TREASURE VALLEY, IDAHO, AREA AIR POLLUTANT EMISSION INVENTORY

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TREASURE VALLEY AIR POLLUTANT EMISSION INVENTORY

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PREFACE

This report, which presents the emission inventory for the Treasure Valley Area, is another in a series of surveys outlining the sources and emissions of air pollutants for major metropolitan areas in the country. These surveys, conducted by the National Inventory of Air Pollutant Emissions and Control Branch of the National Air Pollution Control Administration, provide estimates of the present levels of air pollutant emissions and status of their control. The pollutants, which include sulfur oxides, particulates, carbon monoxide, hydrocarbons and nitrogen oxides, are delineated with respect to source type, season of the year and geographical distribution within the area. The general procedure for the surveys is based upon the rapid survey technique for estimating air pollutant emissions.[1] These reports are intended to serve as aids in the proposing of boundaries of Air Quality Control Regions, as directed by the Air Quality Act of 1967.

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INTRODUCTION

This report is a summary of the Treasure Valley (Boise, Idaho) Area air pollutant emission inventory conducted in May 1970. Since these inventories are based on the calendar year, data and emission estimates presented here are based on conditions that existed during the year 1969.

The Study Area, which was chosen on the basis of population distribution and air pollution sources, consists of six counties in the western portion of the state of Idaho. This area had a 1969 population of 208,570 and covers approximately 7,500 square miles.

A grid coordinate system was used to show geographical distribution of emissions within each of the counties. The grid system divides the Study Area into 44 grid zones ranging in size from 25 square kilometers in densely populated areas to 1,600 square kilometers in the rural areas.

All sources of emissions were classified into five categories--transportation, stationary fuel combustion, industrial processes, refuse and evaporative losses. Each of these source categories was divided into two subgroups--point sources and area sources. Facilities which emit large quanties of air pollutants were considered individually as point sources, while the many remaining contributors such as motor vehicles, residential fuel users, small commercial and industrial facilities and on-site refuse burning equipment, were considered collectively as area sources. For this report, 21 individual sources were classified as point sources based on information available.

Emissions were estimated by using various indicators such as fuel consumption, refuse burning rates, production data and control efficiencies and emission factors relating these indicators to emission rates.[2] These factors represent average emission rates for a particular source category. Since individual sources have inherent differences that cannot always be taken into consideration, discrepancies between the actual and estimated emissions are more likely in individual sources than in total emissions for a source category.

As in all emission surveys, the data presented are estimates and should not be interpreted as absolute values. The estimates are, in some cases, partial totals due to lack of emission factors and production data. Despite these limitations, the estimates are of sufficient accuracy and validity in defining the extent and distribution of air pollutant emissions within the Study Area.

SUMMARY OF RESULTS

The annual emissions as estimated in the Treasure Valley Metropolitan Area Air Pollutant Emission Inventory are as follows (tons/year):

Sulfur Oxides	3,600
Particulates	5,800
Carbon Monoxide	90,400
Hydrocarbons	16,900
Nitrogen Oxides	10,900

The following is a brief summary of pollutant emissions and sources as presented in Tables 1 and 1A:

Sulfur Oxides	The major source of sulfur oxides in the Study Area is fuel combustion which amounts to 81% of the total emission of this pollutant.
Particulates	Combustion of fuels, process losses, and transportation are the largest sources of particulates, contributing 26%, 39%, and 25%, respectively.
Carbon Monoxide	The large contributor of carbon monoxide is road vehicles (91%). Other significant sources include fuel combustion and refuse disposal.
Hydrocarbons	Evaporative losses (44%) and transportation (48%) are the two most important sources of hydrocarbon emissions in the Study Area.
Oxides of Nitrogen	Fuel combustion and transportation sources were the contributors of 97% of these pollutant emissions.

TABLE 1 SUMMARY OF AIR POLLUTANT EMISSIONS FOR THE TREASURE VALLEY STUDY AREA (Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	550	940	82,340	7,100	6,640
Other	90	510	3,240	980	810
Subtotal	640	1,450	85,580	8,080	7,450
Stationary Fuel Combustion					
Industrial	220	270	40	10	680
Residential	1,100	280	580	150	420
Commercial and Institutional	1,600	970	1,090	250	1,950
Subtotal	2,920	1,520	1,710	410	3,050
Solid Waste Disposal					
Incineration	20	90	380	10	30
Open Burning	30	520	2,760	970	360
Subtotal	50	610	3,140	980	390
Industrial Processes	--	2,260	--	--	--
Evaporative Losses					
Automobile	--	--	--	5,800	--
Other	--	--	--	1,580	--
Subtotal	--	--	--	7,380	--
TOTAL*	3,610	5,840	90,430	16,850	10,890

* = Rounded to the nearest ten.

TABLE 1A SUMMARY OF AIR POLLUTANT EMISSIONS FOR THE TREASURE VALLEY STUDY AREA (10^3 Kg/Year)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Motor Vehicles	500	850	74,700	6,400	6,030
Other	80	460	2,940	890	730
Subtotal	580	1,310	77,640	7,330	6,760
Stationary Fuel Combustion					
Industrial	200	240	30	10	620
Residential	1,000	250	520	140	380
Commercial and Institutional	1,460	880	990	230	1,770
Subtotal	2,660	1,370	1,540	380	2,770
Solid Wastes Disposal					
Incineration	20	80	350	10	20
Open Burning	30	470	2,500	880	320
Subtotal	50	550	2,850	890	340
Industrial Processes	--	2,050	--	--	--
Evaporative Losses					
Automobile	--	--	--	5,260	--
Other	--	--	--	1,430	--
Subtotal	--	--	--	6,690	--
TOTAL*	3,290	5,280	82,030	15,290	9,870

* = Rounded to the nearest ten.

STUDY AREA

The Study Area for the Treasure Valley Metropolitan Area is in south western Idaho, bordered on the west by the Snake River. It consists of six adjoining counties--Ada, Canyon, Elmore, Payette, Gem and Boise. Figure one shows the six county area and the State of Idaho and their relative location with respect to neighboring states and cities.

Figure 2 is a more detailed map of the Study Area showing county boundaries and major urban areas. The study area occupies a land area of approximately 7,500 square miles. The six counties had a total 1969 population of 209,000. This figure represents an increase of 9% from 1960 (see Table 2). Figure 3, population density, shows heavy concentrations around the Boise area.

TOPOGRAPHY[4]

Boise, the population center of the Study Area, is located in the Boise River Valley at an elevation of about 2,700 feet. To the north and east of the city the Boise Mountains rise to 5,000 to 6,000 feet above sea level. Downstream from the city the Boise Valley widens and joins the valley of the Snake River about 40 miles to the northwest.

The Snake River borders Payette, Canyon, Ada, and Elmore Counties. Boise County is occupied primarily by the Boise National Forest with elevations in some locations reaching over 9,000 feet. Elmore County contains Mount Bennett with peaks over 7,000 feet above sea level.

CLIMATOLOGY[4]

In general, the climate in the Boise area is dry and temperate. Pacific airmasses alternating with other airmasses produce periods of cloudy or stormy and mild weather in the winter months. Climate during the summer season is typical upland continental. Temperature variations are extreme overall, although day to day changes are gradual. The average annual temperature (1968) was 52.2 degrees. The lowest monthly average temperature for that year was 29.5 degrees (January). The highest monthly average temperature (July) was 77.3 degrees. Prevailing winds are from the southeast averaging 9 miles per hour.

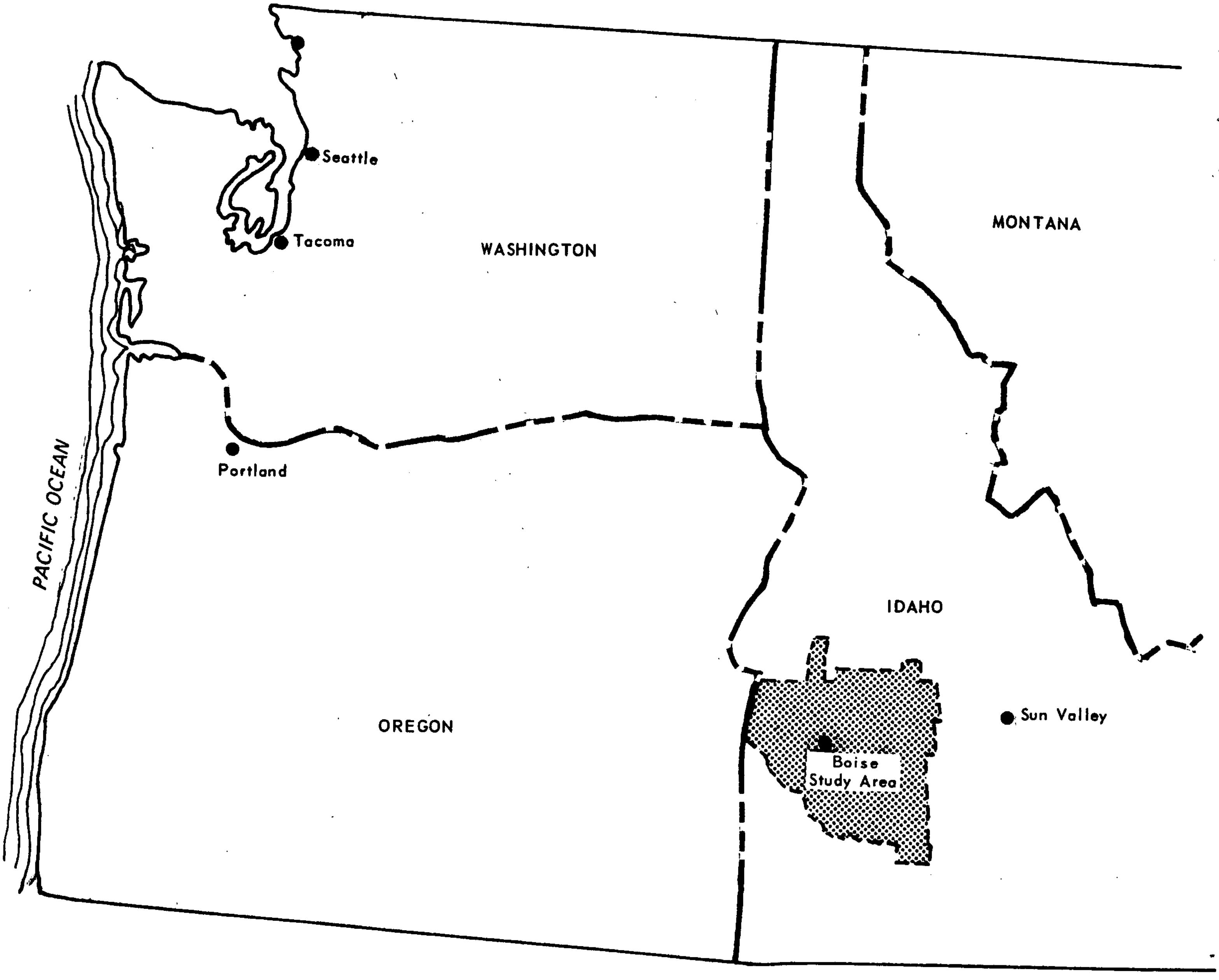

Figure 1. Treasure Valley study area and vicinity.

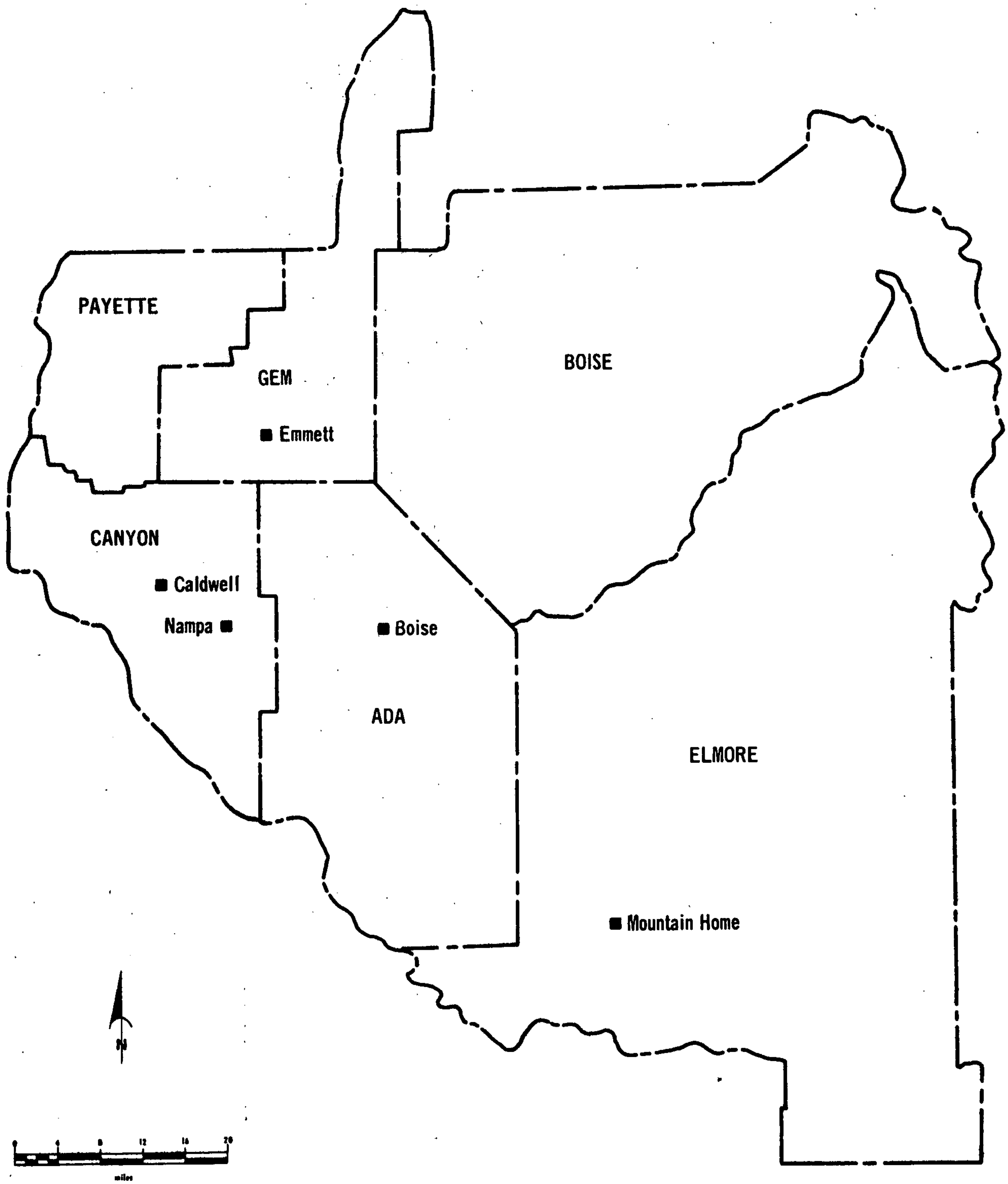

Figure 2. Treasure Valley study area.

TABLE 2 POPULATION AND AREA CHARACTERISTICS FOR THE TREASURE VALLEY STUDY AREA

County	Population 1960	Population 1969	Area, $Mi.^2$	Population Density, 1969
Ada	93,460	101,780	1,043	97.6
Canyon	57,660	61,890	578	107.1
Elmore	16,720	20,100	3,048	6.6
Payette	12,360	13,370	402	33.3
Gem	9,130	9,700	555	17.4
Boise	1,650	1,730	1,910	0.9
TOTAL	190,980	208,570	7,536	27.7

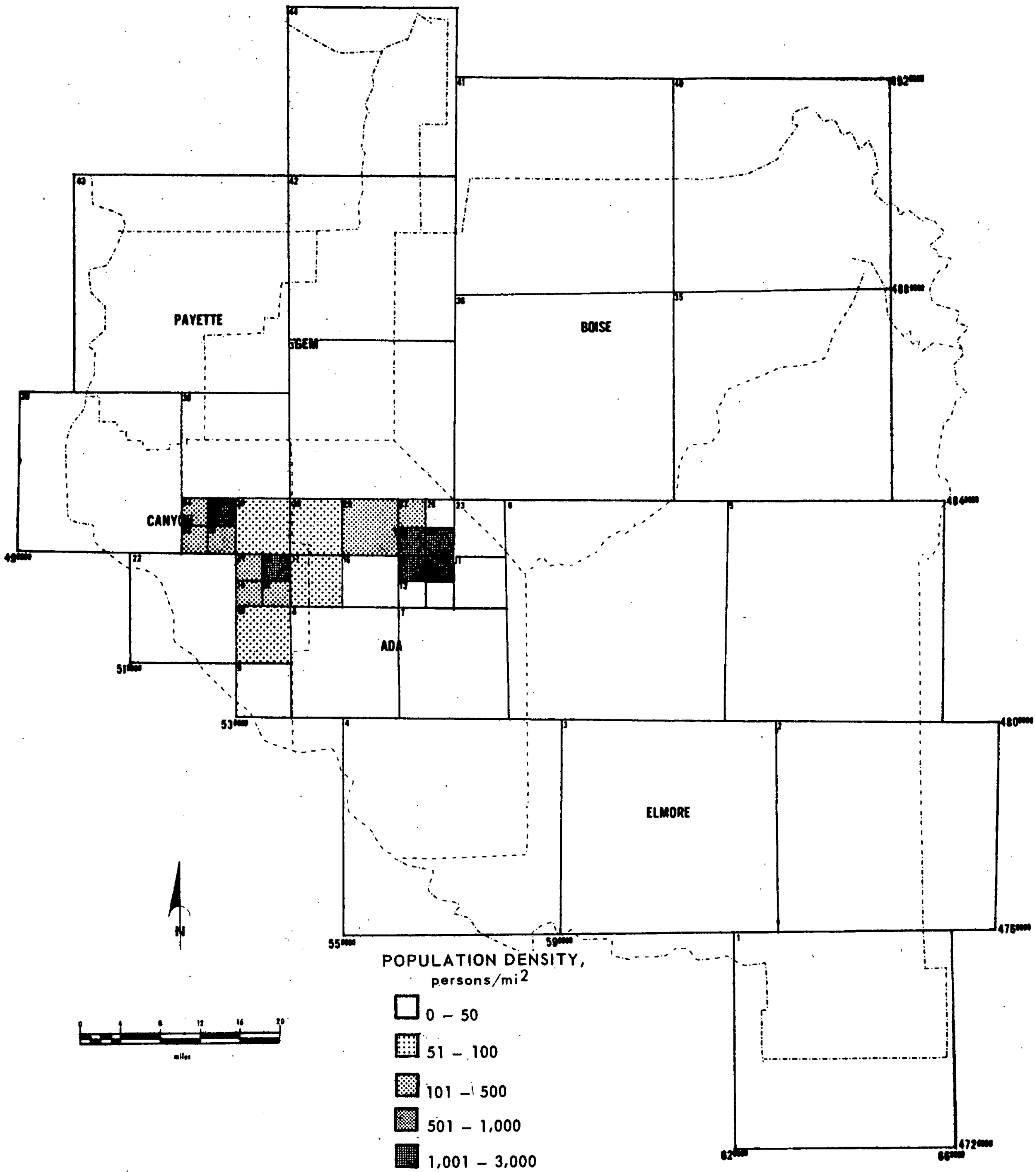

Figure 3. Population density for Treasure Valley study area, 1969.

GRID COORDINATE SYSTEM

A grid coordinate system, based on the Universal Transverse Mercator Projection (UTM), was used in the Treasure Valley Study Area to indicate the geographical distribution of emissions. A map showing the grid coordinate system is presented in Figure 4.

An evaluation of all the available coordinate systems was completed before the UTM system was chosen to present emissions. The most convenient systems evaluated were the State Plane, Longitude-Latitude, and UTM. Although each of the systems had valuable qualities, the use of the UTM coordinate system was felt to be necessary to meet the requirements of these emission inventories.

The two primary requisites of the grid coordinate system were used to evaluate each system. The first requirement was that the grid coordinate system had to have square grid zones, since the data were to be used in meteorological dispersion models. The grid zones, which the UTM system and most of the State Plane systems project, are always square, but the longitude-latitude system projects grid zones that become skewed as the zones become further from the equator. The other quality the grid coordinate system had to possess was consistency. Each emission inventory should be conducted on a grid coordinate system which uses the same reference point throughout the Study Area. Since some air pollutant inventories would include areas in two or more states, the State Plane systems could not be used. However, since the UTM system, as well as the longitude-latitude system, is not referenced to points in individual states, it is not influenced by jurisdiction boundaries. The UTM system was chosen since it was the only prevalent coordinate system which can project square grid zones over any Study Area using a common reference point.

The Universe Transverse Mercator Projection is based upon the metric system. Each north-south and east-west grid line, as illustrated in Figure 4, is identified by a coordinate number expressed in meters.

Each point source and grid, using its geographical center, is identified by a horizontal and vertical coordinate to the nearest 100 meters.

Grid zones of different sizes are used in the grid coordinate system to allow a statisfactory definition of the geographical gradation of emissions and to limit the number of grid zones. The majority of the emissions is usually concentrated in the populated and industrialized portions of a Study Area. Smaller grids are placed over these areas to allow the grid coordinate system to reflect the changes of emissions over short distances. Grid zones smaller than the 25 square kilometer grid zones used in this report are not usually warranted because of the inherent inaccuracies in the data. Larger grid zones are used in the rural portions, because a smaller percentage of the total emissions usually occurs in lightly populated areas.

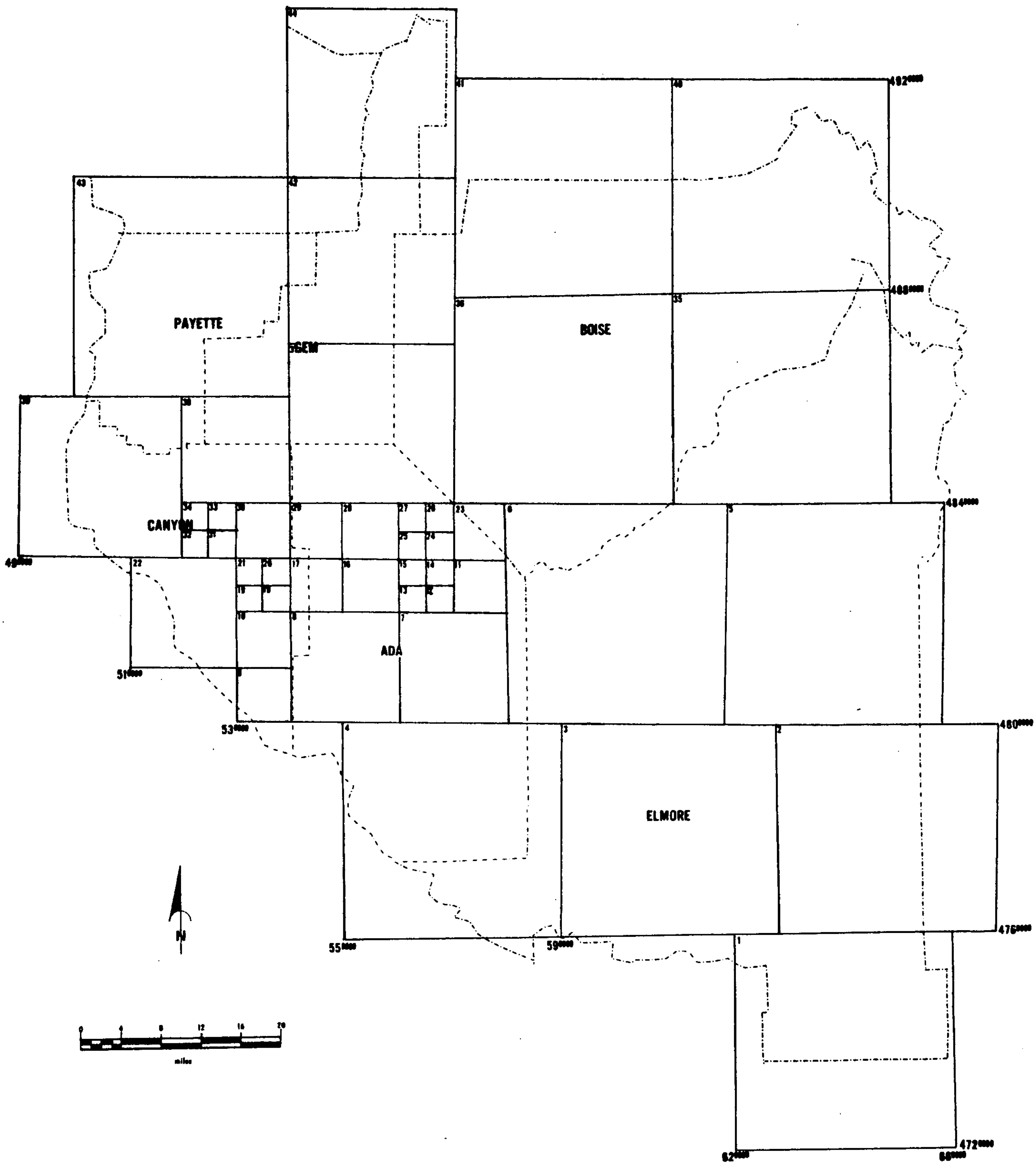

Figure 4. Grid coordinate system for the study area.

EMISSIONS BY CATEGORY

TRANSPORTATION

Transportation, a mobile source of air pollutants, includes: road vehicles (gasoline and diesel powered), aircraft and railroads. With the exception of aircraft, all transportation sources are dealt with as area pollution sources. Aircraft are considered to be point sources because the majority of emissions are attributable to the immediate vicinity of airports.

Road Vehicles

METHODOLOGY: Total vehicle-miles of travel were obtained by applying an average fuel consumption to gasoline sales (gallons) obtained from Idaho State Tax Commission, Motor Fuel Division. Highway Statistics were used as a means to check these figures (see Table 3).[3]

Vehicle-miles of travel were apportioned onto the grid system by population except where traffic flow maps were available. The Boise Metropolitan transportation Study Traffic flow maps were used in the Boise area. Flow maps were not available for other portions of the Study Area.

Approximately 1.5 to 2.0 percent of gasoline is lost through evaporation from gasoline tank and carburetor losses. (This is exclusive of hydrocarbon exhaust emissions). It was assumed that no diesel fuel was lost from evaporation. Since 1963 the majority of new automobiles were equipped with positive crankcase ventilation (PCV) valves that reduce crankcase hydrocarbon emissions by about 90 percent. It was assumed that only 20 percent of the automobiles were not equipped with PCV valves due to lag time in automobile replacement.

TABLE 3 VEHICLE MILES OF TRAVEL AND MOTOR FUEL CONSUMPTION FOR THE STUDY AREA, 1969

County	Total Vehicle Miles (10^3/Day)	Gasoline (10^3 Gal/Year)	Diesel (10^3 Gal/Year)
Ada	2,140	61,040	3,350
Canyon	1,040	29,520	2,040
Elmore	320	9,260	660
Payette	230	6,680	440
Gem	140	3,910	320
Boise	10	280	60
TOTAL	3,880	110,690	6,870

RESULTS: Over 1.4 billion miles were traveled by motor vehicles in 1969. In the process, 111 million gallons of gasoline and 6.9 million gallons of diesel fuel were consumed by highway vehicles. Table 3 indicates that 56 percent of the miles traveled were in Ada County. The majority of these were in the Boise Metropolitan Area.

Table 4 shows emissions by pollutant and motor vehicle category for the Study Area. Motor vehicles are the major contributors of carbon monoxide (96 percent) and hydrocarbons (93 percent) of the transportation sources.

Aircraft

METHODOLOGY: The total number of flights by type were obtained from the Federal Aviation Administration for the Boise Airport. Mountain Home Air Force Base flights were obtained directly from the Air Force. A flight is defined as a take-off and a landing. Estimates of flights by airplane type and number of engines were obtained from the Boise Airport control tower (see Table 5).

The emissions, as shown in Table 6, were arrived at by applying the proper emission factors to the total number of flights in each engine type and number category.

RESULTS: The emissions that resulted from the two airports in the Study Area reveal that the piston engine planes contribute 94 percent of the total carbon monoxide and 83 percent of the total hydrocarbons from aircraft sources (see Table 4).

Trains

METHODOLOGY: The total fuel use by the railroads in Idaho was taken from the Bureau of Mines' Mineral Industry Surveys.[4] The quantity used in the Study Area was approximated from the ratio of the Study Area population to the State population times the total State consumption. The fuel was then apportioned to grids taking into account railroad routes and yards.

TABLE 4 AIR POLLUTANT EMISSION FOR TRANSPORTATION SOURCES FOR THE STUDY AREA, 1969 (Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Motor Vehicles					
Gasoline					
Exhaust	410	550	82,130	6,630	5,870
Evaporation	--	--	--	5,800	--
Diesel	140	380	210	470	770
Aircraft					
Jet	N	240	200	110	160
Turboprop	N	N	N	N	N
Piston	N	10	2,900	550	140
Railroads	90	260	140	320	520
TOTAL	640	1,440	85,580	13,880	7,460

N = Negligible

TABLE 5 AIRCRAFT FLIGHTS FOR THE STUDY AREA

Airport and Engine Type	Number of Flights 1 Engine	2 Engine	3 Engine	4 Engine
Boise Airport				
Conventional	1,200	13,900	4,200	0
Fan Jet	0	4,200	0	0
Turboprop	0	2,900	0	0
Piston	17,600	15,200	0	600
Mountain Home Air Force Base				
Conventional	0	5,100	0	0
Fan Jet	0	5,100	0	0

TABLE 6 AIR POLLUTANT EMISSIONS FROM AIRCRAFT (Tons/Year)

Airport	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Boise	N	200	3,050	620	260
Mountain Home Air Force Base	N	50	50	40	40
TOTAL	N	250	3,100	660	300

RESULTS: Table 4 shows that trains amount to 18 percent of the particulates and 14 percent of the sulfur oxides from transportation sources.

FUEL COMBUSTION IN STATIONARY SOURCES

All three major fuels (coal, oil and natural gas) are consumed in the Treasure Valley Study Area, with distillate fuel oil being the most important and natural gas running a close second. In 1969 distillate fuel oil produced 11 x 10^{12} BTU's of energy (50 percent of the total), natural gas produced 39 percent of the total (9 x 10^{12} BTU's of energy) and coal produced 11 percent (2 x 10^{12} BTU's). Tables 7, 8, and 9 show the quantity of each type of fuel consumed and a breakdown by user category.

Distillate fuel oil is consumed primarily by residential and commercial-institutional users. Residual oil is consumed only in negligible quantity hence no data was available on its consumption. Natural gas is used by all three consumer categories. Coal is also used by all three categories, but its use, especially as a residential fuel, is on the decline. There are no steam-electric power plants in the area. Power is produced hydroelectrically.

METHODOLOGY: Approximate area source distillate oil consumption was obtained from the Air Pollution Control Section of the Idaho Department of Health. Industrial use was assumed to be negligible, so consumption was classified as either residential or commercial-institutional.[4,5]

Natural gas consumption by consumer category was obtained from the Intermountain Gas Company for Ada, Canyon, Gem and Payette Counties. These figures are considered to be accurate. Gas use for Elmore County was estimated, hence these figures are only approximations.

Coal consumption was obtained from the Air Pollution Control Section, Idaho Department of Health. These figures, as are the oil figures, are considered to be approximations.

TABLE 7 NATURAL GAS CONSUMPTION BY USER CATEGORY, 1969
(10^6 Ft^3/Year)

County	Residential	Commercial	Industrial
Ada	1,590	1,120	890
Canyon	570	490	2,980
Elmore	150	150	N
Payette	160	100	260
Gem	80	60	40
Boise	0	0	0
TOTAL	2,550	1,920	4,170

TABLE 8 FUEL OIL CONSUMPTION BY USER CATEGORY, 1969
(10^3 Gallons)

County	Distillate Oil		
	Residential	Commercial	Industrial
Ada	14,540	31,000	N
Canyon	9,260	9,000	160
Elmore	2,510	1,600	N
Payette	2,010	1,100	N
Gem	1,620	3,400	N
Boise	320	300	N
TOTAL	30,260	46,400	160

TABLE 9 COAL CONSUMPTION BY USER CATEGORY, 1969 (10^3 Tons/Year)

County	Residential	Commercial	Industrial
Ada	12	15	N
Canyon	10	5	23
Elmore	1	18	N
Payette	2	1	N
Gem	1	2	N
Boise	N	N	N
TOTAL	26	41	23

RESULTS: Emissions from fuel combustion are shown in Table 10. Coal, the lowest contributor of energy, provides the majority of particulates, carbon monoxide, and hydrocarbons. Distillate oil provides the majority of sulfur oxides and nitrogen oxides emissions.

Fuel combustion in stationary sources is a significant contributor of sulfur oxides (81 percent), particulates (26 percent), and nitrogen oxides (28 percent).

SOLID WASTE

METHODOLOGY: The total solid waste generation for the Study Area was found by applying the national average per capita rate of 10 pounds of refuse per day.[6] Due to the lack of large industrial sources in the area 3 lbs./day per capita was subtracted from this, and the remaining 7 lbs./day figure was applied to the Study Area population. This waste rate includes both collected (5.5 lbs./day) and uncollected waste (1.5 lbs./day).

Disposal methods were obtained from the Solid Waste Section of Idaho Department of Health. The Solid Waste Section also supplied estimated burning rates (tons/day) at each open burning dump.

There are no large municipal or commercial incinerators in the area. Uncollected waste was divided into on-site open burning (1.0 lb./day) and on-site incineration (0.5 lbs./day).

RESULTS; Table 11, the solid waste balance for the Study Area, shows a breakdown of refuse disposal methods. This area contains a predominance of sanitary landfills. Emissions, as shown in Table 12, result predominantly from open burning.

TABLE 10 AIR POLLUTANT EMISSIONS FROM STATIONARY FUEL COMBUSTION, 1969 (Tons/Year)

Fuel User Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Distillate Fuel Oil					
Residential	890	120	30	40	180
Commercial-Institutional	1,240	350	50	50	1,670
Industrial	N	N	N	N	10
Natural Gas					
Residential	N	20	N	N	150
Commercial-Institutional	N	20	N	N	110
Industrial	N	40	N	N	450
Coal					
Residential	210	140	540	110	90
Commercial-Institutional	370	600	1,040	210	170
Industrial	210	230	30	10	230
TOTAL	2,920	1,520	1,690	420	3,060

TABLE 11 SOLID WASTE DISPOSAL PRACTICES FOR THE STUDY AREA, 1969

(10^3 Tons/Year)

County	Total Generated	Sanitary Landfills	On-Site Incineration	Open Dumps	Burning On-Site
Ada	130	90	8	16	16
Canyon	80	61	6	2	11
Elmore	27	17	2	4	4
Payette	17	7	1	6	2
Gem	12	8	1	1	2
Boise	2	1	N	1	N
TOTAL	268	184	18	30	35

TABLE 12 AIR POLLUTANT EMISSIONS FROM SOLID WASTE DISPOSAL, 1969

(Tons/Year)

Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Incineration On-site	20	90	380	10	30
Open Burning					
On-Site	20	280	1,490	520	190
Dump	10	240	1,270	450	160
Total	30	520	2,760	970	350
TOTAL	50	610	3,140	980	380

INDUSTRIAL PROCESSES

The only significant cause of pollutant emissions from process losses in the Study Area was due to asphalt batching. In 1969 the rate of particulate emission from this source was 2,300 tons/year. The four batching plants are located near the Boise Metropolitan area. They account for approximately 39 percent of the total Study Area particulate emissions.

EVAPORATIVE LOSSES

Three sources of solvent evaporation were considered in this survey: motor vehicles, dry cleaning and gasoline handling.

METHODOLOGY: Dry cleaning evaporation was calculated using the per capita factor of 4.0 lb./year.[7] This was apportioned on the grid system by population. Gasoline handling losses were figured using the factor of 9.4 lb./1000 gallons of throughput for filling service station tanks and 11.6 lb./1000 gallons of throughput for filling automobile tanks. This also was apportioned by population to the grid system. Automobile evaporation losses at the gas tank and carburetor were calculated taking into account vehicle-miles, age of vehicle and extent of control equipment. These emissions were apportioned the same as motor vehicle exhaust emissions (see Transportation Section, Road Vehicles).

RESULTS: Approximately 5,800 tons of hydrocarbons were emitted in 1969 by motor vehicles in the Study Area. Dry cleaning amounted to 400 tons of hydrocarbons. Gasoline storage and handling resulted in emissions of approximately 1,200 tons.

EMISSIONS BY JURISDICTION

Up to this point this report has dealt primarily with emissions by source category. Tables 13 through 18 present emissions by jurisdiction. Numbers have been rounded.

TABLE 13 SUMMARY OF POLLUTANT EMISSIONS IN ADA COUNTY

(Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Road Vehicles	300	520	49,770	4,190	3,660
Other	30	270	3,090	700	400
Subtotal	330	790	52,860	4,890	4,060
Stationary Fuel Combustion					
Industrial	N	10	N	N	100
Residential	530	140	270	70	220
Commercial-Institutional	970	480	410	110	1,240
Subtotal	1,500	630	680	180	1,560
Refuse Disposal					
Incineration	10	40	170	N	10
Open Burning	20	260	1,360	480	180
Subtotal	30	300	1,530	480	190
Process Losses	0	2,260	0	0	0
Evaporative Losses	0	0	0	4,040	0
GRAND TOTAL	1,860	3,980	55,070	9,590	5,810

TABLE 14 SUMMARY OF POLLUTANT EMISSIONS IN CANYON COUNTY, 1969

(Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	150	250	19,470	1,740	1,770
Other	20	70	40	80	130
Subtotal	170	320	19,510	1,820	1,900
Stationary Fuel Combustion					
Industrial	220	260	40	10	560
Residential	350	100	230	60	120
Commercial-Institutional	290	150	130	30	370
Subtotal	860	510	400	100	1,050
Refuse Disposal					
Incineration	10	30	120	N	10
Open Burning	10	100	550	200	70
Subtotal	20	130	670	200	80
Process Losses	0	0	0	0	0
Evaporative Losses	0	0	0	1,990	0
GRAND TOTAL	1,050	960	20,580	4,110	3,030

TABLE 15 SUMMARY OF POLLUTANT EMISSIONS IN ELMORE COUNTY

(Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	50	80	6,030	540	560
Other	10	90	80	90	120
Subtotal	60	170	6,110	630	680
Stationary Fuel Combustion					
Industrial	N	N	N	N	N
Residential	80	20	20	10	30
Commercial-Institutional	190	250	450	90	140
Subtotal	270	270	470	100	170
Refuse Disposal					
Incineration	N	10	40	N	N
Open Burning	N	60	310	110	40
Subtotal	N	70	350	110	40
Process Losses	0	0	0	0	0
Evaporative Losses	0	0	0	620	0
GRAND TOTAL	330	510	6,930	1,460	890

TABLE 16 SUMMARY OF POLLUTANT EMISSIONS IN PAYETTE COUNTY (Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	30	60	4,340	390	400
Other	10	20	10	20	40
Subtotal	40	80	4,350	410	440
Stationary Fuel Combustion					
Industrial	N	N	N	N	30
Residential	70	20	40	10	30
Commercial-Institutional	40	30	40	10	50
Subtotal	110	50	80	20	110
Refuse Disposal					
Incineration	N	10	30	N	N
Open Burning	N	70	380	130	50
Subtotal	N	80	410	130	50
Process Losses	0	0	0	0	0
Evaporative Losses	0	0	0	440	0
GRAND TOTAL	150	210	4,840	1,000	600

TABLE 17 SUMMARY OF POLLUTANT EMISSIONS IN GEM COUNTY
(Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	20	30	2,540	230	230
Other	10	30	20	40	60
Subtotal	30	60	2,560	270	290
Stationary Fuel Combustion					
Industrial	N	N	N	N	N
Residential	50	10	10	N	20
Commercial-Institutional	110	50	50	10	130
Subtotal	160	60	60	10	150
Refuse Disposal					
Incineration	N	N	20	N	N
Open Burning	N	20	130	40	20
Subtotal	N	20	150	40	20
Process Losses	0	0	0	0	0
Evaporative Losses	0	0	0	260	0
GRAND TOTAL	190	140	2,770	580	460

TABLE 18 SUMMARY OF POLLUTANT EMISSIONS IN BOISE COUNTY

(Tons/Year)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Motor Vehicles	N	N	180	20	20
Other	10	30	20	40	70
Subtotal	10	30	200	60	90
Stationary Fuel Combustion					
Industrial	0	0	0	0	0
Residential	10	N	N	N	N
Commercial-Institutional	10	10	10	N	10
Subtotal	20	10	10	N	10
Refuse Disposal					
Incineration	N	N	N	N	N
Open Burning	N	10	30	10	N
Subtotal	N	10	30	10	N
Process Losses	0	0	0	0	0
Evaporative Losses	0	0	0	20	0
GRAND TOTAL	30	50	240	90	100

EMISSIONS BY GRID

In the following tables emissions by grid are given for the purpose of describing geographic distribution of air pollutant emissions. Emissions were divided into two source groups--point and area sources. The 21 point sources are identified individually with respect to locations and emissions.

Figure 5 shows the location of the 21 point sources in the area. Collectively these point sources account for 9 percent of the sulfur oxides, 51 percent of the particulates, 5 percent of the carbon monoxide, 7 percent of the hydrocarbons and 6 percent of the nitrogen oxides. The percentage of particulates is high due to asphalt batching, which is responsible for approximately 39 percent of the total particulate emissions for the Study Area. A summary of point source emissions is given in Table 19.

Area sources are sources of pollutant emissions that are relatively insignificant by themselves, but emit a large quantity of pollutants collectively. Examples of area sources are motor vehicles, residential housing, backyard burning, and small commercial establishments. Table 20 is total emissions by grid for the Study Area.

The emissions are presented for an annual average day, and average winter day (December, January, February) and an average summer day (June, July and August). The annual average daily emission rates were obtained by dividing yearly totals by 365. Seasonal averages were calculated by the use of space heating variations in fuel consumption and variations in motor vehicle traffic activity. This method is described in detail in the appendix. Other sources were assumed constant throughout the year.

TABLE 19 SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES
TONS/ DAY

				SOX			PART			CO			HC			NOX		
ID	GR	HC	VC	S	W	A	S	W	A	S	W	A	S	W	A	S	W	A
5	3	6105	47760	0.0	0.0	0.0	0.08	0.08	0.08	0.42	0.42	0.42	0.15	0.15	0.15	0.05	0.05	0.05
7	3	5925	47630	0.0	0.7	0.3	0.16	0.16	0.16	0.20	0.20	0.20	0.13	0.13	0.13	0.11	0.11	0.11
5	8	5350	47280	0.0	0.0	0.0	0.00	0.00	0.00	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00
5	8	5400	48040	0.0	0.0	0.0	0.00	0.00	0.00	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
5	12	5690	48215	0.0	0.0	0.0	0.24	0.24	0.24	1.27	1.27	1.27	0.44	0.44	0.44	0.16	0.16	0.16
7	13	5630	48240	0.0	0.0	0.0	0.54	0.54	0.54	8.35	8.35	8.35	1.68	1.68	1.68	0.70	0.70	0.70
2	14	5685	48275	0.0	0.0	0.0	2.95	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	16	5610	48280	0.0	0.0	0.0	2.95	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	21	5350	48285	0.5	0.6	0.6	0.59	0.66	0.62	0.09	0.10	0.09	0.03	0.03	0.03	0.61	0.68	0.64
2	25	5640	48240	0.0	0.0	0.0	3.39	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	25	5630	483[illegible]0	0.0	0.0	0.0	3.07	0.00	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	27	5610	48390	0.0	0.0	0.0	0.06	0.06	0.06	0.31	0.31	0.31	0.11	0.11	0.11	0.04	0.04	0.04
5	37	5550	48440	0.0	0.0	0.0	0.04	0.04	0.04	0.23	0.23	0.23	0.08	0.08	0.08	0.03	0.03	0.03
5	37	5420	48450	0.0	0.0	0.0	0.00	0.00	0.00	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00
5	37	5440	48550	0.0	0.0	0.0	0.02	0.02	0.02	0.14	0.14	0.14	0.05	0.05	0.05	0.01	0.01	0.01
5	37	5630	48615	0.0	0.0	0.0	0.01	0.01	0.01	0.05	0.05	0.05	0.02	0.02	0.02	0.00	0.00	0.00
5	38	5290	48450	0.0	0.0	0.0	0.00	0.00	0.00	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00
5	39	5050	48510	0.0	0.0	0.0	0.00	0.00	0.00	0.04	0.04	0.04	0.01	0.01	0.01	0.00	0.00	0.00
5	39	5150	48340	0.0	0.0	0.0	0.02	0.02	0.02	0.12	0.12	0.12	0.04	0.04	0.04	0.01	0.01	0.01
5	43	5050	48650	0.0	0.0	0.0	0.06	0.06	0.06	0.31	0.31	0.31	0.11	0.11	0.11	0.04	0.04	0.04
5	43	5090	48810	0.0	0.0	0.0	0.08	0.08	0.08	0.42	0.42	0.42	0.15	0.15	0.15	0.05	0.05	0.05

TABLE 20 SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES
TONS/ DAY

GRID	AREA	SOX S	SOX W	SOX A	PART S	PART W	PART A	CO S	CO W	CO A	HC S	HC W	HC A	NOX S	NOX W	NOX A
1	617.7	0.0	0.1	0.1	0.1	0.1	0.1	2.6	1.7	2.2	0.5	0.4	0.5	0.3	0.3	0.3
2	617.7	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	0.9	0.2	0.1	0.2	0.1	0.1	0.1
3	617.7	0.2	1.4	0.7	0.6	0.8	0.7	15.1	10.3	12.8	3.1	2.3	2.7	1.7	1.4	1.6
4	617.7	0.0	0.1	0.1	0.1	0.1	0.1	2.8	2.1	2.4	0.5	0.4	0.5	0.3	0.3	0.3
5	617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.4	0.1	0.1	0.1	0.0	0.0	0.0
6	617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.6	0.8	0.2	0.1	0.1	0.1	0.1	0.1
7	154.4	0.1	0.2	0.1	0.1	0.2	0.2	3.7	2.9	3.3	0.8	0.6	0.7	0.5	0.6	0.5
8	154.4	0.1	0.3	0.2	0.1	0.2	0.2	6.1	4.9	5.5	1.2	1.0	1.1	0.6	0.8	0.7
9	38.6	0.0	0.1	0.1	0.0	0.1	0.1	1.3	1.1	1.3	0.3	0.3	0.3	0.2	0.3	0.2
10	38.6	0.0	0.1	0.0	0.0	0.0	0.0	2.0	1.5	1.8	0.3	0.3	0.3	0.2	0.2	0.2
11	38.6	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.1	0.1	0.1	0.0	0.1	0.1
12	9.6	0.0	0.0	0.0	0.3	0.3	0.3	2.5	2.2	2.4	0.7	0.6	0.7	0.3	0.3	0.3
13	9.6	0.0	0.0	0.0	0.6	0.6	0.6	8.7	8.6	8.7	1.7	1.7	1.7	0.7	0.7	0.7
14	9.6	0.1	1.0	0.5	3.2	0.6	1.8	10.1	8.3	9.1	2.0	1.8	1.9	1.0	1.7	1.3
15	9.6	0.2	2.0	1.0	0.3	1.1	0.7	29.8	23.9	26.6	4.4	3.8	4.1	1.8	3.3	2.5
16	38.6	0.0	0.2	0.1	3.0	0.1	1.6	3.5	2.8	3.1	0.6	0.5	0.6	0.3	0.4	0.4
17	38.6	0.1	0.4	0.2	0.1	0.2	0.2	5.9	4.7	5.4	1.1	0.9	1.0	0.6	0.8	0.7
18	9.6	0.0	0.4	0.2	0.1	0.3	0.2	4.5	3.6	4.3	1.0	0.8	0.9	0.5	0.9	0.7
19	9.6	0.0	0.1	0.1	0.0	0.1	0.0	2.1	1.6	2.0	0.3	0.3	0.3	0.1	0.3	0.2
20	9.6	0.1	1.6	0.8	0.3	1.0	0.6	16.1	12.9	15.3	3.5	3.0	3.4	1.7	3.3	2.5
21	9.6	0.6	0.8	0.7	0.7	0.7	0.7	3.0	2.3	2.8	0.5	0.4	0.5	0.9	0.9	0.9
22	154.4	0.0	0.1	0.1	0.0	0.1	0.0	1.3	1.0	1.2	0.3	0.2	0.3	0.1	0.3	0.2
23	38.6	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0
24	9.6	0.1	1.5	0.8	0.3	0.8	0.5	16.8	13.7	15.1	3.3	2.8	3.0	1.6	2.6	2.1
25	9.6	0.3	2.5	1.3	7.1	1.4	4.2	54.6	43.3	48.4	7.8	6.5	7.1	3.2	4.9	4.0

26	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
27	9.6	0.0	0.2	0.1	0.1	0.2	0.1	2.3	1.9	2.1	0.5	0.4	0.5	0.2	0.4	0.3
28	38.6	0.1	0.9	0.5	0.2	0.5	0.4	14.0	11.2	12.5	2.6	2.2	2.4	1.3	1.8	1.5
29	38.6	0.1	0.3	0.2	0.1	0.2	0.2	6.0	4.8	5.4	1.1	0.9	1.0	0.6	0.8	0.7
30	38.6	0.0	0.1	0.0	0.0	0.0	0.0	2.0	1.5	1.8	0.3	0.3	0.3	0.2	0.2	0.2
31	9.6	0.0	0.2	0.1	0.0	0.1	0.1	3.7	2.8	3.5	0.6	0.5	0.6	0.3	0.3	0.3
32	9.6	0.0	0.1	0.1	0.0	0.1	0.0	1.3	1.0	1.2	0.3	0.2	0.3	0.1	0.3	0.2
33	9.6	0.1	0.5	0.3	0.2	0.3	0.2	11.1	8.6	10.4	1.9	1.5	1.8	1.0	0.9	1.0
34	9.6	0.0	0.1	0.0	0.0	0.0	0.0	1.9	1.5	1.8	0.3	0.3	0.3	0.2	0.2	0.2
35	617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.4	0.1	0.1	0.1	0.0	0.0	0.0
36	617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	347.4	0.1	0.9	0.5	0.3	0.6	0.5	10.3	7.6	9.0	2.1	1.7	1.9	1.1	1.6	1.3
38	154.4	0.0	0.3	0.2	0.1	0.3	0.2	3.5	2.7	3.3	0.8	0.7	0.8	0.5	0.7	0.6
39	347.4	0.1	0.2	0.1	0.2	0.2	0.2	4.7	3.7	4.4	0.9	0.7	0.9	0.6	0.5	0.6
40	617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	617.7	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
42	347.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1
43	617.7	0.2	0.9	0.5	0.5	0.8	0.6	15.2	10.6	14.1	3.1	2.3	3.0	1.6	1.8	1.8
44	347.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

EMISSION DENSITIES

In order to provide a visual representation of the emissions of pollutants by grid, emission density maps have been provided. Figures 6 through 10 show variation in emission densities for the respective grids throughout the Study Area. As expected the emissions generally follow the pattern and degree of urbanization. Emission densities are higher in grids with high populations and correspondingly high vehicular and industrial activity.

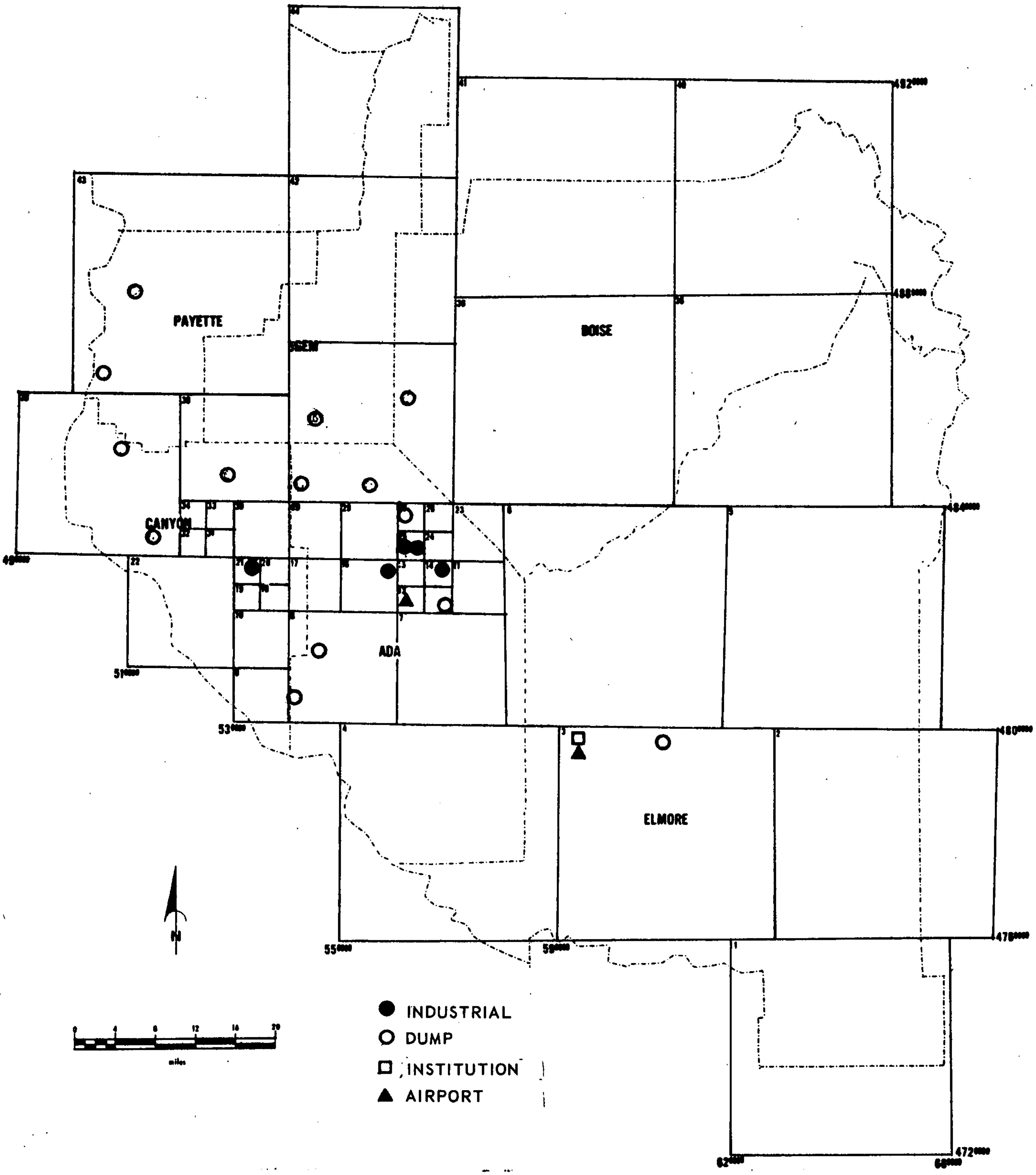

Figure 5. Point source locations for the study area.

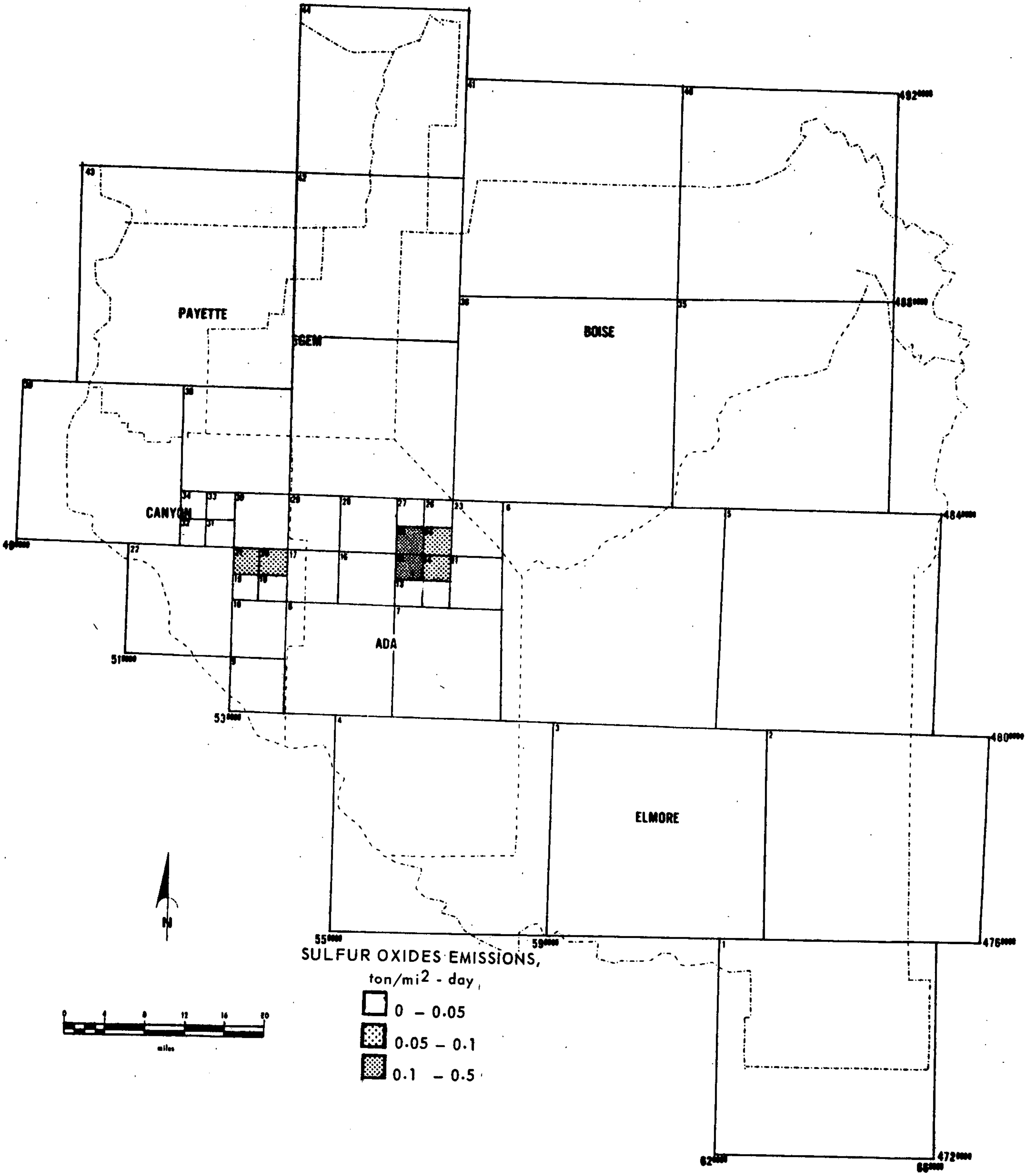

Figure 6. Sulfur oxides emission density for the study area, 1969.

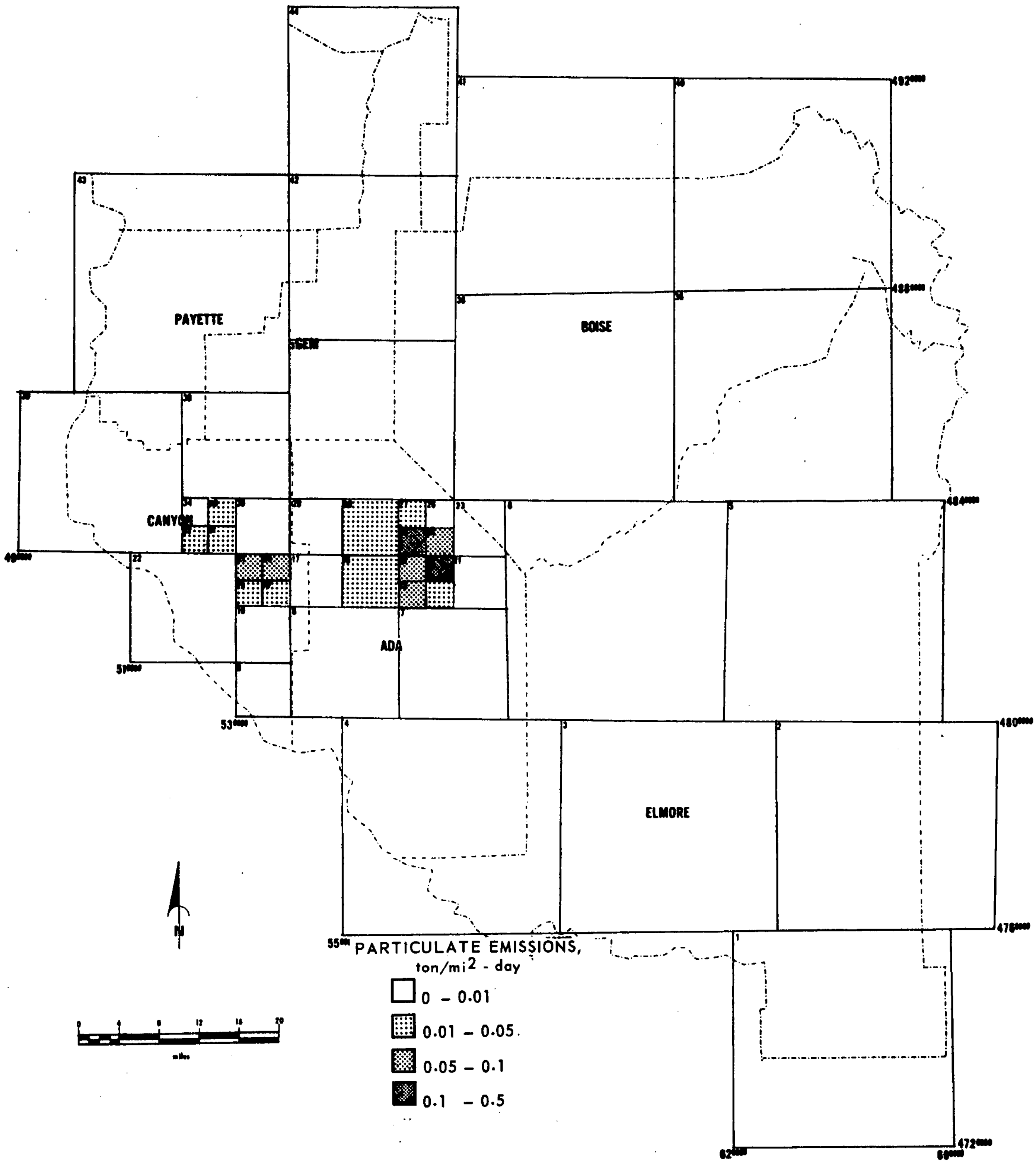

Figure 7. Particulate emission density for the study area, 1969.

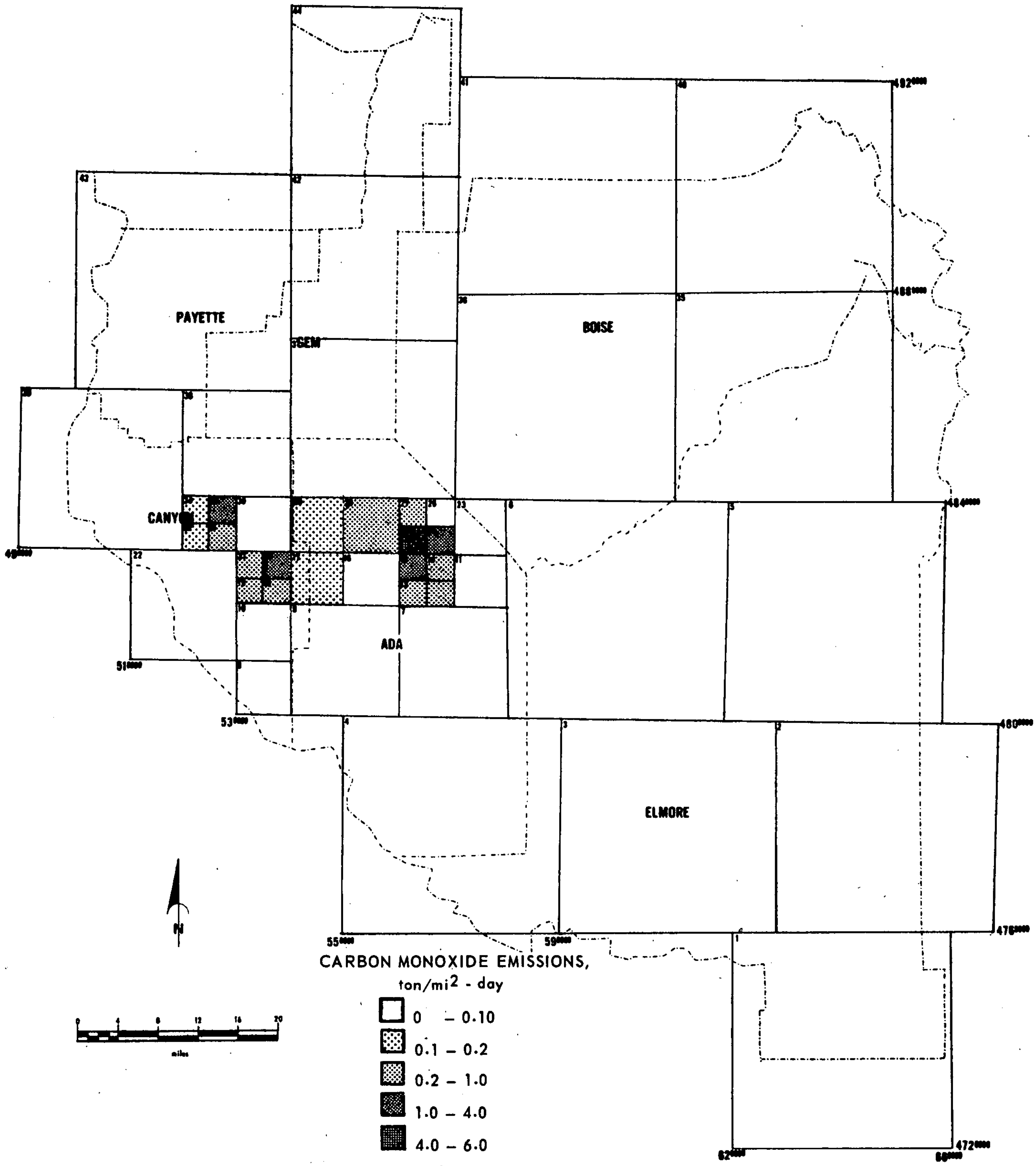

Figure 8. Carbon monoxide emission density for the study area, 1969.

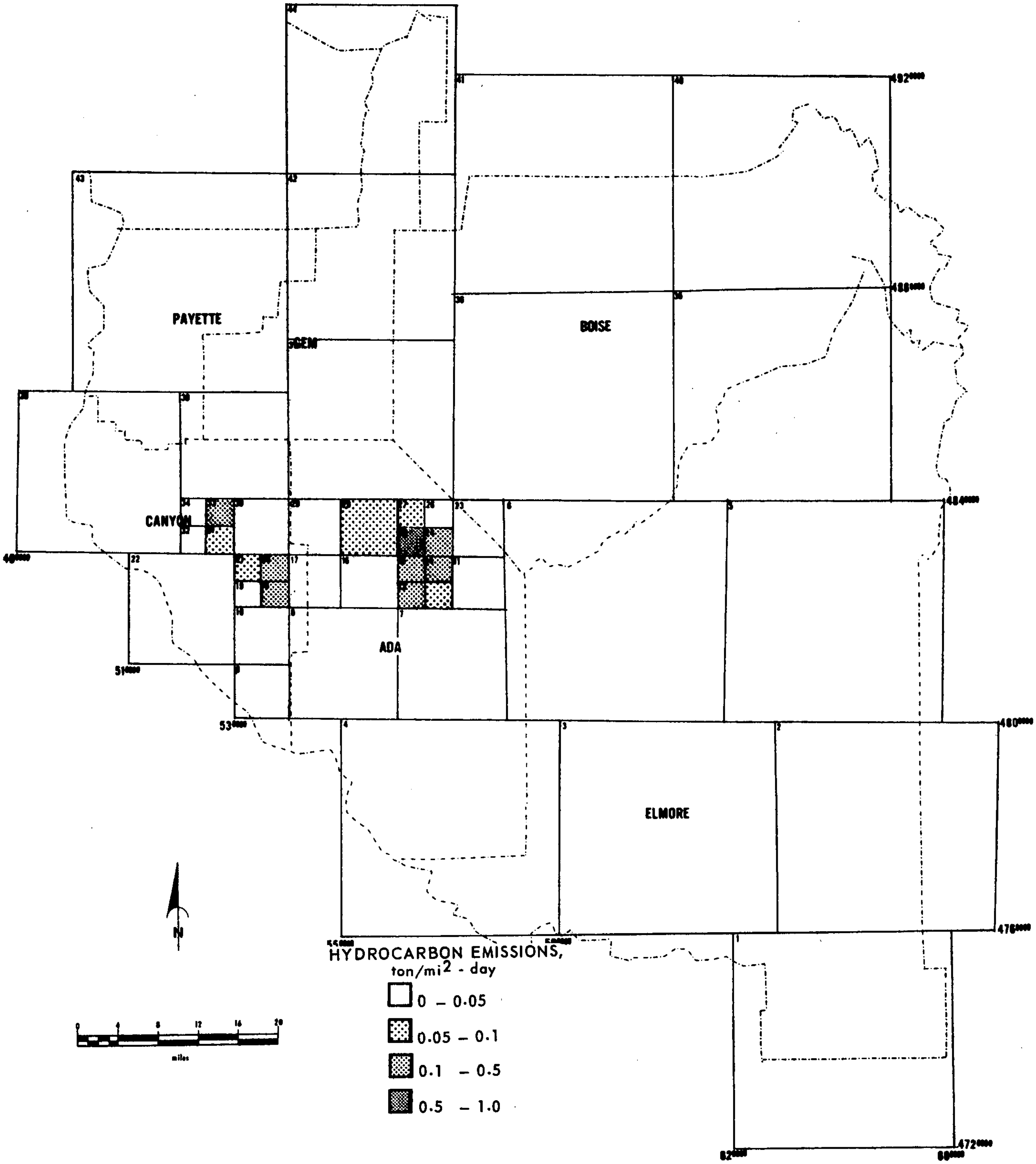

Figure 9. Hydrocarbon emission density for the study area, 1969.

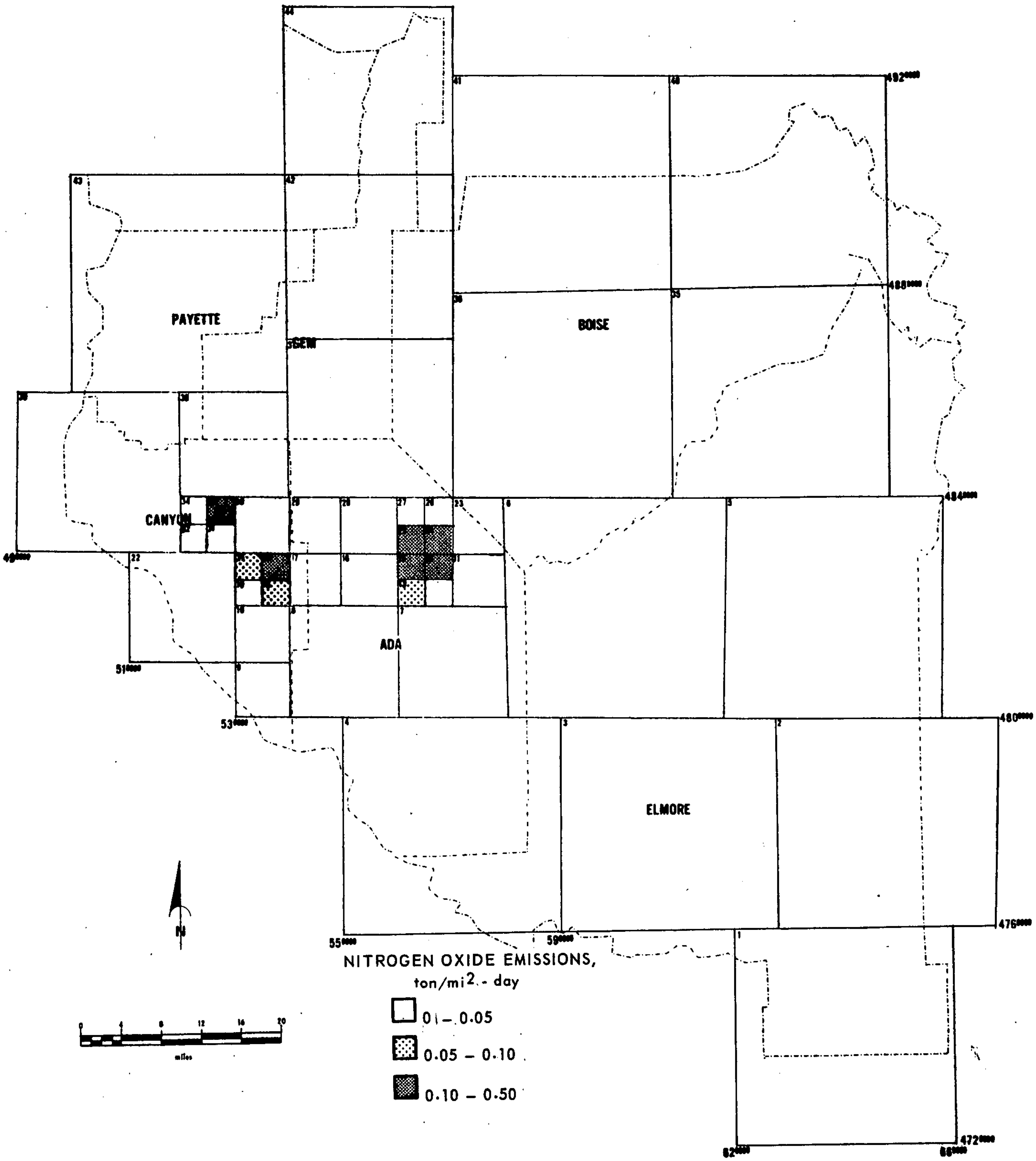

Figure 10. Nitrogen oxides emission density for the study area, 1969.

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APPENDIX

METHOD FOR CALCULATING SUMMER, WINTER AND ANNUAL AVERAGE EMISSIONS FOR FUEL CONSUMPTION IN STATIONARY SOURCES

YEARLY AVERAGE (A)

$$A = \frac{\text{Fuel Consumed x Emission Factor (E. F.)}}{\text{Days of Operation}}$$

e.g. A plant consumed 100,000 tons of coal in 1967 while operating 365 days. The total degree days for the area was 4,800 and 2,800 for the three winter months. The plant was estimated to use 15 percent of the fuel for space heating and 85 percent for process heating. From this information, the annual average emission for carbon monoxide would be the following:

$$A = \frac{\text{100,000 Tons/year x 3 lbs. CO/Ton coal}}{\text{365 Days/year x 2,000 lb./Ton}}$$

A = 0.41 Ton/Day

WINTER AVERAGE (W)

$$W = \frac{\text{Fuel Consumed x E.F.}}{\text{Days of Winter Operation}} \times \frac{\text{Winter Degree Days}}{\text{Total Degree Days}} \times \text{\% Fuel Used for space heating}$$

$$+ \frac{\text{Fuel Consumed x E.F.}}{365} \times \text{\% Fuel used for process heating}$$

$$W = \left[\frac{100{,}000 \times 2{,}800}{90 \times 4{,}800} \times 0.15 + \frac{100{,}000}{365} \times 0.85\right] \frac{3}{2{,}000}$$

W = 0.49 Ton/Day

SUMMER AVERAGE (S)

$$S = \frac{\text{Fuel Consumed x E.F.}}{\text{Days of Summer Operation}} \times \frac{\text{Summer Degree Days}}{\text{Total Degree Days}} \times \text{\% Fuel Used for space heating}$$

$$+ \frac{\text{Fuel Consumed x E.F.}}{365} \times \text{\% Fuel used for process heating}$$

$$S = \left[\frac{100{,}000}{90} \times \frac{0}{4{,}800} \times 0.15 + \frac{100{,}000}{365} \times 0.85\right] \frac{3}{2{,}000}$$

S = 0.35 Ton/Day

APPENDIX B

METRIC CONVERSION FACTORS

Multiply	By.	To Obtain
Feet	0.3048	Meters
Miles	1609	Meters
Square Feet	0.0929	Square meters
Square Miles	2.59	Square kilometers
Pounds	453.6	Grams
Pounds	$453.6/10^4$	Tons (metric)
Tons (metric)	1.103	Tons (short)
Tons (short)	907.2	Kilograms
Tons (short)	.9072	Tons (metric)
To Obtain	By	Divide