

## ENVIRONMENT &amp; NATURAL RESOURCES

*Physical Regions*

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The present-day physical landscape of Kentucky, as we have seen, is a result of both ancient and recent geological processes. The accumulation of transported sediments during the Paleozoic, when this region was a shallow marine environment, produced a veneer of sedimentary strata thousands of feet in thickness over the much older basement rocks. Tectonic processes, involving the movement of crustal plates, fractured, warped and folded the rock layers to impose structural features within the bedrock mass. Because these structural features vary across the length and width of the Commonwealth, and because different types of sedimentary rocks vary in their resistance to weathering and erosion, there is

a distinct pattern of variation of the surface landscape. Kentucky's 40,409 square miles of land and water can thus be divided into discrete physiographic regions according to characteristics of the topography. As one travels across the state, moving from one region to another, the natural scenery often changes rather dramatically.

The five main physical regions of Kentucky, from east to west, are: the Eastern Kentucky Coal Field, the Bluegrass, the Mississippian Plateau, the Western Kentucky Coal Field, and the Mississippi

Embayment. The labels used for these regions are not completely standardized, so that books about Kentucky may refer to a region by different names. For example, the Mississippian Plateau is sometimes known as the Pennyroyal (or Pennyrile) Plateau, named for a plant of the mint family found in the region, and the Mississippi Embayment has historically been referred to as the Purchase or Jackson Purchase region, since it was added to the state in 1818 during the administration of Andrew Jackson. Multiple designations also apply to some of the major features within the regions; the western edge of the Eastern Kentucky Coal Field is sometimes known as the Pottsville Escarpment and sometimes as the Cumberland Escarpment.

Adding to the potential confusion, the physical regions of Kentucky are included within the larger geomorphic provinces of the United States. The Eastern Kentucky Coal Field is part of the Appalachian Plateaus that stretch

from New York to Georgia; the Bluegrass, Mississippian Plateau and the Western Kentucky Coal Field are contained within the Interior Low Plateaus that include parts of southern Illinois, Indiana and Ohio; and the Mississippi Embayment is a section of the much larger Gulf Coastal Plain.

Broadly speaking, the landscape of Kentucky consists of dissected highland plateaus, east and west, separated by escarpments from gently rolling plains in central and southern Kentucky. The plateau areas; the two coal field regions, are capped by



**Lexington reservoir**

*Source: Sid Webb*

sandstones and conglomerate rocks, which have eroded less rapidly than the limestones and shales of the Bluegrass and Mississippian plateau. The Eastern Kentucky Coal Field can be described as mountainous (part of the Appalachians), and the Western Kentucky Coal Field as hilly. The Bluegrass and the Mississippian Plateau are characterized by karst topography; a landscape of sinkholes, sinking streams, springs and caves resulting from the dissolution of carbonate bedrock by the percolation of acidic groundwater. The Mississippi Embayment is a low-lying dissected plain situated on thick deposits of Mesozoic and Cenezoic sand and gravel. Elevations range from more than 4,000 feet above sea level in the eastern mountains, between 800 to 1,000 feet in the Bluegrass, to less than 300 feet in the embayment.

#### **EASTERN KENTUCKY COAL FIELD (Cumberland Plateau, Eastern Kentucky)**

The Eastern Coal Field region, an area of about 10,500 square miles, is part of the Central Appalachian Mountains and has very mature and rugged terrain. The long-standing economic significance of numerous seams of bituminous coal is reflected in the name given to the region. The heavily forested topography consists of steep and narrow ridges separated by v-shaped valleys, with the mountain elevations increasing toward the southeast. Black Mountain in Harlan County is the highest point in the state, with an elevation of 4,145 feet.

Cumberland Mountain, a narrow linear ridge, marks part of the southeastern boundary with Virginia, and is paralleled within Kentucky by the very similar Pine Mountain that continues the boundary with Virginia to the northeast. These mountain ridges were formed by folding and faulting during the late Paleozoic Allegheny Orogeny associated with the assembly of Pangea. The steep northwestern face of Pine Mountain is the leading edge of an overthrust fault block shoved, in places, nearly a dozen miles past underlying strata. These ridges, which were significant barriers to the pioneer settlement of the state, are cut by gaps in only a few locations, notably Cumberland Gap in the Cumberland Mountain and the Pineville Gap in Pine Mountain. The Pine Mountain ridge reaches a height of 3,200 feet in Letcher County.

Northwest of Pine Mountain, the much larger area of mountainous terrain in Eastern Kentucky is of lesser height and is often referred to as the Cumberland Mountains (as distinct from the Cumberland Mountain of the Virginia border). These mountains are not of tectonic origin and are thus

unlike the Pine and Cumberland ridges, and the folded and fault block mountains farther east. The mountains of the Eastern Coal Field, except in the southeast corner, are the result of a deep and intricate dissection by stream erosion of a plateau of relatively flat-lying rock strata, alternating layers of sandstone, shale, coal, and limestone.

The western boundary of the Eastern Coal Field is defined by the Pottsville (Cumberland) Escarpment, which trends in a southwestern direction from Lewis County, on the Ohio River, toward the Tennessee border. The escarpment rises 200 to 300 feet from the adjacent terrain and is capped by sandstone and conglomerate rocks that are highly resistant to erosion. The edge of the escarpment is thoroughly dissected, and is bordered by conical hills known as "Knobs" that are erosional remnants left by the retreat of the escarpment. The escarpment area is very scenic, with many attractive stream-carved gorges, waterfalls, and natural arches produced by the narrowing of ridges. More than 450,000 acres of the Daniel Boone National Forest are located along the escarpment area, as are the Red River Gorge Geological Area and the nearby Natural Bridge State Park. The escarpment also contains numerous caves developed in limestone exposed by the erosion of the landscape.

Most of the region is drained by four streams and their tributaries, all of which flow northward to the Ohio River: the Big Sandy River, which forms the boundary between Kentucky and West Virginia; the Licking River; the Cumberland River, which flows southward into Tennessee but returns to Kentucky in the western part of the state; and the Kentucky River, which is divided into three separate branches. Because of the very steep and rugged terrain, most communities in the region are located in floodplains. As a consequence, flooding is a serious hazard for these towns.

#### **BLUEGRASS**

Adjacent to the Eastern Coal Field and sharing the Escarpment as a border is the Bluegrass region, which contains about 8,000 square miles and is subdivided into the Inner and Outer Bluegrass sub-regions, separated by the Eden Shale belt. The fertile lands of the Bluegrass were the first to be settled by the pioneers, and in this region today resides most of the population of the state. Frankfort, the state capital, is located here, as are the two largest cities: Louisville and Lexington, and the metropolitan areas of Newport and Covington, across the Ohio River from Cincinnati. The region is named for a grass, *Poa pratensis*, that was introduced by the early settlers of the area, probably by

accident. The Bluegrass is bordered to the north by the Ohio River and separated from the rest of the state by the Knobs, which extend completely around the region in a belt 10 to 15 miles wide from Lewis County in the east to Jefferson County in the west. The Knobs range from about 50 feet to nearly 1,000 feet in height, with the highest toward eastern Kentucky. The terrain is gently rolling, with a belt of low hills that separates the Inner from the Outer Bluegrass.

The topography is developed upon the upward rock strata of the Cincinnati Arch. The Bluegrass region is centered upon the Jessamine Dome, the highest point of the Arch, so that the older rocks in the middle are surrounded by irregular concentric bands of younger strata, wider to the north and west. The changing nature of the bedrock, nearly all of Ordovician age, accounts for the changing nature of the terrain. The Inner Bluegrass is a karst landscape of about 2,000 square miles situated upon limestone, and characterized by numerous sinkholes and natural springs. Many sinkholes contain small ponds. This is

one of the most fertile agricultural regions in Kentucky. Surrounding the Inner Bluegrass is the Eden Shale belt, sometimes referred to as the Hills of the Bluegrass because the topography is more rugged and contains little level land, with many low hills and narrow valleys. Because shale is the dominant bedrock, soils in this region are generally thin and infertile. The Outer Bluegrass encircles the region outside the shale belt, and, as a gently rolling karst plain, is very similar to that of the Inner Bluegrass.

The Bluegrass region is drained by the Kentucky River and its tributaries, which, as they flow through the Bluegrass, are entrenched in sinuous meanders 200 to 300 feet below the adjacent uplands.

#### MISSISSIPPIAN PLATEAU

(Pennyroyal Plateau, Pennyrite Plateau)

The Mississippian Plateau, with 12,000 square

miles, is the largest region of Kentucky and shares borders with all of the other regions. From the Pottsville Escarpment, which forms the eastern boundary, the region extends west to the Mississippi Embayment and northward to the Knobs of the Bluegrass and nearly encircles the Western Coal

Field region. Except for the southern boundary with Tennessee, which is political, the geographic bounds of the region are derived from the underlying geologic structure. The upwarp of the Cincinnati Arch extends from Ohio to Tennessee, and contains two structural highs, the Jessamine Dome, centered nearly on Lexington, and the similar Nashville Dome, centered near Nashville, Tenn. The rock strata dip away from the two domes, so that each dome is surrounded by belts of younger rock, but between the Jessamine and Nashville domes is a slight structural low known as the Cumberland Saddle in which the surface bedrock is all of Mississippian age. The region is separated from the Western Coal Field by



Two women on a rock in  
the Big Sandy River  
Source: Kentucky Department of  
Libraries & Archives

an escarpment similar to the Pottsville Escarpment along the boundary with the Eastern Kentucky Coal Field, but of lesser relief.

The topography of the region, and associated land use, is related to the surface bedrock. Where the bedrock is limestone, the terrain generally consists of gently rolling hills that are good farmland. Where resistant sandstone caprock still exists to protect the limestone from erosion, the terrain tends to be more rugged, cut up into steep hills and valleys. Since the rocks of the Mississippian Plateau are mainly limestones, a large proportion of the region is considered karst and much of the regional drainage is subsurface. Mammoth Cave and many others are located in the stream-dissected Chester Upland near the southeastern border of the Western Coal Field, developed in the limestones underlying a band of sandstone caprock known as the

Big Clifty that encircles the Coal Field.

The outer edge of the Chester Upland is the Dripping Springs Escarpment, which rises 150 to 300 feet above the surrounding landscape. Southeast from the escarpment is an area of complex sinkhole patterns known as the Sinkhole Plain, in which surface streams are almost entirely absent since the local drainage is underground. The early settlers referred to this area as the "Barrens," a term used for a grassland prairie. Northward from the Sinkhole Plain, the Mississippian Plateau is separated from the Bluegrass region by the Muldraugh's Hill limestone escarpment, at the base of which is the most extensive area of Knobs in the state.

Much of the landscape of the eastern and central Mississippian Plateau is also karst. The eastern section of the Mississippian Plateau tends to have a more rugged topography, particularly near the border with the Eastern Coal Field and in the vicinity of the deeply entrenched Cumberland River, Lake Cumberland, and Dale Hollow Lake. North and west from the lakes, the terrain is more suitable for agriculture. Most of the Mississippian Plateau region is drained by the Green River and its tributaries, and to a lesser extent by the Cumberland River in the eastern and western parts of the region. The Mississippian Plateau topography extends southward into Middle Tennessee, where it is known as the Highland Rim.

#### **WESTERN KENTUCKY COAL FIELD**

The 4,680 square-mile Western Kentucky Coal Field, like its eastern counterpart, owes its name to the long-standing economic significance of coal mining in the region. The Ohio River forms the northern border, and elsewhere the Coal Field is surrounded by the Mississippian Plateau region on all sides. The topography of the region is derived from the underlying structural downwarp feature: the Illinois Basin. The basin originated during the early Paleozoic, slowly subsiding as it accumulated a great thickness of marine sediments. Most of the 60,000 square-mile basin lies in Illinois and Indiana; only the southern tip extends into Kentucky. Since this is a basin, the oldest strata are on the perimeter, unlike the structure of the Jessamine Dome in the Bluegrass where the oldest rocks are in the center.

The margin of the Western Coal Field is a narrow belt of rough, hilly land whose outer edge forms an escarpment, very similar to the Pottsville Escarpment bordering the Eastern Kentucky Coal Field but not as high. Within the rim of hills is a lower interior of rolling hills. The region is drained by the Green, Tradewater and Ohio rivers. The Green

and Tradewater rivers, and their tributaries, flow through wide valleys which contain an alluvial fill nearly 200 feet thick in places, deposited as floodplain and lake sediments during periods of glaciation when glacial outwash dammed the mouths of the rivers. Radical alterations of the topography have been made across broad areas by the surface mining of coal carried on extensively in the region.

#### **MISSISSIPPI EMBAYMENT**

(Jackson Purchase, Purchase)

The Embayment region is completely unlike any other part of Kentucky in its geology and topography. The landscape is geologically the youngest and lowest terrain of the state, and, historically, the most recent territory incorporated into the Commonwealth. This region has traditionally been called The Jackson Purchase because it was acquired in 1818 from the Chickasaw Indians during the administration of Andrew Jackson. The 2,396 square-mile region is bounded by the Tennessee River and the impoundment of Kentucky Lake to the east, by the Ohio River to the north, and by the Mississippi River to the west. The Tennessee state line forms the southern boundary. There are some boundary anomalies along the Mississippi River border with Missouri. This boundary was originally established as a line down the center of the Mississippi river, but shifts over time in the course of the river have stranded small sections of Kentucky on what is now the opposite side of the river. An error made in the 1780 Walker survey created the Kentucky Bend enclave, the state's most western territory. This tract of about 5 square miles is isolated within a hairpin bend of the Mississippi, completely separated from the rest of the state and accessible only from Tennessee.

The region is located at the head of the Mississippi Embayment, a depositional trough that formed during the late Mesozoic and accumulated thick deposits of marine sediments overlain by more recent deposits of alluvium and loess. Low hills and rolling plains of deeply weathered gravel in the eastern part slope gradually to low, flat plains of sand, gravel, silt and clay in the west. The landscape is poorly drained in the southern part, dissected by a network of low-gradient creeks and small rivers often bordered by wetland areas, but well-drained farmland is found to the north. In the west, the uplands end in a line of bluffs along the Mississippi River, 100 to 180 feet high, overlooking the floodplain of the great river. The flows of the Ohio and Mississippi join just above Wickliffe in Ballard County, and the floodplains of these rivers exhibit many meander scars and oxbow lakes.

