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MERAMEC RIVER, MISSOURI COMPREHENSIVE BASIN STUDY. VOLUME II. A--ETC(U)

JAN 64 E L ULLMAN, R R BOYCE, D J VOLK

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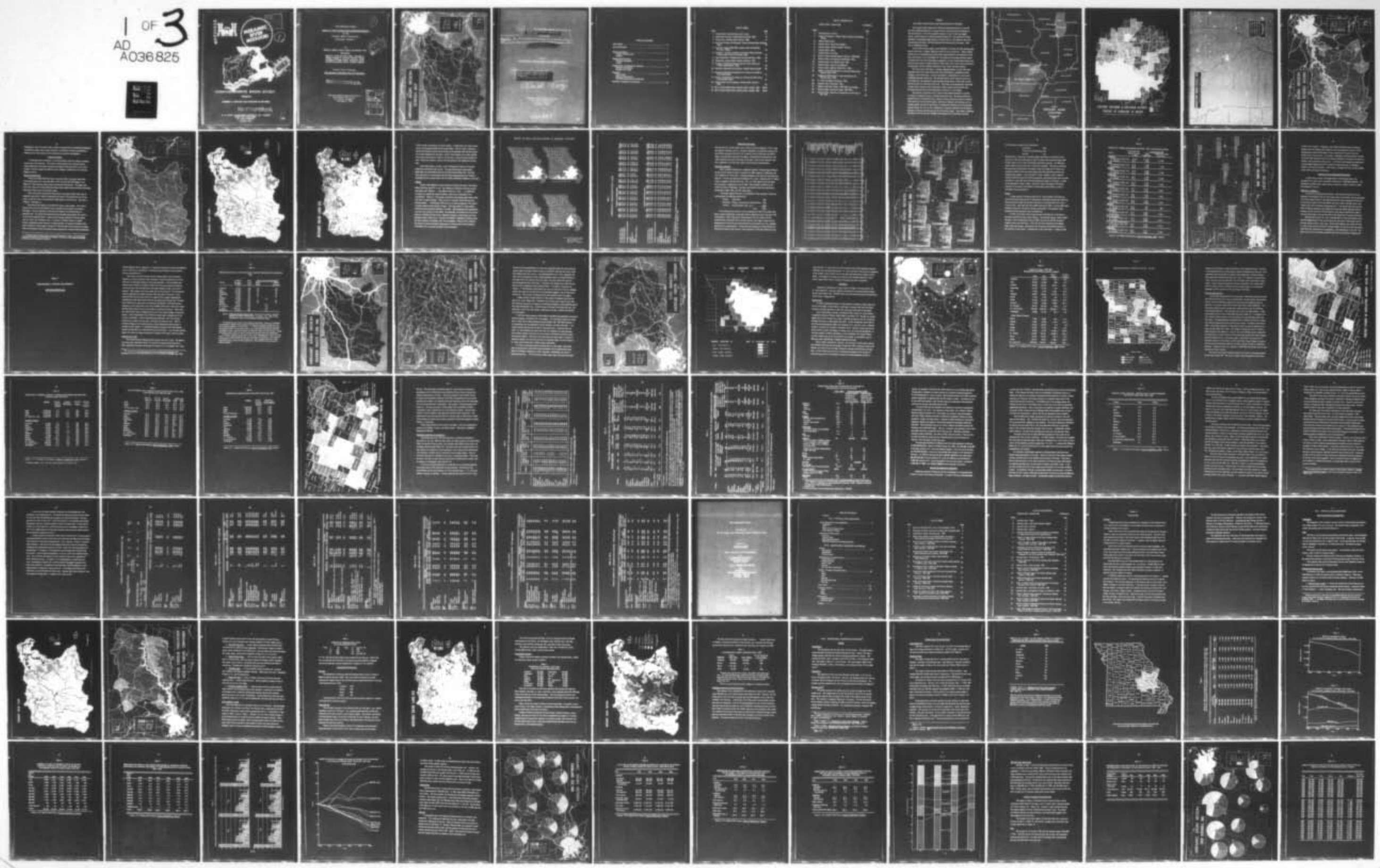


MERAMEC RIVER MISSOURI

COMPREHENSIVE BASIN STUDY.

VOLUME II.

APPENDIX A.– ECONOMY AND CHARACTER OF THE BASIN.

U. S. ARMY ENGINEER DISTRICT, ST LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

JANUARY 1964

166

THE MERAMEC BASIN

Report of the Meramec Basin Research Project

to the

Meramec Basin Corporation

Kirkwood, Missouri

by

Edward L. Ullman, Ronald R. Boyce, and Donald J. Volk

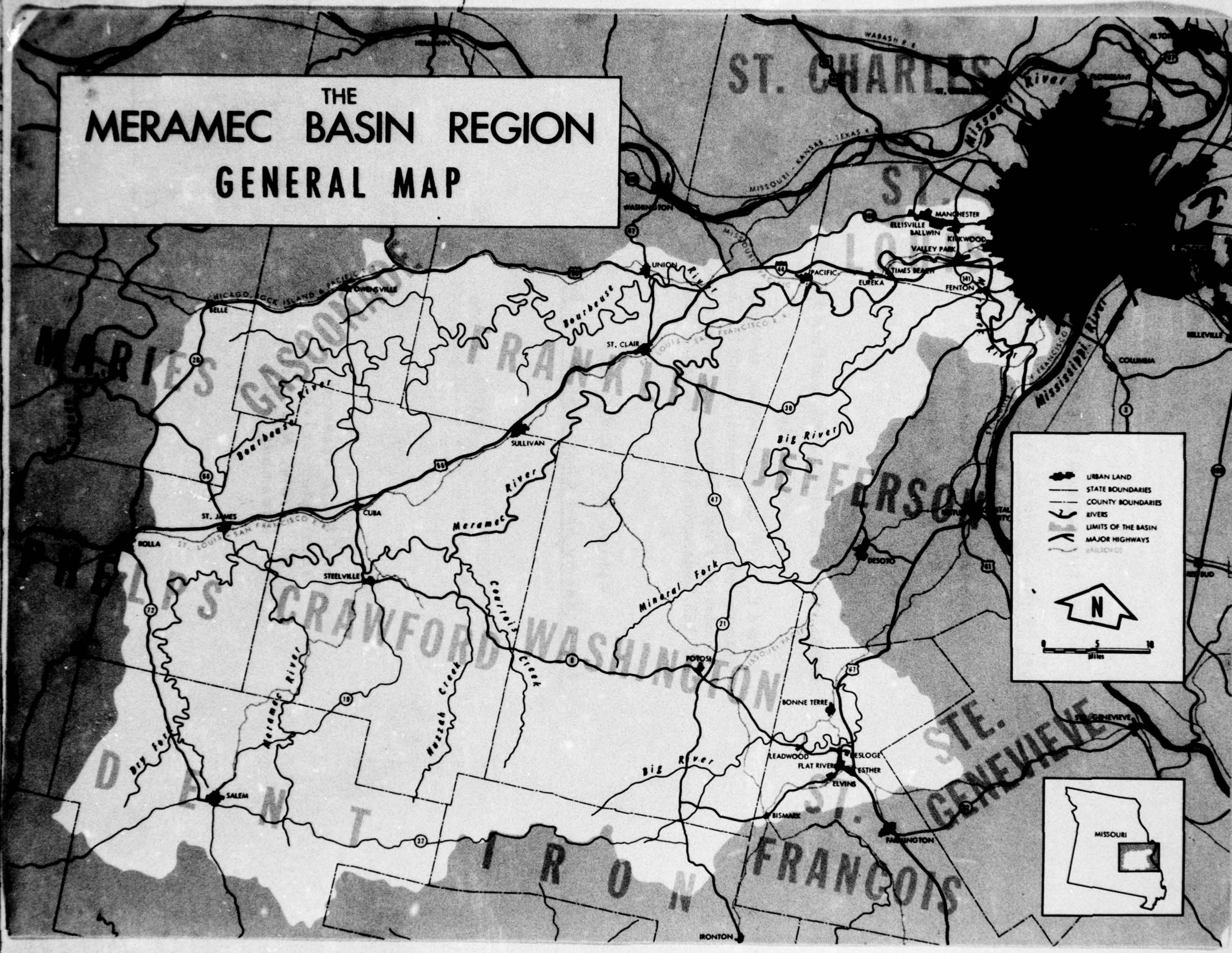
with parts by

Richard C. Smith and Frank Miller, University of Missouri; Anthony C. Tennison, Donald K. Knapp, and Robert D. Knight, Missouri Geological Survey; U.S. Soil Conservation Service, Columbia, Missouri.

Volume II of 3 Volumes

The Economy and Character of the Basin

Meramec Basin Research Project
Washington University
St. Louis, Missouri
December 1961


THE
MERAMEC BASIN REGION
GENERAL MAP
ST. CHARLES
ST. LOUIS
FRANKLIN
JEFFERSON
GASCONADE
MARIES
PHELPS
CRAWFORD
WASHINGTON
DENT
IRON
ST. FRANCOIS
STE. GENEVIEVE
WABASH R.R.
MISSOURI - KANSAS - TEXAS R.R.
CHICAGO, ROCK ISLAND & PACIFIC R.R.
ST. LOUIS - SAN FRANCISCO R.R.
MISSOURI PACIFIC R.R.
Missouri River
Mississippi River
Meramec River
Bourbeuse River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
WASHINGTON
UNION
PACIFIC
EUREKA
TIMES BEACH
FENTON
VALLEY PARK
KIRKWOOD
BALLWIN
ELLISVILLE
MANCHESTER
ST. CLAIR
SULLIVAN
OWENSVILLE
BELLE
CUBA
ST. JAMES
ROLLA
STEELVILLE
SALEM
POTOSI
BONNE TERRE
DESLOGE
LEADWOOD
FLAT RIVER
ESTHER
ELVINS
BISMARK
FARMINGTON
IRONTON
DESOTO
STE. GENEVIEVE
COLUMBIA
BELLEVILLE
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
RAILROADS
N
0 5 10
Miles
MISSOURI

(6)

THE MERAMEC BASIN

Meramec River, Missouri Comprehensive Basin Study.

Volume II.

Appendix A. The Economy and Character of the Meramec Basin.

Chapter I

LOCATION, POPULATION AND DEVELOPMENT

(10) Edward L. Ullman, Ronald R. Boyce,
Donald J. Volk, Richard C. Smith
Frank Miller

(11) Jan 64 (12) 266p.

Meramec Basin Research Project
Washington University
St. Louis, Missouri
December 1961

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Chapter I

LOCATION, POPULATION AND DEVELOPMENT OF THE BASIN

The Meramec Basin extends about 100 miles southwesterly from St. Louis into the Ozark Highlands between the Missouri River on the north and the Mississippi on the east (Figure 1). Of all the quadrants around St. Louis it is the most rugged, scenic, forested (Figure 2), and least populated (Figure 3). The population of about 200,000 is concentrated approximately one-half in the St. Louis suburbs in the lower-most portion of the basin, with the remaining half scattered over the region. Total area is 3,980 square miles.

Much of the economy verges on semi-depressed in common with other farming areas based on thin soils, or regions which have been cut over or mined out. However fertile pockets of soil in bottomlands and wider belts of good agriculture are scattered over the area, particularly on the north (Figure 4). The forests are recovering and show promise of coming back even more under proper management, and new mineral discoveries in new areas not only promise to replace decline in older areas, but in time to form the basis for a much larger and more efficient production of iron, lead, and other minerals.

The central part of the basin, a wooded, dissected plateau, is one of the least populated areas in the whole eastern half of the United States, resembling northern Michigan or the Adirondacks, in spite of proximity to Metropolitan St. Louis and its 2,000,000 population (Figure 3). The principal streams are the Meramec and its two main tributaries, the Bourbeuse flowing through farming country on the north, and the Big flowing from the Lead Belt on the south. The streams are preponderately entrenched in steep valleys and have narrow flood plains which in places provide fertile soils. Most development of towns and transportation, however, is on the ridges.

The proximity of the basin to St. Louis is of the greatest importance, not only as a source of change but also as a principal economic asset. The nearer portions are suburbanized, an intermediate zone is subject to various influences typical of "exurbia" which extend out into the whole region, declining in influence with distance, but increasing rapidly over time in recent years as transportation improves and the metropolis expands (Figures 13, 14, 15, 19). Residential, commuting, industrial and recreational patterns are affected and influence the life of the whole region. The wooded, wilderness character of much of the area, although discouraging much conventional economic

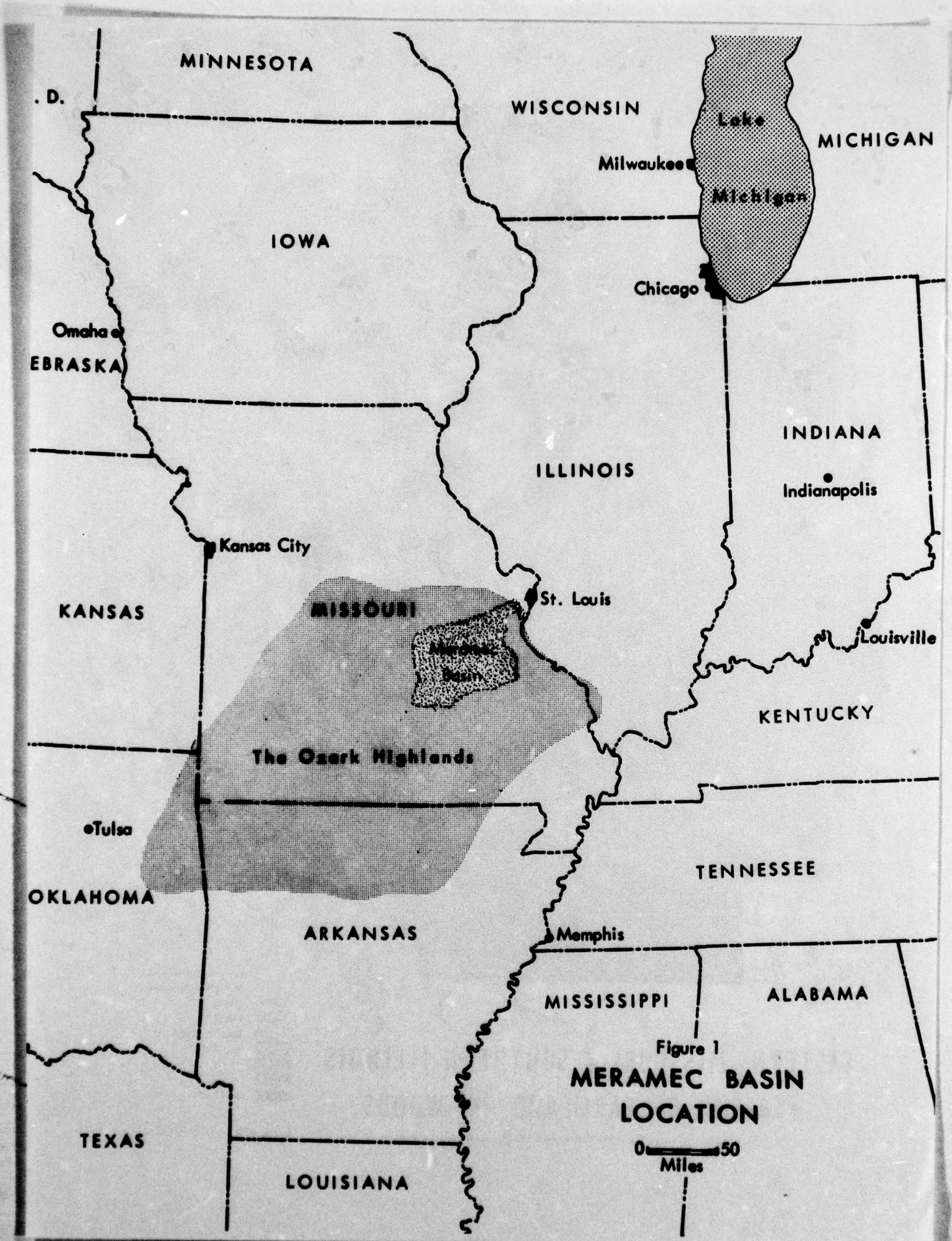
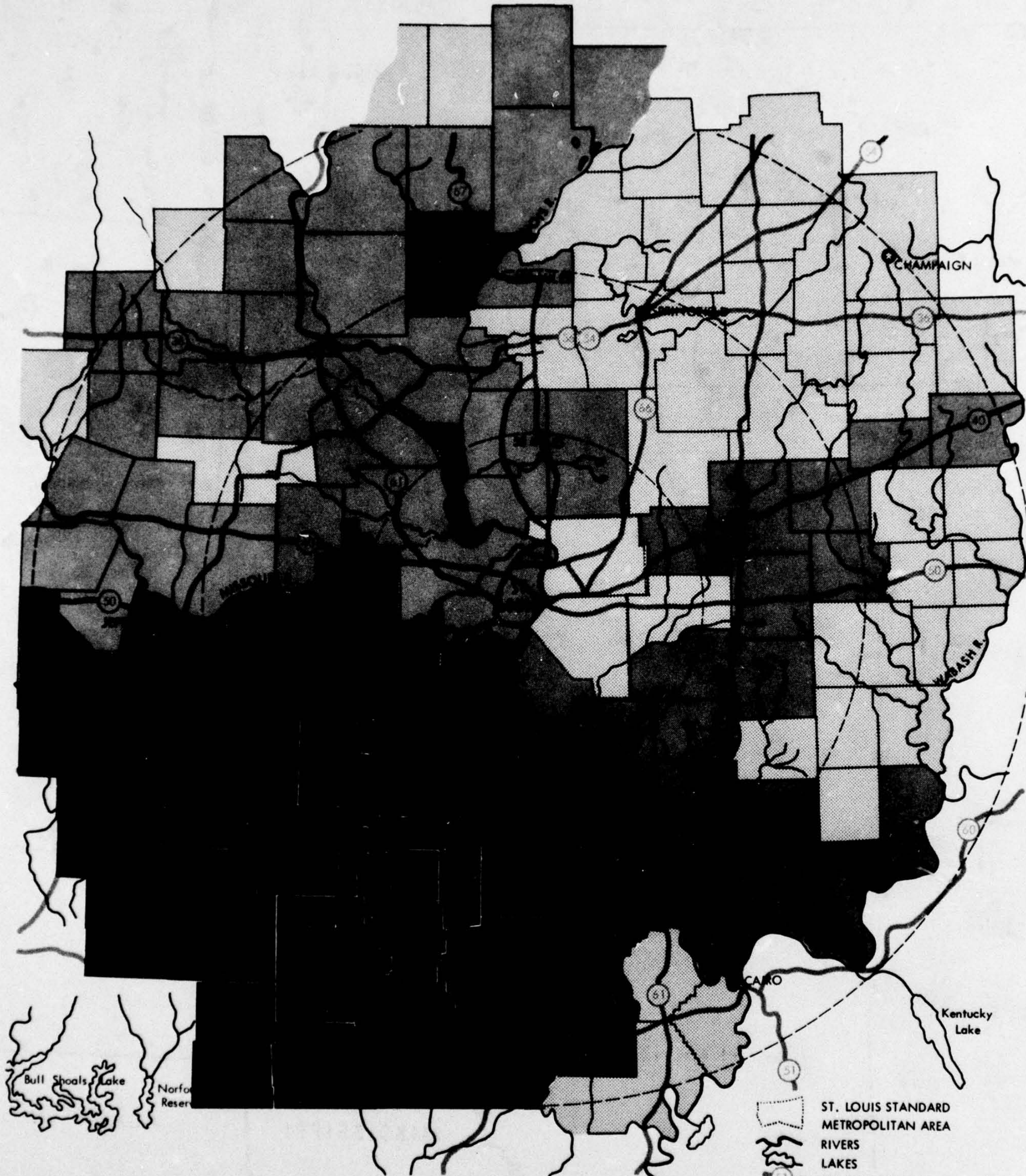


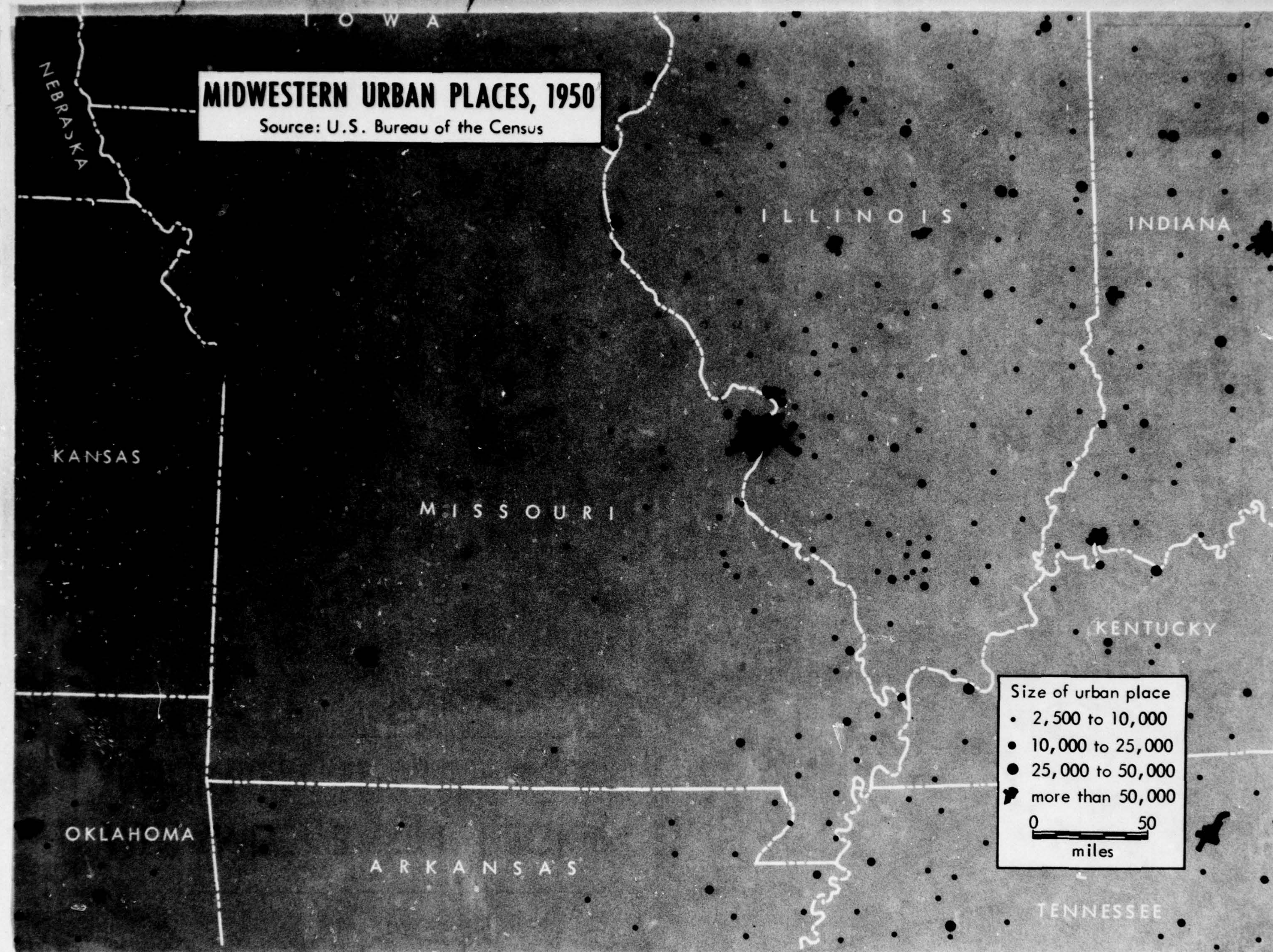
Figure 1
MERAMEC BASIN LOCATION

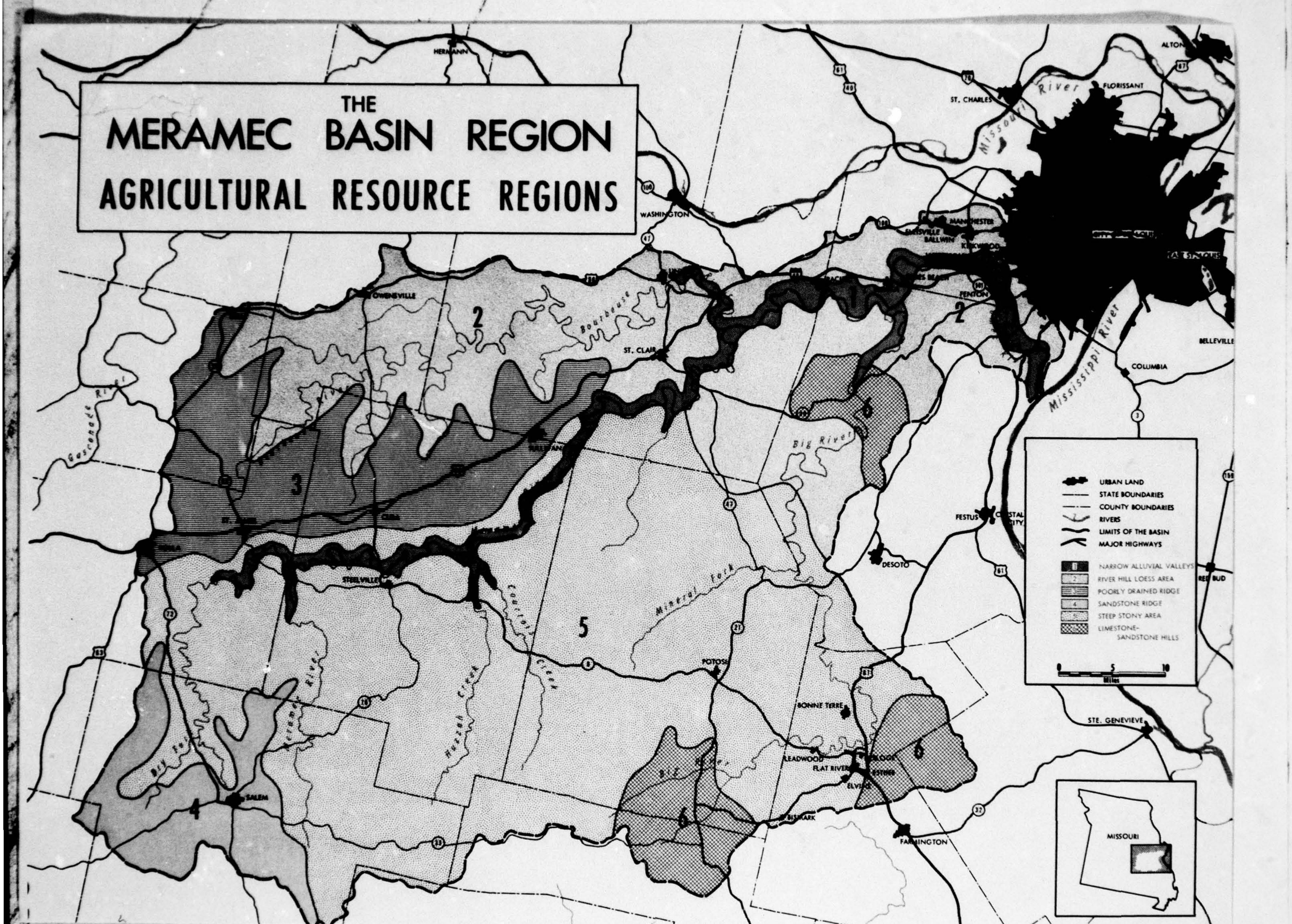


EASTERN MISSOURI & SOUTHERN ILLINOIS PERCENT OF FARMLAND IN WOODS

Map reproduced through the courtesy of the Outdoor Recreation Resources Review Commission

Source: 1954 Census of Agriculture


MIDWESTERN URBAN PLACES, 1950
Source: U.S. Bureau of the Census
IOWA
NEBRASKA
KANSAS
MISSOURI
ILLINOIS
INDIANA
KENTUCKY
TENNESSEE
ARKANSAS
OKLAHOMA
Size of urban place
2,500 to 10,000
10,000 to 25,000
25,000 to 50,000
more than 50,000
0
50
miles


THE
MERAMEC BASIN REGION
AGRICULTURAL RESOURCE REGIONS
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
NARROW ALLUVIAL VALLEYS
RIVER HILL LOESS AREA
POORLY DRAINED RIDGE
SANDSTONE RIDGE
STEEP STONY AREA
LIMESTONE-
SANDSTONE HILLS
0 5 10
Miles
MISSOURI
HERMANN
ALTON
FLORISSANT
ST. CHARLES
Missouri River
WASHINGTON
MANCHESTER
BALLWIN
KIRKWOOD
FENTON
OWENSVILLE
ST. CLAIR
Bourbeuse
Big River
Mississippi River
BELLEVILLE
COLUMBIA
FESTUS
DESOTO
RED BUD
STEELVILLE
Courtois Creek
Mineral Fork
Huzzah Creek
Meramec River
POTOSI
BONNE TERRE
LEADWOOD
FLAT RIVER
ELVINS
BISMARK
FARMINGTON
STE. GENEVIEVE
SALEM
Gasconade River
1
2
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6

development, does, by the same token, present an opportunity for recreational development benefiting the region and its nearby metropolis, particularly if water and related land resources are not only preserved, but enhanced by constructive development.

Terrain and Climate

As indicated, most of the basin is a dissected plateau with river valleys occupying a minor part of the land area. The terrain is gently rolling on the north and predominantly agricultural and becomes progressively rougher toward the south as well as more wooded. Elevation ranges from 400 feet on the northeast to 1400 feet on the southwest (Figures 5 and 6).

Terrain and forest cover

Forests cover about 60% of the land, crops about 20%, and pasture about 20%. In the south forest cover is more than 80%, in the north less than 40% (Figure 7 and Figure 2).[1] The stands are mostly second and later growth hardwoods. The bigger trees are in the valleys and on the north facing valley slopes; smaller trees are found on the south facing drier slopes and on the extensive ridges.

Soils on the ridges are generally thin and poor and support neither large trees nor productive agriculture. Erosion is generally most severe in the agricultural areas of the north, on the east, and on the agricultural Salem plateau in Dent County. (See maps in Chapter 2, Agriculture.)

The streams of the region are entrenched in narrow, steep valleys. Over most of the area they are swift and relatively clear, especially in the southern two-thirds of the region. Here the tributaries of the Meramec heading in the forested hills are generally clear. By contrast the Bourbeuse flowing through predominantly farm country on the north is generally turbid. Large perennial springs, especially Maramec Spring near St. James, also contribute water. In contrast to northern Missouri or central Illinois, underground water resources, in deeper aquifers, are generally abundant. (See map in Chapter 3, Water Supply, Volume III.) The main stem of the Meramec has enough water at all seasons to permit canoeing and some boating from Maramec Springs downstream,

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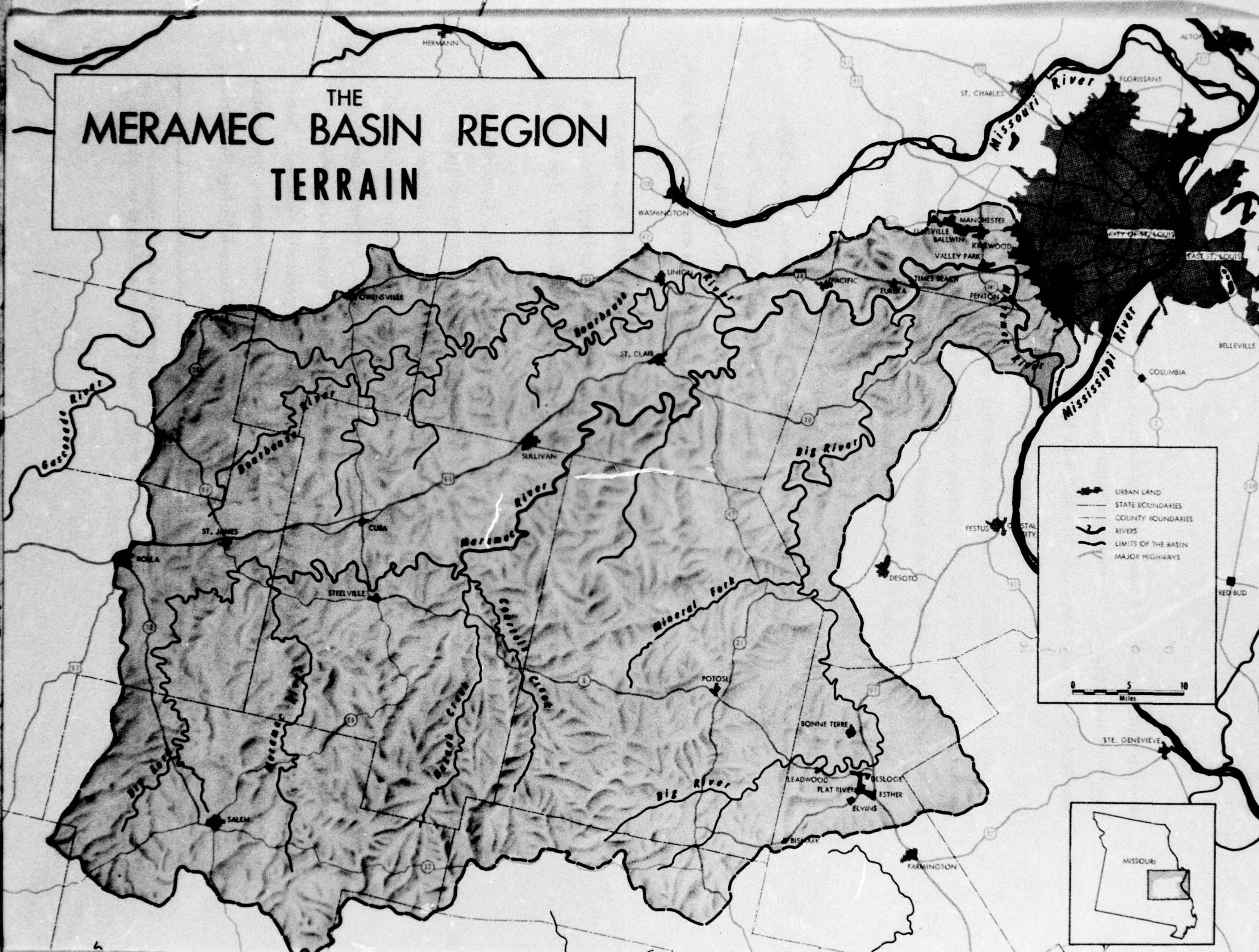
[1] Note that Figure 2 shows only percentage of farmland in woods. If non-farm land (national forests, etc.) was included, the Meramec would have even higher percentages of forest cover as indicated in the text.


THE
MERAMEC BASIN REGION
TERRAIN
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
0 5 10
Miles
MISSOURI
Missouri River
Mississippi River
Meramec River
Big River
Mineral Fork
Bourbeuse River
Gasconade River
Courtois Creek
Huzzah Creek
HERMANN
WASHINGTON
ST. CHARLES
FLORISSANT
ALTON
CITY OF ST. LOUIS
EAST ST. LOUIS
MANCHESTER
BALLWIN
KIRKWOOD
VALLEY PARK
TIMES BEACH
FENTON
EUREKA
PACIFIC
UNION
OWENSVILLE
ST. CLAIR
SULLIVAN
CUBA
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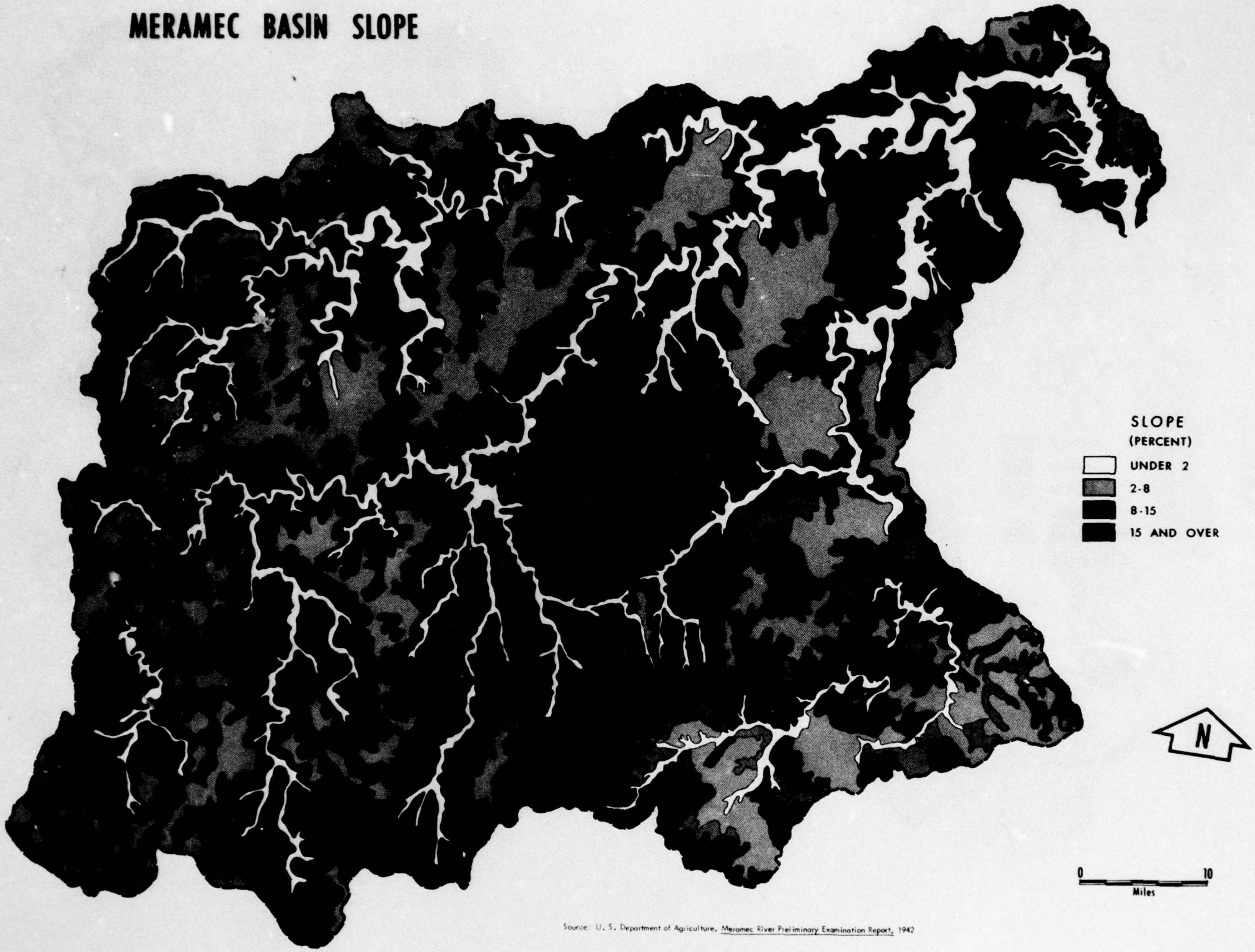
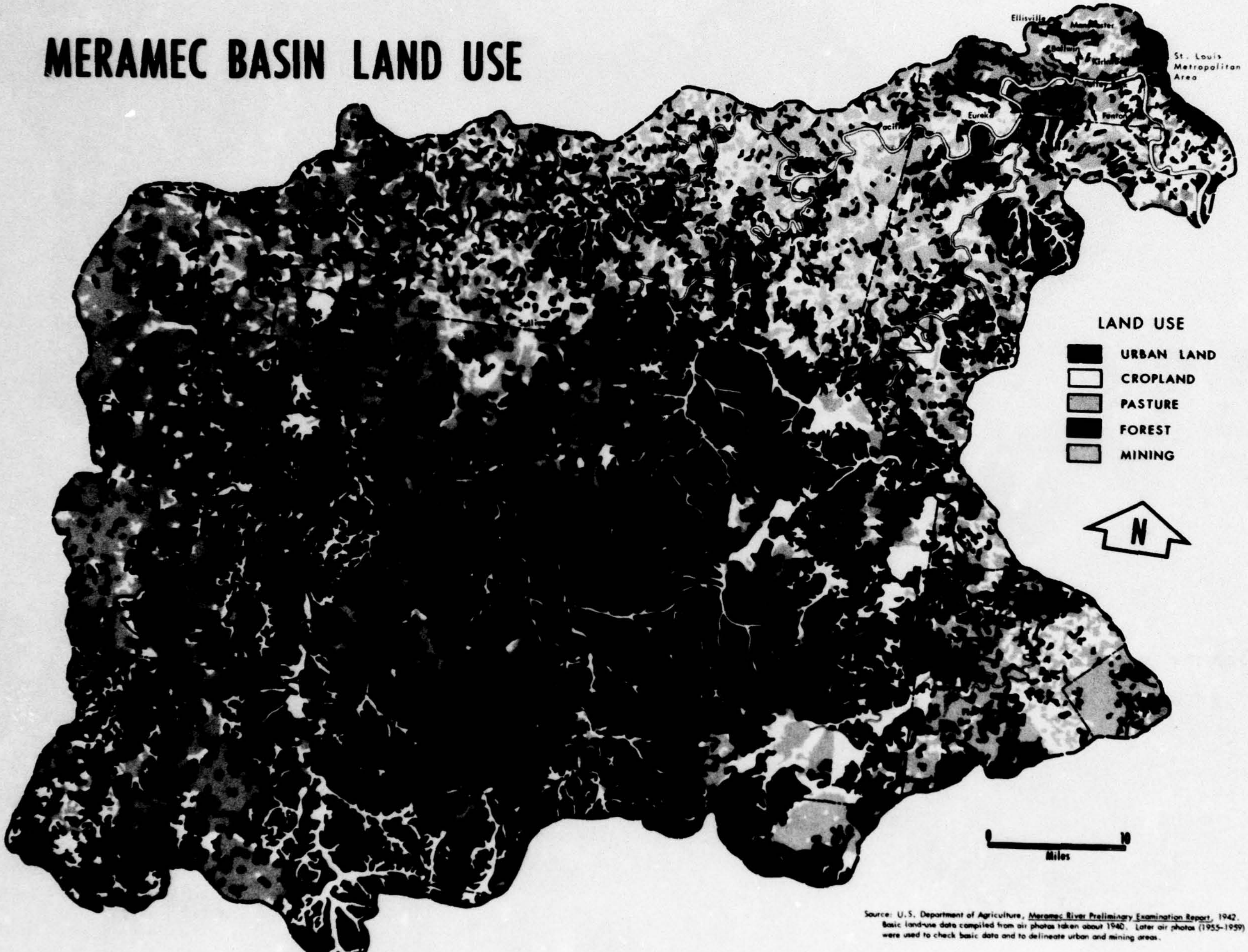
FLAT RIVER
ESTHER
ELVINS
BISMARK
FARMINGTON
DESOTO
FESTUS
BELLEVILLE
COLUMBIA
RED BUD
STE. GENEVIEVE

MERAMEC BASIN SLOPE



Source: U. S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942

MERAMEC BASIN LAND USE



Source: U.S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942. Basic land-use data compiled from air photos taken about 1940. Later air photos (1955-1959) were used to check basic data and to delineate urban and mining areas.

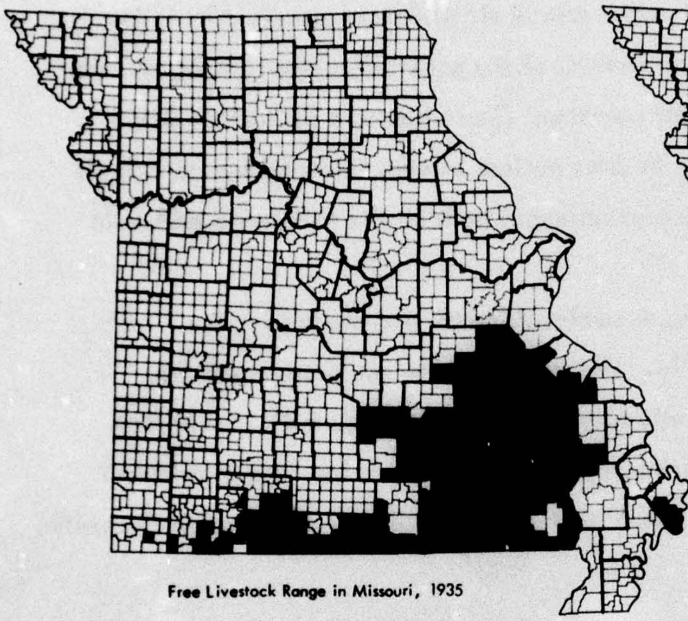
with the volume increasing in the lower reaches. At high water a few other streams can be used including portions of the two principal, and more turbid, tributaries, the Big and Bourbeuse and the lower portions of the generally clear flowing Huzzah and Courtois emptying into the upper Meramec (See Chapter 4 for further details). Many other streams become trickles in drier periods or cease flowing for periods of time. Floods are, however, common occurrences both on the tributaries and main stem.

Much of the region, as noted, is semi-wilderness and much of it was semi-subsistence agriculture until recently. The maps showing open-range grazing graphically and dramatically illustrate this characteristic (Figure 8). Note that even today there is a considerable amount of open range grazing land in Missouri extending into the Meramec Basin from the Ozarks immediately adjacent on the south.

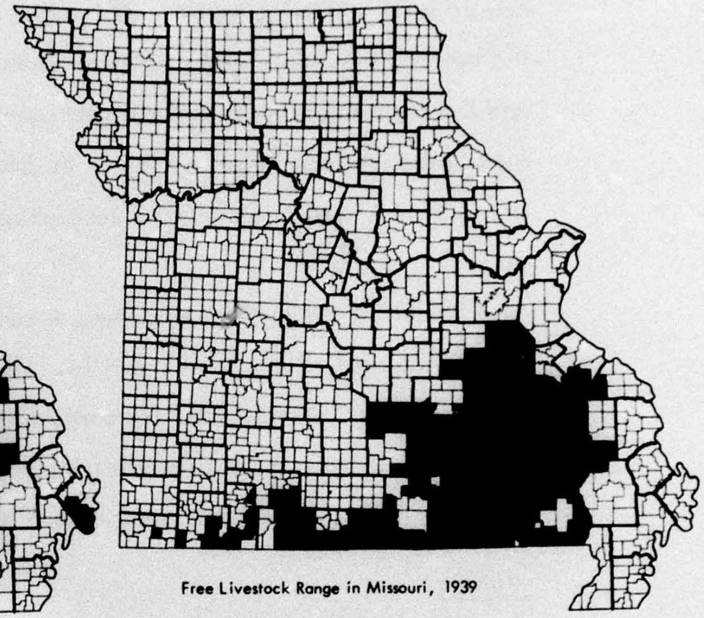
Climate

In spite of the highland, forested character of much of the basin, the climate differs little from that of St. Louis. The difference in elevation with only a small area higher than 1200 feet -- some 600 feet above St. Louis -- is insufficient to produce any significant summer cooling or winter snows comparable to the Appalachians. (Table 1). The forested countryside often appears appreciably cooler than close-in urban locations. This is common in suburban wooded areas around cities generally. Microclimatic differences are of some consequence with comfort in summer related to wind and air drainage. Thus many closed-in valley bottoms without breezes can become stifling in hot spells. Both temperature and precipitation vary from year to year as in the Middle West generally, but drouths are not as severe because of springs and forest cover, although in long dry periods streams are lower and some shallow wells dry up. Generally the climate is classified as humid and thus far little irrigation is practiced, other than for gardens. Because of the warmth of the climate during some months of some summers, development of water resources is desirable if the recreation potential is to be developed.

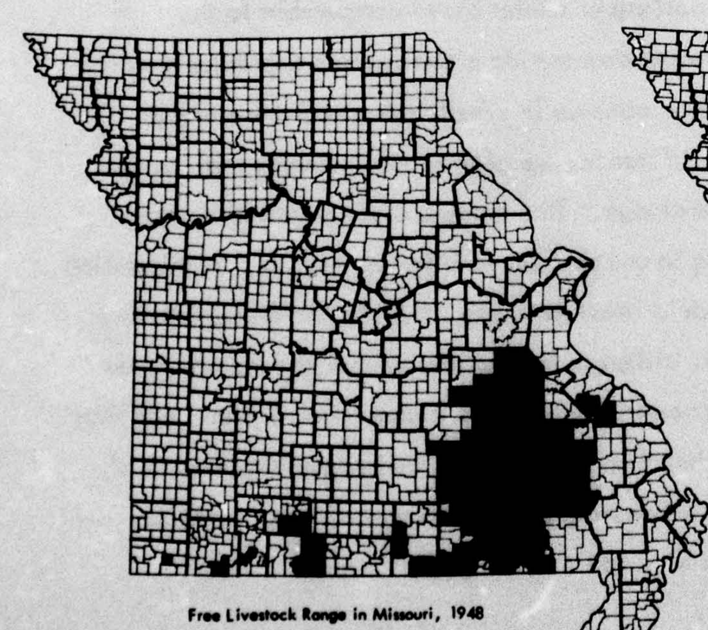
EXTENT OF FREE LIVESTOCK RANGE IN MISSOURI, 1935-1960



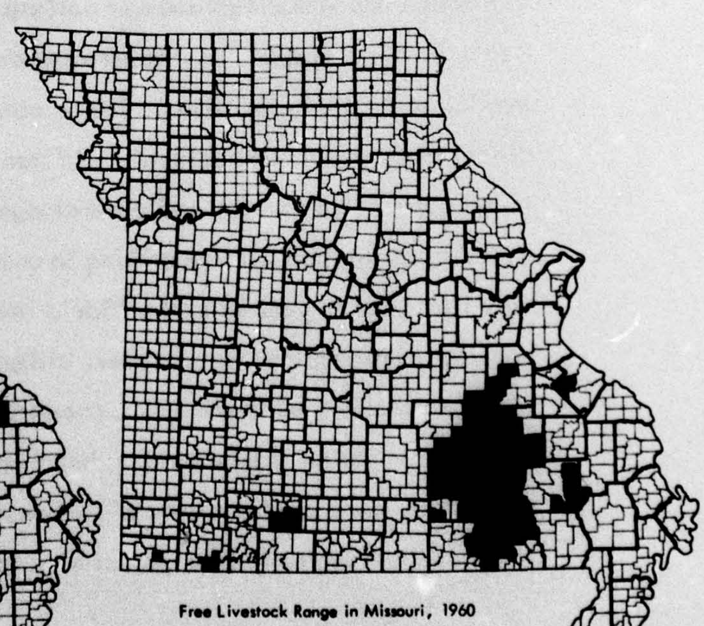
Free Livestock Range in Missouri, 1935



Free Livestock Range in Missouri, 1939



Free Livestock Range in Missouri, 1948



Free Livestock Range in Missouri, 1960

Source: Allen Brohn and Thomas S. Baskett
"Free Livestock Range in Missouri"
University of Missouri
Agricultural Experiment Station
Bulletin 761 January 1961

Table 1

CLIMATIC DATA, MERAMEC BASIN AND ST. LOUIS

AVERAGE TEMPERATURES

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
St. Louis RFC City	33.3	36.7	45.3	56.5	66.2	75.8	80.6	78.6	71.4	60.6	46.0	36.2	57.3
St. Louis University	34.1	36.8	45.0	56.6	66.6	76.7	81.1	78.9	71.5	60.8	45.9	36.3	57.5
St. Louis WB Airport	32.2	35.7	44.4	55.6	65.4	75.1	79.7	77.7	70.4	59.4	45.0	35.1	56.3
Average—3 St.Louis stations	33.2	36.4	44.9	56.2	66.0	75.9	80.5	78.4	71.1	60.3	45.6	35.9	57.0
Arcadia	33.7	36.4	44.3	55.4	63.7	73.1	77.1	76.0	68.5	57.8	44.6	35.7	55.5
Farmington 1E	35.1	37.9	45.7	56.3	64.9	74.6	78.5	76.8	69.5	58.8	45.4	36.9	56.7
Salem	34.1	37.0	44.9	55.5	64.2	73.9	78	76.4	68.7	58.5	44.8	36.0	56.0
Rolla School of Mines	33.7	36.6	44.7	56.1	64.9	74.1	78.6	77	69.7	59.6	45.1	35.8	56.3

AVERAGE PRECIPITATION

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
St. Louis RFC City	2.32	1.97	3.64	4.01	4.10	3.80	2.91	3.77	3.38	2.90	2.72	2.43	37.95
St. Louis University	2.23	2.25	3.40	3.59	3.54	3.54	3.11	3.72	2.89	2.70	2.45	2.02	35.44
St. Louis WB Airport	1.92	1.73	3.42	3.93	4.02	4.37	2.58	3.55	3.54	3.08	2.57	2.09	36.80
Average—3 St.Louis stations	2.16	1.99	3.49	3.84	3.89	3.90	2.87	3.68	3.27	2.89	2.58	2.18	36.73
Arcadia	3.08	2.49	3.92	4.25	4.73	4.54	3.32	3.04	3.36	3.60	3.74	2.44	42.51
Farmington 1E	2.89	2.54	3.70	4.16	4.78	4.11	3.75	3.20	3.66	3.42	3.38	2.22	41.81
Fredericktown	3.42	2.65	3.75	4.10	4.43	4.19	3.45	3.12	3.70	3.51	3.21	2.40	41.93
Salem	2.27	2.53	3.70	4.20	5.14	4.77	2.79	3.38	3.82	3.61	3.11	2.51	41.83
Rolla School of Mines	2.21	2.21	3.17	3.81	4.94	5.64	3.12	3.94	3.76	3.69	2.85	2.12	41.46
Hermann	2.03	1.75	2.88	3.79	4.56	4.81	2.82	3.53	3.76	3.23	2.88	1.81	37.85
Union 1SE	2.12	1.95	3.02	3.75	4.45	4.30	3.37	3.31	3.56	3.12	2.63	1.94	37.52

Source: U.S. Department of Commerce, Weather Bureau, Climatological Data, Missouri, Annual Summary, 1960 Vol. 64, No. 13, Asheville, 1961

Employment and Income

Economically the Meramec Basin can be divided into three subregions: (1) St. Louis and adjacent Jefferson County, a suburban, essentially non-agricultural area on the east; (2) the urbanized Lead Belt in St. Francois County on the south; and (3) the large, non-urbanized remainder of the basin, with agricultural development in the north fraying out into forest wilderness on the south. Even in this remainder, however, agriculture is not the main support of the majority of the population.

Principal occupations

Table 2 presents employment by categories together with percentage employed, for the counties wholly or partly in the basin for 1950, inasmuch as 1960 data were not available even in late 1961. Details by location can be read from this table and Figure 9. Thus the non-agricultural character of St. Louis, Jefferson, and St. Francois County is apparent with only about 2%, 12%, and 10% respectively of the labor force employed in agriculture, even in 1950. The remainder is typified by the central counties of Washington, Crawford, and Franklin which have agricultural percentages of 30%, 39%, and 24% respectively.

A reasonably typical allocation of employment for this remainder of the basin would produce the following combinations:

Primary:	Agriculture	30%
Secondary:	Mining, Construction & Manufacturing	30%
Tertiary:	Services (Retail trade, etc.)	40%
	Total	100%

If one allocates the tertiary or service employment of 40% to the essentially basic or export employment a reasonable order of magnitude result would give: 10% to agriculture, 15% to mining and manufacturing, and 15% to other services. Manufacturing is allocated 15% of tertiary because of the higher income and purchasing power in this sector; services themselves are allocated only 15%, probably somewhat of an undercounting. Adding these percentages gives approximately the following indication of the relative, basic importance of the three different sectors

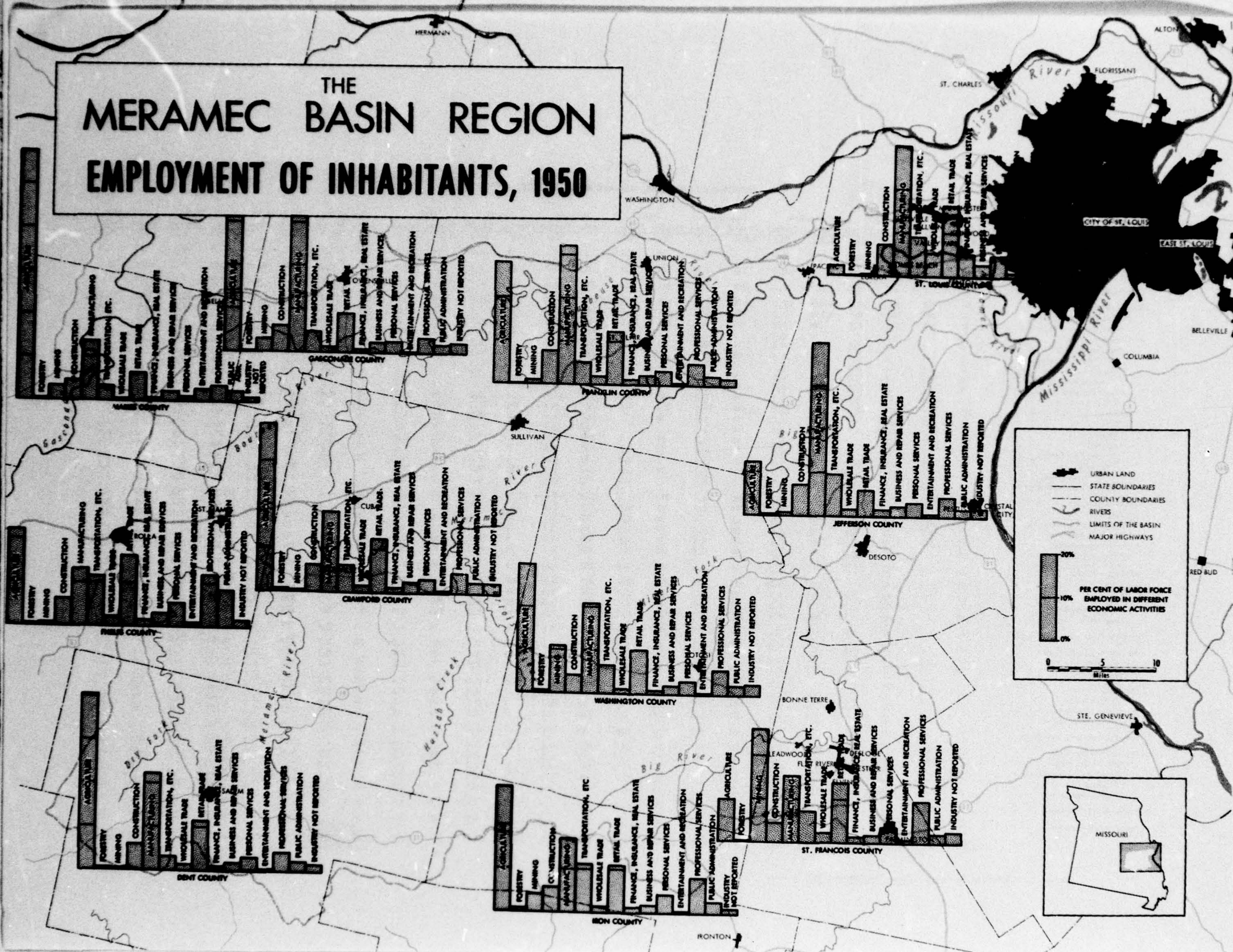
Table 2

EMPLOYMENT STRUCTURE, MERAMEC BASIN COUNTIES, 1950

	Crawford Number	Crawford Percent	Dent Number	Dent Percent	Franklin Number	Franklin Percent	Gasconade Number	Gasconade Percent	Iron Number	Iron Percent	Jefferson Number	Jefferson Percent
Agriculture	1,449	38.6	1,626	40.4	3,323	23.8	1,606	31.1	798	28.7	1,664	12.2
Forestry	26	0.7	20	0.5	10	0.1	5	0.1	23	0.8	2	0.1
Mining	10	0.3	18	0.4	123	0.9	156	3.0	118	4.2	90	0.7
Construction	230	6.1	231	5.8	1,081	7.7	309	6.0	161	5.8	970	7.1
Manufacturing	691	18.4	896	22.3	4,497	32.1	1,619	31.3	472	17.0	5,475	40.0
Durable Manufacturing	326	8.7	347	8.6	1,150	8.2	177	3.4	354	12.7	4,148	30.3
Furniture, lumber, wood	214	5.7	291	7.2	126	0.9	24	0.5	301	10.8	109	0.8
Primary metal	3	0.1			15	0.1			7	0.3	445	3.3
Fabricated metal	4	0.1	24	0.6	50	0.4	4	0.1	5	0.2	263	1.9
Machinery (ex. elec.)	78	2.1	6	0.1	189	1.4	13	0.3	9	0.3	124	0.9
Electrical machines	3	0.1	4	0.1	30	0.2	1	0.1	2	0.1	69	0.5
Motor vehicles & equip.	6	0.2	4	0.1	278	1.9	3	0.1	10	0.4	117	0.9
Transportation (ex. motor)	4	0.1	3	0.1	32	0.2	13	0.3	4	0.1	53	0.4
Other durable	14	0.4	15	0.1	430	3.1	119	2.3	16	0.6	2,968	21.7
Nondurable Manufacturing	365	9.7	549	13.7	3,347	23.9	1,442	27.9	118	4.2	1,327	9.7
Food	29	0.8	35	8.7	160	1.1	36	0.7	20	0.7	263	1.9
Textiles			3	0.1	138	1.0	2	0.1			18	0.1
Apparel	103	2.7	237	5.9	209	1.5	40	0.8	59	2.1	138	1.0
Printing, publishing	25	0.7	14	0.1	74	0.5	22	0.4	13	0.5	109	0.8
Chemicals	22	0.6	2	0.1	20	0.1	31	0.6	1	0.1	86	0.6
Other nondurable	181	4.8	250	6.2	2,732	19.5	1,308	25.3	24	0.9	698	5.1
Not Specified Manufacturing	5	0.1	8	0.2	14	0.1	3	0.1	1	0.1	15	0.1
Transportation, etc.	234	6.2	126	3.1	712	5.1	243	4.7	312	11.2	1,314	9.6
Railroads	58	1.5	10	0.2	244	1.7	49	0.9	161	5.8	713	5.2
Trucking and warehousing	75	2.0	65	1.6	177	1.3	66	1.3	59	2.1	197	1.4
Other transportation	29	0.8	15	0.4	83	0.6	53	1.0	27	1.0	95	0.7
Telecommunications	25	0.7	10	0.2	90	0.6	29	0.6	19	0.7	109	0.8
Utility and sanitary	47	1.2	26	0.6	118	0.8	46	0.9	46	1.7	200	1.5
Wholesale Trade	58	1.5	51	1.3	277	2.0	63	1.2	40	1.4	200	1.5
Retail Trade	462	12.3	459	11.4	1,720	12.29	463	9.0	304	10.9	816	6.0
Food	65	1.7	82	2.0	314	2.2	87	1.7	65	2.3	352	2.6
Eating and drinking	127	3.4	75	1.9	417	2.5	96	1.9	57	2.1	353	2.6
Other retail	270	7.2	302	7.5	989	7.1	280	5.4	182	6.5	1,011	7.4
Finance, Insurance, Real Estate	46	1.2	37	0.9	167	1.2	37	0.7	35	1.3	220	1.6
Business and Repair Service	91	2.4	72	1.8	322	2.3	121	2.3	51	1.8	317	2.3
Business service	13	3.5	4	0.1	33	0.2	3	0.1	5	0.2	56	0.4
Repair service	78	2.1	68	1.7	289	2.1	118	2.3	46	1.7	261	1.9
Personal Service	121	3.2	124	3.1	464	3.3	135	2.6	119	4.3	442	3.2
Private household	42	1.1	52	1.3	192	1.4	52	1.0	49	1.8	170	1.2
Hotels and lodging	27	0.7	20	0.5	74	0.5	14	0.3	28	1.0	60	0.4
Other personal service	52	1.4	52	1.3	198	1.2	69	1.3	42	1.5	212	1.6
Entertainment and Recreation	25	0.7	21	0.5	66	0.5	11	0.2	10	0.4	83	0.6
Professional Services	173	4.6	172	4.3	692	5.0	183	3.5	227	8.2	627	4.6
Medical and health	21	0.6	29	0.7	199	1.4	32	0.6	63	2.3	159	1.2
Educational, government	112	3.0	104	2.6	277	2.0	88	1.7	93	3.3	247	1.8
Education, private	9	0.2	9	0.2	93	0.7	26	0.5	26	0.9	74	0.5
Other professional	31	0.8	30	0.7	123	0.9	37	0.7	45	1.6	147	1.1
Public Administration	95	2.5	97	2.4	301	2.2	100	1.9	77	2.8	279	2.0
Industry Not Reported	41	2.5	70	1.7	239	1.7	114	2.2	36	1.3	284	2.1
Total	3,752	100.0	4,020	100.0	13,994	100.0	5,165	100.0	2,783	100.0	13,683	100.0

	Maries Number	Maries Percent	Phelps Number	Phelps Percent	Reynolds Number	Reynolds Percent	St. Francois Number	St. Francois Percent	St. Louis Number	St. Louis Percent	Washington Number	Washington Percent
Agriculture	1,497	57.5	1,484	22.0	1,091	49.8	1,099	9.7	3,590	2.3	1,097	29.6
Forestry	5	0.2	34	0.5	25	1.1	1	0.1	25	0.1	20	0.5
Mining	83	3.2	44	0.7	1	0.1	2,934	26.0	255	0.2	408	11.0
Construction	117	4.5	416	6.2	86	3.9	494	4.4	11,307	7.2	155	4.2
Manufacturing	358	13.7	893	13.2	372	17.0	1,712	15.2	47,142	30.1	765	20.7
Durable Manufacturing	44	1.7	148	2.2	349	15.9	275	2.4	26,924	17.2	370	10.0
Furniture, lumber, wood	24	0.9	81	1.2	328	15.0	109	1.0	1,187	0.8	271	7.3
Primary metal	10	0.4	11	0.2	1	0.1	31	0.3	2,130	1.4	11	0.3
Fabricated metal	1	0.1	1	0.1	2	0.1	15	0.1	3,480	2.2	37	1.0
Machinery (ex. elec.)	1	0.1	30	0.4	2	0.1	18	0.2	4,311	2.8	7	0.2
Electrical machines	1	0.1			1	0.1	6	0.1	5,786	3.7	4	0.1
Motor vehicles & equip.	3	0.1	4	0.1	3	0.1	20	0.2	3,335	2.1	13	0.4
Transportation (ex. motor)			1	0.1	4	0.2	8	0.1	3,126	2.0	5	0.1
Other durable	4	0.2	20	0.3	8	0.4	68	0.6	3,569	2.3	22	0.6
Nondurable Manufacturing	314	12.1	741	11.0	23	1.1	1,437	13.0	20,218	12.9	368	10.0
Food	4	0.2	69	1.0	3	0.1	171	1.5	4,767	3.1	30	0.8
Textiles			1	0.1	1	0.1	32	0.3	560	0.4	1	0.1
Apparel	10	0.4	150	2.2	2	0.1	252	2.2	2,792	1.8	4	0.1
Printing, publishing	7	2.7	43	0.6	7	0.3	67	0.6	3,389	2.2	9	0.2
Chemicals	6	2.3	6	0.1	10	0.5	9	0.1	3,347	2.1	2	0.1
Other nondurable	285	10.9	474	7.0			897	8.0	4,794	3.1	344	9.3
Not Specified Manufacturing	2	0.1	2	0.1			9	0.1	569	0.4	5	0.1
Transportation, etc.	85	3.3	435	6.4	108	4.9	805	7.1	14,280	9.1	239	6.5
Railroads	13	0.5	169	2.5	5	0.1	348	3.1	4,146	2.7	143	3.9
Trucking and warehousing	37	1.4	95	1.4	36	1.7	120	1.1	2,324	1.5	47	1.3
Other transportation	6	2.3	65	1.0	27	1.2	62	0.5	2,197	1.4	13	0.4
Telecommunications	8	0.3	53	0.8	21	1.0	84	0.7	2,774	1.8	13	0.4
Utility and sanitary	21	0.8	53	0.8	19	0.9	191	1.7	2,839	1.8	23	0.6
Wholesale Trade	8	0.3	144	2.1	18	0.8	254	2.3	8,511	5.4	41	1.1
Retail Trade	167	6.4	1,094	16.2	201	9.2	1,543	13.7	25,690	16.4	375	10.1
Food	24	0.9	203	3.0	38	1.7	375	3.3	5,022	3.2	117	3.2
Eating and drinking	30	1.2	296	4.4	36	1.7	270	2.4	3,204	2.1	79	2.1
Other retail	113	4.3	595	8.8	127	5.8	898	8.0	17,464	11.2	179	4.8
Finance, Insurance, Real Estate	16	0.6	94	1.4	8	0.4	159	1.4	8,267	5.3	29	0.8
Business and Repair Service	54	2.1	201	3.0	37	1.7	187	1.7	4,366	2.8	74	2.0
Business service	2	0.1	29	0.4	1	0.1	22	0.2	2,184	1.4	5	0.1
Repair service	52	2.0	172	2.6	36	1.7	165	1.5	2,182	1.4	69	1.9
Personal Service	25	1.0	367	5.4	43	2.0	403	3.6	7,655	4.9	110	3.0
Private household	11	0.4	103	1.5	18	0.8	109	1.0	4,200	2.7	56	1.5
Hotels and lodging	2	0.1	121	1.8	14	0.6	39	0.3	634	0.4	15	0.4
Other personal service	12	0.5	143	2.1	11	0.5	255	2.3	2,821	1.8	39	1.0
Entertainment and Recreation	7	2.7	66	1.0	2	0.1	95	0.8	1,564	1.0	7	0.2
Professional Services	93	3.6	807	11.9	103	4.7	1,083	9.6	14,507	9.3	211	5.7
Medical and health	7	2.7	108	1.6	10	0.5	482	4.3	4,947	3.2	18	0.5
Educational, government	56	2.2	535	7.9	78	3.6	410	3.6	2,728	1.7	130	3.5
Education, private	14	0.5	53	0.8			52	0.5	2,888	1.9	19	0.5
Other professional	16	0.6	111	1.6	15	0.7	139	1.2	3,944	2.5	44	1.2
Public Administration	63	2.4	573	8.5	60	2.7	242	2.1	6,893	4.4	80	2.2
Industry Not Reported	27	1.0	107	1.6	34	1.6	292	2.6	2,474	1.6	93	2.5
Total	2,605	100.0	6,759	100.0	2,189	100.0	11,304	100.0	156,516	100.0	3,704	100.0

Source: U. S. Bureau of the Census, Census of Population, 1950, Missouri


THE
MERAMEC BASIN REGION
EMPLOYMENT OF INHABITANTS, 1950
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
PER CENT OF LABOR FORCE EMPLOYED IN DIFFERENT ECONOMIC ACTIVITIES
20%
10%
0%
0
5
10
Miles
MISSOURI
AGRICULTURE
FORESTRY
MINING
CONSTRUCTION
MANUFACTURING
TRANSPORTATION, ETC.
WHOLESALE TRADE
RETAIL TRADE
FINANCE, INSURANCE, REAL ESTATE
BUSINESS AND REPAIR SERVICES
PERSONAL SERVICES
ENTERTAINMENT AND RECREATION
PROFESSIONAL SERVICES
PUBLIC ADMINISTRATION
INDUSTRY NOT REPORTED
MARIES COUNTY
GASCONADE COUNTY
FRANKLIN COUNTY
ST. LOUIS COUNTY
JEFFERSON COUNTY
PHELPS COUNTY
CRAWFORD COUNTY
WASHINGTON COUNTY
DENT COUNTY
IRON COUNTY
ST. FRANCOIS COUNTY
HERMANN
ALTON
FLORISSANT
ST. CHARLES
WASHINGTON
UNION
SULLIVAN
CUBA
ROLLA
SALEM
CITY OF ST. LOUIS
EAST ST. LOUIS
BELLEVILLE
COLUMBIA
RED BUD
DESOTO
BONNE TERRE
LEADWOOD
STE. GENEVIEVE
IRONTON
Missouri River
Mississippi River
Big River
Meramec River
Huzzah Creek
Dry Fork

of the economy as supports of the population:

Agriculture	40%
Mining and Manufacturing	45%
Services	15%

This procedure, if anything, overstates slightly agriculture's contribution which comes out to 40% and understates all other activities which account for about 60% of basic support even in these traditionally agricultural counties. For 1960 agriculture's share would be still lower if data were available. This is not to minimize the importance of agriculture, but simply to show the change even in these rural counties by 1950 over the time, some decades past, when agriculture was the overwhelming basic support. If one includes St. Louis, Jefferson, and St. Francois counties which have more than half the population, agriculture's basic share of course dwindles to a very small part of the total employment support of the basin. Details of the agricultural, forest, mining, industrial, and service support of the basin's economy will be found in the chapters on these topics which follow, as well as indications of tourist potential.

Income

Average income in the basin, outside the St. Louis suburbs, is relatively low, reflecting characteristics common to agricultural or depressed mining areas (Table 3). Incomes generally range from less than one-third to two-thirds those for St. Louis County or City. Here again the only reliable data are for 1950. Data for 1960 would probably indicate an even greater contrast, particularly in the Lead Belt where depressed mining has produced much unemployment.

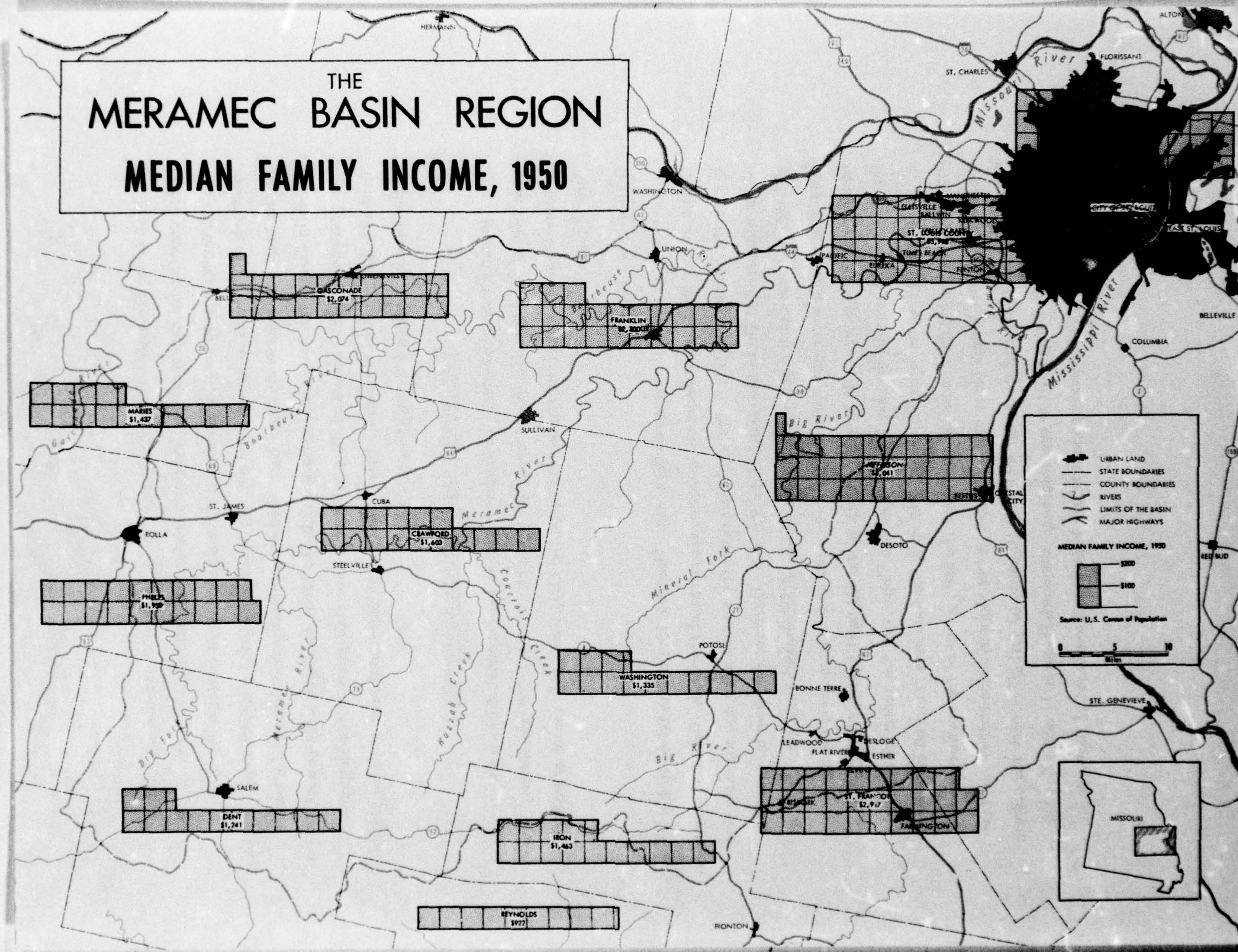
In Table 3 and Figure 10 the lowest incomes are farthest out in the basin in the poorer agricultural areas without industry. Thus Reynolds County, mostly outside the basin, with average family income of $922, has less than half the income of Franklin County near the center. Urban and non-farm incomes are only slightly higher than total incomes, reflecting in part the general interrelated character of the economy of each county. Unemployment is also rather high -- being over 6%

Table 3

Income Data: Families and Unrelated Individuals, 1950, Meramec Basin Counties

County	% of Total with Income Less than $1,000	Median Income ($)	
		Total Population	Urban & Non-farm Population
Crawford			
1) Families & unrel. ind.	36.2%	$1,367	$1,392
2) Families	29.7	1,603	
Dent			
1) Families & unrel. ind.	44.8	1,089	1,449
2) Families	40.8	1,241	
Franklin			
1) Families & unrel. ind.	25.3	2,080	2,250
2) Families	19.3	2,300	
Gasconade			
1) Families & unrel. ind.	30.2	1,747	2,092
2) Families	22.4	2,074	
Iron			
1) Families & unrel. ind.	42.8	1,196	1,404
2) Families	34.6	1,463	
Jefferson			
1) Families & unrel. ind.	19.1	2,797	2,947
2) Families	13.4	3,041	
Maries			
1) Families & unrel. ind.	40.6	1,254	1,750
2) Families	33.6	1,437	
Phelps			
1) Families & unrel. ind.	35.6	1,400	1,476
2) Families	22.3	1,959	
Reynolds			
1) Families & unrel. ind.	55.1	845	899
2) Families	51.8	922	
St. Francois			
1) Families & unrel. ind.	22.1	2,635	2,708
2) Families	16.0	2,917	
St. Louis County			
1) Families & unrel. ind.	13.3	3,628	3,661
2) Families	6.5	3,998	
St. Louis City (outside basin)			
1) Families & unrel. ind.	18.2	2,718	2,718
2) Families	10.7	3,205	
Washington			
1) Families & unrel. ind.	44.5	1,112	1,280
2) Families	37.8	1,335	

Source: U.S. Bureau of the Census, Census of Population, 1950, Missouri


THE
MERAMEC BASIN REGION
MEDIAN FAMILY INCOME, 1950
GASCONADE
$2,074
FRANKLIN
MARIES
$1,437
PHELPS
$1,959
CRAWFORD
$1,603
JEFFERSON
WASHINGTON
$1,335
DENT
$1,241
IRON
$1,463
ST. FRANCOIS
$2,917
REYNOLDS
$927
HERMANN
WASHINGTON
UNION
PACIFIC
EUREKA
FENTON
ST. CHARLES
FLORISSANT
ALTON
BELLEVILLE
COLUMBIA
SULLIVAN
CUBA
STEELVILLE
ST. JAMES
ROLLA
SALEM
POTOSI
BONNE TERRE
DESOTO
LEADWOOD
FLAT RIVER
DESLOGE
ESTHER
FARMINGTON
IRONTON
STE. GENEVIEVE
RED BUD
Missouri River
Mississippi River
Meramec River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
Bourbeuse River
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
MEDIAN FAMILY INCOME, 1950
$200
$100
Source: U.S. Census of Population
0
5
10
Miles
MISSOURI

in 1961 in St. Francois, Washington, and Franklin Counties and thus qualifying these counties for depressed area assistance under the Depressed Areas Act of 1961. Unemployment would be still higher if many workers did not commute the long distance to St. Louis to work. St. Francois, Washington, and some adjacent counties in the Lead Belt outside the basin have filed an application and program for assistance. Franklin County has been working on one. In the latter case temporary unemployment was presumably high because of the closing of a large shoe plant in Washington, Missouri, just north of the basin. Dent County, a strongly rural area was also eligible under certain provisions for assistance.

Transportation and Metropolitan Relationships

In many ways, as noted, the biggest factor in the Meramec Basin is the proximity of St. Louis and its metropolitan influences of 2,000,000 population. The transportation pattern of the region focuses on the city, whether in routes or traffic flow (Figures 11 and 12).

Railroads and highways

Two main line railroads serve the basin. The main line of the Frisco to the southwest runs through the heart of the northern portion of the basin, the main passenger line of the Missouri Pacific to the southwest skirts the eastern edge, and the main line of the Missouri Pacific to the west follows the lower Meramec and then turns to the Missouri just north of the basin running westward. A few branch lines also serve the basin including a secondary main freight line of the Rock Island along the northern boundary and the newly built 26-mile branch of the Missouri Pacific from Cadet on the east central edge to the new iron mine at Pea Ridge near the center of the basin.

Highways also focus on St. Louis, including the four lane Route 66 (new Interstate 44) paralleling the Frisco and serving as the main street of the northern part of the basin along its famous ridge route. Several other highways also radiate out from St. Louis to the south and southwest including Highway 67 just off or near the eastern edge which also is being built to superhighway standards (Figures 11 and 12). The least served area is the sparsely populated zone south and southwest of Highway 30,

Figure 11

MERAMEC BASIN: RAILWAYS AND HIGHWAYS

(SEE FRONTISPIECE MAP)

between Highway 66 and Highway 21. If extensive mining and recreation development occur in this zone a new highway in the future may be called for to the southwest between Routes 66 and 21.

Local roads, in most of the parts of the Meramec Basin which are sparsely populated, are fewer and poorer than elsewhere as would be expected, but in most instances are reasonably adequate to serve the population. Some secondary hard surfaced roads actually have lighter traffic than in other more populous localities. Most local roads, and the larger part of the total mileage of roads, are not hard surfaced. Their surfaces vary from crushed rock to natural gravel. Even the poorest roads are generally all-weather because of the stony nature of the soil. In the extensive hilly areas the roads follow the ridges and have largely supplanted the unsatisfactory tracks along stream beds used by wagons some 50 years ago.[2] However most of these local ridge routes are winding and roundabout, with long driveways necessary to serve farms based on the only available fertile land in the narrow stream bottoms characteristic of much of the southern two-thirds of the basin. These roads also utilize either fords or inexpensive, low-water "hog trough" bridges to cross many streams. Local transportation thus is difficult in these areas, although most of the country is accessible. Roads are gradually being improved, and with increased recreation and forestry in many areas, will need to be improved more. Table 4 indicates mileage of rural roads (exclusive of state highways) and percentages of mileage meeting "design" or "tolerable" standards as defined by the State Highway Department (see Table 4 for definitions) for selected counties. Most Meramec counties appear to be close to average conditions of a sample of 50 Missouri counties studied.

Relation to St. Louis

The existing improved highways bring the area close to St. Louis. The highway travel time map, especially made for this report from numerous field trips by the staff, graphically illustrates the nearness of the basin to St. Louis (Figure 13). Note

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[2] Cf. Carl Sauer, The Geography of the Ozark Highlands of Missouri, The Geographic Society of Chicago, Bulletin No. 7, University of Chicago Press, 1920.

Table 4

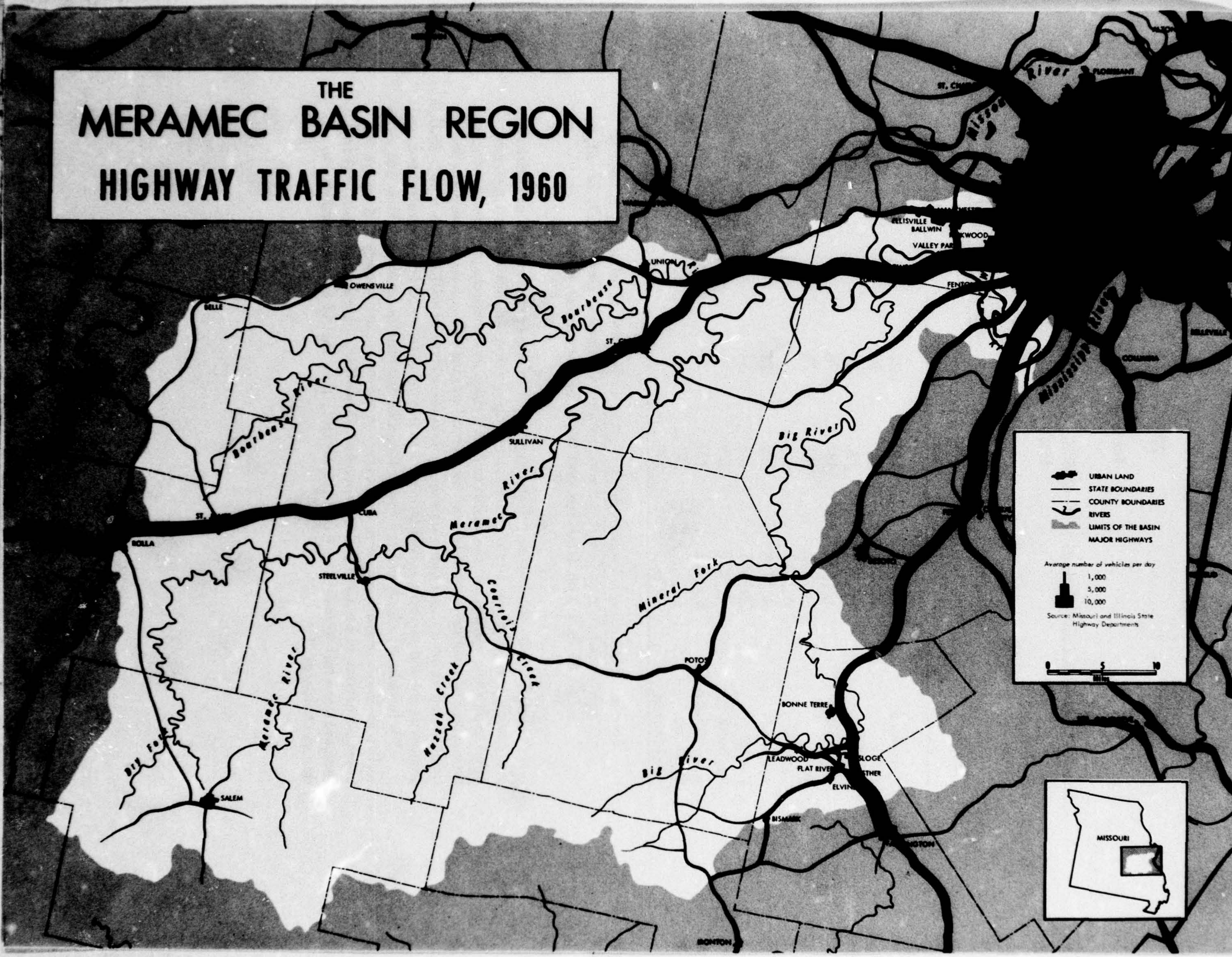
RURAL ROAD MILEAGE AND STANDARDS, SELECTED MERAMEC BASIN COUNTIES
1960

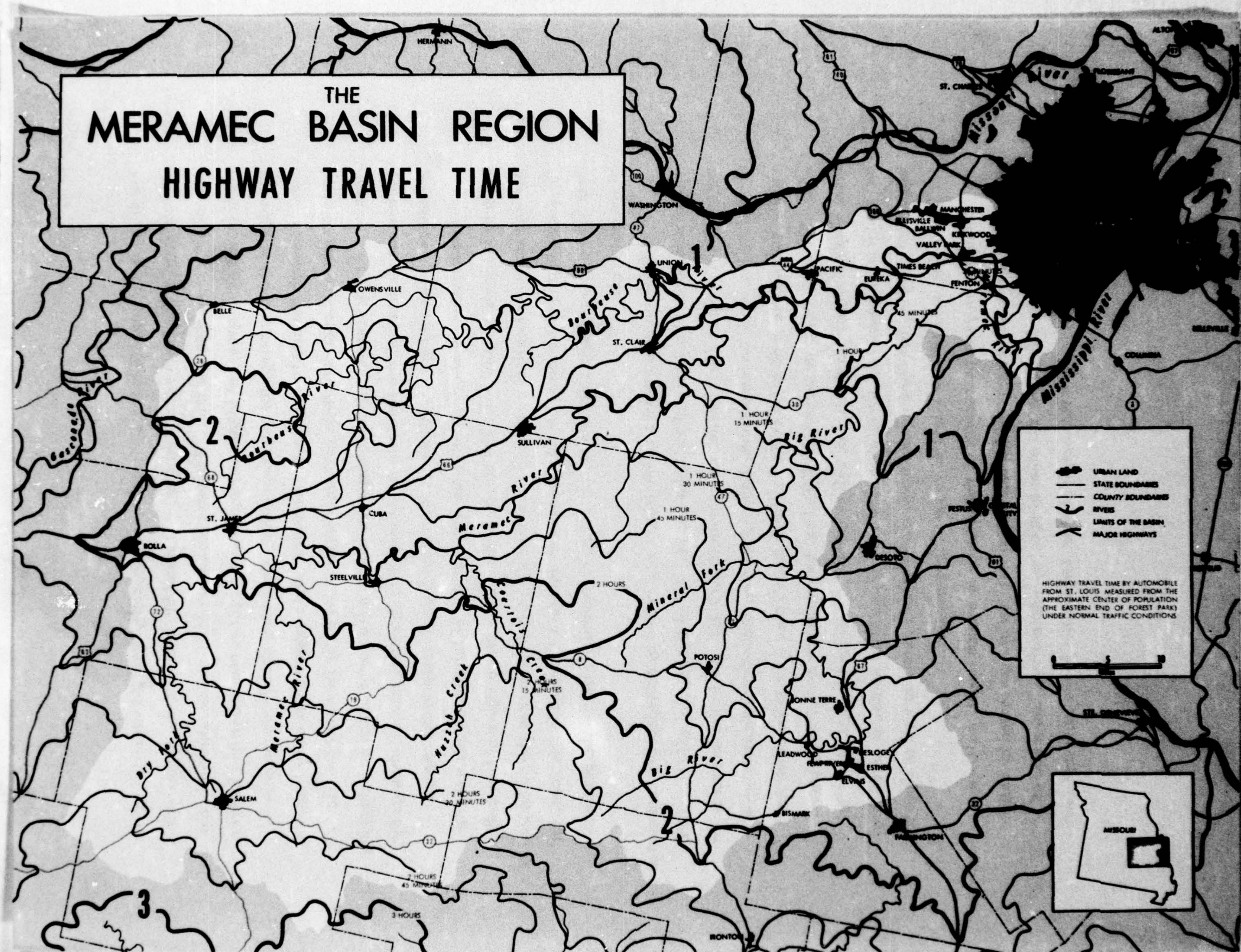
County	Assessed Valuation ($1,000)	Rural Road Miles	Percent of Rural Road Miles[a] Below Design	Percent of Rural Road Miles[a] Below Tolerance
Crawford	15,796	460	78	56
Dent	10,187	515	90	90
Franklin	69,909	726	81	60
Gasconade	17,662	431	76	31
Iron	9,535	202	73	59
Jefferson	90,589	601	n.d.	
Maries	8,990	322	86	57
Phelps	28,315	466	64	53
Reynolds	3,431	379	n.d.	
St. Francois	60,992	293	n.d.	
St. Louis	1,364,151	391	n.d.	
Washington	17,690	298	n.d.	

Source: Financing Missouri's Road Needs, University of Missouri, School of Business and Public Administration, Columbia, Dec. 1960, 27-28, 40 (based on State Tax and Highway Commission data).

[a]As defined by the Missouri State Highway Department: Both sets of standards are based upon judgment and experience of Engineering Advisory Committees and other highway engineers in the counties. "...Design standards embrace the necessary physical features to provide as safe a road as possible commensurate with the anticipated volume, speed and vehicle characteristics that will use the road. Design standards are the criteria to which a road section should build or be constructed.

Tolerable standards are the lower limits of the road geometrics which can carry traffic at lower operating speeds and with less safety and efficiency. They are the base geometrics to be met for the movement of traffic imposed upon them. When road sections fail to meet the lower geometrics, they should be reconstructed to design standards."


THE
MERAMEC BASIN REGION
HIGHWAY TRAFFIC FLOW, 1960
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
Average number of vehicles per day
1,000
5,000
10,000
Source: Missouri and Illinois State Highway Departments
0
5
10
MISSOURI
OWENSVILLE
BELLE
SULLIVAN
CUBA
ROLLA
STEELVILLE
SALEM
POTOSI
BONNE TERRE
LEADWOOD
FLAT RIVER
ELVINS
BISMARK
ELLISVILLE
BALLWIN
VALLEY PARK
FENTON
COLUMBIA
Meramec River
Bourbeuse River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
Mississippi River
Missouri River

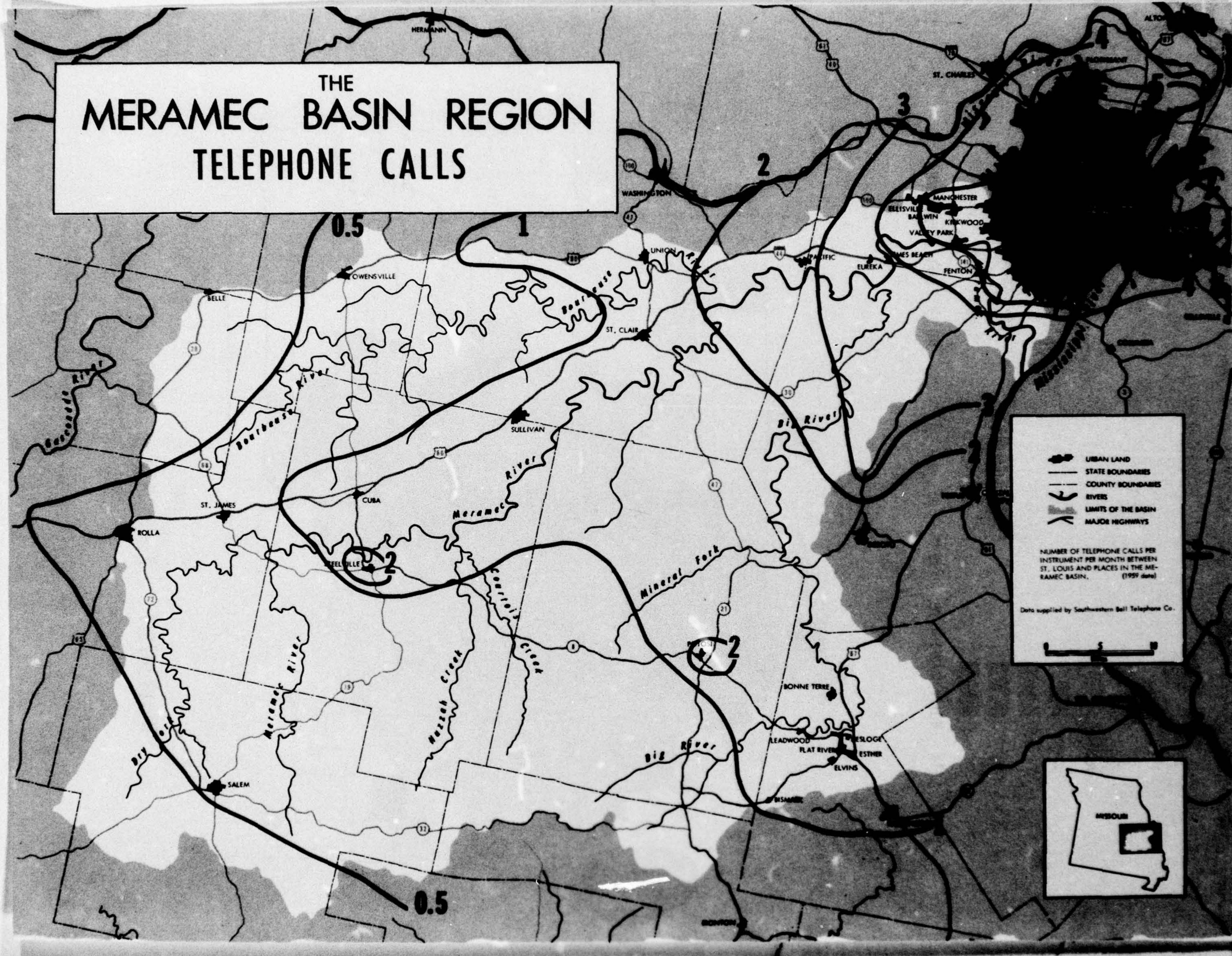

THE
MERAMEC BASIN REGION
HIGHWAY TRAVEL TIME
HERMANN
WASHINGTON
OWENSVILLE
BELLE
UNION
PACIFIC
EUREKA
MANCHESTER
VALLEY PARK
KIRKWOOD
TIMES BEACH
FENTON
ST. CLAIR
SULLIVAN
ST. JAMES
CUBA
ROLLA
STEELVILLE
POTOSI
BONNE TERRE
LEADWOOD
ELVINS
ESTHER
BISMARK
FARMINGTON
SALEM
DESOTO
FESTUS
COLUMBIA
Meramec River
Big River
Mineral Fork
Huzzah Creek
Dry Fork
Mississippi River
Missouri River
45 MINUTES
1 HOUR
1 HOUR 15 MINUTES
1 HOUR 30 MINUTES
1 HOUR 45 MINUTES
2 HOURS
2 HOURS 15 MINUTES
2 HOURS 30 MINUTES
2 HOURS 45 MINUTES
3 HOURS
1
2
3
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
HIGHWAY TRAVEL TIME BY AUTOMOBILE FROM ST. LOUIS MEASURED FROM THE APPROXIMATE CENTER OF POPULATION (THE EASTERN END OF FOREST PARK) UNDER NORMAL TRAFFIC CONDITIONS
MISSOURI

the effect of the superhighways on travel time, especially Route 66 which brings the western edge of the basin within two hours of central St. Louis and the center within only slightly more than one hour. The suburbanization of St. Louis, especially the rapid recent development of large outlying shopping centers and industrial plants on the edge of the city brings the city even closer, since they obviate the need for driving through the city to downtown. Commuters and shoppers move daily from the basin to jobs or shopping to these outlying centers. Car pools for commuters are common. At Christmastime special busses are even run from some of the new shopping centers many miles out into the basin to accommodate shoppers, most of whom go by private car. The city and its influences have been brought close to the region.

Another measure of urban influence is the number of telephone calls from the basin to St. Louis (Figure 14). The Bureau of the Census uses a figure of four calls per instrument per month as a measure for determining whether an area should be part of the census metropolitan area. Note that most of the basin lies outside this zone, but does have a two or three call density, reflecting an exurban, satelite characteristic of the metropolis.

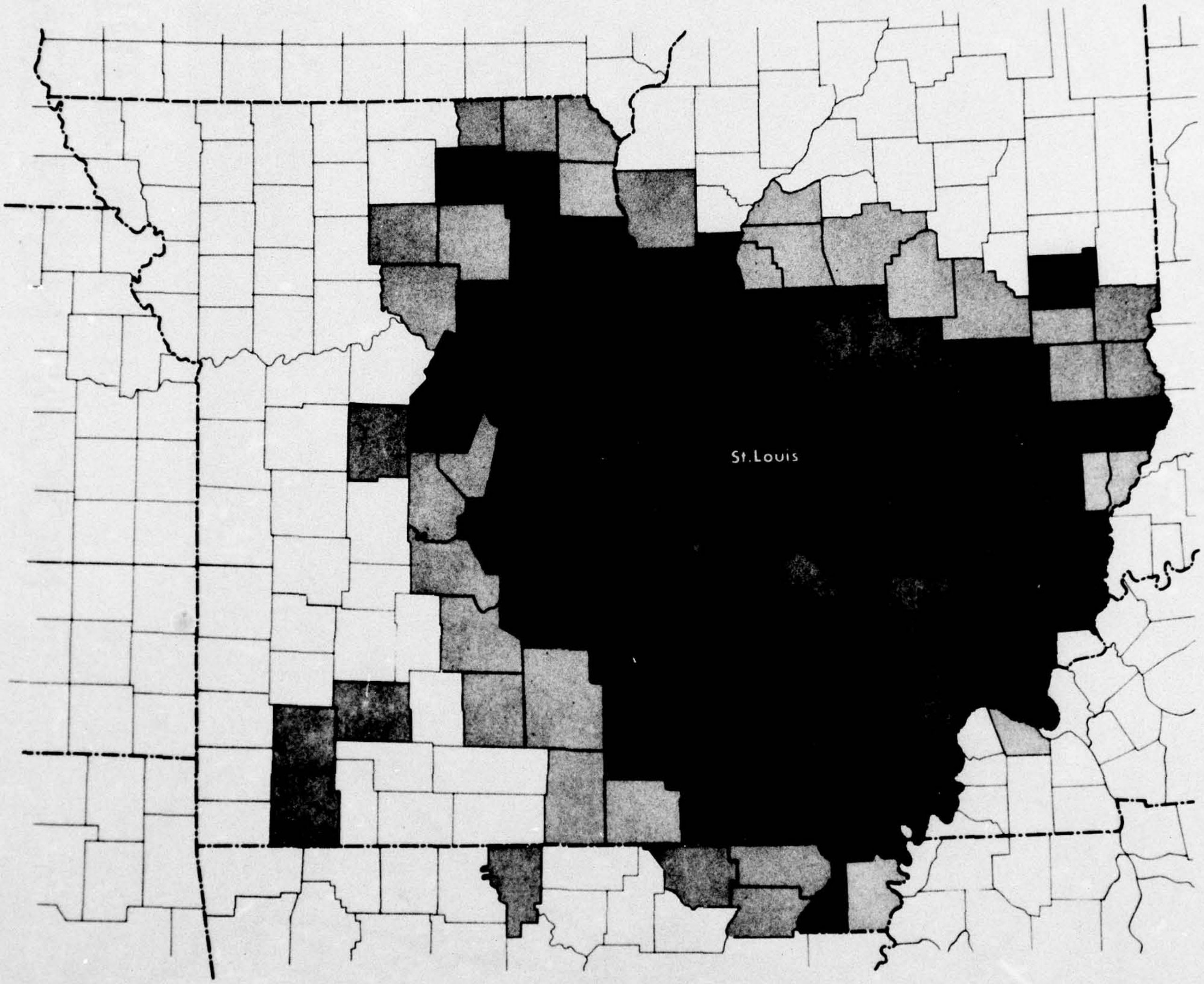
A still less intense measure on the fringes is provided by an especially constructed map of newspaper circulation of St. Louis papers. All of the basin clearly lies within the St. Louis orbit on this quantitative measure (Figure 15). Still other measures -- of wholesaling, bank correspondents, branch factories, and other indicators -- all clearly indicate the area to be in the St. Louis trade zone. Numerous other ties exist: St. Louis residents own much of the land for recreation and other purposes, local citizens migrate to the city as well as using its facilities for medical, social, and business purposes. The towns of the basin also serve local needs, as noted in a subsequent chapter, but since all the towns are relatively small, as well as close to St. Louis, they provide only a limited range of specialties.

St. Louis in years past served as the gateway to a much larger, multi-state area in the southwest, which still has many economic ties as represented by head offices of railroads, telephone and other companies, wholesaling, and a host of specialized services. With the growth of other large cities in the south and south-


THE
MERAMEC BASIN REGION
TELEPHONE CALLS
0.5
1
2
3
0.5
HERMANN
WASHINGTON
ST. CHARLES
MANCHESTER
ELLISVILLE
BALDWIN
KIRKWOOD
VALLEY PARK
FENTON
EUREKA
PACIFIC
UNION
OWENSVILLE
BELLE
ST. CLAIR
SULLIVAN
CUBA
ST. JAMES
ROLLA
STEELVILLE
SALEM
BONNE TERRE
LEADWOOD
FLAT RIVER
DESLOGE
ESTHER
ELVINS
BISMARCK
Bourbeuse River
Meramec River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
Gasconade River
Mississippi River
MISSOURI
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
NUMBER OF TELEPHONE CALLS PER INSTRUMENT PER MONTH BETWEEN ST. LOUIS AND PLACES IN THE MERAMEC BASIN. (1959 data)
Data supplied by Southwestern Bell Telephone Co.

ST. LOUIS NEWSPAPER CIRCULATION

1960



COMBINED CIRCULATION OF:

DAILY POST-DISPATCH

SUNDAY POST-DISPATCH

DAILY GLOBE DEMOCRAT

SUNDAY GLOBE DEMOCRAT

INDEX OF CIRCULATION PER CAPITA

.75 -.50

.50 -.25

.25 - .10

.10 - .01

.01 -.001

west, however, St. Louis lost much of this business as the other metropolises reached sufficient size to perform such services. St. Louis, however, still serves as the gateway to the Ozarks, much of which is one of the least developed areas in eastern United States. Development in the basin and adjacent areas therefore affects St. Louis, since it looks to the city for so much of its business and other connections.

Population

Population of the basin as a whole is about 210,000, with almost half in the St. Louis suburbs (St. Louis and Jefferson counties) and the remaining half scattered over the basin (Figure 16). Detailed figures and many characteristics of the population will be found in Figures 5-12.

Recent trends

As noted, population beyond St. Louis suburbs in the basin is rather sparse and on the outer margins is either static or declining, in common with most rural areas. However, the basin generally is unlike the rural areas of the state in this regard.

Most Meramec Basin counties, including all those close to St. Louis, gained in population between 1950 and 1960, (Table 5 and Figure 17). This gain ran sharply against the trend for Missouri as a whole, where 88 counties lost and only 26 gained, although the state as a whole gained about 8%. Further examination reveals that of the 26 counties that gained, eight were contiguous to St. Louis (St. Louis, Jefferson, Franklin, Crawford, St. Francois in the basin, and St. Charles, Lincoln and Warren to the north and west), five adjacent to Kansas City, one contained Springfield, six had state schools or military installations, such as Columbia, Fort Leonard Wood, or Rolla, leaving only six not accounted for by proximity to metropolitan areas or with some state, educational, or federal military institutions.

Three of these remaining six, however, were counties in which large, actively used artificial lakes had been developed, Camden and Miller counties on Lake of the Ozarks, and Taney County with Lake Taneycomo and parts of Bull Shoals and Table Rock. In all of these counties active recreational development over a number of years has occurred which undoubtedly reversed the normal population decline in

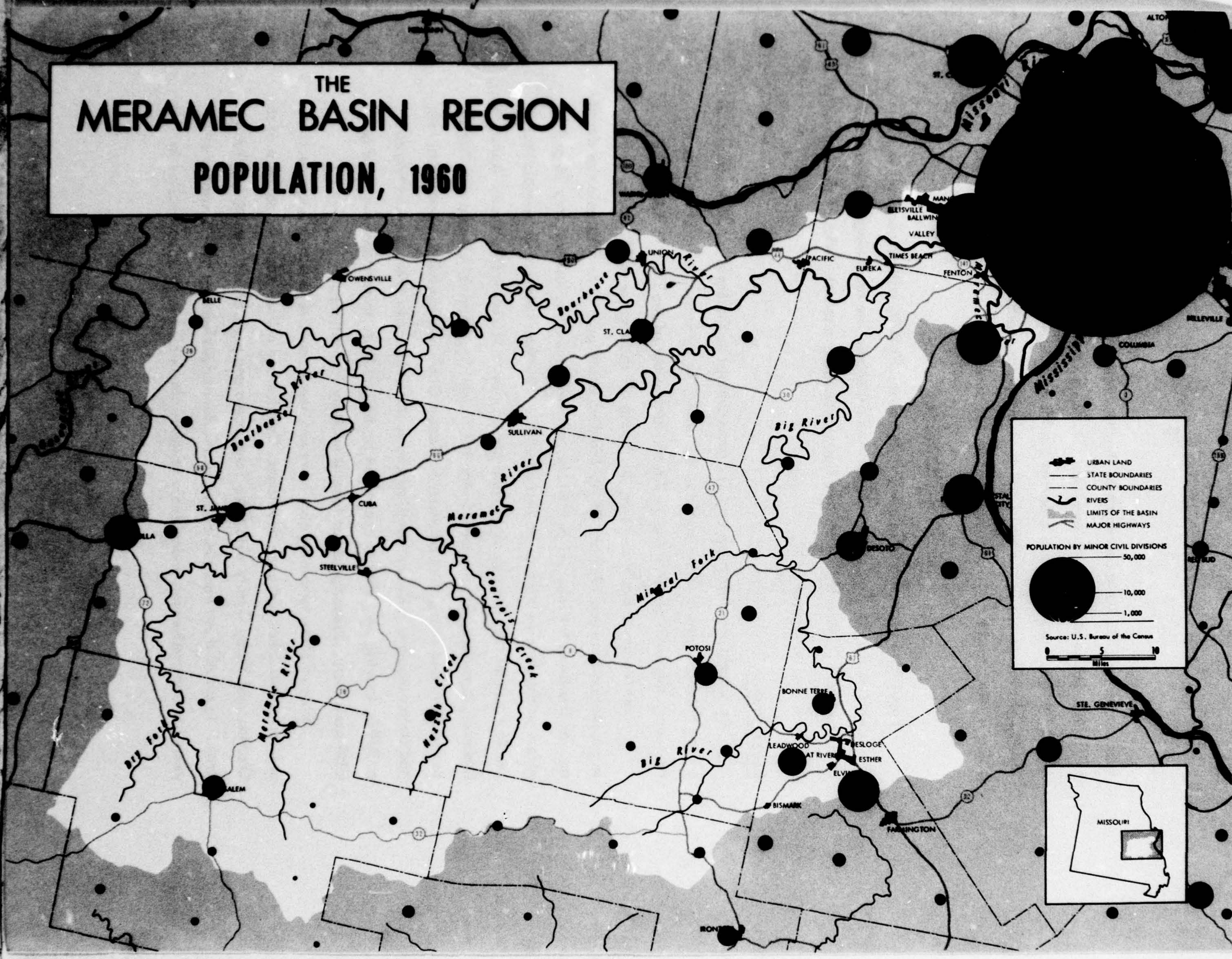

THE
MERAMEC BASIN REGION
POPULATION, 1960
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
POPULATION BY MINOR CIVIL DIVISIONS
50,000
10,000
1,000
Source: U.S. Bureau of the Census
0
5
10
Miles
MISSOURI
OWENSVILLE
BELLE
UNION
PACIFIC
EUREKA
TIMES BEACH
FENTON
VALLEY
BALLWIN
ST. CLA
SULLIVAN
CUBA
STEELVILLE
POTOSI
BONNE TERRE
LEADWOOD
DESLOGE
ESTHER
BISMARK
FARMINGTON
DESOTO
COLUMBIA
BELLEVILLE
STE. GENEVIEVE
Meramec River
Bourbeuse River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Big Fork
Missouri
Mississippi

Table 5

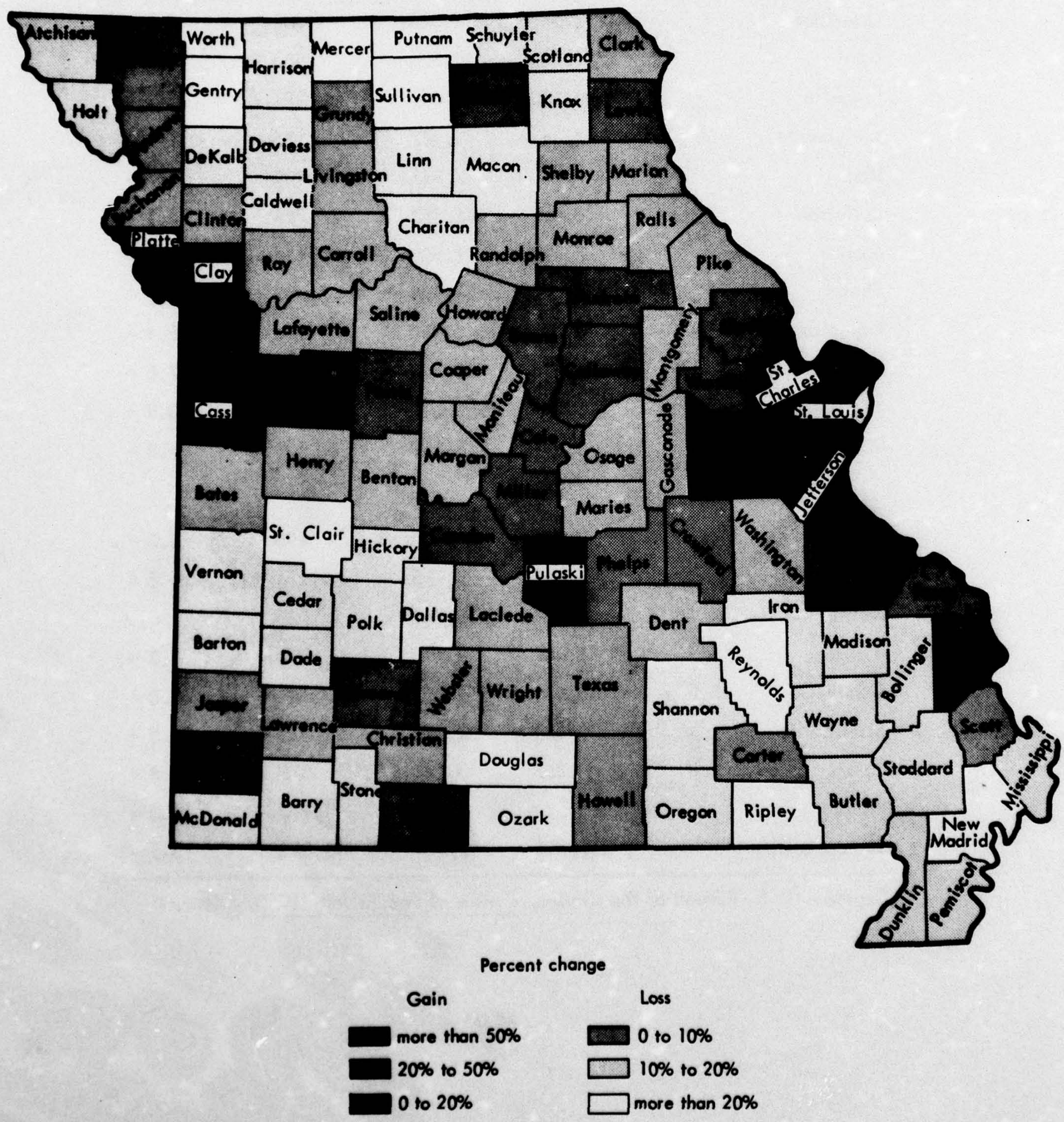
Population Change, 1950-1960
Meramec Basin and Selected Counties, Missouri

	1950	1960	Gain + or Loss -	% Gain + or Loss -
Crawford	11,615	12,576	961 +	8.3 +
Dent	10,936	10,378	558 -	5.1 -
Franklin	36,046	44,367	8,321 +	23.1
Gasconade	12,342	12,167	175 -	1.4 -
Iron	9,458	7,977	1,481	15.7 -
Jefferson	38,007	65,801	27,794 +	73.1 +
Maries	7,423	7,269	154 -	2.1 -
Phelps	21,504	25,196	3,692 +	17.2 +
Reynolds	6,918	5,090	1,828 -	26.4 -
St. Francois	35,276	36,206	930 +	2.6 +
St. Louis County	406,349	694,010	287,661 +	70.8 +
Washington	14,689	14,130	559 -	3.8 -
Other Missouri Counties				
Benton	9,080	8,630	450 -	5.0 -
Camden	7,861	8,985	1,124 +	14.3 +
Miller	13,734	13,749	15 +	.01+
Morgan	10,207	9,413	794 -	7.8 -
Ozark	8,856	6,752	2,104 -	23.8 -
St. Charles	29,834	52,671	22,837 +	76.5 +
Taney	9,863	10,140	277 +	2.8 +
Wayne	10,514	8,521	1,993 -	19.0 -
St. Louis City	856,796	740,424	116,372	13.6 -

Source: U. S. Bureau of the Census, Census of Population, 1960, Missouri

Figure 17

POPULATION CHANGE IN MISSOURI COUNTIES, 1950-1960



Missouri's rural counties, in spite of flooding of some agricultural land. Proximity to a metropolitan area, an impoundment or special installation provided most of the exception to general decline of Missouri county populations, with the Meramec Basin apparently reflecting proximity to St. Louis. If a reservoir or reservoirs are built in the future this too apparently will still further arrest the decline or cause growth. Figure 18, showing population trends by townships in the Meramec Basin, shows the same increase in suburban and near suburban areas to St. Louis, and a progressive decline generally to the outer edges of the basin.

Selected characteristics

Several other characteristics of the population, particularly the age structure, also reflect proximity to St. Louis, or characteristics of more remote rural counties. Thus St. Louis and Jefferson counties have the lowest percentages over age 65, about 7%, in contrast to about 14% for most other basin counties (Table 7). To a much lesser degree the same counties had a higher percent under 18, reflecting their suburban character. The reverse for most of the remaining counties -- high percentage over 65 as well as rather high percentage under 18 -- is related to the low incomes of these counties, since such persons are more generally outside the labor force. This age-population composition thus correlates with the low incomes and relatively depressed character of the rural counties. It is both a cause and an effect, since larger proportions of the productive labor force have migrated out of these counties, many to St. Louis. The change in median age between 1950 and 1960 accentuates the difference. Thus St. Louis and Jefferson County average has declined from 31.4 to 30.2 down to 29.6 to give these counties the lowest average, except for Phelps County on the western edge, where Rolla, the largest town in the basin outside St. Louis suburbs, and the seat of the Missouri School of Mines as well as several governmental agencies, provides a special situation not duplicated elsewhere. Figures for towns and cities above 2500 (Table 8) indicate much the same situation as in their counties.

Particularly revealing is the map of population over 65 by townships prepared for this report (Figure 19). This shows in greater detail the gradient outward from

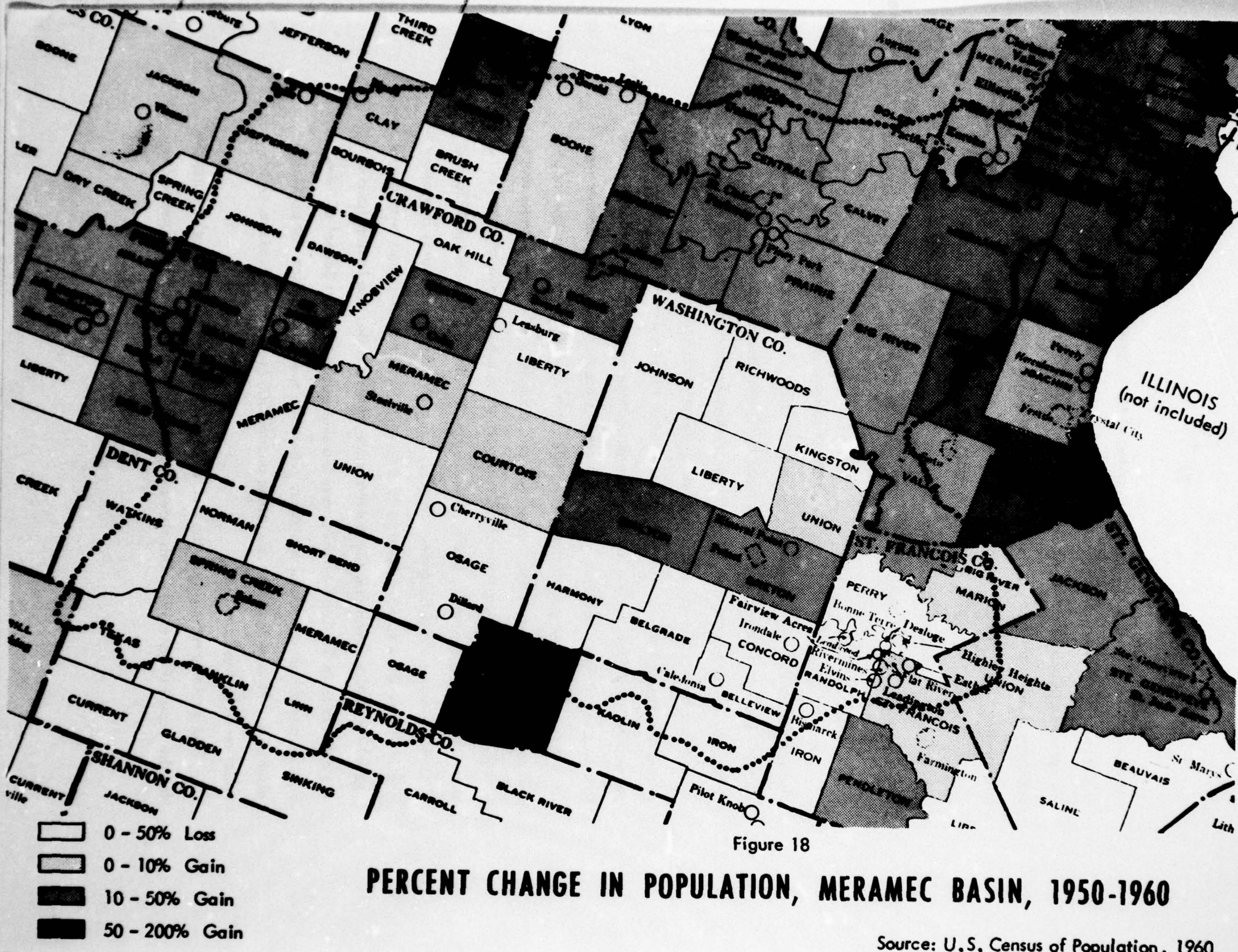


Figure 18

PERCENT CHANGE IN POPULATION, MERAMEC BASIN, 1950-1960

Source: U.S. Census of Population, 1960

Table 6

POPULATION: INCREASE, FERTILITY, PERCENT NON-WHITE AND MALE 1960, MERAMEC BASIN AND STATE

	Number	Percent Increase 1950-60	Percent Non-White	Fertility Ratio[1]	Per Cent Male Over 18
State	4,319,813	9.2	9.2	484	47.8
Urban	2,876,557	13.2	12.5	478	46.2
Rural	1,443,256	-5.2	2.6	500	50.9
St. Louis Met. Area	2,060,103	19.8	14.5	512	46.7
Meramec Counties					
Crawford	12,647	3.9	0.1	548	49.5
Dent	10,445	-4.5	- -	460	48.4
Franklin	44,566	23.6	1.2	551	49.2
Gasconade	12,195	-1.2	- -	438	49.3
Iron	8,041	-15.0	0.6	468	48.2
Jefferson	66,377	74.6	1.3	590	49.6
Maries	7,282	-1.9	- -	519	51.4
Phelps	25,396	13.1	1.0	523	54.9
Reynolds	5,161	-25.4	0.2	462	49.5
St. Francois	36,516	3.5	0.5	453	47.4
St. Louis County	703,532	73.1	2.8	518	47.5
Washington	14,346	-2.3	1.0	612	50.1

Source: U. S. Bureau of the Census, Census of Population, 1960, Missouri

[1] Children under 5 yrs. old per 1,000 women 15 to 49 yrs. old.

Table 7

AGE OF POPULATION, MERAMEC BASIN COUNTIES AND STATE, 1960, AND MEDIAN AGE 1950 AND 1960

	Percent Under 18	Percent 18 to 64	Percent 65 & older	Median Age 1960	Median Age 1950
State	33.8	54.6	11.7	32.6	31.6
Urban	33.1	56.0	10.9	33.1	31.5
Rural	35.1	51.8	13.1	31.6	31.8
St. Louis Met. Area	35.3	55.5	9.3	30.5	32.5
Meramec Counties					
Crawford	35.2	49.2	15.6	33.8	31.7
Dent	32.6	51.0	16.4	36.7	32.1
Franklin	36.1	52.1	11.8	30.6	32.2
Gasconade	31.0	53.3	15.7	38	34.6
Iron	35.3	49.2	15.4	33.2	27.5
Jefferson	40.5	51.8	7.7	29.6	30.3
Maries	36.5	50.9	12.6	31	30.2
Phelps	32.7	56.8	10.5	26	29.5
Reynolds	38.0	48.2	13.9	32.8	25.8
St. Francois	33.7	52.6	13.6	34	31.5
St. Louis County	37.8	55.3	7.0	29.7	31.4
Washington	42.6	46.7	10.7	33.4	34.1

Source: U. S. Bureau of the Census, Census of Population, 1960, Missouri

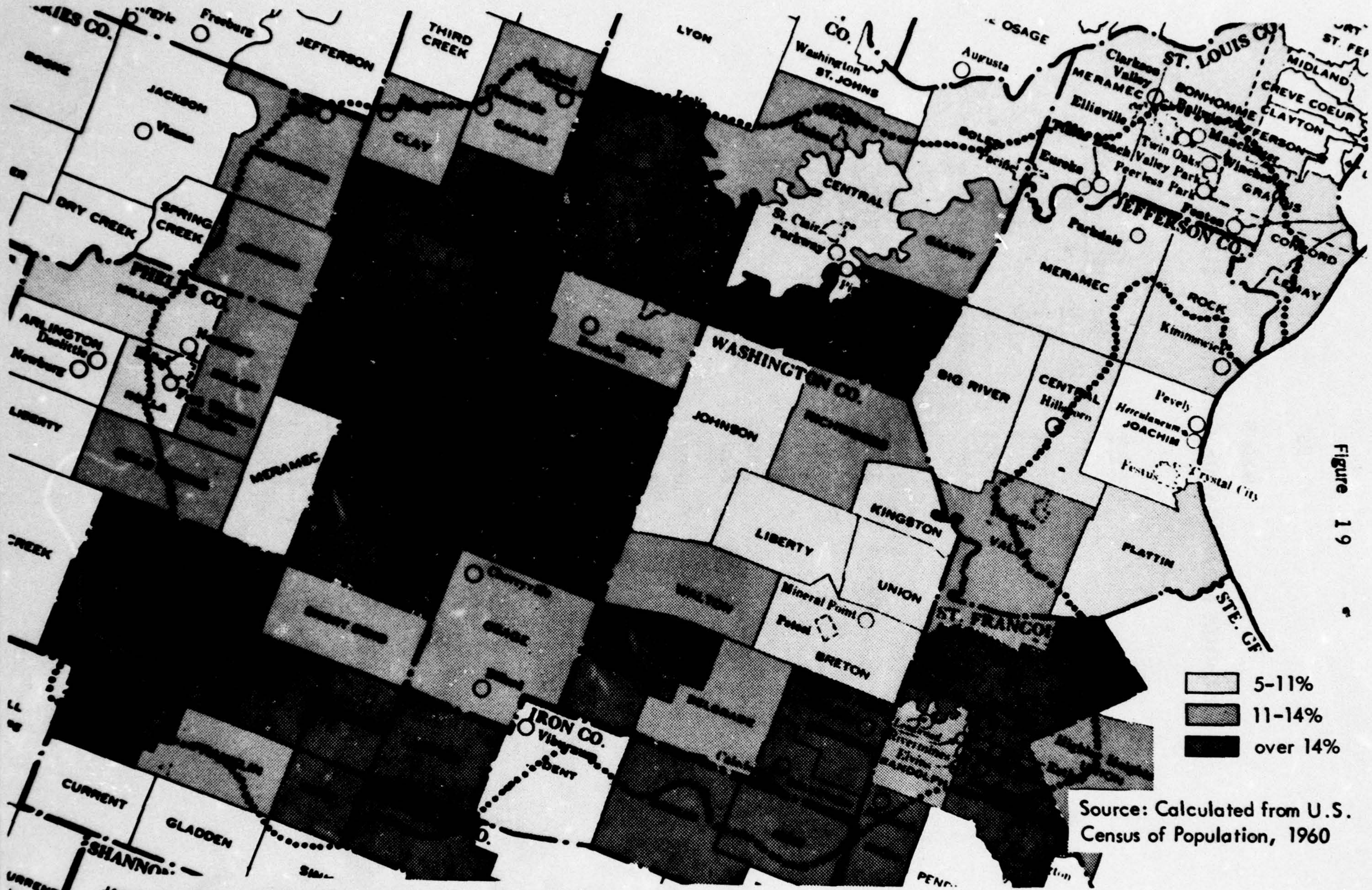
Table 8

HOUSEHOLDS MERAMEC BASIN COUNTIES AND STATE, 1960

	Number	Percent Increase 1950-60	Population Per Household
State	1,359,826	13.4	3.09
Urban	922,575	23.3	3.04
Rural	437,251	-3.0	3.21
St.Louis Met.Area	624,641	23.4	3.23
Meramec Counties			
Crawford	4,122	17.0	3.05
Dent	3,486	5.3	2.98
Franklin	13,483	25.2	3.29
Gasconade	4,030	5.5	3.01
Iron	2,440	-3.7	3.20
Jefferson	18,580	67.0	3.53
Maries	2,199	4.0	3.31
Phelps	7,521	23.5	3.13
Reynolds	1,559	-16.1	3.31
St. Francois	10,973	11.4	3.11
St. Louis County	198,483	73.5	3.49
Washington	3,966	1.6	3.60

Source: U. S. Bureau of the Census, Census of Population, 1960, Missouri

Figure 19



PERCENTAGE OF POPULATION AGE 65 AND OVER, MERAMEC BASIN 1960
(by townships)

the city. Thus the suburban townships around St. Louis have by far the lowest percentage over 65, reflecting the young families living in houses raising young children characteristic of suburbs. This pattern pushes out into Franklin County to merge into intermediate categories and finally into generally the more remote, agricultural townships or the depressed Lead Belt mining area where the percentage over 65 is three times that in the suburbs. The younger, working age groups have moved out. The major exception to this gradient rule is provided by northern Washington County, somewhat far out to be classed as a suburb. This area does coincide with the emptiest, least agricultural portion of the whole basin. This characteristic may well mean that there are very few farms or small towns to which retired people can retreat and the sparse population is otherwise engaged in mining, forestry, or commuting.

Other characteristics will be found in the tables. Most of the population is native born of English, German, and French origins. Non-white is negligible. (Table 6 and Table 9).

Population projections and predictions

Population trends since 1920 and projections or estimated predictions of population for the year 2000 have been made, for whole counties in the basin (Table 10) for the portions of the counties in the Meramec Basin (Table 11) and towns and localities within the basin (Table 12). The smaller the area covered naturally, the less reliable is the estimate of future population, since exactly where development will take place is subject to more uncertainty than for larger regions. Thus the individual estimates for localities are only order of magnitude guesses. They have, however, been made in order to provide some basis for planning future needs, such as adequacy of underground water supplies, etc.

For all areas straight projections are indicated, but any realistic prediction must modify these so that predictions are also presented. The firmest of such modifications and the most necessary is in future suburban areas -- St. Louis and Jefferson counties in particular. Merely projecting the trends for all of St. Louis

Table 9

SUMMARY OF POPULATION CHARACTERISTICS FOR URBAN PLACES OVER 2,500 IN MERAMEC BASIN, 1960

Area	Population								Households		
	All Persons							18 Years Old and Over			
	Number	Percent Increase, 1950 to 1960	Percent Non-White	Percent Under 18 Yrs. Old	Percent 18 to 64 Years Old	Percent 65 Yrs. And Over	Fertility Ratio[a]	Percent Male	Number	Percent Increase 1950 to 1960	Population Per Household
Bonne Terre	3,219	-8.9	1.1	32.8	50.6	16.6	442	46.4	1,081	2.1	2.94
*Brentwood	12,250	63.2	5.4	34.3	59.6	6.1	482	46.5	3,854	85.3	3.17
*Clayton	15,245	-4.9	1.5	22.6	63.2	14.1	247	42.9	5,273	7.4	2.70
*Crystal City	3,678	5.1	5.4	33.3	58.7	8.0	396	47.6	1,180	14.6	3.12
*De Soto	5,804	8.3	2.4	36.5	51.2	12.3	519	47.9	1,795	6.3	3.21
*Festus	7,021	35.0	5.3	39.1	52.5	8.4	532	46.6	2,096	35.7	3.34
Flat River	4,515	-14.9	-	31.4	54.9	13.7	453	46.2	1,547	-5.8	2.89
Kirkwood	29,421	57.8	3.2	38.5	54.1	7.5	471	46.7	8,293	56.1	3.50
Pacific	2,795	40.8	5.1	36.8	53.8	9.4	529	49.0	844	44.0	3.30
Potosi	2,805	18.9	3.8	38.0	51.7	10.2	522	46.9	885	22.9	3.17
Rolla	11,132	19.0	1.7	27.3	64.2	8.4	500	60.0	3,260	26.5	2.94
St. Clair	2,711	52.4	-	36.7	51.8	11.5	526	47.3	889	53.3	3.05
Salem	3,870	7.2	-	28.8	51.9	19.3	440	45.1	1,443	21.3	2.64
Sullivan	4,098	35.7	0.1	35.6	51.6	12.8	506	46.5	1,336	35.6	3.04
Union	3,937	35.0	0.5	36.4	52.8	10.8	550	46.2	1,218	33.0	3.21
Valley Park	3,452	16.8	1.3	39.3	53.0	7.7	596	51.3	906	18.0	3.67
*Washington	7,961	16.2	1.0	34.8	54.8	10.4	560	47.1	2,435	19.7	3.24

[a]Children under 5 years old per 1,000 women 15 to 49 years old.

Source: U. S. Bureau of the Census, Census of Population, 1960, Missouri

*Outside basin.

Table 10

POPULATION PROJECTIONS AND ESTIMATES, MERAMEC BASIN COUNTIES (1,000's)

Counties	Previous Populations			Gain or Loss		Estimated Population year 2000			
	1920	1950	1960	% Gain 1920-60	% Gain 1950-60	Based on rate 1920-60	Based on rate 1950-60	Adjusted median corrected for proximity to St. Louis and/or some new mining	Adjusted high corrected for additional recreation, forestry, mining, etc.
	a	b	c	d	e	f	g	h	i
Crawford	12.4	11.6	12.5	+0.8	+7.8	12.6	16.9	25	35
Dent	12.3	11	10.3	-1.9	-6.4	10.1	7.9	15	25
Franklin	28	36	44	+57.1	+22.2	69.1	98.1	110	130
Gasconade	12	12.3	12.2	+1.6	-0.8	12.4	11.8	12	20
Iron	9.5	9.5	8	-15.8	-15.8	6.7	4.0	10	20
Jefferson	27	38	66	+144.4	+73.3	161.3	595.3	250-350	250-350
Maries	9.5	7.4	7.3	-23.2	-1.3	5.6	6.9	7*	10
Phelps	15	21.5	25	+66.7	+16.3	41.7	45.8	40	50
Reynolds	10	7	5	-50	-28.6	2.5	1.3	5*	10
St. Francois	31	35	36	+16.1	+2.9	41.8	40.3	35	40
St. Louis Co.	100	406	700	+600	+72.4	4900	6181	1400-1600	1400-1600
Washington	13.8	14.7	14.1	+2.1	-4.1	14.4	12	20	30
Total	280.5	578.5	940.4	235.2	62.5	5278.3	7021.3	1930-2230	2030-2320
St. Louis-Jefferson	127	444	766	503.1	72.5	5061.3	6776.3	1650-1950	1650-1950
Except St. Louis-Jefferson	153.5	134.5	174.4	13.6	29.7	216.9	245	280	370

Totals rounded.

* = Minimum figure which is arbitrarily high to avoid depopulating county.

Note: Estimates for St. Louis and Jefferson Counties based on close to 100% increase of estimated population for all Metropolitan St. Louis to almost 4,000,000 in 2000, with following allocations; East Side (Illinois) 1,000,000, West Side almost 3,000,000 (St. Louis City 700,000-800,000 [little increase], St. Charles County 350,000-450,000).

The St. Louis SMA estimate for the year 2000 is 4,000,000, based on data from two sources. The U.S. Senate Select Committee on National Water Resources, Water Resources Activities in the United States: Population Projections and Economic Assumptions, (Committee Print No. 5, Washington, D.C., March, 1960, p.20) estimates a range of 3,400,000 to 5,700,000. An estimate of 3,600,000 is made by Jerome Pickard, Metropolitanization of the United States, (Urban Land Institute Research Monograph No. 2, Washington, D.C., 1952, p.92).

Table 11

POPULATION PROJECTIONS AND ESTIMATES FOR PORTIONS OF COUNTIES IN MERAMEC BASIN (1,000's)

Counties	1950	1960	% in Mer. Basin of total 1950 County pop.	% in Mer. Basin of total 1960 County pop. (Estimate)	% Gain 1950-60 (Estimate)	Estimated Population year 2000: Based on rate 1920-60	Based on rate 1950-60	Adjusted Median (Corrected for proximity to St. Louis and/or some new mining	Adjusted High (Corrected for additional recreation, forestry, mining, etc.
	(1)	(2)	(3)	(4)	(5)	(6*)	(7**)	(8)	(9)
Crawford	11.6	12.5	100	100	+7.6	12.6	16.8	25	35
Dent	8.6	9.0	78.2	87.4	+4.7	8.8	10.7	12	22
Franklin	21.0	26.0	58.3	59.1	+23.8	40.9	61.1	75	90
Gasconade	2.5	2.5	20.3	20.8	0	2.5	2.5	3	6
Iron	1.5	1.5	15.8	18.8	0	1.3	1.5	5	8
Jefferson	11.0	28.0	28.9	42.4	+154.5	68.4	1174.6	200-300	200-300
Maries	1.8	2.0	24.3	27.4	11.1	1.5	3.0	2	3
Phelps	16.1	20.0	74.9	80.0	+24.2	33.3	38.4	35	40
Reynolds	.1	.1	1.4	2.0	0	.5	.1	negligible	negligible
St. Francois	25.0	25.0	71.4	69.4	0	29.0	25.0	25	27
St. Louis Co.	30.0	60-80	7.4	8.7-11.5	+100-166.7	426-563	960-4047.2	200-300	200-300
Washington	14.7	14.1	100.0	100.0	-4.1	14.4	12.0	20	30
Total	143.9	200.7-220.7	24.9	21.5-23.6	39.5-53.4	640-776	2306-5393	600-800	660-860
St. Louis-Jefferson	41.0	88-108	9.23	11.6-14.2	114.6-163.4	495-632	2135-5221	400-600	400-600
Except St. Louis-Jefferson	102.9	112.7	15.7	9.9-9.4	9.5	144.4	171.2	200	260

* Based on rate for whole county 1920-60 (Col. f, Table 10 x percent in Meramec Basin in 1960 (Col. 4, Table 11)

** Based on percent gain 1950-60 in Col. 5 $(1 + g)^4$ x 1960 Population (Col. 2).

Totals rounded.

Table 12

POPULATION ESTIMATES OF PORTIONS OF COUNTIES IN MERAMEC BASIN AND MAJOR TOWNS

	Actual 1960*	Estimated Population 2000*: Adjusted Median (Corrected for proximity to St. Louis and/or some new mining)	Estimated Population 2000*: Adjusted High (Corrected for additional recreation, forestry, mining, etc.)
Crawford	12.5	25	35
Bourbon		3	10
Cuba	1.6	5	15
Steelville	1.1	5	15
Dent	9.0	12	22
Salem	3.8	10	20
Franklin	26.0	75	90
Sullivan (also Crawford Co.)	4.0	20	30
St. Clair	2.7	10	20
Pacific-Gray Summit	2.8**	10	20
Union	3.9	15	25
Gasconade	2.5	3	6
Owensville (whole town including part outside Basin)	2.4	5	10
Iron	1.5	5	8
Viburnum		3	8
Jefferson	28	200-300	200-300
(Whole of northern Jefferson County to have suburban or semi-suburban density by 2000 as far as Hillsboro and Cedar Hill)			
Hillsboro Area (partly outside Basin)		15	30
Cedar Hill Area		15	30
Maries	2	2	3
Phelps	20	35	40
Rolla (partly outside Basin)	11	20	35
St. James	2.3	5	10
Reynolds	.1	negligible	
St. Francois	25	25	27
Flat River-Bonne Terre and suburbs	7.7***	25	30
St. Louis County	60-80	200-300	200-300
(Whole of St. Louis County to have suburban density by 2000)			
Washington	14.1	20	30
Potosi	2.7	5	10

* 1960 population of towns for city limits only, generally 30-60% less than actual built-up area. Where no 1960 figure is given population is less than 1,000. Population estimates for 2000 cover whole built-up area.

** Pacific only.

*** Flat River-Bonne Terre city limits only; whole area c. 20,000+

County, for example, would fill up the whole county at a very unlikely high density. The procedure, therefore, for these counties was to allocate estimated population for all Metropolitan St. Louis as made by other estimates noted on the tables, assuming spread of population at approximately the same density as today. Conversely for one or two small rural counties a small arbitrary figure was estimated so that population would not be zero from extending present trends.

For most of the basin the estimates were modified on the basis of development and proximity to St. Louis. Two estimates are thus made: (1) a "median" estimate based on relative proximity to St. Louis and/or new mining or other development; and, (2) a "high" estimate corrected for additional development related to mining, recreation, forestry and other factors. Prospects for these activities are examined in subsequent chapters and applied to the detailed analysis of population predictions presented. These predictions thus are in a sense a measure of possible economic development and anticipated change. They are, of course, only estimates, since no one can predict the future, especially when a long way off. Population predictions resemble weather predictions: the nearer in time, the more certain. However water and other facilities are amortized over a 50-year period, so some estimates are required, and a best guess is better than none.

The estimated predictions for 2000 thus call for a total population in the basin of 600,000-860,000, a three to fourfold increase over 1960, with 400,000 to 600,000 in the basin portions of St. Louis and Jefferson counties, a four to six times increase, and 200,000-250,000, a two to two and one-half-fold increase for the remainder of the basin. For 1980 the estimates are about 350,000-550,000 for the whole basin, 200,000-350,000 for basin portions of St. Louis and Jefferson counties (based on 3,000,000 estimate for St. Louis Metropolitan Area from same sources, compared to 4,000,000 for 2000), and 150,000-200,000 for the remainder of the basin.

Economic Development and Education

Raising the standard of living and economic development is a strong objective of most, if not all, the citizens of the basin. In common with many underdeveloped or rural areas this is difficult, although distinct possibilities exist in much of the Meramec Basin. In the chapters that follow some of the prospects and desirable measures to achieve this objective are discussed including improving agriculture, forestry, mining, acquiring new industries, developing recreation, and general improvement of the natural and material environment. Nevertheless many of the younger persons will continue to leave some of the smaller towns or rural areas in the future to seek better opportunities elsewhere. Both to equip these new migrants to compete elsewhere, and to provide a better trained and more intelligent labor and managerial force at home to attract local development, requires that they be educated as well as possible.

Both the oldest and youngest age groups are relatively numerous in the rural areas of the Meramec. This, coupled with present low incomes, means that education of the young is costly, although no less necessary. How good is the present education? In common with most small town or rural areas educational services are generally poorer in the Meramec Basin than in larger cities or towns. Considerable variation exists, however, with some towns devoting more resources to the task than others.

The present study does not permit definitive assessment of the quality of the education from town to town in the basin. For 1950, however, the latest year available, the Census Bureau indicates median school year completed for St. Louis County as 10.5, and for all the remaining counties ranging from 7.1 to 8.8 -- a considerable difference (Table 13). St. Louis City had only 8.7; in this respect the lower income central city resembled the rural counties.

On the basis of other figures reported to the State Board of Education some further strong presumptions can be made. Table 14 at the end of this chapter presents numerous characteristics for the classified school systems of the basin. These serve the overwhelming portion of the school attendance, but there are some other schools not reported; generally they are even poorer in quality and smaller in size. A few one-room schools still exist in more remote parts of the basin, but we have no figures on them. Consolidation, however, has proceeded rapidly in recent years, in common with most of rural America, reflecting increased ease of access over improved highways, higher standards, and higher incomes. Considerable progress thus has been made and

Table 13

MERAMEC BASIN COUNTIES, MEDIAN SCHOOL YEARS COMPLETED
PERSONS 25 YEARS AND OVER, 1950

County	Male	Female
Crawford	8.3	8.5
Dent	8.3	8.4
Franklin	8.4	8.5
Gasconade	8.4	8.4
Iron	8.1	8.3
Jefferson	8.5	8.6
Maries	8.2	8.4
Phelps	8.8	8.6
Reynolds	8.1	8.2
St. Francois	8.5	8.8
St. Louis County	10.5	10.3
St. Louis City (outside basin)	8.7	8.7
Washington	7.1	8.2

Source: U. S. Bureau of the Census, Census of Population, 1950, Missouri

reflects real credit on the region and its citizens. Much yet remains to be done. This will not only cost money, but will require intelligence, effort, and putting aside of many local prejudices.

For the consolidated school systems (Table 14), out of about 35 high schools only 13 were classified AAA, the highest Missouri rating, (based on number of subjects offered, teacher education, and other factors) which in itself is somewhat of a minimum standard and of course no guarantee of quality or even best measure of quality. Of these 13, five were in the urbanized Lead Belt, four in St. Louis County, two (Washington and DeSoto) were outside the basin but may serve a few basin students, one was at Rolla on the western boundary, leaving only one in the remainder, Sullivan. The classifications correlate closely with the size of the town and the consequent size of the high school.

Still other conclusions can be made from the same data. Most of the high schools are too small according to some standards. If a minimum graduating class of 100 is considered desirable in order to have a reasonable curriculum and trained teachers in the various disciplines, virtually no high school in the basin qualifies save five in St. Louis County, four of which are AAA. About a third of the high schools have less than 250 total enrollment and less than 10 or 11 teachers. Small high schools can, however, provide advantages of more personal attention, especially desirable if some superior teachers are on the staff. Number of pupils per teacher varies somewhat. Surprisingly, however, many of the smaller schools out in the basin have about the same number (19 - 20 pupils per teacher), or more, as the larger, better schools in St. Louis County.

We have made a further calculation in the last column of the second half of Table 14 to arrive at local tax expenditures per pupil. Local expenditures are supplemented by state aid which partially equalizes expenditures for some of its programs but in a few cases works the other way. Basically, however, it is toward equalization, but does not go all the way. Unfortunately, we could not obtain data on the amount of state aid to all individual schools. The discrepancy for local expenditures is great, with typically more than $300 spent per pupil annually for most St. Louis County schools and about $150 in other parts of the basin -- with some of the small schools dropping below $100. By way of contrast, the annual expenditure per pupil for some of the better schools in St. Louis County outside the basin is $862 in Clayton, $457 in University City and $394 in Webster Groves. St. Louis City spends $292 per pupil.

The result is lower pay for teachers in the poorer schools and poorer facilities with a consequent lowering of the quality of education, although undoubtedly there are many dedicated teachers working at the lower rates. Turnover in some of the systems is consequently high, although some teachers stay long periods. (Which is actually better in many cases is somewhat of an open question!)

As a final note, the quality of education in most rural areas in the basin may well be lower than in the towns. In Dent County, for example, a 1961 report states: "The big problem arises when the students from the five rural school districts enter the 9th grade of the Salem Public Schools. Over six years of testing, using the Iowa Tests of Educational Development and the Stanford Achievement Tests, show the incoming rural students are, as a group, 2.5 years behind the same grade level group of the Salem Public School system." This has further implications, inasmuch as 60% of the students in the Salem High School are rural students, necessitating grouping and additional services and equipment.[3]

There are no universities in the basin proper. However, the well-known State School of Mines at Rolla, on the western edge of the basin, offers a limited general curriculum as well as extensive engineering and scientific curricula, and has an enrollment of about 3,500 students. Two private universities are in St. Louis, and Flat River has a junior college. A few technical and trade schools exist, including the small, jointly operated Lead Belt Technical School at Bonne Terre. Retraining of labor to fit new jobs in business and industry is desirable and practical programs to step this up have been suggested. Here care should be taken not to dilute the more academic or intellectual programs in existing high schools, many of which are below standard.

---

[3] "An analysis of the economic situation in Dent County, Missouri", Overall Economic Development Program, Rural Area Development Countil, Salem, Mo., 1961, p.24.

In any event the school situation illustrates one of the quandaries of less developed or semi-depressed areas. The smaller and poorer towns have poorer schools. To the extent that this handicaps the population they get farther behind. The poor get poorer and the rich get richer! Part of the solution is to consolidate some smaller high schools still more, perfectly possible in this day of good roads. In this case the benefits of a local school and a small student body and its advantages to local pride have to be weighed against the advantages of greater efficiency and a better product, and reasonable compromises arrived at.

Greater economic development which would increase the size of some communities and particularly increase the tax base would obviously also help the school systems if the funds were voted and intelligently used. Here, however, we have a cause and effect dilemma: to the extent that development takes place where the citizens are intelligent and a good school system can aid this, those towns with good schools will develop faster. At present, it is precisely the most developed towns that have the best schools. Much economic development, of course, comes from outside the local area. How to achieve development is still a mystery in many ways, especially if local conditions are poor. To repeat: even if development in a region does not occur, development of people can, and they should be equipped to prosper to the best of their abilities. Development of the individual is the first objective, as any thinking parent would agree, wherever he lives. If the brains can be kept in the local areas, so much the better for those areas. Meramec Basin towns, however, have no monopoly on losing talent. It happens to St. Louis as well.

Table 14, Part 1

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960

	AAA	AA	A	App	U	Total
Meramec Basin Districts with High Schools: Totals	13 (5 in Lead Belt) (4 in St. Louis Co.)	7	13	2	0	35
State Districts with High Schools:	100	66	331	64	2	563

State: Aver. Salary Elem.: $4,291 (Teachers)
" " High: 4,737 "
Total Aver. Salary: 4,593 "

		Classification	Assessed Valuation	Tax Levies (¢/$100 valuation)	Total School Tax	Grades
Crawford						
R-I	Bourbon	A	2,580,000	225	58,050	8-4
R-II	Cuba	A	4,041,580	205	82,852	8-4
R-III	Steelville	A	3,618,410	180	65,131	8-4
R-IV	Cherryville	App	1,850,000	170	31,450	8-4
Dent						
80	Salem(part)	A	3,775,118	320	120,804	6-3-3
Franklin						
R-VI	Pacific	AA	4,520,700	325	146,923	6-2-4
*R-XI	Union	AA	5,702,160	280	159,676	K-6-6
R-XIII	St. Clair	AA	4,962,270	320	158,793	K-8-4
C-2	Sullivan	AAA	5,077,830	295	149,796	K-8-4
*	Washington(part?)	AAA	10,699,145	165	176,536	8-4

Table 14, Part 1

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960 (continued)

		Classification	Assessed Valuation	Tax Levies (¢/$100 valuation)	Total School Tax	Grades
Gasconade						
R-II	Owensville(part)	AA	6,636,528	225	149,322	8-4
R-III	Bland(part)	A	1,509,920	360	54,357	6-2-4
Iron						
R-I	Annapolis(outside)	App	1,350,000	225	30,375	6-3-3
R-II	Arcadia Valley [Ironton] (part)	A	4,300,000	250	107,500	6-2-4
Jefferson						
R-I	Northwest [House Springs]	A	9,935,604	368	365,630	6-2-4
R-III	Hillsboro(part)	AA	4,654,566	400	186,183	6-2-4
*R-V	Herculaneum(outside)	AA	3,780,180	345	130,416	K-7-5
*R-VI	Festus(outside)	AAA	7,131,308	395	281,687	K-8-4
C-6	Fox [Arnold] (outside)	A	8,849,555	399	353,097	6-2-4
*47	Crystal City(outside)	AAA	6,613,080	310	205,005	K-8-4
*73	De Soto(part)	AAA	6,448,337	395	254,709	K-8-4
Maries						
R-I	Vienna(outside)	A	1,504,100	210	31,586	8-4
R-II	Belle(part)	A	1,552,356	280	43,466	K-8-4
Phelps						
R-I	St. James	A	4,609,367	240	110,625	K-8-4
R-II	Newburg	A	1,473,190	300	44,196	8-4
*	Rolla(part)	AAA	12,114,235	280	339,199	K-6-2-4
St. Francois						
R-V	Bismark(part)	A	2,764,590	325	89,849	6-2-4
R-VI	Doe Run (outside)	A	1,325,790	360	47,728	8-4

Table 14, Part 1

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960 (continued)

		Classification	Assessed Valuation	Tax Levies (¢/$100 valuation	Total School Tax	Grades
St. Francois (continued)						
7	Elvins	AA	3,588,985	320	114,848	K-6-6
*R-I	Bonne Terre	AAA	5,851,355	310	181,392	K-6-6
	(Also Lead Belt Technical School, joint with other towns, 7 teachers.)					
*R-III	Esther	AAA	3,209,145	315	101,088	K-6-6
*R-II	Desloge	AAA	5,135,525	300	154,066	K-6-2-4
*61	Flat River	AAA	7,352,495	315	231,604	K-6-3-3-2
	(Also Junior College, 12 teachers, 314 students.)					
*R-IV	Leadwood	AAA	4,093,485	335	137,132	K-6-6
St. Louis County						
*R-VI	Eureka	AA	27,327,050	325	888,129	6-2-4
*R-VII	Kirkwood, 516 S. Kirk. Rd. (part 1/2?)	AAA	98,163,820	330	3,239,406	K-6-3-3
*R-VIII	Lindburgh, 4900 S. (part 1/2?)	AAA	60,422,860	285	1,722,052	K-6-3-3
R-IX	Mehlville, 3200 Lemay Ferry Rd. (part 1/2?)	AAA	47,445,530	310	1,470,811	K-6-2-4
*C-2	Parkway, Mason Rd. & D. Boone Parkway, Creve Coeur (part 1/2?)	AAA	34,252,065	295	1,010,436	K-6-6
...	Valley Park, 356 Meramec St. Rd.	App	4,389,480	390	171,190	K-6-2-4
Washington						
R-III	Potosi	A	7,741,000	265	205,137	5-3-4
R-VI	Valley [Caledonia]	A	2,010,000	310	62,310	8-4

Source: Missouri State Department Education, Division Public Schools, Bulletin Classified School Districts, 1960-61 (mailed, November 1960).

* Member North Central Association of Colleges & Secondary Schools

R=Reorganized school district

C=Consolidated school district

Table 14, Part 2

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960

		High School			Elementary			Pupils[b]		Local Tax Expenditure per Resident Pupil[c]
		Number Teachers	Number Pupils	Pupils per Teacher	Number Teachers	Number Pupils	Pupils per Teacher	Total	Resident	
Crawford										
R-I	Bourbon	7	139	19.86	12	368	30.67	507	506	114
R-II	Cuba	11	221	20.09	17	528	31.06	749	749	111
R-III	Steelville	10	223	22.30	20	621	31.05	844	841	77
R-IV	Cherryville	8	133	16.63	10	321	32.10	454	449	69
Dent										
80	Salem (part)	19	330	17.37	18	470	26.11	1075	770	157
Franklin										
R-VI	Pacific	13	280	21.54	20	448	22.40	912	854	172
*R-XI	Union	22	554	25.18	17	496	29.18	1140	996	160
R-XIII	St. Clair	24	370	15.42	29	862	29.72	1334	1278	124
C-2	Sullivan	23	450	19.57	27	828	30.67	1364	1210	124
*	Washington (part?)	22	535	24.32	24	486	20.25	1021	751	235
Gasconade										
R-II	Owensville (part)	15	380	25.33	27	685	25.37	1065	1012	148
R-III	Bland (part)	7	75	10.71	6	186	31.00	324	324	168
Iron										
R-I	Annapolis (outside)	8	133	16.63	10	209	20.90	431	428	70
R-II	Arcadia Valley[Ironton] (part)	18	314	17.44	17	427	25.12	941	893	120

Table 14, Part 2

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960 (continued)

		High School			Elementary			Pupils[b]		Local Tax Expenditure per Resident Pupil[c]
		Number Teachers	Number Pupils	Pupils per Teacher	Number Teachers	Number Pupils	Pupils per Teacher	Total	Resident	
Jefferson										
R-I	Northwest [House Springs]	23	579	25.17	51	1439	28.22	2446	2418	151
R-III	Hillsboro (part)	15	283	18.87	19	534	28.11	986	933	200
*R-V	Herculaneum (outside)	23	482	20.96	15	413	27.53	971	699	187
*R-VI	Festus (outside)	27	540	20.00	40	1059	26.48	1825	1723	163
C-6	Fox [Arnold] (outside)	22	493	22.41	46	1305	28.37	2222	2213	160
*47	Crystal City (outside)	24	428	17.83	19	429	22.58	931	725	283
*73	De Soto (part)	27	571	21.15	44	1053	23.93	1728	1583	161
Maries										
R-I	Vienna (outside)	10	185	18.50	12	236	19.67	421	332	95
R-II	Belle (part)	12	206	17.17	11	307	27.91	513	448	97
Phelps										
R-I	St. James	13	279	21.46	19	683	35.89	1028	957	116
R-II	Newburg	11	201	18.27	18	462	25.67	663	635	70
*	Rolla (part)	41	846	20.63	45	1006	22.36	2398	2091	162
St. Francois										
R-V	Bismark (part)	11	158	14.36	13	334	25.67	607	605	148
R-VI	Doe Run (outside)	6	102	17.00	11	299	27.18	401	398	119
7	Elvins	16	252	15.75	15	413	27.53	703	701	163
*R-I	Bonne Terre	19	403	21.21	23	505	21.96	984	983	184
	(Also Lead Belt Technical School, joint with other towns, 7 teachers.)									
*R-III	Esther	16	376	23.50	15	371	24.73	803	799	126
*R-II	Desloge	21	297	14.14	25	603	24.12	1161	1150	134

Table 14, Part 2

SCHOOL DISTRICT DATA, MERAMEC BASIN COUNTIES, 1960[a] (continued)

		High School			Elementary			Pupils[b]		Local Tax Expenditure per Resident Pupil[c]
		Number Teachers	Number Pupils	Pupils per Teacher	Number Teachers	Number Pupils	Pupils per Teacher	Total	Resident	
St. Francois (continued)										
*61	Flat River	10	165	16.50	24	441	18.38	885	881	262
	(Also Junior College, 12 teachers, 314 students.)									
*R-IV	Leadwood	18	391	21.74	19	464	24.42	913	913	150
St. Louis County[d]										
*R-VI	Eureka	37	785	21.22	101	2397	23.73	3912	3910	227
*R-VII	Kirkwood, 516 S. Kirk. Rd. (part 1/2 ?)	78	1602	20.54	194	3989	20.56	8403	8410	386
*R-VIII	Lindburgh, 4900 S. (part 1/2?)	42	828	19.71	134	2726	20.34	5509	5509	313
R-IX	Mehlville, 3200 Lemay Ferry Rd. (part 1/2 ?)	57	1087	19.07	85	1877	22.08	4207	4207	350
*C-2	Parkway, Mason Rd. & Daniel Boone Parkway, Creve Coeur (part 1/2 ?)	55	1070	19.45	72	1369	19.01	2712	2704	373
...	Valley Park, 356 Meramec Station Rd.	11	194	17.63	17	494	29.06	956	955	179
Washington										
R-III	Potosi	23	484	21.04	36	1007	27.97	1850	1742	118
R-VI	Valley [Caledonia]	9	197	21.89	14	375	26.79	572	503	124

a. Includes all listed districts wholly or partially in Meramec Basin. Table also lists some additional schools adjacent to basin and marked (outside). Districts partially in basin are marked (part).

b. Includes Kindergarten, Elementary, Junior & Senior High Schools.

c. Local tax expenditures are supplemented by state aid.

d. Other comparisons: Local tax expenditures per pupil for Clayton, $862; University City, $457; Webster Groves, $394 (all in St. Louis County); St. Louis City, $292.

THE MERAMEC BASIN

Volume II

The Economy and Character of the Meramec Basin

Chapter 2

<u>AGRICULTURE</u>

Part 1: PHYSICAL LAND CONDITIONS

by
U.S. Department of Agriculture
Soil Conservation Service
Columbia, Missouri

Part 2: AGRICULTURAL TRENDS

by
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Columbia, Missouri

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Chapter II

AGRICULTURE

Summary

Although agriculture does not dominate the employment of the Meramec Basin, it is a major source of employment, and its present and future status is important in economic planning for the region.

None of the area has been extraordinarily endowed with agricultural resources. However, there are some good agricultural areas within the basin. The soils in the area possess characteristics of the Ozark region, which distinguish them from all of the soils in the state outside of the Ozarks. In general, they are light in color and comparatively low in organic matter.

Much of the land in the Meramec Basin has rolling to steep topography, and poor cherty and stony limestone soils. There are pockets of fair sandstone soils in the south, and a large area of fairly good agricultural land in the north (mostly loess). Fairly good soils are found in the narrow alluvial valleys which make up only a small portion of the total land in the basin.

More than 50% of the soils in the Meramec Basin are classified by the Soil Conservation Service as suited primarily for non-crop use. Another 40% are classified as having fairly complex problems requiring special treatment in order to be cultivated. The remainder (less than 10%) is classified as having no problems, or problems relatively simple to overcome.

In 1959 the predominant land use in the Meramec Basin was woodland -- making up about two-thirds of the total. The remaining one-third was made up of cropland and woodland. The principal crops grown in the Meramec Basin are small grain, corn, alfalfa, lespedeza, red clover and fescue. In the past 30 years acreage of corn has declined slightly, acreages of wheat and oats have declined approximately 50%, and soybeans have shown a slight increase. Acreages devoted to hay have fluctuated widely, but show no definite trend. While the acreage of most of the principal crops has been declining, yields have been rising. Trends in the number of livestock have been mixed. The largest crop acreages and the largest numbers of livestock are found in the northern counties.

The past 30 years have witnessed a decrease in the number of farms and an increase in the size of operating units. However, the average size of farms in the Meramec Basin is still only 200 acres. Accompanying these changes has been a decrease in the degree of dependence of farmers on their farms. In 1959 approximately half of the farm operators worked 100 days or more off their farms and received more income from other sources than from the sale of farm products. Part-time farming is becoming increasingly important.

The adjustments that have taken place in the Meramec Basin have improved levels of living among the people. Agriculture will continue to be important, but fewer people can depend upon it if income per family is to continue to rise.

Part 1. PHYSICAL LAND CONDITIONS[1]

Land Characteristics and Capabilities

Topography

The topography of the watershed is gently rolling to rolling around the perimeter, and rolling to steep in the rest of the area. The steepest slopes are generally in the central and southern parts of the basin (Figure 1).

Soils

The soils in the area possess characteristics of the Ozark region, which distinguish them from all other soils in the state outside of the Ozarks. In general, they are light in color and comparatively low in organic matter. For the most part they are timbered, hilly in topography, and rather low in mineral plant food. The subsoils are gray, yellow, and red.

The content of chert gravel varies greatly. In some places it covers the entire surface, while in others it is entirely absent.

The most important soil-forming rocks in this area are limestone, therefore, it has required the breakdown of many feet of the purer beds to form a thin layer of soil.

Soils classified under the Soil Conservation Service Land Capability Classes are all represented in the area of the Meramec Basin.

Physical land resource areas

The Meramec River Basin, covering approximately 3,980 square miles, can be subdivided into six different resource areas as indicated in Figure 2. These areas represent different soil and related slope and erosion problems. Each area is briefly defined as follows:

1. Narrow alluvial valleys -- Mostly well drained soils, but include spots of wet soils, gravelly soils and frequent meandering stream channels. Frequently subject to "flash flooding" -- mostly Huntington soils. This area includes a predominance

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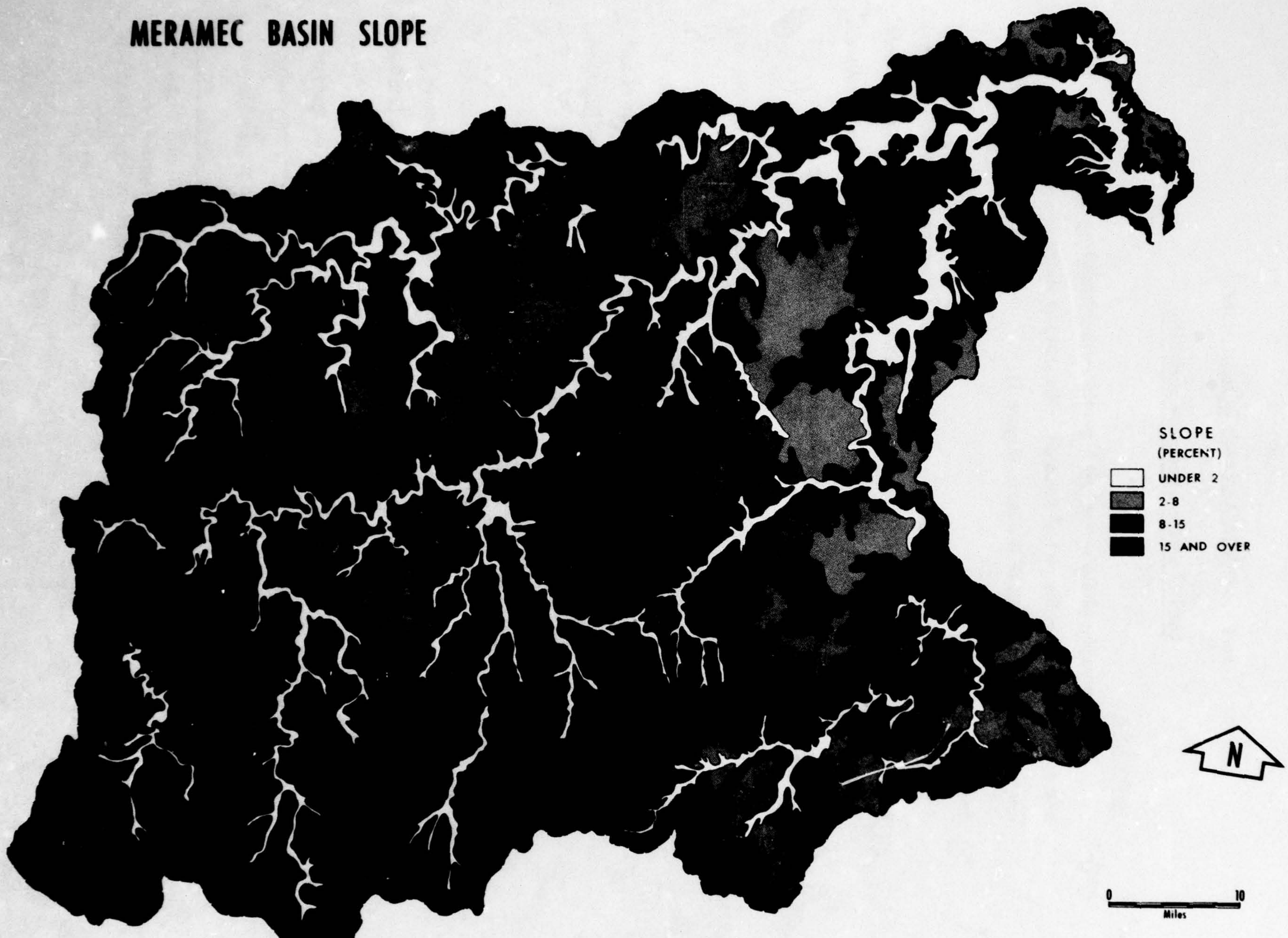
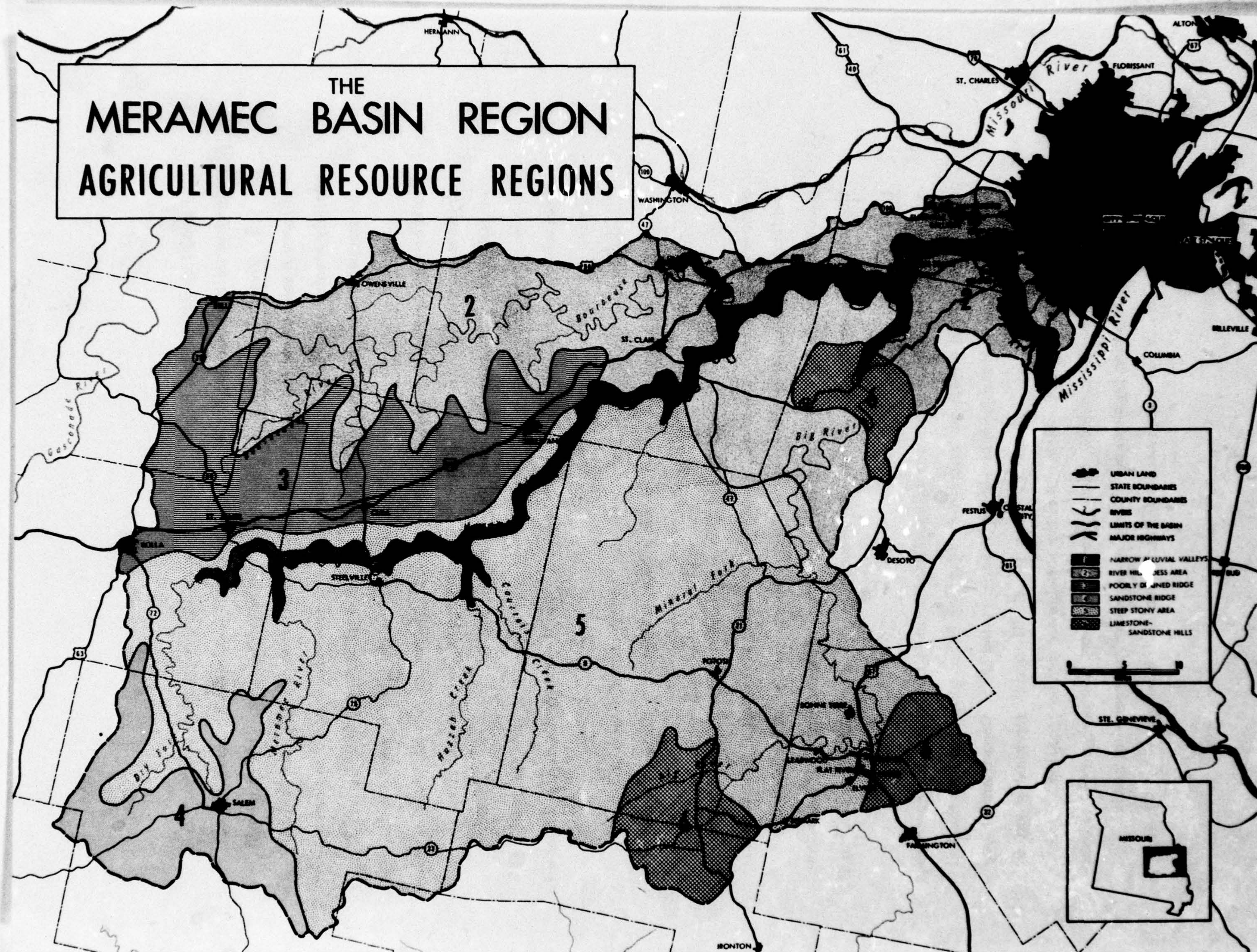
[1] Material contained in this report is unpublished data from the Soil and Water Conservation Needs Inventory prepared by the U. S. Department of Agriculture in 1958 to 1959 -- and other information from the Soil Conservation Service Records at Columbia, Missouri.

MERAMEC BASIN SLOPE



Source: U. S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942


THE
MERAMEC BASIN REGION
AGRICULTURAL RESOURCE REGIONS
HERMANN
ST. CHARLES
FLORISSANT
ALTON
Missouri River
WASHINGTON
OWENSVILLE
ST. CLAIR
Bourbeuse
Gasconade River
Mississippi River
BELLEVILLE
COLUMBIA
Big River
FESTUS
DESOTO
STEELVILLE
Mineral Fork
Courtois Creek
Huzzah Creek
Meramec River
Dry Fork
SALEM
FARMINGTON
STE. GENEVIEVE
IRONTON
MISSOURI
2
3
4
5
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
NARROW ALLUVIAL VALLEYS
SANDSTONE RIDGE
STEEP STONY AREA
LIMESTONE-
SANDSTONE HILLS

of Land Capability Class II and III soils with some significant areas of Class 1. (Similar soils occur along the minor tributary streams in all other problem areas.)

2. River hill loess area -- Mostly deep to moderately deep (18-48 inches) of loessial soils on rolling to steep topography. Well drained, subject to erosion, mostly Menfro-Winfield-Dickson-Union soils, with some cherty and stony areas along the steeper slopes, predominantly Capability Classes III, IV, VI, and VII.

3. Poorly drained ridge -- This is an area of nearly level to gently rolling soils on a major divide, generally poorly drained with hardpan subsoil; droughty in dry seasons, mostly Lebanon and Guthrie soils with some Cherokee and Eldon in western part. Predominantly Capability Classes III and IV.

4. Sandstone ridge -- An area of gently rolling to rolling soils, primarily from sandstone with frequent sandstone outcrops. Mostly Hanceville soils. Capability Classes III, IV, and VI predominate.

5. Steep stony area -- This is a rolling to steep area of cherty and stony limestone soils -- mostly Clarksville soils. Mostly Capability Classes VII and VI with some III and IV on the ridges.

6. Limestone-Sandstone hills -- These are three relatively small scattered areas located in the southeastern part of the watershed, consisting of well-drained red limestone soils, moderately well-drained sandstone derived soils and some granite outcrops in the vicinity of Farmington. Mostly Hagerstown-Tilsit-Ashe soils. Capability Classes III, IV, VI, and VII predominate with some small areas of Class II.

Land capability classes

All of the eight land use capability classes occur in the basin. The percentage distribution of land classes occurring in the Meramec Basin, projected from the Soil and Water Conservation Needs Inventory prepared by the U. S. Department of Agriculture in 1959, is shown in Table 1. Classes I, II, III, and IV represent groups of soil and related physical conditions that are suitable for regular cropping. Class I land having no special problems, Class II having problems relatively simple to overcome, Class III having problems more complex in nature and requiring special treatment, Class IV lands are suitable for occasional or limited cropping. Classes V,

Table 1

PERCENT OF MERAMEC BASIN LAND
IN EACH CAPABILITY CLASS

Class	I	4%	Class	V	less than 1%
	II	6%		VI	10%
	III	20%		VII	41%
	IV	18%		VIII	less than 1%

VI, VII, and VIII are land classes suited primarily for non-crop use. Class V has few or no hazards when utilized for non-crop uses and the problems or hazards, even to non-crop use, increase progressively in Classes VI, VII, and VIII.

Land Use and Conservation

Land use

The distribution of land uses within the Meramec Basin is shown in Figure 3 (based on data for the year 1940). More recent data from the Soil and Water Conservation Needs Inventory show the following percentage distribution of land use in the Meramec Basin in 1959:

Cropland	22%
Pasture	13%
Woods	62%
Other	3%

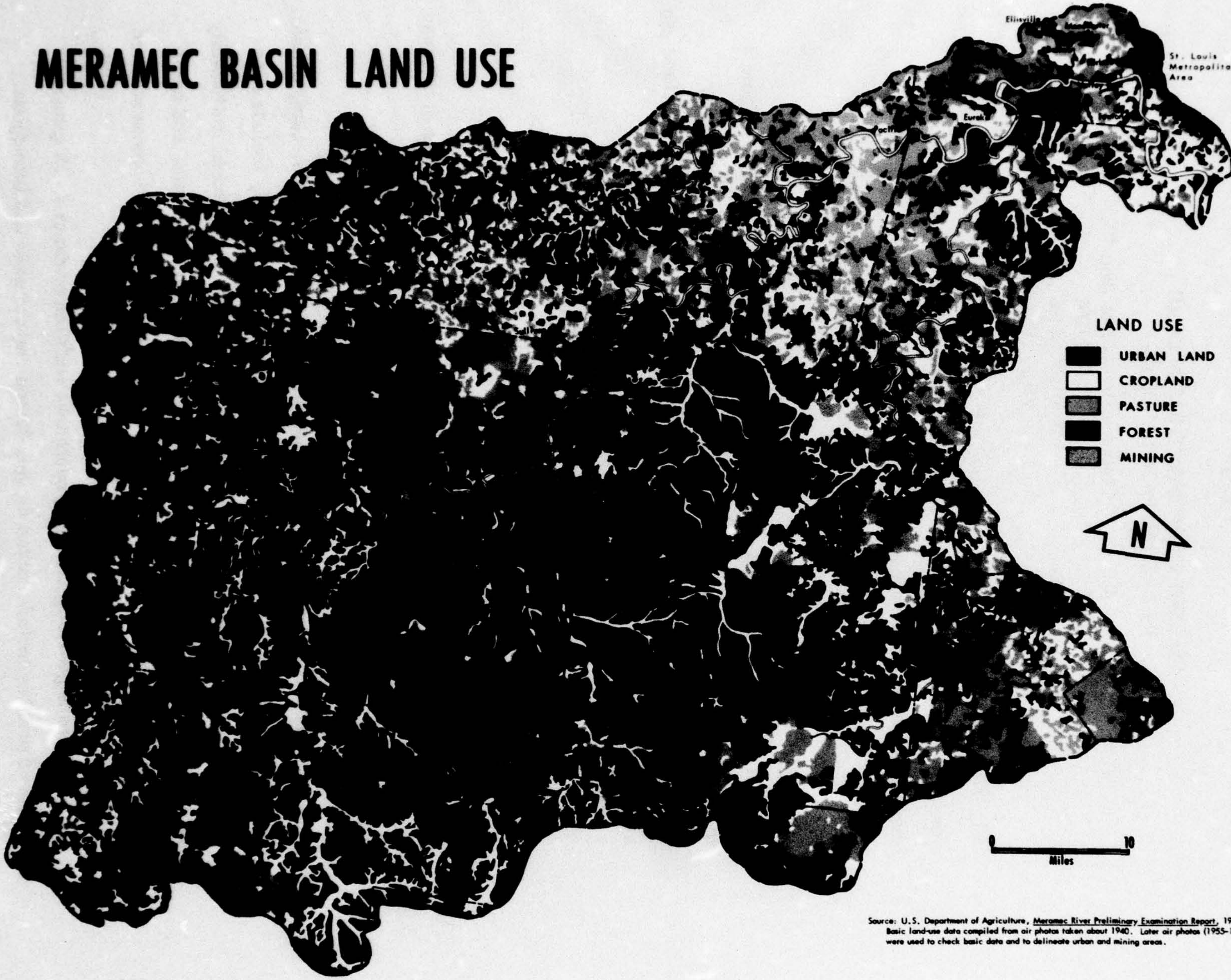
Trends expected in the next 15-20 year period indicate a decrease in cropland and woods and an increase in pasture.

Types of Crops

The principal crops grown in the Meramec Basin are small grain, corn, alfalfa, lespedeza, red clover, and fescue. The cropping systems generally include corn followed by small grain seeded to grass-legume meadows. Some fields, particularly in the bottomland areas, are used more intensively for corn, soybeans, and small grain whereas many of the more rolling or odd shaped fields of the uplands are used primarily for small grain and hay.

Pasture is generally bluegrass overgrown with lespedeza and wild grasses. Improved pastures include ladino clover, fescue orchard grass and bromegrass.

MERAMEC BASIN LAND USE



Source: U.S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942. Basic land-use data compiled from air photos taken about 1940. Later air photos (1955-1959) were used to check basic data and to delineate urban and mining areas.

The woods area generally has been cut over in times past and now includes second growth of oak (white, red, blackjack, post), shortleaf pine, red cedar, primarily on the uplands; cottonwood, ash, and walnut in the valley areas.

The relatively small area designated as "other uses" includes lots, roads, railroad rights-of-way, lakes, ponds and mine dumps.

Conservation practices

Fifteen counties are wholly or partially included in the Meramec Basin. Extent of inclusion by county is given in Table 2.

Table 2

PROPORTION OF COUNTY LAND AREA INCLUDED WITHIN MERAMEC BASIN

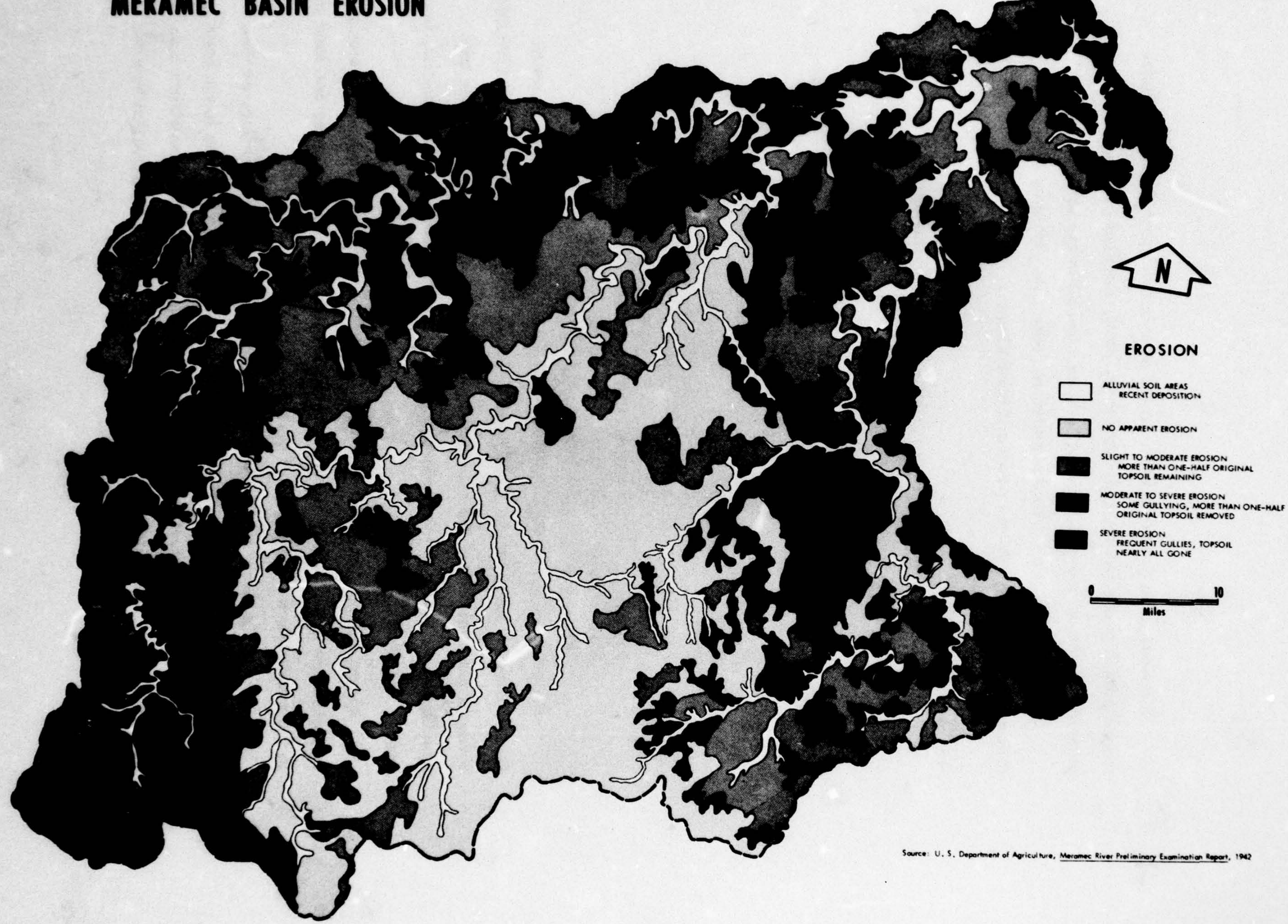
Crawford	100.00%	Gasconade	34.59%
Washington	99.67%	St. Louis	28.23%
Dent	66.16%	Maries	22.72%
Franklin	63.88%	Iron	21.90%
Jefferson	48.70%	Ste. Genevieve	5.33%
Phelps	41.40%	Reynolds	0.39%
St. Francois	39.51%	Texas	0.37%
Gasconade	34.59%	Osage	0.20%

Only five of the above counties have organized Soil Conservation Districts: Dent, Franklin, Reynolds, St. Louis, and Texas, which represents about 31% (790,000 acres) of the total area of the Meramec Basin. The Soil Conservation Service has contributed materially to the conservation treatment of the land in these counties, but none to the other 69%.

Figure 4 shows the extent of erosion in the Meramec Basin. In general, erosion is most severe in the Salem, Big River, and Bourbeuse River farming areas, and least severe in the wooded south central part of the basin.

Problems of timber management and improvement, tributary flooding, erosion control, and land conversions in line with use capabilities are problems in the Basin. A small amount of conservation treatment is occurring annually with assistance from the Soil Conservation Service, Agricultural Stabilization and Conservation Service, Forest Service, and Extension Services.

MERAMEC BASIN EROSION



Source: U. S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942

The Soil and Water Conservation Needs Inventory for the eastern Ozarks area of Missouri, projected specifically to the Meramec area, indicates the following general data regarding acres treated and acres remaining to be treated as of 1959.

Table 3

CONSERVATION NEEDS, MERAMEC BASIN, 1959[a]

Land Use	Approx. Total Acres	Acres Treated	Percent Remaining to be treated
Cropland	490,000	160,000	66%
Pasture	290,000	165,000	43%
Woods	1,512,000	b	b
Other	80,000	57,000	30%

[a]Includes only private land in farms, about 88% of the total basin area. (Because of differences in definition of farms, this figure does not agree with that of the 1959 Census of Agriculture.) The remaining 12% is comprised of cities, roads, water areas, federally-owned forest land, etc.

[b]Little or none of the private farm woodland is completely treated.

Watershed protection and flood prevention

There appears to be a possibility for the justification of some small watersheds under 250,000 acres in the Meramec Basin under Public Law 566. However, the Soil Conservation Service has had no requests from qualified sponsors in any of the area included in the Meramec. Justification of a PL-566 project would probably include some land use adjustments, extensive forest management on many acres of woodland and some flood prevention measures, such as floodwater retarding structures to control local tributary flooding and fish and wildlife improvement and municipal water supply. It is unlikely that flood prevention measures under the Small Watershed Program would have any appreciable affect on the flood plain damages on the lower reaches of the Meramec. The primary benefits would be in the upper tributaries.

Part 2. AGRICULTURAL CONDITIONS AND TRENDS[2]

Climate

Precipitation

The precipitation for the area varies with the seasons. The largest amount comes during the spring and the smallest during the winter. Summer and autumn rainfall usually is between the winter and spring precipitation in amount. The average for March, April, and May is from 12 to 14 inches. The average for June, July, and August is between 11 and 12 inches. The lowest amount comes in the months of December, January, and February, and averages between five and eight inches.[3]

Temperature

The temperature of the area moves through a wide range. It can vary as much as 60 degrees within a few hours. However, the average maximum for January is between 40 and 44 degrees and the minimum between 20 and 24 degrees. The average maximum temperature for July is 90 degrees and the minimum, 66 degrees.[4]

Growing season[5]

The growing season in the northern part of the basin is longer than in the southern part. The average date of the last killing frost is April 5 in the counties bordering the Missouri River and April 10 for those in the southern portion of the area. This variation is caused by differences in elevation. The first killing frost for the northern counties is between the 20th and 25th of October, and for the southern counties between October 10 and 20. The average growing season is between 190 and 200 days.

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[2] The data contained in this report are for the following counties: Crawford, Dent, Franklin, Gasconade, Iron, Jefferson, Maries, Phelps, St. Francois, St. Louis, and Washington.

[3] Buel F. Lanpher, Jr., Productivity of Farm Land in Missouri, Missouri Agricultural Experiment Station Research Bulletin No. 465, 1950, p.23.

[4] James E. Collier, Agricultural Atlas of Missouri, University of Missouri College of Agriculture, Bulletin 645, 1955, p.22.

[5] Ibid, p.24.

Characteristics of Land and Farms

Land productivity

With the exception of St. Louis County, the land in the Meramec Basin is below the average of the State in productivity. All of the other counties are in the lower one-third when ranked according to productivity[6] (Table 4).

Number of farms

This report includes data from 11 counties southwest of St. Louis that lie partially or entirely in the Meramec Basin. (See Figure 5.) The area included in each and the number of farms in the census years from 1935 to 1960 are given in Table 5.

The number of farms has decreased 46% since 1935 according to data compiled from the United States Census of Agriculture. The decline has been relatively steady, but has been somewhat accelerated since 1950 (Figure 6).

The decline in number of farms has been accompanied by an increase in the size of operating units. However, the increase has not been rapid. In 1935, 55% of the farms were smaller than 100 acres. In 1935, 86% of the farms were smaller than 220 acres; by 1960 this proportion had dropped to 72%. In 1935 only 14% were in the larger size groups. Further details as to number and percentage of farms in the various size groups are given in Tables 6 and 7 and in Figures 7, 8, and 9.

Many factors have caused the change in the size of farms, but the major cause of consolidation of small units into larger farms has been the need for larger acreages because of technological advances in agriculture. Modern equipment is expensive. The cost per acre of hour of use decreases as the annual units of use increase. The cost of providing a two-row picker to harvest no more than 20 acres of corn is $6.69 per acre. If the same machine is used to harvest 250 acres, the cost is reduced to $1.02 per acre.[7] This principle applies to every machine that

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[6] Ibid, p.26.

[7] James E. Dillion, Use and Annual Cost of Farm Machinery in Missouri, University of Missouri, 1951.

Table 4

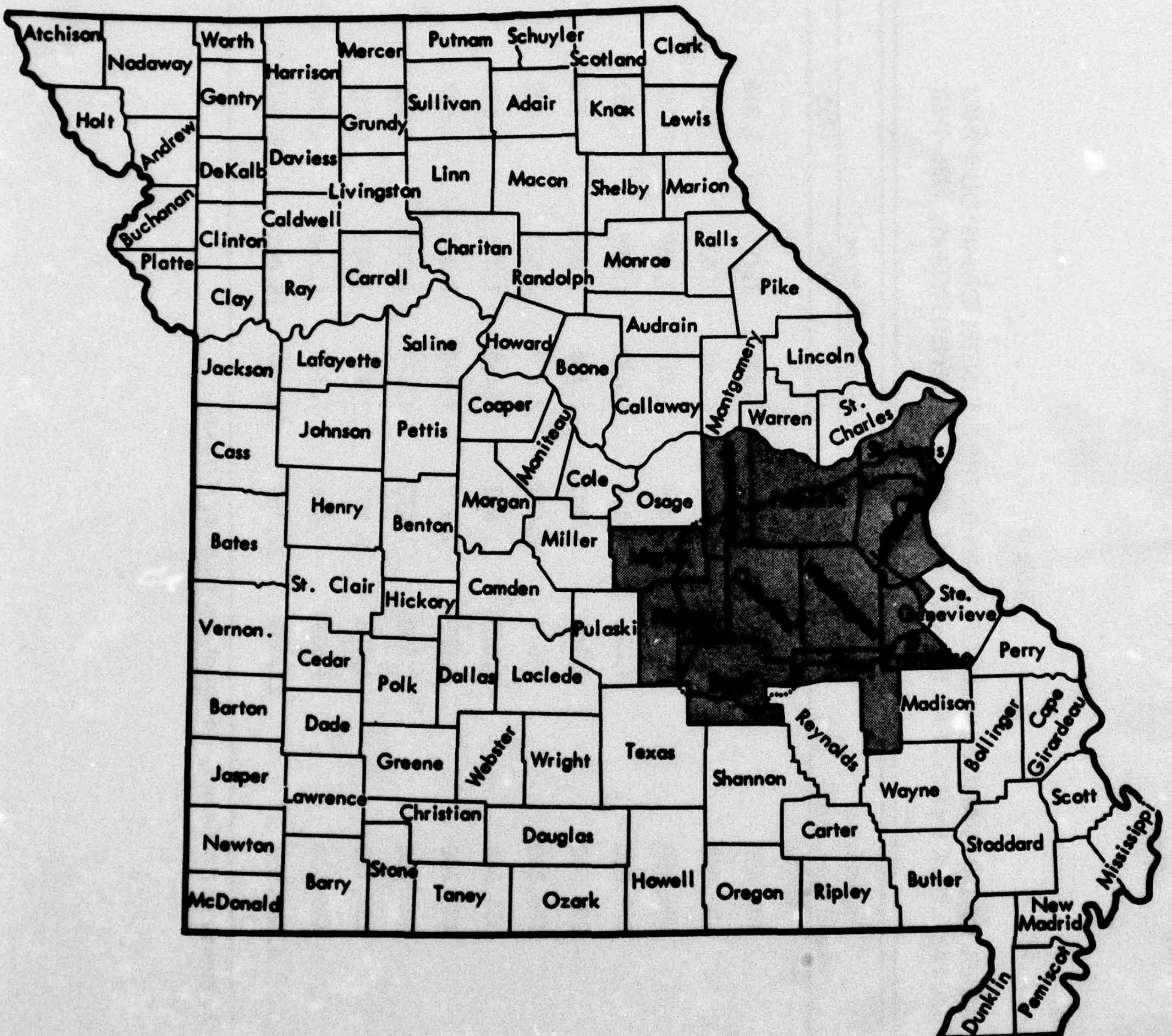
RANK OF THE COUNTIES IN THE MERAMEC BASIN ACCORDING TO THEIR RELATIVE GROSS PRODUCTIVITY PER ACRE OF LAND*

County	Rank
St. Louis	31
Franklin	76
Gasconade	77
St. Francois	80
Jefferson	82
Maries	93
Washington	95
Dent	100
Phelps	101
Crawford	104
Iron	105

* Lanpher, Buel F. Jr., Productivity of Farm Land in Missouri, Missouri Agricultural Experiment Station Research Bulletin 465, 1950, 23.

The 114 counties of the state are numbered according to the average productivity of the land in them. Pemiscot is the most productive and Reynolds the least. In the Meramec Basin, St. Louis is the most productive and Iron the least. All of the other counties are below the average for the state in productivity of agricultural land resources. Only nine counties are less productive than Iron County.

Figure 5



LOCATION OF THE ELEVEN COUNTIES INCLUDED IN THE ANALYSIS OF AGRICULTURAL TRENDS IN THE MERAMEC BASIN

Table 5

ACRES OF LAND AND NUMBER OF FARMS IN THE COUNTIES OF MISSOURI THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY CENSUS YEARS, 1935-1960

County	Approximate Land area, 1960 (acres)	Number of farms					
		1935	1940	1945	1950	1955	1960
Crawford	486,400	1,897	1,875	1,521	1,490	1,316	1,110
Dent	483,840	1,914	1,707	1,641	1,632	1,423	1,179
Franklin	596,480	3,548	3,394	3,427	3,169	2,752	2,424
Gasconade	332,800	1,625	1,564	1,612	1,399	1,351	1,162
Iron	354,560	1,109	1,205	1,105	852	752	504
Jefferson	426,880	2,614	2,642	2,312	1,831	1,809	1,200
Maries	336,640	1,695	1,693	1,468	1,431	1,316	1,083
Phelps	433,260	1,879	1,919	1,905	1,350	1,647	1,145
St. Francois	292,480	1,598	1,473	1,471	1,201	1,185	908
St. Louis	357,120	4,186	3,259	2,877	2,482	1,715	1,195
Washington	486,400	1,539	1,428	1,118	1,258	1,097	821
TOTAL	4,586,860	23,159	22,159	20,459	18,095	16,363	12,731

Source: U. S. Bureau of the Census, Census of Agriculture, Missouri

Figure 6

TREND IN NUMBER OF FARMS
IN THE ELEVEN MERAMEC BASIN COUNTIES, 1935-1960

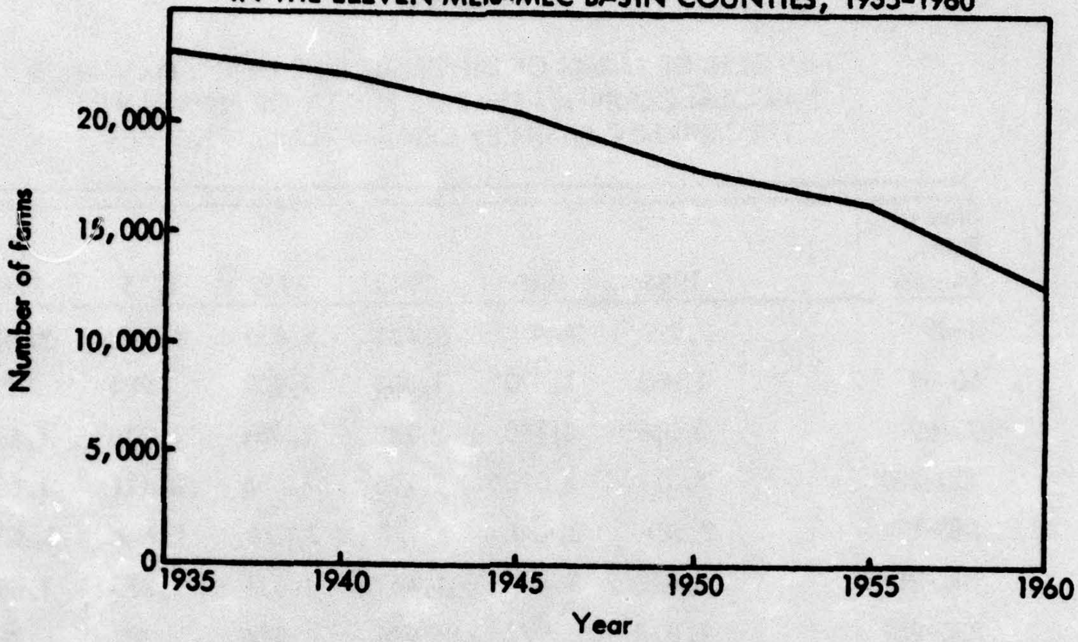


Figure 7

TREND IN NUMBER OF DIFFERENT SIZE FARMS
IN THE ELEVEN MERAMEC BASIN COUNTIES, 1935-1960

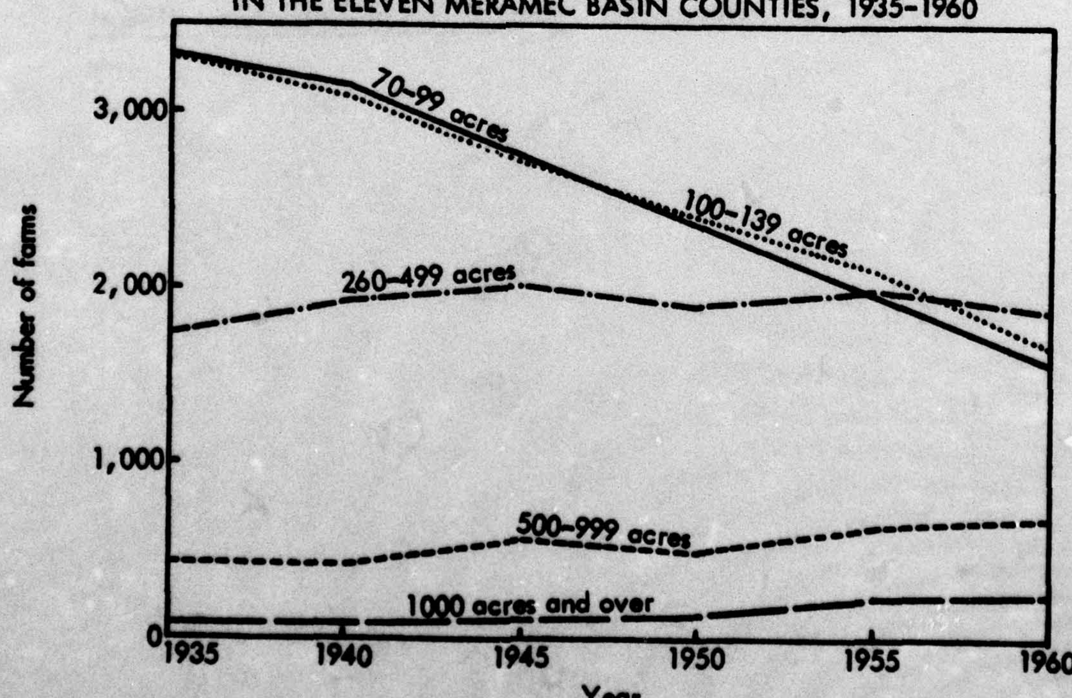


Table 6

NUMBERS OF FARMS OF DIFFERENT SIZE IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY CENSUS YEARS, 1935-1959

Size of Farm (Acres)	1935	1940	1945	1950	1955	1960
1-49	7,929	7,301	6,425	5,430	4,571	2,788
50-69	1,602	1,370	1,303	1,109	984	704
70-99	3,324	3,150	2,752	2,364	1,976	1,574
100-139	3,311	3,092	2,726	2,406	2,121	1,681
140-179	2,581	2,438	2,177	2,024	1,759	1,423
180-219	1,489	1,407	1,457	1,324	1,275	1,048
220-259	1,007	972	926	926	837	806
260-499	1,736	1,938	2,024	1,885	2,003	1,873
500-999	445	429	558	495	642	681
1,000 and over	80	92	111	132	145	153
TOTAL	23,604	22,189	20,459	18,095	16,363	12,731

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Table 7

PERCENTAGE OF FARMS IN THE VARIOUS SIZE GROUPS IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY CENSUS YEARS, 1935 - 1960

Size of Farm Acres	1935	1940	1945	1950	1955	1960
1-49	33.6	32.9	31.4	30.0	27.9	21.9
50-69	6.8	6.2	6.4	6.1	6.0	5.5
70-99	14.1	14.2	13.5	13.1	12.1	12.4
100-139	14.0	13.9	13.3	13.3	13.0	13.2
140-179	10.9	11.0	10.7	11.2	10.8	11.2
180-219	6.7	6.4	7.1	7.3	7.8	8.2
220-259	4.3	4.4	4.5	5.1	5.4	6.4
260-499	7.4	8.7	9.9	10.4	12.2	14.7
500-999	1.9	1.9	2.7	2.8	3.9	5.3
1,000 and over	.3	.4	.5	.7	.9	1.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Figure 8

PERCENTAGE OF FARMS IN DIFFERENT SIZE GROUPS IN THE ELEVEN MERAMEC BASIN COUNTIES BY CENSUS YEARS, 1935-1960

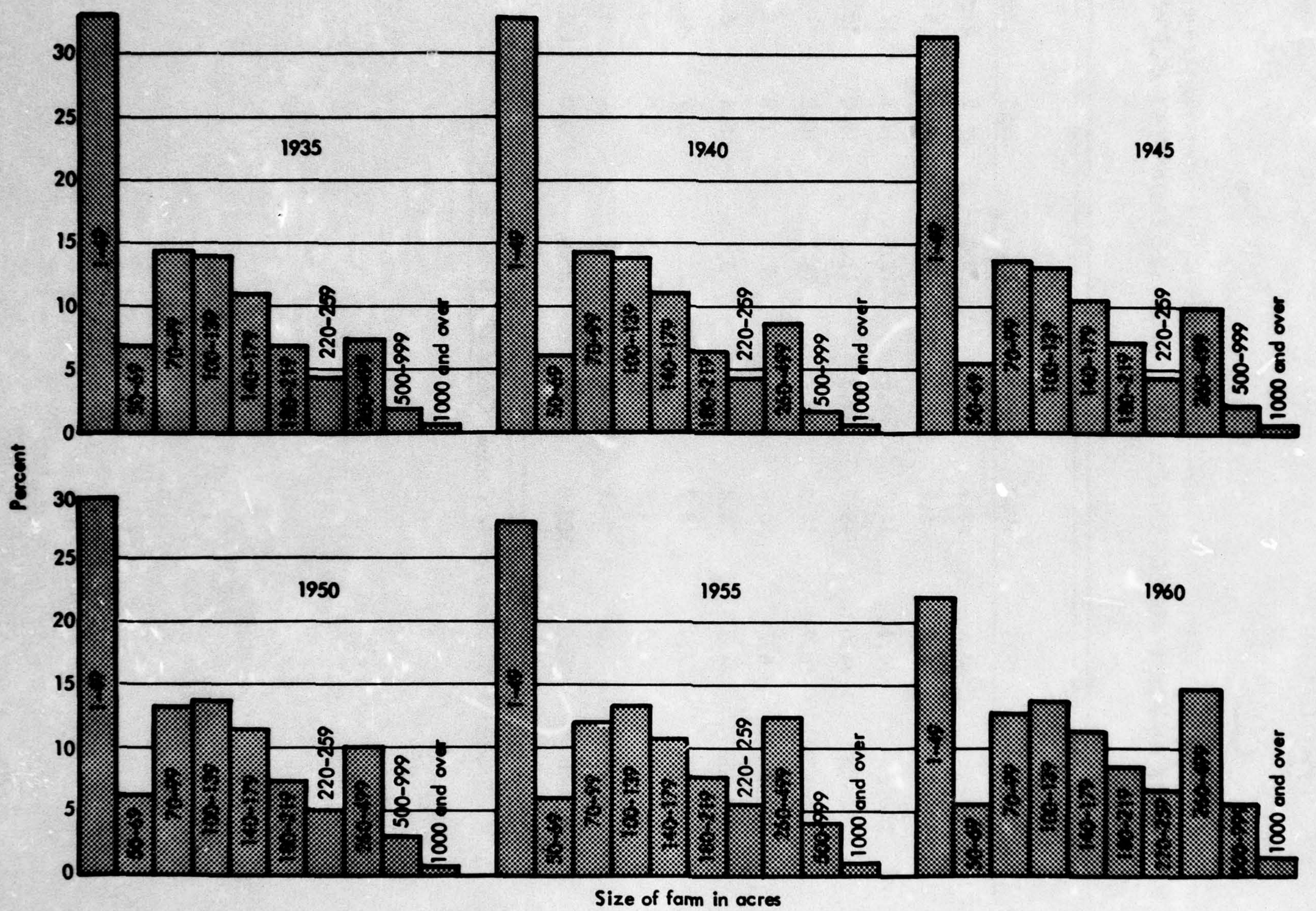
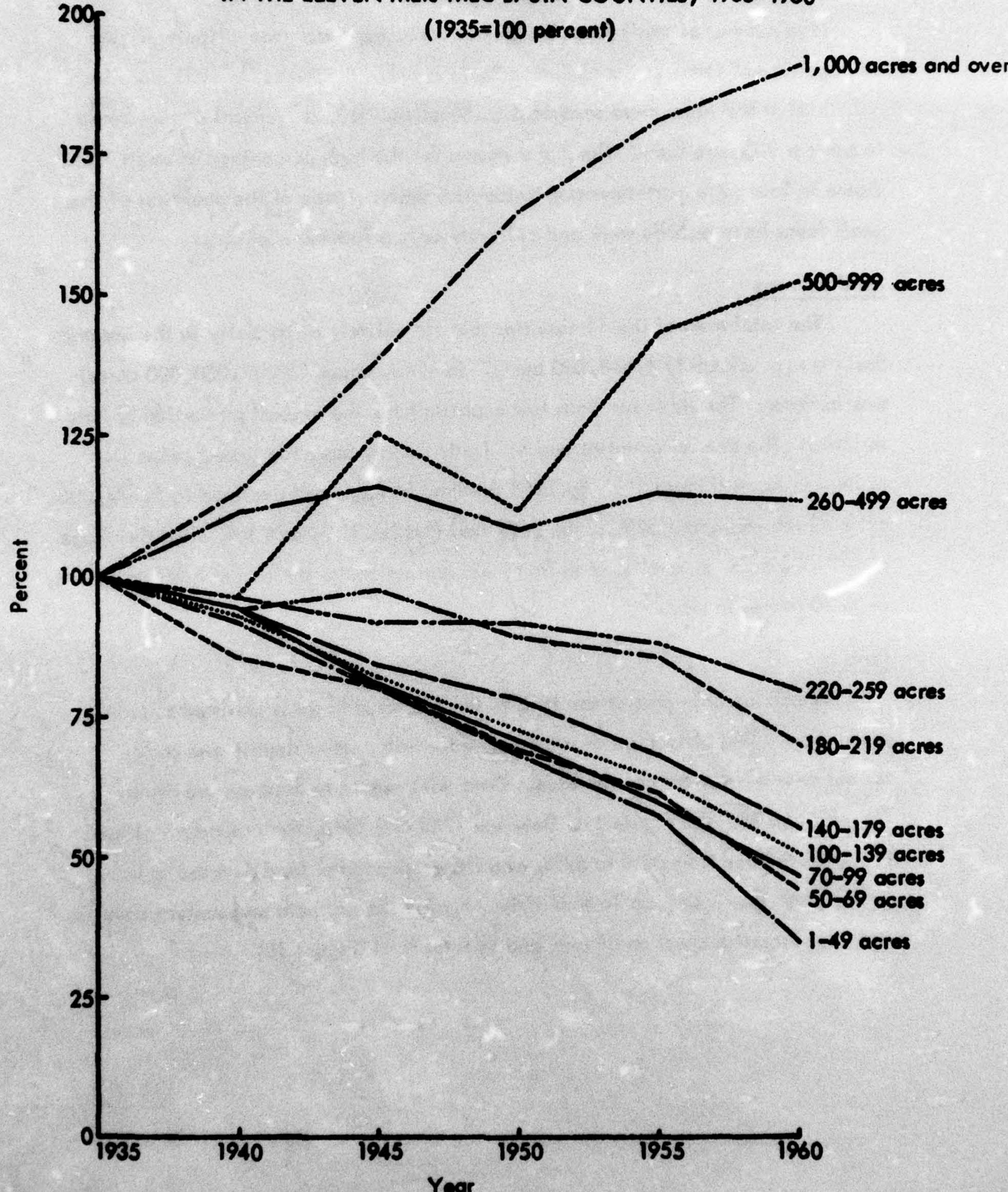


Figure 9

PERCENT CHANGE IN NUMBER OF FARMS OF DIFFERENT SIZE CATEGORIES IN THE ELEVEN MERAMEC BASIN COUNTIES, 1935-1960

(1935=100 percent)



is used on a farm. In other words, low operating costs require that each machine be used to its full seasonal capacity.

The number of small farms has been decreasing each year. However, the average size of farms in the Meramec Basin is only 200 acres. In 1935 more than one-third of the farms were smaller than 50 acres. It takes several of these units to make a 200 acre farm. The major reason for the high percentage of small farms shown in Table 7 is part-time and residential units. Many of the operators of these small farms have outside work and cultivate only a few acres of crops.

Land in farms

The total area of the 11 counties that lie entirely or partially in the Meramec Basin is approximately 4,548,000 acres. In 1945, about 65% (2,950,000 acres) was in farms. The three northern tier counties have the highest proportion of land in farms. The central counties and St. Louis County have the lowest proportion of land in farms (Figure 10). By 1960 the land in farms had declined to 2,373,000 acres which was about 52% of the land area (Tables 8, 9, and 10). This shrinkage of 577,000 acres in total land in farms was equivalent to the loss of 2,882 operating units 200 acres in size.

Land use

A considerable part of the land in the Meramec Basin is unsuited to crop production. This is because of relatively poor soils, steep slopes, and rocky terrain over a large part of the area. Data with regard to land use are shown in Tables 9 and 10, and Figure 11. Between 1945 and 1960, the proportion of land in farms declined from 65% to 52%, and the proportion of land devoted to harvested crops declined from 16% to 10%. Again, the northern and eastern counties have the largest proportion of cropland to total land (Figure 10).

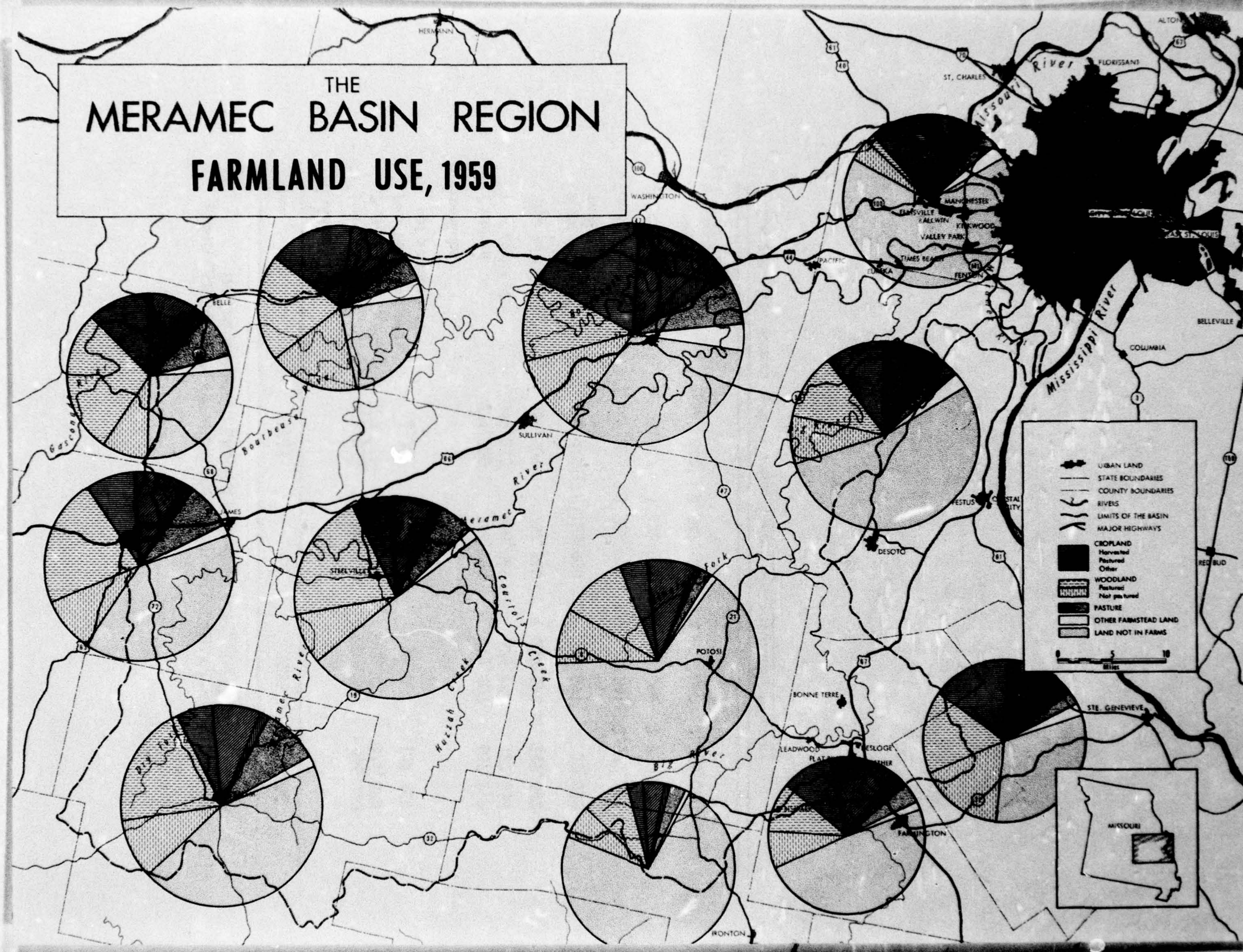

THE
MERAMEC BASIN REGION
FARMLAND USE, 1959
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
CROPLAND
Harvested
Pastured
Other
WOODLAND
Pastured
Not pastured
PASTURE
OTHER FARMSTEAD LAND
LAND NOT IN FARMS
0 5 10
Miles
MISSOURI
HERMANN
WASHINGTON
ST. CHARLES
FLORISSANT
ALTON
Missouri River
Mississippi River
MANCHESTER
KIRKWOOD
VALLEY PARK
TIMES BEACH
FENTON
PACIFIC
EUREKA
BELLEVILLE
COLUMBIA
SULLIVAN
BELLE
Boutbeuse
Gasconade
Meramec River
Courtois Creek
Huzzah Creek
STEELVILLE
POTOSI
BONNE TERRE
DESOTO
FESTUS
RED BUD
STE. GENEVIEVE
LEADWOOD
FARMINGTON
IRONTON
Big River

Table 8

LAND USE IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY CENSUS YEARS, 1945-1960 (ACRES)

Item	1945	1950	1955	1960
Cropland				
Harvested	726,065	565,265	521,067	466,752
Pastured	209,744	400,829	382,103	373,698
Not harvested and not pastured	84,783	119,464	95,751	104,859
Woodland				
Pastured	774,740	746,824	912,407	687,299
Not pastured	362,235	498,069	376,944	420,354
Other pasture	556,309	267,560	287,598	249,442
Farmstead, roads and other land	235,917	125,908	101,891	70,885
Total land in farms	2,949,793	2,723,919	2,677,761	2,373,289
Other land	1,598,047	1,823,921	1,090,099	2,213,571
Approximate acres in counties	4,547,840	4,547,840	4,586,860	4,586,860

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Table 9

PERCENTAGE OF LAND AREA IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN IN DIFFERENT USES BY CENSUS YEARS 1945-1960

Item	1945	1950	1955	1960
Cropland				
Harvested	16.0	12.4	11.4	10.2
Pastured	4.6	8.8	8.3	8.1
Not pastured and not harvested	1.9	2.7	2.1	2.3
Woodland				
Pastured	17.0	16.4	19.9	15.0
Not pastured	8.0	11.0	8.2	9.2
Other pasture	12.2	5.9	6.3	5.4
Farmstead roads and other land	5.2	2.8	2.2	1.5
Total land in farms	64.9	60.0	58.4	51.7
Other land	35.1	40.0	41.6	48.3
Approximate area in counties	100.0	100.0	100.0	100.0

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Table 10

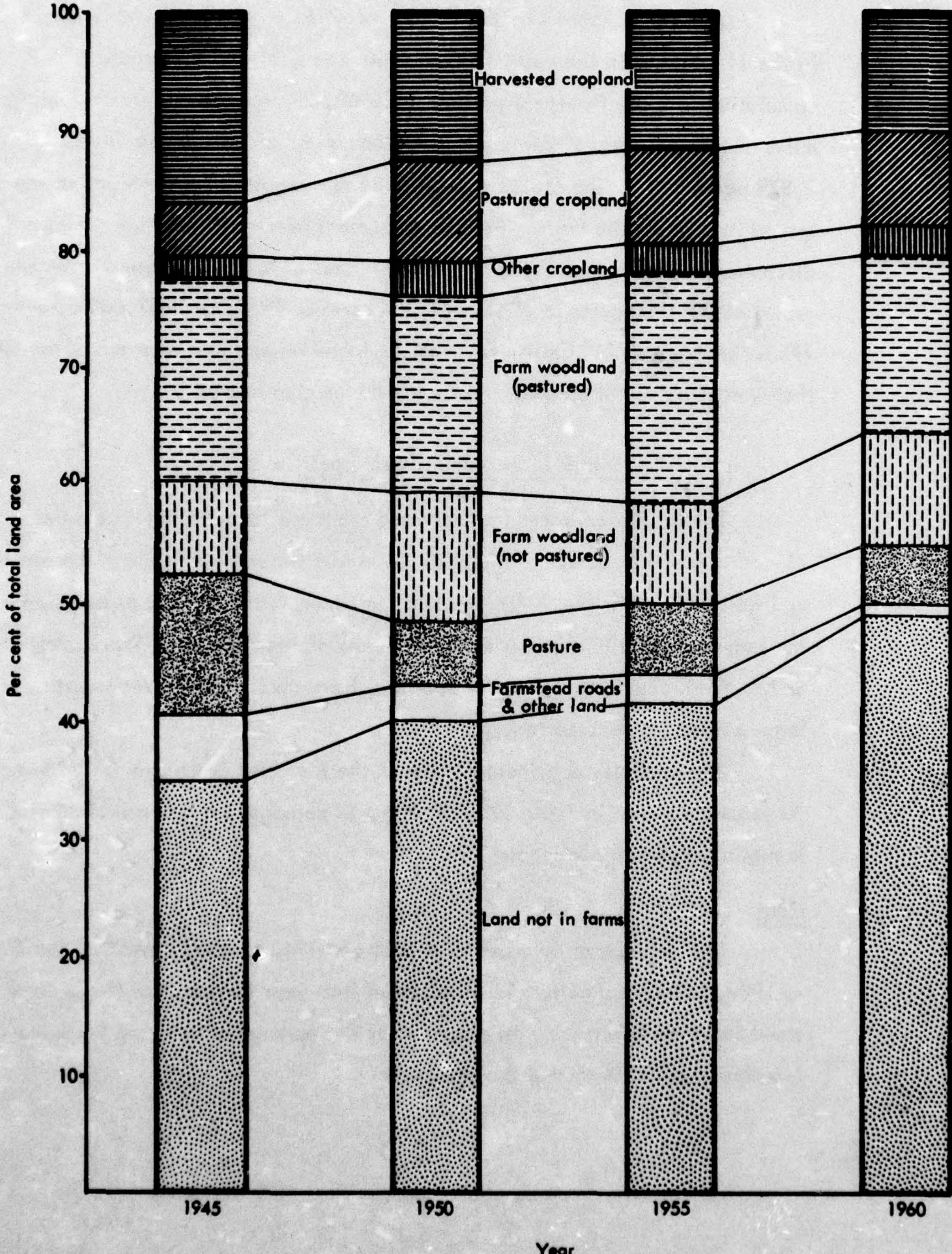
PERCENTAGE OF LAND IN FARMS IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN IN DIFFERENT USES BY CENSUS YEARS, 1945-1960

Item	1945	1950	1955	1960
Cropland				
Harvested	24.6	20.8	19.4	19.7
Pastured	7.1	14.7	14.3	15.7
Not harvested and not pastured	2.9	4.4	3.4	4.4
Woodland				
Pastured	26.2	27.4	34.1	29.0
Not pastured	12.3	18.3	14.1	17.7
Other pasture	18.9	9.8	10.7	10.5
Farmstead, roads and other land	8.0	4.6	3.8	3.0
TOTAL LAND IN FARMS	100.0	100.0	100.0	100.0

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Figure 11

TREND IN LAND USE IN THE ELEVEN MERAMEC BASIN COUNTIES, 1945-1960



Soil and water conservation

The data in Table 11 show the conservation practices that were used on farms in the 11 counties in the years 1956 to 1960. Several of these practices are cumulative. In the five-year period, 1956-60, 272 terrace outlets were built; 612 miles of terraces were constructed; 91 water control structures were installed, and 2,379 ponds built. The practice of planting row crops on the contour became widespread throughout the basin. Perhaps even more important than these measures was discontinuance of crop production on many acres of land. Harvested crops were grown on 726;000 acres in 1945, 521,000 acres in 1955, and 467,000 acres in 1960. Without doubt, grass and timber replaced other cover on much of the land that was taken out of crops, thus reducing the erosion hazard.

Trends in Acreage of Principal Crops

The largest acreages in cultivated crops are found in those counties along the northern border of the basin, and to a lesser extent, along the eastern and western margins also (Figure 12). In general, these counties also have the largest proportion of their cultivated land planted in corn. The central and southern counties, by way of contrast, have small total acreages with a large proportion devoted to hay.

The acreages of principal crops in the Meramec Basin over a period of 30 years are shown in Table 12. The trend in acreages for five principal crops is shown graphically in Figure 13.

Corn

The acreage of corn between 1930 and 1960 reached a peak of 266,000 in 1939. Wide fluctuations have occurred from year to year, but the general trend has been downward. In recent years the acreage of this crop has been less than two-thirds that of the peak year.

Table 11

CONSERVATION WORK COMPLETED IN THE ELEVEN COUNTIES OF MISSOURI THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN, 1956 - 1960

Conservation Measure	Unit of Measure	1956	1957	1958	1959	1960
Terrace outlets	number	50	38	89	54	41
Terraces built	miles	108	110	189	129	76
Water control structures	number	10	9	24	33	15
Crops contoured	acres	83,950	17,095	44,111	43,480	33,410
Ponds	number	804	454	422	346	353
Crops irrigated	acres	7,206	1,137	2,020	2,046	813

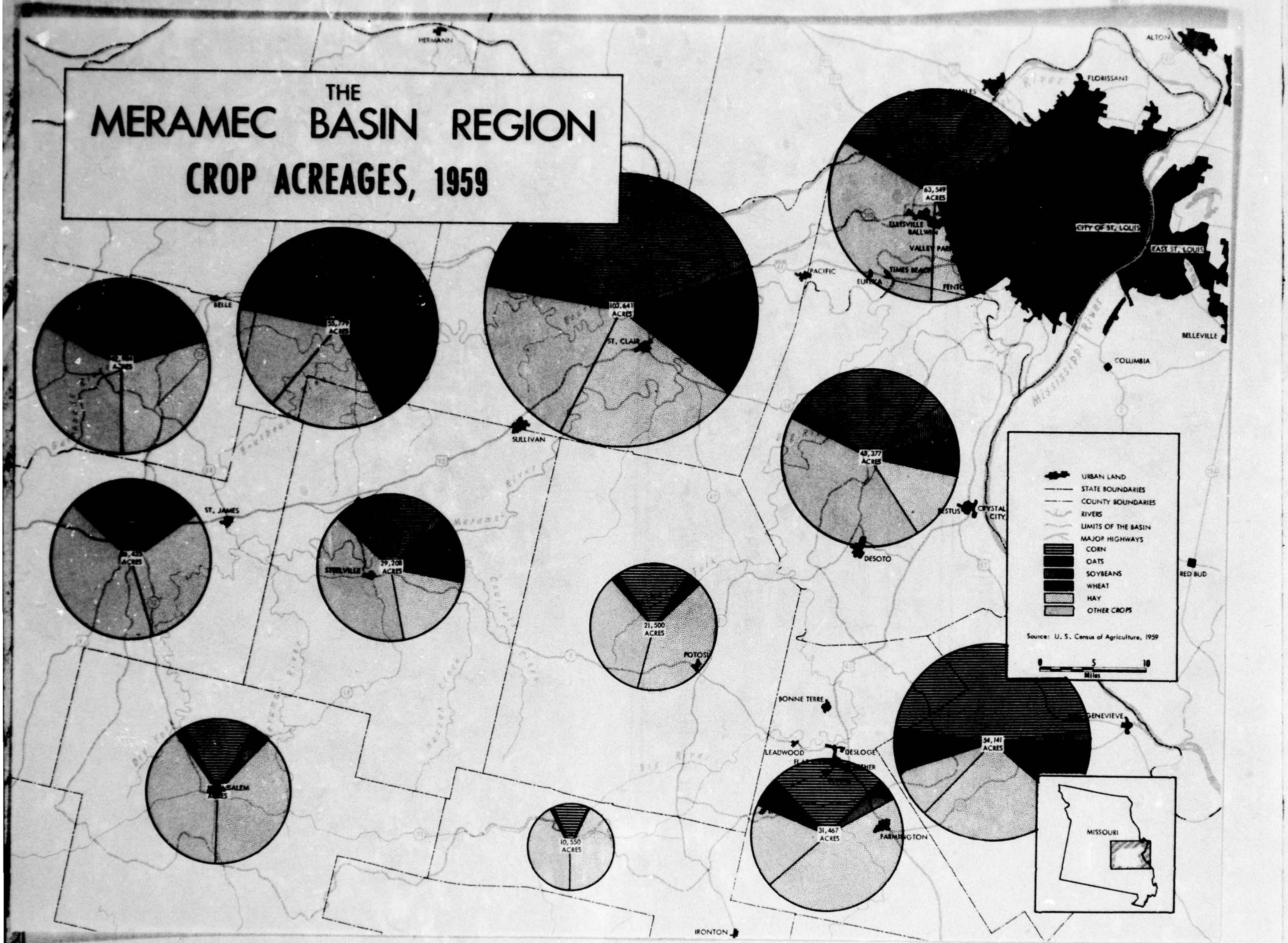

THE
MERAMEC BASIN REGION
CROP ACREAGES, 1959
HERMANN
ALTON
FLORISSANT
63,549
ACRES
ELLISVILLE
BALLWIN
VALLEY PARK
TIMES BEACH
EUREKA
PACIFIC
CITY OF ST. LOUIS
EAST ST. LOUIS
BELLEVILLE
COLUMBIA
Mississippi River
BELLE
103,641
ACRES
ST. CLAIR
SULLIVAN
48,377
ACRES
FESTUS
CRYSTAL CITY
DESOTO
ST. JAMES
29,208
ACRES
STEELVILLE
21,500
ACRES
POTOSI
RED BUD
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
CORN
OATS
SOYBEANS
WHEAT
HAY
OTHER CROPS
Source: U. S. Census of Agriculture, 1959
0 5 10
Miles
BONNE TERRE
LEADWOOD
DESLOGE
GENEVIEVE
54,141
ACRES
31,467
ACRES
FARMINGTON
10,550
ACRES
MISSOURI
IRONTON
SALEM
ACRES
Meramec River
Big River

Table 12

ACRES OF PRINCIPAL CROPS IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN, 1930-59

Year	Corn	Oats	Wheat	Hay	Soybeans	All Cultivated Crops
1930	233,940	74,220	148,900	267,210		457,060
1931	251,090	81,320	170,670	254,320		503,080
1932	246,540	66,360	126,420	251,900		439,320
1933	222,990	53,780	145,010	237,290		421,780
1934	199,490	36,600	158,260	273,280		394,350
1935	147,100	42,890	175,050	225,240		365,040
1936	211,420	63,300	149,800	246,560		424,520
1937	189,570	51,200	175,710	229,620		416,480
1938	219,640	47,590	136,930	266,640		404,160
1939	265,770	50,950	121,920	277,840		438,640
1940	264,550	39,980	118,160	269,620	10,110	432,800
1941	161,520	47,900	124,950	264,200	600	334,970
1942	174,300	75,810	153,400	281,700	13,000	316,510
1943	184,880	62,510	183,140	277,100	11,700	342,230
1944	204,400	62,500	129,000	275,100	11,600	407,500
1945	172,000	63,100	147,200	272,800	9,290	391,590
1946	205,800	77,900	120,900	299,300	13,300	417,900
1947	191,000	45,100	148,500	312,500	9,700	394,300
1948	223,400	59,200	129,800	297,700	9,200	421,600
1949	186,900	55,200	149,200	312,900	10,400	401,700
1950	175,000	54,900	118,400	274,200	14,300	362,600
1951	162,900	47,300	112,100	343,700	8,400	330,700
1952	173,200	40,400	97,200	264,700	14,900	325,700
1953	169,300	48,700	103,900	189,900	13,300	335,200
1954	154,500	54,500	74,400	179,000	13,300	296,700
1955	177,100	38,400	104,700	256,500	16,700	336,900
1956	154,000	42,800	74,100	324,100	12,100	283,000
1957	134,000	24,800	73,300	254,000	13,800	245,900
1958	150,000	17,500	63,200	252,100	12,100	242,800
1959	184,300	22,800	65,900	206,000	18,700	291,700

AD-A036 825 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 8/6

MERAMEC RIVER, MISSOURI COMPREHENSIVE BASIN STUDY. VOLUME II. A--ETC(U)

JAN 64 E L ULLMAN, R R BOYCE, D J VOLK

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2 OF 3

AD A036825

Figure 13

TRENDS IN ACRES OF PRINCIPAL CROPS IN THE ELEVEN MERAMEC BASIN COUNTIES, 1930-1959

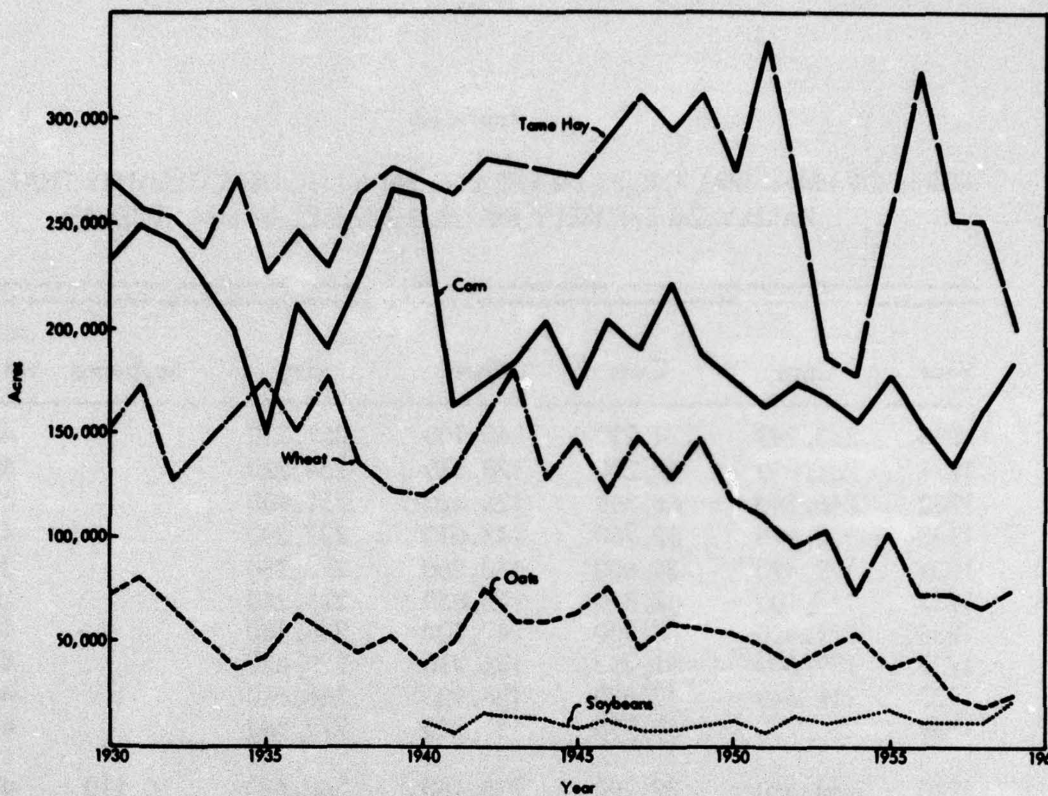
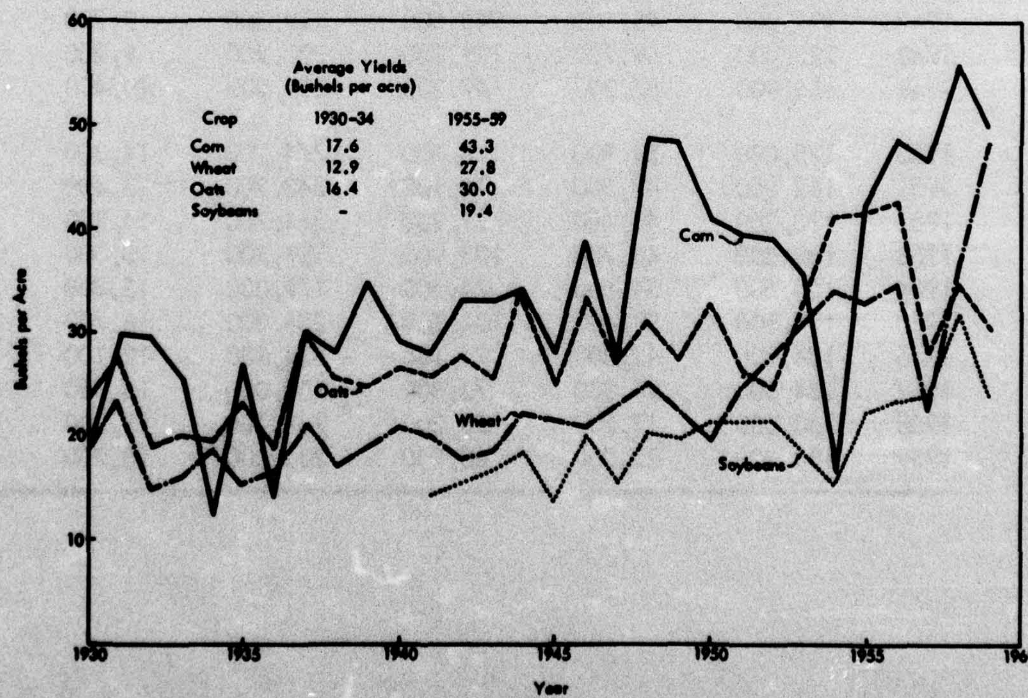


Figure 14

YIELDS OF PRINCIPAL CROPS IN THE ELEVEN MERAMEC BASIN COUNTIES, 1930-1959



Wheat

Wheat is the second most important cultivated crop. The acreage reached a peak of 175,000 in 1935. Since that year the trend has been irregularly downward reaching a low of 63,000 acres in 1958.

Oats

In 1931, 81,000 acres were planted to oats in the 11 counties. As has been the case with crops, the trend has been irregularly downward reaching a low of 17,500 acres in 1958.

Soybeans

Soybeans were first listed in the crops for the area in 1940 when 10,000 acres were reported. The acreage has varied from year to year, but it is the only major crop that has shown an upward trend. In 1959, about 19,000 acres were reported. No doubt acreage allotments for corn and wheat have influenced this trend.

Five principal crops

When the five principal cultivated crops are considered, a definite downward trend in acreage is evident, particularly since 1948 (Table 12). The peak for the 1930-1959 period (503,000 acres) was reached in 1931. In 1948, 422,000 acres of the five principal crops were grown. The acreage dropped to 243,000 in 1958 which was only 48% of the 1931 peak and 58% of the 1948 acreage.

Tame hay

While the acreage of cultivated crops has been declining the area used for tame hay crops has shown no definite trend. The peak (344,000 acres) was reached in 1951 and the low (179,000 acres) in 1954. Annual variations reflect weather conditions (Figure 13).

Crop Yields

While the acreage of most of the principal crops has been declining, yields have been rising. This fact is shown by the data presented in Table 13 and

Table 13

YIELDS OF PRINCIPAL CROPS IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN, 1930-59

Year	Corn (Bushels)	Oats (Bushels)	Wheat (Bushels)	Soybeans (Bushels)	Hay (Tons)
1930	12.5	18.0	12.5		.54
1931	24.5	22.8	18.4		.89
1932	24.1	13.8	9.9		.77
1933	20.0	14.7	10.2		.81
1934	7.0	13.6	13.3		.71
1935	21.2	18.2	10.4		1.10
1936	9.4	13.8	10.7		.61
1937	24.3	24.6	15.8		1.10
1938	22.1	20.3	11.7		1.08
1939	29.3	19.2	13.9		1.13
1940	23.9	21.1	15.3		.98
1941	22.1	21.0	13.5	9.0	.98
1942	27.7	22.0	12.3	10.0	1.26
1943	27.5	20.5	12.9	11.8	1.12
1944	28.1	28.9	16.8	13.8	.91
1945	22.3	19.9	16.1	8.5	1.09
1946	33.4	27.9	15.1	15.0	1.25
1947	22.5	22.0	17.9	10.7	1.12
1948	43.7	25.5	19.5	15.1	1.34
1949	42.4	21.9	16.3	14.3	1.40
1950	36.4	26.7	14.8	15.4	1.25
1951	34.1	21.1	18.6	15.6	1.33
1952	33.7	18.9	20.7	16.1	1.01
1953	29.3	25.0	24.8	12.4	.99
1954	11.2	35.5	28.5	10.5	1.10
1955	36.9	35.8	27.7	16.4	1.45
1956	43.6	37.3	28.6	17.4	1.42
1957	41.0	22.4	16.5	17.8	1.49
1958	50.7	28.8	24.5	25.7	1.44
1959	44.4	26.0	41.9	19.5	1.36

Figures 14 and 15. Average corn yields in the 1955-59 period were 2.5 times those of 1930-34. Wheat yields went up from 12.9 bushels per acre to 27.8 bushels. Oats advanced from 16.4 bushels to 30.0 bushels. Yields of tame hay also doubled. These increases in yields kept the production of grain from declining as much as the decrease in acreage.

Livestock Numbers

Cattle

The downward trend in cultivated crops, particularly feed grains, has influenced the livestock population in the area (Table 14). The trend in cattle numbers has been upward. The peak of 259,000 head came in 1956, but the number still remains high (Figure 16). The distribution of cattle within the basin is similar to the distribution of cultivated land -- larger numbers on the margins, particularly the northern margin, and smaller numbers in the central and southern counties (Figure 17).

Most of the cattle are produced for beef. The Meramec Basin is much nearer St. Louis than is the southwest Missouri Dairy area from which the city obtains a considerable part of its milk supply.

Relatively few farmers have dairy cattle as their principal enterprise. In 1959, only 600 out of 12,800 were listed as dairy farmers. In 1954, 10,200 farmers listed milk cows as part of their livestock. The average number of milk cows on these farms was 4.6 head. In 1959, 4,900 farmers reported 27,700 milk cows for an average of 4.7 cows per farm. Franklin and Jefferson counties, two counties near St. Louis, have the highest proportion of milk cows to total cattle. Washington and Iron counties, in the south-central part of the basin, have the lowest proportion (Figure 17).

The trend in milk cows is downward. The number in the 11 counties reached a peak of 80,500 head in 1944 and declined to 38,400 head in 1959 (Table 14 and Figure 16). Apparently milk production cannot compete with industry for labor and capital in this area. Where good jobs are available without any investment in

Figure 15

YIELDS OF TAME HAY IN THE ELEVEN MERAMEC BASIN COUNTIES, 1930-1959

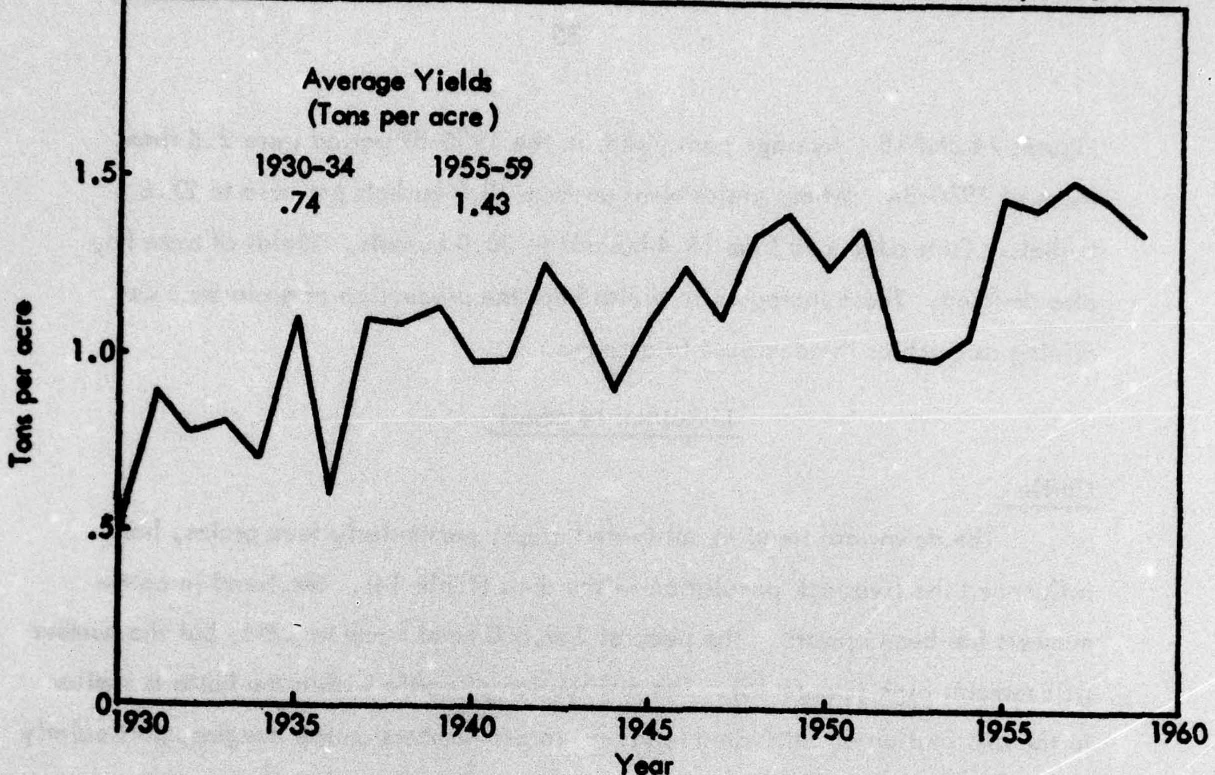


Figure 16

HEAD OF ALL CATTLE AND OF DAIRY COWS
IN THE ELEVEN MERAMEC BASIN COUNTIES, JANUARY 1, 1930-1959

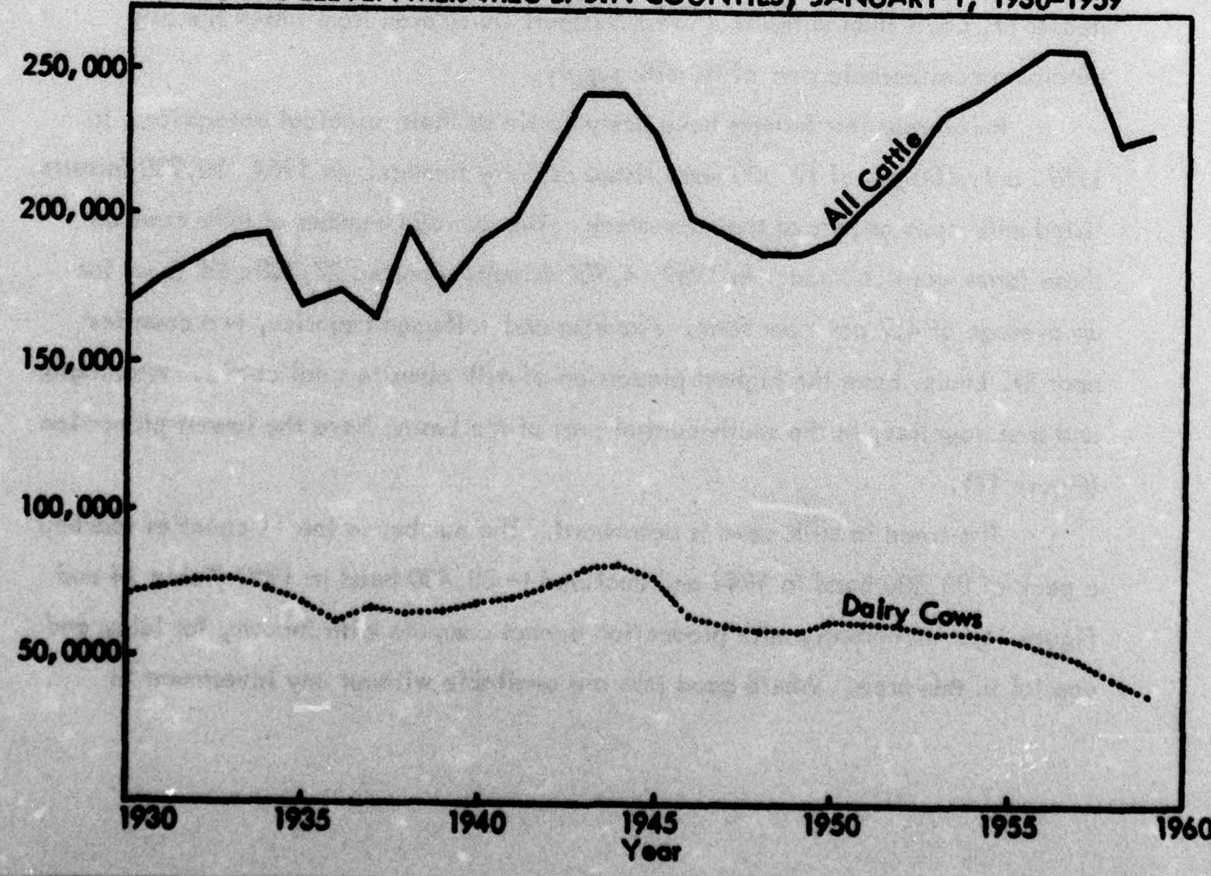
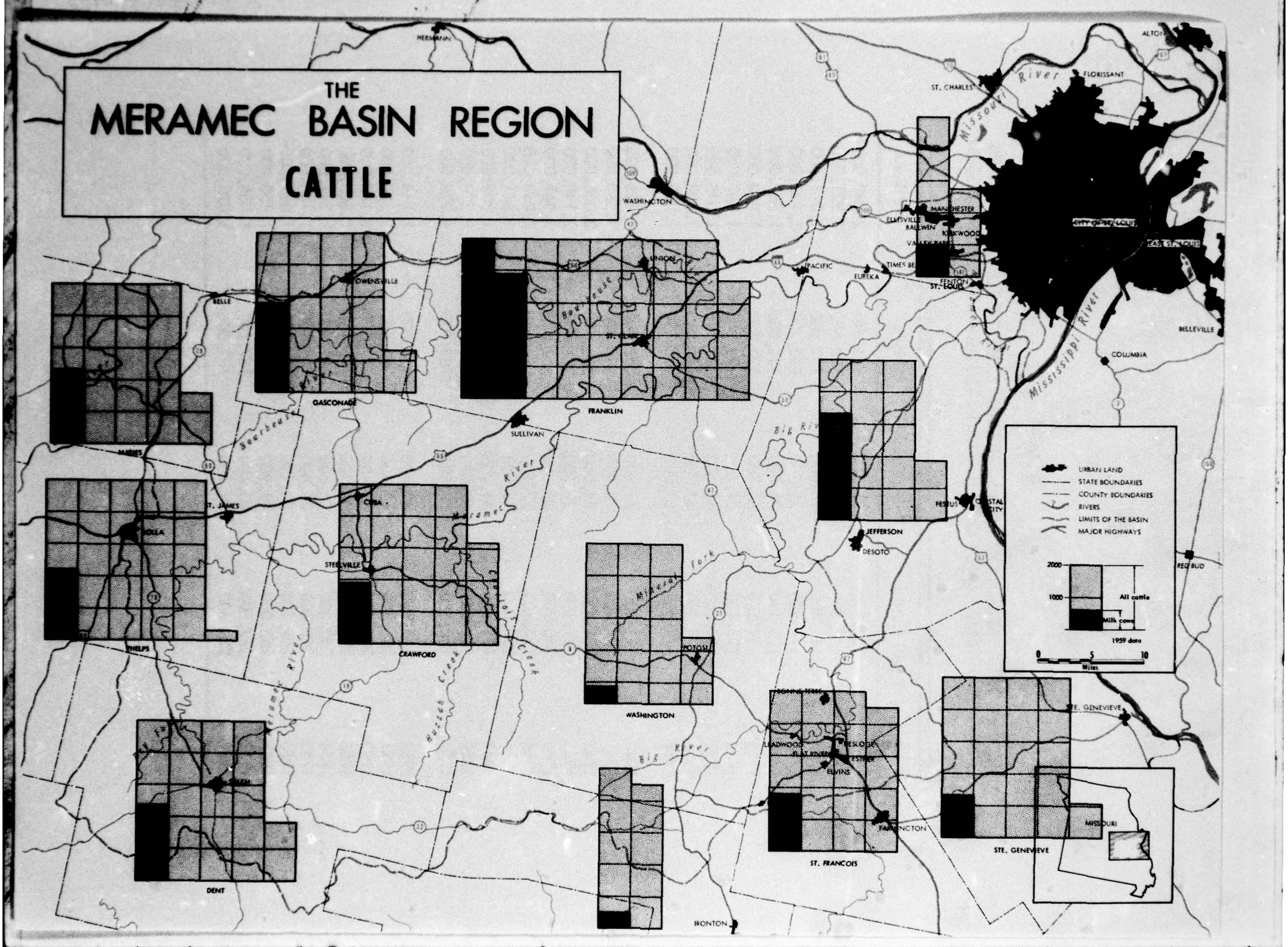


Table 14

NUMBER OF LIVESTOCK ON FARMS JANUARY 1, IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN, 1930-59

Year	All Cattle	Dairy Cows	Hogs	Chickens
1930	169,500	71,100	134,740-	2,349,000+
1931	177,800	73,200	180,600	1,931,000
1932	185,400	75,000	171,500	1,841,000
1933	191,900	75,700	203,100	1,932,000
1934	193,100	71,800	186,300	1,861,000
1935	169,500	68,600	174,100	1,662,000
1936	173,100	61,400	135,900	1,602,000
1937	164,600-	66,300	139,100	1,548,000
1938	195,600	63,760	140,900	1,438,000
1939	174,300	64,900	165,600	1,589,000
1940	191,500	67,400	202,700	1,626,000
1941	199,700	70,900	194,000	1,580,000
1942	221,700	74,000	250,500	2,036,000
1943	241,600	79,500	281,000	2,110,000
1944	240,700	80,500+	281,100+	1,961,000
1945	228,400	77,700	224,700	2,032,000
1946	200,800	63,700	183,700	1,861,000
1947	193,500	61,200	179,200	1,807,000
1948	188,500	59,800	188,500	1,728,000
1949	188,500	59,800	188,500	1,728,000
1950	192,900	62,700	193,000	1,548,000
1951	206,400	62,400	203,600	1,388,000
1952	218,100	61,100	179,200	1,186,000
1953	235,700	58,300	148,100	1,266,000
1954	242,300	58,600	141,500	1,249,000
1955	250,000	56,800	144,400	1,133,000
1956	259,100+	53,100	176,600	1,029,000-
1957	258,000	49,900	173,600	1,158,000
1958	227,500	43,400	157,200	1,055,000
1959	230,600	38,400-	181,500	1,070,000


THE
MERAMEC BASIN REGION
CATTLE
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
2000
1000
All cattle
Milk cows
1959 data
0
5
10
Miles
GASCONADE
FRANKLIN
MARIES
PHELPS
CRAWFORD
DENT
WASHINGTON
JEFFERSON
ST. FRANCOIS
STE. GENEVIEVE
MISSOURI
HERMANN
WASHINGTON
ST. CHARLES
FLORISSANT
ALTON
CITY OF ST. LOUIS
EAST ST. LOUIS
BELLEVILLE
COLUMBIA
RED BUD
MANCHESTER
ELLISVILLE
BALLWIN
KIRKWOOD
PACIFIC
EUREKA
UNION
OWENSVILLE
BELLE
SULLIVAN
ST. JAMES
ROLLA
CUBA
STEELVILLE
POTOSI
FESTUS
DESOTO
FLAT RIVER
ELVINS
LEADWOOD
FARMINGTON
STE. GENEVIEVE
IRONTON
Missouri River
Mississippi River
Big River
Meramec River
Bourbeuse River
Mineral Fork
Huzzah Creek
Courtois Creek

flocks and herds or in equipment for their care, there is a tendency to work off the farm. This appears to be the situation in the Meramec Basin.

Hogs

The number of hogs and chickens in the Meramec area is shown in Figure 18. Hog numbers rose from 135,000 on January 1, 1930 to 281,000 in 1944, then dropped to 141,500 in 1954. Since that year the trend has been irregularly upward, but the number is not likely to go much above 200,000 if feed grain production does not increase (Figure 19).

Poultry

On January 1, 1930, farmers in the counties that lie partly or entirely in the Meramec Basin had 2,350,000 chickens. The number declined to 1,440,000 in 1938 and then rose to 2,110,000 in 1943. Since that date the downward trend has been almost constant. In 1957 only 1,070,000 were reported in the area (Figure 20).

Two important factors in the decline in poultry numbers have been the movement toward specialized laying flocks with mass production of both eggs and poultry meat and the decline in locally produced feed grain. The 1930 level of poultry production is not likely to return unless a concentrated area is established to produce eggs and meat for a specific market.

Farm Income

Commercial farms

The United States Census Bureau places commercial farms in six classes according to their gross annual sales. The results are shown in Tables 15 and 16. These data are for the census years 1940 through 1960.

As shown in Table 15 and Figure 21, the number of commercial farms in the area has decreased considerably in the past 20 years. The decline has been from a high of 21,500 in the year 1940, to a low of 5,800 in 1960. However, it appears that gross sales per farm were larger in 1960 than in previous census years.

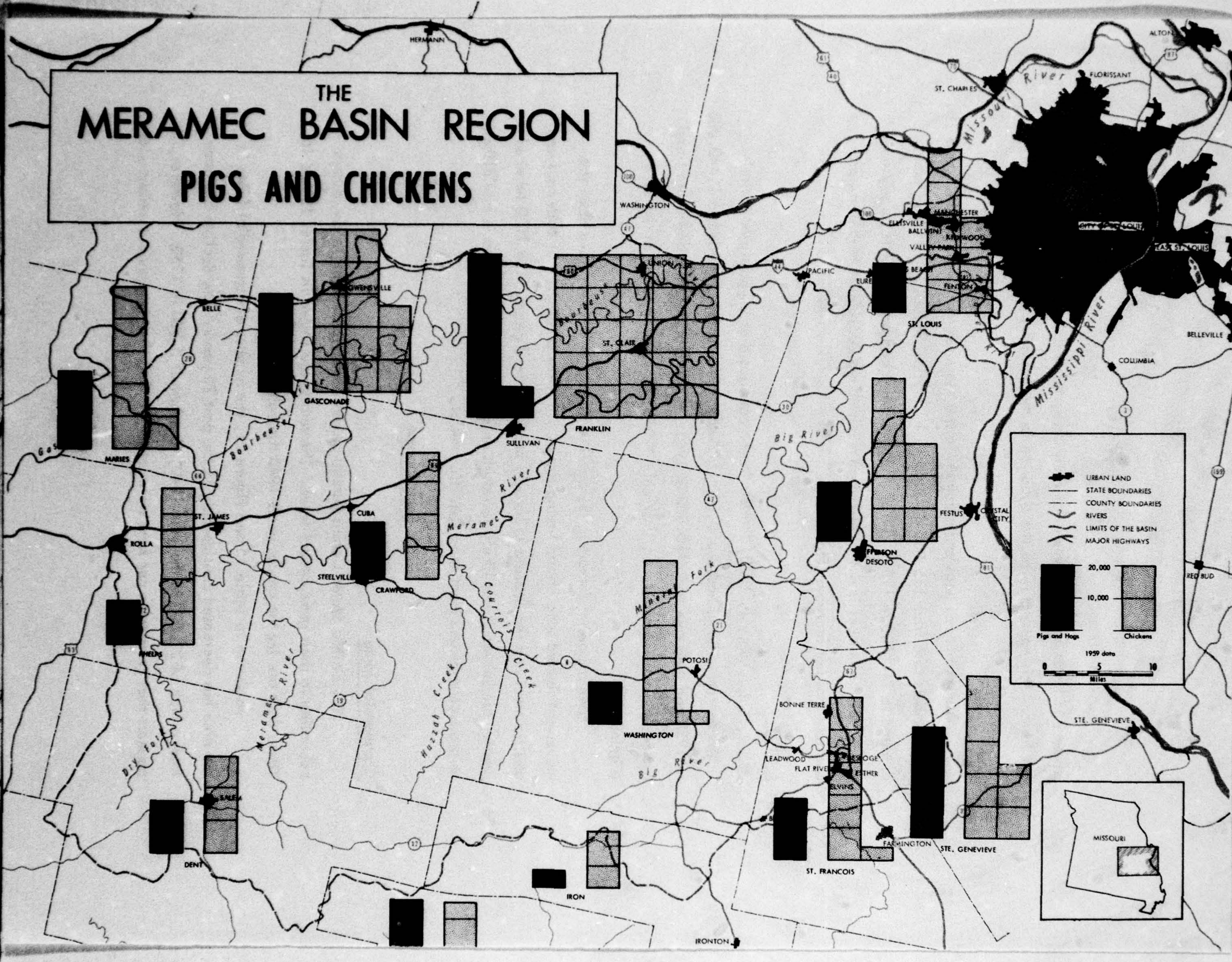

THE
MERAMEC BASIN REGION
PIGS AND CHICKENS
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
20,000
10,000
Pigs and Hogs
Chickens
1959 data
0 5 10
Miles
MISSOURI
HERMANN
ST. CHARLES
FLORISSANT
ALTON
WASHINGTON
BELLEVILLE
COLUMBIA
RED BUD
STE. GENEVIEVE
FESTUS
CRYSTAL CITY
DESOTO
ST. LOUIS
FENTON
PACIFIC
ELLISVILLE
BALLWIN
MANCHESTER
KIRKWOOD
ST. CLAIR
FRANKLIN
SULLIVAN
GASCONADE
BELLE
MARIES
ST. JAMES
ROLLA
CUBA
STEELVILLE
CRAWFORD
POTOSI
WASHINGTON
BONNE TERRE
LEADWOOD
FLAT RIVER
ESTHER
ELVINS
FARMINGTON
ST. FRANCOIS
STE. GENEVIEVE
DENT
IRON
IRONTON
Missouri River
Mississippi River
Meramec River
Big River
Bourbeuse River
Courtois Creek
Huzzah Creek
Dry Fork
Mineral Fork

Figure 19

HEAD OF SWINE ON FARMS IN THE ELEVEN MERAMEC BASIN COUNTIES, JANUARY 1, 1930-1959

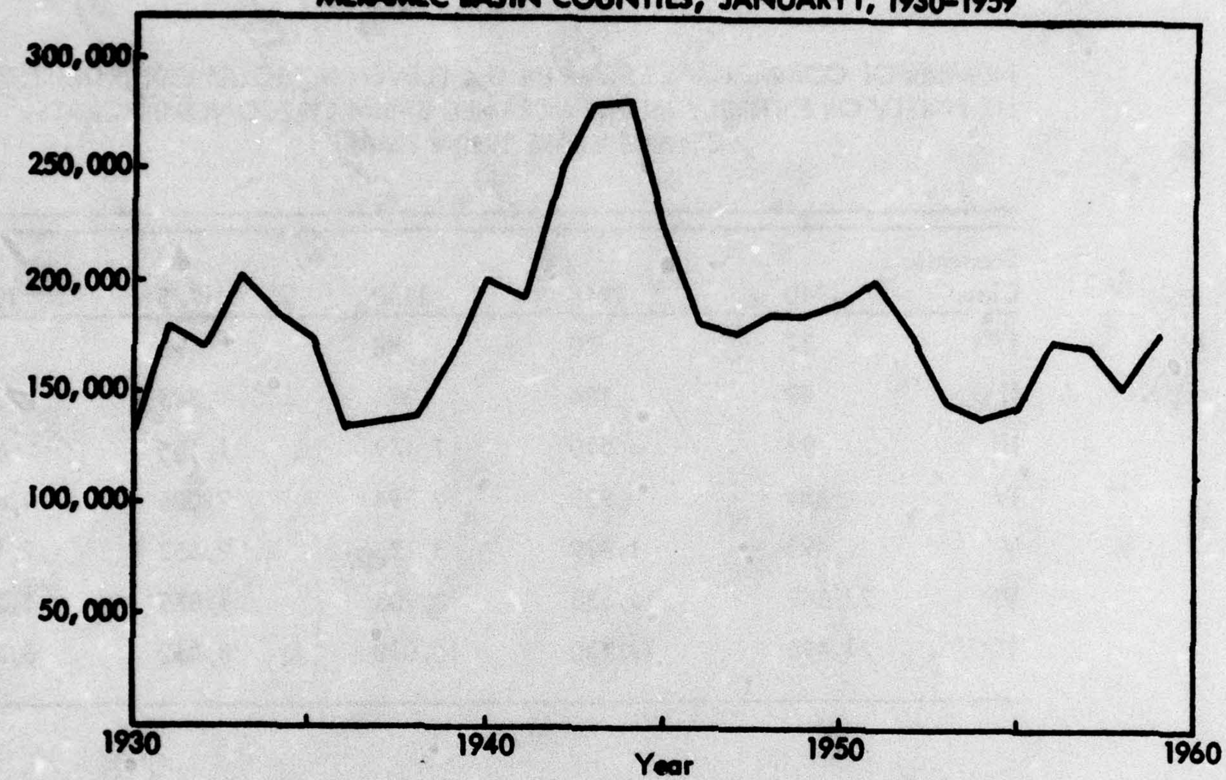


Figure 20

NUMBER OF CHICKENS ON FARMS IN THE ELEVEN MERAMEC BASIN COUNTIES, JANUARY 1, 1930-1959

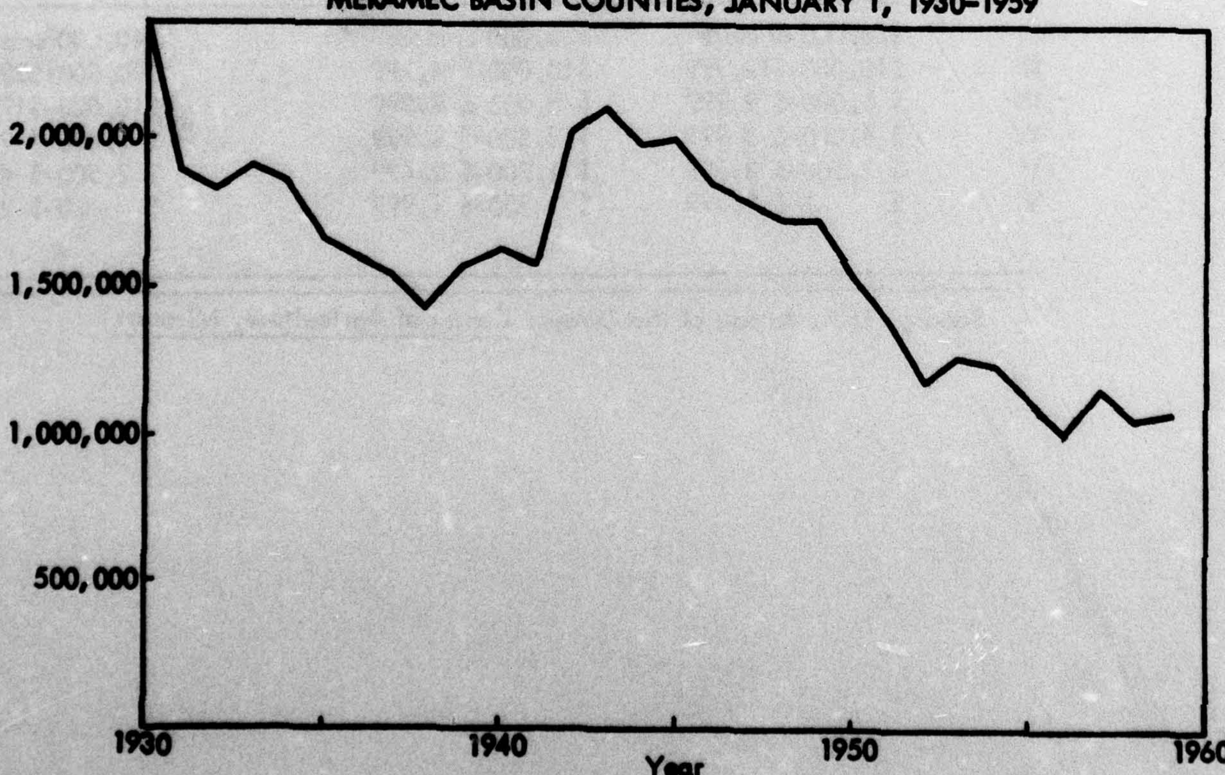


Table 15

NUMBER OF COMMERCIAL FARMS IN THE ELEVEN MISSOURI COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY ECONOMIC CLASS, CENSUS YEARS 1940 - 1960*

Economic Class	1940	1945	1950	1955	1960
I	27	70	88	96	67
II	49	184	370	348	174
III	91	510	1,179	1,105	614
IV	189	929	2,294	2,086	1,449
V	491	1,899	3,176	2,652	2,155
VI	20,649	16,338	2,903	1,875	1,334
TOTAL	21,496	19,930	10,010	8,162	5,793

*Farms were classified as follows:

Class	1940 and 1945 Gross Sales	1950 and 1955 Gross Sales	1960 Gross Sales
I	$20,000 or more	$25,000 or more	$40,000 or more
II	$10,000-$19,999	$10,000-$24,999	$20,000-$39,999
III	$ 6,000-$ 9,999	$ 5,000-$ 9,999	$10,000-$19,999
IV	$ 4,000-$ 5,999	$ 2,500-$ 4,999	$ 5,000-$ 9,999
V	$ 2,500-$ 3,999	$ 1,200-$ 2,499	$ 2,500-$ 4,999
VI	$ 1-$ 2,499	$ 250-$ 1,999	$ 50-$ 2,499

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Table 16

PERCENTAGE OF COMMERCIAL FARMS IN THE VARIOUS ECONOMIC CLASSES IN THE ELEVEN COUNTIES THAT LIE PARTLY OR ENTIRELY IN THE MERAMEC BASIN BY CENSUS YEARS 1940-60

Economic Class	1940	1945	1950	1955	1960
I	.1	.3	.9	1.2	1.2
II	.2	.9	3.7	4.3	3.0
III	.4	2.6	11.8	13.5	10.6
IV	.9	4.7	22.9	25.5	25.0
V	2.3	9.5	31.7	32.5	37.2
VI	96.1	82.0	29.0	23.0	23.0
Total	100.0	100.0	100.0	100.0	100.0

Source: U.S. Bureau of the Census, Census of Agriculture, Missouri

Figure 21

NUMBER OF COMMERCIAL FARMS
IN THE ELEVEN MERAMEC BASIN COUNTIES, 1940 - 1960

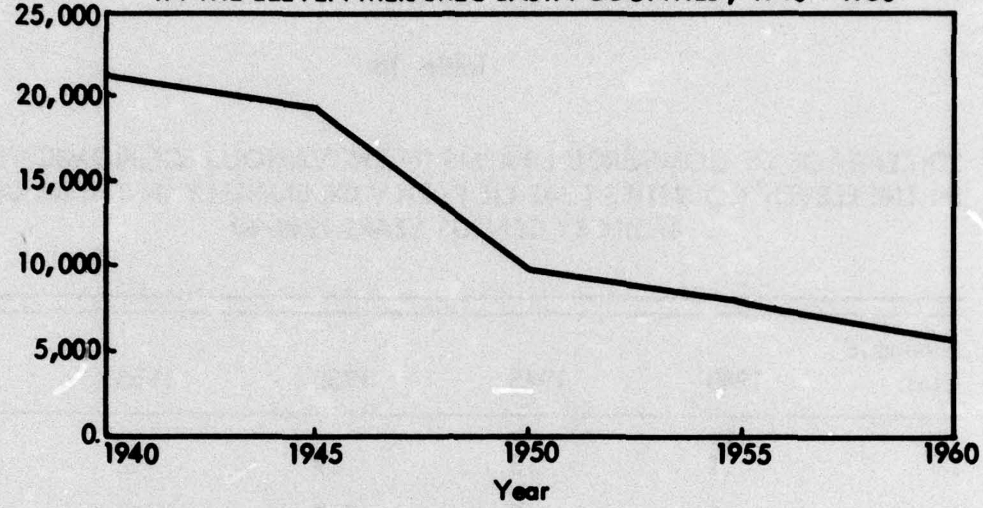
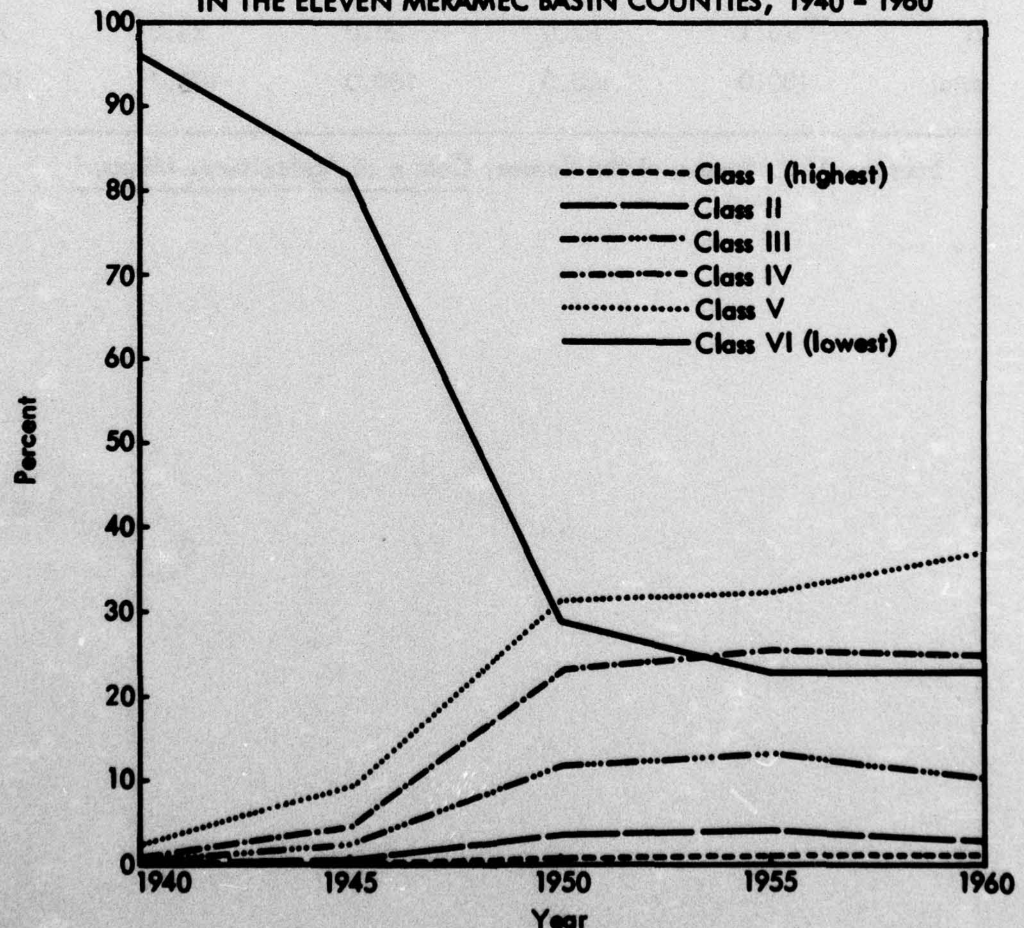


Figure 22

PERCENTAGE OF COMMERCIAL FARMS IN THE VARIOUS ECONOMIC CLASSES
IN THE ELEVEN MERAMEC BASIN COUNTIES, 1940 - 1960



In 1940, 96% of the farms were in the groups that sold and/or consumed less than $2,500 worth of products. Less than 1% sold and/or consumed products valued at $6,000 or more. In 1960, only 23% of the farmers were in the extremely low income group and 15% sold and/or consumed products valued at $10,000 or more (Table 16 and Figure 22).

Off-farm work

In 1959, the number of farm operators doing some work off the farm was 6,760 or 53% of the total. Of these, approximately 5,250 (about 41%) worked 100 or more days off their farms. The increase in the proportion of off-farm workers between 1949 and 1959 was from 42% to 53%. (Because of the decrease in number of farms, the actual number of off-farm workers declined.)

In 1949, about 38% of the farm families received more income from other sources than from the sale of farm products. By 1959, this proportion had increased to 54% (6,910 families). Although family farm income has continued to rise, the number of families depending primarily on farm income has declined from approximately 11,300 in 1949 to slightly more than 5,800 in 1959. This trend toward greater reliance on non-agricultural sources of income will probably continue in the future. Planning for economic improvement in the Meramec Basin can best be furthered by taking such trends into account, and attempting to make the transition as easy as possible.

Summary

The purpose of this analysis was to describe the Meramec Basin with regard to its agricultural resources. Particular attention was given to agricultural trends, and the following facts noted:

1. The acreage of land in farms declined from 2,950,000 in 1945 to 2,373,000 in 1950.

2. The number of farms went down from 23,600 in 1935 to 12,700 in 1960. The number of commercial farms declined from 21,500 in 1940 to 5,800 in 1960.

3. The acreages of three principal crops (corn, oats, wheat) have shown an irregularly downward trend since 1930. Since 1940, the soybean acreage has tended to increase; however, it accounts for a relatively small percentage of the total cultivated acreage in the area. The trend in acreage of the principal cultivated crops has been irregularly downward, decreasing from 457,000 acres in 1930 to 292,000 acres in 1959. The average yield per acre of crops during this period has been generally upward.

Soil conservation work in the area during the 1956-60 five-year period included construction of 272 terrace outlets, 612 miles of terraces, and 2,379 ponds. More than 30,000 acres of crops have been planted on the contour each year since 1957.

4. Livestock trends have been irregular. Cattle numbers moved up from 170,000 in 1930 to 231,000 in 1959. The number of dairy cows reached a high of 80,500 in 1944, but by 1959 had decreased to 38,400 head. The Meramec Basin is much closer to St. Louis than the area that supplies the city with a high percentage of its fluid milk. Apparently jobs in factories give farmers higher incomes than keeping dairy cows.

The number of hogs in the area has varied greatly, increasing irregularly from 135,000 head in 1930 to 281,000 in 1944 then decreasing to 141,500 in 1954. Since 1954 the trend has been irregularly upward and by 1959 there were 181,500 head on farms in the area.

In 1943 farmers in the 11 counties that lie partly or entirely in the Meramec Basin had 2,110,000 chickens. This number has declined almost constantly. In 1959 there were 1,070,000 chickens in the area.

5. The decrease in number of commercial farms has been accompanied by an increase in size of operating units and average income per farm. In 1940, 96% of the farm operators sold and/or consumed less than $2,500 worth of products. In 1960, only 23% were in this low income group. In 1940, less than 1% of the farmers sold, and/or consumed products worth $6,000 or more. In 1960, 15% sold and/or consumed products valued at $10,000 or more, and 40% sold or consumed products worth $5,000 or more.

6. The adjustments that have taken place in the Meramec Basin have improved levels of living among the people. Further advances depend upon development of the mineral, water, recreational, and industrial resources of this section of Missouri. Agriculture will continue to be important, but fewer people can depend upon it if income per family is to continue to rise.

THE MERAMEC BASIN

Volume II

The Economy and Character of the Meramec Basin

Chapter 3

FORESTRY

by

Richard C. Smith
Professor of Forestry
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Meramec Basin Research Project
Washington University
St. Louis, Missouri
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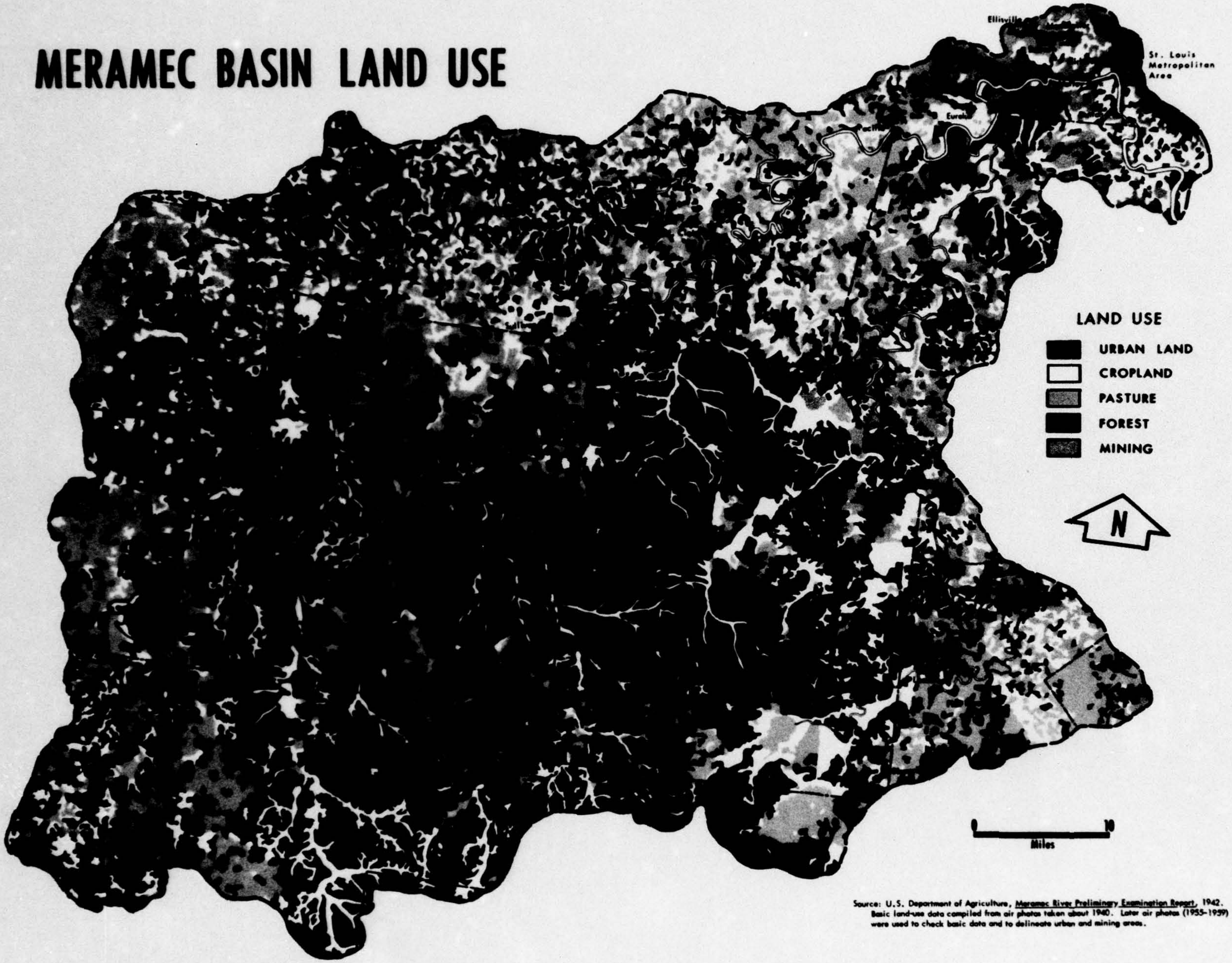
MERAMEC BASIN LAND USE



Source: U.S. Department of Agriculture, Meramec River Preliminary Examination Report, 1942. Basic land-use data compiled from air photos taken about 1940. Later air photos (1955-1959) were used to check basic data and to delineate urban and mining areas.

SUMMARY

FORESTRY IN THE MERAMEC BASIN

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The ultimate success of any plan for land-use in the Meramec Basin will depend greatly on the rehabilitation of the area's forests so that they may contribute their full share in creating a favorable setting for recreation and wildlife, providing a stable flow of water, minimizing soil erosion, and providing employment and other gains from harvesting timber and manufacturing wood products.

Although the past has been discouraging, there are many signs of a healthy future. Much progress has been made. If current trends in forest management and industrial demand continue, moderate advances in the future can be expected. Much more improvement, however, is needed.

Forest areas are now receiving and responding to better protection. Fire has always been a major problem but statistics reflect a decrease in area burned. Fire in the basin is tied closely to the people. The incendiarist and the debris-burner are still active but protection programs are becoming increasingly effective.

Open-range grazing has decreased. With the development of more valuable cattle breeds and the growing realization that a few acres of improved pasture can replace several hundred acres of woodland grazing, the number of cattle in the woods can be expected to decline.

New and expanding markets are providing better outlets for a variety of wood materials. Higher stumpage values result from competition for higher-quality timber. With rehabilitation of depleted stands, continued expansion by industries seems inevitable.

Agency programs, development of a more stable industrial structure and increased demand for wood products have resulted in significant changes in attitudes of people regarding forest land. Wood has finally been recognized as a resource capable of contributing to the economy of the family, industry, and the community.

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*The following have kindly read this report: Edwin Glaser, Missouri Conservation Commission; L.L. Sluzalis, U.S. Forest Service, Rolla, Missouri; R.H. Westveld, Director, and Lee K. Paulsell, School of Forestry, University of Missouri; R.A. Ralston, Leader, Columbia Forest Research Center, U.S. Forest Service. Still others contributed valuable suggestions and are noted in footnote [1], p 3.

In the Meramec Basin, 1,512,000 acres are forested, 60% of the land area. The southern one-half is more heavily forested and includes large blocks of unbroken timber. Private owners hold 85% of the forest land and farmers are the largest single class of owners. Forested portions of farms include 680,000 acres, 45% of the total. Other people own 591,000 acres. State-owned land in parks, state forests and wildlife refuges exceeds 34,000 acres, and the federal government owns 195,000 acres, administered by the Forest Service.

About 24% of the forest area is in sawtimber, 40% is in poletimber, and 15% is in satisfactorily stocked seedlings and saplings. A major weakness is that 21% of the forest area does not support an adequate stocking of trees -- wasted space.

The forest area supports 926 million board feet of sawtimber. Expressed in cords of 128 cubic feet, the total volume of growing stock in trees 5 inches in diameter and larger is about 8 million cords. Over 1 million cords are in crooked, decayed or otherwise worthless trees, about 12% of the total timber volume. How to dispose of this overburden is one of the serious forestry problems. About 90% of the volume is in hard hardwoods, chiefly oaks, and plans for industrial use of timber must be oriented to using hard hardwoods.

Estimated current annual growth is more than 400,000 cords. Approximately 6% is added to the total volume per year and sawtimber trees are increasing 9% in volume annually. Based on field estimates of tree condition and vigor, 258 cords of wood can be cut annually for several years if the proper trees are removed. Of this amount, 44 million board feet of sawtimber should be cut. Proper harvesting will ultimately build up the volume and increase the proportion of valuable trees.

Forests provide the setting for most outdoor recreation. How attractive a region is for fishing, hunting, camping and water sports depends in large measure on proper care and management of its forests to produce an aesthetic surrounding which will promote recreation. That hardwood forests provide an attractive setting is attested by the increasingly heavy use of major streams, impoundments and state parks by both Missouri residents and out-of-state visitors. With the exception of upland game hunting, outdoor recreation usually centers around water. The forest area actually used for recreation is relatively small but a considerably larger area adjacent to water courses and roads can be managed to increase aesthetic values, promoting the maximum in recreation use.

One of the most valuable benefits provided to man by forests is its effect on water as it falls as precipitation and as it moves through the soil. An unbroken cover of trees stabilizes water flow in several ways. The force of rain is broken by the trees and their leaves. Rain falls to a forest floor of leaves and other litter, which breaks the impact and protects the soil. A porous layer of vegetative material in all stages of decomposition allows water to soak into the soil rather than run off.

Organic matter mixed with the upper mineral soil does much to improve the physical structure. In short, a forest functions as a huge sponge to catch and hold precipitation. Following heavy rainfall, flooding may be reduced because water is more slowly released to streams from the forested drainage. In dry periods the flow of streams originating in forested watersheds is often prolonged after streams from non-forested watersheds have ceased to flow. This can be of special significance in the Meramec Basin where the future emphasis will be on water for recreation and where the occurrence of flooding and erosion is common at present.

The Forest Service on national forest land, the Missouri Conservation Commission on state forests and wildlife refuges, and larger private owners are managing their forests. There are examples of excellent forestry on woodlands of small owners but this is the exception rather than the rule. Beyond fire protection and prevention of timber theft small owners have shown little interest. If forest management can be demonstrated to be profitable or desirable, probably by a long educational process, these owners may be induced to adopt timber growing as a major objective.

Technical forestry assistance is available to land owners from Farm Foresters of the Missouri Conservation Commission. Farm Foresters at Owensville, Steelville and Farmington advise forest owners without cost on management and timber sales. They also help buyers and processors of timber locate timber supplies and assist in technical matters. But reaching a substantial portion of the owners will be a long-term task.

At the present time utilization of wood in Missouri is dominated by sawmills and other small single-product industries. Although these markets are welcome ones for the forest owner, he is hampered by being able to sell only a small portion of most trees. For example, if a sale of a tree containing stave bolt material is made, the remainder of the tree above the section that contains wood meeting stave bolt specifications can rarely be sold for another product such as sawlogs. Manufacture of a single type of product such as flooring results in processing waste that might be used for charcoal, if a charcoal firm were nearby. Economic inefficiencies, for which processors are not solely responsible, are reflected in lower stumpage value for the forest owner. The main wood-using industries in the basin make lumber, railroad cross ties, flooring, charcoal, barrel staves, posts and poles and handles for tools. They employ 821 workers and 561 woods workers supply them with raw material. Annual payrolls are $2,300,000. Wood-using firms pay $3,764,000 for wood material supplied to them and the sales value of products is $8,961,000 per year.

If trends in forest management and industrial expansion continue at their present rate, moderate advances will be made. A full-scale, concentrated rehabilitation of forests, in which undesirable trees are removed, crowded stands thinned, and open areas planted, coupled with improved timber marketing and integrated industrial use will permit timber harvests double those of recent years, 70 million feet by the year 2000. Labor requirements in woods and plants can increase from 2,500 men to 8,600 men in the next 40 years.

The huge task of rehabilitating timber stands will require a large labor force. A minimum of 500,000 man-days of labor will be required to complete non-commercial work such as girdling small trees. Additional work including planting open areas, soil stabilization on exposed slopes, and road construction will increase the requirement. Proposals for a youth conservation organization similar to the Civilian Conservation Corps of the 1930's have been made in the Congress. It is apparent that sufficient useful work can be done in the forests of the Meramec Basin to fully utilize the labor of such a movement for an extended period of time. The results of a large-scale work program would serve as an effective demonstration, and the social benefits would outweigh costs, particularly if a cost-sharing plan by land owners and future recreationists could be devised.

Forests in the basin can make an important contribution to the future timber economy. The potential benefits from forests to successful recreation and watershed management are significant. Both public agencies and forest land owners must recognize this as an opportunity in intensive land management that will aid the orderly development of the basin.

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FORESTRY IN THE MERAMEC BASIN[1]

The ultimate success of any plan for land-use in the Meramec Basin will depend greatly on the rehabilitation of the area's forests so that they may contribute their full share in creating a favorable setting for recreation and wildlife, providing a stable flow of water, minimizing soil erosion, and providing employment and other gains from harvesting timber and manufacturing wood products.

At present forest land covers about 60% of the basin. Through efforts of the Missouri Conservation Commission, U.S. Forest Service and others the concepts of conservation and timber management are slowly being accepted. Industries that depend on forests for raw material are established here but for the most part they are small. Inadequate plant financing and poor utilization of timber are common. Markets exist primarily for material of sawlog size. Some industries, such as those producing flooring, are well organized and efficiently operated. They make excellent use of low-value lumber by carrying processing to the finished product, ready for consumer use.

Since early settlement, timber has played an important part in the physical development of Central Missouri and in the economic life of the settlers. Local timber furnished much of the building material. Later it was used for railroad cross ties, charcoal for iron smelting and mine props for the shafts of mines in the Lead Belt. Little thought was directed to future timber supplies. Much timber was wastefully used. Land had to be cleared for crops. Wasteful, abusive treatment continued until the 1930's, when only a beaten remnant of the forest resource remained. There was little merchantable timber and one-third to one-half of the forest area burned annually. Although there had been attempts to control fires and an occasional land owner "husbanded" his timber, a forestry and conservation movement did not begin until the 1930's with the purchase of forest land by the Forest Service for national forests. There was little of value on the land and most people saw no future in growing timber. With the severe economic depression, tax delinquency on rural lands was at an all-time high.

Several decades will be required to rebuild the timber resource to its productive potential. Although progress has been made in educating a limited number of land owners, knowledge of timber and potential benefits from forest management must reach and be accepted by several thousand owners before substantial changes can occur. Forest recreation opportunities are largely unexplored. Here lies perhaps the outstanding opportunity for realizing the greatest public and private benefits in the Meramec Basin.

The Nation's Forestry Situation

The forest resource

A brief look at the nation's forest situation will help to understand the problems and opportunities associated with forests in the Meramec Basin.[2] Nation-wide trends in forestry and use of wood will strongly influence changes in local areas.

One-third of the land area of the United States is forest land, 664 million acres. Another one-third is pasture and range land. Cropland occupies 21% of the land surface and 9% is occupied by towns, highways, water and other land-uses. One-fourth of the entire United States is forest land capable of producing tree crops.

This vast area of forest land provides our wood products, much of our outdoor recreation, wildlife habitat, and adequate tree cover prevents erosion of priceless soil. It catches and stores water for irrigation, domestic and industrial use. A stable flow of water from forested watersheds is perhaps the most valuable service contributed by forests to the protection and comfort of people and development of the nation's economy.

Not all forests provide these benefits equally. About 175 million acres, 9% of the forest area, is noncommercial timber land. It includes parks and other areas in which trees are not harvested, alpine forests and rocky or other areas of low productive capacity. Noncommercial forest land, however, includes some of our most scenic recreation areas and critical watersheds and it supports a substantial part of the big game and other wildlife.

Three-quarters of the 489 million acres of commercial forests upon which we depend for wood products is in private ownership and public agencies hold the remainder.

Although only 25% of the forest land is in the West, these lands support 70% of the sawtimber volume. Most of this volume is in old-growth stands in mountainous, less accessible terrain. The bulk of the nation's forest land is east of the Plains States, and much of it is in small tracts, under 500 acres in size, owned by 4.5 million individuals.

One of the most favorable features in our timber situation is that growth is increasing. Although we are growing more timber than is needed to satisfy our current wood requirement the future need for wood appears much greater.

Because of repeated cutting of better trees in stands the proportion of defective or crooked trees is high. Protection of forests from fire has increased in effectiveness but insects and disease still take a heavy toll by destroying wood and reducing growth.

Some residues are inevitable in logging and manufacturing, but the forest resource is utilized less completely than it might be. One-fourth of the timber cut is left in the woods or is unused in the mill. However, great strides have been made toward closer utilization, such as the use of waste from pine sawmills for pulp and paper. A few large firms almost completely utilize their timber, including the bark. Many wood waste problems can be solved by the development of plants integrated to make combinations of products for which most of a tree's volume is suitable.

Do we have enough forest land? There is enough to meet present needs. Current trends in the construction of highways, pipelines, electric transmission lines and water impoundments are shrinking the forest area. So are suburban residential developments. Conversely, poor-quality agricultural land is reverting to trees. For the future the answer depends greatly on population trends, changes in wood requirements and how well we manage our forests.

Many of our present-day problems center around the owner of small forests, his lack of interest in growing timber and the low state of timber productivity on his land. It is certain that he will have to furnish a greater part of the national timber supply in the future.

Current demand for wood

From the days of the board sidewalk, picket fence and gingerbread trim on houses, our consumption of lumber steadily declined. Competing materials have taken over many uses which were once almost exclusively held by wood. Concrete and steel have replaced lumber, gas and oil have replaced wood fuel, asphalt roofing has taken place of wood shingles. Substitution of modified wood for natural wood has occurred: paperboard cartons for boxes made of lumber, paper matches for wood matches.

Many changes came about through technical advantages gained by use of materials other than wood but the wood industries generally have neglected to advance the use of their products through research and promotion. Prices for some wood products have advanced more rapidly than prices for competing materials so wood has lost additional markets.

However, the nation still uses a lot of wood and during the past 20 years the total amount has been increasing.[3] During 1960 the estimated wood needed was 10.34 billion cubic feet, equivalent to 49.4 billion board feet[4] (Table 1). The major products consumed and the approximate percentages were:

Product	Percent
Lumber	52
Pulpwood	22
Fuelwood	16
Veneer and plywood	4
Other	6
Total	100

Although the per-capita use of lumber is declining, the total demand is increasing because of a swelling population. Lumber in many sizes for hundreds of uses takes over one-half of the wood consumed. Paper and paperboard consumption have increased from 58 pounds per person in 1899 to more than 450 pounds per person in 1960. Technological advances have revolutionized packaging which now

TABLE 1

ESTIMATED UNITED STATES CONSUMPTION OF WOOD PRODUCTS AND RAW MATERIAL REQUIRED

Product	Consumption 1960		Log and bolt requirements[a] (billion cubic feet) 1960	1975
Lumber				
Hardwood	8.5	billion board feet	1.26	1.46
Softwood	32.5	" " "	4.75	5.36
Plywood and veneer				
Hardwood	1.1	" " "	0.19	0.24
Softwood	4.6	billion square feet 3/8 in.	0.33	0.56
Pulpwood[b]	34.8	million cords	2.29	2.81
Total pulp	24.3	million tons air dry	-	-
Paper	23.3	" " " "	-	-
Paperboard	16.6	" " " "	-	-
Fuelwood	34	million cords	0.77	0.37
Other products[c]	370	million cubic feet	0.75	0.74
		Total	10.34	11.54

Source: Stanford Research Institute, America's demand for wood 1929-1975, Stanford Research Institute, Stanford, 1954.

[a]From living commercial timber. Total requirements 15 to 20% higher.

[b]Used for all kinds of pulp production: paper, paperboard, rayon, cellophane, cellulose acetate.

[c]Includes shingles, cooperage, piling, poles, charcoal, and mine timbers.

requires a sizeable portion of our timber production. The importance of fuelwood, though requiring 16% of the total, has declined. It is used chiefly for industrial fuel and fireplaces. In local areas where wood is plentiful it is still used for cooking and heating but the convenience and lower cost of other fuels has made heavy inroads in its use.

__Future wood requirements__

During the next 30 to 40 years substantial population increases, technological advances, and increases in living standards will expand the economy of the United States. Corresponding increases in residential and commercial construction, use of shipping containers and manufacturing are expected to provide major markets for timber products. Lumber prices are expected to rise faster than prices for other products, but less rapidly than in the past. Smaller average tree size, less accessible timber stands, higher labor costs, and slower technological advance as compared to other manufacturing all point toward higher costs, and average lower quality trees probably means less total income. However, because of greater population and increased construction activity lumber manufacturers will be able to sell all they produce and the total amount consumed will increase even with continued substitution of other competing materials.

Major increases are expected in the consumption of pulp, paper and paperboard products. Among the possible new paper products are disposable paper clothing and bed "linen". There are hundreds of other potential uses for paper, yet undeveloped. Veneer and plywood, hardboard and insulating board also are expected to make major advances in construction and manufacturing. Prices for pulp and paper products are expected to hold their own with prices of competing materials. Plywood prices will increase, but less rapidly than lumber prices. Prices for hardboard and similar materials may decline relative to competing materials because increased use of wood waste and advanced technology will reduce processing cost. A major decline in consumption of wood for fuel is expected. Small or moderate changes are foreseen for other wood products. A comparison of log and bolt requirements needed to satisfy demand in 1960 and 1975 is given in Table 1.

Other sources[5] recognizing greater population increases and more favorable price relationships for wood indicate total annual requirements for the year 2000 to be between 18 to 26 billion cubic feet in contrast to 10 billion cubic feet currently needed!

No matter how estimates of future demand are adjusted up or down, within reason, all indications point to the need for a marked increase in the supply of timber. Less and less can we depend on a vast storehouse of old-growth Western timber -- a gift of nature to man. More effort must be directed to growing timber. The public forests and industrial forests cannot be counted on to supply a major part of future requirements, even though the quality of forest management on these lands continues at high levels. We must look eventually to the 4.5 million small owners who control most of the productive forest land in the East and South to grow timber crops in order to meet future demand indicated by informed estimates.

It appears that prices for wood products relative to prices for competing materials will strongly influence the amount of wood consumed. In the future, wood-using industries can be expected to do everything possible to reduce costs of timber and its processing in order to remain competitive. From current trends it appears that processing techniques will be directed to more complete utilization of tree volume and the use of low-quality trees by "chopping up" wood and re-forming it into sheets or other useful shapes. Under such conditions there will be less premium on high quality trees, although there will be a market for clear wood. Timber growers will have less incentive to invest money to grow large, high-quality trees and wait the length of time required for them to mature. Instead they will be concerned with producing maximum timber volume at lowest cost, that is, with growing trees to relatively small size and investing little in cultural measures such as thinning and pruning. But that is a long way off. For several decades, at least, we must be concerned with rehabilitating our forests and growing the highest quality timber possible. As long as consumer demand and processing is based on quality, timber production must be oriented to the same standards.

The Meramec Basin Forest Resource

Forest land area

In the Meramec Basin 1,512,000 acres are forested, 60% of the land area. (Frontispiece) Other land-uses for crops, pasture, town sites and roads occupy the remaining 40%. About 12,000 acres of the total forest area should be excluded from a discussion of timber growing. This area is in parks and other public reservations in which trees are not subject to cutting and areas of extremely low productivity because of rock outcrops or extremely shallow soil. Privately owned forest land, of unknown area, dedicated to nature study or recreation where cutting of trees is incompatible with the primary objective of the owner also should be excluded. Most of these ownerships adjoin the major streams and rivers.

There are about 1.5 million acres of commercial forest land in the basin capable of producing tree crops.[6] The southern one-half is more heavily forested and includes large blocks of unbroken forests. Crawford, Washington and Dent Counties are 75% forested and the other counties are about 55% forested.

During the past 15 years several major influences have altered the forested area. Land clearing for residential and commercial sites, expansion of fields and pastures and construction of new roads have reduced the forest area. Land clearing has been concentrated in St. Louis County, northern Jefferson County and along the main highways. But during the same period crop and pasture land of low productivity has been abandoned and is reverting to forest cover. The net effect probably has been a reduction in forest land amounting to several thousand acres.

In the area adjacent to St. Louis this trend is expected to continue, but in the more rural part of the basin farms of uneconomic size persist. It seems probable that many small farms will revert to forest cover, with the forest land area stabilizing at about 1,450,000 acres in the next 20 years.

Ownership

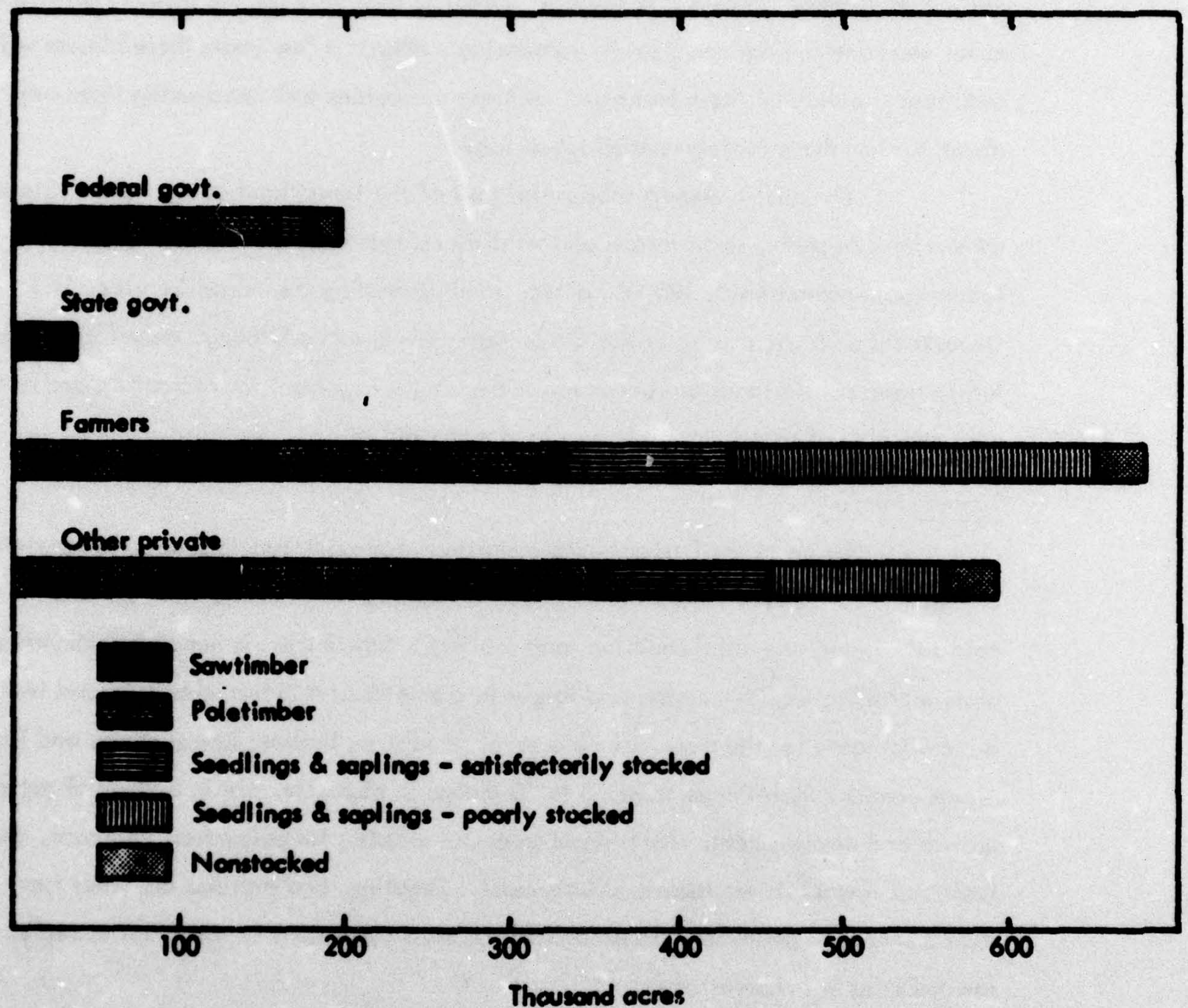
Private owners hold 85% of the forest land and farmers are the largest single class of owners. Forested portions of farms account for 680,000 acres, 45% of the total (Figure 1). Other owners, such as industrial firms, businessmen, professional men, heirs of estates and many other people own 591,000 acres, almost 40% of the total. Purchases of forest land by professional people, retired couples, investors speculating on mineral deposits and those who want to own land for the pride of ownership or for weekend outings are steadily increasing. Within a few years these classes will own over one-half of the forest area. Mining companies and wood-using firms own about 10% of the privately-owned forest land.

The public owns a substantial part of the forest land of the basin. State-owned land in parks, state forests and wildlife refuges exceeds 34,000 acres. The federal government holds 195,000 acres, administered by the Forest Service, U.S. Department of Agriculture, in the Clark National Forest. Although only 15% of the total, these public lands are becoming increasingly important for recreation and as a demonstration of sound, multiple-use land management.

Timber stand-size

To be in the best possible condition to provide regular, continuing yields of timber a forest area should be composed of roughly one-third sawtimber, one-third poletimber and one-third seedlings and saplings. Sawtimber, a general descriptive class including trees 11 inches and larger in diameter at 4.5 feet above ground level, is merchantable for the more valuable products such as lumber, barrel staves and furniture veneer. Poletimber trees, 5 to 10 inches in diameter, are in a stage of rapid growth and development. Pole-sized trees are suitable for pulpwood, charcoal, and fuelwood if markets for these products exist. Seedlings and saplings are trees less than 5 inches in diameter. These small trees must be present in the forest to replace sawtimber as it is harvested.

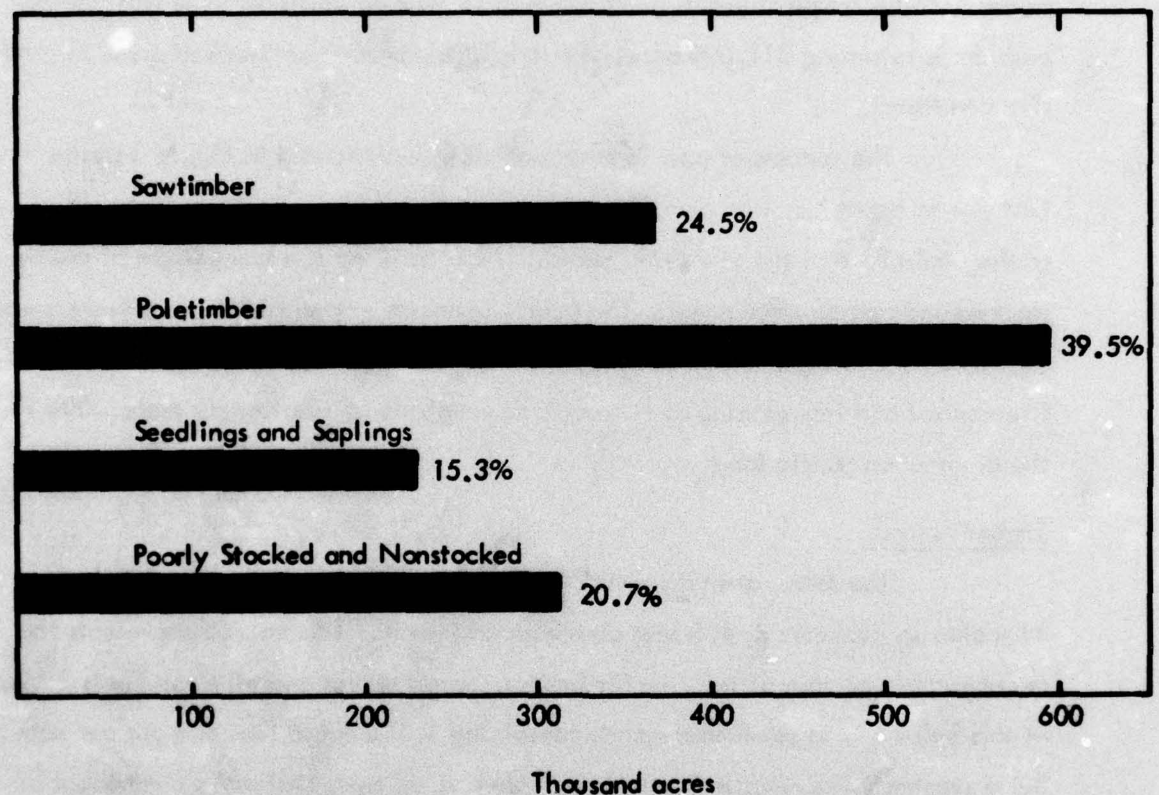
How does the forest resource of the basin measure up? It appears to be rapidly recovering from generations of abuse and unplanned timber cutting. Figure 2 shows that 24.5% of the area is sawtimber, 39.5% is poletimber and 15.3% is satisfactorily stocked seedlings and saplings. A major weakness is that 20.7% of the area does not support an adequate stocking of trees -- wasted space.



COMMERCIAL FOREST LAND BY OWNERSHIP AND STAND SIZE, MERAMEC BASIN.

Figure 1.

Figure 2.



COMMERCIAL FOREST LAND BY STAND-SIZE CLASS,
MERAMEC BASIN, ACRES AND PERCENT OF TOTAL

Figure 2 should not be interpreted to mean that the sawtimber and poletimber areas support a desirable amount of timber volume. Several decades of conservative treatment will be required to build growing stock (sawtimber and poletimber combined) to optimum levels on areas supporting the larger tree sizes. It does appear that within 20 or 30 years large areas of poletimber will grow to sawtimber size. Systematic forest management will become more attractive economically to the private owner because frequent yields of saleable wood will be possible. The most serious problem is returning 311,000 acres of poorly stocked and non-stocked areas to productive condition.

The success of past forestry practices is indicated in Figure 1 by the fact that public agencies, who own 13% of the forest land, have built up timber stocking so they hold 21% of the sawtimber stands. More striking is a comparison of poorly stocked and non-stocked areas. The public agencies own only 9% but private owners own 91%. Planting or direct seeding of pine seedlings on open areas, more effective fire control and less grazing of livestock in young stands are largely responsible for the progress on public lands.

Timber volume

The forest area supports 926.2 million board feet of sawtimber in trees 11 inches in diameter at 4.5 feet above ground level. This volume represents the merchantable portion of trees -- for lumber, barrel staves and other products. Most of this volume is in sawtimber stands containing 1,500 board feet or more per acre. But a substantial portion is in small sawtimber-sized trees that are a component of pole stands.

Growing stock, including all trees 5 inches and larger, is a better indication of total volume, because it includes smaller trees with no current merchantable volume but which hold increasing importance as markets develop. Poletimber stocking also indicates the stocking of future sawtimber stands. Expressed in cords of 128 cubic feet of stacked 4-foot sticks of wood, the total growing stock is about 8 million cords. One-half of the volume is in pole-sized trees and one-half is in sawtimber trees, including the volume contained in large limbs. If the growing stock can be brought up to a more desirable level, about two-thirds of the total should be in sawtimber trees.

An additional volume is found in cull trees. Cull trees are those that because of crookedness, decay or other defects have no merchantable volume or show no indication of becoming saleable in the future. Over a million cords are contained in these worthless trees, about 12% of the volume of all trees. How to dispose of this timber overburden is one of the serious forestry problems.

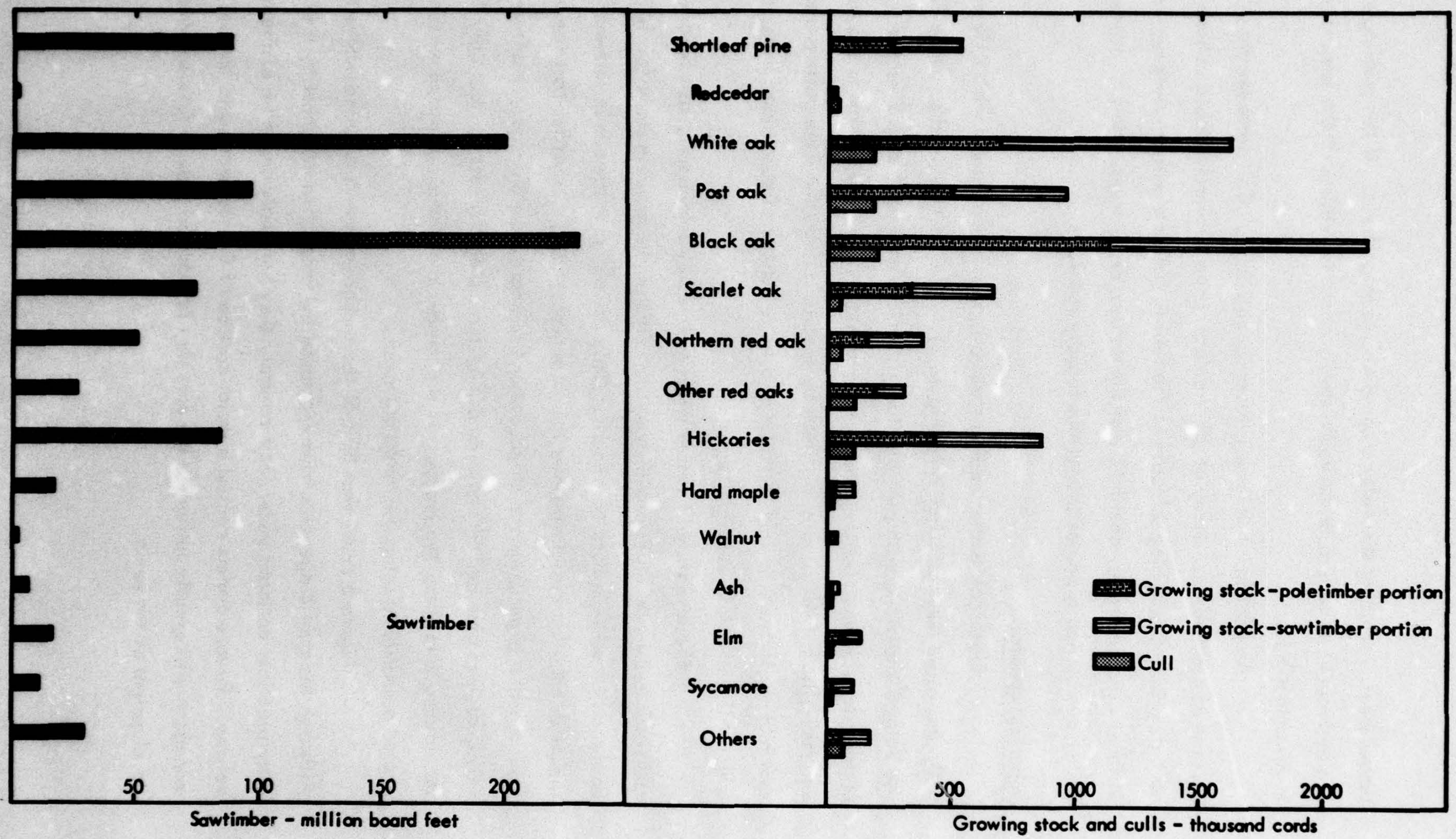
Important species

Black oak is the leading species in sawtimber volume with 25% of the total and white oak comprises 22% (Figure 3). All oaks combined comprise 73% of the volume and along with pine and the hickories, each with over 9%, make up the bulk of the volume. Twelve other species contain the remaining 9% of the sawtimber volume. The volume of growing stock by species follows the same pattern except that hickory is fourth in rank because of a large number of pole-sized trees, many of which will not attain sawlog size.

The inventory of timber when grouped by softwoods[7], soft hardwoods[8] and hard hardwoods[9] in Figure 4 shows that 88% of the growing stock (excluding hardwood limbs) is in hard hardwoods. Only 8% of the volume is in softwoods. Sawtimber distribution closely follows the same proportions. Industries that use small trees to make paper pulp and chipboard or hardboard from chips prefer soft-textured wood, such as pine and soft hardwoods, for technological reasons, but only 12% of the volume is in these two groups. It is apparent that industrial use of wood must be geared primarily to using the hard hardwoods.

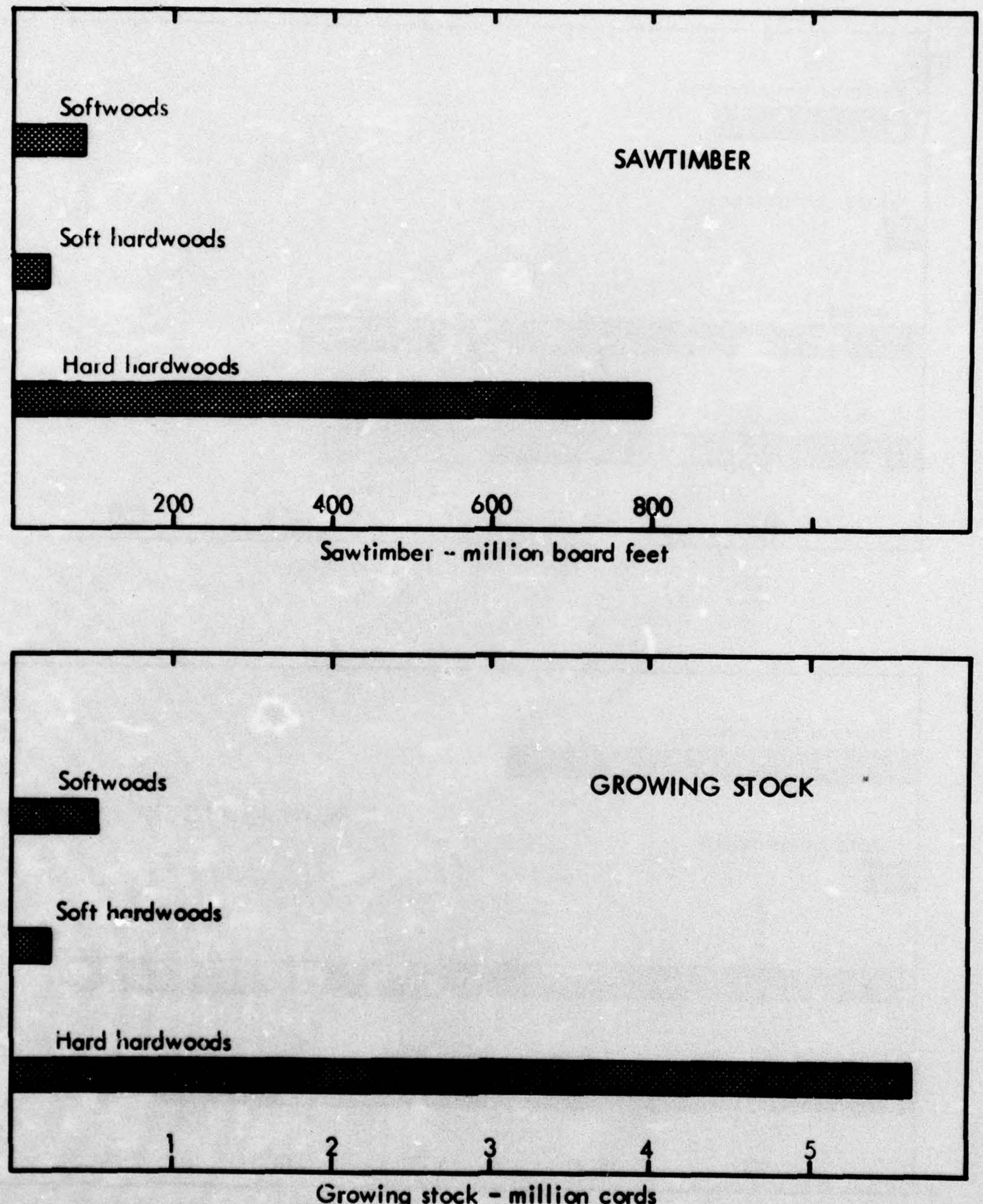
Figure 5 shows that 80% of the timber volume is on private forest land. Although the public agencies have increased the proportion of timber by sound forestry practices on lands under their control, they hold only one-fifth of the total volume. Private owners control a major portion of the resource, and how well they manage it will greatly influence the part that forests can play in future economic development of the basin.

Figure 3.



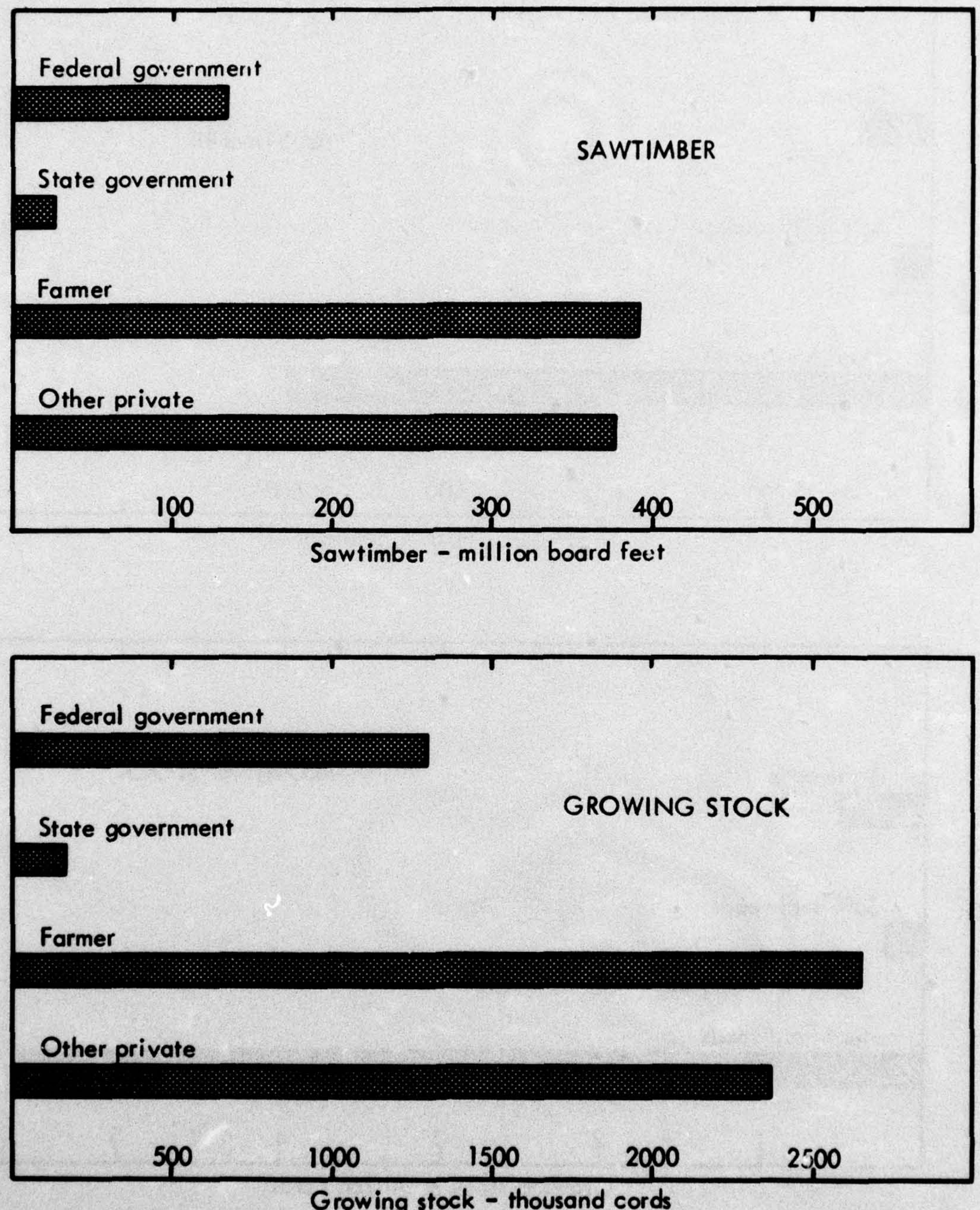
NET TIMBER VOLUME ON COMMERCIAL FOREST LAND BY SPECIES, MERAMEC BASIN.

Figure 4.



NET TIMBER VOLUME BY SPECIES GROUP, MERAMEC BASIN.

Figure 5.



OWNERSHIP OF NET TIMBER VOLUME, MERAMEC BASIN.

<u>Current growth</u>

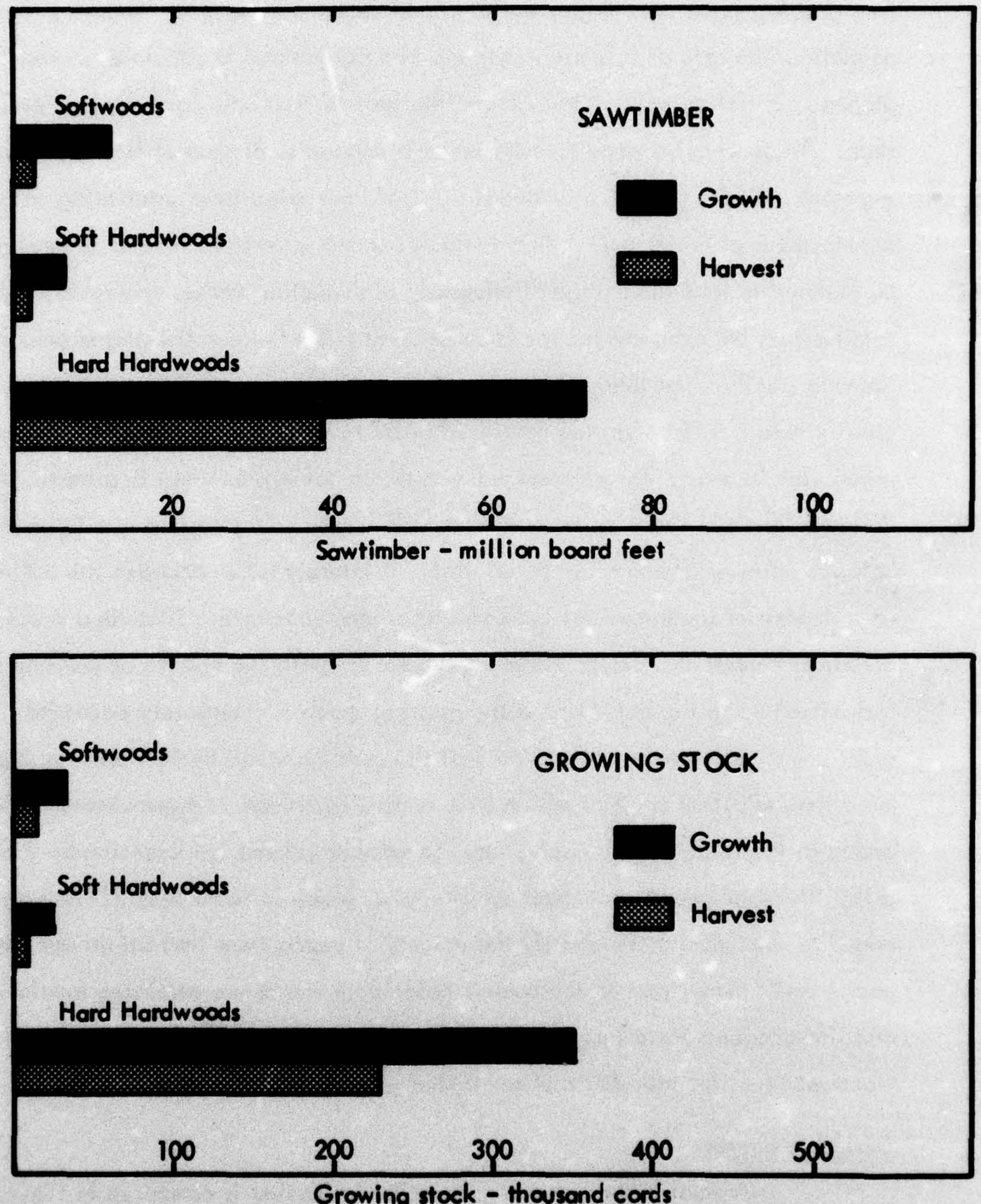
One of the major concerns of the forest manager is the manipulation of tree growing stock to replace, build up and improve his tree inventory as rapidly as possible. The rate of volume growth must be determined to regulate harvests. A planned harvest purposely may exceed the growth, but only for a limited period of time. An over-cut is good forestry when it is done to dispose of less desirable growing stock, excess trees in crowded stands, or low-value trees interfering with the development of better ones. A cut which exceeds growth for one or several years may be planned to take advantage of unusually high market prices. However, such over-cutting must be compensated for in subsequent years to keep the proper amount of growing stock on the land. In previously unmanaged forests an immediate objective usually is to cut less than the growth in order to build up growing stock to the most productive level. A forest stand is much like a savings account in a bank. A small dollar balance in the account earns a small amount of interest, and a large dollar balance earns a large amount of interest. If interest is compounded the amount earned on a deposit of given amount increases at a geometric rate. Trees in a stand add growth (interest) at a compound rate, increasing with the volume of growing stock (principal) up to the point where the growing space is completely occupied.

Estimated annual growth of the growing stock in the Meramec Basin is more than 400,000 cords of which 86% is hard hardwoods. Approximately 6% is added to the total volume each year. Sawtimber volume is increasing by 9% annually. The increase of sawtimber volume takes place in two ways: (1) growth that is added to sawtimber trees and (2) the volume of young trees that attain sawtimber size each year. Many trees in the basin's poletimber stands are attaining sawtimber size and this accounts for a large portion of the increase in sawtimber volume. Hard hardwoods account for four-fifths of sawtimber growth.

<u>Desirable harvest</u>

Annual timber growth and desirable harvest is compared in Figure 6. Of the 409,000 cords added annually to the frowing stock through growth, 258,000 cords

Figure 6.



ESTIMATED CURRENT ANNUAL TIMBER GROWTH AND HARVEST NEEDED TO REHABILITATE TIMBER STANDS, MERAMEC BASIN.

can be cut if the proper trees are removed. The estimated cut is based on classification of tree vigor and condition. In justifying a harvest of less than the amount of growth, it is important to remember the objectives: (1) build up volume, (2) increase the proportion of more valuable trees, and (3) achieve a more favorable size-class distribution. Thus, about one-half of the softwood and soft hardwood growing stock and 65% of the hard hardwood growing stock should be cut. Pine generally has a higher value than hardwoods and contains less decay; therefore, in order to build up the value of the forest inventory, a smaller portion of the pine growth should be cut. The harvest of hardwoods should be concentrated on over-mature and defective merchantable trees.

The sawtimber portion is increasing by 90 million board feet annually and 44 million feet can be harvested. Only 23% of the pine sawtimber should be cut. About 32% of the growth, of soft hardwoods can be cut and 55% of the growth of the hard hardwoods.

It should be pointed out that with existing markets only trees cut for pine posts and poles and hardwood charcoal will come from growing stock. The major harvest must be made in sawtimber trees because the present economy is essentially for sawlogs.

Productivity of forest land

Even the casual observer can see marked differences in the appearance of trees growing at different locations. Closer observation discloses that trees grow more rapidly on some sites; they are taller, better formed and more vigorous. The productivity of land for growing trees depends on soil moisture, nutritional quality of the soil and temperature -- the whole environment. Several indicators have been used to describe land productivity, often termed site quality. Tree height is a commonly used indicator of the capacity of land to produce wood -- tall trees occur on good sites and short, stubby ones on unfavorable sites. In Missouri, site quality is closely correlated with topography because soil productivity and differences in exposure to high temperature under limited soil-moisture conditions during the summer months.

Generally, poor timber growing sites are found on broad high ridges with fine, heavily compacted soil. Shallow soils and rock outcroppings can support only poor-quality, slow-growing trees. On extremely poor soils trees are unable to survive. Cedar, post oak and blackjack oak are commonly found on poor sites, not because they prefer severe growing conditions, but rather because they are able to survive. Medium quality sites typically occur on but are not confined to south-and west-facing slopes and ridges with better soil. Black oak and post oak are characteristic of these sites. *Shortleaf pine reaches its best development on soils of sandstone origin.* Good growing sites are found on north-and east-facing slopes, in deep draws and fertile stream bottoms. On the slopes vigorous, tall northern red oak, white oak and black oak are prominent. In the draws and creek bottoms a variety of species including walnut, elms, sycamore and ash occur.

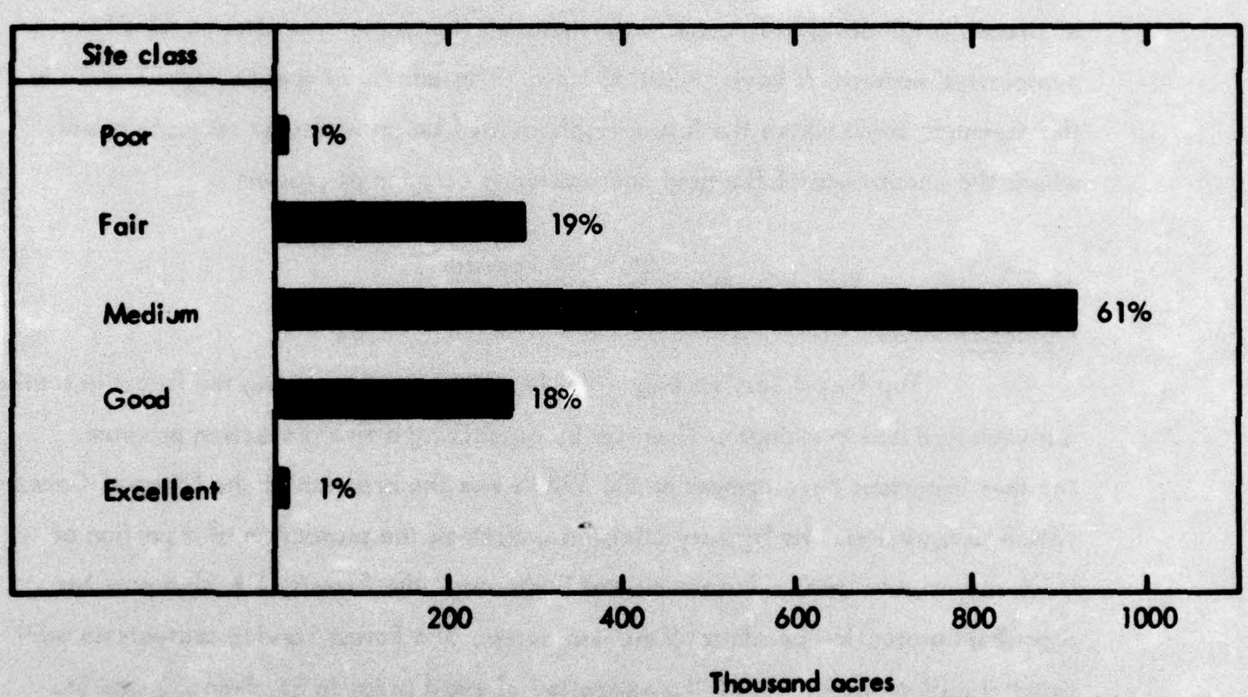
Figure 7 shows the forest land area of the basin classified by site class, based on merchantable height of trees.[10] About 1.21 million acres (80% of the forest area) are medium and better timber-producing land and 300,000 acres are fair or poor.

Forest land uses

Forests provide the setting for most outdoor recreation. How attractive a region is for fishing, hunting, camping and water sports depends in large measure on proper care and management of its forests to produce an aesthetic surrounding which will promote recreation. That hardwood forests provide an attractive setting is attested by the increasingly heavy use of major streams, impoundments and state parks by both Missouri residents and out-of-state visitors. With the exception of upland game hunting, outdoor recreation usually centers around water. The forest area actually used for recreation is relatively small but a considerably larger area adjacent to water courses and roads can be managed to increase aesthetic values, promoting the maximum in recreation use.

One of the most valuable benefits provided to man by the forests is its effect on water as it falls as precipitation and as it moves through the soil. An

Figure 7.



LAND PRODUCTIVITY FOR TIMBER GROWTH BY SITE CLASS, BASED ON MERCHANTABLE HEIGHT OF MATURE TREES, MERAMEC BASIN ACRES AND PERCENT OF TOTAL

unbroken cover of trees stabilizes water flow in several ways. The force of rain is broken by the trees and their leaves. Rain falls to a forest floor of leaves and other litter, which breaks the impact and protects the soil. A porous layer of vegetative material in all stages of decomposition allows water to soak into the soil rather than run off. Organic matter mixed with the upper mineral soil does much to improve the physical structure. In short, a forest functions as a huge sponge to catch and hold precipitation. Following heavy rainfall, flooding may be reduced because water is more slowly released to streams from the forested drainage. In dry periods the flow of streams originating in forested watersheds is often prolonged after streams from nonforested watersheds have ceased to flow. This can be of special significance in the Meramec Basin where the future emphasis will be on water for recreation and where the occurrence of flooding and erosion is common at present.

Status of Forestry

Protection

The Forest Service began the long process of restoring the forest in southern Crawford and Washington Counties by organizing a fire protection program. Another important development of the 1930's was the creation of the Missouri Conservation Commission. Its Forestry Division undertook the protection of a portion of state and private lands. From a modest beginning, the Forestry Division now has organized protection on almost 9 million acres. The Forest Service protects an additional 1 million acres. With the exception of small areas in St. Francois and St. Louis Counties, the Meramec Basin is given protection by the two agencies.

Fire occurrence has been attributed to carelessness, maliciousness, lack of respect for the property of other owners, and the promiscuous use of fire as a tool in land clearing and pasture management. Customs of a hundred years are not broken easily. Because of increased fire control and education the area burned has steadily decreased. Today the area that burns annually is about 0.3% of the total area protected. However, the fire problem has not been completely solved. As in cities, fire risks probably never will be eliminated. In periods of bad fire danger fire protection organizations are unable to cope with all the fires that start. More intensive protection is required to hold the area burned to a minimum. Protection should be extended to the areas currently not covered.

Other changes, in part closely associated with fire protection, have occurred. Theft of timber has decreased. Twenty years ago timber stealing was common and many private owners expected some theft. Timber stealing was not considered a serious offense -- if any. Because of the efforts of public forestry agencies and individuals in prosecuting offenders and land owners affording more intense protection because of increased market value of standing timber, theft has been effectively discouraged. It has not been eliminated, however, and vigilance is necessary to prevent losses, particularly from isolated locations.

The free-and-easy pioneer days in which forage was considered public property are all but gone, and the age-old practice of open-range grazing of livestock is losing ground. The open-range area has declined 62% since 1935 so that most of the basin is closed, but there are still 353,000 acres of open-range land in Crawford and Washington Counties.[11] Many social and economic forces are responsible for the decline. Better breeds of livestock cost too much to risk loss by theft, disease or accident. It has been demonstrated repeatedly that animals make more gain on improved pasture than on open-range. The exclusion of fire from many areas has increased stand densities, drastically reducing woods forage.

Protection of timber from damage by insects and disease organisms has received little attention in our present early stage of forest management. Although less spectacular, the damage from these pests far exceeds that of fire. Not only do insects and diseases kill trees but they reduce their growth and cause a serious degrade of wood products. A considerable volume of affected wood is not usable. Many fungi which cause decay of tree roots and stems pose serious threats to timber growing. Insects such as the pine tip moth and wood and bark beetles contribute to the damage of Missouri forests.

Insects and diseases are difficult to control either directly with chemicals or indirectly by eliminating conditions favorable for their development. Current research by the Forest Service and the University of Missouri is aimed at understanding the life history of these pests and determining the stages when control is feasible. Action programs to control pests over large areas of forest will have greater significance after timber growing practices have become more intensive, when forest values warrant expenditure of both private and public funds with predictable results.

Forest management

The owners of many forests face alternative decisions as to whether to (1) manage their land by applying sound forestry principles, (2) let timber grow with no improvement, or (3) convert to some other land-use. Owners who have undertaken forest management find that the major job is rehabilitation, one that may require many years. The initial step is to insure adequate protection, cooperating when possible with public agencies. The first effort must be given to fire prevention, and it may often be best approached through gaining the understanding of local people in the community. Boundary lines of property must be surveyed and clearly marked. Well marked property lines usually prevent accidental timber trespass and intentional theft is discouraged.

Abandoned fields and other non-stocked areas can be planted with trees that are suited to the site. Productive sites may be planted with walnut or other valuable hardwoods. During these operations the owner may develop a system of low-quality roads to use in other activities such as fire protection, timber stand improvement, and harvesting the timber crops. Large forest owners, industries and public agencies, construct roads to higher engineering standards.

The actual improvement of timber stands is often accomplished through judicious cutting. Trees of merchantable size that should be removed may be marked and sold. Mature and partially defective trees are sold to make the harvest attractive to the buyer.

The owner of undesirable noncommercial trees who wishes to improve his stands has two solutions to his problem. He can develop a market or he can remove undesired trees by girdling or poisoning. From a small property located near a town it may be possible to sell some fuel wood or charcoal wood. Such markets are restricted and the opportunity to sell small, defective trees from large forest areas does not exist at present. The cost of immediate removal or harvest may be more than offset by the replacement of poor trees with better quality growing stock.

The latter choice is commonly made; the technique usually called TSI (*timber stand improvement*). Worthless trees may be felled, girdled or killed by the use of a chemical.

The objective is always improvement of the growing stock which is retained. Trees with decay or insect damage, crooked stems or excessive branching are removed. Crowded clumps are thinned, taking the poorer individuals and leaving the better trees properly spaced for more rapid growth.

Unmanaged natural stands almost always contain undesirable species, excessive decay, insect damage and other defects. Even if given a chance to grow, such stands may be unable to respond. Growth of satisfactory quality if laid on a defective foundation contributes little to the value of the stand. Because of the handicap under which such stands develop in early life, they do not always attain desirable volume or quality production in later years. Hence, even if intensive forestry practices were applied to many present timber stands, we could not expect them to achieve optimum productivity.

The Forest Service on national forest land, the Missouri Conservation Commission on state forests and wildlife refuges, and larger private owners are managing their forests. They have shown that forests can be restored with proper management. The guiding principle of public agencies is to furnish wood, water, recreation, wildlife habitat and forage whenever multiple land-uses are compatible.

There are examples of excellent forestry on woodlands of small owners but this is the exception rather than the rule. Beyond fire protection and prevention of timber theft small owners have shown little interest. Estimates made for other regions indicate that only about 10% of the small woodland owners practice forestry or conservative timber harvesting. They control nearly one-half the forest land.

Ownership problems

The absence of forest management on timber land is attributable to many reasons. One of the dominant ones is a lack of owner interest, which is traceable to a variety of causes. Many owners have other primary interests and objectives concerning use of their land. A farmer with a woodlot is primarily concerned with producing crops and livestock. In many cases the woodlot exists because the area is not suited for field crops or pasture. Only occasionally does he have an opportunity to work in his woods or sell timber. Even if he did an intensive job of forestry, his timber income might comprise but a small share of his total income. Others recognize that a woodlot is a savings bank into which they have stopped making deposits. They tap it periodically for income but spend little time improving the timber capital.

Other owners buy forest land chiefly for mineral deposits that may lie below the surface. Others speculate on a rise in value of standing trees (stumpage value). They buy land, hold it for five or ten years, cut everything that has grown to merchantable size and sell the land to another speculator.

Another type is the owner of a submarginal farm or one that is less than economic size. His financial resources are small; perhaps he is in debt continually. He must rely on his forest land for income at every opportunity, each time a few trees reach merchantable size. It is difficult to interest this man in forestry, frequently a long-term, long-wait activity, when his major problems -- food, clothing and housing -- demand immediate solution.

Still another class of owner is one described by Farrell[12] in a study in Wayne County. He owns land but he is not sure why he bought it or what he will use it for -- it's just a good idea to own land. Such owners with hazy objectives constitute a large segment of the total. If forest management can be demonstrated to be profitable or desirable, probably by a long educational process, these owners may be induced to adopt timber growing as a major objective.

Technical forestry assistance is available to land owners from Farm Foresters of the Missouri Conservation Commission, financed jointly by federal and state funds. Farm Foresters at Owensville, Steelville and Farmington advise forest owners without cost on management and timber sales. They also help buyers and processors of timber locate timber supplies and assist in technical matters. Their service is effective in interesting people in forest management and most owners appear grateful for the help. Reaching a substantial portion of the owners will be a long-term task. Only a small percentage of the land owners know that assistance is available. The services of private forestry consultants probably will be needed as favorable conditions for intensive forest management develop, accompanied by increased interest in forestry by land owners.

Other Factors That Affect Timber Growing

Deferred returns

As an investment opportunity, timber growing can be easily misunderstood. Regular annual yields of substantial amounts are possible only from a forest that is properly organized and regulated as to area, stocking and tree size. In an extreme case, that of an entire forest of immature trees, little or no income will be received until some timber reaches merchantable size. Most forest properties have at least some merchantable timber, even though there may be an excess of young trees. Since their merchantable volume is usually deficient, there may be a waiting period during the period of accretion of value, until the annual flow of substantial income begins.

The yield in money per unit volume of product and per acre of land in many instances is low. But the initial investment in forest land is also small, usually under $10 an acre in Missouri, if there are no additional values attached to the land. The cost of producing a tree crop is low. Nature does most of the work -- but she can be assisted. Gains from forest investments in addition to those from timber growth frequently occur. Stumpage values have increased steadily over the past 60 years, with pronounced rises occurring during periods of expanded building construction, introduction of new uses for wood and shortages of high-quality material. Long-term gains are indicated for the future because of increased demand for wood. Gains to the forest owner come from development of wood-using industries, more efficient use of wood, and refinement and coordination of marketing practices.

Marketing

At the present time utilization of wood in Missouri is dominated by small sawmills and other small single-product industries. Although these markets are welcome ones for the forest owner, he is hampered by being able to sell only a small portion of most trees. For example, if a sale of a tree containing stave bolt material is made, the remainder of the tree can rarely be sold for another product such as sawlogs. Manufacture of a single product such as flooring results in processing residue that might be used for charcoal, if a charcoal firm were nearby. Economic inefficiencies, for which processors are not solely responsible, are reflected in lower stumpage values for the forest owner.

Market practices in general are informal and poorly organized. Buyers for single-product industries operate independently, relying on previous contacts and word-of-mouth to uncover new supplies and to control production of logs and bolts. It is a workable arrangement but not the most efficient. There is little chance for communication between the buyer and forest land owners previously not contacted. Buyers tend to follow established patterns so long as they can locate sufficient raw material to keep a plant running or to fulfill their quota.

Uninformed forest land owners contribute to imperfect marketing conditions. The owner who sells timber infrequently has difficulty understanding tree and product specifications, which appear involved and crammed with strange terminology. Too often he takes the easy way out, contacts a single buyer and sells on a lump sum basis with meager knowledge of either the volume or value of the timber. This, in turn, hurts other owners who try to do a competent job of marketing because buyers naturally prefer to purchase timber on their own terms.

The generally undeveloped and poorly organized market situation suggests a desperate need for marketing research with the objective of improving the entire market organization from the woods to finished-product stage. Both wood-using industries and forest land owners can benefit greatly through improved marketing efficiency.

Recent marketing changes

Our forest economy is still rather lacking in co-ordination and integration. Technological progress is, however, far from static. In recent years the expansion of charcoal making and briqueting has provided a market for small hardwood trees in restricted areas, but to a large degree charcoal wood still comes from land clearing operations. The expansion of markets for pine posts and poles, treated with a preservative before they enter the consumer market, has made possible the beneficial thinning of thousands of acres of dense young pine stands. The development of mechanized walnut hulling and cracking machines and new uses for hulls and walnut meat has provided a multi-million dollar market for woodlot owners.

The increased value of timber stumpage is becoming more generally recognized. An increasing number of owners are seeking technical aid in negotiating timber sales. Buyers are increasingly interested in bidding on timber in which only certain trees in the stand are sold, including some that would have been regarded as culls a few years ago. Integrated utilization in which a buyer of timber, say for a flooring plant, will channel wood suitable for veneer or other higher use to other industries is developing. The alert timber owner may profit from such an arrangement by receiving a higher price.

Roads

In general, most of the forests of the Meramec Basin are accessible by public roads, part of a well-developed state and county road system. Logging costs do not vary appreciably because of a lack of transportation routes. Roads adequate for removal of relatively small per-acre volumes of timber can be bulldozed at low cost. But the fact remains that a heavy rough product such as timber, containing a great weight of water and material that eventually ends up as processing residue, can be transported economically only a relatively short distance. Only markets within a short distance are available to a given timber land owner. Other rough timber products of high value or those containing less waste can be transported greater distances.

Land taxes

Real property taxes on forest land must be paid annually. The owner who sells timber at frequent intervals can pay taxes from his receipts but one who owns immature timber must pay taxes year after year from other sources -- an added investment in his property.

From the point of view of the forest owner the real property tax principle is far from ideal. Timber grown from seedlings to sawtimber may be taxed 80 times. If the tax rate or assessed value is excessive the cumulative taxes may approach or exceed the value of the timber when it is harvested. Because of inherent difficulties in fairly assessing forest land, lack of adequate training of assessors, and lack of a requirement that forest land be assessed separately from land in other uses, forest land is taxed higher than other types of rural real property.[13] However, taxes on forest land are not unreasonable. In 26 counties in south Missouri the average tax in 1953 was estimated to be 10.6 cents per acre. By 1959 it had increased 62%, to 16.6 cents. This average probably is representative of counties in the basin. The increase is understandable because expenses of county government have advanced with inflation and the increased demand for government services. If timber prices keep pace with the trend of increasing taxes, the land owner is no worse off, but if taxes rise faster than prices for commodities and services the land owner will find himself gripped in a tightening vice. To what extent this squeeze can be tolerated before owners abandon forest management in favor of liquidation cuttings is not known.

State aid to land owners

The State Forestry Act of 1946 contains a double-barreled aid to private land owners, tax relief and technical forestry assistance including protection from fire and theft. It is developing into an effective way to stimulate interest in forestry. An owner of 40 acres or more of forest land may voluntarily enter into a 25-year contract with the state. The Forest Crop Law is administered by the Forestry Division, Missouri Conservation Commission.

During this period, the owner pays taxes on a flat assessment of $1.00 per acre. On the average, land classified as Forest Crop Land is reduced in assessed value by $4.25 per acre. To reimburse the county for loss of tax revenue the state pays $.10 per acre annually. The state also pays the counties $.07 per acre for all state-owned land, in lieu of taxes. In return, the owner agrees to follow sound forestry practices. Timber harvests must be made in a manner to assure restocking. If the owner elects to harvest timber and sell it within the 25-year period he pays a yield tax, a percentage of the stumpage value of trees cut. To induce owners to hold their timber without making liquidation cuts in order to build up the timber resource the tax rate is graduated:

Year timber is cut	Percentage tax
1 - 10	4
11 - 20	5
21 - 25	6

If he cuts timber after the agreement expires no yield tax is collected. It is apparent that the owner, is relieved of part of his tax load. He also benefits from help in prevention of theft, which in the case of the non-resident own r is a very valuable service. If, during the 25-year period, the owner observes his forest grow into a more productive condition he may become interested in timber management. A benefit to the public can result through the development of a natural resource and a stable tax flow. At the present time, 73,300 acres in the basin are classified as Forest Crop Land. Although this is a small part of the total forest area, forestry operations such as timber stand improvement performed on this land may serve as practical demonstrations to other forest owners.

Much forest land is known or thought to be underlain with mineral deposits. This greatly influences buying and selling of land. The number of speculative purchases for future mineral development, without intention of managing the land for other uses, is unknown. Mining companies, alone, own in excess of 125,000 acres. If these owners are willing to develop a forestry program, they can greatly affect the land-use picture. Timber growing in the Lead Belt region would be profitable because of relatively high productivity of the soils. Short-term timber crops such as posts, poles and pulpwood can provide a source of income until mining operations begin or supplement employment during depressed periods in mining.

Timber Products and Industries

Forested regions support a variety of industries that use wood as a raw material. The products manufactured depend to a large degree on the species of trees in the region. The size of industries and their organization are determined by the nature of the forest resource: size of trees, physical and other properties of the wood, volume available per unit area, and total volume available within an economic procurement area. Industry requirements for labor, machinery, power, transportation, community facilities and other necessities must be geared to the raw material available and products that can be manufactured to compete with those in other regions.

Stages of processing

Wood-using industries can be divided into 2 groups based on the stage of processing. One group is primary manufacturers concerned with initial conversion of a tree into a product such as rough lumber. This group also includes industries that process products used in round form by the consumer, such as fence posts which have been treated with preservative. Firms in this group include loggers who fell trees, buck them into length, and haul them to a processing plant. Most primary industries are small, independently-owned firms that employ less than a dozen persons. Many are family affairs. The owner usually participates as a worker and also performs a supervisory function. His wages may be the only return he receives. Some enterprises are poorly financed, run with a minimum of equipment. They are inefficiently organized and lack managerial knowledge. The small amount of working capital they can obtain requires that their output be sold weekly to meet payrolls and other operating expenses. Business failures of small sawmills are common. The number of firms in operation fluctuates directly with prices. When prices decline the marginal mills go out of business or remain inactive until prices rise.

The other group of industries, secondary manufacturers, converts primary products to a more finished form. This group includes firms which manufacture furniture, flooring, handles and barrels, products that are cut or shaped from rough lumber or heavier dimension stock. The secondary processors are ordinarily larger and better organized and financed than the primary ones. They are better able to weather unfavorable fluctuations in prices and orders. In part this is because they have developed a number of market outlets.

Basis for estimates

To discuss the effect of forest industries on the economy requires detailed factual information. This is difficult to compile. The firms are widely scattered and personal contact is the best method of securing information. In obtaining industry data for a limited region one is usually confronted with situations which make precise estimates difficult: (1) a plant that is located outside but draws wood from the region, (2) a plant within that draws material from outside, (3) employment of a large number of workers on an irregular or part-time basis, (4) collection of data during a period of recession for a given industry, (5) reliance on company representatives for verbal estimates, some meaningful, others obvious misstatements. For these and similar reasons the data presented should be regarded as approximations. They were collected with care and judgement from a number of sources[14] and are believed to be the best available at this time. Data are based in part on output for 1959 and 1960 and estimated output for 1961. As such, the figures represent "current" activity rather than full capacity, which is believed to be considerably greater.

Products and output

More than 60% of the timber cut in Missouri is sawed into lumber and over 90% of the lumber is hardwood, primarily oaks. Hardwood lumber demand is increasing because of a swelling population, and demand is expected to increase from 33% to 66% in the next 15 years, depending on prices of competing materials.

Lumber is used in rough form for building construction, pallets, and blocking for freight shipment. A substantial volume is cut into cross ties and a small amount of clear lumber is used for furniture and fixtures. The largest volume of oak lumber produced is made into flooring.

In 1960, 90 sawmills were operating within the Meramec Basin or were drawing substantial quantities of timber from the area (Table 2). About two-thirds of the mills must be considered part-time operations, sawing intermittently when prices are high or on a custom basis for local needs. Hence, only about 35 firms are in the "commercial" sawmilling business, producing from 300,000 to 5 million board feet per mill annually. Since World War II the number of mills has declined by about 50%. During the war, maximum production of lumber was encouraged and lumber prices, though controlled, were attractive. Previously inactive mills resumed sawing and new mills appeared. Unusually high demand continued after the war and prices soared when controls were removed. In the 1950's demand gradually declined, prices dropped and many marginal mills went out of business. The trend in recent years is away from the small portable mill and toward the semi-permanent mill, with more efficient sawing and lumber-handling equipment.

The wood-using industries, in quantitative terms, are shown grouped by class of product in Table 3. Their location within the basin is shown in Figure 8.

Sawmills produce slightly more than 30 million board feet of sawed products. Four of the mills specialize in sawing red cedar squares, commonly 4 x 4 inches in cross section and 4 to 8 feet in length. They cut 500,000 board feet annually worth $60,000 when sold to manufacturers of cedar closet lining and novelties. Land owners receive over $14,000 from sales of cedar timber.

Three plants consume over 31 million feet of rough oak lumber to make flooring, one of the most important wood-using industries in terms of employment and value of product.

Charcoal was made more than a century ago in the basin for use in iron smelting. As coke replaced charcoal in steel-making the use of charcoal dwindled to

TABLE 2

NUMBER OF ACTIVE SAWMILLS BY PRODUCTION CLASS, 1959 MERAMEC BASIN

Mill-production Class[a]		Mills Number	Percent
1 - 99		39	43.3
100 - 499		35	38.9
500 - 999		5	5.6
1000 - 5000		11	12.2
	Total	90	100.0

[a]Annual production in thousands of board feet lumber tally.

TABLE 3

NUMBER OF MANUFACTURING PLANTS, SPECIES USED, AMOUNT OF WOOD PURCHASED, AND ANNUAL OUTPUT, MERAMEC BASIN

Products	Number of plants	Species of wood used	Wood purchased	Annual output
Rough lumber	90	oaks, cedar, other	28,000 MBF[a]	30,400 MBF
Flooring	3	oaks	31,400 MBF	22,000 MBF
Charcoal	10	oaks, hickory	62,700 cords	24,000 tons
Charcoal briquets[b]	--	charcoal	21,300 tons	23,000 tons
Barrel staves	2	white oaks	156,000 stave ft.[c]	359,000 net staves[d]
Posts and poles	4	pine	839,800 pieces	839,800 pieces
Dimension stock	2	walnut, ash, maple, hackberry, oaks	600 cords	400,000 pieces
High quality logs[e]	-	oaks, walnut	250 MBF	250 MBF

[a]MBF = thousand board feet.

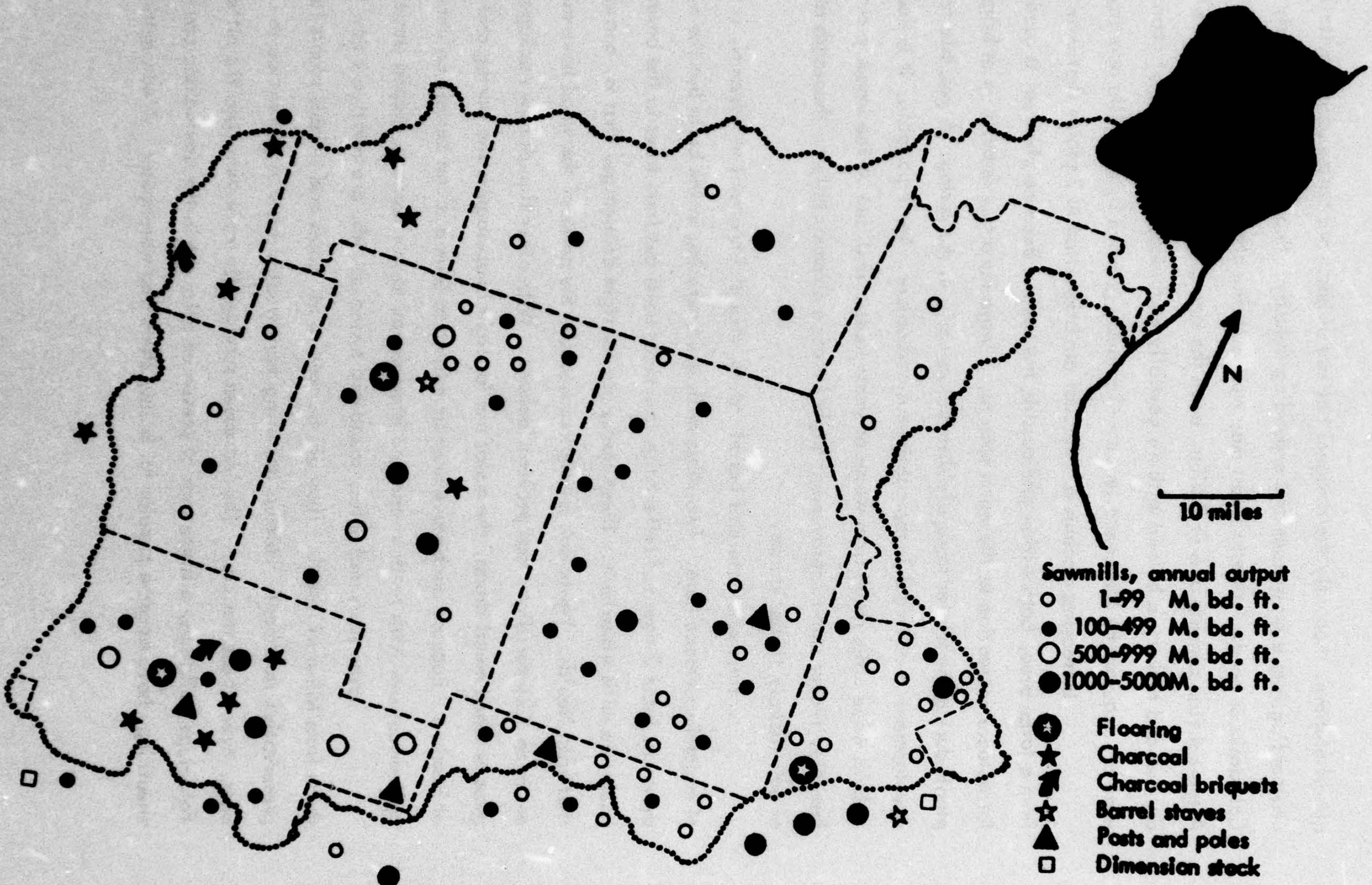
[b]Estimated production of two plants from charcoal produced in the Meramec Basin.

[c]A stave bolt that is 39 inches long and measures 12 inches across a chord on the end of the piece from one point to the opposite point on the circumference of the heartwood contains one stave foot.

[d]A net stave is 4.5 inches in width and 36 inches in length.

[e]Oak veneer and walnut stumpage purchased; logs shipped to plants outside the Meramec Basin.

Figure 8. LOCATION OF WOOD-USING INDUSTRIES IN AND NEAR THE MERAMEC BASIN.



almost nothing. Recently the national pastime of backyard barbecueing revitalized charcoaling into a prosperous and expanding industry. People at a beach party in California or on the Atlantic Coast may well be using charcoal produced in the basin. A typical firm consists of 6 or 7 kilns, each the size of a four-car garage, in which dry oak and hickory is burned with air partially excluded. The making of charcoal is an art acquired by long experience -- jealously guarded by most kiln operators.

Increasing amounts of charcoal are briquetted in 2 plants that draw wood from a large area, both within and outside the basin. Because charcoal is used largely for outdoor recreation in the warm seasons, a large inventory is built up at briquetting plants during the winter to supply distributors early in the spring. A possible future development in charcoal is the continuous carbonizer. Semi-portable, it is designed to burn wood chips made from waste or small trees. If its use in the woods proves feasible, timber stand improvement might be done commercially on thousands of acres of oak-hickory timber stands.

The manufacture of barrel staves, though important in Missouri, is not of major importance here. Two stave mills are operating in the basin but the output shown in Table 3 does not reflect the volume of bolts cut from trees in the basin but hauled to mills elsewhere. These staves are for tight cooperage, that is, barrels that hold liquids. White oak is required because the pores of the wood have numerous mica-like partitions that prevent leakage. With other liquids now packaged in glass or lined metal drums, the major use for tight cooperage is the storing and aging of bourbon. Because each stave must be curved to form a round barrel, an unusual cylindrical saw with teeth at one end is employed to saw properly shaped staves.

Pine posts and poles, round and rossed smooth, are relatively new products from Missouri forests. They are trucked to St. Louis and Illinois plants for preservative treatment. Farmers are using more treated posts in preference to untreated ones, even at greater cost. The increased service life more than pays the difference. Pole-type buildings, a framework of preserved poles set in the ground and covered with sheathing, have become popular for barns, sheds and warehouses. A new market has developed for over 800,000 sticks of pine annually, previously not saleable.

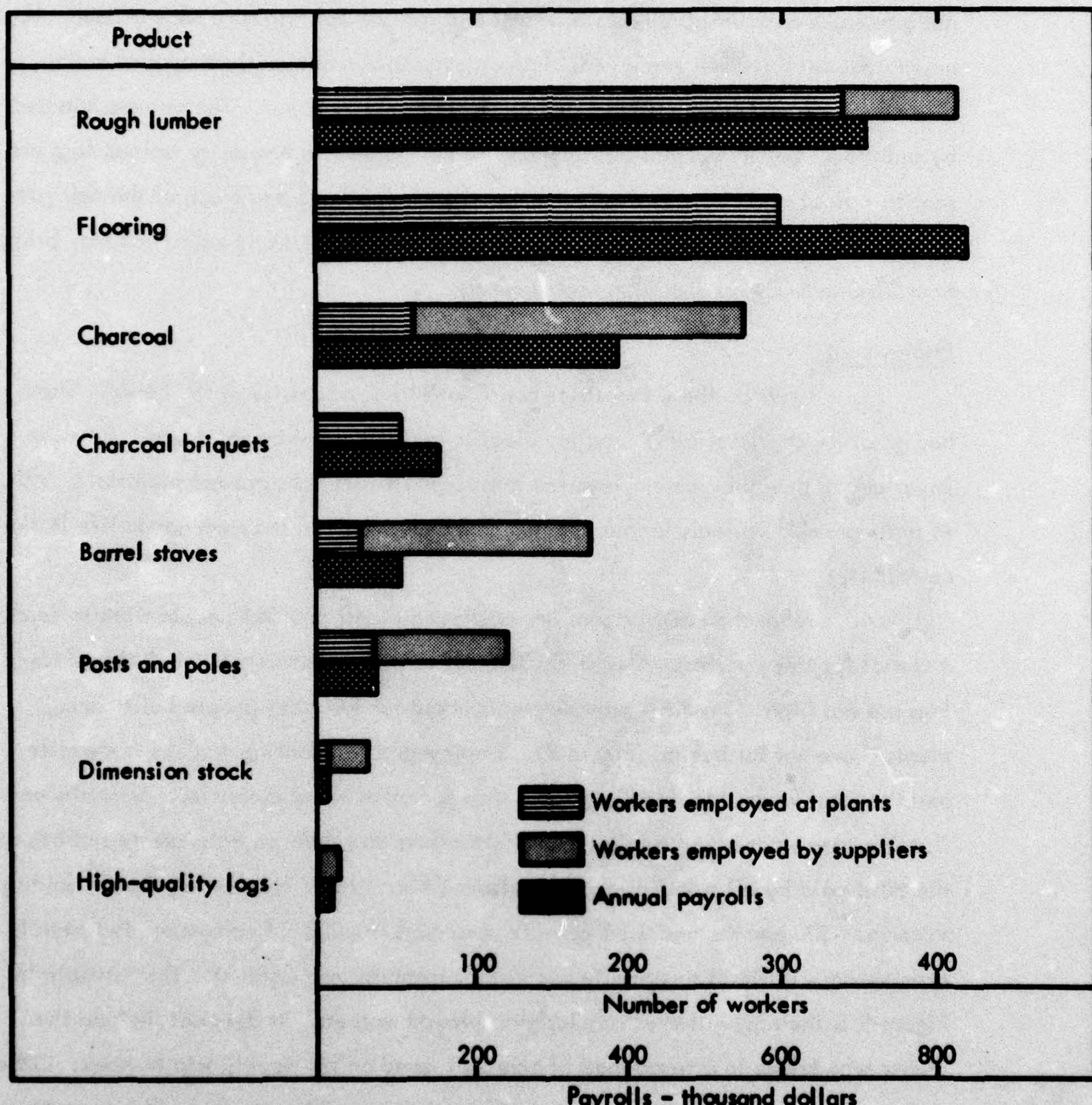
Dimension stock includes material for hickory and ash handles, blanks for furniture legs and other products. The category of high-quality logs includes walnut gunstocks and furniture and white oak and red oak for furniture face veneer. Log buyers may be full-time employees of the processor but frequently they own a store or service station and serve as a "collector" for a company buyer. The volume handled by individual buyers is small and difficult to estimate. High-quality walnut logs are sent to walnut processors in western Missouri and elsewhere and much of the oak goes to Indiana firms. To the land owner, veneer-quality walnut and white oak may bring from $200 to $400 per thousand feet stumpage.

Employment

What do these industries contribute to communities in the basin? They buy gasoline or Diesel fuel, repairs, electric power, and they pay taxes. Of more importance, they provide employment in a region where jobs are not plentiful. Jobs, in turn, provide business for merchants. The industries stabilize economic life in the community.

More than 800 persons are employed plants and 561 people work to supply material for these plants. Almost $2,300,000 is paid to workers but individual earnings are not high. Sawmills provide employment for the most people but flooring plants[15] are not far behind (Figure 9). Employment for flooring workers is steadier and the total wages received is greater than for other wood industries. Sawmills and flooring plants combined employ over 700 workers and their payrolls are two-thirds of the total paid by all wood-using industries. Charcoal and briquetting firms[16] employ more than 300 persons and their payrolls exceed $540,000. Employment and payroll estimates are difficult to compile because of irregular employment. The estimate in Figure 9 is the equivalent of regularly-employed workers. It does not include the farmer who brings in a truck load of charcoal wood on his weekly trip to town. Other workers are made idle by seasonal lay-offs and unfavorable weather. This is particularly true for the suppliers of bolts and logs. Most workers have other activities such

Figure 9.



EMPLOYMENT AND ESTIMATED ANNUAL PAYROLLS
IN WOOD-USING INDUSTRIES, MERAMEC BASIN.

as farming to supplement wages earned from timber work.

Value of output

The value of wood purchased for processing and the value of products output further describe the contribution of the wood-using industry to the economy (Figure 10). Land owners and loggers (also suppliers to flooring plants and charcoal briquetting plants) receive $3,764,000 for material supplied to plants. The sales value of all products at plants is $8,961,000. This figure includes "double counting" in the case of part of the rough lumber sold to flooring plants and part of the charcoal sold to briquetting plants. However, because these transactions took place within the basin, they represent a contribution to the particular industry group concerned. The value added by manufacturing is indicated by the difference between the above figures -- over $5,000,000. No attempt was made to evaluate the return to owners of wood industries.

The importance of sawmilling, flooring and charcoaling firms is indicated both by the value of raw materials and finished products, about 90% of the totals. These firms are the backbone of the wood industry. Compared to the dollar value of agricultural output, transportation, mining and merchandising, $8,961,000 may be small. However, it should be recognized that without the wood-using industries, utilization of the forest resource and employment of people would be limited.

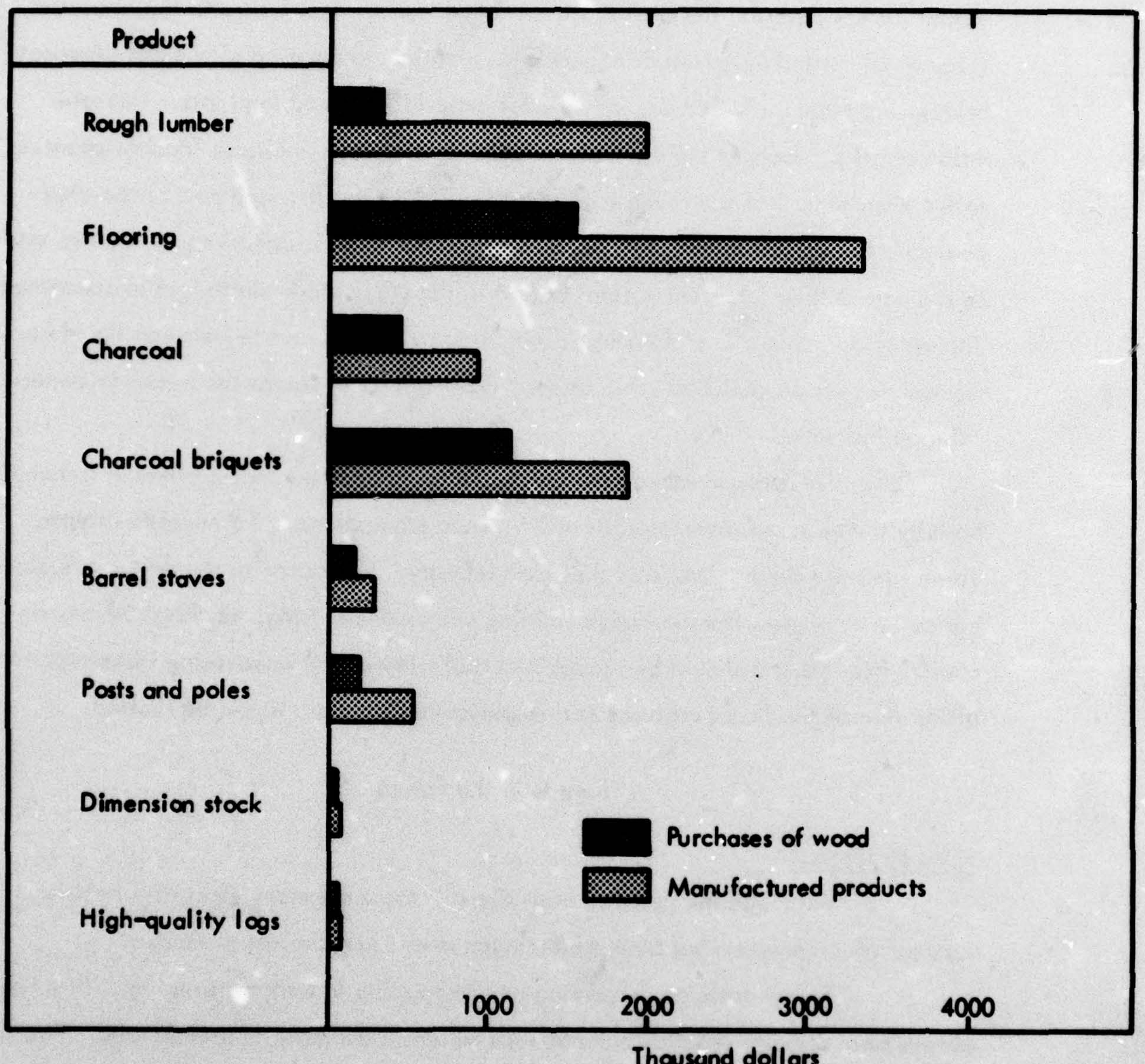
Forests in the Future

Signs of progress

Although the past has been dismal, there are many signs of a healthy future. Much progress has been made; much more improvement is needed.

Forest areas are receiving and responding to better protection. Fire has always been a major problem but statistics reflect a decrease in area burned. Fire in the basin is tied closely to the people. The incendiarist and the debris-burner are still active but protection programs are becoming increasingly effective.

Figure 10.



VALUE OF WOOD PURCHASED BY PROCESSING INDUSTRIES AND VALUE OF MANUFACTURED WOOD PRODUCTS, MERAMEC BASIN.

Open-range grazing has decreased. (Figure 11) With the development of more valuable cattle breeds and the growing realization that a few acres of improved pasture can replace several hundred acres of woodland grazing, the number of cattle in the woods can be expected to decline.

New and expanding markets are providing better outlets for a variety of wood materials. Higher stumpage values result from competition for higher-quality timber. With rehabilitation of depleted stands, continued expansion by industries seems inevitable.

Agency programs, development of a more stable industrial structure and increased demand for wood products have resulted in significant changes in attitudes of people regarding forest land. Wood has finally been recognized as a resource capable of contributing to the economy of the family, industry, and the community.

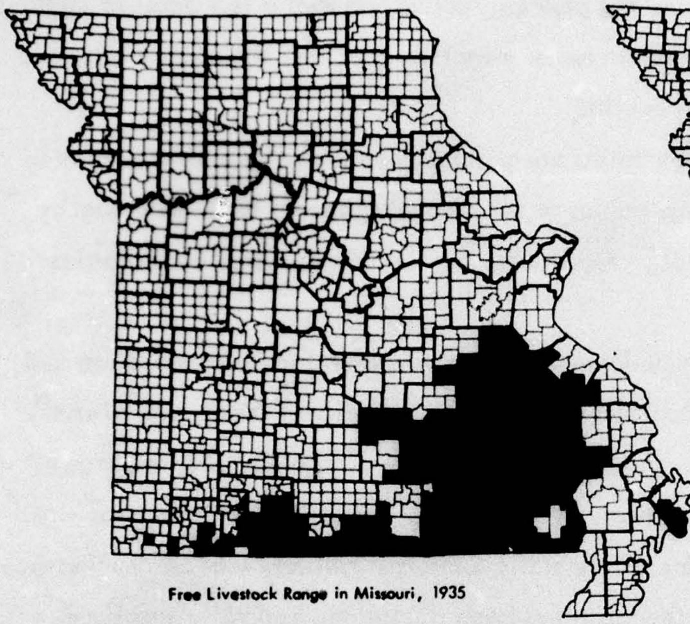
Local populations are rarely static and often reflect local and nationwide business cycles. Population of the basin has been declining, generally speaking, since the turn of the century. Minor fluctuations occur. With increased national prosperity, residents have moved to the high-wage industrial areas. In periods of depression, they have returned to the land. Significant is the fact that the small upland family farm appears to be passing from the picture, thus providing an opportunity for a consolidation and stabilization of forest ownerships.

Timber management[17]

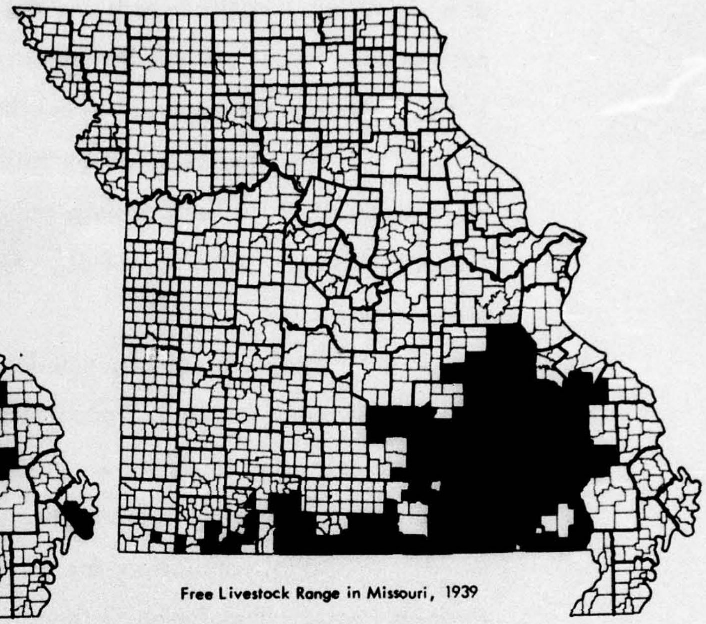
When timber is grown through the efforts of man it is not usually economical to grow large trees, the kind found in existing natural stands. Possibly a few high-value trees can be grown to a diameter of 20 to 30 inches, but most trees, if grown on an economic basis, must be harvested when they have attained a diameter of about 18 inches. Both shortleaf pine and oak-hickory stands on average sites probably will be considered mature at ages of 70 to 80 years.

If timber stands are to produce the maximum value, they must be adequately stocked at a young age with desirable species. Then, the better trees can be brought to maturity in a reasonable length of time before carrying costs accumulate and possibly

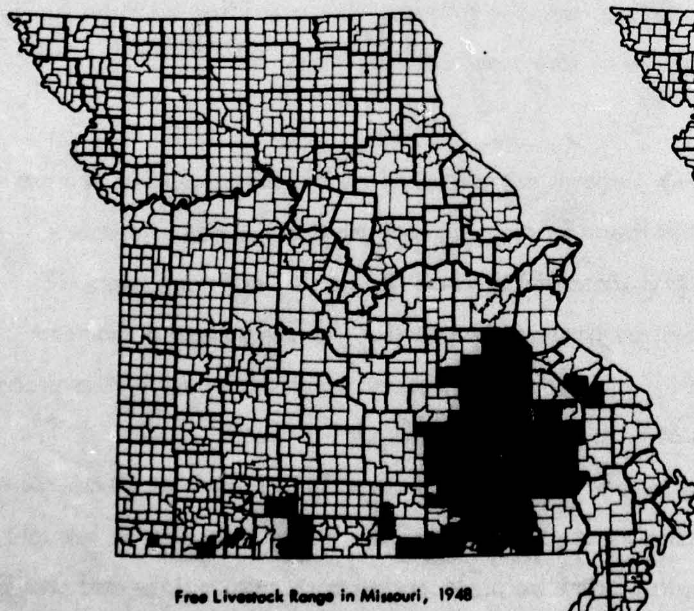
EXTENT OF FREE LIVESTOCK RANGE IN MISSOURI, 1935-1960



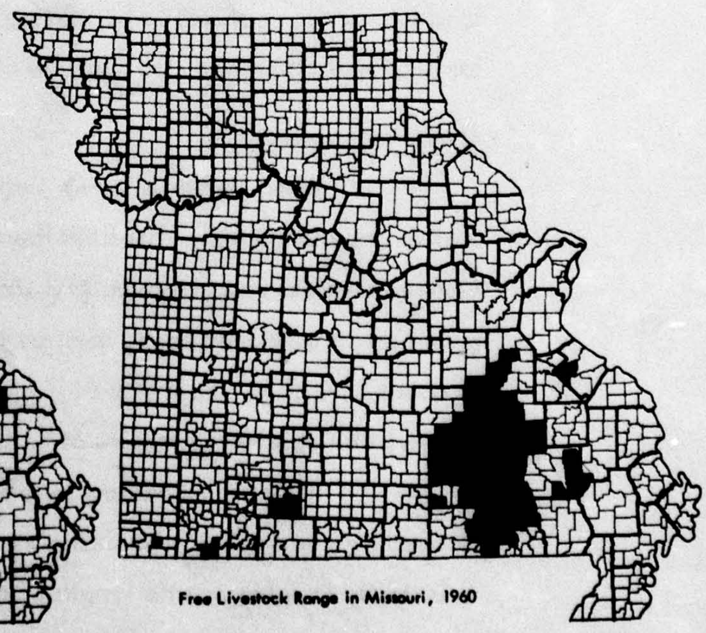
Free Livestock Range in Missouri, 1935



Free Livestock Range in Missouri, 1939



Free Livestock Range in Missouri, 1948



Free Livestock Range in Missouri, 1960

Source: Allen Brohn and Thomas S. Baskett
"Free Livestock Range in Missouri"
University of Missouri
Agricultural Experiment Station
Bulletin 761 January 1961

exceed the final value. Management of our forests probably can be handled best by growing stands of even-age. The establishment of young oak or pine is not successful under all-aged management because they are rather intolerant of overstory shade. Adequate regeneration requires a heavy cutting in the mature stand to create open areas for seedling and sprout establishment. Removal of the remainder of the mature trees after the young stand has been established completes the regeneration process. Logging activity in harvest operations often provides a bare mineral soil, ideal for germination.

In order to increase growth on the better trees, several thinnings should be made between ages 30 and 80 years, probably at intervals of 10 years or less after a stand averages 6 or 8 inches in diameter. Thinnings will pay for themselves if local markets develop for the size and quality of the material removed.

The management of shortleaf pine where it grows naturally presents relatively few problems. Several characteristics of pine tend to favor its management in preference to other species: rapid growth, generally straight stems, and fewer defects. Pine stands usually occur on or near ridge tops and on middle slopes with a south or west exposure.

A hardwood understory can develop on these sites but the hardwoods are usually inferior to pine. Seedling and sapling pines growing under a canopy of hardwoods respond well to overhead release during the first 20 to 30 years. On certain sites this makes possible the conversion of mixed stands to pure pine stands. Aerial and ground spraying with selective herbicides has proved effective in providing release. Because of the danger of injury to animals and other vegetation, aerial application requires careful control. Its use is highly controversial.

In the southern part of the basin, stands of mixed pine and oak commonly are found. In young pine-oak stands the competition from the oak and hickory component is severe, often suppressing the growth of pine. On better sites repeated treatments must be made to reduce hardwood competition. In pine-oak stands of intermediate age the entire stand may convert to hardwood if the pine is removed by cutting. Conversion of such a stand to pine is not simple because hardwoods are prolific sprouters. Natural stands with at least 70% of the volume in shortleaf pine usually are found on abandoned fields or areas disturbed by fire or other influences. Under these conditions pine responds quickly and competes successfully with hardwoods. However, if growing pine is the major objective, one or more treatments to eliminate hardwoods from pine stands may be necessary.

Relatively little is known about management of oak-hickory stands. Experience on the national forests indicates that it is possible to double the rate growth of unmanaged stands. With optimum management, the rate of growth and development of oak-hickory stands can exceed that of pine stands.

The present oak-hickory stands are essentially even-aged. That is, on an area from less than an acre to more than 40 acres, the age of dominant trees are within about 15 years of the average age. Possibly 50% of the basin's forest area is occupied by stands averaging 30 to 60 years, but small remnants may be 90 to 250 years of age.

Regeneration following cutting is not difficult to obtain in the oak-hickory type. Oaks are prolific sprouters as well as heavy producers of seed so that some reproduction is usually obtained after cutting. However, many sprouts are insect infested. A greater problem is the control of species composition.

The major problem in hardwood management is rehabilitation of stands which have been abused. Suitable crop trees are widely scattered. Attempts to bring the most desirable trees in the overstory to maturity, while often warranted and successful, usually do not result in yields that are as high as the potential of the site. Rehabilitation measures are often applied too late in the life of the stand for trees to produce the maximum possible yield.

Forests as an investment

Farrell,[18] in analyzing costs and the returns possible from present stands of hardwoods growing on average quality sites (about 60% of the forest area) found that they can return a profit to the owner only if cultural management is undertaken.

This conclusion assumed that present sawlog prices and markets would prevail and that an interest rate of 2.9% would be applied to costs that must be carried without immediate income. This interest rate was chosen because a forest land owner has the alternative of investing money used for cultural practices in a safe investment such as long-term bonds issued by the federal government which earn 2.9% interest. Stated another way, an owner cannot expect a profit from growing young trees to maturity by investing only in land, paying taxes but doing nothing to improve the timber stand. Speculation has been common in the past. A speculator may buy forest land, hold it long enough for a small amount of merchantable timber to develop, harvest the timber at increased stumpage prices and sell the land at a price higher than the original cost.

Pure pine stands, under similar conditions, can return a profit without cultural treatment, even with stands that are partially stocked. The area of pure pine in the basin, however, is relatively small.

If stumpage prices of hardwoods increase about $10 per thousand board feet above present levels, fully-stocked hardwood stands on reasonably productive sites may prove to be a profitable investment without timber management. But for the prospective investor this seems possible only if land values, taxes and other costs remain at present levels. Experience during the last 10 years indicates that both land prices and taxes are increasing at least as rapidly as prices in other sectors of the economy.

<u>Costs and returns</u>

Farrell's analysis of the records of several owners of Ozark forest land who have managed their timber stands under a variety of conditions indicates that net value returns expected at maturity range from about $11 to $244 per acre. This is equivalent to a net annual return of $.18 to $4.07 per acre.

With cultural management of hardwood stands growing on medium to good sites, a return of $1 to $4 per acre per year can be expected during an 85-year period from stand establishment to final harvest. This assumes continuation of present-day costs, including interest of 2.9%, an increase of stumpage price of $15 to $25 per thousand board feet and timber volume yields estimated by empirical methods. If stumpage prices were to advance to $30 to $40 per thousand, as might be expected for high-quality timber, and a market develop for hardwood pulpwood making thinnings possible, net returns of $5.25 to $7.75 per acre per year appear possible. Alternatively, if the cost of management is high with stumpage prices as low as $25 per thousand board feet, a return of about $1 per acre annually from hardwood stands is possible.

Hardwood stands on fair sites appear marginal under present-day costs and prices without intensive stand management. A stumpage price of $26 per thousand feet is required to break even.

Because of potentially greater yields from better timber sites, more funds can be invested for production on good sites than on poorer ones. Cumulative total costs, including interest, for management operations as currently performed in managed stands may range from about $90 to $500 per acre over an 85-year period. Under favorable conditions hardwood stands on medium to good sites may yield gross returns from about $200 to $875 per acre, and pine stands can return $400 to $1,300 under intensive management.

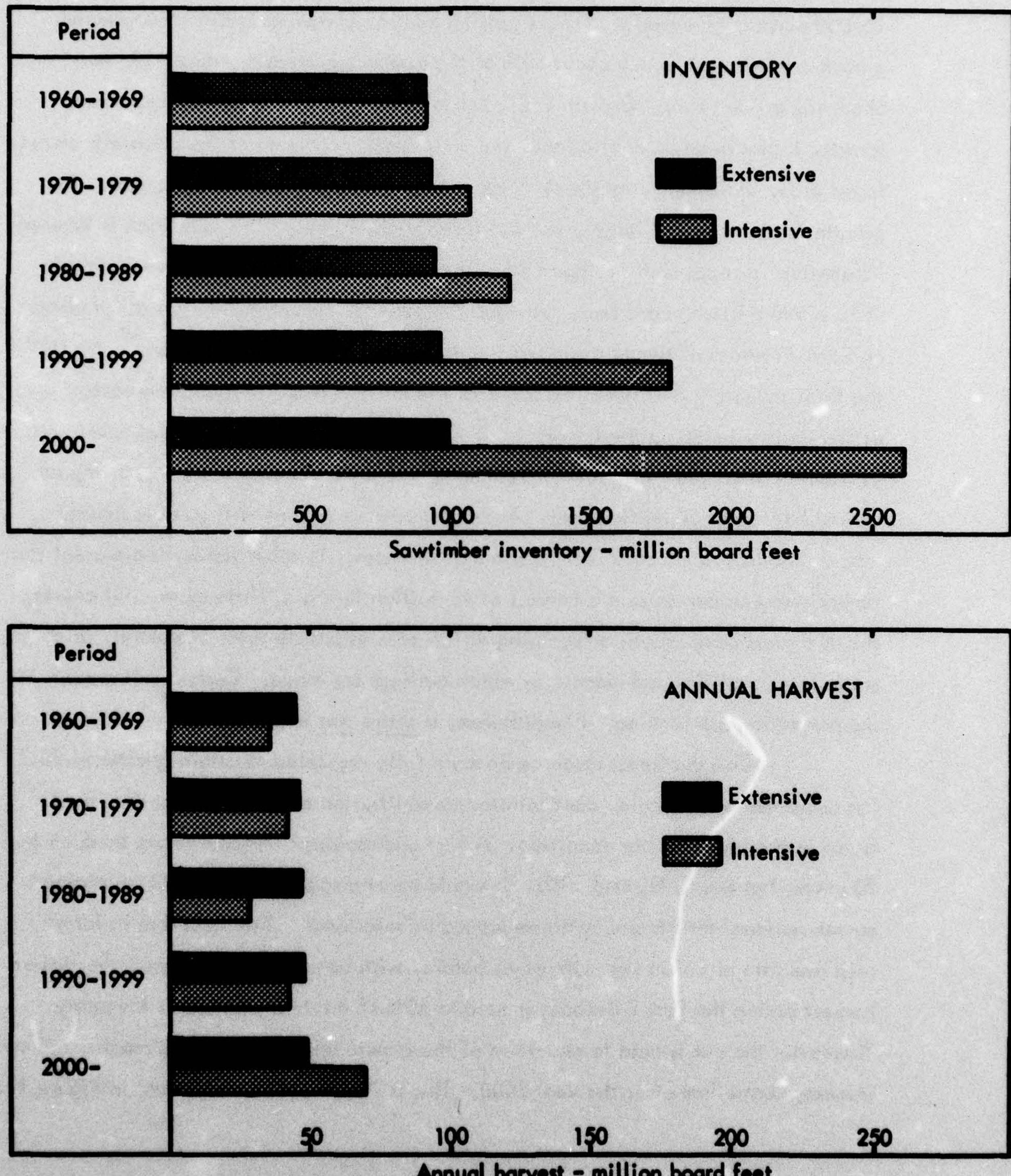
Owners who have acquired land supporting well-stocked stands of desirable species at low prices are in an excellent investment position if taxes and other costs remain at low to average levels. Relatively high net gains are possible if timber management is undertaken and continued.

Timber potential

Let us project the sawtimber resource forward to the year 2000. First, assume that no major changes occur. Present markets continue for sawlogs, stave bolts, charcoal wood and other products. Perhaps consumer demand increases moderately. Markets for new products develop but they are local. There are no major new markets for wood throughout the basin. The forest area stabilizes at 1.45 million acres by 1980 but recreation activity and land purchases by individuals and organizations who wish to maintain forests in a natural state, with no timber cutting permitted, continues to shrink the commercial forest area by 1,000 acres per year -- 10,000 acres each decade. Timber cutting and losses from mortality and reduced growth continue to remove about 50% of the sawtimber inventory every 10 years -- about the present rate. Growth continues to add to the timber inventory. Good forestry is practiced on public lands and on a small proportion of the privately-owned forest area, increasing slightly each year, but with no pronounced advances. The private land is handled largely without forestry objectives. This condition is labeled "Extensive" management in Figure 12. The total sawtimber inventory beginning in 1960 is 926 million board feet, previously reported. Timber cutting for all products and other sources of timber drain remove 46 million board feet annually.[19] By 1970 the total inventory will have increased to 944 million board feet and increased utilization will step up the harvest to 47 million feet. This trend, projected to the year 2000, will result in a total inventory of 996 million board feet, supporting an annual harvest of 50 million feet. Average per-acre volume will have increased from 1,235 to 1,355 board feet, a nominal increase. In other words, the present sawtimber resource can sustain a harvest of 46 million feet or a little more. Of course, this is a gross comparison, submerging differences in growth rates of species, differences in site quality and manner in which cuttings are made. Certain refinements in the projection are lacking. Nevertheless, a status quo is indicated.

Can the forest resource be more fully regulated to attain greater yields? Let us assume a full-scale, concentrated rehabilitation of forest stands; the forest is put in the best possible condition. A vast undertaking! Assume it can be done in 20 years, between 1960 and 1980. It would be at a rate similar to that maintained on the national forests and better-managed private lands. The reduction in forest area and rate of volume growth are as before, with one major difference: the timber harvest during the first 2 decades is held to 40% of the total sawtimber inventory. Thereafter the cut is held to one-third of the growth until the resource reaches optimum stocking, sometime after the year 2000. This is "Intensive" management in Figure 11.

Figure 12.



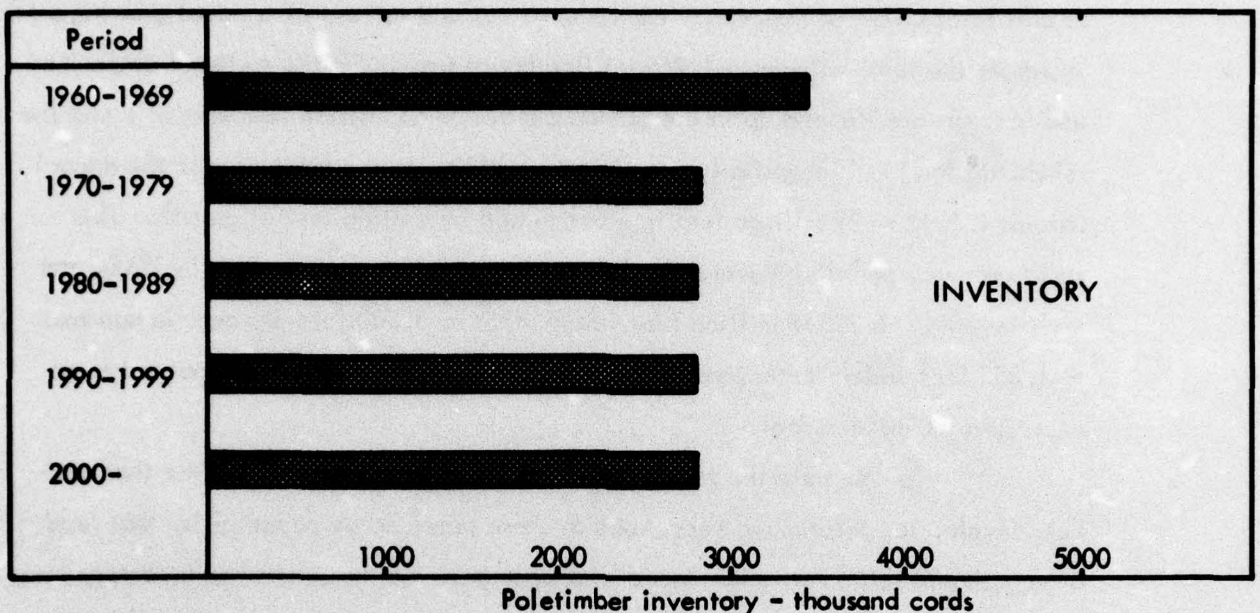
POTENTIAL REHABILITATION OF THE SAWTIMBER RESOURCE UNDER TWO LEVELS OF MANAGEMENT INTENSITY, MERAMEC BASIN.

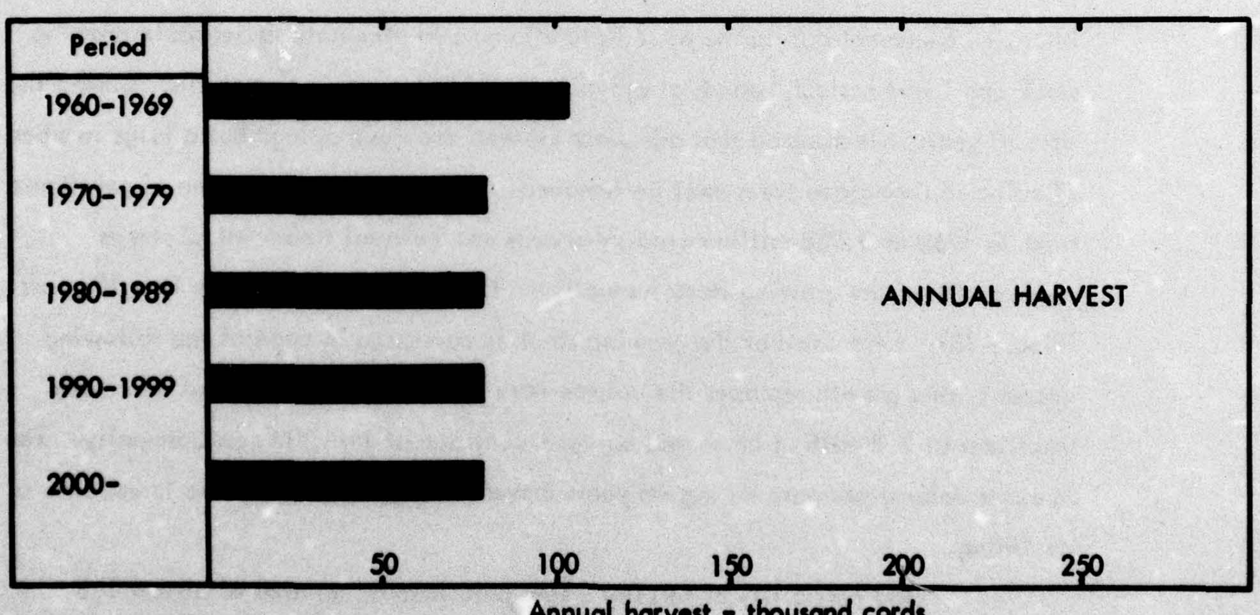
Starting with 926 million feet in 1960, the annual cut is held to 37 million feet, considerably less than the "Extensive" harvest. Further, some of it represents the volume of cull trees killed or removed. The reduced cut and release of residual growing stock increases the total volume to 1,069 million board feet in 1970. Cultural operations and harvests are stepped up in the second decade to 43 million feet annually and the rehabilitation job is essentially completed by 1980. In the third decade the annual harvest is held to 29 million feet in order to add 58 million feet of growth. This stand recovery permits an increased harvest in the following decade. By 2000, the total inventory is 2.618 million feet, equivalent to 3,560 feet per acre in contrast to 1,355 feet under "Extensive" management. The allowable annual harvest is an impressive 70 million feet.

To complete the picture for "Intensive" management, assume that markets develop for poletimber trees, such as those provided by paper mills, that land owners should sell to practice "good" management. As the sawtimber inventory increases there is less area in poletimber stands. It is assumed that initial poletimber area is 40% of the forest area and that it decreases to 30%. These stands are given intensive treatment during the next 10 to 20 years to eliminate undesirable growing stock and leave residual stands at optimum stocking for maximum growth. During the first 10 years it is assumed that adequate markets are developing, but a large number of cull and low-grade trees must be removed. Starting with the volume of poletimber trees in 1960 of 3.938 million cords, harvests and cultural treatment of stands removes 4% of the growing stock annually or 158,000 cords during the first 10 years (Figure 13). One-third of the growing stock is harvested in each of the following decades, and growth replaces the volume harvested. By 2000 the total inventory stabilizes at 3.3 million cords and harvests continue at 110,000 cords annually. The average volume per acre during 40 years increases slightly because the forest area is declining.

The possibility of forestry being practiced on an area of almost 1.5 million acres, with substantial cultural treatment completed in 20 years, with adequate

Figure 13.





ESTIMATED LEVELS OF POLETIMBER GROWING STOCK AND ANNUAL HARVESTS WITH INTENSIVE FOREST MANAGEMENT AND DEVELOPMENT OF ADEQUATE MARKETS, MERAMEC BASIN.

markets developing as needed, is indeed remote. A more realistic projection in light of past progress lies somewhere between the "Extensive" and "Intensive" extremes, but a definite forecast is too subjective to attempt. However, it is apparent that the forest resource can become increasingly important. It can support an industrial expansion eventually if it is conditioned to produce greater yields.

Requirement for woods labor

The huge task of rehabilitating timber stands will require a large labor force. If it is assumed that 1 million acres need timber stand improvement work, a minimum of 500,000 man-days of labor will be required to complete noncommercial work such as girdling small trees. Additional work including planting open areas, soil stabilization on exposed slopes, and road construction will increase the requirement. Proposals for a youth conservation organization similar to the Civilian Conservation Corps of the 1930's have been made in the Congress. It is apparent that sufficient useful work can be done in the forests of the Meramec Basin to fully utilize the labor of such a movement for an extended period of time. The results of a large-scale work program would serve as an effective demonstration, and the social benefits would outweigh costs, particularly if a cost-sharing plan by land owners and future recreationists could be devised.

Development of recreation and watersheds

To achieve improved watershed conditions and suitable surroundings for recreation, certain conditions must be met. Open-range and uncontrolled grazing of cattle must be eliminated to minimize soil compaction and erosion, and to make livestock production more profitable. Fire prevention and control must be so effective that fire no longer constitutes a major problem either to the land owner or the public. Open, exposed sites under all types of land-use must be handled for maximum stabilization of soil. Future road construction should be designed to permit drainage from stabilized cuts and ditches. On steeper slopes logging of timber may require modification to protect watershed and soil values.

Probably the major change in land-use of the basin will be increased recreation. Swimming, lake fishing, camping, picnicking, boating and cottage developments are concentrated on a relatively small part of a given land area. The Meramec Springs Recreation Area near St. James, administered by the James Foundation, is illustrative. In 1960 there were 220,000 visits to this area. Within a total area of 1,600 acres, only 80 acres were intensively used. This 5% of the area is adjacent to the springs and streams. On large areas, the concentrated forms of recreation may take place on an even smaller portion. A recent study by the Forest Service to locate and define areas suitable for intensive recreation on the Missouri National Forests indicates that 1,200 acres within a total area of 900,000 acres have recognized value for recreation use, less than 0.002%. Other forms of recreation such as hunting, enjoyment of scenic values, stream fishing and nature study may extend over large areas. To provide surroundings of maximum value certain practices deemed best for growing timber may require modification. Timber cutting along roads, streams and other courses of travel by recreationists must be light to reduce the amount of logging slash. But recreation and timber harvests on adjacent areas are compatible if logging is done properly.

Improved wildlife habitat

Where wildlife management is an important objective, timber stand improvement operations must be modified to leave den trees and provide other favorable conditions for wildlife. On the other hand, timber cutting operations can provide open areas with increased forage suitable for game animals. Although unsubstantiated by precise information, estimates indicate that optimum conditions for deer require only a minor reduction in the most desirable tree stocking for timber production. In actual practice, open areas would be interspersed with timber stands, occurring as areas of less than 1 acre to several acres in size.

In connection with wildlife management, sacrifices of timber growth to provide better wildlife habitat can be minimized for the land owner. If sportsmen were to accept fee hunting and leasing of private lands for hunting, the owner could realize some return from his efforts to provide wildlife habitat, and he would have an incentive to forego a single-purpose timber growing objective. This approach is widely used in European countries and to a lesser extent in some regions of the United States, for example, the Southeast. Seasonal or long-term leasing to groups or individuals can provide a controlled harvest of game, income to the land owner and better hunting to the lessee. During the 1960 deer season land owners in Douglas County, among others, successfully charged hunters $5 to $10 for hunting privileges. Fee hunting and leasing must not be interpreted as a proposal to limit the program of the Missouri Conservation Commission to manage game resources nor to restrict the Commission from providing public hunting areas, rather they would supplement the state program. Land owners would become partners with the state in promoting wildlife management.

<u>Industrial use of wood</u>

Several influences of regional and national scope will affect future expansion of industries that use wood, aside from future development of the forests of the Meramec Basin. Consumer demand and price relationships with competing materials will strongly influence wood consumption in the future. The intensity of future competition among industries located in other regions will influence industry migration to less-developed areas, including Missouri. With several pulp mills competing for wood in the same procurement area along with industries that make other wood products, competition can be intense, as it is in parts of the South today. It appears reasonable that at least some of these firms will seek plant locations in other areas in the future. An all-important factor in the development of expanding wood markets in the basin is the development of technology which will permit wider use of hardwood raw material. Although hard hardwoods are used to make paper pulp, technical problems and lack of markets for the products make more widespread use of these species unprofitable at the present time. Technology along with economic and other resource factors must be favorable to expect such large-scale, large-investment industries to locate here. When estimated at present price levels and current labor efficiency, by the year 2000 the cost of "Intensive" forest management will be

$3,300,000 greater per year than that for "Extensive" forest management. The value added by manufacture of products made from wood can be $24,600,000 greater under "Intensive" forestry and fully developed industrial use of wood.

Aside from development of industries that make new products, the opportunity to increase the production of existing industries and the opportunities for timber growing are linked to improved market organization and practices. The advantages of an organization set up for integrated buying of several complementary rough wood products need investigation. The organization of cooperatives by land owners to gain the advantage of large-scale sales is one possibility. Broker-operated concentration yards that will buy not only logs and bolts but also rough products is another. Another marketing structure or organization which can provide for planned, coordinated utilization of wood by several plants will benefit both timber owners and industries.

Industry centers

Integrated utilization demands that plants which can more fully utilize trees be located close together so that residue from one plant can be used by another. The most desirable locations for industries require consideration of other equally important factors, such as available labor, building sites, electric power, suitable transportation by rail and truck, and desirable community facilities which will foster stable, happy workers and management. Within the Meramec Basin an industrial wood center is already developing at Salem. Several medium-sized sawmills are located here, as well as a flooring plant, charcoal kilns, a charcoal briquetting plant, and a post and pole yard. Potosi and St. Clair are located tributary to extensive timber areas and have transportation and town facilities which can be strengthened for industries that produce similar products. Outside the basin potential timber centers are Poplar Bluff, Fredericktown and Cape Girardeau. Paper mills are more likely to locate south of the basin, closer to the main pine resource, or along the Missouri and Mississippi Rivers, with convenient access to soft hardwoods.

In the metropolitan area of St. Louis there are many firms which use wood for secondary manufacture. The volume of wood they use is relatively small but its value is high. Most of them use dimension stock produced in other regions of the United States because the physical properties of the species are suited for their product and supplies through highly organized wholesaling firms are reliable. It is possible that Missouri species would prove equally suitable for at least some products if a reliable, large-scale supply develops from better organized markets in Missouri. Dimension stock and lumber can be delivered from within Missouri to St. Louis markets at lower cost than shipments made from distant sources because of smaller transportation charges.

Benefits from intensified processing

From the social point of view the contribution of forests is measured according to benefits gained for society. In the economic sector, the contribution of forests may be indicated by employment provided to people engaged in woods and processing work and the attending benefits that communities receive from wages entering the local trade. From tree stump to final consumer each stage of processing adds value to the final product. Each completed stage adds profit to the firm and increases payrolls to the community. As a rule, the large increases in value occur in secondary manufacture, when processing is most complex. The more of these processes that occur in the locality in which the tree was grown, the greater the benefits to the community. This is accepted generally but little knowledge is available on how much each step or process in the chain increases profits or local benefits. Worley[20] analyzed operating records of successful manufacturers in eastern Kentucky. He found that an integrated wood business producing 2 million board feet annually (the output of the larger mills in the Meramec Basin) of air-dried dressed lumber, siding, molding and specialty products such as truck beds -- in contrast to producing the same volume of green lumber -- can change its receipts and expenditures as follows:

Value of	Increase, percent
Receipts	
Sales	101
Expenditures	
Purchase of wood	0
Payroll	130
Equipment	270
Power	130
Other	130
Unaccounted for margin	160

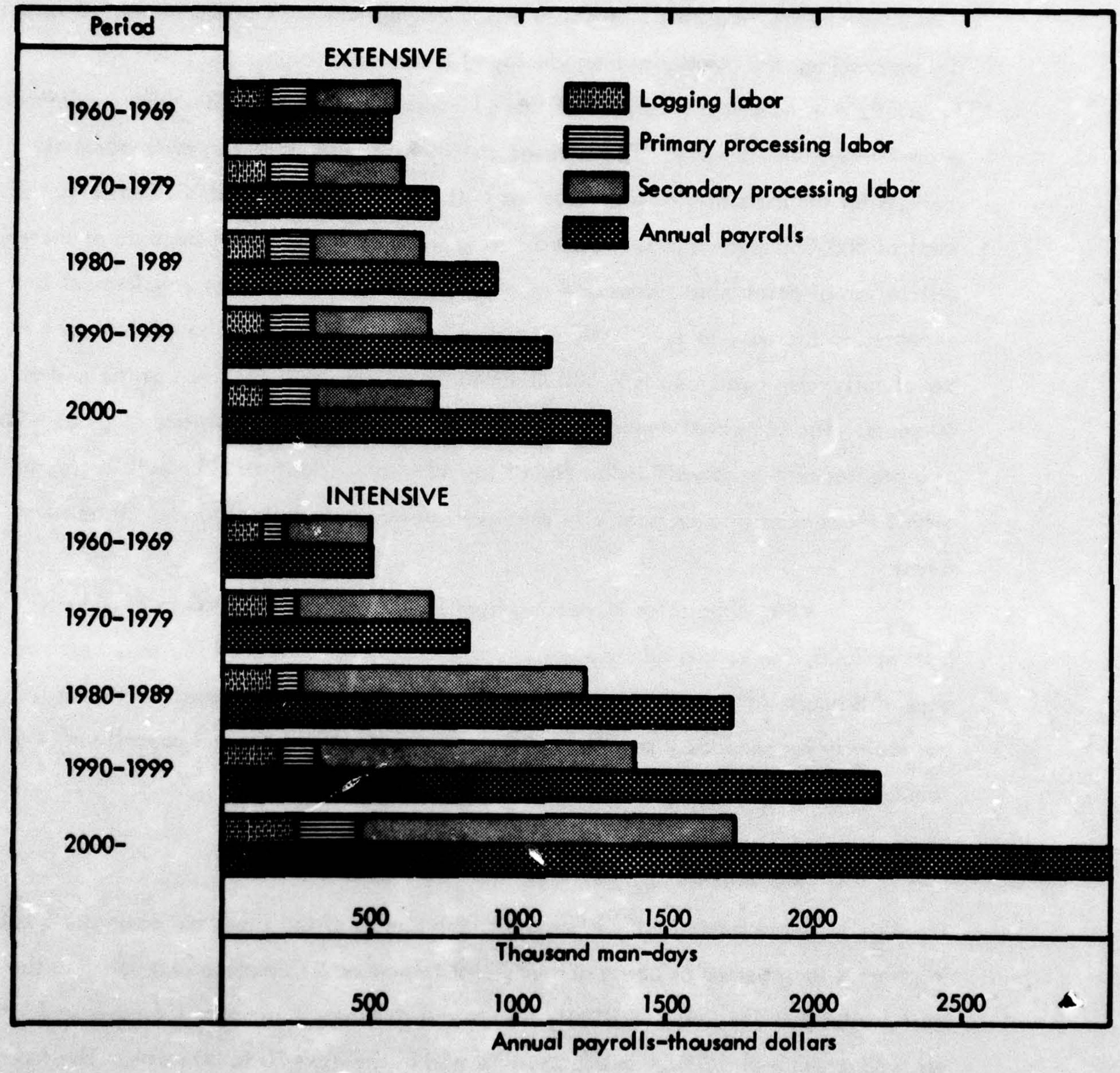
These ratios are based on an increase in receipts from $123,900 to $259,600 and an increase in expenditures from $104,500 to $209,600. Thus, it appears possible to double sales from the same amount of raw material by continuing the processing. This is accompanied by an increase in returns to both labor and capital, in this case about two-and-one-half times greater.

Involved processing such as the manufacture of pulp and paper products can increase the value added by manufacturing from 4 to 5 times that added by sawing green lumber.

Employment opportunity

Labor requirements can be estimated using the annual harvests of timber suggested in Figures 12 and 13 as a base. Figure 14 indicates potential employment in the wood-using industries and forest operations combined under the estimated levels of "Extensive" and "Intensive" forestry. In arriving at this estimate it is assumed that 2 man-days are required to log and haul 1,000 board feet of sawtimber to a mill and that milling and seasoning require 3 man-days per thousand board feet. Other processing requires from 5 to 7 man-days per thousand board feet, increasing as the processing becomes more complex. Logging of cordwood-sized material, it is assumed, requires 1 man-day per cord and that further processing requires 3 to 7 man-days per cord depending on the number of stages of processing. Timber stand improvement work was assumed to require 0.5 man-day per acre.

Figure 14.



POTENTIAL EMPLOYMENT IN WOOD-USING INDUSTRIES AND FOREST OPERATIONS
UNDER EXTENSIVE FORESTRY AND PRESENT MARKETS
AND UNDER INTENSIVE FORESTRY AND FULLY DEVELOPED MARKETS IN THE MERAMEC BASIN

Under "Extensive" forestry the total labor requirement during the decade beginning in 1960 is 588,000 man-days and this increases during the following 40 years to 718,000 man-days. This is equivalent to almost 2,800 men in 1960, increasing to 3,600 men in the year 2000. Because of the assumptions concerning increased secondary processing, the number of men employed is somewhat higher than that reported in Figure 9, but the primary purpose of these figures is to compare them with employment under "Intensive" forestry. Employment under "Intensive" forestry, with adequate markets for all the material indicated for cutting in Figures 12 and 13, shows that a total of 508,000 man-days is required during the next decade, but because of increased utilization of poletimber stands and increased processing, the labor requirement is expected to increase to 1,720,000 man-days by the year 2000. The equivalent number of fully-employed men is 2,500 in 1960, increasing to 8,600 men at the end of 40 years. The increased employment potential through secondary processing, as well as a greater timber harvest at the end of the 40-year period, would result in two-and-a-half times as many men gainfully employed in woods and plants under "Intensive" forestry.

With wage rates increasing from $1.00 per hour in 1960 to $1.80 per hour in 2000, the estimated value of payrolls are shown in Figure 14, based on man-days of 8 hours. The large number of workers required under "Intensive" forestry, particularly for secondary processing, results in a greatly expanded payroll value compared to "Extensive" forestry.

Conclusion

As in other parts of the state, the forests of the Meramec Basin are emerging from a long period of abuse and wasteful treatment. Complete recovery, to the most productive condition, will require several decades, but major increases in forest production and utilization are possible within the next 20 to 30 years. The forest potential of the Meramec Basin probably never will reach that of areas of similar size in the Pacific Northwest and the South, where timber grows faster and the forest economy is already highly developed. In part, this will be compensated for by lower transportation costs because of the close proximity of forests and industries to centers of population. Thus, it appears that forests can make an important contribution to the future wood-products economy of the basin. The potential benefits from forests to successful recreation and watershed management also are significant. Both public agencies and forest land owners must recognize this as an opportunity for intensive land management that will aid the orderly development of the basin.

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1. Valuable suggestions were made by Farm Foresters Gene W. Grey, Ramon D. Gass, John P. Slusher and District Forester John R. Kullman, of the Missouri Conservation Commission; C. Lewis Harrison, Lawrence L. Sluzalis, and Frank W. Meyers of the Missouri National Forests, U.S. Forest Service; Robert E. Elgin, Manager of the James Foundation; and my colleague, Professor Lee K. Paulsell.

2. Based on Forest Service, Timber resources for America's future, Forest Resource Report No. 14, U.S. Dept. of Agriculture, Washington, 1958.

3. Stanford Research Institute, America's demand for wood 1929-1975, Stanford Research Institute, Stanford, 1954.

4. A board foot is a piece of wood one foot square and one inch thick.

5. Forest Service, Timber resources for America's future, Forest Resource Report No. 14, U.S. Dept. of Agrilculture, Washington, 1958.

6. Data from preliminary estimates of the 1959 Forest Survey, Mo. Agr. Expt. Sta., Central States Forest Expt. Sta. and Lake States Forest Expt. Sta. cooperating; from King, Roberts, and Winters, Forest resources and industries of Missouri, Mo. Agr. Expt. Sta. Res. Bull. 452, Columbia, Dec. 1949; and from field observation by several individuals.

7. Shortleaf pine and cedar.

8. Blackgum, cottonwood and sycamore are examples of soft hardwoods.

9. Oaks, hickories and ash are hard hardwoods.

10. Proportion of land in each site class reported in Forest Service, Timber Management Plan, Missouri National Forests, U.S. Dept. of Agriculture, Preliminary Plan, 1960.

11. Brohn, A. and Baskett, T.S., Free livestock range in Missouri, Mo. Agr. Expt. Sta., Bull. 761, Columbia, 1961.

12. Manuscript on private forest land owneship in Wayne County, Missouri, to be published by John H. Farrell, Forest Economist, Central States Forest Experiment Station, Forest Service, U.S. Dept. of Agriculture.

13. Smith, R.C., Taxation of forest land in South Missouri, Mo. Agr. Expt. Sta. Res. Bull. 624, Columbia, 1957.

14. Mo. Agr. Expt. Sta., Research Project 406, Timber products marketing, and estimates of farm foresters, industry foresters, wood buyers and the writer.

15. Workers employed by suppliers of lumber to flooring plants included under rough lumber.

16. Workers employed by suppliers of charcoal included under charcoal.

17. Adapted from a manuscript on economics of timber production on small forests in the Missouri Ozarks, to be published by John H. Farrell, Forest Economist, Central States Forest Experiment Station, Forest Service, U.S. Dept. of Agriculture.

18. From processed paper presented December 9, 1960, before the Karkhagne Club, Salem, Missouri, by John H. Farrell, Forest Economist, Central States Forest Experiment Station, Forest Service, U.S. Dept. of Agriculture.

19. Annual consumption of wood reported in Table 3 totals the equivalent of approximately 30 million board feet. The additional 16 million feet represents disposal of wood which was not estimated in Table 3, such as for fuelwood, losses of timber from destructive agencies and mortality caused by tree competition.

20. Worley, D.P., Local benefits from timber industry expansion, Central States Forest Expt. Sta., Technical Paper 172, Forest Service, U.S. Dept. of Agriculture, Columbia, May 1960.

THE MERAMEC BASIN

Volume II

The Economy and Character of the Meramec Basin

Chapter 4

RECREATIONAL AND SCENIC RESOURCES

Meramec Basin Research Project

Washington University

St. Louis, Missouri

December 1961

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Chapter 4

RECREATIONAL AND SCENIC RESOURCES

Summary

Because of the limited resource base for agriculture and some other activities, and because of favorable topography, vegetation, and population density characteristics, the use of the Meramec Basin for recreation is likely to be its most important use. These factors have resulted in fairly intensive recreational use in the past, particularly by people of the St. Louis area. However, recent years have witnessed a decline in recreational use of the Meramec because people now demand better facilities and can reach them. Clearer water than can be found in most of the Meramec is available in streams in the Current or Black River basins. Swimming pools also provide clearer water and more convenience. Large artificial lakes constructed in the Osage, White, Black, St. Francois, and Tennessee River basins provide larger water surfaces to satisfy the demand for certain kinds of recreation activity. The deterioration of both the natural and man-made recreation facilities, coupled with increases in the income and mobility of recreationists is largely responsible for the increasing tendency to bypass the Meramec Basin.

The present recreation resources of the Meramec are the springs and caves which abound in this region, and the pleasant wooded slopes and streams which are clearer and less intensively used for other purposes than any other streams at comparable distances from St. Louis. Large numbers of St. Louisans still use the recreation facilities of the Meramec, although the proportion is less than it was 30 years ago. In addition to the recreational use of private facilities, several large tracts of public land in the basin receive moderate to heavy use by recreationists.

The future of recreation in the Meramec Basin will be largely governed by public decisions concerning the development of water-recreation resources in the basin. Further increases in population, income, leisure time, and mobility will provide an opportunity for recreational development which is matched by few other areas in the country.

Introduction

One of the major uses, both actual and potential, of the Meramec Basin area is for recreation. Most of the land in the basin is not of high enough quality to compete successfully with agricultural land in other areas. Some agricultural products will be produced, however, and forest products and minerals should continue to grow in importance. Light industrial and trade activities will continue to lend economic support to the region. Without belittling the importance of these types of economic activities, meeting recreational needs seems to be the distinctive contribution the basin can make to the region as a whole, which includes St. Louis and surrounding parts of the midwest within a radius of 100 to 200 miles. Both public and private action can influence this use and take advantage of the potential by wise planning.

The non-recreational uses are discussed in other chapters. This chapter deals with the recreational aspects of the Meramec Basin and the St. Louis area -- past, present, and future.

History of Recreation in the Meramec Basin

The Meramec Basin area has long been used by St. Louisans and others for recreational purposes. The land to the north and east of St. Louis is less wooded and less hilly than the Ozarks, is more completely preempted by agricultural uses, and is somewhat cut off from the city by the Mississippi and Missouri Rivers. By contrast, the Meramec area is hilly and wooded, is not intensively used, is located relatively close, and possesses several good-size, clear streams. (See maps in Volume II, Chapter 1.)

Types of recreational use

The part of the basin closest to the metropolitan area has received the most intensive development,[1] but recreational use extended even up into the headwaters area. (See Figure 1.) In the pre-automobile era the Missouri Pacific and Frisco Railroads encouraged recreational use by scheduling special weekend trains to carry recreationists into the basin. At intervals along these railroad lines small stations existed, and around these stations recreation facilities of various sorts sprang up.

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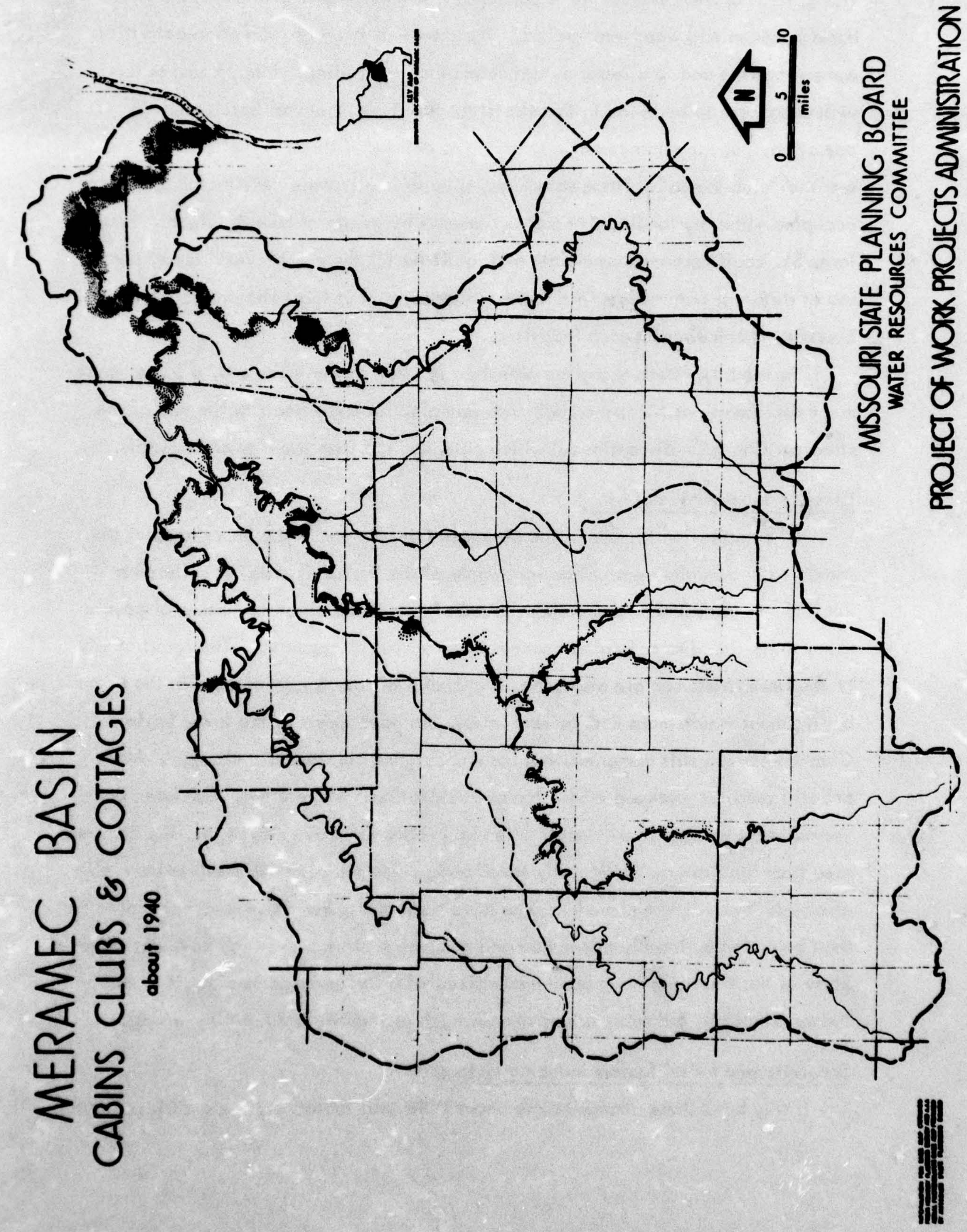
[1] Bill T. Crawford, "The Meramec -- St. Louis Playground", The Rivers of Missouri, Missouri Conservation Commission, Columbia, Mo., no date, pp. 19-23.

Figure 1


MERAMEC BASIN
CABINS CLUBS & COTTAGES
about 1940
N
0 5 10
miles
MISSOURI STATE PLANNING BOARD
WATER RESOURCES COMMITTEE
PROJECT OF WORK PROJECTS ADMINISTRATION

This pattern of recreational use is particularly characteristic of the section of the basin between Kirkwood and Pacific. The principal types of recreation activities were swimming, and to a lesser extent, canoeing and fishing. Many beaches for swimming were to be found in this stretch of the river. Several hotels were in operation, but the characteristic structure associated with these recreation areas was the "club house". These structures, usually small, were constructed and were occupied either by families, or more commonly by groups of friends (clubs). Several large St. Louis corporations maintained facilities for their employees' recreational use at different points along the lower Meramec, and at least one company, Union Electric, still maintains such facilities.

In the hills overlooking the Meramec in what is now Kirkwood, a large amusement park known as Meramec Highlands operated for many years at the end of the streetcar line (now discontinued) which extended out from the city of St. Louis.

Changes in recreational use

The recreation picture in the Meramec has changed. The importance of the Meramec in providing recreation for people of the St. Louis area has suffered a decline -- relatively, and perhaps also in terms of the absolute number of people using the area. The swimming beaches have all but disappeared. The resort hotels of the lower Meramec are also gone. A handful of resorts now operate in the upper basin (about which more will be said later), but none exists in the lower basin. Club-houses are still numerous, but have undergone considerable changes. Many are still used for weekend recreation and relaxation. Many others have been converted into permanent residences, often by people who have moved into the St. Louis area from rural areas, particularly the Ozarks. The structures themselves have also changed. Some new and modern ones have been built, but these have been more than balanced by the disappearance and removal of structures which have deteriorated. Some of the structures have been modernized with the addition of electricity and indoor plumbing, but many others remain much as they were 30 or 40 years ago.

Economic and social factors inducing change

Why have these changes come about? Several factors are responsible. These fall generally into two classifications -- social and economic changes which have taken place in the country as a whole, and physical changes in the basin. The most important factor in this first group is the changes that have taken place in the transportation system. The popularity of automobiles in conjunction with the ever-improving highway system has allowed people to journey farther in search of recreation. As a result, the Meramec is now by-passed by many St. Louis recreationists. A second factor is the rising economic level of living. This has produced a shorter work week which allows people to travel greater distances in search of recreation; has produced dissatisfaction with second rate facilities such as have been found in the Meramec, coupled with the ability to pay for better facilities at more attractive places farther away; and has produced a great interest in, and ability to pay for, motor boating -- which requires larger water surfaces than are presently available in the Meramec.

Physical changes

One of the factors in the second category, physical changes within the basin, is the general deterioration of facilities for recreation. (See Figure 2.) Whether this is actually the cause of the decline in recreation, or is instead an effect, or an interaction of cause and effect, is uncertain. (The latter is most likely.) At any rate, the result has been a simultaneous decline in the physical facilities and a reduction in the recreational use of the basin. The situation is analogous to that of slums in urban areas. Another physical change on which there is little general agreement is the change in water quality in the Meramec. Without doubt the sanitary quality of the water below Valley Park has worsened in the past 20 years, (see Volume III, Chapter 4) whereas the portion of the river above Valley Park has suffered little, if any, from water pollution problems of this type. The question of whether the amount of sediment or the turbidity of the water has also increased is not as easy to settle. Most observers acquainted with the Meramec over this period of time agree that the water has become muddier, but there are some who disagree. Changes in land use practices within the basin would have the probable effect of

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MERAMEC RIVER, MISSOURI COMPREHENSIVE BASIN STUDY. VOLUME II. A--ETC(U)
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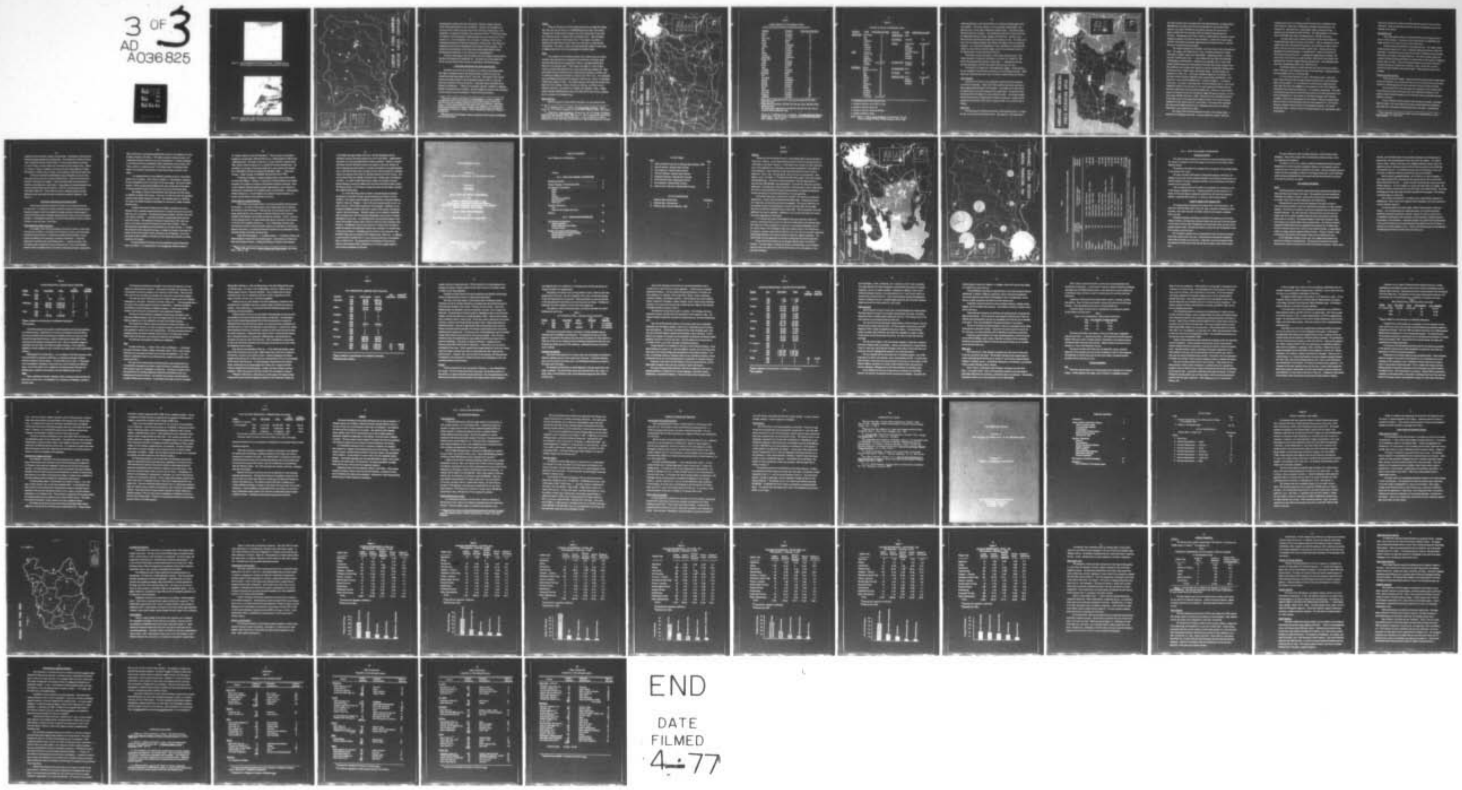

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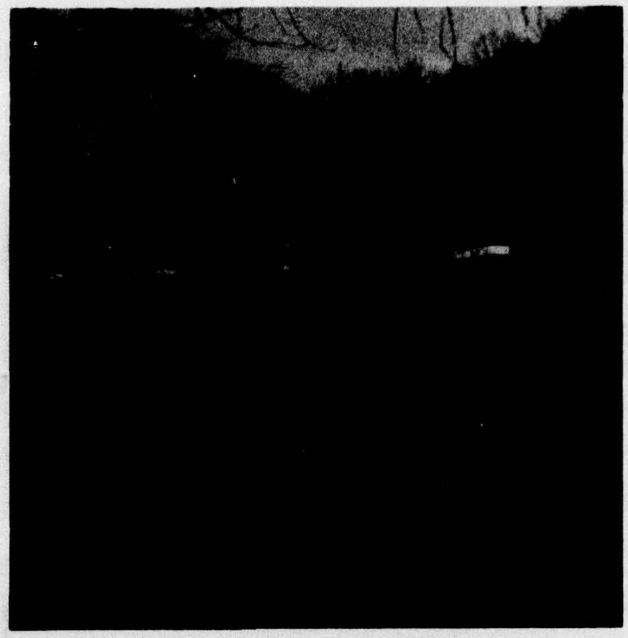
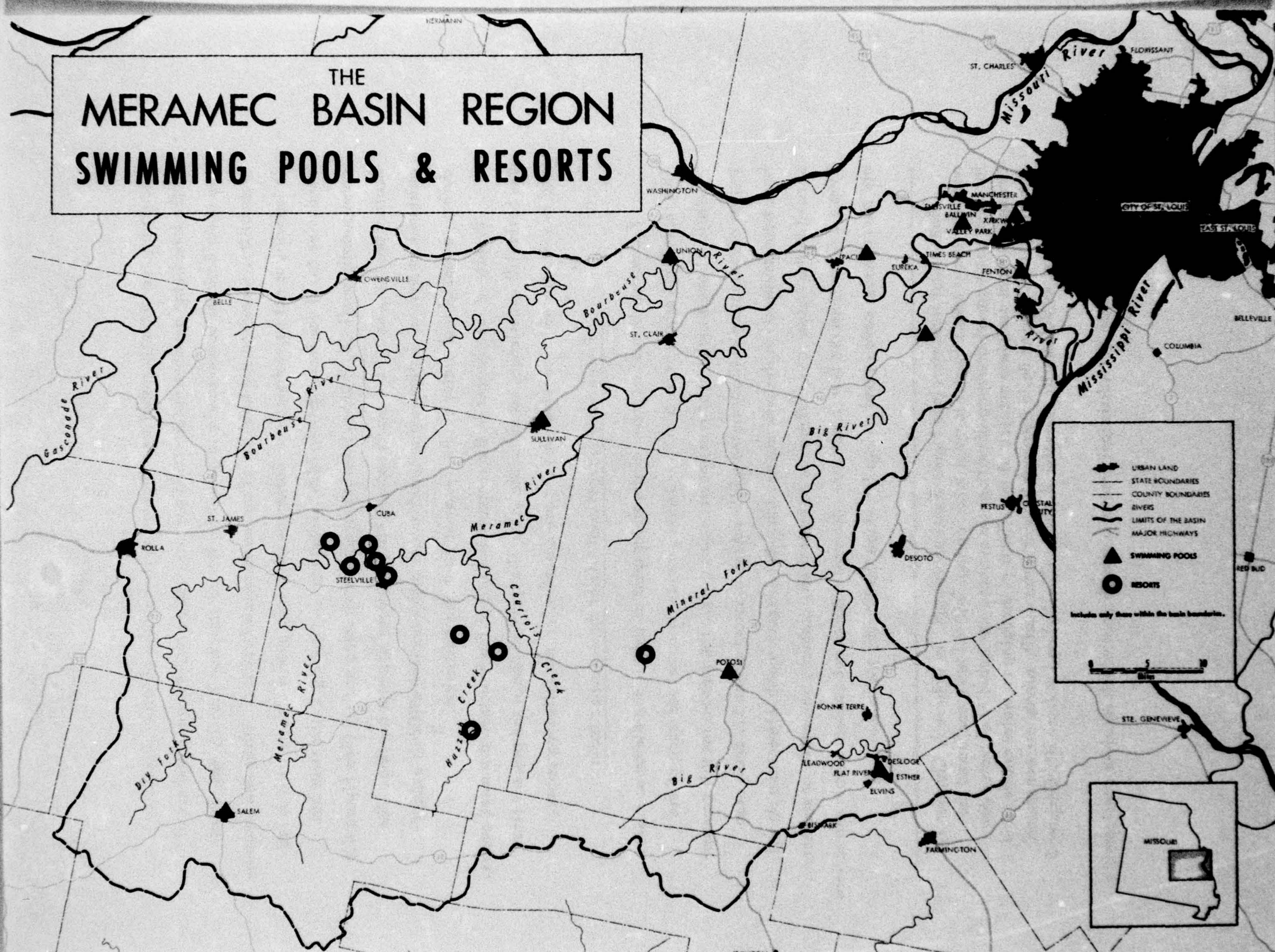


Figure 2. Typical clubhouses of the lower Meramec. Although some are well-maintained, many have become dilapidated and unsightly.

Figure 3. Muddy water in the lower Meramec resulting from gravel dredging operation (at right). Not all operations contribute to these problems.


THE
MERAMEC BASIN REGION
SWIMMING POOLS & RESORTS
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
SWIMMING POOLS
RESORTS
Includes only those within the basin boundaries.
Miles
MISSOURI
Missouri River
Mississippi River
Meramec River
Bourbeuse River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
Gasconade River
HERMANN
ST. CHARLES
FLORISSANT
WASHINGTON
MANCHESTER
BALLWIN
VALLEY PARK
TIMES BEACH
FENTON
EUREKA
UNION
OWENSVILLE
BELLE
ST. CLAIR
SULLIVAN
CUBA
ST. JAMES
ROLLA
STEELVILLE
SALEM
POTOSI
BONNE TERRE
LEADWOOD
FLAT RIVER
DESLOGE
ESTHER
ELVINS
FARMINGTON
IRONTON
DESOTO
FESTUS
STE. GENEVIEVE
RED BUD
COLUMBIA
BELLEVILLE
CITY OF ST. LOUIS
EAST ST. LOUIS

decreasing the turbidity rather than increasing it, because of larger proportion of the land being devoted to forest and pastures. However, the increased use of the lower basin to obtain sand and gravel for the construction industry has, in all probability, increased the turbidity of the water below Pacific.[2] While this increase in turbidity is not objectionable to fishermen (they may even welcome it) it is less conducive to, if not incompatible with, swimming. Swimming in the river has consequently declined, and has been replaced by swimming pools. (See Figure 4.) Boating has likewise all but disappeared with the advent of motor boating. The existence of several shallow-water rapids makes motor boating difficult except during periods of high water on the Meramec or on the Mississippi.[3]

In spite of the changes in the recreational use of the Meramec discussed above, the basin still experiences considerable use. The types of use at the present time and in the areas which receive such use are described on the following pages.

Present-Day Recreational Use of the Meramec Basin

Recreation is even now one of the major users of land in the Meramec Basin. This region and adjacent parts of the Ozarks provide an outlet for much of the recreational needs of the people of the St. Louis area. The reasons for this concentration of recreation activity in the southwestern quadrant of the St. Louis area have been reviewed in the previous section. Large-scale scenic attractions do not abound in the Meramec -- there are no mountains, glaciers, waterfalls or seashores. Specific attractions are few in number. The most notable and unusual scenic attractions are the numerous caverns and springs for which the Ozarks are famous.

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[2] Both visual indicators (see Figure 3 and photographs in Volume I, Chapter 1), and laboratory tests of water samples taken during 1960-61 have confirmed the fact that some gravel dredging operations do increase the turbidity of water downstream. A more complete analysis of the effects of dredging on water quality and details of the Meramec Basin Research Project water quality survey are contained in appendices to Volume III, Chapter 4 (Water Quality) and Volume III, Chapter 5 (Recreation).

[3] Backwater from the Mississippi creates a smooth pool which receives considerable use from motor boaters.

Springs

There are 12 springs of the first magnitude (having an average flow greater than 100 cubic feet per second, or 64,000,000 gallons per day) in the Ozarks. Although most of these springs are found in the Current River Basin to the south, one, Maramec Spring, is located within the Meramec Basin. About 30 smaller springs are also located in the Meramec Basin.[4] (See Figure 5 and Table 1.) Because of the small areas involved, these scenic resources can easily become overcrowded. The carrying capacity of these springs (the number of visitor-days or sightseer-days which can be accommodated) is therefore limited.

Caves

The soluability of the limestone bedrock which underlies most of the basin and gives rise to springs also is responsible for the formation of numerous caves. More than 400 known caves are reported in Missouri, and approximately 50 of these are in the Meramec Basin.[5] (See Figure 5 and Table 2.) Three of these caves are commercially operated and are easily accessible from Highway 66. Most of the others are more isolated and are visited mainly by spelunkers and hikers who are willing to undergo some discomfort in order to visit "wild" caves. The commercial caves are lighted and provided with walkways so that they can, and do, accommodate a fairly large number of visitors. The number of persons who made trips through Onandaga Cave near Leasburg, Meramec Caverns near Stanton, and Fisher's Cave in Meramec State Park, was reported to be slightly under 300,000 in 1960. Perhaps another 100,000-200,000 persons make use of other facilities (picnicking, camping, etc.) at Meramec and Onandaga Caves.

Other attractions

With the exception of these specific attractions, the main reasons for the

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[4] H. C. Beckman and N. S. Hinchey, The Large Springs of Missouri, Second series, Vol. 29, Missouri Geological Survey and Water Resources, Rolla, 1944, Plate 1.

[5] J. Harlan Bretz, Caves of Missouri, Second series, Vol. 39, Missouri Geological Survey and Water Resources, Rolla, 1956, pp.1-5. The list includes 437 caves and the author points out that many more probably exist. A cave is defined as "a natural roofed cavity in rock which may be penetrated for an appreciable distance by a human."

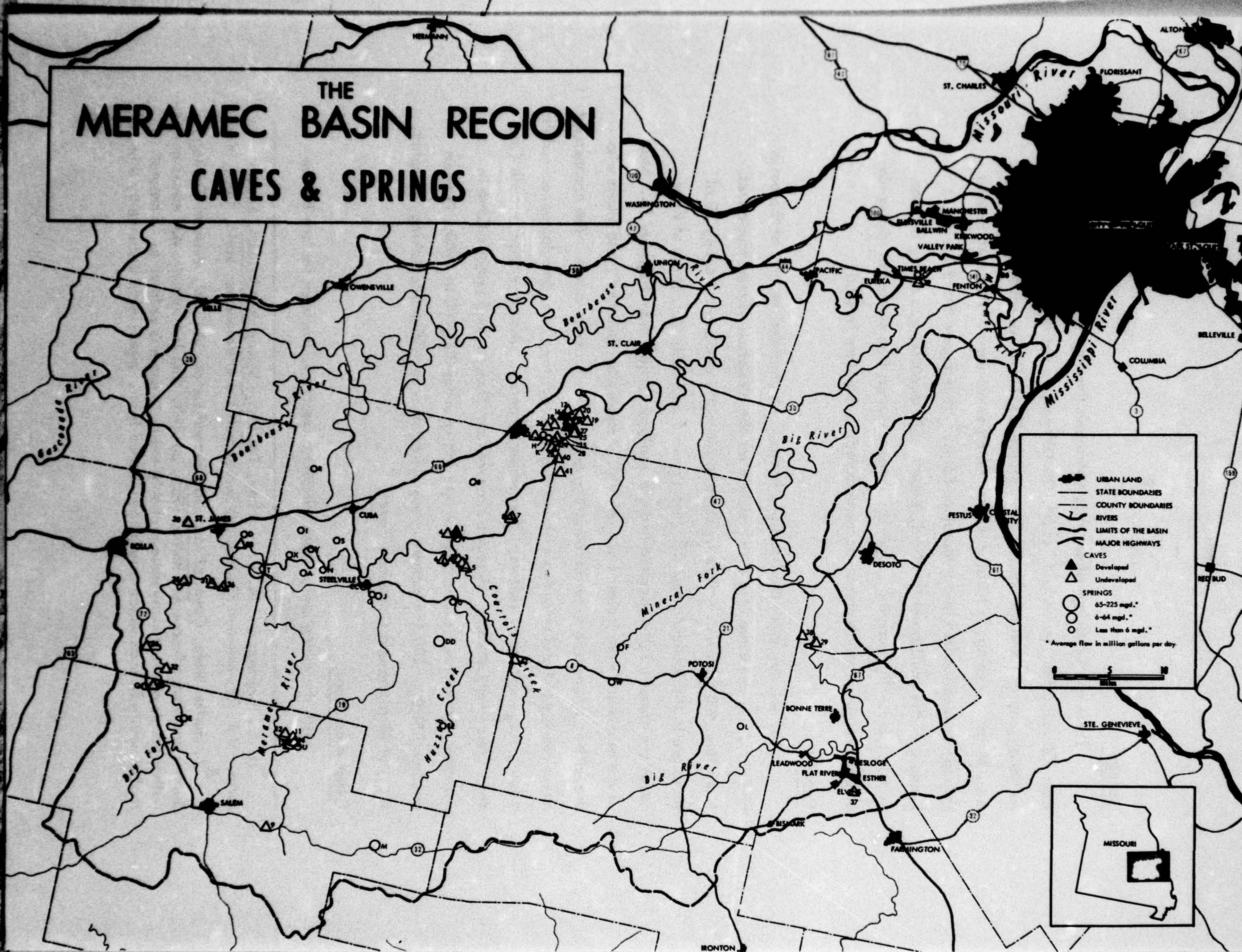

THE
MERAMEC BASIN REGION
CAVES & SPRINGS
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
CAVES
Developed
Undeveloped
SPRINGS
65-225 mgd.*
6-64 mgd.*
Less than 6 mgd.*
* Average flow in million gallons per day
MISSOURI
Missouri River
Mississippi River
Meramec River
Bourbeuse River
Big River
Mineral Fork
Courtois Creek
Huzzah Creek
Dry Fork
Gasconade River
ALTON
FLORISSANT
ST. CHARLES
BELLEVILLE
COLUMBIA
WASHINGTON
HERMANN
OWENSVILLE
BELLE
MANCHESTER
BALLWIN
KIRKWOOD
VALLEY PARK
TIMES BEACH
FENTON
UNION
PACIFIC
EUREKA
ST. CLAIR
CUBA
ST. JAMES
ROLLA
STEELVILLE
SALEM
FESTUS
DESOTO
RED BUD
POTOSI
BONNE TERRE
LEADWOOD
FLAT RIVER
ESTHER
BISMARK
FARMINGTON
IRONTON
STE. GENEVIEVE

TABLE 1

LARGE SPRINGS IN THE MERAMEC BASIN

SPRING	COUNTY	LOCATION ON MAP
Beaver	Crawford	A
Blue	Crawford	B
Blue Grass	St. Louis	C
Brook	Phelps	D
Brown	Dent	E
Cold	Washington	F
Collins	Crawford	G
Elm	Franklin	H
Elm	Crawford	I
Evans	Crawford	J
Falling	Franklin	K
Hopenwell	Washington	L
*Howes Mill	Dent	M
Indian	Crawford	N
James	Crawford	O
*Kratz	Franklin	P
Lake	Dent	Q
McDade	Crawford	R
McIntosh	Crawford	S
**Meramec	Phelps	T
Mint	Dent	U
Onandaga	Crawford	V
Racing	Washington	W
Richart	Crawford	X
Roaring	Crawford	Y
Roaring	Franklin	Z
Rock	St. Louis	AA
Rott Road	St. Louis	BB
Steelville	Crawford	CC
*Westover	Crawford	DD
Woodlock	Crawford	EE

*Approximate average flow 10-99 cubic feet per second (6-64 million gallons per day)

**Approximate average flow 100-349 cubic feet per second (65-225 million gallons per day)

All others have an approximate average flow less than 10 cubic feet per second (6 million gallons per day)

Source: H. C. Beckman and N. S. Hinchey, The Large Springs of Missouri, Second Series, Vol. 29, Missouri Geological Survey and Water Resources, Rolla, Missouri, 1944, Plate I.

TABLE 2

KNOWN CAVES IN THE MERAMEC BASIN

COUNTY	CAVE	LOCATION ON MAP
CRAWFORD	*Onandaga	1
	Bat	2
	Bear	3
	Cathedral	4
	Fault	5
	Puckett	6
	unnamed	7
	unnamed	8
DENT	Guthoerl	9
	Indian Hill	10
	Money	11
	Saltpeter	12
	Short Bend	13
	Watson	not located[1]
	unnamed	14
FRANKLIN	*Fisher	15
	*Meramec Caverns	16
	Bat	17
	Bear	18
	Eddy	19
	Greene	20
	Indian	21
	Mud	22
	Mushroom	23
	Sheep	24
	Walker	25
	unnamed	26
	unnamed	27
	unnamed	28
	3 unnamed	not located[2]
GASCONADE	none	
JEFFERSON	unnamed	29
PHELPS	Castlemans	not located[3]
	Lenox	30
	Marcellus	31
	McClure	32
	St.James Tunnel	33
	Shelton	34
	unnamed	35
	unnamed	36
ST.FRANCOIS	unnamed	37
	unnamed	38
ST.GENEVIEVE	none	
ST.LOUIS	Rankin	39
WASHINGTON	Alum	not located[4]
	Green's	40
	Hamilton	41
	unnamed	42

* A developed commercially-operated cave

1 Located on Meramec River north of Salem

2 Located in Meramec State Park

3 Located on Meramec Springs quadrangle

4 Located in Bellview Valley

Source: Bretz, J. Harlan, Caves of Missouri, Second Series, Vol. 39, Missouri Geological Survey & Water Resources, Rolla, 1956.

continued popularity of the Meramec Basin are its pleasant wooded slopes and its clear streams. The woods, however, are in some places rather scrubby, and generally have a fairly dense underbrush during the summer. This tends to make them less usable for recreation. The wooded areas which lack water can be used for sightseeing, hiking, hunting, camping, and picnicking. However, even these activities are made more pleasant by the presence of water. For other activities, such as swimming, boating, water skiing, and fishing, water is an absolute necessity. As a result of the desirability of water, and because in the Ozarks the valleys are more attractive than the ridges, most of the recreational activity of the Meramec Basin is concentrated near the rivers.

The climate is mild, and results in a fairly long recreation season. (For further discussion of recreation and climate, see Volume III, Chapter 5.) The mild climate also precludes extensive winter sports -- although one ski slope has been developed in the hills near Pacific within the past two years.

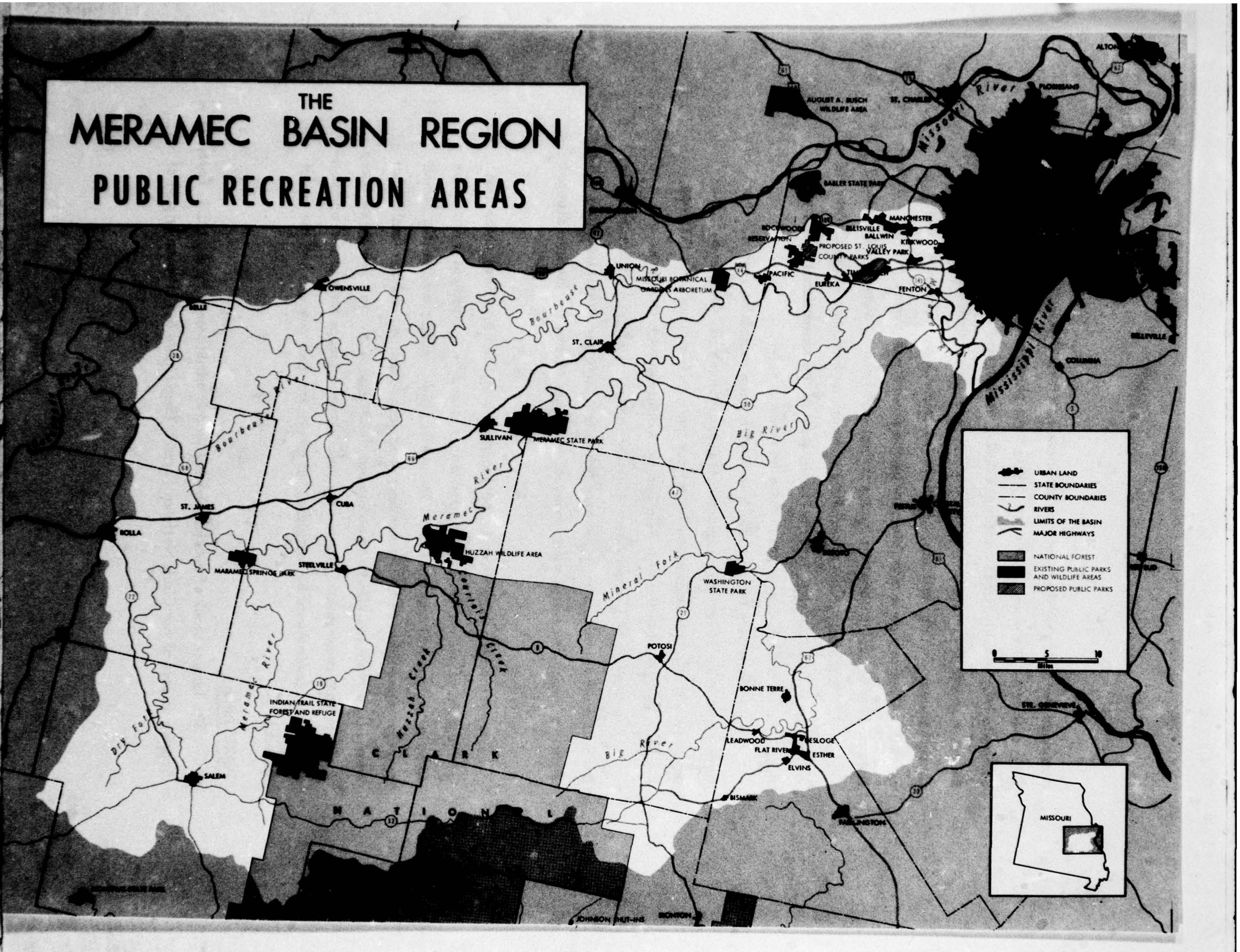
The Museum of Transport near Kirkwood attracts 120,000 visitors annually, but will probably be moved in the near future to a more accessible location. Other attractions include several mills, many of which are rapidly falling into disrepair.

Land ownership

Land used for recreation can be generally classified into three categories on the basis of ownership. Public land is that owned by government agencies (or other organizations) and open to all the public. Semi-public land is that owned by organizations for the use of members of the organization. Private land is that owned by private individuals to be used at their discretion. This private category includes both commercial (operated by individuals or groups for a profit) and non-commercial (maintained by individuals or groups for their own use and the use of friends).

Public land

The largest block of publicly-owned land is administered by the U. S. Forest Service as part of the Clark National Forest. (See Figure 6.) The major part of


THE
MERAMEC BASIN REGION
PUBLIC RECREATION AREAS
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
NATIONAL FOREST
EXISTING PUBLIC PARKS AND WILDLIFE AREAS
PROPOSED PUBLIC PARKS
0 5 10
Miles
MISSOURI
ALTON
FLORISSANT
ST. CHARLES
AUGUST A. BUSCH WILDLIFE AREA
Missouri River
BABLER STATE PARK
ROCKWOODS RESERVATION
ELLISVILLE
BALLWIN
MANCHESTER
KIRKWOOD
PROPOSED ST. LOUIS COUNTY PARKS
VALLEY PARK
EUREKA
FENTON
PACIFIC
UNION
MISSOURI BOTANICAL GARDENS ARBORETUM
OWENSVILLE
BELLE
Bourbeuse
Bourbeuse River
ST. CLAIR
SULLIVAN
MERAMEC STATE PARK
Big River
Mississippi River
BELLEVILLE
COLUMBIA
ST. JAMES
ROLLA
CUBA
Meramec River
HUZZAH WILDLIFE AREA
MARAMEC SPRINGS PARK
STEELVILLE
Mineral Fork
WASHINGTON STATE PARK
Courtois Creek
Huzzah Creek
POTOSI
BONNE TERRE
INDIAN TRAIL STATE FOREST AND REFUGE
Meramec River
Dry Fork
CLARK
NATIONAL
SALEM
Big River
LEADWOOD
DESLOGE
FLAT RIVER
ESTHER
ELVINS
BISMARK
FARMINGTON
STE. GENEVIEVE
JOHNSON SHUT-INS
IRONTON

the Clark National Forest is located south of the basin boundaries, but approximately 400,000 acres are within the National Forest boundaries in the Meramec Basin. However, only about 195,000 acres are actually owned by the Forest Service -- about one-half of the land included within the National Forest boundary in the basin. Although most of the land is relatively undeveloped for recreation, several camping and general-use sites have been developed. In spite of the large acreage involved, recreational use has been light because of the distance from St. Louis and the type of recreation being encouraged.

The Missouri Conservation Commission owns three tracts of land in the Meramec Basin. The largest, most distant from St. Louis, and least used (less than 10,000 visitor-days in 1960) is Indian Trail State Refuge. Located near Salem, it includes more than 13,000 acres of land -- mostly upland with very little water (although a fish hatchery is located there). Somewhat more accessible from St. Louis is the Huzzah Wildlife Reservation at the junction of Huzzah Creek and the Meramec River. The 6,000-acre tract contains much upland, but also has considerable frontage along the Meramec River, Huzzah Creek, and Courtois Creek. Hunting, fishing, and camping are its major uses. Visitor-day attendance figures are not available, but the area is known to receive moderately heavy use by hunters and fishermen. Much closer to St. Louis is Rockwoods Reservation. As shown in Figure 6 it consists of two sections. (A central, connecting tract is to be developed by the St. Louis County Department of Parks in the near future.) No major streams are included within the more than 3,000 acres of the reservation boundary area. However, a natural history museum and numerous nature trails through the rugged hills proved enough of an attraction to draw 38,500 visitor-days in 1960. These tracts along with Babler State Park to the north, are part of the green belt proposed by the St. Louis County Planning Commission for the western end of St. Louis County. The Conservation Commission also owns several scattered small tracts in Washington County known as Meramec State Forest. Use of these tracts is light.

The Missouri State Park Board operates two parks in the Meramec Basin -- Meramec and Washington State Parks. Meramec State Park contains 7,150 acres including several miles of frontage along the Meramec River; Washington State Park consists of 1,100 acres, including some frontage along the Big River and Mineral Fork. Both parks have a dining lodge, cabins, camping facilities, -- generally well developed recreation facilities. The 1960 attendance at Meramec Park was 390,000 visitor-days; at Washington Park, 138,000 visitor-days.

Two other public areas, Maramec Spring Park and the Missouri Botanical Garden Arboretum, deserves mention in this section. They are operated by private organizations rather than government agencies, but since they are open to all the public, they are included in this section as public land. Maramec Spring Park, operated by the James Foundation, is located near St. James at the junction of the Meramec River and Dry Fork. It includes the largest spring in the basin, the ruins of some old iron furnaces, picnic facilities, facilities for trout fishing in the spring branch, and some frontage along the Meramec River. Some 280,000 visitor-days were recorded during 1960 in this 1,600 acre park.

The Missouri Botanical Garden Arboretum near Grey Summit also contains about 1,600 acres, part landscaped and part in its natural state. Attendance figures are not available, but use is relatively light.

St. Louis County operates two parks in the Meramec Basin. Buder Park (near Valley Park) has a short frontage along the Meramec River, some flood plain land, and some upland. It is used primarily for picnicking and organized sports. West Tyson Park (near Times Beach) is all that remains of a park which originally included the Tyson Ordinance Reservation. It is relatively undeveloped. The 2,000 acre Ordinance Reservation has been declared surplus by the federal government, and will be purchased by St. Louis County for recreational purposes when it becomes available. Plans for the development of tract of about 1,500 acres located between the two sections of Rockwoods Reservation have been prepared by St. Louis County. This park, donated to the County by the Greensfelder Foundation, will contain several small lakes. Neither of these two proposed parks has any large streams within its boundaries.

Many of the communities within the Meramec Basin have parks for the use of the community. These are generally small and of only local importance, and are not included in this listing.

Semi-public land

Many organizations maintain recreation facilities in the Meramec area for the use of their members. The number of such organizations is undoubtedly quite large, and only a few of the major ones will be listed here.

The Boy Scouts have facilities in three different areas. The largest, (about 2,500 acres) and nearest to St. Louis, is Beaumont Reservation between Valley Park and Eureka. The other Boy Scout camps are Lion's Den in Jefferson County (outside the basin), and Irondale on the upper Big River. The YMCA maintains cabins and vacation facilities (including facilities for a large variety of water sports) on 500-acre Sunnen Lake near Potosi. Many church groups maintain youth camps in the area.[6] Numerous fishing and hunting clubs, sportsman's clubs, and the like, maintain facilities for their members in the Meramec Basin. These generally involve small acreages.

Private recreation facilities

Within the private category, commercial facilities usually take up larger blocks of land per individual unit, but the total amount of non-commercial private recreation facilities is probably far larger than the commercial private recreation facilities.

Not more than five or ten real resorts are in operation in the Meramec Basin. Most of these are located in the upper basin near Steelville (see Figure 4.) The property usually includes frontages on one of the major streams, generally the upper Meramec or Huzzah.

Several "beaches" operate along the major streams; for example, Minnehaha Beach in Fenton, Twin Rivers Beach near Eureka, several beaches on the Big River near Cedar Hill, and several on the Bourbeuse River near Union. These beaches

---

[6]For a listing see the Health and Welfare Council of Metropolitan St. Louis. Camp Directory. St. Louis, 1961.

generally provide swimming, fishing, and picnicking. The beaches in the lower basin have been largely replaced by swimming pools. (For example McConnell's Swimming Pool in Kirkwood; formerly Kiefer's Beach.) Swimming pools abound in southwest St. Louis County, and most of them are to be found near the Meramec River. (Figure 4.) There is a cluster in Jefferson County near the point where Highway 21 crosses the Meramec, another cluster in Fenton, and one between Kirkwood and Valley Park.

Private non-commercial establishments range considerably in size; from the very small fraction of an acre to several thousand acres. Most of the private facilities fall in the former size category. Almost invariably these private recreational facilities are located near a major stream. Large numbers are located along the lower Meramec between Kirkwood and Glencoe, at Pacific, and along the lower Big River below Cedar Hill. Most of these are used on weekends during the summer although in many cases they have been converted to permanent residences. (See Figure 1.)

The Future of Recreation in the Meramec Basin

What is the recreational outlook for the future in the Meramec Basin and St. Louis area? It is difficult to provide a definitive answer to this question because accurate evaluation of the future demand for outdoor recreation and the supply of recreation facilities require reasonably good predictions of future social and economic conditions. Considerable uncertainty is involved in the prediction of these conditions 40 years, or even 10 years, in the future.

Future demand for outdoor recreation

For example, what will be the changes in the level of income, in the amount of leisure time available, in the ability and inclination to travel, and in the number of persons living in the area? If these basic questions about population, income, leisure and mobility can be answered, a second set of questions -- about the preferences of potential users of the Meramec Basin -- must be answered. How will people prefer to spend their income and leisure time? This is a most difficult question which can probably best be answered by observing past trends, extrapolating them into the future, and perhaps modifying this with one's own judgment as to what is likely to happen in the future. Will outdoor recreation continue to grow, will water-based recreation continue to be such a prominent part of outdoor recreation, or will these activities be superseded by other entertainment such as movies, television, concerts, or spectator sports? All of these factors will influence future trends in the recreation characteristics of the Meramec Basin and the St. Louis region.

It is estimated that by the year 2000 the population of the St. Louis Metropolitan Area will double. (See Volume II, Chapter 1.) The population increase in the non-metropolitan portion of the basin will be more modest. The over-all effect, however, will be an approximate doubling within the next 40 years of the number of users (or potential users) of the recreational resources of the Meramec Basin.

The changes in income of these potential users during the next half century are difficult to predict with accuracy. However, it is safe to say that real disposable personal income should continue to increase. Most estimates agree on a doubling. As a result, the ability of people to participate in, and pay for, outdoor recreation should increase.

Increase in the amount of leisure time available to potential users of the Meramec Basin's recreation resources should serve to increase the amount of use which these resources will receive. The concensus among sociologists is that the work-week will continue to decline -- and should dwindle to approximately 30 hours by the end of the century. This represents a decrease of approximately 25% in the hours spent at work and an increase in the amount of leisure time available. There is less agreement concerning the form this reduction in work-week will take -- whether the work-week will be reduced to four days, or whether the number of work-days will remain at five and the number of hours worked per day will decrease. At any rate, the amount of time available for the pursuit of such leisure-time activities as outdoor recreation will increase.

Increased mobility of Americans will also contribute to greater demand for outdoor recreation. It is estimated that in the next 20 years sizable increases in

St. Louisans' ability to travel will take place.[7] The per capita car ownership is expected to increase about 15% (from 300 cars per 1,000 population to 350 cars per 1,000 population). The number of trips per car is also expected to increase about 15%, and the number of miles per car is expected to increase somewhat more. The net effect is an increase in the annual number of St. Louis vehicle miles traveled from 7,000,000 (in 1957) to an estimated 23,000,000 in 1980 -- a three-fold increase. Further increases will probably take place by the year 2000.

Predictions of changes in consumer preference (how income will be spent) are much more difficult. However, it seems safe to say that preferences for outdoor recreation will continue to increase (as urbanization continues to increase). There is some indication that the tremendous growth experienced by water recreation in recent years is tapering off, but no definite trend is yet discernable. If this tapering off does indeed occur, it would indicate not a decline in water-recreation, but merely a growth which was less rapid than in the past.

Future supply of recreation facilities

Still another very important factor is not concerned directly with the demand for recreation. Its concern is the question of how people might react to supplying the facilities to meet this demand. What decisions will be made by private or public groups concerning the action necessary to make the fullest use of the recreation potential of the Meramec and to satisfy the needs for recreation in the St. Louis area and the Meramec Basin? We might consider the future of recreation in the Meramec on the basis of two possible alternatives -- one in which things continue pretty much as they are with no large-scale public planning, and the other in which public agencies work actively to provide the framework necessary for the achievement of the maximum benefits to potential recreation users.

Under the first assumption -- no public measures -- the future is likely to be shaped largely by trends which are already apparent. Recreational use of the lower basin will continue to decline. Boating and fishing will continue to be important

[7] Wilbur Smith and Associates, Future Highways and Urban Growth, New Haven, Conn., 1961, p. 195.

in the middle and upper reaches of the river, and the development of more commercial resorts in the upper reaches of the river is also likely. Organizational and public use of the area might likewise increase somewhat. However, increased utilization would be limited by (1) poor water quality in the lower reaches, (2) lack of planning and control which, in the past, has resulted in low-grade development, and (3) the limited amount and types of water surface available for recreation. Much of the land has little utility for recreation because of the lack of water. The water surfaces which are available will permit only a limited range of recreational activities. As a result of these three factors, people will continue to journey greater distances in search of suitable water recreation facilities (to places outside the Meramec Basin), or will choose to forego some portion of the outdoor recreation they might otherwise enjoy.

If, on the other hand, steps are taken to promote planned recreational development in the public interest, present trends may be reversed or at least modified. The complete range of problems and possibilities is discussed at greater length in Volume III, Chapter 5. Some of the more important results of such a program, however, will be briefly mentioned in this paragraph. Regulation of sand and gravel dredging activities would help to improve water quality and landscape quality in the lower Meramec. Effective controls are also needed to rehabilitate older recreation areas which have become dilapidated, and to prevent unsuitable development of new areas. An intensified public land acquisition program would help to insure public access to some of the more attractive stream shorelines within the basin. Development of one or more reservoirs of varying sizes would help to satisfy this segment of the demand for outdoor water recreation at a location close to the source of demand. Depending upon the location of such reservoirs, some beneficial effect upon the economy of the Meramec Basin would occur. In addition, a reservoir easily accessible from St. Louis would make that area a more pleasant place in which to live. The opportunities for development of the recreation resources of the Meramec Basin overshadow all of the other possible aspects of water resource development in the basin.

THE MERAMEC BASIN

Volume II
The Economy and Character of the Meramec Basin

Chapter 5
<u>MINING</u>

Part 1: ROCK AND MINERAL COMMODITIES

by

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Division of Geological Survey and Water Resources, Rolla, Missouri
Thomas R. Beveridge, State Geologist

Part 2: SOME FUTURE POSSIBILITIES

by

The Meramec Basin Research Project Staff

Meramec Basin Research Project
Washington University
St. Louis, Missouri
[illegible], 1961

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Chapter 5

MINING

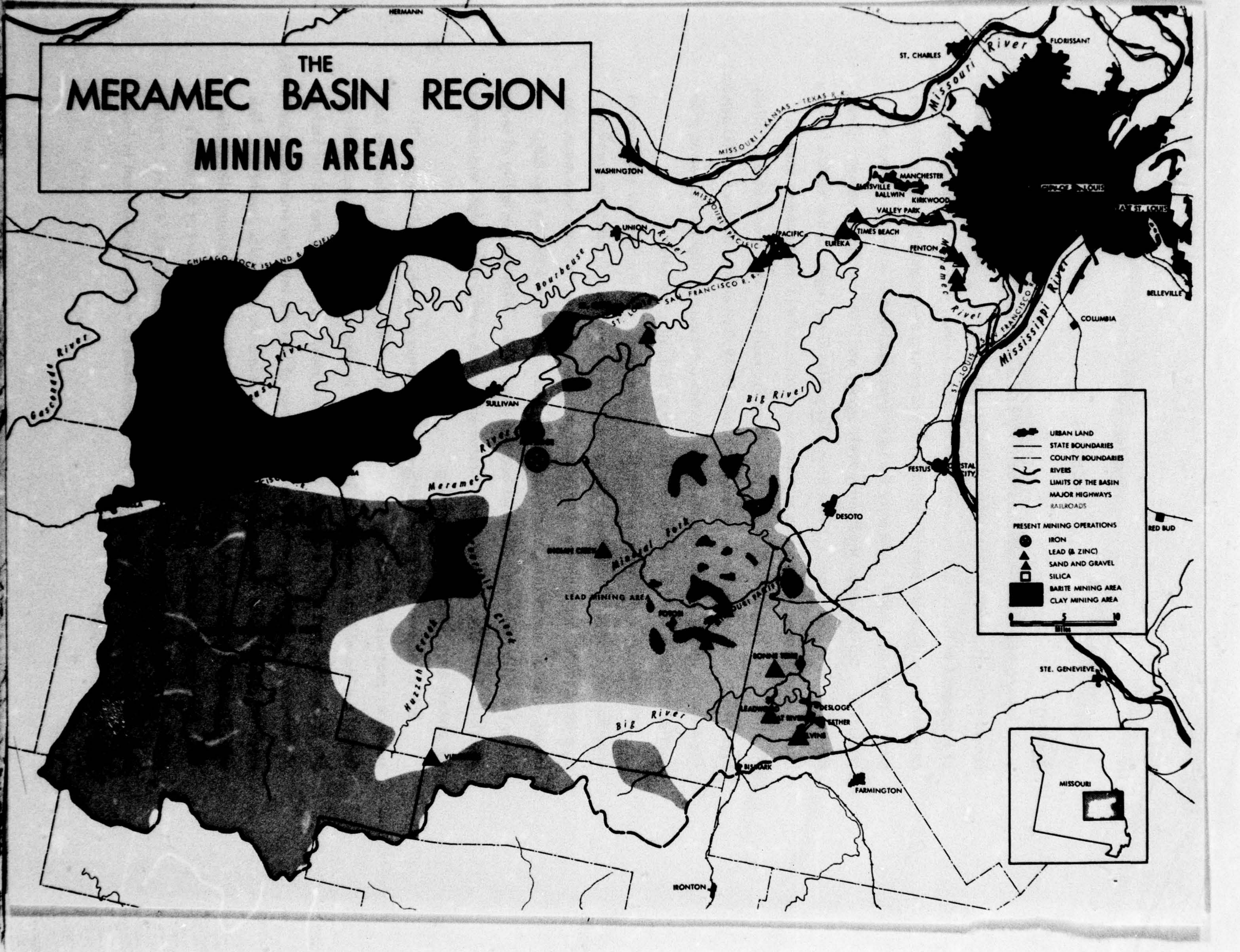
Summary

Mining was once the dominant activity in the Meramec Basin, but has declined in recent years. However, recent mineral discoveries point toward the renewed importance of this aspect of the basin's economy. At the present time, mining is of major importance only in the southeastern part of the basin; future mining developments will probably be more widespread. Lead is presently the most important mineral in terms of value of production. Barite, clay, sand and gravel, stone, and iron are also important. (See Figures 1 and 2, and Table 1.) The Bonne Terre-Flat River region is the world's leading lead-producing area. The value of mineral production within the Meramec Basin is presently about $40,000,000 a year (excluding St. Louis and Ste. Genevieve counties). Employment in Meramec Basin mineral industries in 1950 amounted to about 4,000 persons. The trend in mining employment has been downward because of slightly decreased production and because of increased mechanization of mining operations.

New mineral discoveries, primarily iron and lead, will provide new employment opportunities. Several important discoveries have been made. Prospecting continues on a large scale, and more discoveries can be expected. The two new lead mines can be expected to boost mining employment in the basin by about 10%; the Pea Ridge iron mine will provide an additional boost of about 20%. With the possibility of several additional iron mines in operation, employment in iron mining alone might well surpass the present employment in lead mining.

If it is assumed that present technological factors governing steel making will continue, processing of the iron ore into steel will not take place in the Meramec Basin. Part of the ore will be processed in St. Louis (or in sites along the Mississippi south of St. Louis), and part will be shipped to other steel making centers in the United States. If, however, a process to permit direct reduction of iron ore into iron and steel is perfected, steel making facilities in the vicinity of the iron mines are a definite possibility. This would further increase employment in the basin resulting from the mineral discoveries.

Mining will therefore become an increasingly important aspect of the basin's economy. The exact degree of importance remains to be determined, and will depend upon the nature and extent of new mineral discoveries as well as development in iron and steel technology.


THE
MERAMEC BASIN REGION
MINING AREAS
HERMANN
ST. CHARLES
FLORISSANT
Missouri River
MISSOURI - KANSAS - TEXAS R.R.
WASHINGTON
MANCHESTER
BALLWIN
KIRKWOOD
VALLEY PARK
TIMES BEACH
FENTON
EUREKA
PACIFIC
UNION
River
MISSOURI PACIFIC
BELLEVILLE
COLUMBIA
Mississippi River
Meramec River
Bourbeuse
ST. LOUIS - SAN FRANCISCO R.R.
CHICAGO ROCK ISLAND AND PACIFIC
Gasconade River
SULLIVAN
Big River
Meramec
FESTUS
DESOTO
RED BUD
Mineral Fork
LEAD MINING AREA
Huzzah Creek
Creek
BONNE TERRE
DESLOGE
Big River
BISMARK
FARMINGTON
STE. GENEVIEVE
IRONTON
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
RAILROADS
PRESENT MINING OPERATIONS
IRON
LEAD (& ZINC)
SAND AND GRAVEL
SILICA
BARITE MINING AREA
CLAY MINING AREA
0 5 10
MISSOURI

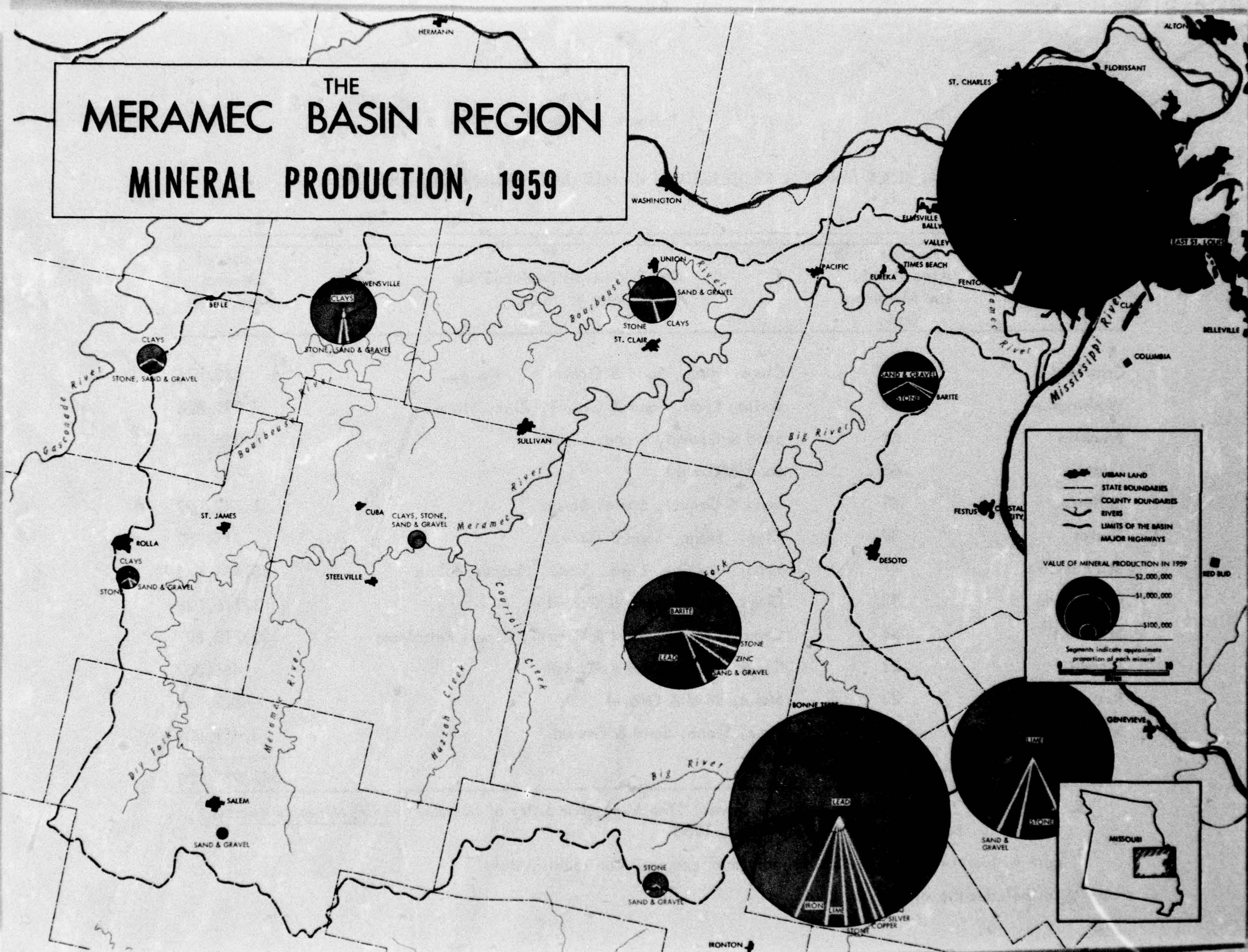

THE
MERAMEC BASIN REGION
MINERAL PRODUCTION, 1959
HERMANN
WASHINGTON
ST. CHARLES
FLORISSANT
ALTON
EAST ST. LOUIS
BELLEVILLE
COLUMBIA
RED BUD
BELLE
CLAYS
STONE, SAND & GRAVEL
STONE, SAND & GRAVEL
UNION
SAND & GRAVEL
STONE
CLAYS
ST. CLAIR
PACIFIC
EUREKA
TIMES BEACH
SAND & GRAVEL
STONE
BARITE
Gasconade River
Bourbeuse River
Big River
Meramec River
Mississippi River
SULLIVAN
ST. JAMES
ROLLA
CLAYS
SAND & GRAVEL
CUBA
CLAYS, STONE, SAND & GRAVEL
STEELVILLE
Courtois Creek
Huzzah Creek
Dry Fork
SALEM
SAND & GRAVEL
FESTUS
DESOTO
BARITE
LEAD
STONE
ZINC
SAND & GRAVEL
BONNE TERRE
LEAD
IRON
LIME
STONE
SILVER
COPPER
LIME
STONE
SAND & GRAVEL
GENEVIEVE
STONE
SAND & GRAVEL
IRONTON
URBAN LAND
STATE BOUNDARIES
COUNTY BOUNDARIES
RIVERS
LIMITS OF THE BASIN
MAJOR HIGHWAYS
VALUE OF MINERAL PRODUCTION IN 1959
$2,000,000
$1,000,000
$100,000
Segments indicate approximate proportion of each mineral
MISSOURI

Table 1

VALUE OF MINERAL PRODUCTION IN MERAMEC BASIN COUNTIES (1959)

County	Percent of Area Within The Meramec Basin	Chief Minerals Produced (in order of value)	Value of Mineral Production
Crawford	100	Clays, Stone, Sand & Gravel	$ 135,795
Washington	99	Barite, Lead, Sand & Gravel, Zinc, Stone	7,299,826
Franklin	62	Sand & Gravel, Stone, Clays	1,058,340
Dent	65	Sand & Gravel	a
Jefferson	49	Sand & Gravel, Stone, Barite	1,772,827
Phelps	39	Clays, Stone, Sand & Gravel	213,352
St. Francois	41	Lead, Iron Ore, Lime, Stone, Copper, Silver	25,461,065
Gasconade	33	Clays, Stone, Sand & Gravel	2,116,023
St. Louis[b]	34	Cement, Stone, Sand & Gravel, Clays, Petroleum	30,712,897
Maries	21	Clays, Stone, Sand & Gravel	466,507
Iron	23	Stone, Sand & Gravel	322,781
Ste.Genevieve	6	Lime, Stone, Sand & Gravel	13,411,804
TOTAL (twelve Meramec counties)			$82,971,000

Source: W.G. Diamond and William C. Hayes, "The Mineral Industry of Missouri", 1959 Minerals Yearbook, U.S. Bureau of Mines, Washington, 1960.

[a] Figure withheld to avoid disclosing individual company confidential data.

[b] Also includes the city of St. Louis.

Part 1. ROCK AND MINERAL COMMODITIES

Introductory Remarks

This report has been compiled and written by the economic geology section of the Missouri Geological Survey at the request of the director of the Meramec Basin Research Project.

The purpose of this report is to evaluate the future potential of the mining industry in the Meramec River Basin.

The report includes a brief summary of the general geology of the basin, the geology of occurrence of each mineral commodity, maps showing producing areas, production statistics and trends, employment statistics, and a brief summary of the future potential of each commodity.

Data on producing areas and localities were assembled from information on file at the Missouri Geological Survey. Production statistics are taken from the U. S. Bureau of Mines data sheets, employment statistics from the State Mine Inspector's Reports, and general data from the U. S. Bureau of Mines Industry Reports.

General Geology of the Meramec Basin

The Meramec Basin is located in the northern flank of the Ozark Dome. The rocks over which the streams flow in this area range in age from Precambrian to Pennsylvanian, and consist of granite and felsite, dolomite and limestone, sandstone, shale, and clay.

Precambrian granites and felsites are exposed in the southern part of the area, whereas Cambrian and Ordovician dolomites underlie the major part of the area except in the extreme east end where Mississippian and Pennsylvanian shales and clay are the principal bedrock types. Pennsylvanian shales and clays also form the bedrock in much of the northern part of the basin.

The Precambrian granites occur as isolated knobs which rise above the general level of the southern part of the area. These knobs are surrounded by sedimentary rocks which dip sharply away from them. Northward, away from the granite knobs, the sediments lose their sharp initial dip and dip very gently to the north and northeast.

The older sedimentary rocks are mainly dolomites, with thin shales and few sandstones. Many of the younger rocks are Pennsylvanian shales and clays, with a few sandstones and limestones.

The region is cut by a few northwest-southeast trending faults which have small displacement but which exercised considerable influence on the deposition and preservation of many of the mineral commodities in the basin. Many economically important mineral and rock commodities are present in the Meramec Basin area, and the following section discusses individually their many aspects and how they influence the economy of the area in which they are mined.

Non-metallic Commodities

Barite

All barite produced in Missouri during the past three years has been taken from mines operating in the Meramec river basin. The production has come entirely from Washington and Jefferson Counties, where barite has been mined in such quantities as to place Missouri first in barite production in the United States.

Although barite is found in most rock formations in the state, it occurs in commercial amounts chiefly in the Potosi and Eminence formations or in their erosional residuum. These rocks are Cambrian in age and are composed mainly of dolomite and dolomitic limestone. The Potosi formation is characterized by the dark color and organic odor of the coarsely crystalline dolomite and by the presence of abundant quartz druse on its surface. The erosional residuum of the Potosi formation is deep red or maroon and is heavily laden with the resistant druse. The Eminence formation is generally differentiated from the underlying Potosi formation by its lighter color, its lack of abundant quartz druse, and by its large dolomite rhombs, so outstanding in relief on a craggy, pinnacle-shaped weathered outcrop. Eminence residuum is light to dark brown and contains white and gray cherts, but very little quartz druse.

In the Washington-Jefferson County area, the workable barite deposits are found in the residuum overlying bedrock. The heaviest concentrations are usually found near the contact zone between the Potosi and Eminence formations. Barite, chert, and clay were left behind when the more soluble carbonates were leached away by ground water, and concentrations of barite were left in the residuum. The mineral occurs as chips, nodules, and masses, some weighing hundreds of pounds, and a rich deposit occurring in residuum as much as 30 feet thick may yield as many as 500 tons of concentrate per acre. For profitable mining a yield of 6% barite per cubic yard of ore dirt, or 200 tons of barite concentrate per acre foot is desirable.

Barite is mined at superficial depths, zero to 30 feet, by open pit methods. A power shovel strips off the overburden and then removes the pay dirt to trucks which make a short haul to the mill -- usually centrally located between several areas where mining is going on. The ore is washed on a grizzly and large chunks are sledged. The soft barite is broken and screened away from the harder, more resistant cherts. The barite screenings pass to jigs where they are further separated from the gangue. The resulting concentrate passes to storage bins.

Uses of barite are myriad but it is chiefly used as a high-density constituent of drilling muds. Barite is also used in pigments such as lithopone, and in the manufacture of many industrial chemicals.

As a barite producer since about 1850, Missouri leads the nation in total production. Wars and depressions have influenced output, but until the last decade production and profit has generally increased. Because the chief use of barite is as a constituent of drilling mud, the consumption of this commodity is directly related to the intensity of oil exploration. Exploration programs rise and fall with the fluctuations of the world oil market and as the past decade has been difficult for the oil industry, it has been so for barite producers as well. Listed on the following page are the production and employment statistics for barite for the past three years.

Table 2

BARITE PRODUCTION, MERAMEC BASIN COUNTIES

County	Year	Tons Mined	Value	Men Employed	Average Wage/day
Jefferson	1958	a	a	b	b
	1959	a	a	b	b
	1960	363	$ 4,719	b	b
Washington	1958	140,246	2,663,614	b	b
	1959	288,154	3,915,660	b	b
	1960	177,707	2,583,101	b	b
Totals	1958	a	a	297	b
	1959	a	a	b	b
	1960	178,070	2,587,820	b	b

[a]Figures withheld to avoid disclosure of confidential information.
[b]Not available.

Most barite producers have greatly curtailed operations and only major producers are mining at present. Exploration is at a minimum and should increase but little as the areas of potential have been hand dug by hundreds of miners over the years with the result that exploration becomes a matter of obtaining the mining rights to areas where barite-rich residuum is already known to be. When an exploration program is conducted, the most widely used method is backhoe trenching. This is especially adaptable to Missouri deposits as they are shallow and chiefly found in the unconsolidated residuum.

With depletion of the high $BaSO_4$ - low iron deposits in the Richwoods area, which were used chiefly for chemical manufacture, an increasing percentage of Missouri barite is consumed by the oil industry. More than 80% is now so used. At the present rate of consumption, Washington County barite may well be produced for another 20 years, but with the advent of new methods for recovering economic fines from old tailings dumps, production could continue for many additional years as well.

Chats

Chats, consisting of limestone, dolomite, felsite, and granite waste rock from the lead, zinc, and iron mines, are stockpiled in St. Francois and Washington counties in the mine areas.

The limestone and dolomite is principally waste rock of the lead and zinc areas mined out of the Bonneterre formation. The granites and felsites are Precambrian, and are associated with the iron deposits at Iron Mountain and Pilot Knob. When the lead, zinc, and iron ores are mined and processed, the waste rock is recovered and dumped.

The chats are used in limited amounts by the Missouri Highway and County Highway Departments as road metal. The chats are of fairly uniform size -- about one-fourth inch -- as a result of the crushing operation during ore beneficiation. Additional grinding of the limestone and dolomite makes it suitable for agstone. A small amount of chats has been used in the past for railroad ballast and as agricultural limestone.

The future of chats utilization is dependent primarily upon the federal, state, and county highway programs, since this is the largest market for the commodity. The highway programs are in turn affected by the vigor of the national economy.

Chat production is directly related to lead and zinc mining in the basin. As mines are closed in one area, new ones are opened in another, so that chats will continue to be produced in several areas in the Meramec Basin. The mines near Bonne Terre are producing smaller and smaller quantities of lead and zinc, but other areas, such as Indian Creek and Viburnum, are increasing in production and development.

All production and employment statistics are confidential.

Clay

All types of fire clay -- plastic, flint, burley, and diaspore -- were mined from pits in Crawford, Franklin, Phelps, Gasconade, Maries, and St. Louis counties. Production from Gasconade and Maries was by far the most important. In St. Louis County a considerable amount of non-refractory clays or shales were mined for use in cement production.

The clays of the Meramec Basin are Pennsylvanian in age and generally occur in broad shallow depressions and smaller circular sink holes in underlying calcareous rocks ranging in age from Mississippian to Ordovician. The clays are thought to have been derived from pre-existing argillaceous dolomites and limestones which were weathered and removed in solution. The insoluble clay minerals were left behind as a residuum filling solution structures. A clay deposit may range in size from depression fillings 300 or 400 feet on a side and 50 feet deep to sink hole fillings 20 feet across and 100 feet deep. Fire clays, to be of high quality, must occur without any significant gangue minerals or chemical impurities. Clays or shales used for cement manufacture may occur in combination with iron up to 6%, magnesium up to 4%, organic material, and some sand, and still be acceptable.

Whereas years ago, some deposits were mined underground, particularly when associated with a marketable coal seam, extraction today is carried out by open pit methods. Clay beneficiation is not practiced other than blending brought about by weathering in layered stockpiles.

Fireclays mined in the area are used chiefly in the production of refractory brick and castables to line blast and open hearth furnaces in steel mills. This dependency upon the steel industry (approximately 60% of the total production is consumed by steelmakers) has caused the refractory industry to cut back production considerably the past three years as a result of the slowdown in steel production. In spite of this, mining and stockpiling of fireclay has continued to increase as well as has the mining of clays for cement manufacture. Employment data, shown in Table 1 for the fireclay industry, show a substantial decrease in employment, indicating that, while production has increased, the clays have come from fewer pits. This is controlled by a quota system by which the refractories companies control the types and amounts of clay sold to them by independent contract miners.

Clay reserves vary depending on their use. In the refractories industry a great deal of flint and plastic clays are used. High alumina clays, while vital constituents of fire brick, are used in much smaller amounts. Intensive exploration and mining programs during the past two or three years have indicated there will be a severe shortage of flint clays in the near future. A critical shortage of high alumina clays already exists, and bauxites are now being shipped into Missouri from Georgia and British Guiana to supplement the faltering supply. Kaolins, also from Georgia, are being employed. Plastic clay remains as the only fireclay still in abundance in Missouri

Although, in the long run, these clays are in short supply, the vigorous mining of the past few years and current depressed conditions in the refractories industry has

Table 3

CLAY PRODUCTION, MERAMEC BASIN COUNTIES

COUNTY	YEAR	TONS MINED	VALUE	MEN EMPLOYED	AVERAGE WAGE/DAY[b]
Gasconade	1958	65,950	$884,416		
	1959	[illegible],278	831,643		
	1960	114,244	970,958		
Maries	1958	72,646	363,722		
	1959	93,136	318,224		
	1960	a	a		
Crawford	1958	a	a		
	1959	a	a		
	1960	a	a		
Franklin	1958	a	a		
	1959	50,772	224,355		
	1960	a	a		
Phelps	1958	a	a		
	1959	a	a		
	1960	a	a		
St. Louis	1958	298,845	316,224		
	1959	298,158	288,214		
	1960	353,298	345,945		
Totals	1958	441,911	1,585,570	110	$13.00
	1959	603,252	1,873,196	131	11.50
	1960	644,550	1,935,267	65	13.25

[a] Figures withheld to avoid disclosure of confidential information.

[b] Excluding cement industry.

caused a build up of large stock piles. This has resulted in a virtual cessation of exploration for fireclay in these counties and only token crews are in the field, mainly to fulfill current lease obligations.

Claystone and shale reserves for cement manufacture are plentiful and the mined product is utilized almost as fast as it is removed from the ground.

The future of the clay industry in the Meramec Basin is extremely complex. Production of clay for cement manufacture is contingent upon the health and growth of the construction business in this country. Fireclays are not so simple. Sales of the finished product are depressed, and the raw materials, the clays, vary in supply with each type. Increased sales of refractory products, dependent as they are upon the steel industry, are best facilitated by an accelerated defense effort. Recent events indicate such a condition is about to come to pass. In this case, sales of refractories will increase and clay production will at least maintain its present level. Other factors help complicate this picture. Reserves of high alumina clays are particularly short and manufacturers are being forced to ship them into Missouri at great expense from areas where subsidiary plants already exist. The time may come when transportation costs will dictate closing Missouri plants and moving closer to the source of supply. Also, the direct reduction process for beneficiating iron ores enables the blast furnace stage to be bypassed in steelmaking. This process is cheap and efficient. Acceptance could eliminate almost 40% of the market for refractories. In this event, new uses must be developed for these clays. Some companies have already entered the "space age" market, others have begun to produce sewer tile as a high profit item with a large and ever growing market. It appears, then, that the future of clay mining in the Meramec Basin is dependent on the procurement of adequate reserves and on development of new and expanding markets for these reserves.

Granite

Granite is quarried from only one locality in this area -- near Graniteville in Iron County. The rock has been quarried for many years, and has been noted for its fine quality as a rough construction and monument stone. One interesting feature of the Missouri granite industry is that about 90% of the rough monument stone is shipped to

New England where it is in demand as a contrasting stone with the gray granites of Vermont and other New England states.

The granite is an igneous rock occurring chiefly as knobs, which rise above the general level of the land. The rock is generally red in color, and the joint spacing is such that large blocks can be quarried. These large blocks are removed and taken to the processing plant where they are cut into many sizes and shapes. Polishing and trimming is done when required, and the rock is then shipped out.

Most granite is used for monumental stone, and smaller quantities are used for building stone and rip rap.

Table 4

GRANITE PRODUCTION, MERAMEC BASIN COUNTIES

County	Year	Tons Mined	Value	Men Employed	Average Wage/day
Iron	1958	3,987	$259,642	40	not available
	1959	2,856	---	40	not available
	1960	3,997	233,340	40	not available

The future of the granite industry in the basin is chiefly dependent upon its continuing use for headstones and monuments. As consumption for this use is fairly constant, real growth in the industry must come from using granite for other applications. Wider use of the rock as a dimension stone for building construction has been the trend during the past three years and if this continues, a substantial increase in production may be realized.

Limestone and dolomite

Most of the rocks exposed in the Meramec Basin area are limestone and dolomite. Cambrian dolomites crop out in the southern part of the area. Ordovician dolomites crop out in the central and northern parts, and Mississippian limestones are exposed in the eastern part of the basin.

The limestones and dolomites are almost flat-lying, with very gentle dips to the north or northeast. The color of these rocks varies from dark buff to red, to gray, to nearly white, and the thickness of the various formations ranges from about 50 feet to 150 or more.

Many of the limestones and dolomites are quarried principally for use as crushed rock for road metal and concrete aggregate. A smaller amount is used for agricultural limestone. The most extensively quarried formation in the basin area is the Jefferson City dolomite, which is quarried in Phelps, Maries, Gasconade, Crawford, Franklin, and Jefferson counties. Other formations such as the Joachim, Plattin, Kimmswick, Burlington, Keokuk, Spergen, and St. Louis are less extensively quarried, but in some cases are much more valuable than the Jefferson City dolomite. Production statistics are given in Table 2.

The formations are quarried by open cut methods. After blasting, the rock is removed to crushers, and then sized and stockpiled for later shipment to users. The Missouri Highway Department is probably the largest consumer, and lime manufacturers next.

The future of the limestone industry in the Meramec Basin area is dependent principally upon the highway program, which in turn is dependent upon the national and world situation. At this time, the limestone future looks reasonably good, since the state and federal highway programs have just begun to gain momentum. No cut-backs in the programs are foreseen, and the production of limestone and dolomite should gradually increase over the next few years. Only the advent of war can be seen as a condition which would cause a decrease in limestone production.

Another possible use of limestone in this area is for the chemical industry. Good quality limestone is present in St. Louis and Jefferson counties, but at the present time these rocks do not meet the high purity specifications of the chemical industry. However, as technology advances, limestones which are now rejected may become a source of chemical rock as new uses and improvements in manufacture of chemicals advance.

Limestone is also used in the steel industry as flux for the open hearths, and the higher grade limestones of the area may some day be used in this manner.

The reserve of good quality limestone in this area is adequate to meet any increased production of crushed rock for concrete aggregate, road metal, cement manufacture, or agricultural limestone. The several high calcium formations such

Table 5

LIMESTONE PRODUCTION, MERAMEC BASIN COUNTIES

County	Year	Tons Mined	Value	Men Employed	Average Wage/day
Crawford	1958	3,821	$ 9,578		
	1959	1,500	1,500		
	1960	---	---		
Franklin	1958	104,990	132,398		
	1959	173,960	183,156		
	1960	140,804	175,617		
Iron	1958	41,850	41,850		
	1959	39,705	45,570		
	1960	38,407	44,603		
Jefferson	1958	70,593	84,664		
	1959	393,159	524,485		
	1960	154,677	190,803		
Maries	1958	25,000	30,000		
	1959	28,870	41,168		
	1960	30,900	44,065		
Phelps	1958	43,519	67,739		
	1959	28,691	48,176		
	1960	65,000	90,000		
St. Francois	1958	a	a		
	1959	a	a		
	1960	a	a		
St. Louis	1958	1,831,929	2,460,332		
	1959	1,724,181	2,181,358		
	1960	1,207,323	1,412,504		
Totals	1958	b	b	271	$14.00
	1959	b	b	b	b
	1960	b	b	b	b

[a]Figures withheld to avoid disclosure of confidential information.

[b]Not available.

as the Burlington, Plattin, Kimmswick, Ste. Gevevieve, and St. Louis, presumably have high potential for further development, and should the need arise for increased production, the rock is readily available. Limestones in Jefferson County are becoming increasingly important as zoning restrictions in St. Louis County continue to encroach upon mining in that area. Some cement producers already hold substantial reserves in Jefferson County as a possible hedge against the time when their limestone supply must come from areas outside St. Louis County.

Sand and gravel

Sand and gravel is found in stream and river beds throughout the Meramec Basin. The larger deposits are found in the Meramec and Bourbeuse river beds, and smaller deposits are found in smaller streams which drain the area. The Meramec is by far the most important sand and gravel producer of the area.

The Meramec River sand and gravel consists entirely of flint and quartz, the plus 20-mesh product being exclusively flint. The finer product is quartz grains and small fragments of flint varying in proportions from place to place. The minus 30-mesh product is usually nearly all quartz, and varies from subangular to angular in shape. In most places the sand is free from silt and clay, but often is mixed with tree bark and twigs.

From the mouth of Big Dry Fork near Meramec Springs to Valley Park, extensive gravel bars of high quality are abundant. Meramec sand and gravel is in great demand in the St. Louis area, and in the past it brought a better price on the market than sand and gravel from the Mississippi River because it was coarser and sharper.

The most important use for sand and gravel is for building purposes, and a fairly large amount is used in road surfacing, and as railroad ballast and fill. In recent years, there has been a trend away from sand and gravel in some types of construction, and the Missouri Highway Department now prefers crushed limestone rather than gravel for concrete aggregate, although gravel is still used extensively for secondary roads.

Local conditions and the size and permanency of operation are controlling factors in the selection of equipment used for quarrying and dredging. In general, the sand and gravel is dug with a dragline, or dredged, either with a suction type dredge or a bucket line or clam shell rig.

Plant portability is becoming an important factor in the sand and gravel business, particularly in relation to highway construction and new community development. Commercial producers have found it advantageous to have a portable plant, so that the unit is easily moved back and forth to and from remote areas.

Preparation of sand and gravel for market includes screening, washing, drying, jigging, and fine grinding when necessary. The material is moved by railroad, trucks, and on waterways.

Commercial sand and gravel are relatively low-priced products, compared with other mined materials. The low price for sand and gravel limits the area of their distribution since transportation costs may be considerably more than the cost of materials at the plant. Thus, local distribution is the general practice in the industry.

The future of the sand and gravel industry in this area is dependent almost wholly on the general construction business. The bulk of the sand and gravel is used in the St. Louis area, and future production will be affected by construction trends there.

Upswings in general business will cause increased production of sand and gravel as more office buildings, plants, streets, sidewalks, and homes will be constructed. Production and employment figures for the sand and gravel industry are not available for the Meramec Basin area.

Silica sand

The Ordovician St. Peter sandstone is presently the only source of silica sand in the area covered by this report. This formation outcrops in the Meramec Basin in a belt running through the Pacific area in western St. Louis County southeast through Goldman in Jefferson County. The formation dips gently to the northeast, and maintains a fairly constant thickness of 80 to 120 feet.

The St. Peter is a high-grade quartz sandstone, averaging more than 98% SiO_2. It is usually white in color, but occasionally contains a small percentage of iron-oxide which stains the rock brown, particularly when it is weathered. The formation is generally massive, but in some localities it may be thin-bedded.

The St. Peter is quarried at Pacific, and the rock is used principally in the manufacture of plate glass. A small amount is used as an abrasive material for polishing plate glass and in finishing dimension stone. Some silica sand is used as molding sand in the foundry trade, and some is used to a limited extent for sand-lime bricks and silica flour.

Preparation of silica sand for the glass industry consists of crushing, grinding, and washing. Then it is dried and screened to remove the oversize sand and foreign material. Glass sand should all pass the No. 20 sieve (0.833 mm).

Production figures for silica sand are confidential, but employment statistics for the industry are given below.

Table 6

SILICA SAND EXTRACTION, EMPLOYMENT STATISTICS

Year	Men Employed	Average wage/day
1958	32	$14.33
1959	32	15.00
1960	32	16.00

The future of the silica sand industry in the area of this report is dependent upon one main factor -- general construction. Since the bulk of the silica sand produced in this area is used in the glass industry, fluctuations in the national economy will directly affect the construction business. Slight increases in production can be foreseen as a result of the population increase.

The reserves of silica sand in this area are substantial, and any increased demand for it can certainly be met by further development of the St. Peter sandstone. The production in the last three years has been quite stable, and should maintain its present rate for some time to come.

Metalic Commodities

Iron

Within the Meramec Basin, iron is being mined at Iron Mountain in St. Francois County. Another deposit at Pea Ridge, south of Sullivan in Washington County is about to come into production. Other deposits in varying stages of development occur at Bourbon in Crawford County, in the Boss-Bixby area at the juncture of Crawford, Dent, and Iron Counties, and at Pilot Knob in Iron County. All of these deposits occur deep underground in Precambrian igneous rocks or in the residual material directly above them. Some surface deposits have been periodically mined in the area but these have been incidental and are not of much economic importance. Their grade is marginal and their yield insignificant, totaling some $300 in 1959, the last year of reportable production.

The Precambrian deposits are presumed to be hydrothermal in origin and occur as joints and fissure fillings or veins, as tabular bodies concordant with bedding planes, and as cementing materials in the conglomerate overlying the granites and felsites of the area. Some of the ore bodies may be hundreds of feet in lateral extent and may be anywhere from 10 to 200 or more feet thick. The crude ore grade varies but usually must be around 35% metallic iron to be economic. Silica content should not exceed 10%, sulfur .1%, and phosphorus not more than .2%. Silica may be tolerated to 20%, but the ore will be severely downgraded at market. New beneficiation processes may increase the amount of permissible sulfur.

Several mining methods have been employed for extraction of the ores associated with the Precambrian. Surface operations were the first used for mining residual hematite boulders that had accumulated on and near the surface of erosion of exposed veins. Hematite boulders are also a constituent of the basal conglomerate of the oldest sediment in the area, the Lamotte formation of late Cambrian age, where it rests upon the eroded Precambrian knobs and hills. The primary veins and replacement ore bodies were initially mined by open pit methods and later by underground stoping.

The room and pillar method is used at Iron Mountain. After mining, the ore passes through a primary crusher underground, is carried to the mill, screened and crushed to minus one-half inch size, joined with dewatered minus 8-mesh jig middling and conveyed to jigs. Concentrate is delivered to bins after dewatering. Dewatered tailings from the jig overflow pass to Deister tables, and the concentrate produced is combined with the regular production. Table tailings pass on to an experimental flotation mill.

At the Pea Ridge Mine, which is not as yet producing, pelletizing of the concentrate, produced by a similar mining process, is planned. Data on cost per ton and ore tenor are not available for publication at this time.

The depth at which mining is taking place, or will take place, varies. At Iron Mountain, drifts are being driven at between 500 and 1000 feet below the surface. At Pea Ridge, the deposit occurs between 1500 and 3000 feet deep. The drilling at Bourbon indicates an ore depth of at least 1600 feet.

As iron and steel are two of the fundamental commodities in our civilization, their production utilizes over 99% of the iron ore mined today. 57% of the ore goes to iron blast furnaces, 7.5% to steel-making furnaces, and 35% to agglomerating plants. The remaining fraction of 1% is used in cement manufacture, paints and dyestuffs, and in ferro-alloy furnaces. Some iron is used as a flux in smelting siliceous non-ferrous ores.

Marketing of iron ores in the United States is influenced chiefly by the grade of ore to be sold and how far it must be shipped by what means. In this respect, the high-grade Lake Superior ores, shipped mainly by water, dominate the iron ore market and thus set the standards by which the market is measured. Ore purchased at the lower Lake Erie ports is priced on a base of 51.5% iron. There are five grades of ore, which, working off their 51.5% iron content base, are classified according to their content of phosphorus, manganese, sulfur, and silica. Missouri iron ores are graded accordingly and are sold chiefly to steel producers at Granite City, Illinois; Birmingham and Woodward, Alabama; and Rockwood, Tennessee. These ores are at a disadvantage, for, whereas Lake Superior ores may be cheaply transported through the Great Lakes, they must be shipped mainly by rail. Only as steel mills become more concentrated in the Midwest, will Missouri ores become more competitive. Development of the direct reduction process for iron ores, a process which bypasses the blast furnace stage of steel making, will allow steel makers to construct smaller and more efficiently run units closer to the source of their ore. Acceptance of this method by the industry could well bring at least this phase of steel making to Missouri.

Production was at a peak in 1960 and should continue at this pace or better, depending upon the defense situation and the rate at which the steelmakers use their presently high inventories. Employment should also increase somewhat with the opening of the Pea Ridge Mine. The prospects for other mines being opened in the area, such as at Bourbon and in the Boss-Bixby area, are difficult to evaluate at this time.

Table 7
IRON PRODUCTION, MERAMEC BASIN COUNTIES

County	Year	Tons Mined	Value	Men Employed	Ave. wage/day
St. Francois	1958	220,963	$2,709,208	166	$23.60
	1959	a	a	148	23.80
	1960	a	a	175	23.62

[a]Figures withheld to avoid disclosure of confidential information.

Prospecting for and developing iron ore deposits, as well as expansion of mine works, and iron ore prices, have all been directly affected by governmental legislation during the past decade. Until May 1953, the Defense Production Act of 1950 authorized federal financial assistance for iron ore prospecting programs. The Internal Revenue Act provided accelerated tax amortization for new development and expansion of existing works until September 1955. During World War II and the Korean War prices were controlled by the federal government.

At the present time the federal government aids iron ore producers by granting a 15% depletion allowance and a 50% subsidization of exploration costs which are approved by the Office of Minerals Exploration.

Prospecting in the Meramec Basin has been proceeding rapidly. Those companies which are engaged in the search for lead deposits are not overlooking iron, but are searching for this commodity as well. Exploration is being conducted on private as well as on government-owned forest lands. The St. Joseph Lead Company has been drilling recently near magnetic anomalies in the Kratz Springs area north of Sullivan in Franklin County. Iron mineralization was reported. Missouri-Cliffs, Incorporated, a subsidiary of Cleveland-Cliffs, Incorporated, is drilling in the Floyd Tower area near Potosi in Washington County, and exploration is going on in other parts of the state as well, such as in Audrain, Jackson, Lafayette, and St. Charles counties. Success in these areas would certainly have good effect on the economy of the Meramec Basin area. An estimate of iron reserves in the basin is impossible to give and depends entirely upon the results of the drilling programs which may well continue for several years. At present, it is estimated that reserves may be sufficient to permit those companies now operating to continue to do so for many years to come.

One factor, entirely controllable by man, may possibly affect the entire iron ore development project in the Meramec Basin. The construction of a dam in the upper Meramec Basin could conceivably create a water problem for the mines which perhaps could mean the difference between profit or loss. It is impossible to predict what actual effect the presence of this water might have, but the balance of considered opinion at this time is that it will probably not be significant.

Lead and zinc (copper and silver)

Lead deposits, in association with minor amounts of zinc, copper, and silver, occur in the Meramec River Basin from the Flat River-Elvins-Bonne Terre district of St. Francois County north into Washington County and west into Iron and Crawford counties. The favored horizon for this ore is the lower portion of the Upper Cambrian Bonneterre formation where the lead occurs disseminated in a medium to coarse grained gray dolamite on the flanks of calcarenite sand ridges, in fracture zones, peripheral to buried Precambrian knobs and ridges and in sedimentary slide breccias.

The lead sulfide, galena, is the principal ore of lead in Missouri. It is a dark gray or silvery mineral, soft, and of cubic crystalline habit. In the Lead Belt area, most of which is in the Meramec River drainage basin, galena is sometimes found in association with minor but commercial amounts of zinc, copper, and silver minerals, particularly in St. Francois County. These minerals are separated with the galena during the milling operation and are smelted to recover their metallic content. The galena is also found with quartz, calcite, dolomite, and clay as gangue minerals.

Ore bodies vary greatly in size but those being mined today produce around 2000 tons of ore per day at a mill feed assay of approximately 3%. Mining is being conducted at depths ranging from 400 to 1000 feet by underground stoping. The ore is crushed and valuable minerals are separated from the gangue in flotation cells to produce a concentrate for smelting which averages 70-80% lead.

Lead is one of the earliest metals known to man and one of the most important to our civilization. Some of its many uses are as a constituent in alloys such as brass, bronze, and bearing metals, and as lead sheeting or stripping for cable covering, calking, collapsible tubes, and foil. Other important uses are in ammunition manufacture, solder, storage batteries and type metal. Zinc, usually occurring as the sulfide, sphalerite, averages less than 1% in the deposits found in the Meramec Basin. When recovered at the mill, it is smelted and sold to manufacturers of alloys, paints, roofing, dry cell batteries, pharmaceuticals, and chemicals. The silver by-product, which occurs in amounts averaging 4 ounces Ag per ton of ore is used for coinage, silver plate, and solders. Copper, also occurring in amounts less than 1%, is recovered by smelting, and finds myriad uses in the electrical industry.

The lead mining industry in the Meramec Basin and adjoining areas has been vigorous or depressed during the past three years, depending on one's point of view. While maintaining its position as the nation's number one lead producing district, production nevertheless has been declining in response to low market prices. Some mines have closed and others intend to close in the near future. Nevertheless, exploration and development is proceeding at a rapid pace, as a result of the discovery of large new lead deposits in the area. The St. Joseph Lead Company opened its new Indian Creek Mine in Washington County in 1954 and it is producing heavily at the present time. Last year marked the initial production from St. Joseph Lead Company's large new Viburnum mines, located in the juncture of Iron, Crawford, and Washington counties. These discoveries have spurred other companies to conduct intensive exploration programs in the area and to lend an atmosphere of confidence in the future of lead in the Meramec Basin. Production and employment statistics for the past three years are listed on the following page.

Table 8

LEAD AND ZINC PRODUCTION, MERAMEC BASIN COUNTIES*

County	Year	Tons Mined	Value	Men Employed*	Average Wage/day**
Crawford, St. Francois, and Washington	1958	6,123,753	$22,067,587	2200	$18.20
	1959	5,664,543	20,922,365	1881	18.20
	1960	6,000,765	22,030,320	1810	18.95

*County totals combined to prevent revelation of confidential data.

**Includes workers involved in extraction of lead, zinc, silver, and copper.

Production statistics for silver and copper are confidential, but the general trend is toward declining production.

These figures indicate no significant variation in the number of men employed but ensuing years should bring a substantial reduction in this number due to the increasing use of automation in mining. The Viburnum Mine is a forerunner of this trend. As the older mines shut down due to increasing production costs and ore grades which fall short of the necessary lead content, they will be followed by mines patterned after the Viburnum project. Thus while production may increase in the area, unemployment may also increase.

Reserves of lead ores in the basin area may be substantial for those companies presently operating there. The potential of the area is impossible to predict but the answer to this may well be seen within two or three years if exploration drilling continues at the present pace. The outlook for lead in the basin is probably one of cautious optimism and hinges, of course, on the result of the exploration and on world lead prices. Current emphasis on conventional arms for the military may well give a boost to ammunition makers which in turn will serve to substantially improve market conditions for lead. Curtailment of lead imports would also be beneficial.

Summary

The trends indicated by the preceding discussions may or may not continue. If adequate reserves are available, production increases are quite likely to occur in the case of lead, iron, sand and gravel, silica sand, and limestone. Use of granite and chats may also increase but not as rapidly. The outlook for barite depends almost entirely on how the oil market behaves and as this is highly sensitive to apparently insignificant happenings in world politics, the barite market is difficult to predict. The clay outlook is again enigmatic but appears that fire clay production will continue to decline and clay mining for cement manufacture will increase.

All commodities expected to show an increase in production are judged by their response to a vigorous and expanding national and world economy. If the world remains at peace, and this country maintains its dynamic economy, the expectations will be realized. If conventional war comes to the world, the production outlook changes. Commodities dependent upon the expanding highway system, such as chats, limestone, and cement clay, will be hard hit. The other commodities, including barite and fire clay, will be much more vigorously produced.

Employment trends will not necessarily conform to this pattern. Where mining methods are complex, such as in the iron and lead industries, automation of mines may well decrease the number of men employed. Employment in other mining ventures should increase in direct proportion to production.

Part 2. SOME FUTURE POSSIBILITIES *

New Mineral Developments

Present operations

As the preceeding section indicates, large reserves of iron and lead, as well as other minerals, are in the Meramec Basin. Prospecting is being conducted on a large scale by at least 14 major companies spending millions of dollars annually in the basin and adjacent territory in southeast Missouri.[1] Several deposits have been located, with three in production or close to operation in the center and southern margins of the basin: Viburnum and Indian Creek for lead, and Pea Ridge for iron. The future level of development of these resources depends not only on the competitive costs of mining the ore but also on markets and organization of the mineral industries.

The Pea Ridge development has a final goal of 2,000,000 tons of pellets per year with an iron content of 65% or more. About $40,000,000 is estimated as final cost; about 800 employees may be required at full operation.[2]

Viburnum has one mine in operation producing 2,200 tons per day, another scheduled for January, 1962, and a third to start in 1964; a total ore production of 6,600 tons is planned for the mill which concentrates the ore into a small volume. Employment is 170 persons, with 50 or 60 additional under full production. Investment will be slightly over $20,000,000. Indian Creek produces 2,200 tons, employs 125, and represents an investment of about $8,000,000. These new, more efficient mines gradually will replace older mines in the old Lead Belt to the east in the basin where St. Joseph Lead Company, the chief producer, has about 1,720 employed, including some overhead staff for the new mines. Total production in the whole area is sufficient to produce about 100,000 tons of pig lead per year, although much of this is going into stockpile.

Factors affecting future mining

It is interesting to speculate as to the future. Reserves, although not exactly known as yet, appear to be ample for expanded production of both lead and iron. The main question appears to be market and competitive costs.

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*Thanks are due to many who provided background for this analysis including especially Professor Thomas R. Smith of the University of Kansas, and several companies.

The new lead mines such as Viburnum are apparently quite efficient; the question then boils down to market and foreign competition. One might assume that new developments such as Viburnum would gradually replace the older, less efficient Lead Belt mining, although perhaps not absorbing all the labor because of greater efficiency and a market limit, unless new uses are developed.

For iron ore the possibilities are greater although perhaps even less certain. Competitive costs in handling ore for depths of 1,000 - 3,000 feet are not known, although modern, economical methods are being used. Assuming that costs are competitive, what is the market? The product, a high quality 65%+ concentrate, apparently is desirable in varying amounts in various furnaces. As such, it can readily stand transport charges into a large market extending into Ohio and perhaps farther. Such areas already pay freight charges for ore equal to probable charges from the Meramec area.[3]

Economic impact

In addition to the Pea Ridge property, American Zinc, in collaboration with Granite City Steel, has staked out a large reserve near Bourbon in the center of the basin, and has announced discovery of ore grade magnetite in the Bass-Bixby area to the south. At least three other ore grade deposits have been outlined in adjacent areas.

If one assumes an ultimate development of five or six mines about Pea Ridge scale, producing a total of 10,000,000 - 12,000,000 tons per year, they would employ 4,000 - 5,000 workers -- more than enough to compensate for the losses in the old Lead Belt. These 4,000 - 5,000 workers would in turn require other services. For the whole region, including Metropolitan St. Louis, the addition of these export workers alone would support approximately an additional 6,000 to 7,500 workers.[4] Perhaps about half of these would be in the St. Louis area outside the basin, and about half in the basin. This would total 10,000 to 12,500 workers; an average annual salary of $4,000 would result in $32,000,000 to $50,000,000 a year; at an average family size of three, the total population supported would be 30,000 to 37,500.

Prospects for Nearby Steel Production

Conventional steel-making processes

These preceeding figures represent a sizable addition to the economy of the basin and to St. Louis based on simply concentrating and exporting the ore. If further processing should develop, the impact could be much greater. Two contrasting possibilities for further processing exist, together with some other combinations and variations.

The first or more conventional possibility is the construction of a new, integrated steel mill, as well as expansion of existing mills. Ample ore reserves appear to exist for such a possibility; if the price of the ore is low this would give a certain advantage to locating close to the ore, but since the ore will be 65% or more iron content, shipment costs will not be excessive, and as indicated, the ore can probably be economically shipped out to large consuming markets either by inland waterway or at low, bulk railroad rates.

Two other considerations apply -- fuel, and particularly market. For fuel, southern Illinois coal, which has been used for coke in recent years, is nearby and cheaply mined. It is combined with iron ore in approximately equal amounts, with addition of limestone as a flux, a widely available resource, and varying amounts of scrap and minor items. On this basis the location should probably be somewhere on the Mississippi both for receiving some raw materials and shipping out some finished products. Location could be at St. Louis or the East Side where present production is concentrated, or at some site on the Mississippi on both the Missouri and Illinois sides, south of St. Louis, with minimum hauls of ore and coal. In any case, a large scale development of this type is unlikely in the Meramec Basin itself.

Direct reduction processes

A second possibility is perfection in ten years or so of some process, or processes, to permit direct reduction of ore into iron and steel, obviating the use of blast furnaces and much coke.[5] Size of plant could also be smaller. In this case the preferred location would be at or near a mine mouth or possibly a joint location near several. Such a process, if perfected, would presumably be much more economical and would require considerably less labor than present methods. It would, however, probably markedly increase employment in the basin.

Market factors

The critical factor in all these possibilities is the market. If there is a large enough and increasing market more economically reached from St. Louis than other areas, construction of a new mill and expansion of local capacity (which recently has been more economical than new construction) is likely. The minimum size for a new integrated, economical mill is on the order of magnitude of 1,000,000 tons a year. Present local capacity at both Granite City and Laclede are around 2,400,000 tons; an extra 1,000,000 tons, plus some expansion of existing mills, would represent a sizable addition to be absorbed by the market. A recent study which showed areas reached "competitively" by St. Louis with absorption of $2.00 and $4.00 a ton on steel shipments, a fairly common practice, indicates a "natural" market area large enough to support considerable expansion. The question then would hinge on the competitive costs of production, both of ore and steel, which the report did not attempt to analyze.[6]

The conjectures above are conditioned by several other unknowns, including the competition of cheap foreign ores located near ocean ports, and therefore cheaply transported to the U. S., new discoveries elsewhere in the U.S., the international situation, changes in technology, and the competitive strategy and plans of steel making companies.[7] The example of five or six large mines ultimately producing 10,000,000 - 12,000,000 tons of ore is merely an example for estimating possible impact. Ore reserves may well support such a scale, but development may be much smaller or even larger.

REFERENCES AND NOTES

[1] Thomas R. Beveridge, "Current Mineral Exploration in Missouri", Rolla, Aug. 24, 1961. (Speech by Missouri state geologist to American Mining Congress, Seattle, Sept. 11, 1961.)

[2] These and some other details on St. Joseph Lead Company operations kindly furnished by Elmer A. Jones, Division Manager, Sept., 1961.

[3] cf. Iron Ore 1960, American Iron Ore Association, Cleveland, Ohio, and Iron Ore Analyses 1961, M. A. Hanna Co., Cleveland.

[4] This rough approximate is based on a multiplier of about 1.5 for metropolitan areas of 2,000,000 (St. Louis) and .8 for areas of 100,000 - 200,000 population (the Meramec Basin). (cf. Edward L. Ullman and Michael F. Dacey, "The Minimum Requirements Approach to the Urban Economic Base" Papers and Proceedings, Regional Science Association, Vol. 6, 1960, 175-94.)

[5] cf. Gunnar Alexanderson, "Changes in the Location Pattern of the Anglo-American Steel Industry: 1948-59." Economic Geography, Vol. 37, 1961, 95-114.

[6] Ford, Bacon, and Davis, Engineers, N. Y. Report of Natural Markets for an Integrated Steel Mill in Missouri, (Missouri Resources and Development Commission, Jefferson City, Oct. 4, 1961.)

[7] cf. U. S. Tariff Commission, Iron Ore, Report on Escape Clause Investigation No. 7-92, Washington, December, 1960.

THE MERAMEC BASIN

Volume II
The Economy and Character of the Meramec Basin

Chapter 6
TOWNS, INDUSTRY, AND TRADE

Meramec Basin Research Project
Washington University
St. Louis, Missouri
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Chapter 6

TOWNS, INDUSTRY, AND TRADE

The Meramec Basin has a population density of about 50 persons per square mile, but much of the basin contains less than five persons per square mile, while urban concentrations contain several thousand persons per square mile. The overall sparseness of population in the Meramec Basin, coupled with the wooded, hilly landscape, might lead one to believe that the area is highly rural and underdeveloped. However, the majority of basin inhabitants live, and many more work in urban environments. Moreover, such urban population is highly concentrated in a few areas. Three general areas of urban settlement account for at least 70% of all population in the basin: (1) the Metropolitan St. Louis urban fringe which is located in the northern portion of the area and contains about one-half of total basin population, (2) the beaded, evenly spaced urban communities ranging in size from 2,000 to 5,000, located along the major highways and railways focusing on Metropolitan St. Louis in the eastern portion of the basin, and (3) the mining communities clustered together in the southeast corner of the area. The remainder of the Meramec Basin is largely rural and sparsely populated.

Not only do the majority of Meramec Basin residents live in urban environments, their most important employment activities are of an urban nature -- manufacturing, mining, and general commerce. Industrial employment looms especially significant when it is realized that over half of all persons in the basin are within commuting distance of factories in Metropolitan St. Louis. (See Chapter 1.)

The Meramec Basin has considerable industry in its own right, however. About 100 industries employing a total of more than 10,000 workers are found in the basin, not including those factories found in the urban fringe portion of Metropolitan St. Louis. (See Table 2 appended to the end of this chapter.) Almost all such industry is found in communities of 2,000 to 5,000 persons located along the major highways and railways. These communities also tap larger work forces commuting via good highways from distant rural areas, so that their effective labor market is enhanced.

Details on industries and communities will be found in the Community Inventory forms in a separate appendix to this chapter. Employment data by counties is presented in Chapter 1. Some summary characterizations, location and development problems are briefly sketched on the pages which follow.

Urban-Industrial Distribution Patterns

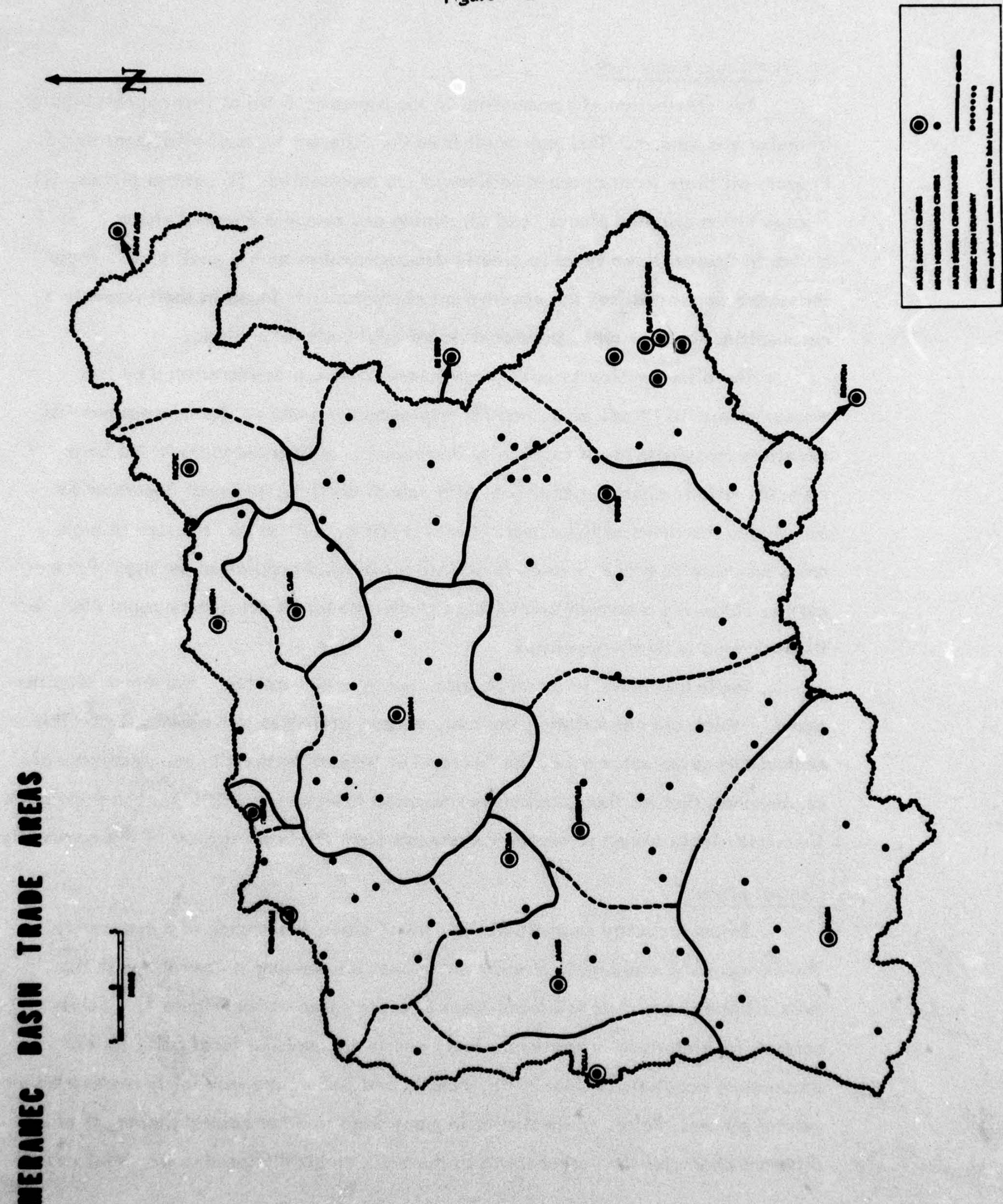
Major and minor centers

For the purposes of this study the basin is considered to contain only two types of communities -- those which contain industry and those which do not. Fortunately, such a breakdown is simple in the Meramec Basin. Commercial aggregations are divided into: (1) "minor centers" with no industry and only token commercial activity, and (2) "major centers" of over 1,000 persons which do contain industry. (Figure 1).

This study is not directly concerned with the minor centers. Nevertheless, they are important in understanding the full commercial structure of the basin. Minor centers are evenly distributed throughout the area in relation to population density. Note, however, that such centers are often five or more miles apart. This is the smallest unit of commercial activity available. Minor centers usually contain a general store, a service station, a grade school, and sometimes a post office. Industry is rarely found in such centers. These minor centers perform strictly a neighborhood function.

The major centers are incorporated communities important to the basin economy in terms of employment. (For purposes of this study the suburban-type communities in the urban fringe of Metropolitan St. Louis are not included.) These centers average several thousand persons in their built-up area, usually have established police and fire departments, a high school, varied shopping facilities, and provide industrial and commercial employment for surrounding population, including part-time farmers. These are the communities around which the basin inhabitants organize their travel habits and their loyalty.

Figure 1



An organizing framework

The distribution of communities in the Meramec Basin at first appears highly irregular and random. This may result from the different types of settlement found. In fact, all three forms or urban settlement are represented: (1) central places, (2) transportation oriented places, and (3) mining and resource oriented places.[1] It is rare to find all three types so clearly demonstrated in such a small area. These settlement patterns affect the employment characteristics found in their respective communities, and, as such, provide a meaningful basis for analysis.

The differing structures of these communities are deomonstrated by two measurements: (1) trade area, and (2) employment structure. Trade areas provide excellent measurements of community dominance. Most trade areas in the basin coincide with telephone exchanges, high school districts, and most important for this study, the limits of the community labor force. Of course, the size of such areas can only be properly interpreted in light of rural population density. For example, Potosi has a comparatively large trade area for its community population, but its trade area is thinly populated.

Employment structure can be measured by a new method, "Minimum Requirements". which aims at isolating the basic support activities of a community.[2] This method allows measurement of the "excess" or "export" workers in each category of employment; that is, those workers not required to serve the existing urban population. Therefore, these excess or export workers represent the basic support of the community.

Central places

Salem is a good example of the central place importance of a community. The monopolistic and highly circular trade area surrounding it contrasts with the more elliptical and distorted trade areas of other communities (Figure 1). Salem controls its hinterland almost exclusively and is the decisive focal point for the surrounding population. Steelville, Potosi, and DeSoto are also fairly representative central places. Rolla, while similar in many ways to other central places, is of a different character than other towns in the basin and is discussed as a special case.

Salem is a near classic central place community. More than 40% of its total export employment is in manufacturing, wholesale-retail trade follows closely. In fact, Salem contains far more excess employment in wholesale-retail trade than any other community in the basin (Figure 2). The predominance of trade clearly reflects the central place, or regional, importance of Salem relative to other basin communities. Manufacturing is the key growth determinant however.

Transportation oriented places

The linear communities rather evenly spaced from Union to Owensville along Highway 50, and from St. Clair to St. James along Highway 66 are clearly located in relation to transportation corridors, but also have central place characteristics. The basic support of these communities is, however, closely allied to good transportation facilities. Partly for this reason such communities have a greater share of manufacturing than other communities. On the other hand, these centers are less important in wholesale-retail trade than the typical central places such as Salem, in large part because they are closer and more accessible to St. Louis competition and there is less farming area surrounding.

Sullivan and Union are the prime representatives of these linear transportation-oriented communities. Manufacturing accounts for almost 70% of excess employment in Union, and about one-half of excess employment in Sullivan (Figures 3 and 4). Wholesale-retail trade makes a poor showing at second place with only 10% to 15% of total excess employment, compared to almost 20% in the case of Salem. Public administration shows up significantly in Union because it is the county seat of Franklin County.

Resource oriented places

The mining communities in the Flat River complex represent an almost classic pattern of resource-located communities. (See Figure 1.) Note how much closer together these communities are than either the central place communities or the transportation oriented communities.

Figure 2

MINIMUM REQUIREMENTS: SALEM, MO.
1950 Population: 3,611 (log = 3.558)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	27	1.97	0.28	1.69	2.3
Mining	7	0.51	0	0.51	0.7
Construction	129	9.43	2.05	7.38	10.2
Manufacturing	452	33.04	2.80[b]	30.24	41.8
Transport., Commun.	89	6.51	2.65	3.86	5.3
Wholesale & Retail Trade	342	25.00	11.69	13.31	18.4
Finance, Insurance	28	2.05	1.17	0.88	1.2
Business Repair Services	45	3.29	1.04	2.25	3.1
Personal Services	91	6.65	1.34	5.31	7.3
Entertainment	15	1.10	0.31	0.79	1.1
Professional Services	94	6.87	3.52	3.35	4.6
Public Administration	49	3.58	0.86	2.72	3.8
TOTAL	1,368	100.00	27.71	72.29	99.8

[a]Computed from regression coefficients

[b]Estimated from Table

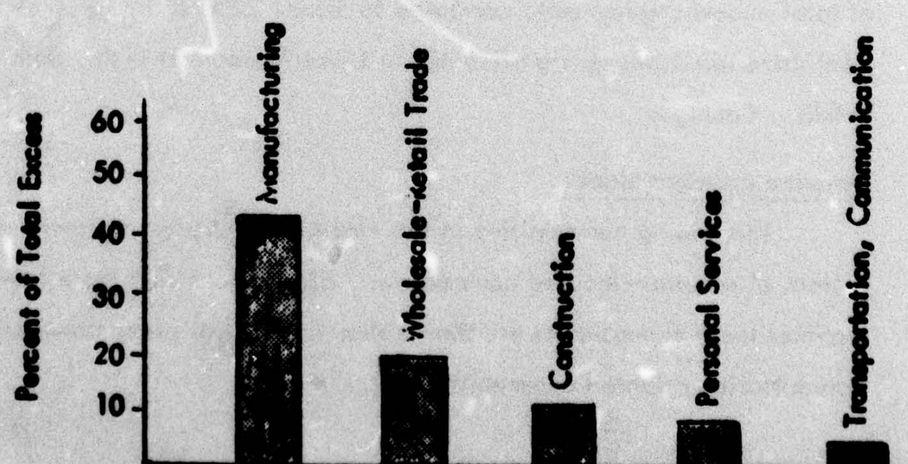


Figure 3

MINIMUM REQUIREMENTS: SULLIVAN, MO.
1950 Population: 3,019 (log = 3.480)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	29	2.58	.26	2.32	3.2
Mining			0		
Construction	95	8.44	1.97	6.47	8.9
Manufacturing	393	34.90	2.80[b]	32.10	44.1
Transport., Commun.	74	6.57	2.59	3.98	5.5
Wholesale & Retail Trade	251	22.29	11.63	10.66	14.6
Finance, Insurance	23	2.04	1.14	0.90	1.2
Business Repair Services	40	3.55	1.01	2.54	3.5
Personal Services	73	6.48	1.30	5.18	7.1
Entertainment	16	1.42	0.30	1.12	1.5
Professional Services	87	7.73	3.41	4.32	5.9
Public Administration	45	4.00	0.81	3.19	4.4
TOTAL	1,126	100.00	27.22	72.78	99.9

[a]Computed from regression coefficients

[b]Estimated from Table

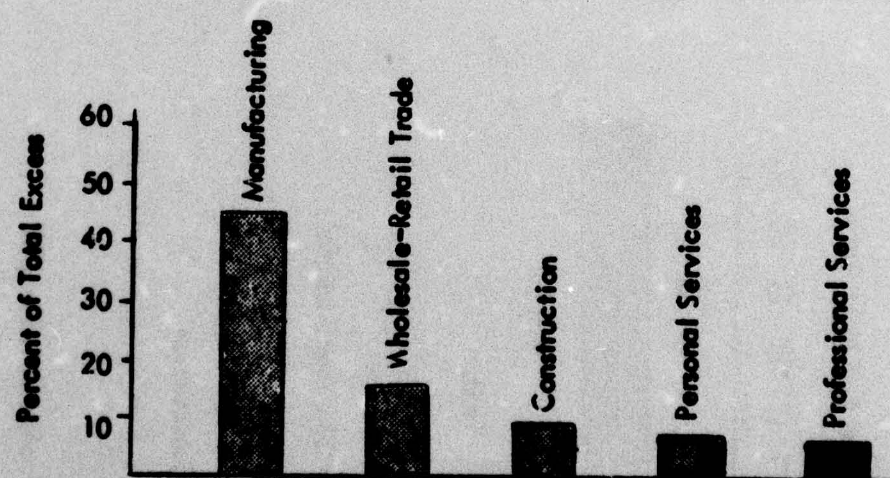


Figure 4

MINIMUM REQUIREMENTS: UNION, MO.
1950 Population: 2,917 (log = 3.464)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	9	0.73	0.26	0.47	0.6
Mining	-	--	0	0	0.0
Construction	64	5.21	1.96	3.25	4.5
Manufacturing	659	53.66	2.80[b]	50.86	69.8
Transport., Commun.	47	3.83	2.59	1.24	1.7
Wholesale & Retail Trade	236	19.22	11.63	7.59	10.4
Finance, Insurance	22	1.79	1.14	0.65	0.9
Business Repair Services	21	1.71	1.01	0.70	1.0
Personal Services	35	2.85	1.30	1.55	2.1
Entertainment	6	0.49	0.30	0.19	0.3
Professional Services	75	6.11	3.39	2.72	3.7
Public Administration	54	4.40	0.80	3.60	4.9
TOTAL	1,228	100.00	27.18	72.82	99.9

[a]Computed from regression coefficients

[b]Estimated from Table

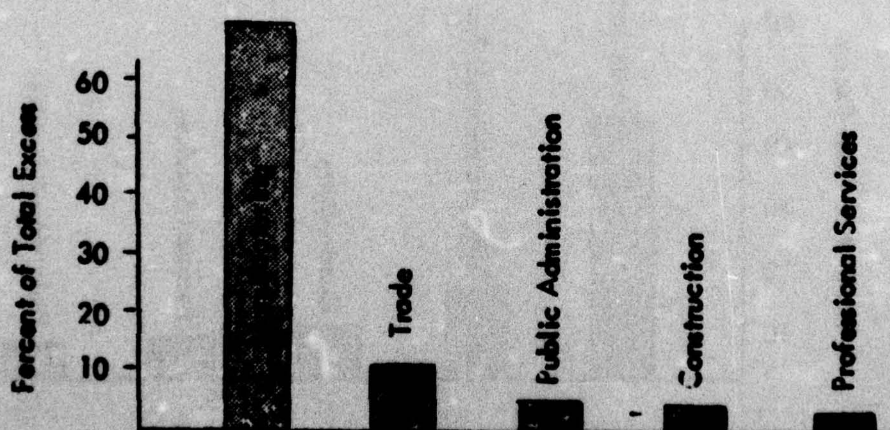


Figure 5

MINIMUM REQUIREMENTS: FLAT RIVER, MO.
1950 Population: 5,308 (log = 3.725)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	8	0.42	0.33	0.09	0.1
Mining	608	31.83	0	31.83	45.4
Construction	68	3.56	2.25	1.31	1.9
Manufacturing	293	15.34	2.40[b]	12.94	18.5
Transport., Commun.	144	7.54	2.81	4.73	6.8
Wholesale & Retail Trade	374	19.58	11.87	7.71	11.0
Finance, Insurance	34	1.78	1.25	0.53	0.8
Business Repair Services	37	1.94	1.11	0.83	1.2
Personal Services	95	4.97	2.75	2.22	3.2
Entertainment	15	0.79	0.35	0.44	0.6
Professional Services	186	9.74	3.83	5.91	8.4
Public Administration	48	2.51	1.00	1.51	2.2
TOTAL	1,910	100.00	29.95	70.05	100.1

[a]Computed from regression coefficients
[b]Estimated from Table

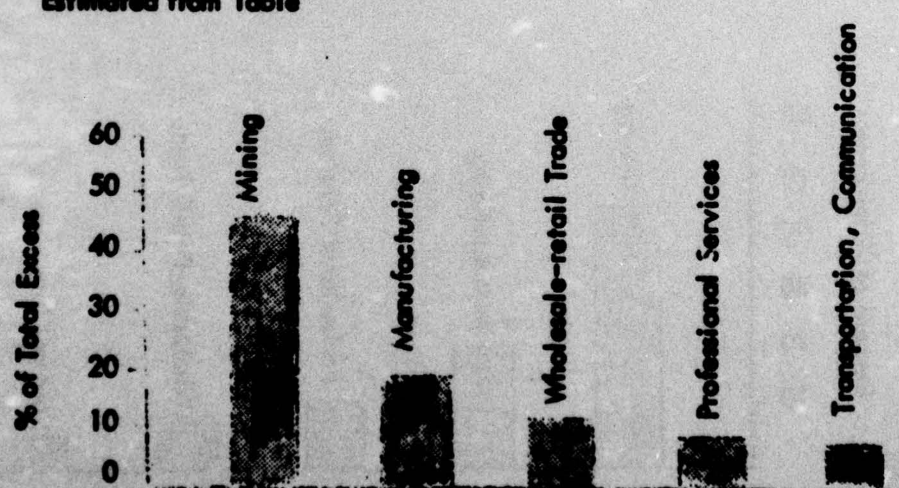


Figure 6

MINIMUM REQUIREMENTS: BONNE TERRE, MO.
1950 Population: 3,533 (log = 3.547)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	6	0.50	0.28	0.22	0.3
Mining	3.81	31.67	0	31.67	43.8
Construction	34	2.83	2.05	0.78	1.1
Manufacturing	215	17.87	2.80[b]	15.07	20.8
Transport., Commun.	133	11.06	2.65	8.41	11.6
Wholesale & Retail Trade	195	16.21	11.69	4.52	6.3
Finance, Insurance	22	1.83	1.17	0.66	0.9
Business Repair Services	22	1.83	1.04	0.79	1.1
Personal Services	45	3.74	1.34	2.40	3.3
Entertainment	5	0.42	0.31	0.11	0.2
Professional Services	122	10.14	3.52	6.62	9.2
Public Administration	23	1.91	0.86	1.05	1.5
TOTAL	1,203	100.01	27.71	72.30	100.1

[a]Computed from regression coefficients
[b]Estimated from Table

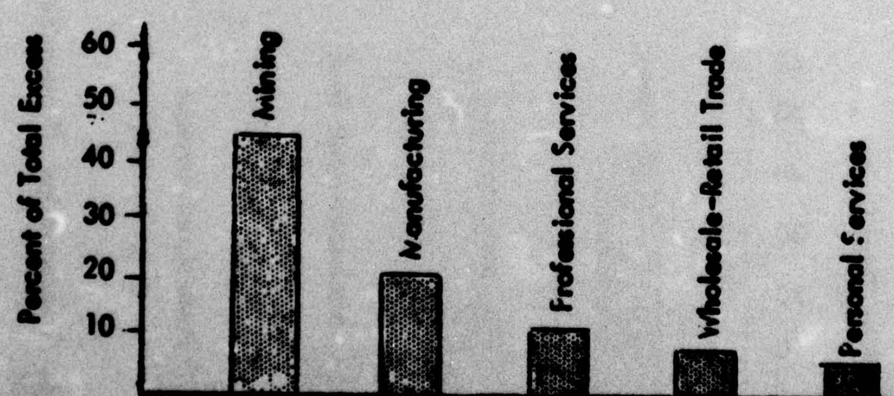


Figure 7

MINIMUM REQUIREMENTS: VALLEY PARK, MO.
1950 Population: 2,956 (log = 3.471)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	28	2.75	0.26	2.49	3.5
Mining	18	1.77	0	1.77	2.5
Construction	111	10.90	1.96	8.94	12.6
Manufacturing	371	36.44	2.80[b]	33.64	47.5
Transport., Commun.	149	14.64	2.59	12.05	17.0
Wholesale & Retail Trade	159	15.62	12.38	3.24	4.6
Finance, Insurance	12	1.18	1.14	0.04	0.0
Business Repair Services	35	3.44	1.01	2.43	3.4
Personal Services	35	3.44	2.60	0.84	1.2
Entertainment	11	1.08	0.30	0.78	1.1
Professional Services	64	6.29	3.39	2.90	4.1
Public Administration	25	2.46	0.80	1.66	2.3
TOTAL	1,018	100.01	29.23	70.78	99.8

[a]Computed from regression coefficients

[b]Estimated from Table

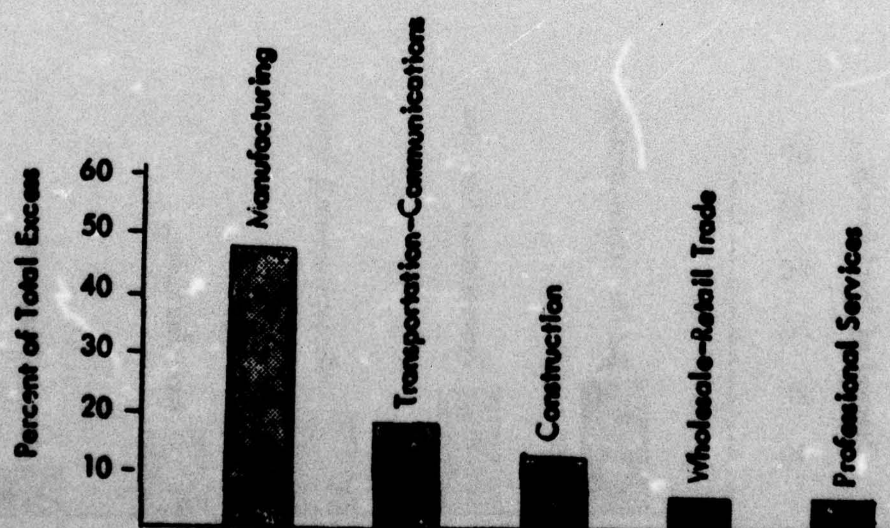


Figure 8

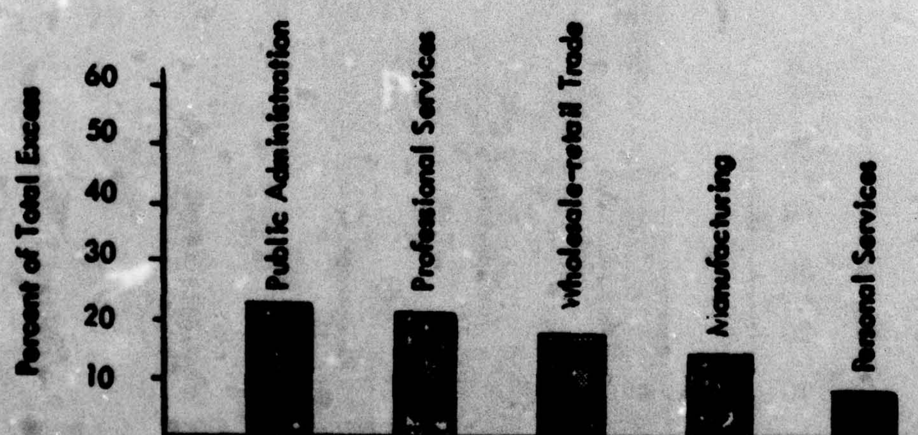
MINIMUM REQUIREMENTS: ROLLA, MO.

1950 Population: 5308 (log = 3.725)

Industry Type	Number Employed	Percent Employed	Minimum Percent Required[a]	Percent Excess	Percent of Total Excess
Agriculture	52	1.80	0.40	1.40	2.1
Mining	17	0.59	0	0.59	0.9
Construction	156	5.39	2.53	2.86	4.2
Manufacturing	334	11.53	2.40[b]	9.13	13.4
Transport., Commun.	161	5.56	3.02	2.54	3.7
Wholesale & Retail Trade	681	23.52	12.11	11.41	17.0
Finance, Insurance	71	2.45	1.35	1.10	1.6
Business Repair Services	92	3.18	1.22	1.96	2.9
Personal Services	246	8.49	2.88	5.61	8.2
Entertainment	48	1.66	0.40	1.26	1.8
Professional Services	558	19.27	4.24	15.03	22.0
Public Administration	480	16.57	1.19	15.38	22.5
TOTAL	2,896	100.01	31.74	68.27	100.3

[a]Computed from regression coefficients

[b]Estimated from Table



As expected, these communities show up extremely high in mining which amounts to over 40% of excess employment in the case of Flat River and Bonne Terre (Figures 5 and 6). Nevertheless, manufacturing runs a close second and is a growing activity. In fact, manufacturing is of some importance in all basin communities.

Some special cases

The community of Rolla and those communities on the fringe of Metropolitan St. Louis which are located in the basin, appear to be special cases of the basin industrial economy. Manufacturing predominates in the urban fringe communities such as Valley Park, but their employment is more similar to the metropolitan complex than the basin economy (Figure 7). Note the unimportance of wholesale-retail trade in the case of Valley Park, for example. This function is largely performed by other areas in the St. Louis metropolis. The nature of industry in Valley Park and other urban fringe communities is different from that in the main concentration of basin communities. These communities in the urban fringe will therefore be used more for contrast purposes than as a prototype of the basin economy.

Rolla is a much different case -- distinct from the aforementioned basin communities (Figure 8). Public administration, professional service, and wholesale-retail trade are the predominant employment activities. Manufacturing, in contrast to all other communities ranks only fourth in importance. Note also that the trade area of Rolla is mostly outside the basin (Figure 1). For most analytical purposes, Rolla should not be considered part of the basin.

On the other hand, some near-by communities are outstanding representatives of the basin industrial economy. Some of these communities have part of their trade areas in the basin as witness DeSoto and Ironton (Figure 1). Washington has none of its trade area in the basin, but is strikingly similar to other communities in the basin. Paradoxically, Washington's activities often reveal more about the industrial economy of the basin than those of the basin communities themselves.

Industrial Composition

General

The Meramec Basin contains approximately 100 industries, and employs over 10,000 workers in industry.[3] (See Appendix A.)

Table 1

INDUSTRIAL COMPOSITION OF SIX LEADING TYPES OF INDUSTRY IN THE MERAMEC BASIN

Industry Type	Number of Firms	Number of Employees	Percent of All Industrial Employees in Meramec Basin
Shoe	20	5,318	52.8
Mineral and Mining	9	2,855	28.4
Apparel	5	735	7.3
Metal	11	502	5.0
Agriculture-based	2	340	3.4
Forest-based	6	313	3.1
TOTAL	63	10,063	100.0

Source: Questionnaires sent to industries and Chambers of Commerce in basin communities. Excludes all communities in the urban fringe of Metropolitan St. Louis except Pacific and Valley Park.

The shoe industry is by far the most important basin industry and accounts for over half of all industrial employees. Mineral and mining industries, apparel and metal industries are also important. Agriculture-based industries, however, are few.

Shoe industries

The shoe industries account for some 25 firms and employ over 5,000 workers. The average number of workers per plant amounts to several hundred. Shoe industries provide the primary excess employment in most basin communities.

All communities in the basin contain at least one shoe company, except those in the urban fringe of Metropolitan St. Louis such as Valley Park. Several mining communities also have no shoe industry, but the mining complex as a unit has several. Most transportation-oriented communities have at least two shoe companies, as at Cuba, Owensville, St. Clair, Sullivan and Union. Brown Shoe Co. and International Shoe Co. own about half the firms and employ more than half the total shoe employees. Both men's and women's shoes are manufactured, but several firms specialize in shoe parts such as heels and soles.

Unfortunately, the shoe industries pay relatively low wages and provide more work for women than for men. In addition, they are all owned by outside basin interests and the top management personnel is provided by the parent companies. Nonetheless, these companies are often the backbone of the community and provide much needed employment for many persons who would be unable to find other work. An assessment of the value of further shoe factory promotion will be discussed in the next section.

Mineral and mining industries

Mineral and mining industries are second in importance in the basin and account for almost 30% of all industrial employees. St. Joseph Lead Company in Bonne Terre is by far the predominant employer, and accounts for about 90% of all mining workers. The other area of major mining and mineral manufacturing is at Pacific where Pioneer Silica Company and many sand and gravel operations exist. Other than these two areas, mineral industries are primarily limited to concrete products. Mineral industries are likely to become more important in the future. (See Chapter 5 of this volume.)

Apparel industries

If it were not for lead deposits, the apparel industry would be next to the shoe industry in importance. In fact, the industrial requirements for apparel manufacturing appear to be similar to those for shoe manufacturing. Nevertheless, the apparel industry is restricted to the southern portion of the basin -- namely Bonne Terre, Bourbon, Salem, and St. James. The major apparel center, Salem, has over 400 of the 735 apparel employees. Unlike shoe industries, apparel industries are owned by a number of separate companies. The main office is usually located in St. Louis, however.

Metal industries

The metal industries are growing rapidly, but are confined to the transportation-oriented communities along Highways 50 and 66. Sullivan is the predominant center and contains almost 300 metal workers. Carburetor parts and piston rings are the main metal products manufactured in Sullivan, but a wide variety of metal products are produced elsewhere. The community of Washington, for example, just north of the basin, has a wide assortment of metal industries. Most metal industries, other than the larger factories, are locally owned and operated although some have moved out from St. Louis. The average number of workers is far less in the metal industries than in the shoe or apparel industries.

Agriculture-based industries

As mentioned, agriculture-based industries are extremely limited. Including Rolla, they account for only some 3% of all basin industrial workers. The largest center of agriculture-based industry is Union which recently has opened a large frozen food company. There may be good potential for such industries, but at the present time they are few in number. It must be pointed out, however, that agricultural product industries are especially prominent in Washington to the north of the basin. Washington is the corncob pipe capital of the world.

Forest-based industries

Forest-based industries employ the smallest percent of industrial workers in the basin. Such industries are located near the better forest land in the southern portion of the basin, notably near Salem, Steelville, and Cuba. Most forest industries manufacture board flooring, but a growing number of firms are developing thriving charcoal businesses. The Meramec Basin appears to have good potential for further development of specialized forest industries, which is now just getting under way.

Industrial assessment

Most industries in the basin appear to manufacture small products such as shoes, specialty items such as corncob pipes, and other products requiring relatively little capital investment and skill. There is much production flexibility since the number of workers is directly related to output. Another common trait is that the raw materials are generally of low value relative to the finished product. The finished product, being small and relatively expensive for its size, can stand high transportation costs.

Most manufacturing is controlled and owned by outside firms. The larger plants especially are branch plants of parent industries, and often manufacture specialized segments of the product rather than the complete product itself.

Most industries in the basin are also "footloose". That is, they can locate many different places in the United States, but often seek out those areas which offer the greatest concessions in terms of taxes, low wage rates, little unionization, etc. Such industries are easily attracted to the basin by inducements, but by the same token are often quick to leave should adverse conditions arise. The newspapers sometimes carry information to the effect that such and such local industry will be forced to move unless a new building is provided by the community. Unfortunately such threats must be taken seriously as they are capable of being carried out.

The Dilemma of Industrial Promotion

Most communities in the basin have active industrial promotion programs. These communities often provide free land, a minimum of taxes, and sometimes free buildings, as well as low wage work force, to an industry which will locate in their area. The number of employees is the primary criterion for judging the desirability of a prospective industry. In fact, it often seems as if some promotion groups are trying to capitalize on the very things the basin is trying to remedy -- low wages, jobs for women only, and unskilled labor.

Nonetheless, these communities are acting rationally. They realize that industry generally is basic or export employment. Most towns and larger promotional agencies, however, do tend to exaggerate the multiplier effect. An export or basic employee in a small town does not support as many service employees as in a large metropolis. A community of 3,000 - 10,000 on the average has about three to five "service" workers to every ten export (factory) employees, as compared to more than twice this number for cities over 100,000.[4]

Faced with the choice of moving, commuting to St. Louis, or going without work, however, local inhabitants have welcomed whatever industry they can get. Such industry is necessary for many "unskilled" part-time farmers or their wives. Over the long run, however, much of this industry should be considered only a transitional aid.

But could these communities become more selective in soliciting industries, and could they attract higher paying industries even if they desired? They could become more selective, but they would probably get few new industries. These communities do have assets, but they are similar to thousands of other communities -- and this is the crux of the problem. Since they are so similar to others elsewhere, they must make themselves attractive by offering concessions. Offering such concessions makes it difficult to provide needed community facilities, -- schools, etc. -- with which to make themselves truly distinctive and attractive. Population, however, does increase, and threshold sizes are reached for the initiation of many private and public facilities not otherwise available, but these again are common to any community of such population.

Industrial development of the type noted can be an asset or a deficit to the area involved. Community services must be improved to accommodate the new industry, land must usually be provided free, and citizens must work at low wages compared to opportunities in St. Louis and elsewhere. Of course any work is better than no work, but this is not the whole argument. The argument is whether such industrial development represents: (1) merely a stopgap in mobility to other areas of the country, (2) the retention of the least capable citizens with little hope of advancement, or (3) a solid asset to the area. Probably it is a little of all three. Nevertheless, many industries in basin towns do not appear really to care about their communities, although there are exceptions. Most are branch plants; their management is transferred from one plant to another; the plant generally has little intention of staying long should conditions change.

Many basin communities of course can do something to improve their situation. Some development can accrue from metropolitan expansion, mining, or recreation servicing, as well as from industry. The local community should assess its position intelligently, cooperate effectively, and work hard to take advantage of whatever distinctive assets it may have or can discover. Basin communities truly need promotion, but inside promotion must precede outside promotion if it is to be effective.

REFERENCES AND NOTES

1. Chauncy D. Harris and Edward L. Ullman, "The Nature of Cities," Annals of the American Academy of Political and Social Science (November, 1945) 7-17.

2. Edward L. Ullman and Michael F. Dacey, "Minimum Requirements Approach to the Urban Economic Base," Proceedings Regional Science Association (1960), 175-194.

3. This information was compiled from questionnaires returned by Chambers of Commerce and industries in the Meramec Basin. Data were checked with the 1954 Census of Manufacturing and appear to be reasonable. The complete list of industries is contained in Appendix A at the end of this chapter. Additional community inventory data obtained from the questionnaires are contained in a separate appendix.

4. Ullman and Dacey, op. cit. The "local" or "service" employment (multiplier) dependent on outside (factory jobs) is in general grossly overestimated for small towns by all advisory groups at both state and national levels.

APPENDIX A

Table 2

INDUSTRY IN THE MERAMEC BASIN[a]

Industry	Number of Employees	Product(s) Manufactured	Years in Operation
Bonne Terre			
Bonne Terre Foundry	15	Iron casting	NA
Murphy Concrete Block	18	Concrete blocks	NA
Reliance Wear Co.	80	Women's wear	NA
St. Joseph Lead	2,500	Lead, zinc, etc.	NA
Service Heel	150	Plastic heels	1
Valley Dolomite	80	Dolomite	NA
	2,843		
Bourbon			
Paramount Cap	175	Headwear	26
Proctor Counter Co.	40	Shoe counters	7
	215		
Cuba			
Convoy Shoe Supplies Co.	150	Parts for shoes	6
Cuba Mfg. Co.	35	Metal lockers	3
Cuba Shoe Co.	240	Women's shoes	9
Echo Supplies Co.	63	Shoe dies	24
Fleming Mfg. Co.	75	Concrete block machines	8
Monarch Mfg. Co.	50	Oak flooring	8
Wayne Metal Co.	3	Metal assembly	1
	616		
DeSoto			
Better-Bilt Mfg. Co.	15	Fabricated metal products	2
Chrome Line Casket Co.[b]	15	Caskets	1
DeSoto Dairy Ice and Supply	15	Ice Cream	50
Hamilton Shoe Co.[b]	250	Shoes	3
Structural Components	5	Plywood and laminated lumber	1
	300		
Flat River			
No information available			

[a] All data obtained from questionnaires sent to Chambers of Commerce and other similar organizations in respective communities.

[b] Obtained from Chamber of Commerce information only.

Table 2 (continued)

INDUSTRY IN THE MERAMEC BASIN

Industry	Number Employees	Product(s) Manufactured	Years in Operation
Owensville			
Allied Chemical Co.[b]	50	Fire clay	17
Brown Shoe Co.	350	Shoes	15
O'Sullivan Industries	50	Metal furniture	6
Owensville Shoe Mfg. Co.	250	Women's shoes	60
	700		
Pacific			
Alton Box Board Co.	120	Cardboard	12
CalciCrete Corp.	45-65	Lightweight bldg.materials	3
Meramec Sand and Gravel Co.	40	River sand and gravel	NA
Pacific Pebbles, Inc.	30	River sand and gravel	20
Pacific Shoe Co.	65	Shoes	20
Pioneer Silica Co.	60	Type of sand used in furnaces (blast) and glass works	13
St.Louis Material & Supply Co.	30	River gravel and sand	40
Shepherd Well Drilling Co.	15	Well drilling & excavating co.	20
	405-425		
Potosi[c]			
Brown Shoe Co.	340	Women's shoes	19
Reed Lumber Co., Inc.	37	Pallet crates & wood products	11
Woodheel Plant (Brown Shoe Co.[b])	250	Wooden shoe heels	11
	627		
Rolla			
Holsum Bakers	100	Bakery goods	11
Johnson-Stephen-Shinkle	350	Women's shoes	25
	450		
Salem			
Banad Lingerie Co. of Salem	100	Ladies sleepwear	7
Floyd Charcoal Plant[b]	50	Charcoal	2
International Shoe Co.	450	Women's shoes	12
Ozark Oak Flooring Co.	31	Oak flooring	1
Salem Sportswear[b]	300	Sportswear	NA
	931		

[b]Obtained from Chamber of Commerce information only.

[c]Over 400 are employed by various mining concerns in the vicinity.

Table 2 (continued)

INDUSTRY IN THE MERAMEC BASIN

Industry	Number Employees	Product(s) Manufactured	Years in Operation
St. Clair			
Deb Shoe Co., Inc.	265	Women's shoes	9
International Shoe Co.	125	Heels and outsoles	5
Missouri Knife Co.[b]	7	Advertising specialties	13
Steelweld Co.[b]	60	Truck bodies	4
	457		
St. James			
International Shoe Co.	130	Sole factory	15
Page Sportswear	80	Jackets	11
	210		
Steelville			
Brown Shoe Co.	150	Boxtoes, insoles, heels	12
Erma's Firearms Mfg.Co., Inc.[b]	12	M-1 Rifle receivers & barrels	2
Hardwood Charcoal Co.[b]	25	Charcoal	31
	187		
Sullivan			
International Shoe Co.	411	Shoes	40
Midwest Footwear, Inc.	202	Women's slippers	10
Nieman Tool & Machine Co.	23	Dies and tools	9
Pacco Corporation[b]	100	Carburetor parts	11
Ramsey Corporation	122	Piston rings	14
	858		
Union			
Brown Shoe Co.[b]	300	Women's shoes	9
Carmo Shoe Mfg. Co.[b]	600	Women's shoes	21
Fraser Shoe Co.	NA	Shoes	NA
Holiday Food Co.	240	Frozen prepared food	2
Union Heel Co.	NA	Shoe heels	NA
	1140		
Valley Park			
Absorbent Cotton Co.	200	Surgical cotton & gauze	44
Archer-Daniel-Midland	65	Alkyd resins, paint oil, varnish	36
Dennis Electrical Contractors	35	Electrical construction	16
Lock Joint Pipe Co.	65	Concrete pipe	25
Masco Materials Co.	12	Concrete	5

[b] Obtained from Chamber of Commerce information only.

Table 2 (continued)

INDUSTRY IN THE MERAMEC BASIN

Industry	Number Employees	Product(s) Manufactured	Years in Operation
Valley Park, continued			
Meramec Valley Block Co.	20	Concrete	16
Precision Forgings Co.	26	Metal forging	8
St.Louis Boat & Canoe Co.	7	Boats, canoes, and parts	36
Simpson Sand & Gravel Co.	40	Sand and gravel	24
Valley Park Bottling Co.	9	Soda water	35
Wainwright Industries	40	Metal stampings	14
Woodenware Products Co.	83	Step and extension ladders, lawn chairs	14
	602		
Washington			
Bueschers Industries, Inc.	60	Corncob pipes	18
Deb Shoe Co.	450	Women's shoes	11
Durham Duenke Co.[b]	8	Metal meter boxes	3
Ernest Hazel, Jr., Inc.	70	County recorders, binders, etc.	0
Hirschl & Bendheim	40	Corncob pipes	90
International Shoe Co.[b]	660	Shoes	54
Jefferson Products Co.	50	Filter driers	8
M. W., Inc.[b]	11	Hand trucks	3
Mid-Continent Tab Card Co.	7	Tabulating cards	1
Missouri Meerschaum Co.	100	Corncob pipes	98
Mutual Garment[b]	85	Ladies undergarments	3
Orna Metals, Inc.[b]	28	Steel commercial furniture	16
Riechens Body Co.	9	Truck bodies	3
Sporlaw Valve Co.[b]	130	Valves	6
Washington Building Blocks[b]	6	Concrete blocks	11
Washington Metal Products[b]	197	Fabricated metals	9
Zero Manufacturing Co.	140	Dairy farm equipment	28
	2,051		
GRAND TOTAL	12,592 - 12,612		

[b] Obtained from Chamber of Commerce information only.