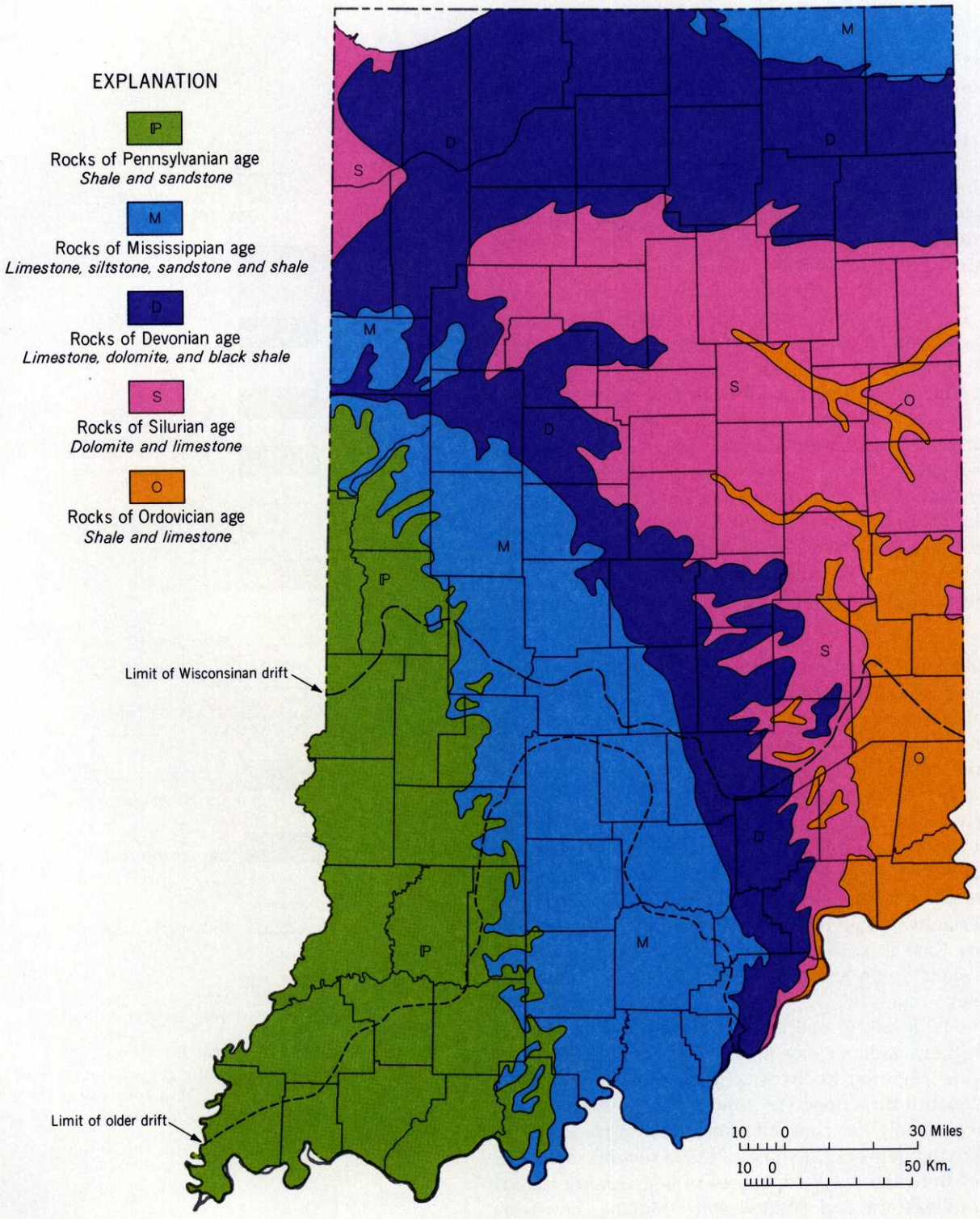

Figure 8
Map of Indiana showing general distribution of bedrock deposits.

Lawrenceburg, and the youngest (Pennsylvanian) rocks underlie Evansville and Terre Haute.

Soils The process of soil formation is controlled by regional climatic conditions. The basis of soil formation is the gradual weathering and decomposition of soil parent materials. The basic parent materials of Indiana soils are glacial drift and various bedrock formations. Figure 9 indicates the location of parent materials of Indiana soils.

During the process of soil formation vegetation establishes itself. As the vegetational communities develop, organic matter accumulates on the ground, and soil profiles are developed. With the introduction of vegetation, micro-flora and fauna also develop. Over time, the modern day soils were developed, each with individual characteristics and physical properties.

Soils and the underlying geologic formations create an intimate association with the water resource. Each individual soil has a distinctive permeability characteristic, which governs its capacity to absorb precipitation and to transmit it to underlying geologic formations. The basic components of soil are sand, clay, and silt. The higher the content of sand, the greater the permeability.

Landforms Northern and central Indiana can be divided into four principal and several subsidiary topographic regions on the basis of characteristic landforms, as shown in Figure 10. Table 1 describes the characteristics of these topographic regions. Only the dissected Wabash Valley region (3h) does not have a nearly completely glacially influenced origin. The upland rim of Lake Michigan (1b) and the northeastern (4) and central (3) regions are flat plains to rolling uplands whose origins relate primarily to deposition by either actively moving or disintegrating ice. The basin of the Kankakee River (2) is basically one of glacial meltwater origin and has been modified by wind. Two subsections (1a, 3g) are flat plains, the former lakebeds of late glacial Lakes Chicago and Maumee.

Southern Indiana can be divided into seven topographic regions, each of which is elongated in a north-south direction. The topography of each region reflects mainly the character and outcrop trend of the underlying bedrock. In some of these regions, soils are rather thin, and many exposures of bedrock are found. In southeastern and southwestern Indiana, however, deposits of the older glaciers extend essentially to the Ohio River, and in both these areas the bedrock surface is partly buried by deposits associated with glacial activity. On the hilltops these deposits commonly are only a few feet thick, but in the larger valleys their thicknesses may reach 100 or more feet.

Figure 9
Map of Indiana showing the general location of parent materials to Indiana soils. Map courtesy of the U.S. Soil Conservation Service.

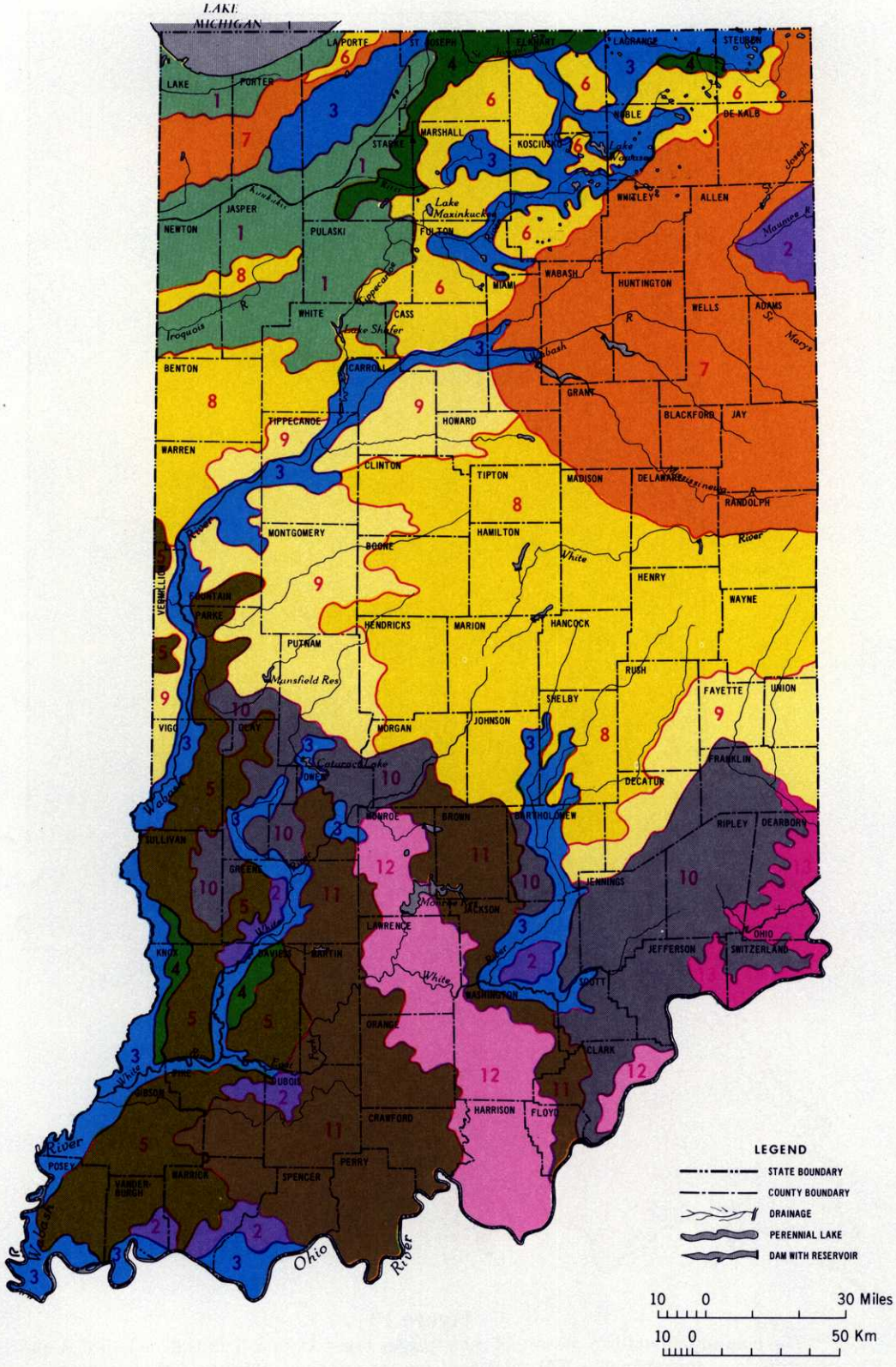
LAKE MICHIGAN
LAPORTE
ST. JOSEPH
ELKHART
LAGRANGE
STEUBEN
LAKE
PORTER
NOBLE
DE KALB
MARSHALL
STARKE
KOSCIUSKO
Lake Wawasee
Lake Maxinkuckee
JASPER
WHITLEY
ALLEN
NEWTON
PULASKI
FULTON
MIAMI
WABASH
HUNTINGTON
WHITE
CASS
Lake Shafer
WELLS
ADAMS
BENTON
CARROLL
GRANT
BLACKFORD
JAY
TIPPECANOE
HOWARD
WARREN
CLINTON
TIPTON
MADISON
DELAWARE
RANDOLPH
MONTGOMERY
BOONE
HAMILTON
HENRY
WAYNE
FOUNTAIN
PARKE
HENDRICKS
MARION
HANCOCK
PUTNAM
Mansfield Res
RUSH
FAYETTE
UNION
SHELBY
VIGO
CLAY
MORGAN
JOHNSON
Cataract Lake
FRANKLIN
DECATUR
MONROE
BROWN
BARTHOLOMEW
RIPLEY
DEARBORN
SULLIVAN
GREENE
JENNINGS
JACKSON
LAWRENCE
KNOX
DAVIESS
MARTIN
JEFFERSON
OHIO
SWITZERLAND
WASHINGTON
SCOTT
ORANGE
CLARK
DUBOIS
PIKE
GIBSON
CRAWFORD
HARRISON
FLOYD
POSEY
PERRY
VANDERBURGH
WARRICK
SPENCER
Wabash River
White River
Ohio River
LEGEND
STATE BOUNDARY
COUNTY BOUNDARY
DRAINAGE
PERENNIAL LAKE
DAM WITH RESERVOIR
10 0 30 Miles
10 0 50 Km

Figure 10

The map of Indiana is a mosaic of nine images taken from a "Landsat" satellite at an altitude of approximately 570 miles showing the principal and subsidiary topographic regions of Indiana.

Table 1

Description of the topographic regions located in Indiana.

Reference Number	*Topographic Unit*
1a	Low, flat, poorly drained clay and till plain of glacial Lake Chicago interspersed with sand, linear swales, and beach ridges
1b	Rolling, hummocky, clayey till on uplands of Valparaiso and Tinley Moraines
2	Low-lying sand and much outwash plain interspersed with sheet and dune, windblown sand
3a	Plain of mostly clayey till interspersed with looping belts of rolling, hummocky, ridged, morainic upland
3b	Morainic ridges and plain with interspersed ice-disintegration forms, dunes, and lake flats
3c	Generally flat but subtly east-west fluted till plain with oriented drainage
3d	Till plain and moraines of loam till, some southwest-oriented drainage troughs and outwash features, grades to dissected Wabash Valley region
3e	Till plain and moraines of loam till interspersed with large-scale, ice-drainage troughs
3f	Plain of clayey till interspersed with narrow looping belts of rolling, hummocky, ridged, moraine upland
3g	Low, flat, poorly drained till-plain bed of glacial Lake Maumee with marginal sandy beach deposits
3h	Stream-dissected till plain and valley bottom underlain by drifts of various ages, bedrock, outwash, and alluvium; grades into bordering topographic regions
4	Complex interlobate loam till and outwash moraine topography with interspersed lakes, bogs, and glacial drainage troughs and plains
5	Rolling plains underlain by loess, till, and bedrock; broad valley flats underlain by thick deposits of alluvium, outwash, and lake deposits
6	Hills of moderate to strong relief underlain principally by shale and sandstone bedrock
7	Broad uplands underlain by limestone, much dissected by streams in some areas and in others marked by a sinkhole plain with extensive underground drainage
8	Steep hills of strong to moderate relief mainly underlain by siltsone bedrock; a fringe area with lower relief has a patchy cover of till
9	Broad plains underlain mainly by till, outwash, and lake deposits; in southern part, low hills of shale bedrock with a thin cover of till
10	Broad uplands underlain by limestone with a thin, patchy till cover, much dissected by streams in most areas
11	Steep hills of strong to moderate relief, underlain by shale and limestone with a thin, patchy till cover

Major Drainage Basins

A very important landform from the water resource standpoint is the drainage basin. A drainage basin is an area that gathers water originating as precipitation and contributes it ultimately to a stream or other body of water. All streams, from the smallest to the largest, have associated drainage basins from which their flows are derived. The two major drainage basins in Indiana are the Great Lakes and the Mississippi River Basin, as shown in Figure 11.

The Great Lakes drainage consists of the Little and Grand Calumet Rivers and minor tributaries to Lake Michigan in northwestern Indiana; the St. Joseph River basin in northern Indiana, which also drains to Lake Michigan; and the Maumee River basin in the northeastern part of the state, which drains to Lake Erie. The Great Lakes drainage portion of Indiana totals approximately 3,545 square miles, including 241 square miles in Lake Michigan.

The Mississippi River drainage consists of two major areas of the state. The first of these is composed of the basins of the Kankakee and Iroquois Rivers, which drain westerly into Illinois and thence to the Mississippi River via the Illinois River. The total area within this section is approximately 3,016 square miles.

The second portion of the Mississippi River drainage, which encompasses about seventy-seven percent of the state, is made up of the basins of the Wabash River, the Whitewater River, and a number of minor tributaries to the Ohio River along the southern portion of the state. These all drain to the Ohio River and thence to the Mississippi. The total area within this section is approximately 29,730 square miles. Table 2 provides information on the major sub-basins and their respective drainage areas, including the out-of-state portions.

The availability of water in Indiana is not totally confined to that originating within the boundaries of the state. There are two general cases in which the availability of water to Indiana is or may be directly influenced by actions of other states.

The first case has reference to those interstate lakes and rivers that comprise a part of the boundaries of the state. These are Lake Michigan, the lower Wabash River, and the Ohio River. The quantities of water available to Indiana in this case are in part a function of water use developments in all the other states in the river or lake basin, and the water uses from the lake or stream in the state or states abutting on the boundary waters. It is perhaps reasonable, or at least conservative, to assume that the quantities of water available to Indiana in this case may tend to decrease rather than to increase.

The second case has reference to those streams entering into Indiana from the States of Michigan, Ohio, and Illinois. Again, the quantities of water entering into the state in this case are dependent upon water resource developments and uses within Michigan, Ohio, and Illinois. The reasonable assumption would be that in time quantities may well be subject to diminution as a result of uses in those states.

Table 2

The areal extent in square miles of the major drainage basins in Indiana and those portions that extend into surrounding states.

Drainage Basins and Rivers	*Indiana*	*Illinois*	*Michigan*	*Ohio*
Great Lakes Drainage Basin				
St. Joseph River	1,778	0	1,964	0
Calumet River	551	34	0	0
Maumee River	1,216	0	234	697
Upper Mississippi River Drainage Basin				
Kankakee and Iroquois Rivers	3,016	0	0	0
Wabash Drainage Basin				
Wabash River	23,950	8,704	0	285
Ohio River Tributary Drainage Basin				
Whitewater River	1,403	0	0	145
Minor Tributaries To Ohio River	4,377	0	0	0

Figure 11
Map of Indiana and adjacent states showing the major and minor drainage basins.