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Distribution of the herpetofauna of Kentucky.

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DISTRIBUTION OF THE HERPETOFAUNA OF KENTUCKY

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INTRODUCTION

Although the herpetofauna of Kentucky is extensive and varied, it has received much less attention than that of most other states. Many herpetologists have reported on various phases of the state's amphibians and reptiles, but for the most part these reports are discrete, either pertaining to a collection, or a generic or specific study. Hence, there is no single adequate work which aptly describes the herpetology of Kentucky as a whole. When one realizes the keystone position of Kentucky in relation to northern and southern forms, the need of a zoogeographical summary of the state becomes even more apparent. Therefore, the purpose of this paper is to summarize and correlate the herpetofauna with the natural factors which influence its present distribution in Kentucky. It is the purpose of this work to present not a detailed and complete study, but rather a generalized summary of the available collections and published reports in the hope that it may be of value not only as a reference but as a stimulus for further investigation of the zoogeography of the state.

In the course of collecting and organizing this scattered mass of material, many people have offered assistance without which this work could not have been completed. The author is deeply indebted to Dr. William M. Clay of the Biology Department of the University of Louisville who suggested this problem and has helped engineer its course. The author would like to thank Dr. P. A. Davies of the University of Louisville, M. Graham Netting of the Carnegie Museum of Pittsburgh, and

Roger Barbour of Morehead State Teachers College for permission to examine and use their Kentucky collections and data. The author is grateful to Dr. Harvey B. Lovell who supplied much valuable information pertaining to the botany of the state.

METHODS

To ascertain which species and subspecies occur in Kentucky the author has utilized many published lists, handbooks, generic monographs, reports on species and subspecies, and private collection material. These publications will be found in the bibliography. Locality records and collection data for each species and subspecies were plotted first on large state maps. It was originally planned that these maps could be reduced and used as an integral part of the text. However, since no inexpensive method of reproduction was available, the distribution of these forms in the state can only be expressed verbally.

In the attempt to determine those factors that could possibly limit the distribution of the herpetofauna in Kentucky, major physiographic, climatic and botanic influences had to be considered. From the vast amount of literature pertaining to these factors the author has summarized their major features and characteristics which seem to play an important role in the present distribution. Some writers (vide infra) have recognized six major physiographic areas of the state. It seems desirable to employ these same subdivisions in the following discussion of ecological factors.

FACTORS INFLUENCING FAUNAL DISTRIBUTION

PHYSIOGRAPHY

In order to correlate the distribution of the herpetofauna with the physical regions of the state, a brief knowledge of the geography and geology of these regions is necessary. The following information has been taken primarily from A. M. Miller's Geology of Kentucky.

Kentucky can be divided into six well defined physiographic regions (fig. 1). These include: 1) the Mississippi embayment or Purchase Region in southwestern Kentucky, 2) the Coal Fields in western Kentucky, 3) the Lower Carboniferous Plateau or Pennyroyal district in southern and southwestern Kentucky, 4) the Bluegrass in north central Kentucky, 5) the Knobs, and 6) the Cumberland plateau including the eastern Kentucky mountains.

The Purchase Region

The "Jackson Purchase" is that part of the Mississippi embayment lying within Kentucky. It comprises an area of 4,600 square miles extending from the Tennessee River west to the southwestern border of the state at the mississippi River. This region is one of low relief, the general elevation sloping from 500 feet at the Tennessee River to about 350 feet near the Mississippi. The bottoms along the Ohio and Mississippi Rivers range between 300 and 350 feet above sea level. The topography of the uplands may be considered generally level. It was as late as the Tertiary Period that the Gulf of Mexico extended up the Mississippi Valley to slightly beyond the mouth of the Ohio. Therefore this region of uplands is a

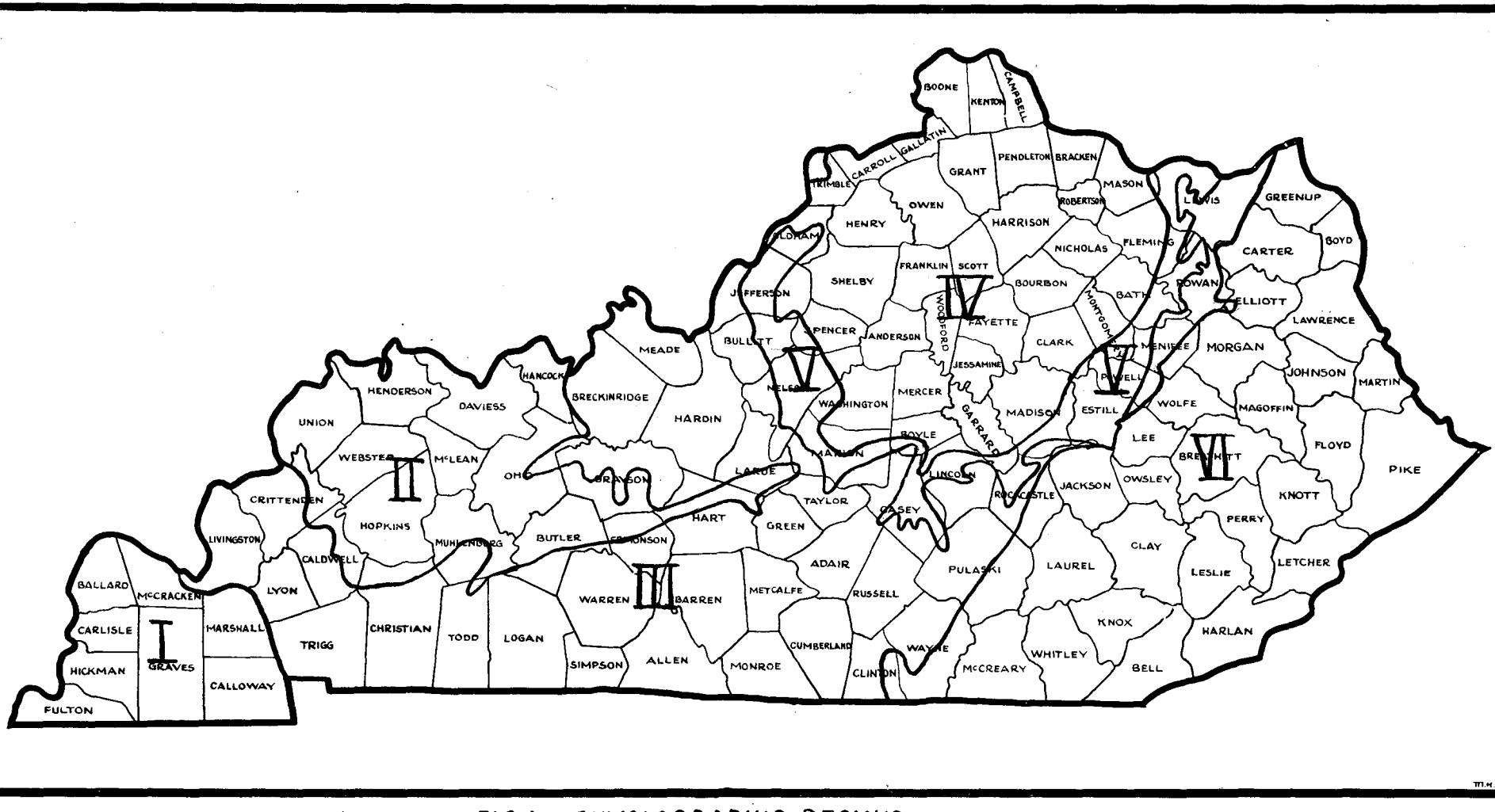

FIG. 1 PHYSIOGRAPHIC REGIONS

I PURCHASE

II WESTERN COAL FIELDS

III PENNYROYAL

IV BLUEGRASS

V KNOBS

VI EASTERN COAL FIELDS

recent geologic addition due to the uplift of the bottom of the northern portion of the Gulf of Mexico. The deposits remaining in this region consist of gravels, sands, clay, and loams. In general they form a level surface; however, due to their unconsolidated character some of the beds erode badly, particularly in the neighborhood of streams in the eastern part. Here in some places the land is broken by the development of recent gullies. The counties included in this region are Marshall, Calloway, McCracken, Graves, Ballard, Carlisle, Hickman, and Fulton.

Western Kentucky Coal Fields

This region, which occupies an area of 4,600 square miles, is surrounded by the Pennyroyal Region on the south, east and west, and its northern boundary extends to the Ohio River. It has a maximum upland elevation of 700 feet above sea level; however, most of it lies between the 500 and 600 feet contours, and considerable parts adjacent to the Ohio and Green Rivers have an elevation of 400 to 500 feet. The higher levels present a mature topography while the lower are flat areas of alluviation. Naturally these lowlands are quite fertile when drained. The soil of the upland is indifferent as it is formed from sandstone and shales. Owing to gentler slopes and less relief, it does not wash as badly as the soil of the eastern Kentucky Coal Fields, though both are composed of the same parent materials. This region includes primarily Union, Henderson, Daviess, Hancock, Webster, McLean, Ohio, Hopkins, Muhlenberg, parts of Butler, Grayson, Edmonson, Christian, Caldwell, and Crittenden Counties.

Pennyroyal Region

The Pennyroyal in Kentucky occupies a total area of 8,000 square miles. It includes, with the exception of the Western Coal Fields, all of the state lying south of the Knobs, west of the eastern Kentucky Mountains including the Cumberland plateau, and east of the Tennessee River. It possesses an altitude of 1,000 to 1,200 feet along its northern edge at Muldraugh's Hill, which is a steep escarpment toward the Bluegrass region. South and west from the escarpment the elevation gradually falls to 800 feet, and at the southwest portion of the area to 600 feet. Part of this region, which forms a narrow strip extending from the Ohio River about 35 miles west of Louisville southward to the Tennessee border, and around westward to the Cumberland River, was treeless in the early days and consequently was named the "Barrens" by the early Kentucky settlers. The geologic formations exposed in this entire region belong to the Mississippian formation. Three Main divisions, Waverly, Cavernous Limestone, and Chester, are noted and will be discussed in the order named.

Waverly. The Waverly formation, the oldest of the three, composes the surface rock of the Cincinnati anticline through this region. The surface in general is quite hilly, although level in Taylor County. The soil is poor but is better than the region of the knobs of the same formation because it is not completely devoid of limestone. The counties primarily affected by the outcrop in this region are Allen,Monroe, Cumberland, Barren, Metcalf, Adair, Casey, Taylor, Lewis, and Rowan.

Cavernous Limestone Area. On either side of the Waverly outcrop is a belt of cave limestone. In this section the highly

soluble limestones have been excavated by underground waters. In some parts sandstones still form a protective covering over the Limestone, while in others these have recently been removed. The regions from which the sandstone capping has been removed are pitted with sinks, forming a karst country. These sinks are former caves and caverns from which the roofs have been removed. The limestone strip south of the Western Coal Fields is not as typical karst country as the Green River area. Counties included in this region are Meade, Hardin, Larue, Hart, Edmonson, Barren, Simpson, Logan, Todd, Christian, Trigg, Lyon, Caldwell, Crittenden, Green, Clinton, Wayne, Russell, and Pulaski. All except the last four compose the "Barrens".

Chester Area. The Chester portion of the Carboniferous Plateau is composed primarily of sandstones and shales giving it a rough topography and a poor soil. It constitutes a strip five to ten miles wide, and is found chiefly surrounding the Western Coal Fields. This belt, composed primarily of Cypress sandstone, is marked off from the rest of the carboniferous district by a rise in the level of the country. The Chester terrace stretches from Breckenridge County through Grayson, Hardin, Hart, Warren, Logan, Todd, Christian, Caldwell, and to the Ohio River again at Crittenden County

North Central Bluegrass

The Bluegrass Region in its most inclusive sense is bounded by the Ohio River on the north, and a semicircular belt of knobs on the east, south, and west. It comprises an area of nearly 8,000 square miles. The Bluegrass Region proper, that limited to the

outcrop of Ordevician strata, is a rolling upland, the highest portion of which is on the Jessamine dome of the Cincinnati uplift. Here, it reaches an elevation of 1,050 feet. Elsewhere in the region the highest portions are about 950 feet; however, in general the upland level ranges between 800 and 900 feet above sea level.

The Bluegrass Region can be divided into three subordinate areas based on the differences in topography and soil which are dependent on the underlying formations. These areas succeed each other outwardly from the Jessamine dome and the order of outcropping is from older to younger. These areas enumerated from within outward are the Lexington (Trenton) - Cynthiana Limestone Area, Eden Shale Belt, and the Maysville - Richmond Limestone Belt.

Lexington-Cynthiana Limestone Area (Inner Bluegrass). It is the outcropping of the Lexington Limestone on and around the Jessamine dome that gives this area its distinctive topography and soil. The underlying High Bridge limestone also outcrops along the Kentucky River and its main tributaries, but enters in very little to the character of this area. The Lexington region is one of gently rolling topography and very rich soil due to the high phosphorus content. The area of Lexington outcrop is a thousand square miles. It includes Harrison, Nicholas, Bourbon, Clark, Madison, Gerrard, Boyle, Mercer, Anderson, Franklin, Scott, Fayette, Woodford, and Jessamine Counties. The Lexington limestone of this area is a mildly karst country, pitted with small sinks and having considerable underground drainage. The Cynthiana portion forms mainly the outer border of the Inner Bluegrass, being widest in Clark, Bourbon, Nicholas, and Harrison Counties. It exists also as patches and strips within the Lexington Limestone area. It covers an area of

1,400 square miles. The Cynthiana soil is not as rich as the Lexington.

Eden Shale Belt. Lying further out on the Jessamine dome the Eden Shale is an irregular ring around the Inner Bluegrass for an area of 2,500 square miles. It extends five to ten miles on the east and west slopes, ten to thirty on the north slope, and is extremely narrow on the south side because of a very steep dip. Fenneman states that in topography, soil, culture, and wealth this district and the Inner Bluegrass are strongly contrasted; only the altitude is similar.[1] Because of the predominance of shale in this region it has been eroded and as maturely dissected by streams as the eastern plateau. Just east of Lexington in Scott and Franklin Counties there are outliers of Eden Shale in the Inner Bluegrass. One commonly accepted theory of their origin is that they are old buffalo trails. The Eden Shale belt lies in western Mercer, eastern Washington, Anderson, Shelby, northern and western Franklin, southeastern Henry, southern Grant, Owen, northern Scott, eastern and western parts of Pendleton and Harrison, extreme eastern parts of Robertson, Nicholas and Bourbon, western Montgomery and Madison, eastern Clark, northern Gerrard, Lincoln and Boyd Counties for only one mile or so.

Maysville-Richmond Area (Outer Bluegrass). Succeeding the Eden Shale Belt to form the outer rim of the bluegrass is the Maysville-Richmond (Cincinnatian) with its limestone over shale.

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1. Fenneman, N. M., 1938. Physiography of Eastern United States, p. 429.

This portion covers an area of 3,200 square miles. The country is more level and resembles the Inner Bluegrass. The remaining counties of the north central Bluegrass Region belong to this area.

Knobs

Surrounding the Bluegrass Region from West Point on the Ohio to Vanceburg on the Ohio is a belt ten or more miles wide characterized by the presence of conical knobs. Geologically these knobs are formed of sandy and shaly members of the Waverly and are known as knobstone. The valley floors between the knobs are usually of Devonian shale and the inner flat border which skirts the region is formed of Devonian sandstone and Niagara limestone and shale. Those knobs which are conical in shape are composed of Waverly sandstones and shales, while those with flat summits are capped by Mississippian limestone and basal conglomerate of the coal measures. The knobs are outliers of a once more extended formation, mainly the Mississippian, the margin of which, retreating in the direction of the dip, forms the northward fronting escarpment known as Muldraugh's Hill. The valley floors from which the knobs arise reach an altitude in some cases of 1,050 feet and the tops of the knobs reach a height of 1,200 to 1,400 feet above sea level. Knobs can be found in Trimble, Oldham, Jefferson, Bullitt, Spencer, Nelson, Washington, Marion, Boyle, Casey, Lincoln, Rockcastle, Gerrard, Madison, Estill, Powell, Montgomery, Menifee, Bath, Rowan, Fleming, and Lewis Counties.

The Cumberland Plateau including the Eastern Kentucky Mountains (Eastern Coal Fields)

The indented border stretching from opposite Portsmouth on the Ohio to the Wayne-Clinton County line at the Tennessee boundary marks the western boundary of this region. It includes all of Kentucky lying east of this arbitrary line. Geologically it is known as the eastern coal fields. Its strata are composed of sandstones and shales. The total area of this region is 10,450 square miles. This maturely dissected plateau if restored to an even surface would reach an altitude of 1,000 feet at its northern limit and 2,000 feet at its southern boundary. In the southeast portion of this plateau there are true mountains of elevation, the Pine and Cumberland Mountains. These ranges are similar in that both are composed of sharply inclined strata and the summit of each is formed of a basal coal measure conglomerate. The dip of the strata of Pine Mountain is to the southeast, while that of the Cumberland Range is to the northwest. The latter forms the Kentucky-Virginia border for a distance of 35 miles. These two mountain ranges are parallel and the distance between them is about 15 miles. Between the two ranges, as well as throughout the entire Cumberland Plateau there is an intricate system of watershed ridges separated by narrow steep-sided valleys. These plateau ridges are highest between the mountain ranges. The highest of these ridges is known as the Black Mountain of Harlan County. The greatest point of altitude is 4,150 feet. The highest point on the Pine Mountain Range is only 3,600 feet above sea level.

Along the western border of the plateau the conglomerate series rises into view. Vertically trenched by streams, it is a very rugged border strip. This strip overlooks steeply the neighboring bluegrass and presents a face intermediate in height to the lower carboniferous plateau. It is a region of pilot knobs, gorges, bold headlands, waterfalls, and natural bridges. This region is sometimes known as the Pottsville Escarpment.

SOILS

The Purchase Region

The soils of the Purchase Region fall into two main soil groups. All of the region, except along the Mississippi and Ohio Rivers, is part of the Quarternary soil area. This transported soil is formed of sandy and silt loams and loess. Chemically this area is deficient in phosphorus and nitrogen. These naturally are the limiting factors. The amount of calcium and potassium present is ample. The soil is fairly acid due to inadequate drainage which is poor enough in some areas to produce swamplands. Along the aforementioned rivers the soil belongs to the River Alluvium. Here the vital elements are present in ample quantities and the soil is more alkaline. By and large the entire Purchase Region is quite productive for farm crops.

Western Kentucky Coal Fields

The soil of the Western Coal Fields is made up of two soil areas. The entire region, with the exception of a narrow strip along the Ohio River, is a residual soil resulting from disintegration of

sandstone, conglomerates, shales, and coal. This part of the region is deficient in phosphorus and nitrogen, and consequently these elements become the limiting factors. The amounts of potassium and calcium present are ample. The poor drainage in this area leads to swampy areas and naturally fairly acid soil.

The area along the Ohio River possesses river alluvium. This is very fertile transported soil which is well supplied with phosphorus, potassium, calcium, and nitrogen, and is not particularly acid. Unlike other soil areas the subsoil is not chemically different from the topsoil. It may be noted that, with the exception of river alluvium, the parent materials of the Western Coal Fields are similar to those of the Eastern Coal Fields, but that the great difference in relief and drainage does in some part change the soil picture of the two regions.

The Pennyroyal Region

The soil of this region is divided into four soil areas, Chester, St. Louis, Waverly, and a narrow border of River Alluvium along the Ohio River.

The Chester area surrounds the Western Coal Fields and is one of the least productive regions of the state. It is a residual soil formed from Chester sandstone, shale, and limestone parent materials. The soil is sandy and extremely deficient in phosphorus. Nitrogen may also be considered a limiting factor. Calcium and potassium are present in ample amounts. The soil is very acid with a small water holding capacity.

The St. Louis area follows the cavernous limestone belt in south central Kentucky. Here loams predominate underlayed by red clay subsoil. The soil is residual in nature resulting from the

disintegration of limestone. The area is richer than the Chester in Phosphorus and calcium. Potassium is ample but nitrogen and phosphorus constitute the limiting factors. The land is well drained and hence not too acid. Because of the underground drainage this region is subject to frequent droughts. Most of the soil is very productive for cultivated crops.

The Waverly area follows the Waverly outcrop. It also possesses a residual soil formed from sandstones, shale, and thin limestone. The soil is very poor, sandy in nature, lacks organic matter, and washes badly. There is a great phosphorus and nitrogen deficiency, but a good supply of soluble potassium and calcium is present. The soil possesses a very high acidity.

The few miles of this physiographic region which borders the Ohio River possesses river alluvium. The soil is high in the necessary elements and has a low acidity.

North Central Bluegrass

The soil of the Bluegrass Region proper has been divided into two main soil areas, Trenton and Cincinnatian. The Trenton area includes the Inner Bluegrass and possesses the most fertile soil of the state. It is a residual soil resulting from the disintegration of Lexington limestone. It approaches a chocolate color and possesses red or yellow subsoils. Usually this land is very well drained, consequently the area has the most alkaline soil of the state. The soil is well supplied with all the vital elements with possibly the exception of nitrogen, which is the only limiting factor. The supply of phosphorus is so abundant that Averitt states that on the average

it contains five to six times as much of this element as the other soils of the state, except small areas of the lower Cincinnatian.[2] As is to be expected, this land is highly prized for cultivation.

The Cincinnatian area includes the Eden Shale and Outer Bluegrass portion of the north central Bluegrass Region. This residual soil is formed from blue limestone, shale, siliceous mudstone, and calcareous sandstone. Although this area is well drained, the soil, particularly the subsoil, is more acid than that of the Trenton area. The amount of phosphorus present is about one-fourth that of the Trenton. The Calcium present, although less than the Trenton, is ample. The soil possesses a large amount of potassium. As in the Trenton, nitrogen is a limiting factor. The Eden Shale outcrop which surrounds the Trenton is fairly unproductive. This is due to the low water holding capacity of the soil, together with the great runoff capacity which subjects this region to frequent droughts. The Outer Bluegrass more closely resembles the Trenton. Along the Ohio River river alluvium is present.

Knobs

The physiographic region of the knobs is composed of two soil areas, Silurian and Devonian. The Silurian is formed from impure limestones, magnesium limestone, and shales; while the soils of the Devonian originate from cherty limestones and black bituminous shales. This soil is deficient in phosphorus and nitrogen. It is not as well supplied with potassium as the Trenton and Cincinnatian areas, but the amount

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2. Averitt, S. D., 1915. Ky. Agricultural Experimental Station Bull. 193., p. 145.

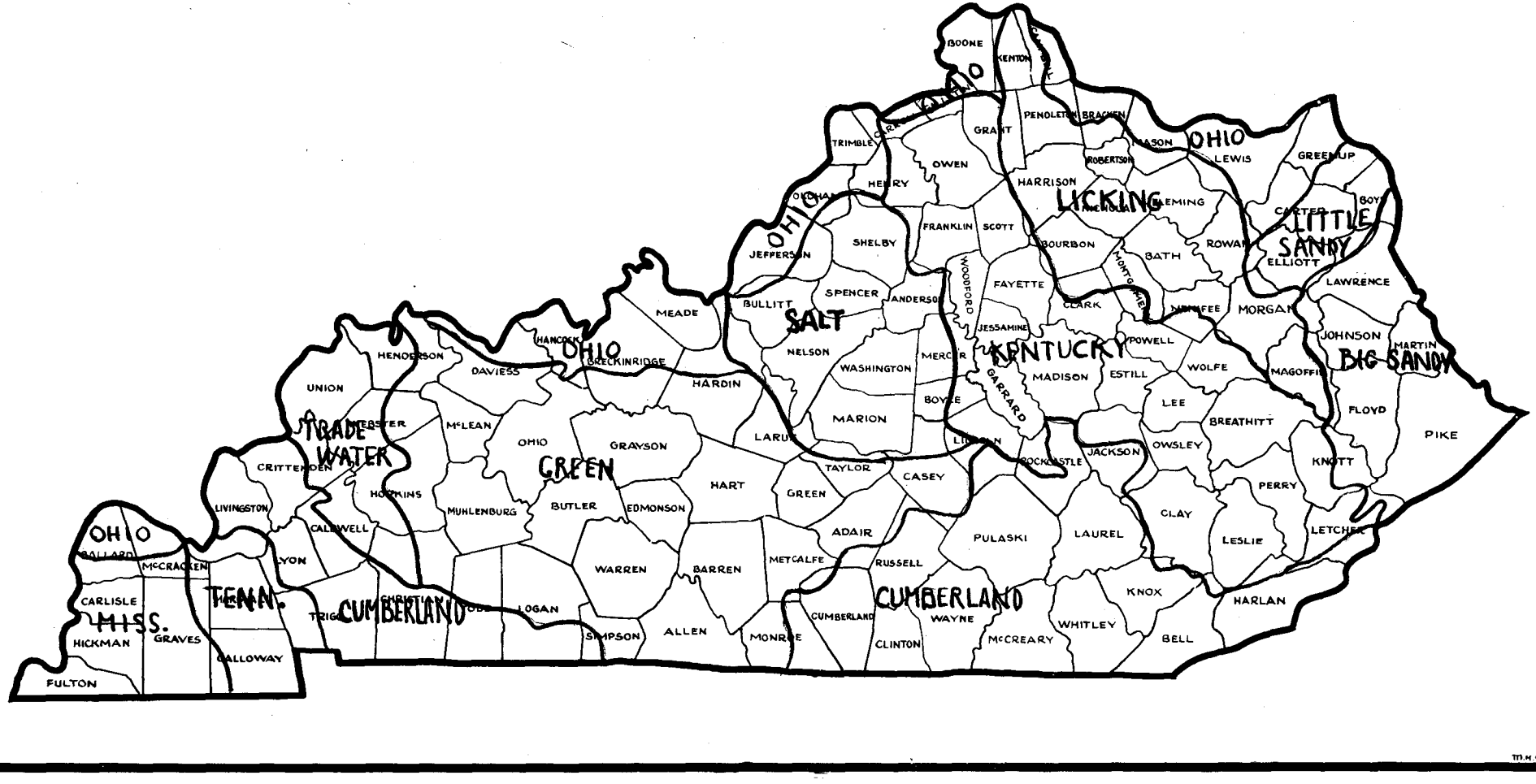

FIG. 2 DRAINAGE

present is ample. The quantity of calcium present is sufficient. The area is well drained, but the pH is low due to the calcium washing out. Limiting factors of this soil are nitrogen and phosphorus.

Eastern Coal Fields

The soil of this area is formed from sandstone, shale, conglomerates, and coal. Generally speaking the land is well drained and the soil is not too acid. It is deficient in phosphorus and nitrogen, therefore these two elements may be considered the limiting factors. The calcium and potassium content is adequate. Along with the Chester and Waverly areas the Eastern Coal Fields are one of the least productive areas of the state. It is interesting to note that the extreme western border of this area which is bedded in basal conglomerates, is much less fertile than the rest of the area. The amount of the vital elements present here is markedly less than in the eastern part of this region. Even the soil is more acid.

DRAINAGE OF THE STATE

(Fig. 2.)

The Purchase Region

The Purchase Region is drained by the Ohio, Mississippi, and Tennessee Rivers. The Tennessee drains the eastern third, the Mississippi the western third, and the remainder of the region is drained by the Ohio.

Western Kentucky Coal Fields

The Western Coal Field is drained primarily by the Green River. The northwestern portion is drained by the Ohio, and the

western third by the Tradewater River.

The Pennyroyal Region

The extreme western margin of this region is drained by the Tennessee River. The southwestern and southeastern portions are drained by the Cumberland River. The Green River drains the extended central region of the Pennyroyal. The parts of this region bordering the Ohio River, especially in Meade and Breckenridge Counties, are drained directly by the Ohio. A small section which borders the southwestern border of the knobs is drained by the Salt River. The northeastern extension of the Pennyroyal is drained by the Ohio, Licking, and Kentucky Rivers.

North Central Bluegrass

The Bluegrass Region is drained by four major streams. The extreme northern and northwest portions are drained by the Ohio River. The Salt River drains the remainder of the western third, the Kentucky the central third, and the forks of the Licking River drain the eastern third of this region.

Knobs

This narrow belt is drained by the Ohio River along its northeastern and northwestern boundaries. The remainder of the western portion is drained by the Salt River. The Kentucky River drains the southern and southeastern portions, and the Licking River drains the remaining western portion of the knobs. A small section of the knobs which extends into Casey County is drained by

the Green River.

Eastern Coal Fields

Six major streams are important in the drainage of the Eastern Coal Fields. The extreme northern tip which reaches the Ohio River is drained by it. The eastern part of the region as far south as Letcher County is drained by the Little and Big Sandy Rivers. The major part of the central portion is drained by the Kentucky River. That part of the region lying north of the Kentucky drainage basin is drained by the Licking river. The southern portion of the Eastern Coal Fields including the mountain ranges is drained by the Cumberland River.

CLIMATE

Kentucky possesses a continental climate of the warm humid type. It is considered continental due to the marked contrast between winter and summer, humid because the mean annual precipitation exceeds twenty inches (so much so, that Kentucky's average is over forty inches), and warm in that the growing season is long and warm enough for corn, and in the southwestern counties, long enough for cotton. Throughout the state there is no drastic contrast in climate. However, there are some appreciable climatic changes from north to south and east to west but these are gradual. One must keep in mind that latitude is significant because the Gulf of Mexico is a great source of moisture. The following data is estimated from the maps in Visher's "Climate of Kentucky" (figs. 3,4,5,6.).

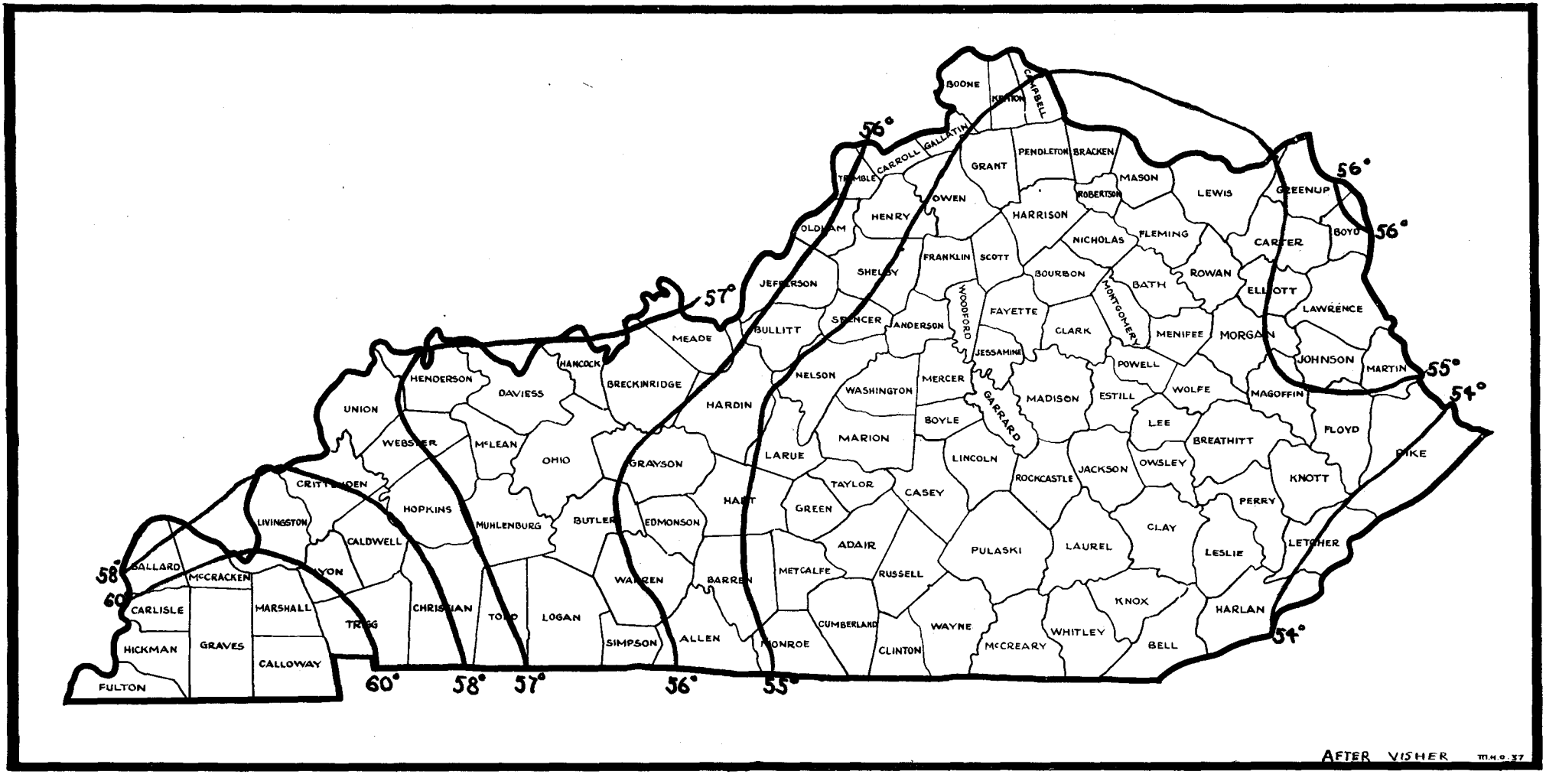

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FIG. 3 MEAN ANNUAL TEMPERATURE

The Purchase Region

The Purchase Region has the warmest climate of the state. The mean annual temperature ranges from 58°F. to slightly over 60°F. in a north to southwest direction. The average winter temperature varies from 36°F. in the north to slightly more than 37°F. in the south. The normal minimum temperature is 0°F. from north to south, while the highest reported temperatures range from 107.5°F. in the east to over 110°F. in the western part of the area. The average annual precipitation varies from 44" in the northwest to 47.5" in the southeast. Per season the average rainfall in autumn is 9.5" to over 10" in an east-west direction; in winter slightly less than 11" to nearly 13" in a northwest to southeast direction; in spring slightly less than 13" to 13.5" in a northwest to southeast direction; and in summer less than 10" to 11" in a west-east direction. The average snowfall per year ranges from 13" in the northern portion of the region to greater than 12" in the southern portion of the region. The average length of growing season without frost is 195 to 200 days from east to west. The first killing frost in the fall occurs about the 20th of October and the last in the spring about the 10th of April.

Western Coal Fields

The mean annual temperature of the Western Coal Fields varies from 56°F. in the eastern section to about 58°F. in the western portion. The range of average winter temperature is 35°F. in the north to approximately 36.5°F. in the south. The normal minimum winter temperature ranges from -2.5°F. to -1°F. in a

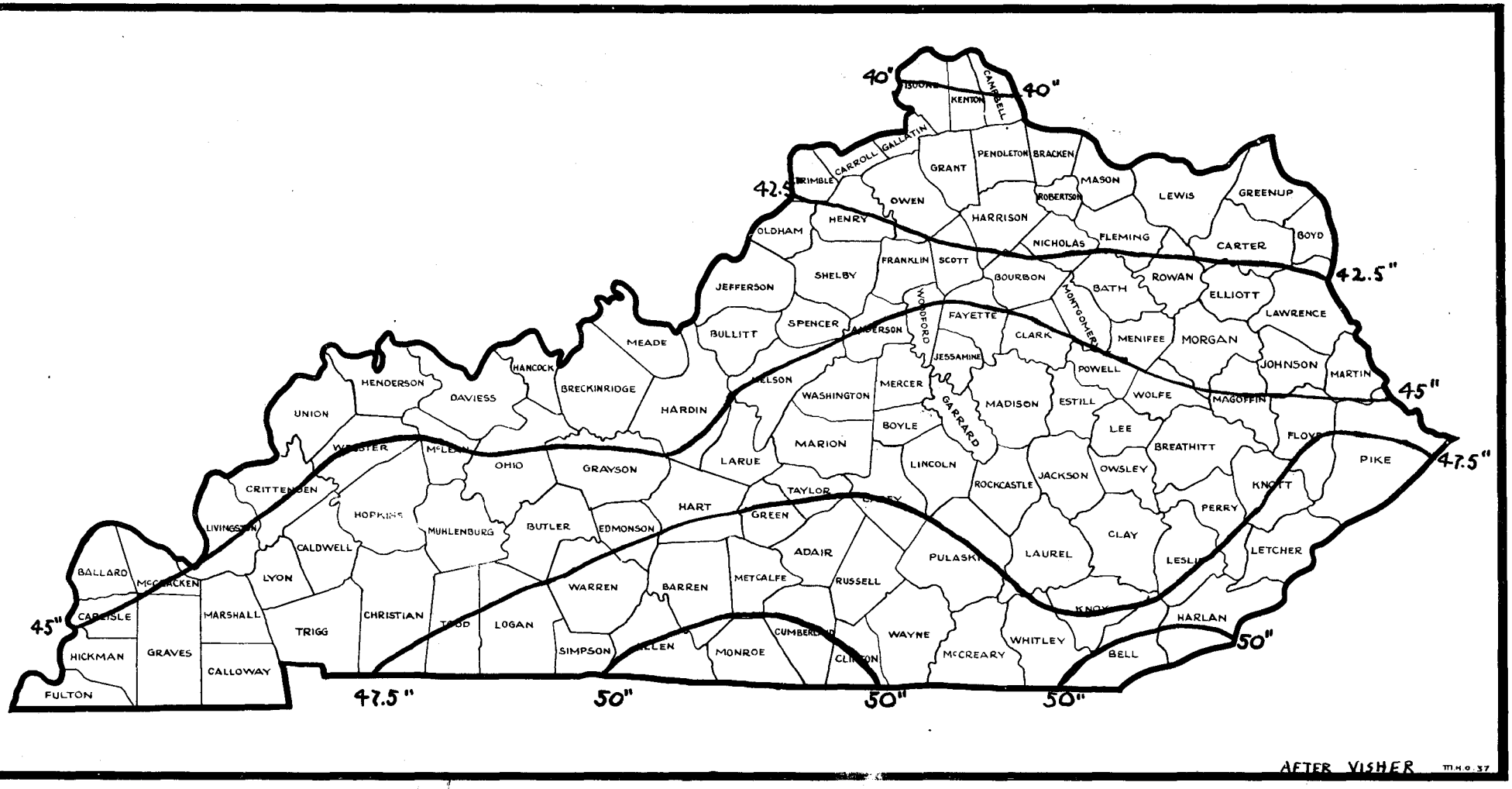

FIG. 4 AVERAGE ANNUAL PRECIPITATION

similar direction, while the highest recorded temperature varies from 107°F. in the eastern portion to 110°F. in the western portion of this region. The average annual precipitation ranges from 44" to 46.5" in a north-south direction. Per season the average rainfall in autumn is 9" to 9.5" in an east to west direction; in winter it is 10" to 12.5" in a north to south direction; in spring it is 13" to 13.5"; and in summer it is 11" to 12" in a west to east direction. The average snowfall per year varies from 16" in the northern section to 13" in the southern. The average length of growing season without frost is 185 days in the east to slightly over 190 days in the west. The average first filling frost usually occurs from the 15th to the 20th of October, and the average last killing frost in the spring occurs around the 15th or 20th of April.

The Pennyroyal Region

The mean annual temperature of this extensive region is 60°F. in the west to 54.5°F. in the eastern portion. The average winter temperature varies in a north-south direction from slightly colder than 35°F. to 37°F. The normal minium temperature extends from 0°F. in the southern portion to -2°F. in the north, while the highest recorded temperature is 101°F. in the east to 110°F. in the extreme western projection of this region near the Ohio River. The average annual precipitation varies in a north-south direction from 43.5" to over 50". Per season the autumn rainfall is 9" with the exception of the western corner of Meade County which is 10"; in winter it is 11" to 13" from north to south; in spring it is 13" to 15" from north to south; and in summer it is 11" to 13.5" from

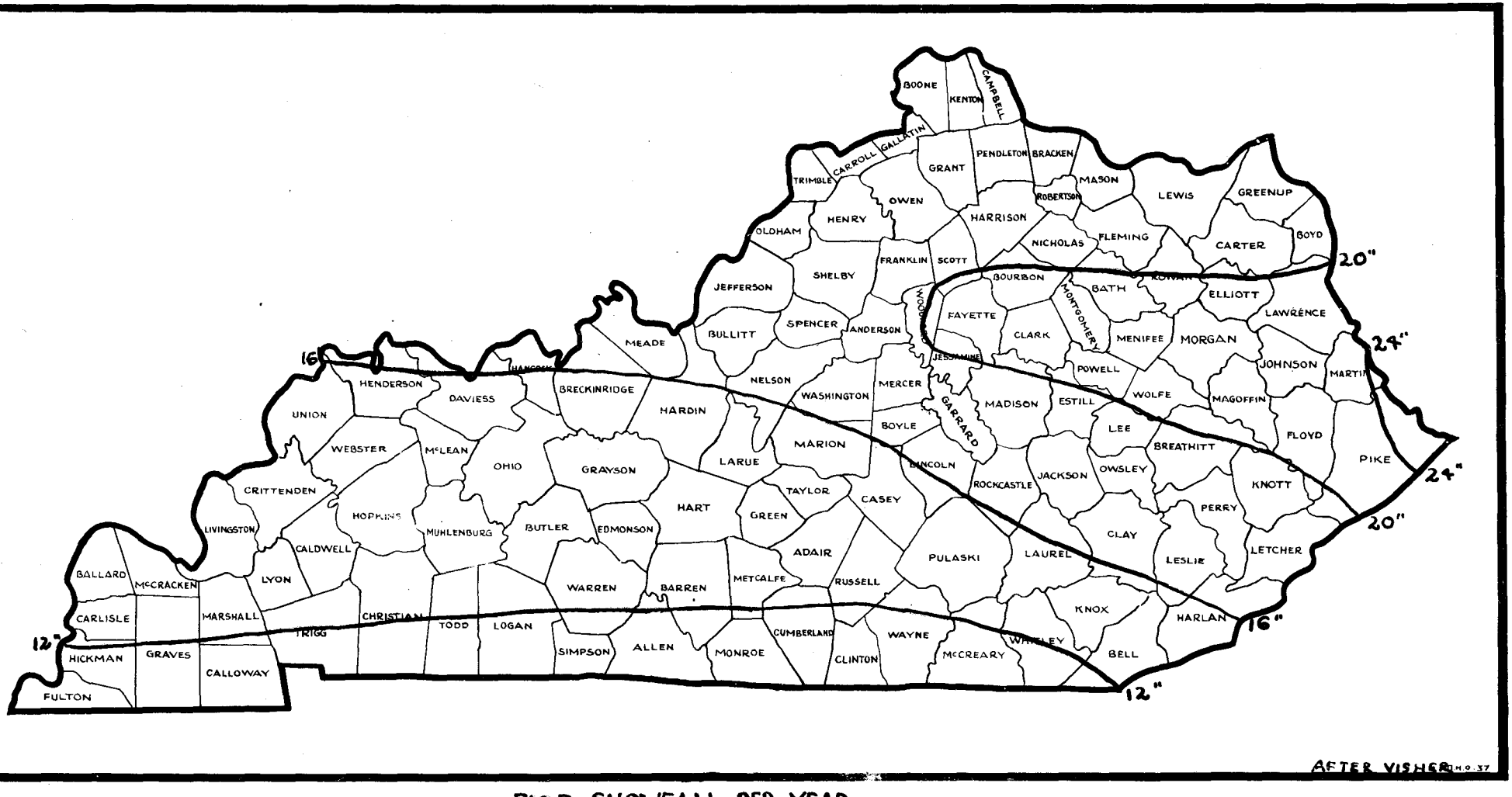

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FIG.5 SNOWFALL PER YEAR

west to east. The annual snowfall ranges from 12" to 16" in the western portion to nearly 20" in the northeast. The average length of growing season without frost is 185 to 190 days from east to west, with the first killing frost occurring around the 15th to 20th of October, and the last killing frost occurring around the 15th to 20th of April.

North Central Bluegrass

The mean annual temperature of the Bluegrass Region ranges from 55°F. in the east to 56°F. in the west. The average winter temperature of this region varies from less than 32°F. at the Ohio border to 34.5°F. in the southern portion. The normal minimum winter temperature ranges from -4°F. in the north to -2°F. in the south, while the highest recorded temperature varies from 102°F. to 106°F. in an east-west direction. The average annual precipitation at the Ohio border is less than 40" and it increases to 46" in the southern counties of this region. Per season the autumn rainfall is 8" to 9" in an east to west direction; the winter rainfall varies from 10" in the north to over 12" in the south; in spring it is less than 12" in the north to over 13" in the south; and in summer it is about 12", slightly less in the western counties and more in the east. The snowfall per year in the Bluegrass Region is approximately 20", being slightly more in the southeastern counties. The average length of growing season without frost is 185 days, with the first killing frost occurring about the 15th to 20th of October, and the last killing frost occurring about April 15th.

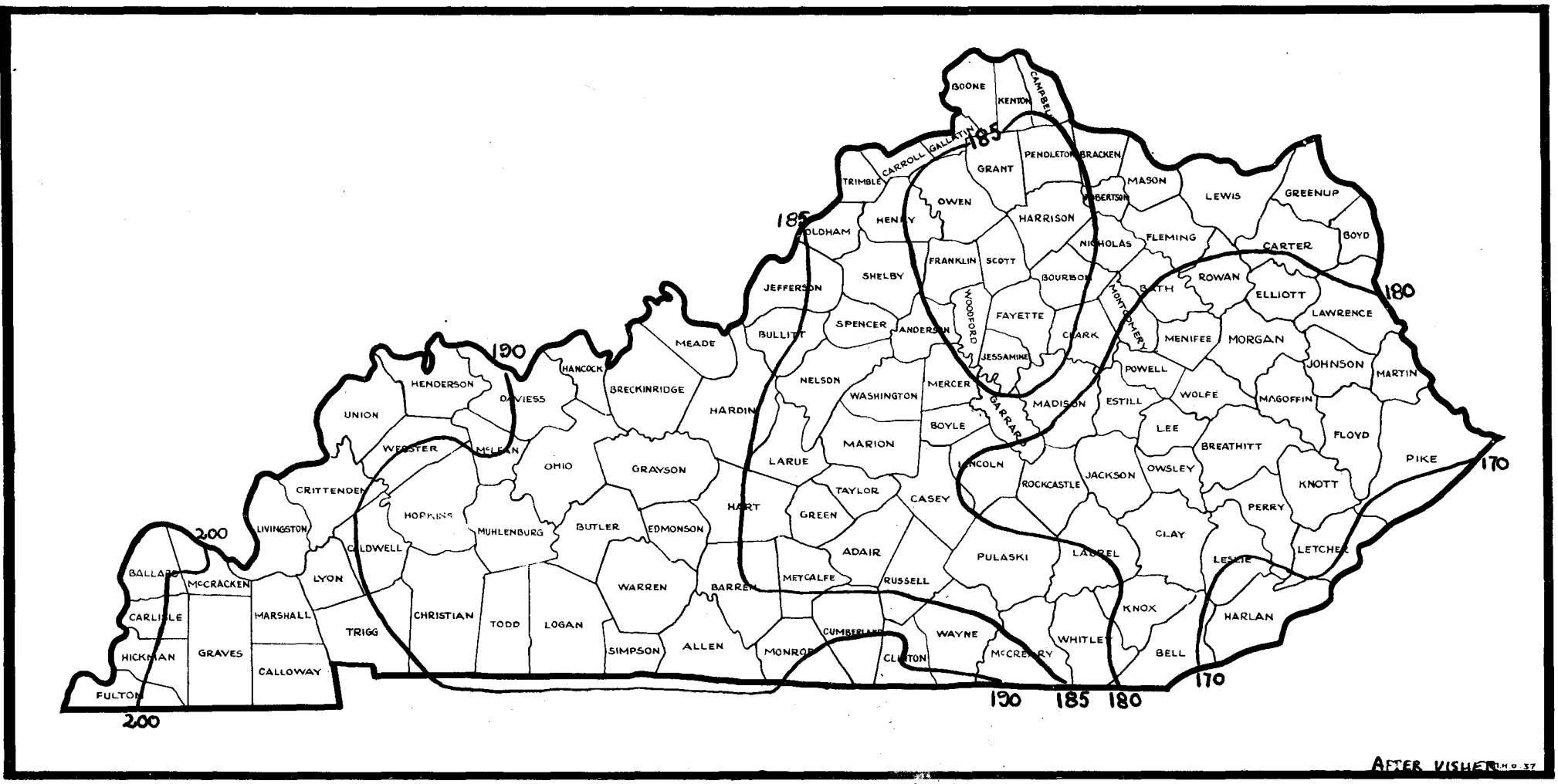

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FIG.6 AVERAGE LENGTH OF SEASON WITHOUT FROST

Knobs

This narrow, semicircular belt of hills lacks a distinctive or uniform climate, and is best regarded as resembling in climatic characteristics the parts of the bordering physiographic regions. Approximations are included, however, to facilitate comparisons with other areas of the state. The mean annual temperature of this region is 55°F. to 56°F., the western half assuming the higher figure. The average winter temperature varies from 33°F. to 34°F. in a north-south direction. The normal minimum temperature is as low as -3°F. in the north to -2°F. in the south, while the highest recorded temperature is a 102°F. in the east and 106°F. in the western portion of the region. The average annual precipitation varies in a north-south direction from 41" to 46". Per season the autumn precipitation is less than 8" to 9" in an east-west direction; the winter rainfall is 10" to 12" in a north to south direction; in spring it is less than 12" to 13" in a north to south direction; and in summer it is 11" to 13" in a west to southeast direction. Snowfall per year ranges from an inch or two less than 20" in the west to over 20" in the east. The length of growing season without frost is 185 to 190 days from west to east. The average first killing frost occurs the 15th of October and the last the 15th of April.

Eastern Coal Fields

The mean annual temperature of the Eastern Coal Fields is 54°F. in the southeast to 55°F. in the northwest. A small portion of the northeastern counties of Greenup and Boyd near the border possess a mean annual temperature of 56°F. The average winter

temperature varies from 33°F. in the north to 36°F. in the south. The normal minimum temperature ranges from -3.5°F. to slightly warmer than 0°F. from north to south, while the highest recorded temperature varies from less than 100°F. to 101°F. in an east-west direction. Average annual precipitation ranges from 41" in the north to over 50" in the southern mountains. Autumn rainfall is about 8"; winter rainfall is 10.5" in the north to over 13" in the south; in spring rainfall ranges from 12" in the northern counties to over 15" in the extreme southern region; and in summer rainfall ranges from 12" in the northwest to over 14" in the southeast. Snowfall per year is about 12" in the south to more than 20" in the north. A small portion of Martin and Pike Counties on the extreme eastern border have as much as 24" of snowfall per year. The average length of season without frost is 170 to 180 days, the shorter season in the east. The first killing frost occurs from the 10th to the 15th of October, the last killing frost from the 20th to 30th of April.

BOTANY

Plants are one of the important features in the environment of terrestrial animals. Directly and indirectly they furnish shelter, sites for homes, nesting material, protection from enemies, and food. Often animals are restricted to particular vegetation types. Consequently the author feels that any discussion of animal distribution would be incomplete without a summary of the plants that occur in the particular region studied.

The plant life of Kentucky is quite varied. From the discussion of climate it is evident that climatic conditions vary slightly and too gradually throughout the state to account alone for the abrupt

changes in plant species. According to B. B. McInteer[3], variation in the factor of soil rather than those of climate have been the determining cause in the distribution of plants under consideration. However, one must keep in mind that the existence of a plant in a particular region depends not upon a certain factor but on the sum total of all the factors.

Because of its geographic location, Kentucky is the meeting place of northern and southern species. This is particularly true in the Eastern Coal Fields. The northern element is made up of species of general northern range which reach their southern limit here and are uncommon southward, and species growing in the north or northeast and in higher mountains southward.[4] The southern Appalachian element is made up of species whose general range is that of the southern Blueridge province.[5] Then too, in wet meadows and swamps or on low knobs there are even coastal plain species.[6] The distribution of all these forms may be explained by the geologic history of the area. The western part of the state exhibits another picture. In the Jackson Purchase and extending to the Western Coal Fields there is a predominance of southern coastal plain forms. McInteer[7] notes that in some cases the southern forms in the Jackson Purchase are not the same southern forms

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3. McInteer, B. B., 1947, Castanea, vol. 12, no. 1, p. 1.
4. Braun, E. L., 1937. Rhodora, vol. 39, no.462, p. 205.
5. Ibid p. 204.
6. Ibid p. 203.
7. McInteer, B. B., 1944. Castanea, vol. 9, pp. 102-105.

that extend into southeastern Kentucky. The latter species cannot extend into southwestern Kentucky due to the acid soil conditions required for their growth. It is true that the soil in the Jackson Purchase and Western Coal Fields is acid, but this area is surrounded by a cavernous limestone belt which is less acid and a Chester sandstone belt which is more acid than the region of habitat of these plants. The remainder of the state is an area of integradation of northern and southern forms.

Following is a summary of the flora of Kentucky in relation to the geological regions of the state, composed by B. B. McInteer.[8] Here the species mentioned are rated as to their abundance and rarity. The author feels that those species that are rare in a particular isolated area may be as important in animal distribution as the more common forms. From th e summary of the flora one can readily see that certain species are common throughout the state, while others are limited to particular areas. In the following table the relative abundance of the plants is expressed as follows: 1 - very rare; 2 - rare; 3 - very scarce; 4 - scarce; 5 - rather common; 6 - common; 7 - very common; 8 - rather abundant; 9 - abundant; 10 - very abundant.

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8. McInteer, B. B., 1941. Ky. Dept. Mines and Min. Ser. 8, Bull. 6, pp. 1-19.

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Acer negundo	9	7	1	3	1	1	2	7	6	Box Elder
Acer nigrum	8	7		1	1	1	2			Black Maple
Acer pennsylvanicum							2			Striped Maple
Acer rubrum			10	9	7	9	9	9	10	Red Maple
Acer saccharinum					1	1	2	4	2	Silver Maple
Acer saccharum	9	10	7	10	10	9	8	9	7	Sugar Maple
Acer spicatum							1			Mountain Maple
Aesulus glabra	8	9	1	1	1	1	3			Ohio Buckeye
Aesculus octandra	3	2	1	5	1		3		3	Yellow Buckeye
Alnus rugosa					1		6	2	3	Smooth Alder
Amelanchier canadensis		1	5	3	2	4	6	1	1	Service Berry
Amorpha fruticosa								2	1	Indigo Bush
Ampelopsis arborea									1	Pepper Vine
Aralia spinosa			6	3	5	4	4	3	6	Hercules Club
Aronia melanocarpa					1	1	1			Black Chokecherry
Arundinaria gigantea	4		1	2			3	3	1	Southern Cane

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Ascyrum hypericoides				4	5	5		1	1	St. Andrews Cross
Asimina triloba	7	8	6	9	3	4	7	5	3	Pawpaw
Benzoin aestivate	9	5	3	7	6	5	5	4	1	Spice Bush
Betula lenta							4			Sweet Birch
Betula nigra			5				7	7	6	Black Birch
Bignonia capreolata	7	8	6	9	3	4	7	5	3	Cross vein
Bumelia lycoides						1				Southern Buckthorn
Campsis radicans	3	5	4	3	2	4	1	6	6	Trumpet Creeper
Carpinus caroliniana	8	8	5	8	2	4	5	6	7	Blue Beech
Carya cordiformis	8	9	6	3	1	1	1	3	5	Bitternut Hickory
Carya glabra	3	8	9	8	8	8	7	7	7	Black or Pignut Hickory
Carya laciniosa	3	7	2	2	5	1	3	3	3	Kingnut Hickory
Carya ovata	1	9	4	7	8	8	3	5	3	Shellbark Hickory
Carya palada							2			Pale Hickory
Carya pecan								3	3	Pecan
Carya tormentosa			7	6	7	4	5	6	6	Mockernut
Castanea dentata			2	8	7	8	8	1		Chestnut

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Castanea pumila							2	1		Chinquapin Chestnut
Ceanothus americanus		1				1	1	2		New Jersey Tea
Celastrus scandens	7	3	1	3	7	2		1	1	American Bittersweet
Celtis pumila	4		4	2	7	6				Georgia Hackberry
Celtis laevigata					1			8	8	Southern Hackberry
Celtis occidentalis	9	8	2	3	2	2	2	1		Common Hackberry
Celphalanthus occidentalis	2				1	3	4	8	8	Common Buttonbush
Cercis canadensis	9	9	6	7	7	9	6	9	7	Redbud
Chionathus virginica					3					Fringe tree
Cladrastis lutea	1									Yellow wood
Clethra acuminata			1				4			Sweet Pepperbush
Cornus alternifolia	1			1			2			Alternate leved Cornel
Cornus amomum					1		1		1	Silky Dogwood
Cornus asperifolia	2	5			1			1		Rough leaved Dogwood
Cornus florida	4	8	9	10	10	9	9	9	9	Flowering Dogwood
Cornus racemosa								1		Panicled Dogwood

	Bluegrass		Knobs	Pennyroyal			Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
	Trenton	Cincinnatian	Crawford-sville	Borden	Cavernous Limestone	Chester				
Cornus stricta			1							Stiff Dogwood
Corylus mericana		5	3	4	9	7	3	5	8	American Hazelnut
Decodon verticil-lantus								1		Swamp Looserbill
Diospyrus virginia	1	1	9	6	8	7	6	7	9	Persimmon
Dirca palustris	2			3	1		2			Leatherwood
Evonymus americanus			3	8	3	5	7			Brook Evonymus
Evonymus atropur-pureus	7	5	1	1	1	3				Burning Bush
Evonymus obovatus	6									Running Evonymus
Fagus grandifolia	1	6	8	10	8	8	9	7	1	Beech
Forestiera acuminata								7	3	Crooked Brush
Forestiera ligustrina						1				
Fraxinus americana	9	9	9	9	8	9	5	9	7	White Ash
Fraxinus biltmoreana	1	7	3		2	4	1	2	1	Biltmore Ash
Fraxinus lanceolata	1	2		3		1	3	2	2	Green Ash
Fraxinus quadrangulata	10	7		1	1					Blue Ash

	Bluegrass		Knobs	Pennyroyal			Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
	Fenton	Cincinnatian	Chatta-nooga	Borden	Cavernous Limestone	Chester				
Fraxinus tormentosa								1	2	Pumpkin Ash
Gaylussacia buccata			1		1		2			Highbush Huckleberry
Gleditsia triacanthos	7	7	1	3	2	3	1	7	7	Honey Locust
Grossularia cynosbati	3				1					Dogberry
Gynocladus dioica	4	2				1		1		Ky. Coffee Tree
Hamamalis virginiana	3	1	1	3	1	1	4			Common witch-hazel
Hydrangea arborescens	7			3	1	2	4	2	1	Smooth Hydrangea
Hypericum dolabriforme				1		1				Straggling St. Johns Wort
Hypericum prolificum			3	1	1		2			Shrubby St. Johns Wort
Ilex decidua									2	Possum Haw or Swamp holly
Ilex dubia							1			Mountain Holly
Ilex opaca							6			American Holly
Ilex verticillata			2		1					Common Winterberry
Itea virginica					1		6			Virginia Willow
Juglans cinerea	7	5	3	4	5	2	5			Buttermut
Juglans nigra	9	8	3	5	7	7	6	7	2	Black Walnut

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Juniperus virginiana	9	8	3	8	10	6	3	6	3	Red Cedar
Kalmia latifolia				1		1	8			Mt. Laurel
Leiophyllum buxifolium							1			Sand Myrtle
Liquidambar styraciflua			9	6	6	1	7	8	10	Sweet gum
Liriodendron tulipifera	1	2	6	9	8	6	8	7	5	Tuliptoe
Lonicera sempervirens					1	1				Trumpet Honeysuckle
Lyonia ligustrina							1			Male Berry
Magnolia acuminata				3			6			Cucumber Tree
Magnolia frageri							2			Earleaved Magnolia
Magnolia macrophylla							5	1		Great leaved Magnolia
Magnolia tripetala			3		1	1	9			Umbrella tree
Menispermum canadense	6	3	2	3	2	2	3	5	5	Moonseed Vine
Morus rubra	7	8	7	8	8	7	5	7	8	Red Mulberry
Nyssa sylvatica		7	10	9	9	9	9	7	9	Black and sour Gum
Ostrya virginiana	7	8	3	5	1	9	3	6	4	Hop Hornbean
Oxydendrum arboreum			7	7	1	6	9	1		Sourwood

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Pachistima canbyi					1					Canby's Mt. Lover
Parthenocissus quinquefolia	7	7	7	6	7	7	6	6	7	Virginia Creeper
Physocarpus opulifolius	1	1			1					Ninebark
Pinus echinata			3				7			Yellow Pine
Pinus rigida							8			Pitch Pine
Pinus strobus							3			White Pine
Pinus virginiana			10	3	1	2	7	2		Scrub Pine
Platanus occidentalis	6	3	7	5	2	4	6	6	7	Sycamore
Populus grandidentata			2							Large tooth Aspen
Populus heterophylla								6		Swamp Cottonwood
Prunus americana	3	2	3			5	2	5	1	Wild Red Plum
Prunus mahaleb					1			1		Perfumed Cherry
Prunus serotina	6	7	6	7	7	4	3	7	6	Wild Black Cherry
Prunus virginiana	2									Common Chokecherry
Ptelia trifoliata	3									Common Hoptree
Pyrularia pubera							3			Buffalo Oilnut

	Bluegrass		Knobs	Pennyroyal			Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester				
Quercus alba	5	9	10	9	10	10	8	9	10	White Oak
Quercus bicolor			2					1		Swamp White Oak
Quercus borealis	9	10	6	8	9	9	6	7	6	Red Oak
Quercus coccinea		2	8	3		3	6	2		Scarlet Oak
Quercus falcata			7	7	9	8	4	7	10	Spanish Oak
Quercus imbricaria		5	2	2	3	2		4	6	Shingle Oak
Quercus lyrata					1			7		Overcup Oak
Quercus macrocarpa	3							3	1	Bur Oak
Quercus marilandica		3	3		6	4	3	2	3	Black Jack Oak
Quercus Montana		6	7	1		4	7			Chestnut Oak
Quercus muhlenbergii	9	10		6	8	4	2			Chinquapin Oak
Quercus palustris			3	1	6	1	3	9	6	Pin Oak
Quercus phellos					1				1	Willow Oak
Quercus primus					1		4	5	3	Cow Oak
Quercus stella	1		9	4	9	7	3	7	8	Post Oak
Quercus velutina	4	2	8	8	9	10	6	8	8	Black Oak

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Calciferous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Rhamnos carloniana	8	3	4	6	8	8	1			Carolina Buckthorn
Rhamnos lanceolata	7	1								Lanceleaf Buckthorn
Rhodedendron maximum							7			Great Laurel Rhododendron
Rhus aromatica	7	2	1	2	1	1				Fragrant Sumac
Rhus copallina			9	4	7	7	6	5	6	Mountain Sumac
Rhus glabra	3	6	7	4	5	4	3	2	5	Smooth Sumac
Rhus typhina	2									Staghorn Sumac
Rabinia hispida						1	2			Rose Acacia
Rabinia pseudoacacia	6	6	1	2	2	1	5	2	3	Black Locust
Rubus allagheniensis			6	5	6	7	7	7	7	Allegheny Blackberry
Rubus flagellaris	1			1		2	1			Dewberry
Rubus occidentalis	7	5		3	5	3	4			Black Raspberry
Rubus odoratus							1			Flowering Raspberry
Salix humilis			1			1				Prairie Willow
Salix nigra	2	3	2	2	2	3	3	2	2	Black Willow
Salix tristis			1				2			Dwarf Pussy Willow

	Bluegrass		Knobs	Pennyroyal			Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester				
Sambucus canadensis	4	2	5	4	3	3	3	6	6	Common Elderberry
Sambucus pubens							2			Redberry Elder
Sassafras albidim	4	2	5	4	3	3	6	6	6	Sassafrass
Smilex bona-nox	8			1	3	1	1			Fringed Greenbrier
Smilex rotundifolia	5	3	8	7	7	5	7	6	2	Round leaf Greenbrier
Spiraea tomentosa			1		1		1			Hardhack
Staphilea tripolia	7	5	5	1	1		1	1	2	American Bladdernut
Stewartia pentagyna	7						5			Mountain Stewartia
Symphorcarpos orbiculatus		7	7	4	7	7	1	7	2	Coralberry, Buckbush
Taxodium distichum								7	7	Bald Cypress
Taxus canadensis							2			Ground Hemlock, Yew
Tilia americana	8	3			5		6			American Basswood Linden
Tilia heterophylla	1						1			White Basswood
Tauga canadensis				1	1	1	9			Hemlock, Spruce Pine
Ulmus alata	3		6	6	1	8	4	3	2	Winged Elm
Ulmus americana	10	7	2	3	3	2	3	1	1	White Elm

	BLUEGRASS		KNOBS	PENNYROYAL						
	Trenton	Cincinnatian	Chattanooga	Borden	Cavernous Limestone	Chester	Eastern Coal Fields	Western Coal Fields	Jackson Purchase	
Ulmus fulva	8	9	7	5	6	7	5	8	9	Slippery Elm
Ulmus racemosa	4				4	5	6		3	Rock Elm
Vaccinium arboreum				1		6		5		Farkleberry
Vaccinium stamineum			2		1		5			Deerberry, Mt. Gooseberry
Vaccinium vacillans							5			Late low Blueberry
Viburnium acerifolium		1		5	1		5			Maple Leaf Viburnum
Viburnum cassinoides							1			Wild raisin, Witherod
Viburnum prunifolium	7	7	4	1	7	3	2		2	Black Haw
Viburnum pubescens							1			Deam's Viburnum
Viburnum rufidulum				1		1				Southern Black Haw
Vitis aestivalis	2	6	8	3	7	7	3	6	5	Summer Grape
Vitis palmata								1		Red Grape
Vitis rotundifolia							2			Southern Foxgrape
Vitis vulpina	7	7	2				1			Frost grape
Zanthoxylium americanum		3					3			Common Prickly Ash
Zanthorrihiza apiifolia							3			Shrub Yellow Root

HERPETOFAUNA OF KENTUCKY

The remainder of this work is devoted to a presentation of a state summary of the herpetofauna; a discussion of the regional distributions; and finally an attempted correlation of the ranges of the various forms with the ecological factors previously discussed. The nomenclature and general range are based upon the Stejneger and Barbour Checklist (1943), with such changes, however, as are required by more recent studies and actual locality records.

The reader is again reminded that these lists and ranges cannot be completely accurate for in many cases the data is incomplete and further collecting is necessary.

STATE SUMMARY

The following list is a summary of the 106 species and subspecies of amphibians and reptiles which occur in the state of Kentucky. Of these, there are 29 salamanders, 2 toads, 16 frogs, 7 lizards, 38 snakes, and 14 turtles. The presence of these forms in Kentucky is based primarily on actual locality records. For completeness those forms whose ranges extend into the state but for which the author has no records have been included. These species are denoted by an asterisk.

CLASS AMPHIBIA

Order Caudata

Suborder Proteida

Family Necturidae

Necturus maculosus maculosus (Rafinesque)

Suborder Mutabilia

Family Amphiumidae

Amphiuma means tridactylum Cuvier

Family Cryptobranchidae

Cryptobranchus alleganiensis (Daudin)

Family Salamandridae

Triturus viridescens viridescens (Rafinesque)

**Triturus viridescens louisianensis* (Wolterstorff)

Family Ambystomidae

Ambystoma jeffersonianum (Green)

Ambystoma maculatum (Shaw)

Ambystoma opacum (Gravenhorst)

**Ambystoma talpoideum* (Holbrook)

Ambystoma texanum (Matthes)

Ambystoma tigrinum tigrinum (Green)

Family Plethodontidae

Desmognathus fuscus fuscus (Rafinesque)

Desmognathus orhrophaeus orhrophaeus (Cope)

Desmognathus phoca (Matthes)

Plethodon cinereus cinereus (Green)

Plethodon cinereus dorsalis Cope

Plethodon glutinosus glutinosus (Green)

Plethodon richmondi Netting and Mittleman

**Hemidactylium scutatum* (Schlegel)

Aneides aeneus (Cope)

Gyrinophilus porphyriticus porphyriticus (Green)

Grinophilus porphyriticus duri (Weller)

Grinophilus danielsi danielsi (Blatchly)

Pseudotriton montanus diastictus Bishop

Pseudotriton ruber ruber (Sonnini)

Eurycea bislineata bislineata (Green)

Eurycea longicauda lonicauda (Green)

Eurycea lucifuga Rafinesque

Suborder Meantes

Family Sirenidae

Siren intermedia nettingi Goin

Order Salientia

Suborder Linguata

Family Bufonidae

Bufo americanus americanus (Holbrook)

Bufo woodhousii fowleri (Hinckley)

Family Hylidae

Acris crepitans Baird

Pseudacris brachyphona (Cope)

Pseudacris nigrita triseriata (Wied)

Hyla avivoca Viosca

Hyla cinerea cinerea (Schneider)

Hyla crucifer crucifer Wied

*Hyla squirella Latreille

Hyla versicolor versicolor (LeConte)

Family Ranidae

Rana areolata circulosa Rice and Davis

Rana catesbeiana Shaw

Rana clamitans Latreille

Rana palustris Le Conte

Rana pipeins pipiens Schreber

Rana pipiens sphenocephala (Cope)

Rana sylvatica sylvatica (LeConte)

Family Brevicipitidae

*Gastrophryne carolinensis (Holbrook)

CLASS REPTILIA

Subclass Diapsida

Order Squamata

Suborder Sauria

Family Iguanidae

Sceloporus undulatus fasciatur (Green)

Family Anguidae

*Ophisaurus ventralis (Linne)

Family Teiidae

Cnemidophorus sexlineatus (Linne)

Family Scincidae

Leiolopisma laterale (Say)

*Eumeces anthracinus (Baird)

Eumeces fasciatus (Linne)

Eumeces laticeps (Schneider)

Suborder Serpentes

Family Colubridae

Carphophis amoena amoena (Say)

Carphophis amoena helenae (Kennicott)

Cemophora coccinea Blumenbach

Farancia abacura reinwardtii (Schlegel)

Diadophis punctatus edwardsii (Merrem)

Diadophis punctatus strictogenys Cope

Heterodon contortrix contortrix (Linne)

* Heterodon simus (Linne)

Opheodrys aestivus (Linne)

Coluber constrictor constrictor (Linne)

Elaphe obsoleta obsoleta (Say)

Elaphe obsoleta confinis (Baird and Gerard)

Lampropeltis calligaster (Harlan)

Lampropeltis getulus niger (Yarrow)

Lampropeltis triangulum triangulum (Lacepede)

Lampropeltis triangulum elapsoides (Holbrook)

Lampropeltis triangulum syspila (Cope)

Natrix cyclopion cyclopion (Dumeril and Bibron)

Natrix erythrogaster erythrogaster (Forster)

Natrix kirtlandii (Kennicott)

Natrix rhombifera rhombifera (Hallowell)

Natrix septemvittata (Say)

Natrix sipedon sipedon (Linne)

Natrix sipedon confluens (Blanchard)

Natrix sipedon pleuralis (Cope)

Pituophis melanoleucus melanoleucus Daudin

Storeria dekayi (Holbrook)

Storeria occiptomaculata (Storer)

* Haldea valeriae valeriae (Baird and Gerard)

* Haldea valeriae elegans (Kennicott)

Tantilla coronata coronata (Baird and Girard)

Thamnophis sauritus sauritus (Linne)

Thamnophis sirtalis sirtalis (Linne)

Family Crotalidae

Agkistrodon mokeson mokeson (Daudin)

*Agkistrodon mokeson austrinus Gloyd and Conant

Agkistrodon piscivorus leucostoma (Troost)

Crotalus horridus horridus (Linne)

*Crotalus horridus atricaudatus (Latreille)

Subclass Synapsida

Order Testudinata

Family Kinosternidae

Sternotherus ordoratus (Latreille)

*Kinosternum subrubrum subrubrum (Lacepede)

Family Chelydridae

*Macrochelys temminckii (Troost)

Chelydra serpe tina serpentina (Linne)

Family Testudinidae

Terrapene carolina carolina (Linne)

Graptemys geographica (LeSueur)

Graptemys pseudogeographica pseudogeographica (Gray)

Chrysemys bellii marginata (Agassiz)

*Chrysemys picta dorsalis (Agassiz)

Pseudemys concinna heiroglyphica (Holbrook)

Pseudemys scripta troosti (Holbrook)

Pseudemys elegans (Wied)

Family Trionychidae

Amyda mutica (LeSueur)

Amyda Spinifera Spinifera (LeSueur)

FAUNAL DISTRIBUTION

STATE WIDE FORMS

Of the 106 species and subspecies occurring in Kentucky 35 forms have a range which includes all of the state. Some these are of northern origin, others of southern. It is interesting to note that a few races which are state wide have areas of intergradation within Kentucky.

Necturus maculosus maculosus (Rafinesque)

Ambystoma opacum (Graven horst)

Plethodon glutinosus glutinosus (Green)

Eurycea longicauda longicauda (Green)

Bufo americanus americanus (Holbrook)

Bufo woodhousii fowleri (Hinckley)

Acris crepitans (Baird)

Pseudacris nigrita triseriata (Wied)

Hyla crucifer crucifer Wied

Hyla versicolor versicolor (LeConte)

Rana catesbeiana Shaw

Rana clamitans Latreille

Rana Palustris LeConte

Rana Pipiens pipiens Schreber

Rana pipiens sphenocephala (Cope)

Rana sylvatica sylvatica (LeConte)

Sceloporus undulatus fasciatus (Green)

Eumeces laticeps (Schneider)

Eumeces fasciatus (Linne)

Leiolopisma laterale (Say)

Carphophis amoena helnae (Kennicott) This form intergrades in eastern Kentucky with Carphophis amoena amoena (Say)

Lampropeltis getulus nigra (Yarrow)

Heterodon contortrix contortrix (Linne)

Opheodrys aestivus (Linne)

Coluber constrictor constrictor (Linne)

Elaphe obsoleta obsoleta (Say) This form intergrades in western Kentucky with Elaphe obsoleta (Baird and Girard)

Storeria dekayi (Holbrook)

Storeria occiptomaculata (Storer)

Thamnophis sauritus sauritus (Linne)

Thamnophis sirtalis sirtalis (Linne)

Sternotherus odoratus (Latreille)

Chelydra serpertina serpentina (Linne)

Terrapene carolina carolina (Linne)

Pseudemys scripta troosti (Holbrook)

Amyda spinifera spinifera (LeSueur)

REGIONAL DISTRIBUTION

The remaining 71 species and subspecies which occur in Kentucky are not state wide. These forms will be listed and discussed under the various region of the state in which they occur.

Purchase Region

Recalling the physiography, soils, climate, drainage and vegetation of the Purchase Region it is easy to predict the herpetofauna whose ranges extend into and are almost limited to this area in Kentucky. As previously mentioned the Purchase Region is that part of the Mississippi Embayment lying within the state, therefore, Coastal Plain and Mississippi Valley reptiles and amphibians enter into it. The low relief of the land invites these lowland forms. The climate is warm enough for southern races to thrive here. It is interesting to note that this region along with extreme southern Illinois and Indiana is the northern limit of these southern forms. As one would expect there is no sharp barrier limiting the ranges of these races, hence they do extend into the extreme western portions of the Western Coal Fields and Pennyroyal Regions.

The vegetation conforms to this pattern also. The southern species which are present in this area are Mississippi Valley and Coastal Plain forms. As the herpetofauna, some of the flora which appear to be limited to this area extend into the Western Coal Fields.

The following 18 forms are the species and subspecies whose ranges in Kentucky are almost exclusively limited to the Purchase Region.

Amphiuma means tridactylum Cuvier

Triturus viridescens louisianensis (Wolterstorff)

Ambystoma talpoideum (Holbrook)

Siren intermedia nettingi Goin

Hyla avivoca Viosca

Hyla cinerea cinerea (Schneider)

Hyla squirella Latreille

Farancia abacura reinwardtii (Schlegel)

Diadophis punctatus stictogenys Cope

Natrix cyclopion cyclopion (Dumeril and Bibron)

Natrix sipedon confluens (Blanchard)

Natrix rhombifera rhombifera (Hallowell)

Haldea valeriae elegans (Kennicott)

Agkistrodon mokeson austrinus Gloyd and Conant

Agkistrodon piscivorous leucostoma (Troost)

Crotalus horridus atricaudatus (Latreille)

Chrysemys picta dorsalis (Agassiz)

Macrochelys temminckii (Troost)

Although Siren intermedia nettingi extends beyond the Purchase Region, it has been included here because it follows the pattern of the southern forms which extend up the Mississippi into the Ohio River and then down the Tennessee, Cumberland and Tradewater Rivers into northwestern Tennessee.

There are two races of Natrix sipedon which intergrade in the Purchase Region. These are Natrix s. confluens which is a western Mississippi Valley form and Natrix s. pleuralis which is an inland southeastern form. Records are available for N. s. pleuralis and and N. s. confluens in this region (fig. 7).

Western Kentucky

The following 13 species and subspecies are limited to the western half of the state. These forms fall into two categories; those that extend to the Knobs including the Purchase Region, Western Coal

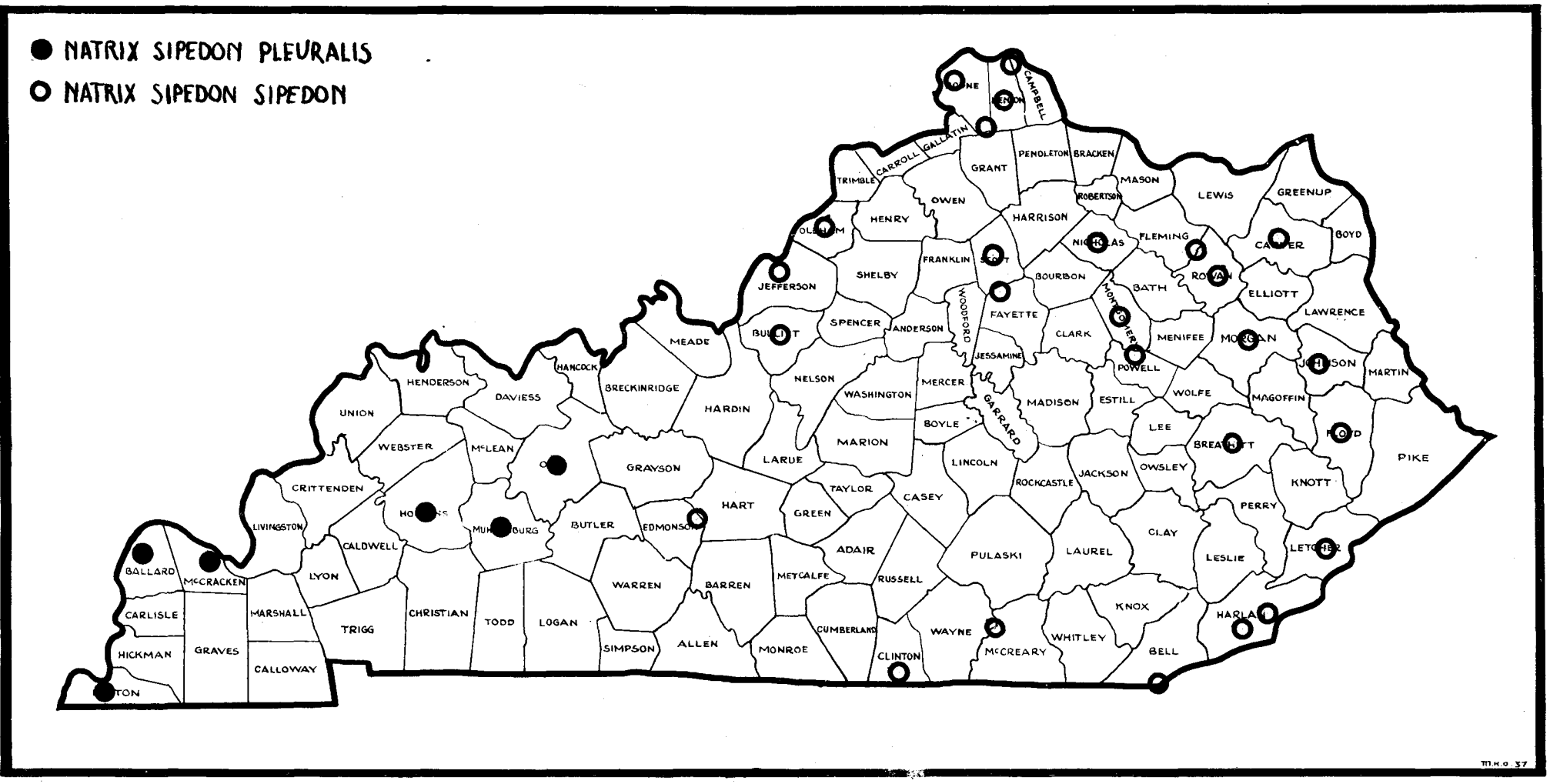

● NATRIX SIPEDON PLEURALIS
○ NATRIX SIPEDON SIPEDON
CAMPBELL
GALLATIN
CARROLL
TRIMBLE
GRANT
PENDLETON
BRACKEN
MASON
ROBERTSON
LEWIS
GREENUP
OWEN
HENRY
HARRISON
FLEMING
CARTER
BOYD
FRANKLIN
SHELBY
JEFFERSON
BOURBON
BATH
ROWAN
ELLIOTT
LAWRENCE
WOODFORD
FAYETTE
SPENCER
ANDERSON
BULLITT
CLARK
MENIFEE
MORGAN
JOHNSON
MARTIN
MEADE
HANCOCK
BRECKINRIDGE
NELSON
WASHINGTON
MERCER
JESSAMINE
POWELL
HENDERSON
DAVIESS
HARDIN
GARRARD
MADISON
ESTILL
WOLFE
MAGOFFIN
UNION
WEBSTER
McLEAN
LARUE
MARION
BOYLE
LEE
BREATHITT
FLOYD
PIKE
GRAYSON
CRITTENDEN
TAYLOR
CASEY
LINCOLN
ROCKCASTLE
JACKSON
OWSLEY
KNOTT
HART
GREEN
LIVINGSTON
BUTLER
EDMONSON
PERRY
CALDWELL
ADAIR
PULASKI
LAUREL
CLAY
LESLIE
LETCHER
BALLARD
McCRACKEN
LYON
METCALFE
RUSSELL
WARREN
BARREN
CARLISLE
MARSHALL
CHRISTIAN
TODD
LOGAN
TRIGG
KNOX
HARLAN
HICKMAN
GRAVES
CALLOWAY
SIMPSON
ALLEN
MONROE
CUMBERLAND
CLINTON
WAYNE
McCREARY
WHITLEY
BELL

FIG. 7

Fields and western half of the Pennyroyal; and those that cross the Knobs and occur in the western half of the Bluegrass. These latter forms might possibly extend throughout the entire Bluegrass, however, from the locality records at hand they appear to remain on the western side of the Cincinnati Anticline. These forms are,

Ambystoma tigrinum tigrinum (Green)

Plethodon cinereus dorsalis Cope

Graptemys pseudogeographica pseudogeographica (Gray)

This last form is a Mississippi Valley race which circumvents the Kentucky Knobs by following the Ohio River Basin to Ohio.

The species and subspecies which extend to the Knobs are possibly limited in their ranges by the physiography. These are primarily lowland forms, either ranging from the Mississippi Valley and Coastal Plains or the Central Plains. Possible barriers are the change in temperature, soil, and the shorter growing season east of the Knobs. These forms are,

Rana areolata circulosa Rice and Davis

Gastrophryne carolinensis (Holbrook)

Ophisaurus ventralis (Linne)

Cnemidophorus sexlineatus (Linne)

Lampropeltis calligaster (Harlan)

Lampropeltis triangulum syspila (Cope)

Natrix sipedon pleuralis (Cope)

Heterodon simus (Linne)

Tantilla coronata coronata (Baird and Girard)

Pseudemys concinna heiroglyphica (Holbrook)

Central Kentucky

The records for the following forms are very incomplete. From the available data it seems that these forms occur in Central Kentucky. Further collecting might reveal either eastern or western range extensions. These forms are:

Natrix septimvittata (Say)

Kinosternon subrubrum subrubrum (Lacepede)

State Wide Except Eastern Mountains

There are three species whose ranges include all of the state except the eastern mountains. These forms are:

Ambystoma maculatum (Shaw)

Elaphe obsoleta confinis (Baird and Girard)

Natrix erythrogaster erythogaster (Forster)

Ambystoma maculatum has been reported as far east as Floyd and Cumberland Counties. It seems not to have been collected in Pine and Cumberland Mountains. Consequently the author assumes that it does not occur in the high eastern mountains of the state.

Elaphe obsoleta confinis has been reported as far east as Clark and Nicholas Counties and an intergrade with Elaphe o. obsoleta has been collected in Rowan County. It is possible that these two forms intergrade on the western half of the Cumberland Plateau (fig. 8).

Natrix erythrogaster erythrogaster seems not to have been reported from the Eastern Coal Fields.

The Cumberland Plateau and High Eastern Mountains

There are three species whose ranges in Kentucky are limited to the Cumberland Plateau and High eastern mountains. These are:

Desmognathus ochrophaeus ochrophaeus (Cope)

Aneides aeneus (Cope)

Gyrinophilus danielsi (Blatchly)

The first two forms occur in the Cumberland Plateau and the Pine and Cumberland Mountain ranges. They are of norther origin and hence are able to thrive in this highland area. Gyrinophilus danielsi has a very limited range in Kentucky, occurring only in the highest points of the Cumberland and Pine Mountain ranges. It prefers high mountain streams, therefore, its distribution is restricted to the high southern section of the Blue Ridge Mountains.

Eastern Half of the State

There are 13 species and subspecies whose ranges in Kentucky are limited to the eastern half of the state. These forms fall into two categories: those that extend through the eastern half of the Bluegrass; and those that extend to the Western Coal Fields. For the former group there are records as far west as Kenton and Campbell counties. Since there is no obvious barrier these forms might extend throughout the entire Bluegrass region or even as far west as the Western Coal Fields. It is highly probable that some of the forms as Plethodon cinereus cinereus use the Bluegrass as an area of intergradation. The forms limited to this part of the state are:

Plethodon cinereus cinereus (Green)

Plethodon richmondi Netting and Mittleman

Pseudacris brachyphona (Cope)

Haldea valeriae valeriae (Baird and Girard)

Those forms which extend beyond the Bluegrass appear to be limited by the Western Coal Fields and western Pennyroyal. These races are primarily of northern origin and are unable to adjust to the variations in climate, soil, and physiography which occur in the western half of the state. These forms are:

Desmognathus phoca (Matthes)

Gyrinophilus porphyriticus porphyriticus (Green)

This form occurrs through eastern Kentucky with the exception of the high eastern mountains.

Pseudotriton montanus diasticus Bishop

Pseudotriton ruber ruber (Sonnini)

This form is nearly state wide with the exception of the Western Coal Fields and the Purchase Region.

Carphophis amoena amoena (Say)

This form is limited by the Western Coal Fields but intergrades with C. a. helenae throughout most of its range in Kentucky.

Diadophis punctatus edwardsii (Merrem)

This form intergrades with D. p. stictogenys in the Western Coal Fields.

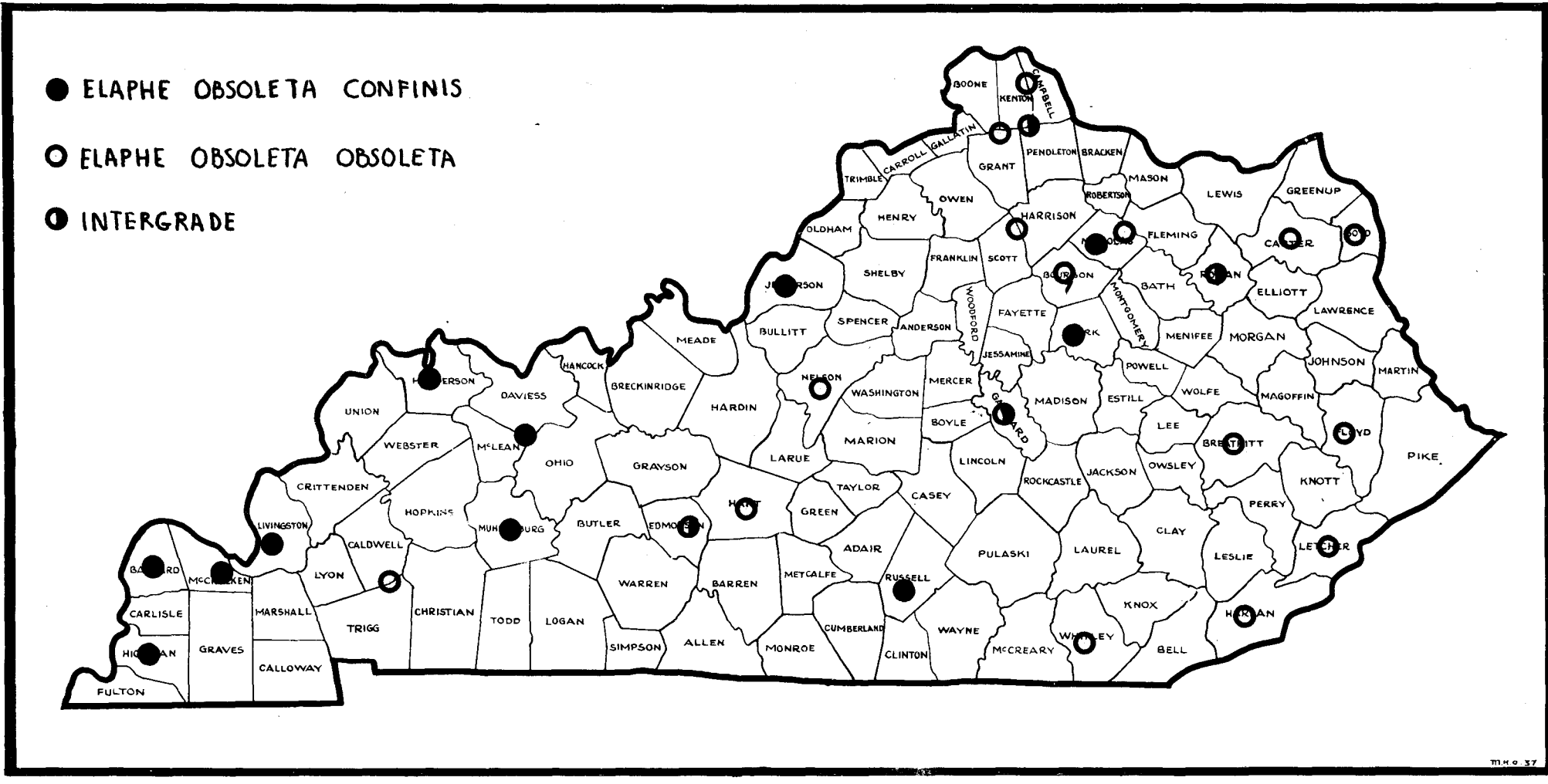

● ELAPHE OBSOLETA CONFINIS
O ELAPHE OBSOLETA OBSOLETA
◐ INTERGRADE
BOONE
KENTON
CAMPBELL
GALLATIN
GRANT
PENDLETON
BRACKEN
TRIMBLE
CARROLL
MASON
ROBERTSON
LEWIS
GREENUP
OWEN
HENRY
HARRISON
OLDHAM
FLEMING
CARTER
SHELBY
FRANKLIN
SCOTT
BATH
ELLIOTT
LAWRENCE
SPENCER
ANDERSON
WOODFORD
FAYETTE
MONTGOMERY
MENIFEE
MORGAN
BULLITT
MEADE
JESSAMINE
POWELL
JOHNSON
MARTIN
HANCOCK
BRECKINRIDGE
NELSON
WASHINGTON
MERCER
UNION
DAVIESS
HARDIN
MADISON
ESTILL
WOLFE
MAGOFFIN
BOYLE
WEBSTER
McLEAN
OHIO
GRAYSON
MARION
LEE
BREATHITT
LARUE
LINCOLN
JACKSON
OWSLEY
KNOTT
PIKE
CRITTENDEN
TAYLOR
CASEY
ROCKCASTLE
HOPKINS
PERRY
LIVINGSTON
BUTLER
GREEN
CALDWELL
ADAIR
PULASKI
LAUREL
CLAY
LESLIE
LYON
WARREN
BARREN
METCALFE
RUSSELL
CARLISLE
MARSHALL
CHRISTIAN
TODD
LOGAN
TRIGG
KNOX
GRAVES
SIMPSON
ALLEN
MONROE
CUMBERLAND
WAYNE
McCREARY
BELL
CALLOWAY
CLINTON
FULTON

FIG. 8

Lampropeltis triangulum triangulum (Lacepede)

Natrix sipedon sipedon (Linne)

There is one other form occurring in eastern Kentucky which does not fall into either category. It is:

Lampropeltis triangulum elapsoides (Holbrook)

This is an east coast plain race which extends into south-eastern and south central Kentucky according to available data. The author assumes this form intergrades with L. t. triangulum in the north-eastern part of the state.

Statewide except the Purchase

Seven forms occur through the state with the exception of the Purchase Region. This region which is so conducive to Mississippi Valley and southern forms because of its southern influences and lowland topography now becomes a barrier to these norther races. Some of these forms meet their "southern counterparts" at the border of the Purchase Region in the area of the Tennessee and Cumberland Rivers and intergrade there. These forms are:

Triturus viridescens viridencens (Rafinesque) Intergrades with T. v. louisianensis

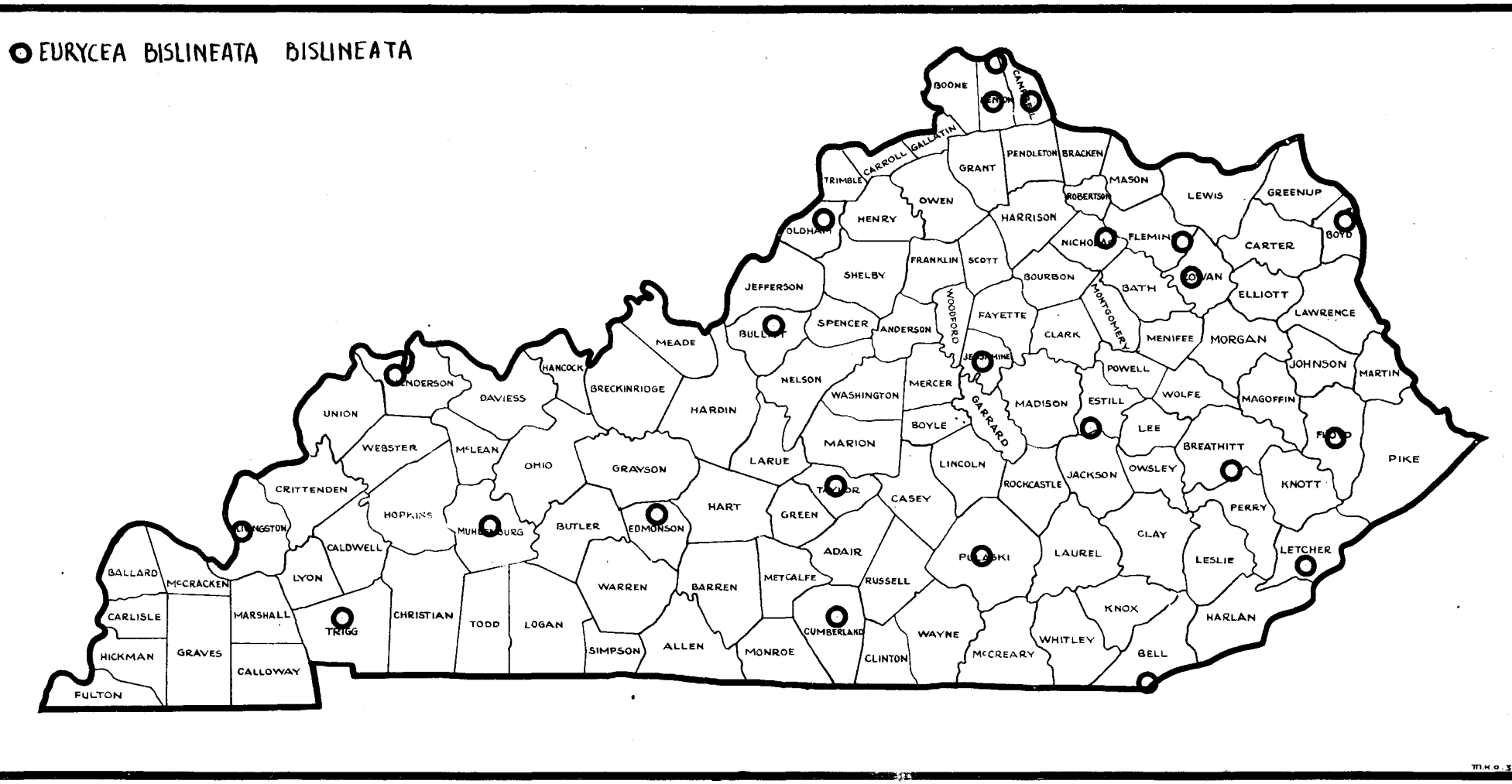
Desmognathus fuscus fuscus (Rafinesque)

Eurycea bislineata bislineata (Green) (fig. 9).

Eurycea lucifuga Rafinesque

Hemidactylium scutatum (Schlegel)

Agkistrodon mokeson mokeson (Daudin) Intergrades with A. m. austrinus Gloyd and Conant


EURYCEA BISLINEATA BISLINEATA
BOONE
KENTON
CAMPBELL
GALLATIN
CARROLL
TRIMBLE
OLDHAM
HENRY
OWEN
GRANT
PENDLETON
BRACKEN
ROBERTSON
MASON
LEWIS
GREENUP
BOYD
HARRISON
NICHOLAS
FLEMING
CARTER
FRANKLIN
SCOTT
SHELBY
JEFFERSON
BOURBON
BATH
ROWAN
ELLIOTT
LAWRENCE
BULLITT
SPENCER
ANDERSON
WOODFORD
FAYETTE
CLARK
MONTGOMERY
MENIFEE
MORGAN
JOHNSON
MARTIN
MEADE
HANCOCK
HENDERSON
DAVIESS
BRECKINRIDGE
NELSON
WASHINGTON
MERCER
JESSAMINE
POWELL
UNION
HARDIN
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MADISON
ESTILL
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MAGOFFIN
WEBSTER
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OHIO
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HOPKINS
MUHLENBURG
BUTLER
EDMONSON
HART
GREEN
TAYLOR
CASEY
LINCOLN
ROCKCASTLE
JACKSON
OWSLEY
KNOTT
PERRY
LIVINGSTON
CALDWELL
LYON
TRIGG
CHRISTIAN
TODD
LOGAN
WARREN
BARREN
METCALFE
ADAIR
RUSSELL
PULASKI
LAUREL
CLAY
LESLIE
LETCHER
BALLARD
McCRACKEN
CARLISLE
MARSHALL
GRAVES
HICKMAN
CALLOWAY
FULTON
SIMPSON
ALLEN
MONROE
CUMBERLAND
CLINTON
WAYNE
McCREARY
WHITLEY
KNOX
BELL
HARLAN

FIG. 9

Crotalus horridus horridus (Linne) Intergrades with C. h. atricaudatus (Latreille)

Northern Half of the State

There are seven forms whose ranges in Kentucky are limited to the northern half of the state. Two species follow the Ohio River only, and avoid the Purchase Region. These are:

Cryptogranchus alleganiensis (Daudin)

Chrysemys bellii marginata (Agassiz)

Four species follow the Ohio and Mississippi drainage in Kentucky and consequently include the Purchase. They are:

Ambystoma Texanum (Matthes)

Graptemys geographica (LeSueur)

Pseudemys elegans (Wied)

Amyda mutica (LeSueur)

One other form which occurs only in the northeastern corner of the state is:

Gyrinophilus porphyriticus duryi Weller

Miscellaneous

Five species remain which do not fall into any of the above distribution areas. These are:

Ambystoma jeffersonianum (Green) Reported only from Mammoth Cave in Kentucky

Emeces anthracinus (Baird) Expected to occur in the Western Coal Fields.

Cemophora coccinea Blumenback One unpublished record.

Natrix kirtlandii (Kennicott) Possibly occurs in northeastern Kentucky, however, only records from Jefferson County (Louisville) have been available.

Pituophis melanoleucus melanoleucus Daudin Reported by Hibbard (1936) from Mammoth Cave and by Funhouser (1925) from Corbin and Turla.

CONCLUSION

In summarizing this work one is impressed not only with the many species and subspecies of amphibians and reptiles occuring in the state, but with the diverse environments present in Kentucky. The presence of a rich herpetofauna in the state is due to the diphasic ecology which provides habitats suitable for both northern and southern forms. The western portion of the state is a lowland area with a warm climate which is contiguous with the "heart" of the Mississippi Valley. Therefore, it is feasible that the flora and fauna of the Coastal Plain and Mississippi Valley regions would thrive here. Conversely the eastern portion of the state is a highland area which is part of the Appalachian Range. This area has a cooler climate and a shorter growing season which are only conducive to northern or southern mountainous forms. The remainder of the state is basically a blending of these opposing influences. In some cases it provides a large area of intergradation for those northern subspecies that have southern counterparts.

The author has no doubt that there are other influences which

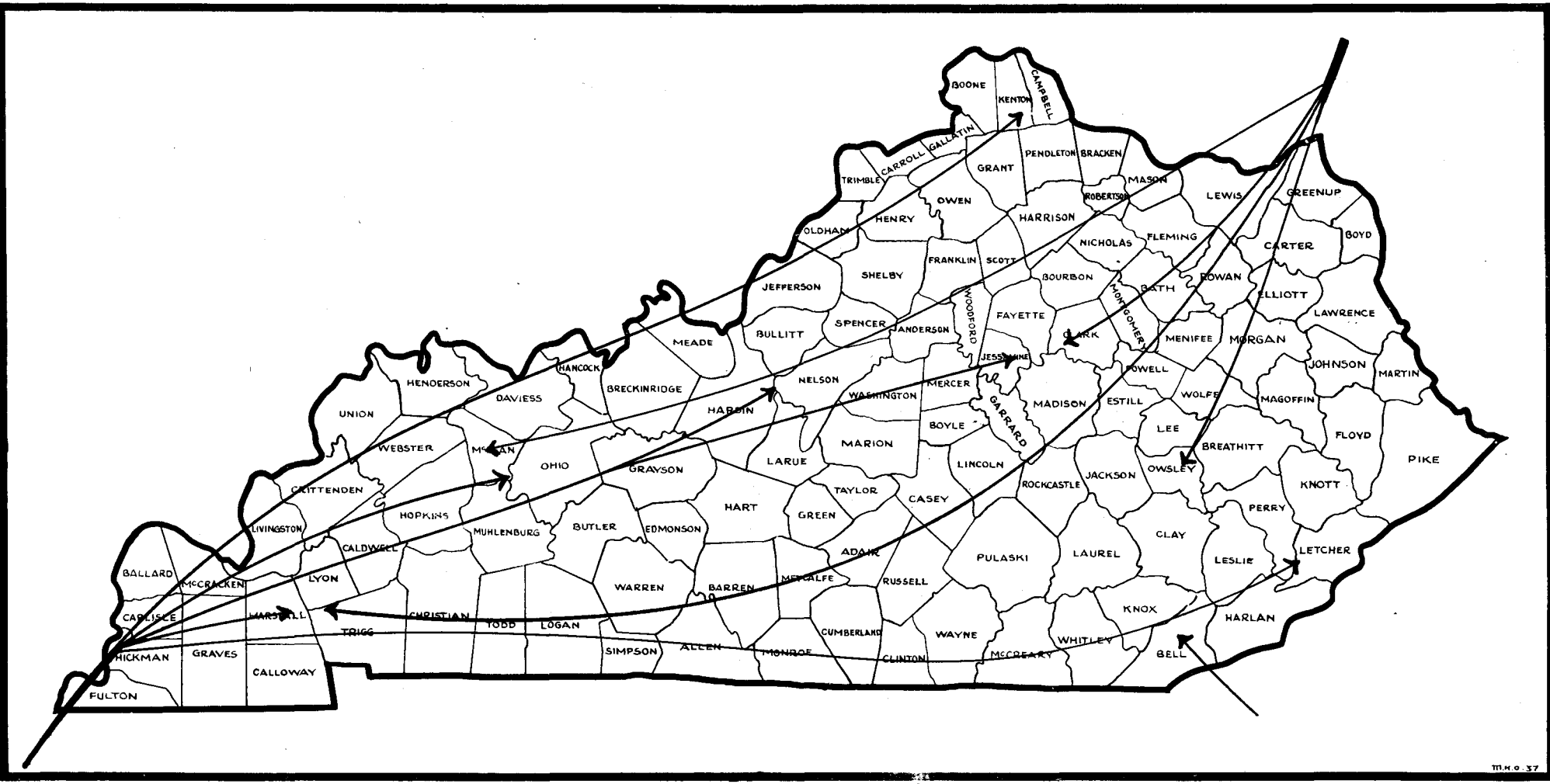

FIG. 10 AVENUES OF DISTRIBUTION

govern distribution in the state; however, these are the most striking and important. Much further investigation is necessary to clarify the distributional discrepancies and the ecological influences which the author has been unable to solve with the material available at this time. It is hoped that this work will provide a stimulus for further study of the distribution of the herpetofauna of the state of Kentucky.

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