively large portions affected by emission densities of over 0.02 tons per square mile.

Figure 10 shows the mean daily emission density of sulfur dioxides by study area grid zone. Nearly all of Montgomery and Miami counties are affected by emission densities of over 0.01 tons per square mile. Once again, emission densities are high in several outlying, low population-density zones due to the location of steam-electric power plants.

Figure 11 shows the mean daily emission density of carbon monoxide by study area grid zone. As is normally true, carbon

*The values in Table 2 have been rounded-off to the nearest one-hundredth ton (20 pounds) while the densities shown on the grid maps are to the nearest one-thousandth ton. Therefore, a value such as 0.018 ton per square mile appears on the map in the 0.01 to 0.02 range whereas it is shown in Table 2 as 0.02 tons per square mile.

TABLE 2

TOTAL EMISSION DENSITY BY GRID ZONE
(TONS PER DAY PER SQUARE MILE)

Grid Number	Density of Sulfur Dioxide Emissions	Density of Particulate Emissions	Density of Carbon Monoxide Emissions
1	0.01	0.02	0.05
2	0.01	0.02	0.07
3	0.01	0.02	0.18
4	2.89*	2.43*	0.98
5	0.01	0.01	0.08
6	0.01	0.02	0.02
7	0.01	0.01	0.01
8	0.01	0.02	0.06
9	0.01	0.01	0.11
10	0.01	0.02	0.09*
11	0.20*	0.24*	1.22
12	0.05	0.09	2.24
13	0.01	0.02	0.30
14	0.04	0.05	0.34
15	0.01	0.07*	0.45
16	0.09	0.15	0.32
17	10.10*	2.55*	5.25
18	2.61*	2.32*	7.08
19	0.10	0.17	4.38
20	0.10	0.16	3.78
21	0.20	0.25	5.16
22	1.69*	5.42*	7.87

Table 2 continued

Grid Number	Density of Sulfur Dioxide Emissions	Density of Particulate Emissions	Density of Carbon Monoxide Emissions
23	0.11*	0.16*	4.09
24	0.03	0.05*	0.73
25	0.01	0.02	0.15
26	0.00	0.01	0.06
27	0.01	0.01	0.07
28	0.01	0.01	0.10
29	0.01	0.03*	0.46
30	0.02	0.04	1.32
31	0.03	0.05	1.31
32	1.00*	0.31*	0.81
33	0.02	0.03	0.28
34	0.01	0.03	0.17
35	0.00	0.00	0.06
36	0.05*	0.11*	0.30
37	0.01	0.02	0.12
38	0.00	0.01	0.05
39	0.00	0.01	0.07
40	0.11*	0.24*	0.36
41	0.03	0.03	0.12
42	0.00	0.00	0.06
43	0.00	0.00	0.02
44	0.17*	0.39*	0.07
45	0.13	0.37	2.03

Table 2 continued

Grid Number	Density of Sulfur Dioxide Emissions	Density of Particulate Emissions	Density of Carbon Monoxide Emissions
46	0.00	0.00	0.05
47	0.00	0.00	0.04
48	0.00	0.00	0.06
49	0.00	0.00	0.03

* More than 50% of emissions in the grid are due to point sources

FIGURE 9. MEAN DAILY EMISSION DENSITY OF PARTICULATES IN THE STUDY AREA, 1967

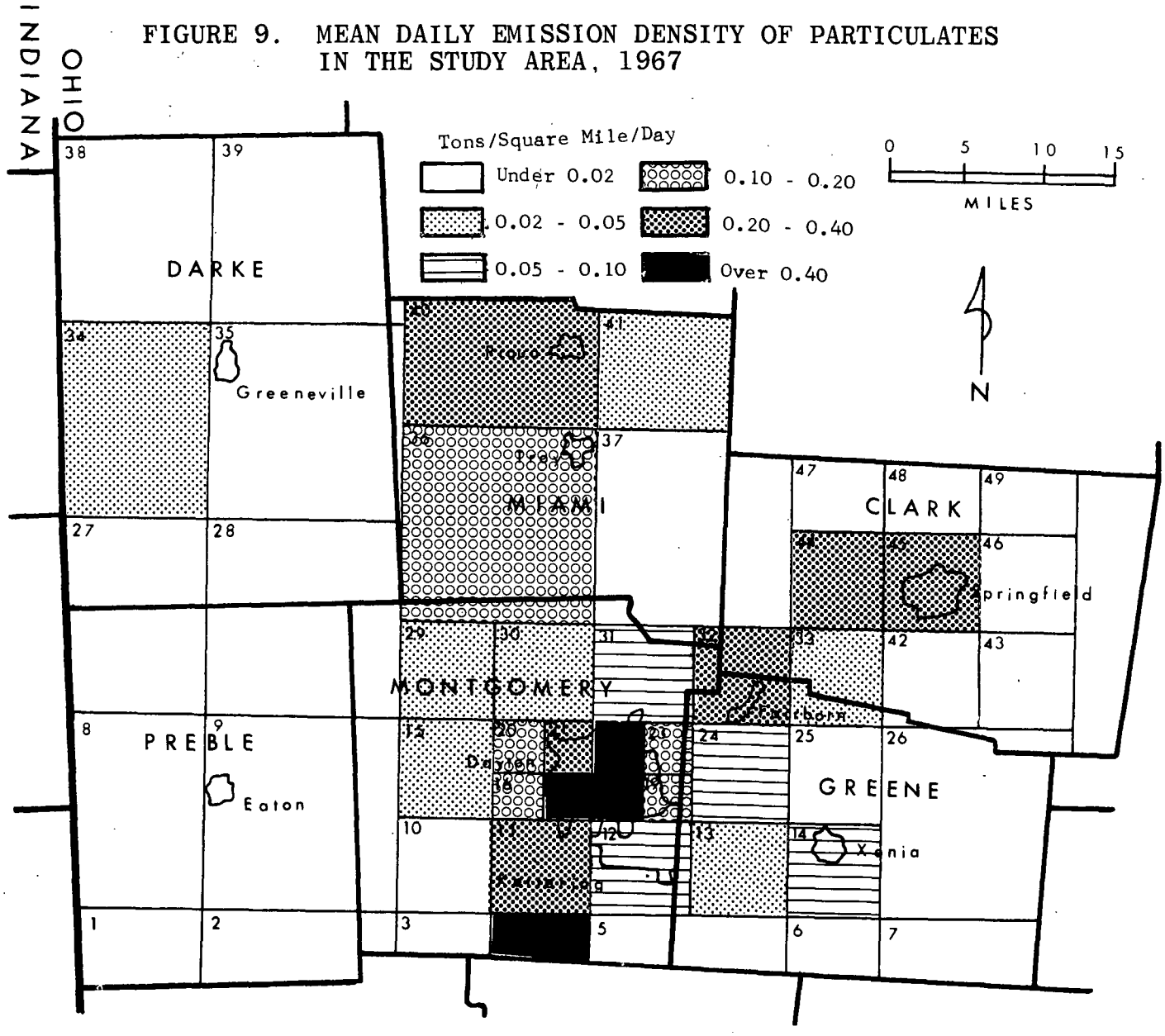


FIGURE 10. MEAN DAILY EMISSION DENSITY OF SULFUR DIOXIDE IN THE STUDY AREA, 1967.

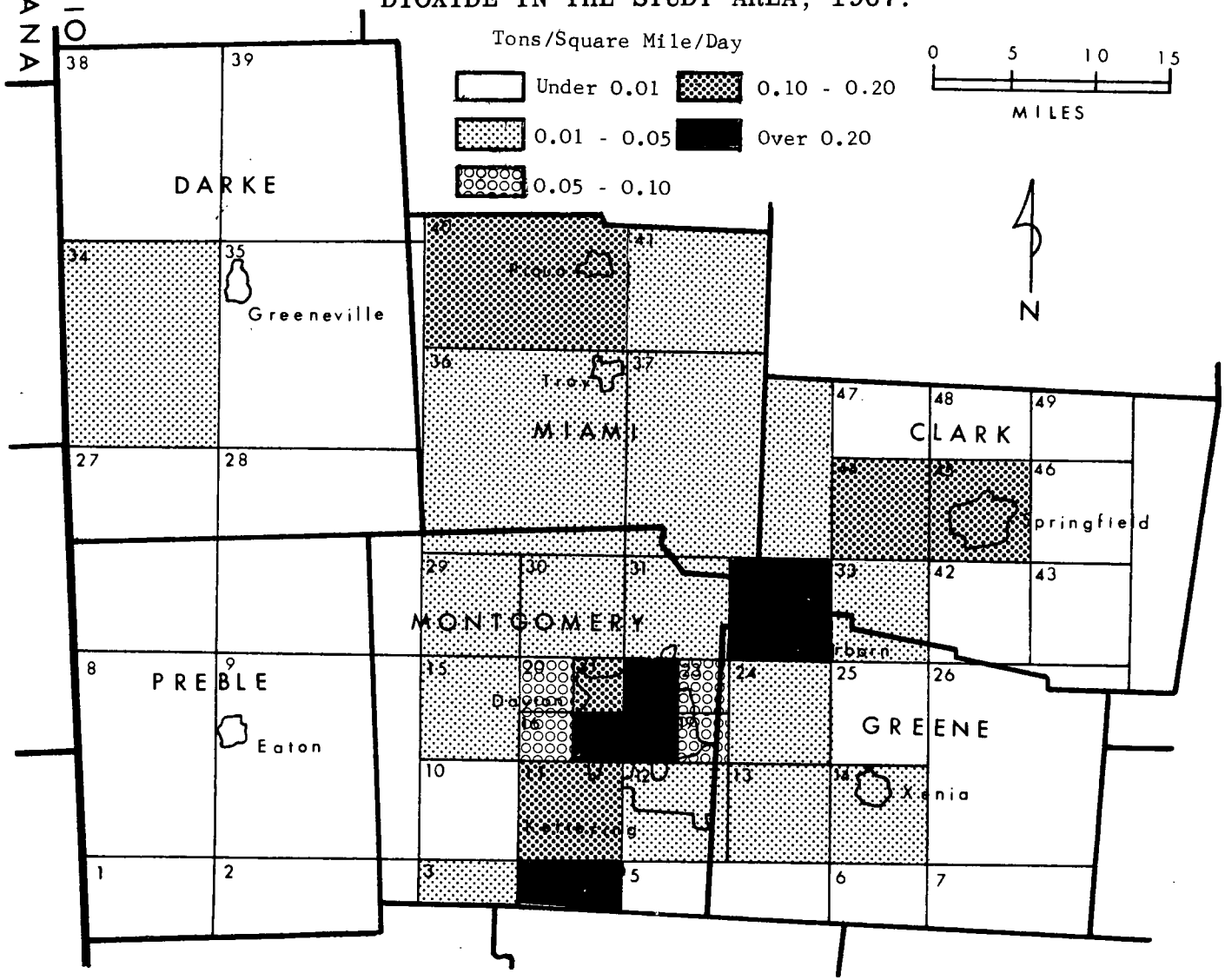
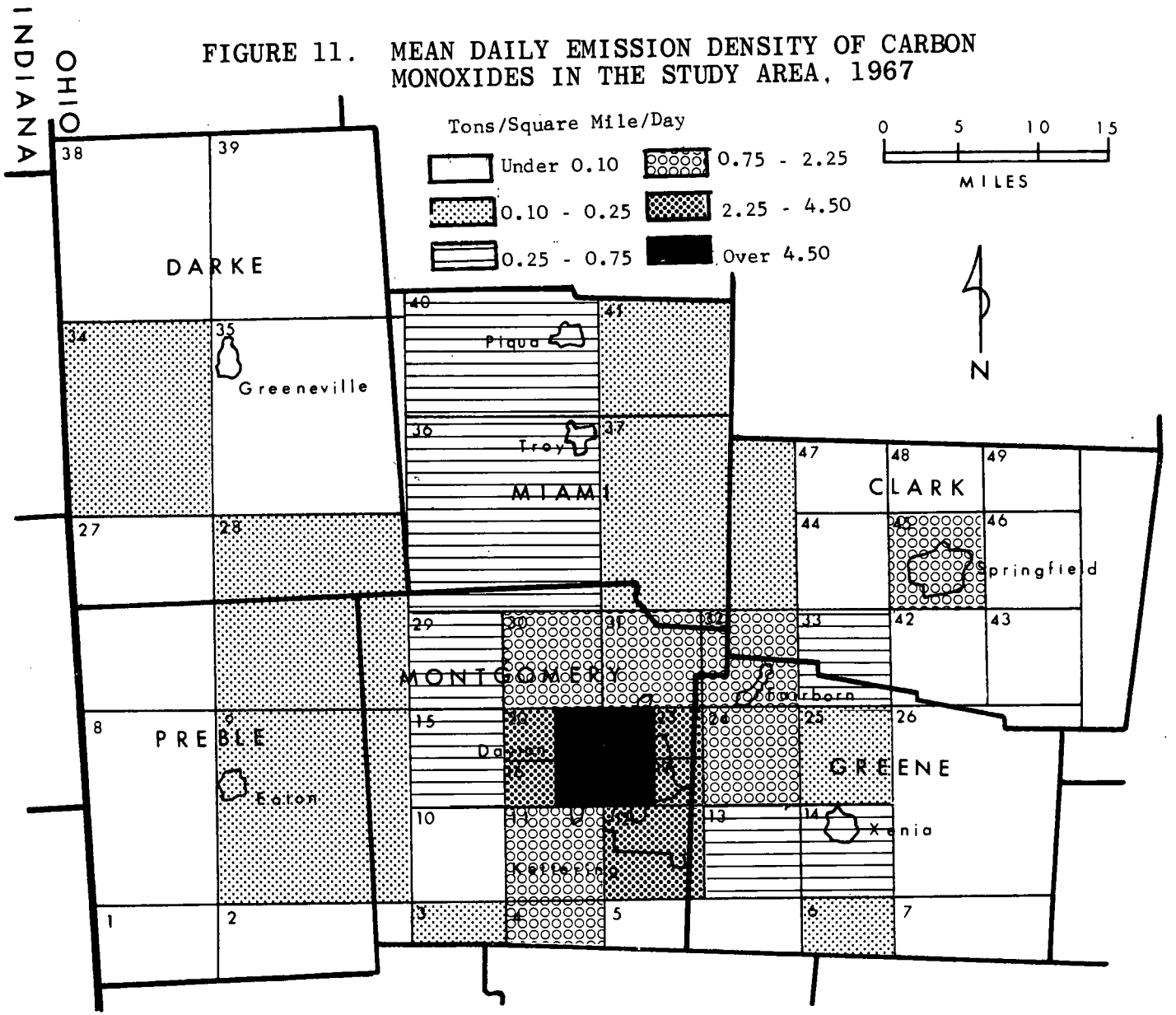


FIGURE 11. MEAN DAILY EMISSION DENSITY OF CARBON MONOXIDES IN THE STUDY AREA, 1967



monoxide densities are highest in the urban core of the region -- the downtown area of Dayton. The higher emission densities reflect heavily travelled highways such as the interstate freeways (I-75 and I-70).

POINT SOURCES

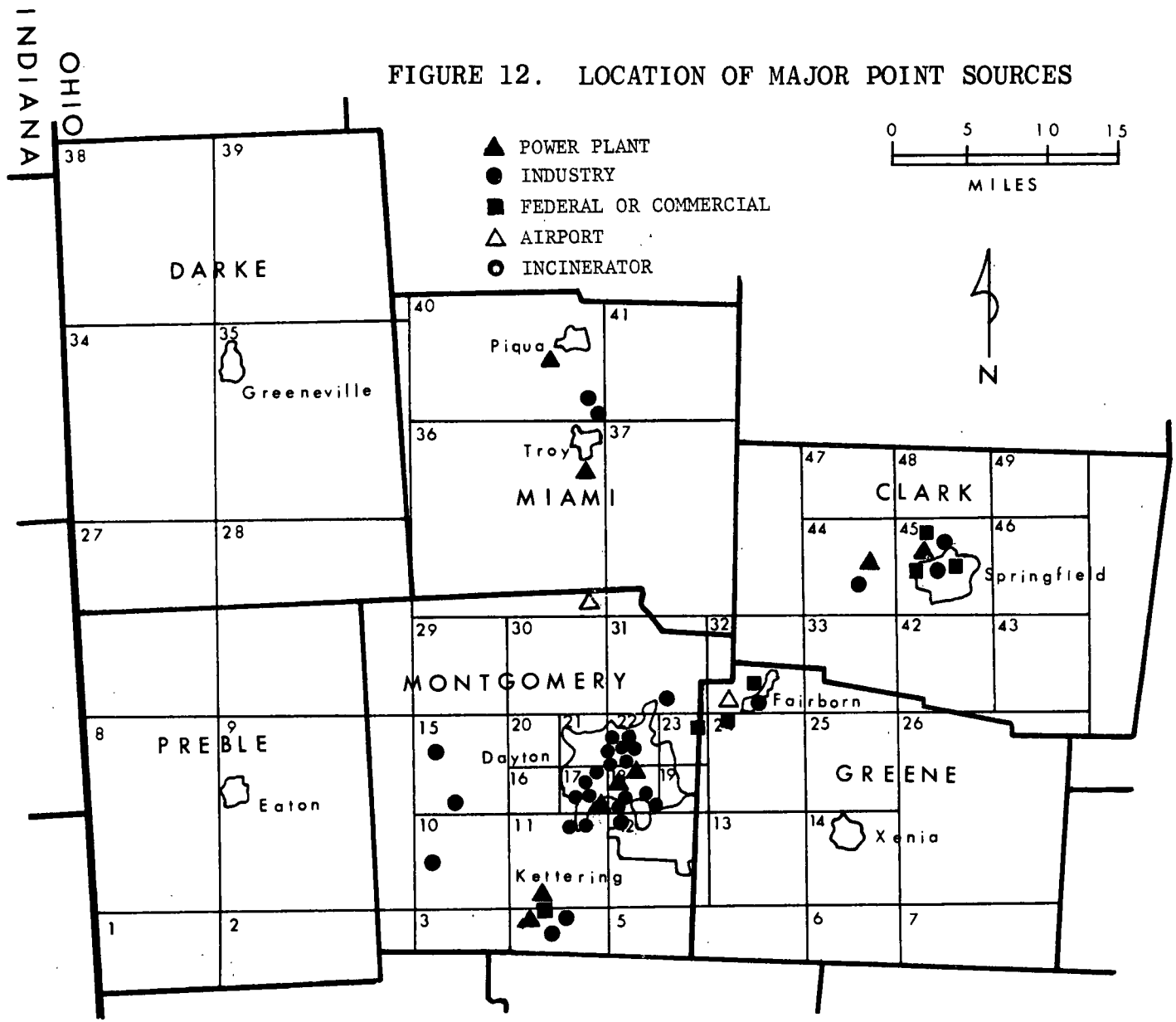
Figure 12 shows the location of major point sources within the study area. Nine steam-electric power plants were operating within the study area during 1967, two of which consumed over one-half million tons of coal during the year. Other point sources in the Dayton area included six foundries, seven cement or batching plants, five asphaltic batching plants, and two grain storage and handling facilities. Major sources of aircraft emissions were James Cox Municipal Air Port in Vandalia and Wright-Patterson Airforce Base in Greene County.

AIR QUALITY ANALYSIS

The regional approach to air resource management requires that all the major sources of pollution in an urban area be located within the same air quality control region. One must also consider the influence of pollution upon people and property once it is emitted into the ambient air. Upon determining this, a region which will envelop nearly all the sources and receptors for a particular metropolitan area may be selected.

Two important indices may be used to determine the peripheral extent of the air pollution problem within a region. First, long-term air sampling data, where available, may be

FIGURE 12. LOCATION OF MAJOR POINT SOURCES



evaluated. Unfortunately, few areas have sufficiently extensive sampling networks to be useful in selecting region boundaries. In these instances, diffusion modeling may be used to measure the peripheral extent of air pollution in an area. This technique results in an estimate of long-term average air quality by taking into account the location and magnitude of air pollutant emissions, and possible meteorological conditions.

Following is a brief discussion of the diffusion model, and a summary of measured air sampling data and estimated air quality levels in the Dayton area.

DIFFUSION MODEL

A meteorological diffusion model was used to predict suspended particulate, sulfur dioxide, and carbon monoxide concentrations in the ambient air at various receptor locations throughout the region. The Martin-Tikvart model was applied to each of these three pollutants for an average summer, winter, and annual day.[2] This model predicts long-term rather than episodic air quality conditions based on seasonal and annual average emission and meteorological data. The model has various intrinsic characteristics which limit its capabilities. However, its ability to determine reasonable spatial distributions of air pollutant concentrations has been verified by comparison with model results of air sampling data in other metropolitan areas.

Table 3 shows the average mixing depths for Dayton during the winter, summer, and annual averaging periods. These mixing depths, when combined with wind speed and direction data (see Figure 5), are used in the diffusion model. The meteorological data tabulated in this report was obtained from the National Weather Records Center (ESSA).

Table 3

AVERAGE MIXING DEPTHS FOR DAYTON
BY SEASON AND TIME OF DAY

Season	Mixing Depths, Meters		
	Average Morning	Average Afternoon	Average Morning and Afternoon
Winter (Dec., Jan., Feb.)	461	749	605
Summer (June, July, Aug.)	349	1661	1005
Annual (Four Seasons)	408	1324	866

A final note of caution regarding the air pollutant concentrations resulting from the diffusion model: the concentration contours are theoretical in nature and are not intended to show absolute levels of ambient air quality. The contour lines show relative levels and should be used as a guide to examine areas affected by inventoried pollutant emissions.

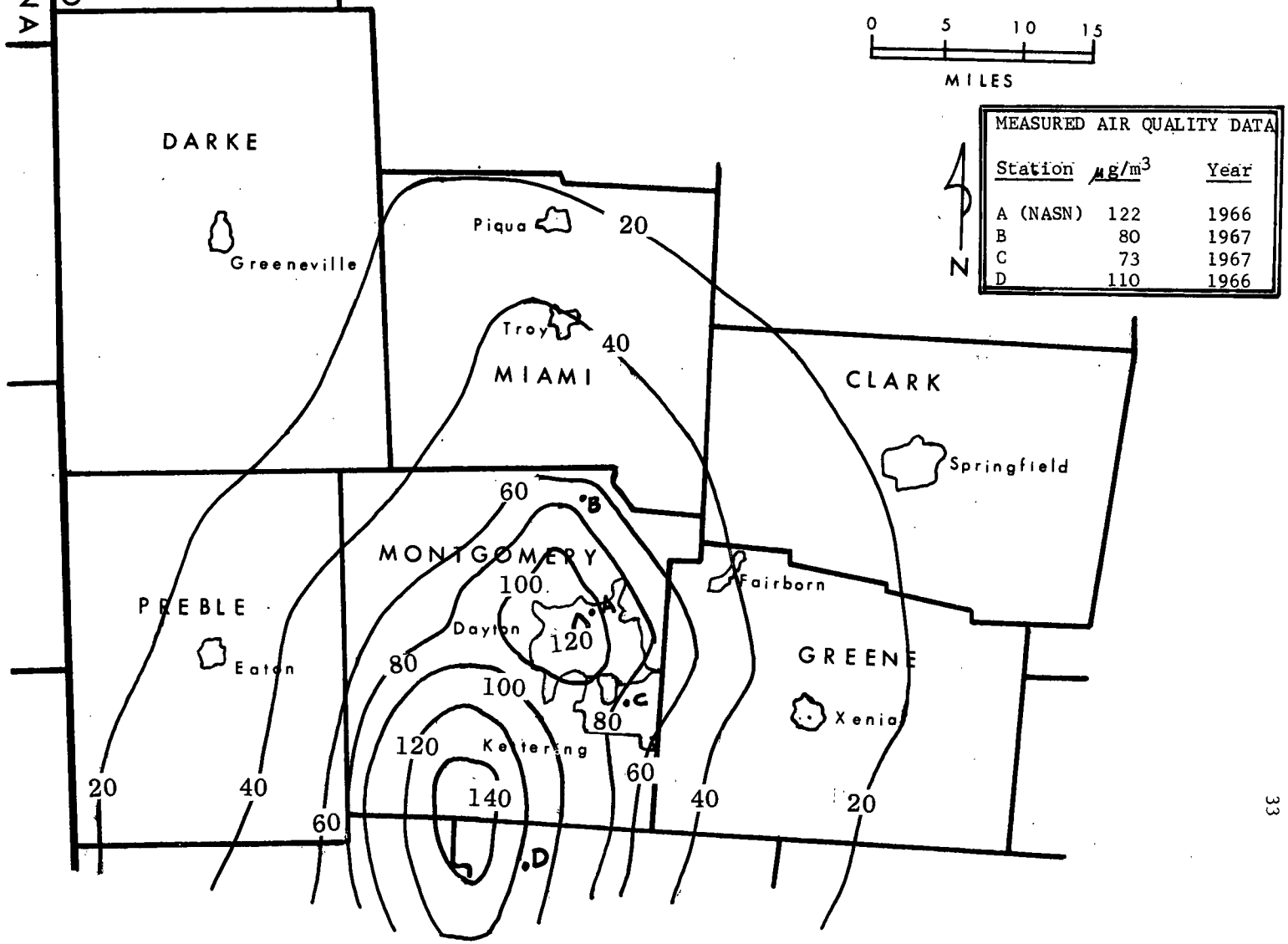
SUSPENDED PARTICULATES

Figure 13 shows theoretical suspended particulate concentrations as determined by the diffusion model. The contour lines, known as isopleths, represent conditions on an average summer day. A study of the extent of the affected area on a summer, winter, and annual basis reveals that summer meteorological conditions and emission levels cause the most widespread effects. Due to the impact of Cincinnati and Hamilton-Middletown emission sources upon the Dayton area, the concentrations shown in Figure 13 represent a combination of the Cincinnati and Dayton diffusion model isopleths. Finally, it should be noted that emissions from sources in Clark County were not included in the diffusion model analysis for this study. Such inclusion would have likely extended the higher concentration isopleths northeastward from Dayton and into Clark County.

The suspended particulate concentrations appear greater in two locations: (1) southwestern Montgomery County, in the path of prevailing winds from the Middletown industrial complex and (2) downtown Dayton. Significant levels of suspended particulates extend outward to Preble, Miami, Clark, and Greene Counties.

Figure 13 also shows the location and long-term average concentrations recorded at four air sampling stations in the Dayton area. Data collected by Federal (NASN), State, and local agencies,

FIGURE 13. THEORETICAL SUSPENDED PARTICULATE CONCENTRATIONS Adjusted for the combined effect of Dayton and Cincinnati study areas (excluding Clark County). Summer Basis. Values in micrograms per cubic meter.

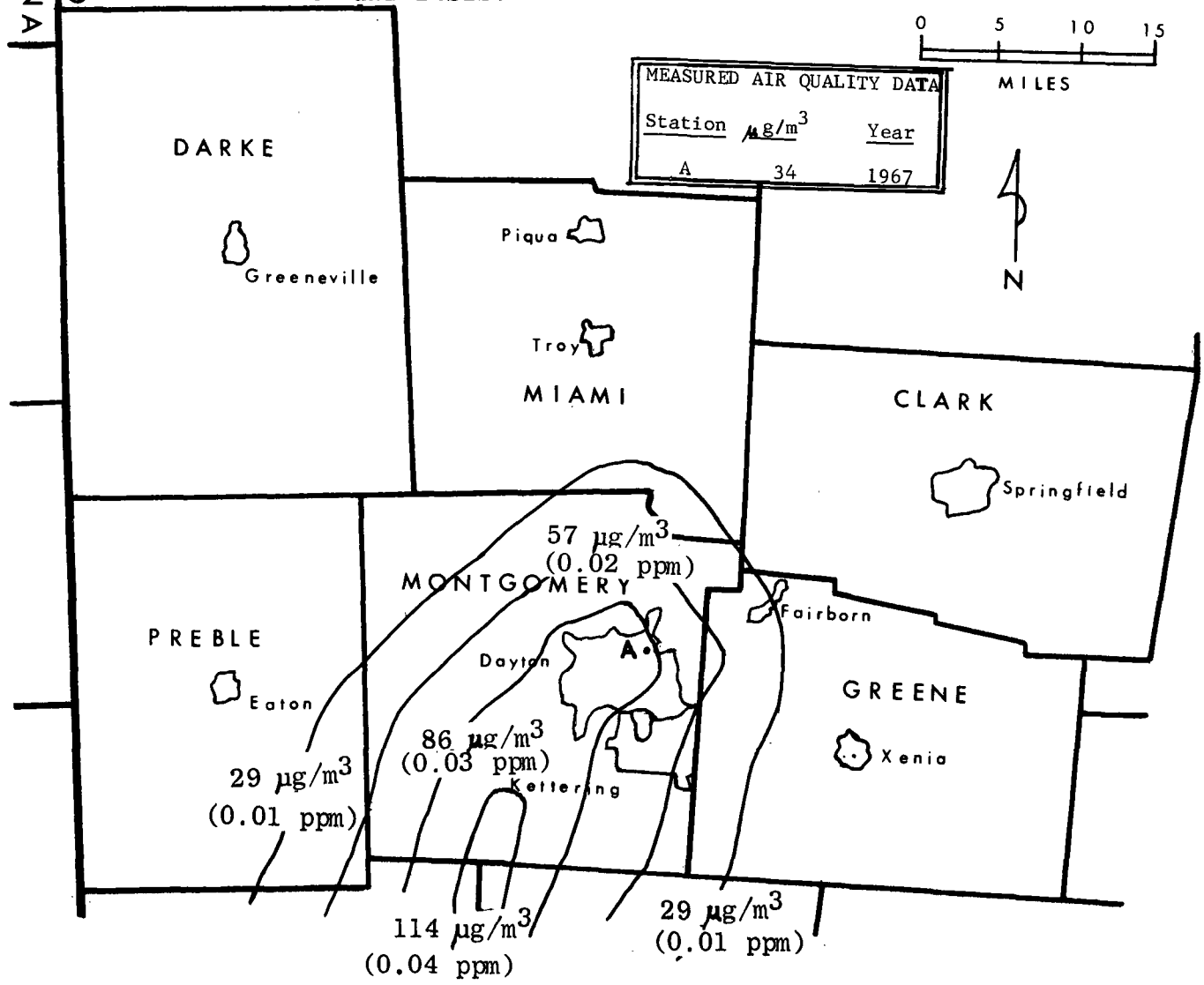


shows high correlation with the theoretical estimates of air quality levels. Three of the stations measured within approximately $\pm$ 10 $\mu g/m^3$ of the predicted suspended particulate values while measurements at the fourth station appeared nearly identical with predicted values. In addition to those sampling stations shown in Figure 13, two sampling stations maintained by the State of Ohio in outlying communities also recorded relatively high average values for recent periods - 145 $\mu g/m^3$ in Piqua, Miami County (1963-65); and 91 $\mu g/m^3$ in Greenville, Darke County (1966-67). These values further indicate that serious consideration should be given these outlying counties for inclusion in the Dayton Region.

SULFUR DIOXIDES

Figure 14 present average annual theoretical concentration contours for sulfur dioxide in the Dayton area. Once again, the combined impact of the Dayton and Cincinnati diffusion models are shown on the map. Nearly all of Montgomery County and portions of Preble, Miami, Clark, and Greene counties are encompassed by the 29 $\mu g/m^3$ counties line. If Clark County sources had been included, a much larger portion of that county would likely to have been affected by this outermost isopleth. Highest levels of sulfur dioxide concentrations (over 114 $\mu g/m^3$ or 0.04 ppm) were found in the area comprised of the Middletown industrial complex and southern Montgomery County, the latter containing two steam-electric power plants.

FIGURE 14. THEORETICAL SULFUR OXIDES CONCENTRATION
Adjusted for the combined effect of Dayton and Cincinnati study areas (excluding Clark County).
Annual Basis.



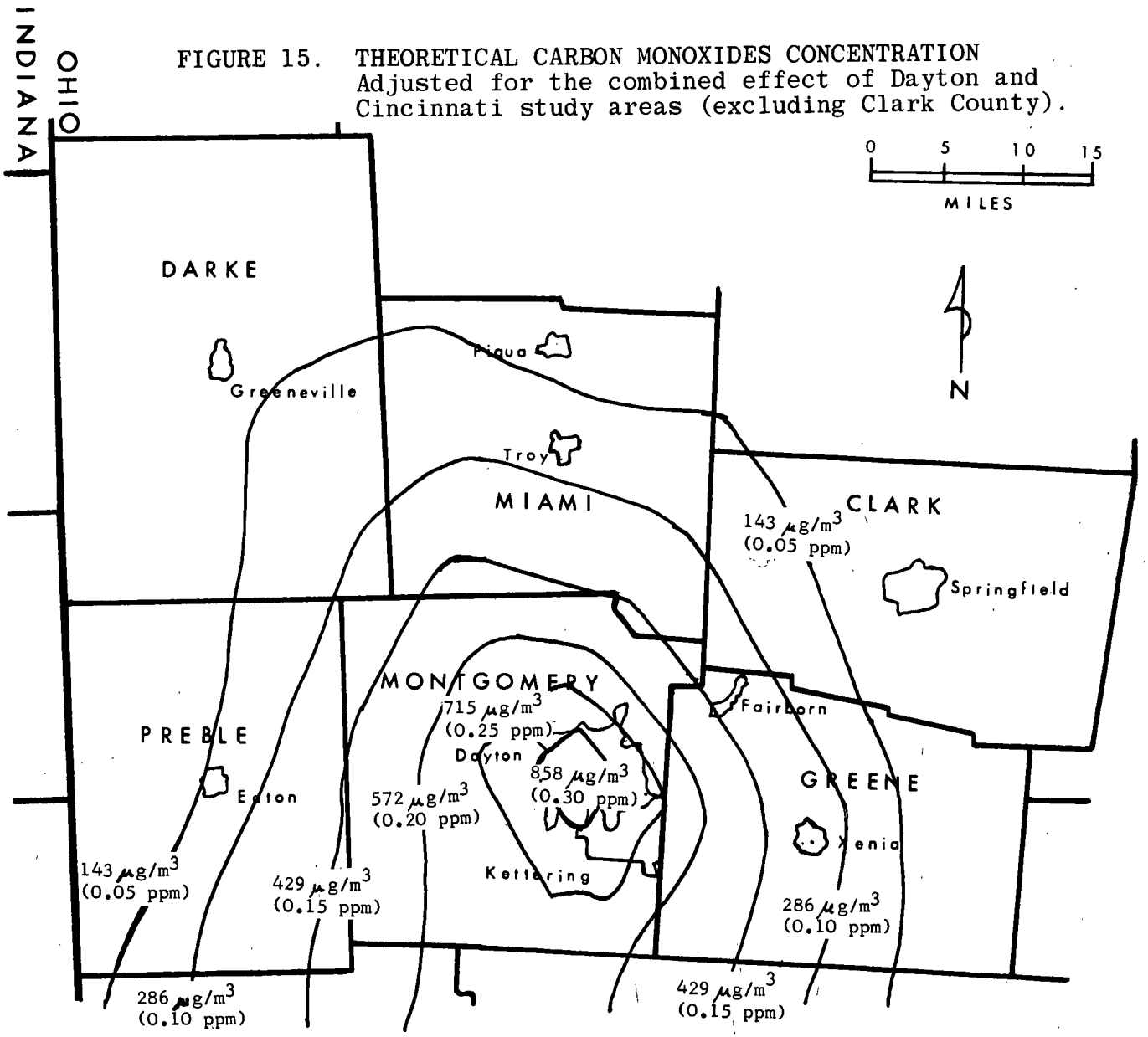
The only air sampling stations with measured data for sulfur dioxide were located in Dayton. The five stations measured an annual average value of $34 \mu g/m^3$ (0.012 ppm) using the West-Gaeke method. This value is about one-half the theoretical value and possibly differs because of a particular location and/or the fact that Dayton lies about 18 miles from the core concentration of sulfur dioxide pollution. A deviation factor of 2 was also found in the Cincinnati area.

CARBON MONOXIDE

Figure 15 shows the theoretical concentration contours for carbon monoxide based on contribution from the Dayton and Cincinnati areas. Highest predicted carbon monoxide levels occur in summer. Greatest concentrations occur along the Cincinnati to Dayton transportation corridor. As anticipated, highest individual concentrations exist in the downtown portions of Dayton where motor-vehicle traffic density is greatest. Inclusion of Clark County carbon monoxide emissions would be likely to produce a secondary core around the city of Springfield. Springfield is the second largest population center in the study area and contains a major east-west interstate freeway (I-70).

There does not exist any long-term, average concentration data for carbon monoxide in the Dayton area. An extensive study of downtown intersections in 1966, however, showed mean, 2-hour carbon monoxide levels of 26 to 43 ppm.[3] Other urban sites average 10.0ppm. These values are much higher than the average annual values predicted by the diffusion mode, since the sampling stations in the Ramsey study were placed at locations where high concentration of carbon monoxide would be expected.

FIGURE 15. THEORETICAL CARBON MONOXIDES CONCENTRATION Adjusted for the combined effect of Dayton and Cincinnati study areas (excluding Clark County).



EVALUATION OF URBAN FACTORS

A number of urban factors are relevant to the problem of defining air quality control region boundaries. Since human activity is the primary cause of air pollution, and humans are the ultimate victims, the location of population is an important consideration. The projected population growth pattern is another important consideration, since an air quality control region should be designed not only for the present but also for the future. Land use patterns proposed by regional planning agencies often give good indications of future growth patterns. For similar reasons, the location of industrial activity and industrial growth patterns are relevant considerations. Present and proposed transportation arteries and facilities must be considered. Political and jurisdictional considerations are especially important since the Clean Air Act envisions regional air pollution programs based on cooperative efforts among many political jurisdictions. The following discussion of urban factors will present these considerations as they apply to the Dayton area.

POPULATION

The area under study includes two Standard Metropolitan Statistical Areas (Dayton and Springfield) containing 1969

populations of 832,500 and 152,000, respectively (see Figure 3, page 10). Surrounding counties range in size from 7,000 to 83,000 persons. Tables 4 and 5 show the population and population densities for these counties in 1950, 1960, and 1969. In addition, the populations of major cities within each county are given for these years. Such data portrays a relatively rapid increase in population in the Dayton area during the past twenty years, especially within the Dayton SMSA which has increased 52 per cent since 1950.

Figure 16 shows the 1969 population density for counties in the Dayton area. Highest densities occur along a southwest to northeast orientation from Butler to Clark Counties, with the highest density (1,295 persons per square mile) in Montgomery County.

Population in the Dayton-Springfield SMSA's is expected to grow by 31% between 1969 and 1985. Within the Dayton area, the counties projected for the highest growth rates are located in the aforementioned SMSA's. Highest percentage growth should occur in Greene County (67%) as the overflow from the Dayton urban complex spills over and into western Greene County. Population increase expressed in absolute numerical terms shows that the core county, Montgomery, will have the largest growth - 137,700 or 369 persons per square mile. Table 6 shows the projected population density changes by county in the entire Dayton area

TABLE 4
POPULATION GROWTH IN THE DAYTON AREA, 1950-1969

Jurisdiction	1950 Population	1960 Population	Estimated 1969 Population	Percent Change 1950-1969	Numerical Change 1950-1969
OHIO					
Butler Co.	147,203	199,076	220,000	49	72,797
Hamilton	57,951	72,354	70,000	21	12,049
Middletown	33,695	42,115	46,500	38	12,805
Champaign Co.	26,793	29,714	32,600	22	5,807
Urbana	9,335	10,461	11,100	19	1,765
Clark Co.	111,661	131,440	152,000	36	40,339
Springfield	78,508	82,723	80,000	2	1,492
Clinton Co.	25,572	30,004	31,900	24	6,328
Wilmington	7,387	8,915	9,600	30	2,213
Drake Co.	41,799	45,610	53,500	28	11,701
Greenville	8,859	10,585	12,000	35	3,141
Fayette Co.	22,554	24,775	25,500	13	2,946
Washington C.H.	10,560	12,388	13,100	24	2,540
Greene Co.	58,892	94,642	119,000	102	60,108
Fairborn	7,847	19,453	32,000	308	24,153
Xenia	12,877	20,445	22,000	71	9,123
Logan Co.	31,329	34,803	33,800	8	2,471
Bellefontaine	10,232	11,424	11,800	16	1,568
Madison Co.	22,300	26,454	28,200	26	5,900
Mercer Co.	28,311	32,559	34,000	20	5,689

TABLE 4 CONTINUED

Jurisdiction	1950 Population	1960 Population	Estimated 1969 Population	Percent Change 1950-1969	Numerical Change 1950-1969
OHIO					
Miami Co.	61,309	72,901	85,000	38	23,691
Piqua	17,447	19,219	20,500	18	3,053
Troy	10,661	13,685	15,300	44	4,639
Montgomery Co.	398,441	527,080	593,000	49	194,559
Dayton	243,872	262,332	255,000	5	11,128
Kettering	22,200	54,462	72,000	225	49,800
Miamisburg	6,329	9,893	11,800	87	5,471
Preble Co.	27,081	32,498	35,500	31	8,419
Eaton	4,242	5,034	5,000	18	758
Shelby Co.	28,488	33,586	37,800	33	9,312
Sidney	11,491	14,663	15,900	38	4,409
Warren Co.	38,505	65,711	84,000	118	45,495
Lebanon	4,618	5,993	7,200	56	2,582
INDIANA					
Jay Co.	23,157	22,572	24,300	5	1,143
Portland	7,064	6,999	7,000	-1	-64
Randolph Co.	27,141	28,434	30,300	12	3,159
Union Co.	6,412	6,457	7,000	9	588
Wayne Co.	68,566	74,039	83,000	21	14,434
Richmond	39,539	44,149	48,000	21	8,461

TABLE 5
POPULATION DENSITIES OF COUNTIES IN THE DAYTON AREA, 1950-1969

County	Area (Sq. Miles)	1950 Population Density	1960 Population Density	1969 Population Density	Additional Residents Per Square Mile (1950-1969)
OHIO					
Butler	468	315	423	467	152
Champaign	432	62	69	76	14
Clark	402	277	327	377	100
Clinton	410	62	73	78	16
Darke	605	69	75	88	19
Fayette	406	56	61	63	7
Greene	415	142	228	287	145
Logan	460	68	76	74	6
Madison	464	48	57	61	13
Mercer	454	62	72	75	13
Miami	407	150	179	209	59
Montgomery	459	868	1,150	1,295	427
Preble	427	64	76	83	19
Shelby	408	70	82	93	23
Warren	408	94	161	206	112
INDIANA					
Jay	386	60	59	63	3
Randolph	457	59	62	66	7
Union	168	38	38	42	4
Wayne	405	170	183	205	35

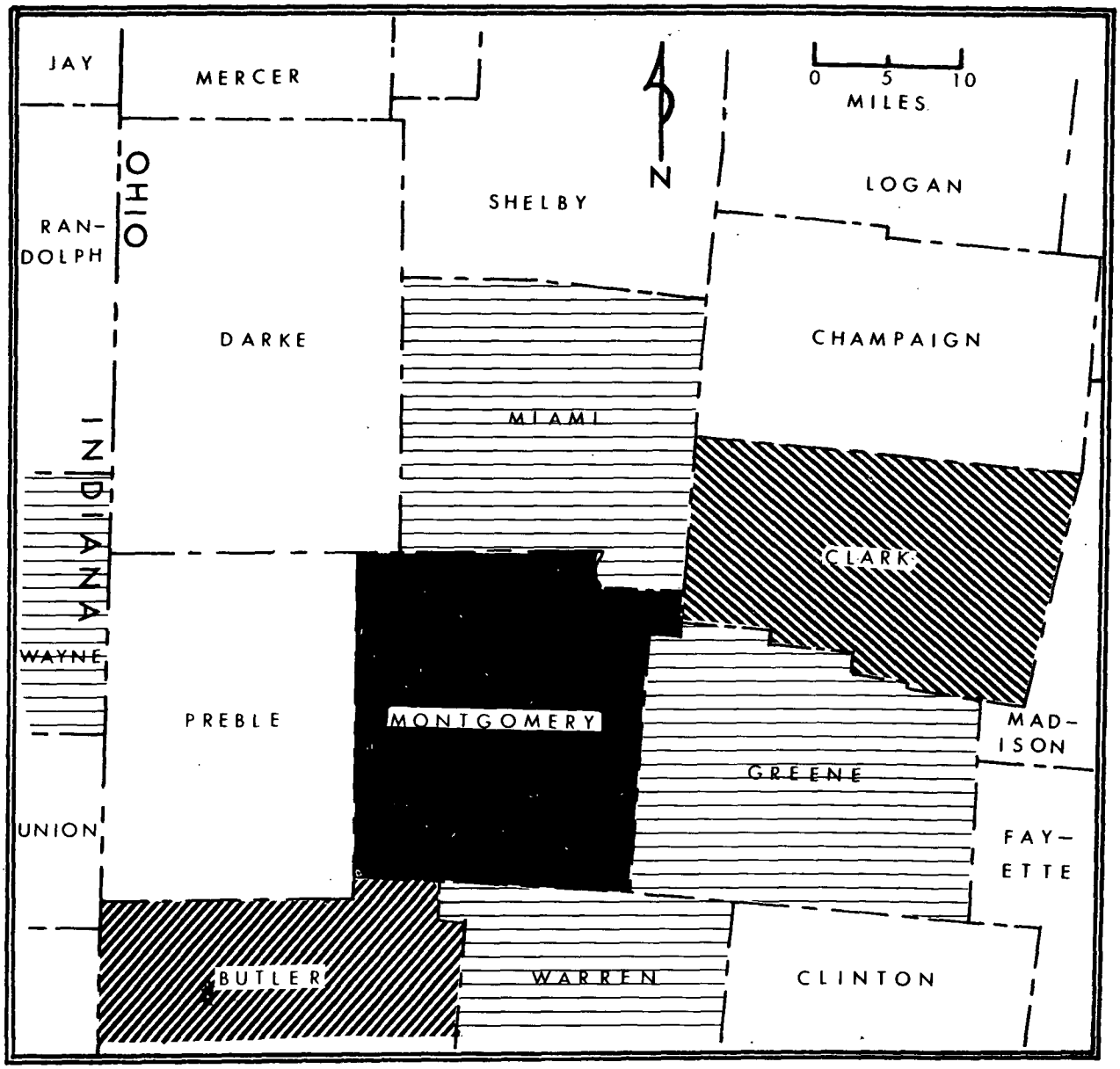


FIGURE 16. 1969 POPULATION DENSITY

STATE BOUNDARY

COUNTY BOUNDARIES

Residents Per Square Mile

More than 1,000

300 to 1,000

100 to 300

Residents Per Square Mile

Less than 100

TABLE 6

PROJECTED POPULATION AND DENSITY GROWTH BY COUNTY
IN THE DAYTON AREA, 1969-1985

County	1969[1] Population	1975 Population	1980 Population	1985 Population	1985 Population Density	Additional Residents Per Sq. Mi. 1969-1985
OHIO[2]						
Butler	222,000	235,900	254,100	276,200	587	+120
Champaign	32,600	33,100	36,000	37,400	87	+ 11
Clark	152,000	166,100	185,700	210,900	523	+146
Clinton	31,900	36,900	40,200	44,400	108	+ 30
Darke	53,500	54,000	55,400	59,100	98	+ 10
Fayette	25,500	28,100	29,900	32,100	79	+ 16
Greene	119,000	144,600	170,300	198,400	478	+ 67
Logan	33,800	37,700	39,500	41,500	90	+ 16
Madison	28,200	32,400	35,500	38,900	84	+ 23
Mercer	34,000	38,600	41,500	45,000	99	+ 24
Miami	85,000	91,300	100,000	110,000	260	+ 51
Montgomery	593,000	623,000	669,200	730,700	1,614	+369
Preble	35,500	38,700	41,500	44,700	105	+ 22
Shelby	37,800	40,800	43,900	47,600	117	+ 24
Warren	84,000	102,700	117,300	134,500	330	+124
INDIANA[3]						
Jay	24,300	21,849	21,623	21,400	56	- 7
Randolph	30,300	29,957	30,695	31,471	69	+ 3
Union	7,000	6,297	6,319	6,342	38	- 4
Wayne	83,000	80,914	83,821	86,772	214	+ 9

1. Commercial Atlas and Marketing Guide, One-Hundredth Edition, 1969, Rand McNally and Company.

2. "Ohio Population Forecasts," Ohio Department of Development, Economic Research Division. Median Projections.

3. "Indiana Population Projection, 1965-1985," Vol. 1, Indiana University, Bloomington, Indiana, 1965 Series B projections. Discrepancies between 1969 and 1975 estimates result of higher growth rates following 1965 estimates.

for the 1969 to 1985 period. The growth data is portrayed in Figure 17 (Additional Residents Per Square Mile) and Figure 18 (Population Change in Percent).

To summarize the population analysis, the core of the study area is Montgomery County with nearly three times the population and density of the next county in size, Butler County. Population density is also high in counties lying east and northeast of Montgomery County, as well as to the south in the direction of Cincinnati. Population growth during the remainder of this century is likely to take place along the Dayton-Springfield-Columbus corridor and northward along the Miami River Valley. An estimate for the year 2000 shows a population of 1,727,000 in the five-county area under the Miami Valley Regional Planning Commission.[4]

LAND USE

An important factor to consider in selecting the boundaries of an air quality control region is present and future land use. Figure 19 is a map showing land use for urban purposes in the Dayton area for the year 1965. With the exception of the areas within and surrounding the cities of Dayton and Springfield, most of the urban land area consists of small cities and scattered villages. Strong links appear to exist between the Montgomery-Greene Counties urban complex and the counties of Miami and Clark.

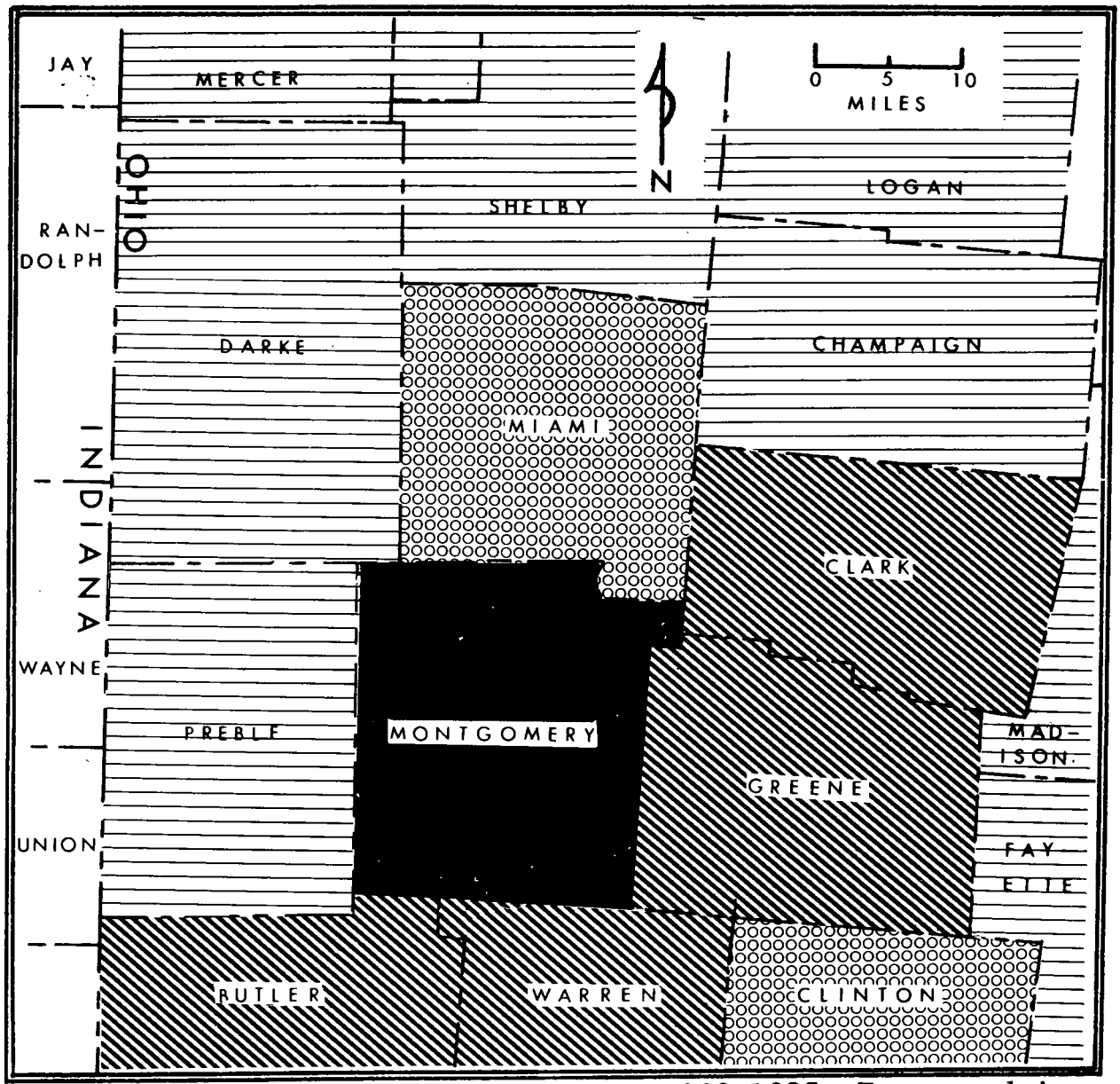


FIGURE 17. POPULATION GROWTH, 1969-1985, Expressed in Absolute Terms of Additional Residents Per Square Mile.

STATE BOUNDARY

COUNTY BOUNDARIES

Additional Residents Per Square Mile

- Greater than 300
- 100 to 300
- 25 to 100
- 10 to 25
- Less than 10

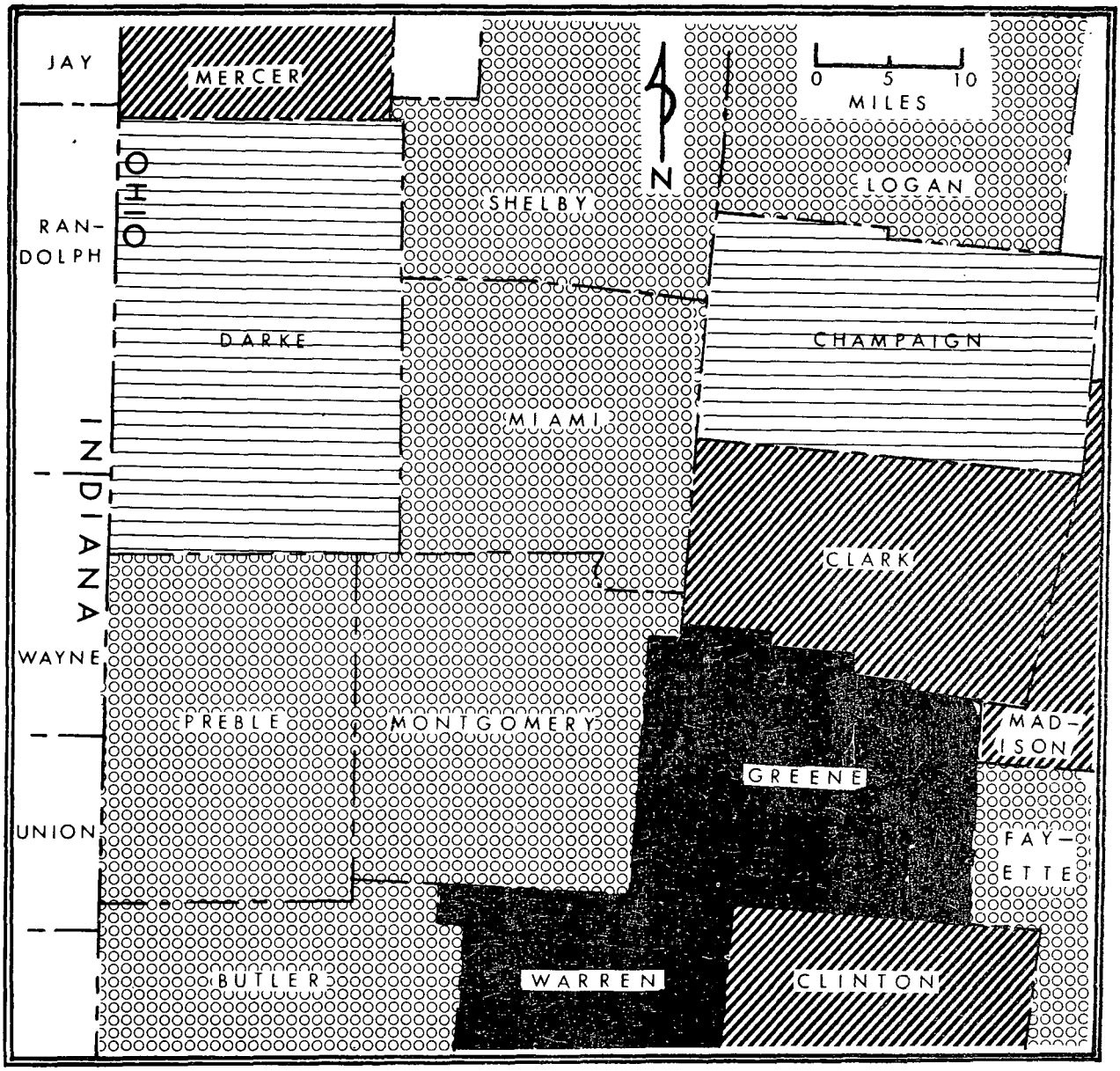


FIGURE 18. POPULATION GROWTH, 1969-1985, Expressed in Per Cent Increase in Additional Residents

STATE BOUNDARY

COUNTY BOUNDARIES

Per Cent Growth

Greater than 50

30 to 50

20 to 30

Per Cent Growth

10 to 20

Less than 10

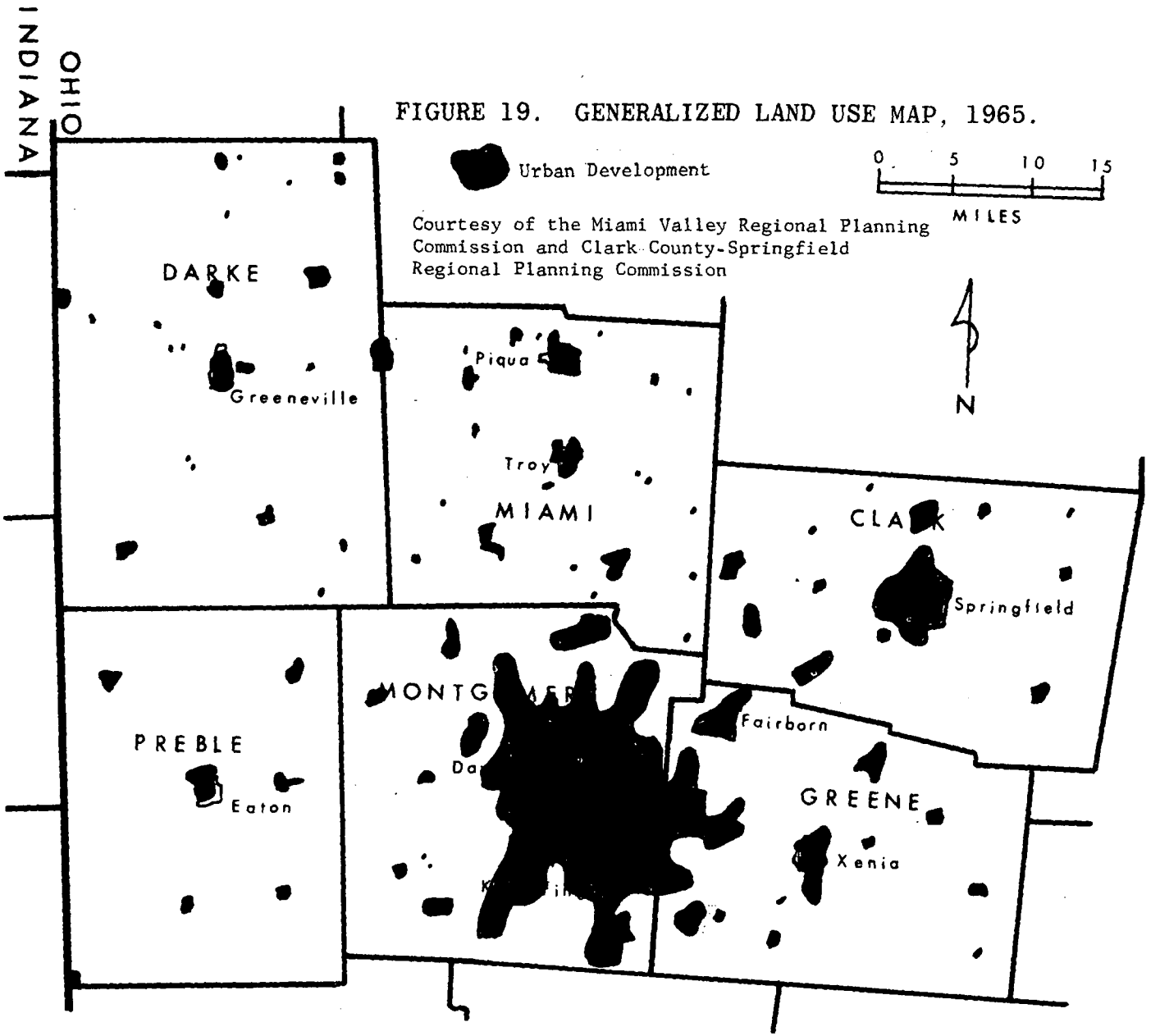


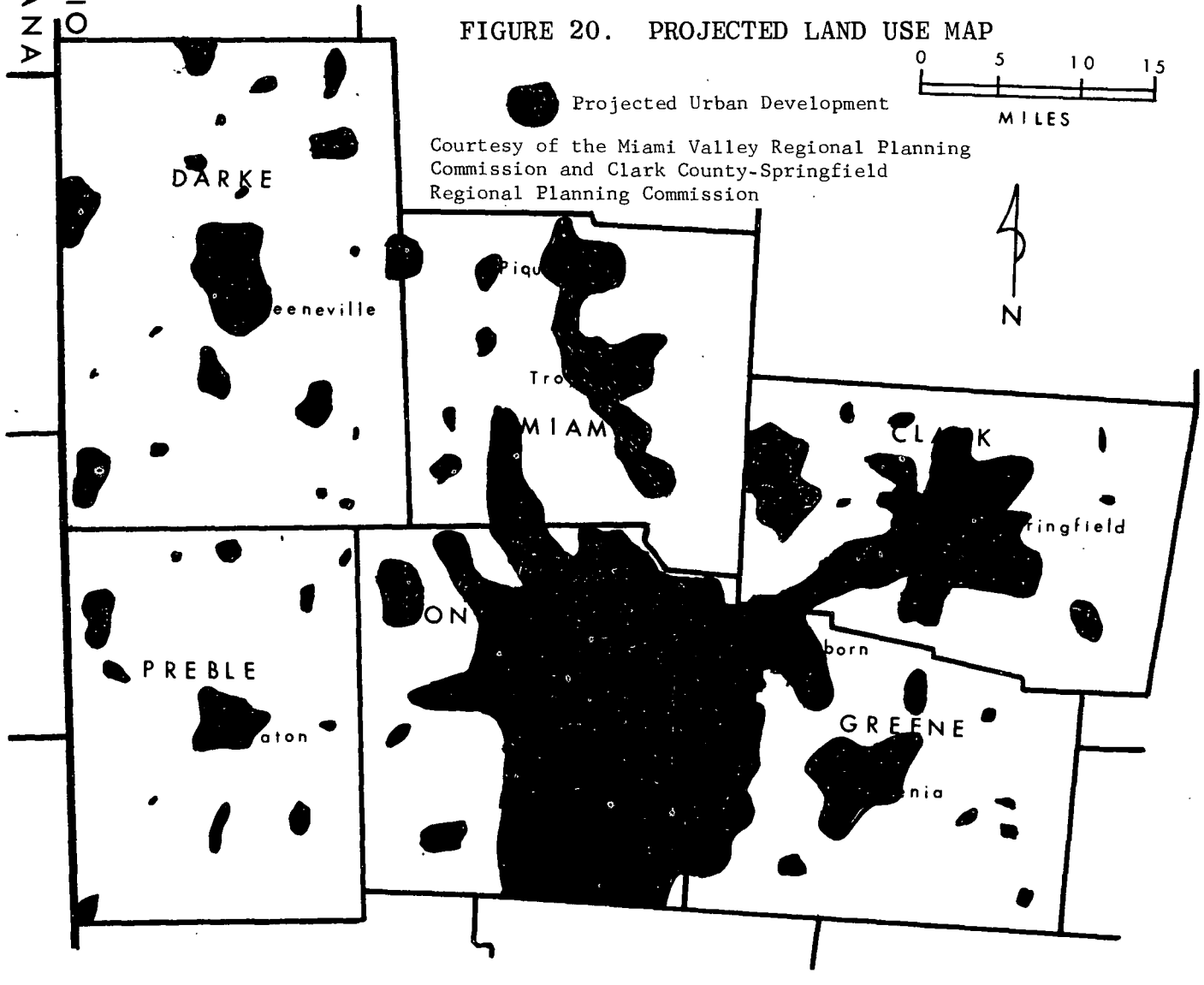
FIGURE 19. GENERALIZED LAND USE MAP, 1965.

Figure 20 shows projected urban land usage for the same area based on an interim plan developed by the Miami Valley Regional Planning Commission with several modifications using additional data. Clark County growth patterns are based on information obtained from the Clark County-Springfield Regional Planning Commission. The map portrays an even stronger link between Dayton and both the Springfield area and the northern Miami River Valley communities. Of prime consideration for selecting the air quality control region is the increased urban land usage in Preble and Darke counties. It should also be noted that most of the projected urban growth has occurred in areas nearest to Dayton rather than on the outer extremities of the study area.

INDUSTRY

Industrial activity is one of the major causes of air pollution. Because of this, their location plays a key role in selecting air quality control region boundaries. Two methods of examining industrial activities are used in this study. The first method requires the examination of manufacturing employment density and growth rates on a county basis. Figure 21 shows the density of manufacturing employment throughout the Dayton area in 1963. Montgomery County contains over five times greater density of employees engaged in manufacturing than any other county in the region. Other counties having relatively high manufacturing employment density include Butler, Clark, and Miami. Figure 22 shows the projected increase in manufacturing

FIGURE 20. PROJECTED LAND USE MAP



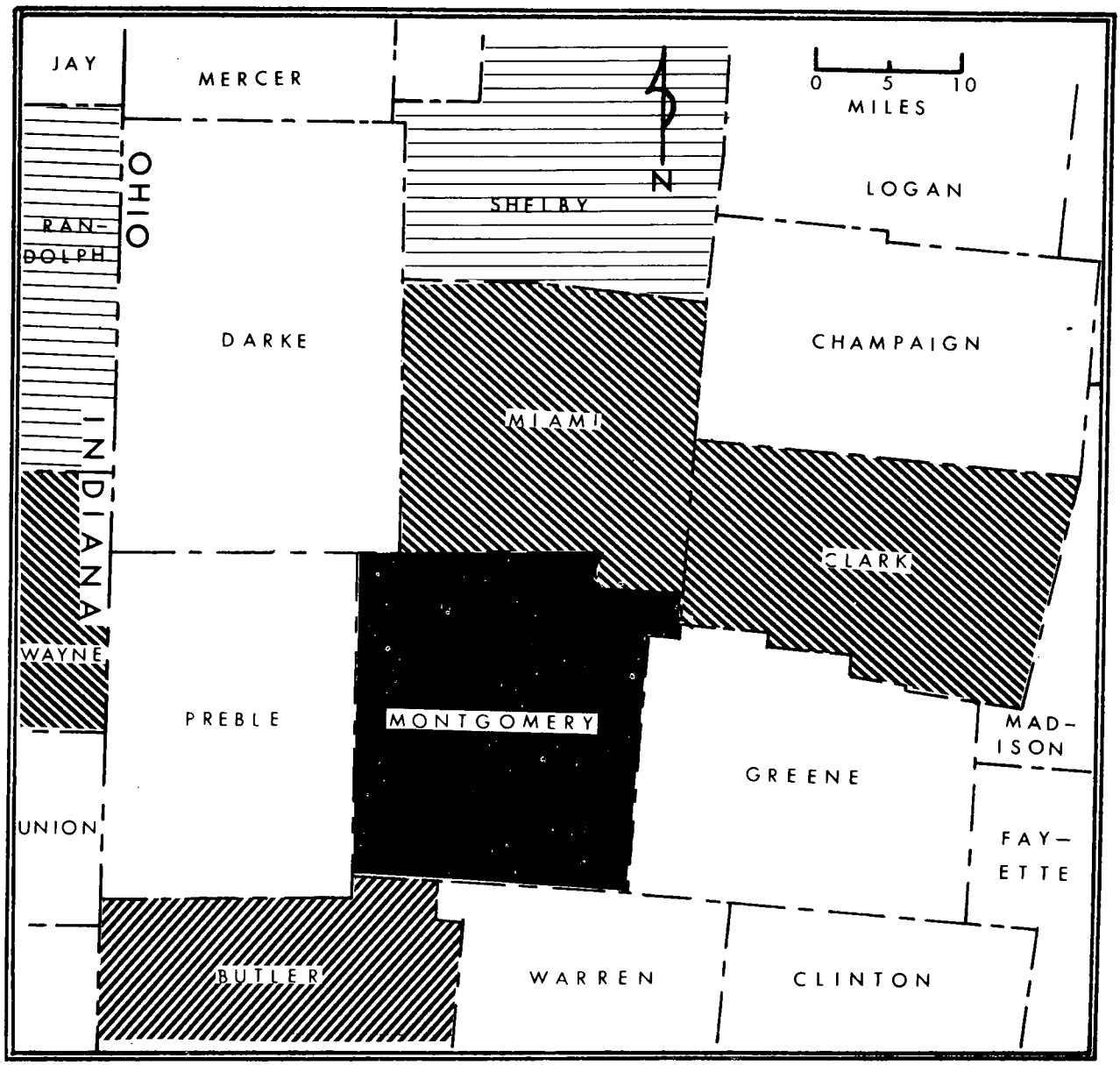


FIGURE 21. 1963 MANUFACTURING EMPLOYMENT DENSITY

STATE BOUNDARY

COUNTY BOUNDARIES

Manufacturing Employees Per Square Mile

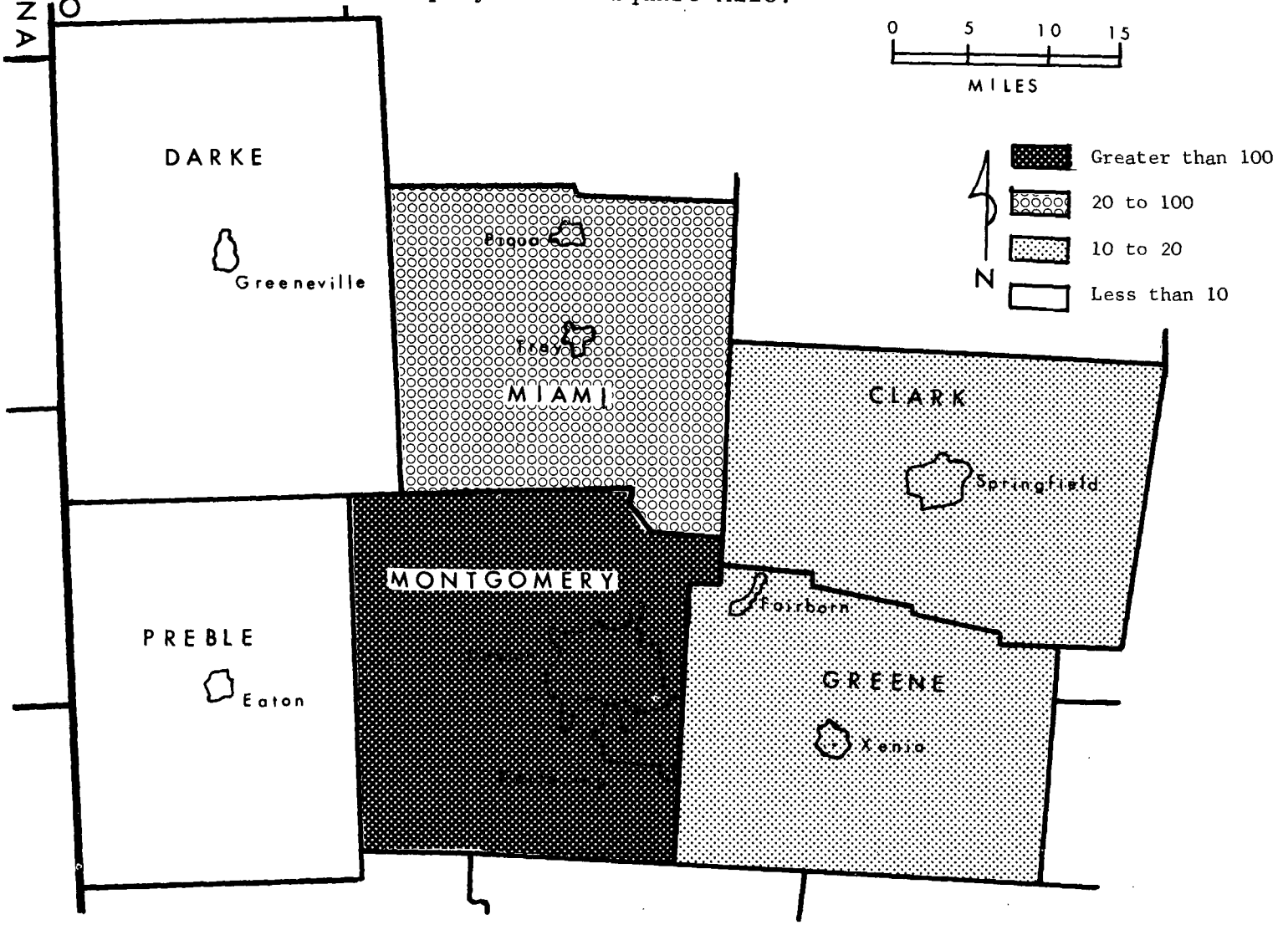
More than 100

25 to 100

10 to 25

Less than 10

FIGURE 22. MANUFACTURING EMPLOYMENT GROWTH, 1963-1985, Expressed in Absolute Terms of Additional Employees Per Square Mile.



employment density between 1963 and 1985 for the immediate Dayton area. It is obvious that Montgomery County will receive the greatest increase during this time period -- eight times that of the next county, Miami. Figure 23 expresses percentage of increase in manufacturing employment. The outlying counties of Darke and Preble show relatively high growth rates and thus should be considered for the proposed Region. Table 7 summarizes this data. Present and future industrial land use is shown in Figure 24. Miami and Greene Counties have a relatively large number of new industrial sites.

TRANSPORTATION

Figure 25 shows the major highways and airports in the Dayton area. Since the majority of air pollutant emissions in the nation are from the automobile, the pattern of transportation routes is an important factor in selecting the boundaries of an air quality control region. Two major interstate freeways cross in Montgomery County — I-70, which extends from San Francisco to Baltimore and I-75, extending from the Canadian border to Florida The latter carries an exceptionally heavy volume of traffic through the heart of the Miami River Valley. I-75 is the major route between the Toledo-Detroit urban complex and the southern Appalachian and Florida resort areas.

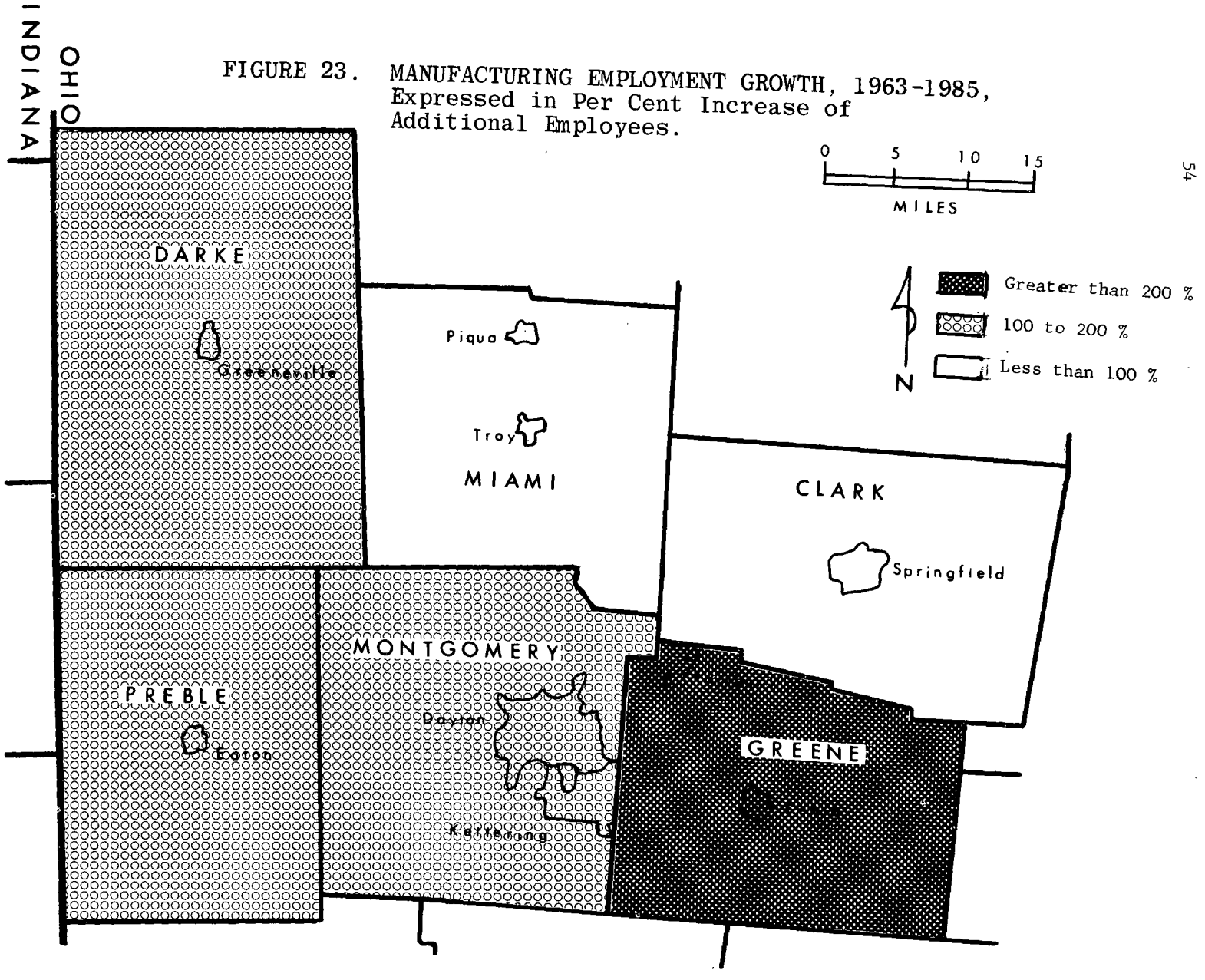


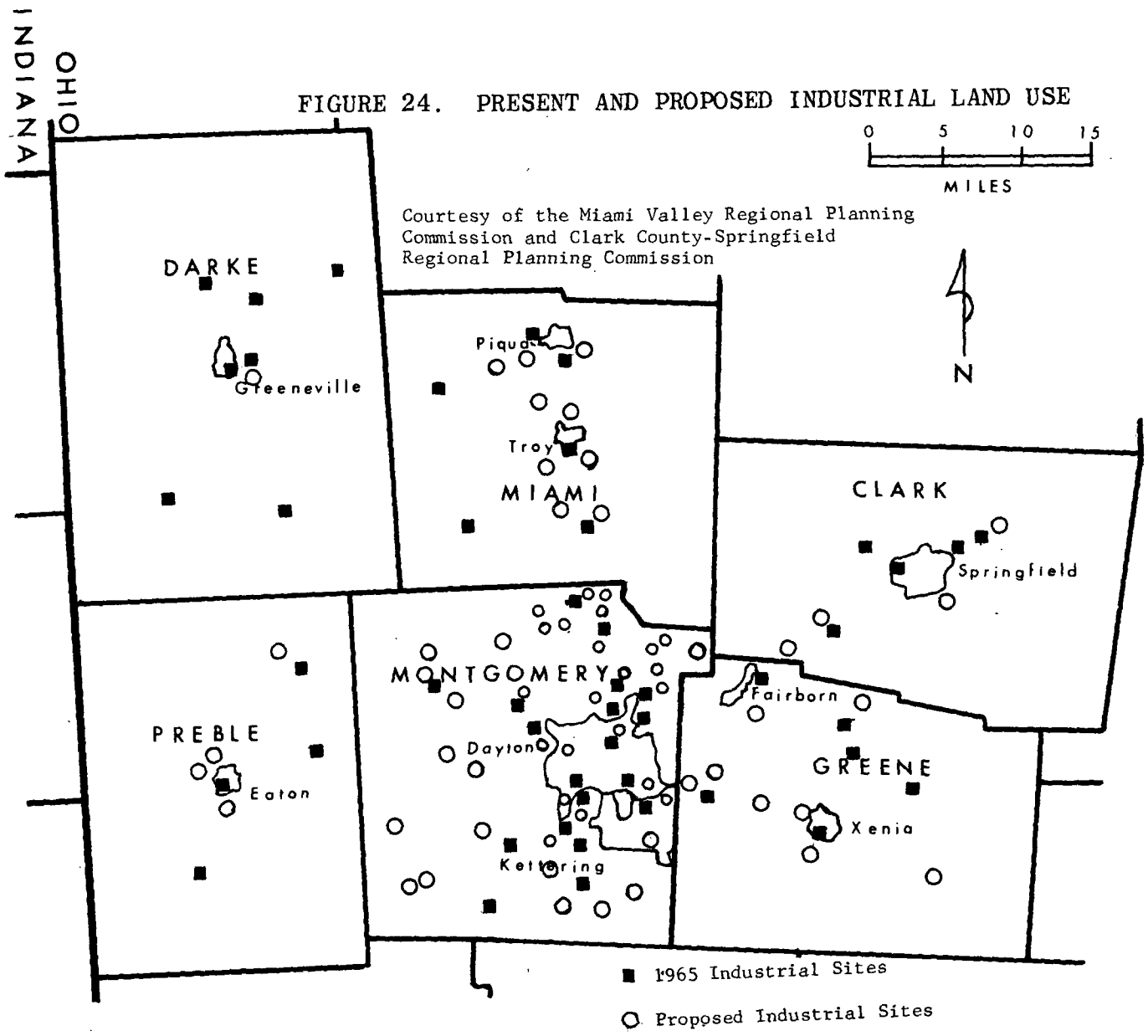
FIGURE 23. MANUFACTURING EMPLOYMENT GROWTH, 1963-1985, Expressed in Per Cent Increase of Additional Employees.

TABLE 7

TRENDS IN MANUFACTURING EMPLOYMENT BY COUNTY IN THE DAYTON AREA, 1963-1985

County	1963 Manufacturing Employment	1985 Manufacturing Employment	Additional Manuf. Employ. Per Square Mile	% Increase in Manufacturing Employment, 1963-1985
Clark	16,388	24,267	19	48
Darke	2,721	6,334	6	133
Greene	2,424	8,597	15	254
Miami	10,240	19,649	23	92
Montgomery	90,671	188,412	214	108
Preble	854	2,536	4	197

FIGURE 24. PRESENT AND PROPOSED INDUSTRIAL LAND USE



Dayton is a major air transportation center famed for its aviation heritage. Two airfields comprise Wright-Patterson Air Force Base northeast of Dayton. Commercially-served airports in the region include municipal airports for the cities of Dayton and Richmond, Indiana. Numerous additional airports are located in the area, as can be noted in Figure 25.

AIR POLLUTION CONTROL PROGRAMS

Within the State of Ohio, responsibility for air pollution control rests with the Air Pollution Control Board of the State Department of Health. The Board is authorized to prescribe ambient air quality standards for various sections of the State, to enforce emission standards designed to achieve the air quality standards in those sections, and to issue variance permits for exceptional circumstances. The State program has an annual budget of approximately $250,000.

Under Ohio's existing law, county governments may develop air pollution control programs only as a part of their health programs. County regulations concerning air pollution control do not apply within municipal boundaries if a city or incorporated area has its own regulations. Because of this limitation on county jurisdiction, municipal government has become the most common unit in Ohio for administration of local air pollution control programs.

On the local level, the Miami Valley Regional Planning Commission and the Dayton Area Chamber of Commerce sponsored an

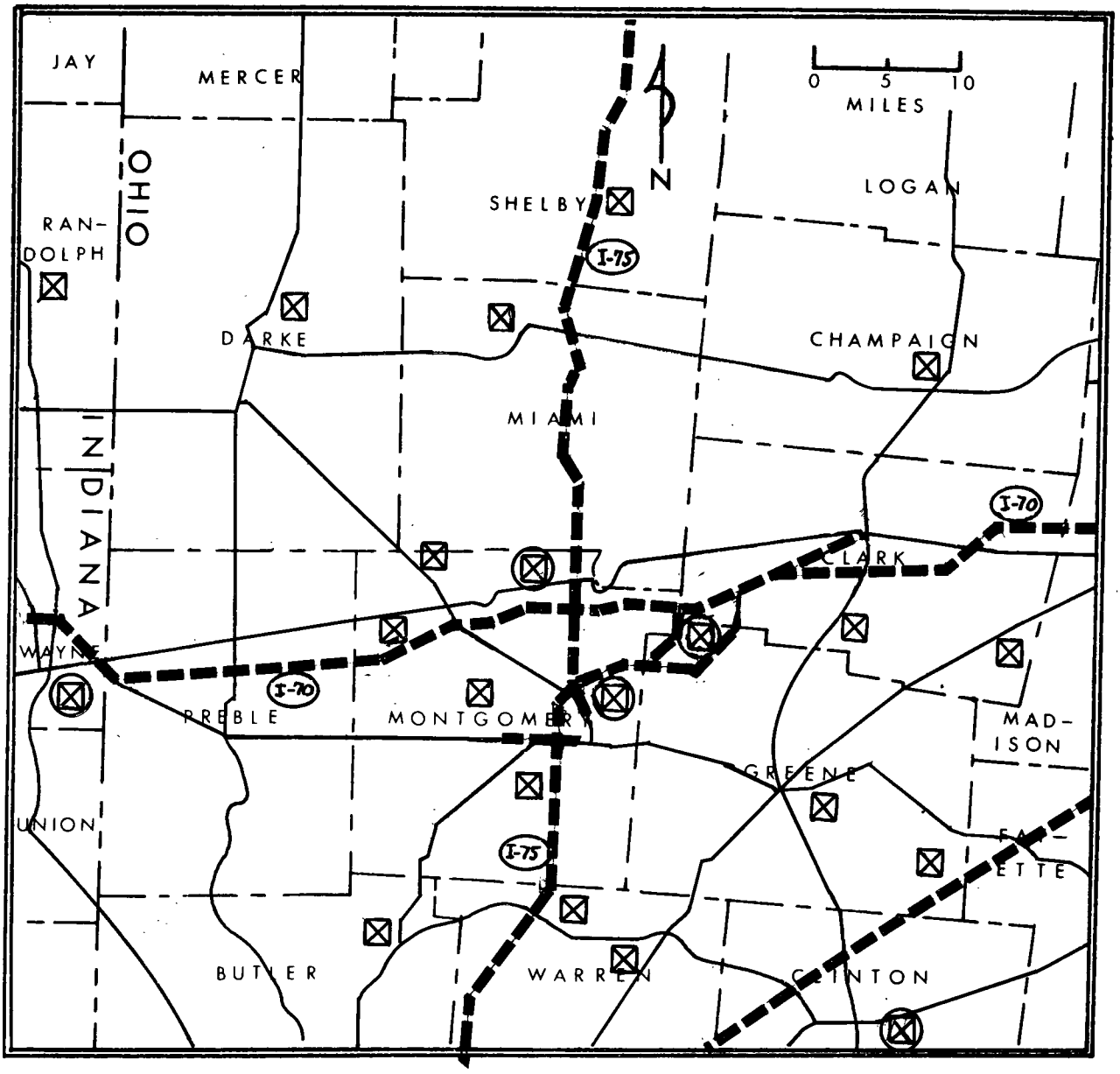


FIGURE 25. MAJOR TRANSPORTATION ARTERIALS AND FACILITIES IN THE DAYTON AREA

STATE BOUNDARY

COUNTY BOUNDARIES

FREEWAYS

OTHER MAJOR HIGHWAYS

COMMERCIALLY SERVED OR MILITARY AIRPORTS

MUNICIPAL AIRPORTS

Air Resources Symposium in 1966. As a result of this symposium, the Montgomery County Commissioners and the City of Dayton signed a joint resolution in 1967 for establishing an air-resource management program to assure uniform air pollution control legislation and enforcement in both the City of Dayton and Montgomery County. In January 1968, the National Air Pollution Control Administration awarded a grant to the Montgomery County Health Department to initiate an "Air Resource Management Study of the Montgomery County Area." A private consulting firm was contracted to study the sources and concentrations of the major air pollutants and the contributing factors affecting the extent of the problem. The study recommendation was that the regional approach be used, requiring the organization of an air pollution control agency encompassing the counties of Darke, Miami, Montgomery, Preble, and Greene, and the cities therein.[5] The Ohio State Law is at present unclear on the ability of the Boards of Health of counties to join or even contract between one another. The establishment of an air quality control region may assist in calrifying this inter-county problem.

Local programs for air pollution control include those administered by the Montgomery County Health Department and the City of Dayton. The Montgomery County program includes a project director, three chemists, one engineer, two inspectors, and sixteen sanitarians (part-time). Their operating budget is

approximately $120,000, of which $90,000 is Federal funds. The City of Dayton program is administrated through the Bureau of Air Pollution Control, employing an engineer and chemist on its professional staff. Current operating budget is approximately $16,500 per year.

REGIONAL PLANNING

The Dayton study area under consideration for an air quality control region consists of the northern half of the Miami Valley State Economic Region as defined by the Ohio Department of Development. This economic region had the second highest population growth rate of the eight Ohio economic regions between 1960 and 1965. Regional planning for the area under consideration is conducted primarily by the Miami Valley Regional Planning Commission and the Clark County-Springfield Regional Planning Commission. The Housing and Urban Development Department has designated these two commissions under Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966 as the area wide planning agencies. The State of Ohio has recently enacted legislation giving official regional planning agencies enforcement powers within their respective jurisdictions. Figure 26 shows the jurisdictional authority of regional planning agencies in the Dayton area.

The Miami Valley Regional Planning Commission, created in 1964, consists of Darke, Greene, Miami, Montgomery, and Preble

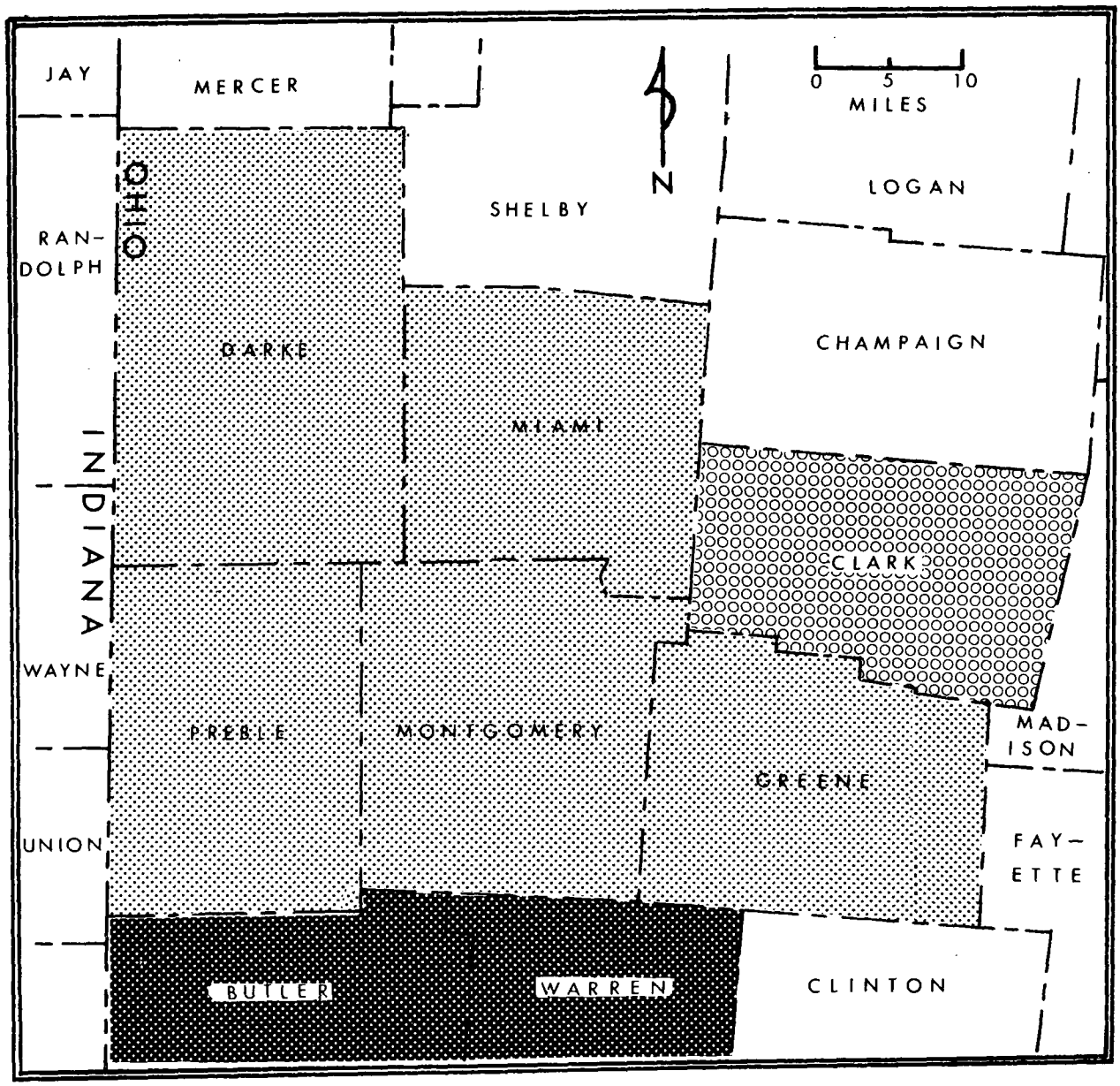


FIGURE 26. REGIONAL PLANNING AGENCY JURISDICTION IN THE DAYTON AREA

STATE BOUNDARY

COUNTY BOUNDARIES

Miami Valley Regional Planning Commission

Clark County-Springfield Regional Planning Commission

Ohio-Kentucky-Indiana Regional Planning Authority

Counties. With its creation came a mandate to prepare "a comprehensive regional development plan" which would provide proper and logical guidance to the various jurisdictions and organizations concerned with the physical environment. Thus, the Miami Valley Regional Planning Commission has the responsibility for providing not only physical, but social and economic planning for the five-county area. The annual operating budget of the Commission, which has a staff of twenty-five, is between $450,000-500,000. Seventy per cent of the members are elected officials. Finally, the Miami Valley Regional Planning Commission membership represents about 98% of the population in a region containing five counties, 71 municipalities, 69 townships, 62 school districts, and 22 special districts.

The Clark County-Springfield Regional Planning Commission, created in 1954, has a staff of nine persons. Its annual operating budget is approximately $50,000 in local projects and $16,000 in Federal grants.

THE PROPOSED REGION

Subject to the scheduled consultation, the Secretary, Department of Health, Education, and Welfare, proposes to designate an air quality control region for the Dayton area, consisting of the following jurisdictions in Ohio:

Clark County
Darke County
Greene County
Miami County
Montgomery County
Preble County

As so proposed, the Metropolitan Dayton Intrastate Air Quality Control Region would consist of the territorial area encompassed by the outermost boundaries of the proposed jurisdictions. The proposed Region is illustrated in Figure 27. Figure 28 locates the Region in relation to the remainder of Ohio, the surrounding states and existing and proposed air quality control regions.

DISCUSSION OF THE PROPOSAL

To be successful, an air quality control region should meet three basic conditions. First, its boundaries should encompass most pollution sources as well as most people and property affected by those sources. Second, the boundaries should encompass those locations where industrial and residential development will create significant air pollution problems in the future. Third, the boundaries should be chosen in a way which is compatible with and even fosters unified and cooperative governmental administration of the air resources throughout the region. The "Evaluation of Engineering Factors" (beginning with page 11) discussed the first of these conditions, and the "Evaluation of Urban Factors" (page 38), the second and third.

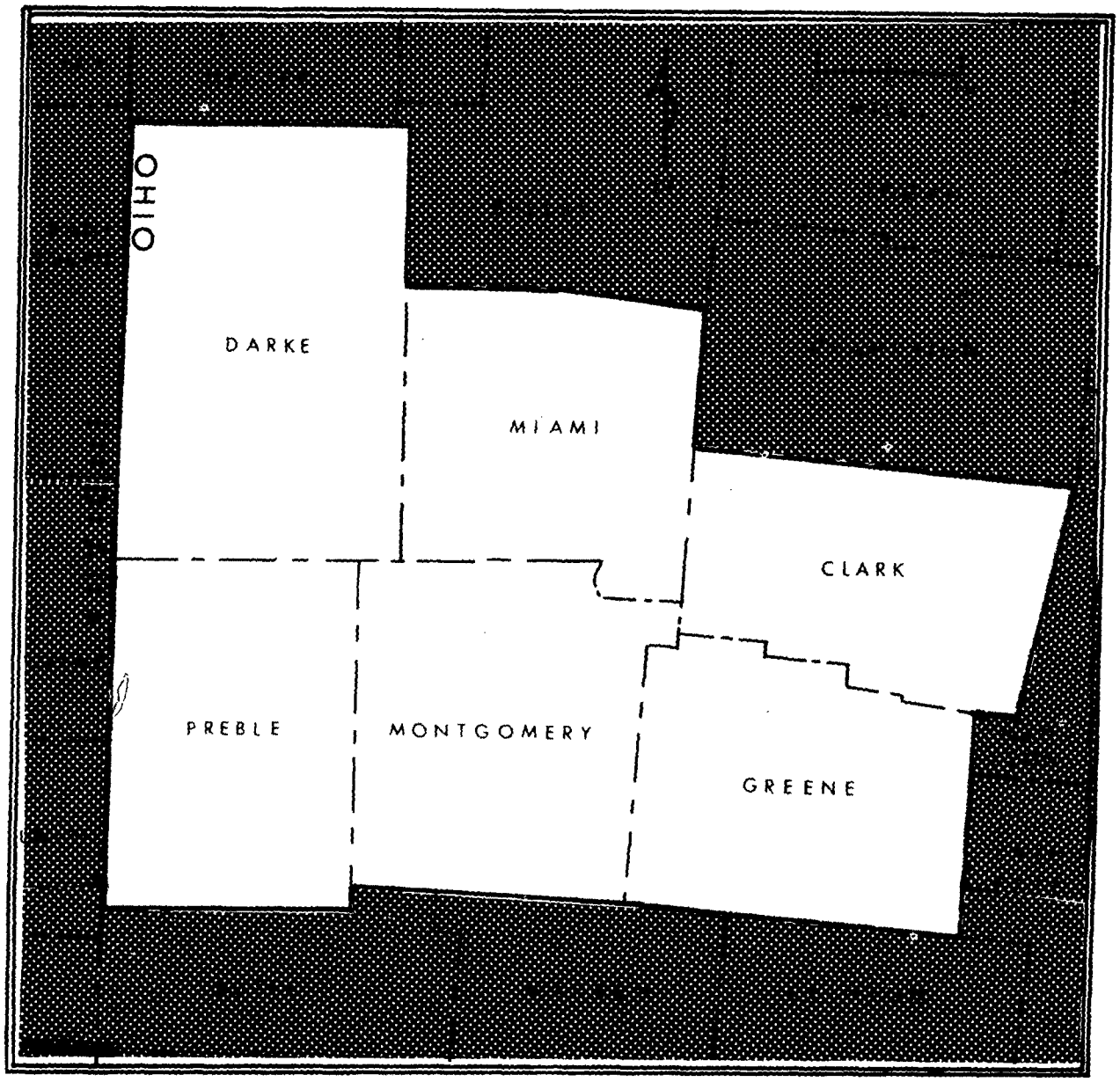
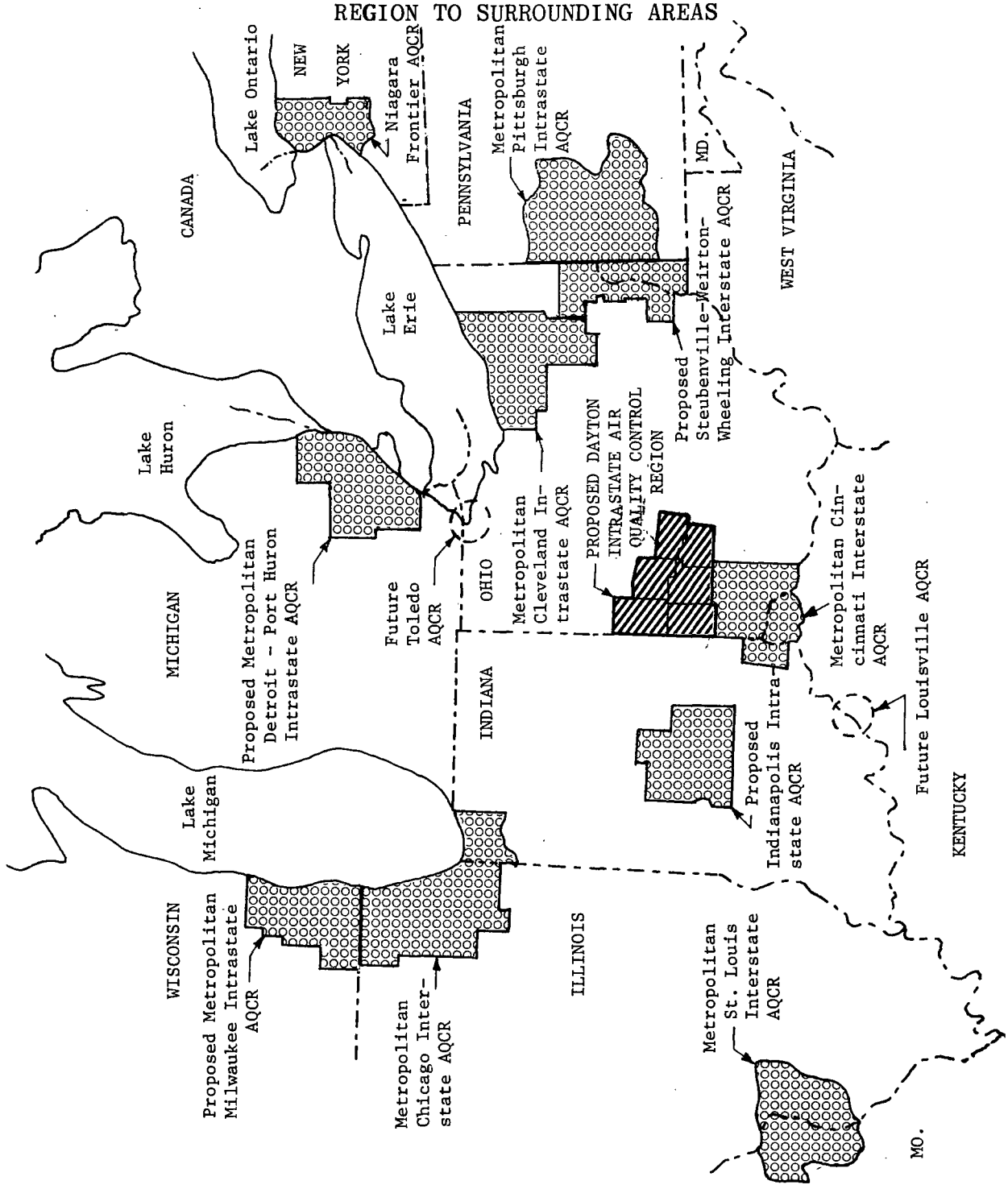


FIGURE 27. PROPOSED BOUNDARIES OF THE DAYTON INTRASTATE AIR QUALITY CONTROL REGION

——— STATE BOUNDARY

——— COUNTY BOUNDARIES

FIGURE 28 . RELATIONSHIP OF PROPOSED METROPOLITAN DAYTON INTRASTATE AIR QUALITY CONTROL REGION TO SURROUNDING AREAS



agreed upon.[6] The counties of Warren and Butler have already been designated as components within the Metropolitan Cicinnati Interstate Air Quality Control Region and thus will not be considered further in this report.

All major point sources (emissions of over one ton per day of any single pollutant -- particulates, SO_2, or CO) are concentrated in four of six counties proposed for the region. Emission densities for each of the three major pollutants are also highest in these same four counties -- Miami, Clark, Greene, and Montgomery. Therefore, based on the location of pollutant source emissions, a four-county region is required as a minimum.

The extent of the regional air pollution problem has been examined by studying theoretical concentrations of pollutants under different meteorological conditions. The results of the diffusion model analysis are shown in Figures 13 to 15. The air quality in the counties of Miami, Greene, Clark, and Montgomery is significantly affected by pollutants emitted into the ambient air. The air quality of Preble County is influenced by the transport of suspended particulates and carbon monoxide from the urban core. Finally, air sampling data from Darke County shows suspended particulate levels warranting inclusion.

The proposed Region has a 1969 estimated population of 1,038,000. Over 90% of the population resides in the core counties of Clark, Greene, Miami, and Montgomery, which contain population densities

of 200 - 1,300 persons per square mile. The seven counties surrounding the core counties to the north, east, and west all have population densities considerably lower (less than 100 persons per square mile).

The second major consideration is directed toward future population and industrial expansion. Population growth rates will be highest in the four core counties, although rates of growth appear to be increasing in the two outlying counties of the proposed Region. Since 1960, for example, Darke County has grown at a rate of more than double its rate in the 1950-1960 decade. Projected urban land use data portrays a linking of the Springfield-Dayton areas and predicts corridors of urban growth reaching west and northwest toward Preble and Darke Counties. These growth patterns appear to solidify the argument for joining the six counties for regional control of the area's air quality.

The third objective relates to governmental administration in the area. The two official regional planning agencies in the study area have jurisdiction over an area conterminous with the proposed Region. Administratively, this situation presents many opportunities for cooperative and successful control of air pollution in the Dayton area.

The following is a brief discussion of the reasons for not including the counties on the periphery of the Region. Clinton, Fayette, and Madison Counties were not included as they have relatively low population densities, few industries, and no large

population increases predicted for the foreseeable future. Madison and Fayette Counties are more closely linked to the Columbus area than to Dayton. Champaign, Shelby, and Mercer Counties are on the northern boundary of the proposed Region. Low population density and projected growth rates exist in two of these counties -- Champaign and Mercer. Shelby County, however, has a somewhat higher manufacturing employment density and is the only one of these counties within the Southwestern Ohio State Economic Area. Shelby County should be carefully reviewed at a later date to see if higher than anticipated population or industrial growth has warranted its addition to the proposed Region. The counties in Indiana along the western boundary of Ohio -- Randolph, Wayne, and Union -- appear to be separated from the Dayton area by the counties of Darke and Preble. In the distant future, urban growth patterns may extend along the Interstate -- 70 corridor through Preble County and link Richmond (Wayne County) and Dayton. A decision will have to be made at that time whether to add Wayne County to the proposed Region or create a separate air quality control region.

In summary, the Region proposed is considered on the whole to be the most cohesive and yet inclusive area within which an effective regional effort can be mounted to prevent and control air pollution in the Dayton Area.

REFERENCES

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6. Report for Consultation on the Metropolitan Cincinnati Interstate Air Quality Control Region. U.S. DHEW, NAPCA, January, 1969, p. 50.