

Ecoregions denote areas of general similarity in ecosystems and in the type, regional physiographic, geologic, land use, and soil characteristics. Deciduous Literature Cited: quality, and quantity of environmental resources. They are designed to serve as a forests widely covered Kentucky at the time of European settlement. About half Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and spatial framework for the research, assessment, management, and monitoring of is still forested. Extensive "barrens" (i.e. bluestem prairies) were once maintained ecosystems and ecosystem components. By recognizing the spatial differences in by fires set by Native Americans on rolling to flat parts of the Interior Plateau the capacities and potentials of ecosystems, ecoregions stratify the environment (71) and Mississippi Valley Loess Plains (74). Today, these areas are dominated by its probable response to disturbance (Bryce and others, 1999). Ecoregions are by cropland and pastureland and the historic "barrens" are nearly extinct. Major general purpose regions that are critical for structuring and implementing coal fields occur in the Southwestern Appalachians (68), Central Appalachians ecosystem management strategies across federal agencies, state agencies, and (69), Western Allegheny Plateau (70), and Interior River Valleys and Hills (72). nongovernment organizations that are responsible for different types of resources in the same geographical areas (Omernik and others, 2000).

regions can be identified through the analysis of the spatial patterns and the This poster is part of a collaborative project primarily between USEPA Region 4, composition of biotic and abiotic phenomena that affect or reflect differences in USEPA National Health and Environmental Effects Research Laboratory McMahon, G., Gregonis, S.M., Waltman, S.W., Omernik, J.M., Thorson, T.D., Freeouf, J.A. ecosystem quality and integrity (Wiken, 1986; Omernik, 1987, 1995). These (Corvallis, Oregon), and the Kentucky Natural Resources and Environmental phenomena include geology, physiography, vegetation, climate, soils, land use, Protection Cabinet-Department for Environmental Protection (KDEP). wildlife, and hydrology. The relative importance of each phenomenon varies Collaboration and consultation also occurred with the U.S. Department of from one ecological region to another regardless of ecoregion hierarchical level. Agriculture–Forest Service (USFS), U.S. Department of Interior–Geological A Roman numeral hierarchical scheme has been adopted for different levels of Survey (USGS), The Nature Conservancy, Eastern Kentucky University (EKU), ecological regions. Level I is the coarsest level, dividing North America into 15 USGS–Earth Resources Observation Systems Data Center, Kentucky Geological ecological regions. Level II divides the continent into 52 regions (Commission Survey, and other Commonwealth of Kentucky agencies. for Environmental Cooperation Working Group, 1997). At level III, the continental United States contains 104 ecoregions and the conterminous United States has 84 ecoregions (U.S. Environmental Protection Agency [USEPA], 2002). Level IV is a further subdivision of level III ecoregions. Explanations of the methods used to define the USEPA's ecoregions are given in Omernik mapping methodologies applied to develop the most common ecoregion-type (1995), Omernik and others (2000), and Gallant and others (1989).

In Kentucky, there are 7 level III ecoregions and 25 level IV ecoregions; all but Conservation Service (1981). As each of these frameworks is further refined, four level IV ecoregions continue into ecologically similar parts of adjacent their differences are becoming less discernible. Each collaborative ecoregion states (Griffith, Omernik, and Azevedo, 1998; Woods and others, 1998). project, such as this one in Kentucky, comprises a step toward attaining Woods, A.J., Omernik, J.M., Brockman, C.S., Gerber, T.D., Hosteter, W.D., and Azevedo, Ecological and biological diversity in Kentucky is very strongly related to consensus and consistency in ecoregion frameworks for the entire nation.

<b>68</b> 68a 68c	<b>Southwestern Appalachians</b> Cumberland Plateau Plateau Escarpment	Level III ecoregion County Level IV ecoregion State b	y bounda ooundary
<b>69</b> 69d 69e	<b>Central Appalachians</b> Dissected Appalachian Plateau Cumberland Mountain Thrust Block	SCALE 1:1 000 00	00
70	Western Allegheny Plateau	15 10 5 0 30	
70b	Monongahela Transition Zone		
70d	Knobs–Lower Scioto Dissected		
70f	Plateau Obio/Wantualuy Carboniferous	30 20 10 0 60	
/01	Plateau	Alberta Equal Area Drain	ation
70g	Northern Forested Plateau	Albers Equal Alea Ploje Standard parrallels 37° N at	nd 30° N
	Escarpment	Standard partanets 57 TV ar	.iu 57 iv
70h	Carter Hills		
71	Interior Plateau		
71a	Crawford–Mammoth Cave		
	Uplands	Level III Ecoregions of the Conte	ermino
71b	Mitchell Plain	N WE	
71c	Knobs–Norman Upland		
71d	Outer Bluegrass	10 15 141 42 Deer and 148 49 June	2 and and a start of the start
71e	Western Pennyroyal Karst Plain	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	him
/11 71σ	Fastern Highland Rim	43	- A 50
71h	Outer Nashville Basin	185	53
71k	Hills of the Bluegrass	What was provided by 18 that the start of 47	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
711	Inner Bluegrass		54
72	Interior River Valleys and Hills	Company of the for the 2 27 the state	72
72a	Wabash–Ohio Bottomlands		And C
72c	Green River-Southern Wabash	and the second of the second o	1.
	Lowlands	81 23 h	C Col
72h	Caseyville Hills		4 65
73	Mississippi Alluvial Plain	24 30 33	-
73a	Holocene Meander Belts	A SAL THE COMMENT	<b>X</b>
74	Mississippi Valley Loess Plains	31 Januar	

74a Bluff Hills 74b Loess Plains



The nearly level to rolling Inner Bluegrass is a weakly dissected agricultural plain

73. Mississippi Alluvial Plain Ecoregion 73 is mostly a flat, broad alluvial plain with river terraces, swales, and levees providing the main elements of relief. Soils are typically finer-textured and more poorly-drained than the upland soils of Ecoregion 74. However, better-drained loamy, silty, and sandy soils also occur. Winters are mild and summers are hot. Bottomland forests dominated by water-tolerant oaks and swamp forests of tupelo and bald cypress were once common. Grasslands occurred on well-drained sandy sites. Much of the natural vegetation has been cleared and drained for cultivation. Streams are extremely low in gradient and have sandy to muddy substrates. Fish assemblages, with the exception of a few rare and sporadically occurring species, are similar to those in the lowland streams in Ecoregion 74. **73a** The Holocene Meander Belts ecoregion contains floodplains, low terraces, levees, abandoned channels, oxbow lakes, wetlands, and bayous. Soils are derived from deep the ecoregion is dominated by soybean, corn, small grain, and livestock farming. Only limited areas Quaternary alluvium and are naturally fertile. They support a potential natural vegetation of southern of bottomland forests and swamps still occur. The remaining bottomland forests are dominated by floodplain forest that is distinct from the oak-hickory forest of nearby upland ecoregions. Aquatic water-tolerant oaks, maples, sweetgum, sugarberry, sycamore, American elm, and pecan. Th

mantled by thin loess. Valleys are narrower and are much less extensive than in Ecoregion 2c but are wider, deeper, and more numerous than in Ecoregion 71a. Ecoregion 72h is underlain by **72c** The Green River–Southern Wabash Lowlands ecoregion is dominated by agriculture and pennsylvanian sandstones, siltstones, shales, and coal of the Tradewater and Caseyville formations

## 74. Mississippi Valley Loess Plains Ecoregion 74 in far western Kentucky consists of irregular plains, gently rolling hills, and, near the Mississippi River, bluffs. It is characteristically covered by thick loess and alluvium and is underlain by unconsolidated coastal plain sediments that are susceptible to rapid erosion. Ecoregion 74 is lithologically distinct from the consolidated bedrock of the Interior Plateau (71) and the Interior River Valleys and Hills (72). Ecoregion 74 has less relief than Ecoregions 71 and 72. Elevations and relief are much lower than in the Appalachian Mountains (i.e. Ecoregions 68, 69, and 70). Potential natural vegetation is oak-hickory forest and is unlike the southern floodplain forest of the Mississippi Alluvial Plain (73). Forested wetlands were once extensive but have been replaced by extensive cropland and pastureland.

Streams typically have low gradients and gravelly to sandy bottoms. Stream alkalinity and hardness levels are lower than in Ecoregion 71. Fish assemblages, with the exception of several locally endemic species, are similar to those of Ecoregions 72 and 73. Virtually all of the major stream systems have been channelized to some degree. **74a** The highly dissected **Bluff Hills** ecoregion is a narrow belt of rugged terrain that is mantled by thick loess and underlain by unconsolidated coastal plain sediments. The Bluff Hills **74b** The **Loess Plains** ecoregion is a productive agricultural area that is composed of gently rolling uplands, broad bottomlands, and terraces. It is mantled by thick loess and alluvium (74a) ecoregion is highly susceptible to landslides and erosion if disturbed. Ecoregion 74a is higher and is underlain by weak, unconsolidated coastal plain sediments. Ecoregion 74b is lithologically and more rugged than adjacent ecoregions. Steep hills, bluffs, winding ridges, and narrow valleys distinct from higher, more easterly ecoregions. Potential natural vegetation is a mosaic of occur and have a mosaic of macroenvironments. Drier uplands are covered in oak-hickory forest and oak-hickory forest and bluestem prairie and is unlike the southern floodplain forest of Ecoregions mixed oak forests. Mesic slopes have closed forests that are dominated by sugar maple, bitternut 72a and 73a. Grasslands and forested wetlands were once widespread here and in the Western (74b), such as Little Cypress Creek in hickory, vellow-poplar, and beech. Aquatic habitats and fish assemblages are more typical of Pennyroyal Karst Plain (71e). Most of the original vegetation has now been replaced by cropland.

and rivers of Ecoregion 74b. Many channelized streams occur.

Ecoregion 74 although several species are unique to a particular river basin. **72a** The **Wabash–Ohio Bottomlands** ecoregion is composed of nearly level, poorly-drained channelization projects. Channelized streams lack riparian forests and have very warm water, high floodplains and undulating terraces. Wetlands, ponds, abandoned channels, oxbow lakes, turbidity, and limited concentrations of dissolved oxygen. Acid coal mine runoff has decreased The copperbelly water snake is a rare and low ridges occur. Potential natural vegetation is mapped as southern floodplain forest. Ecoregion biological productivity in streams; many tributaries have low numbers of fish and fish species while inhabitant of sloughs, marshes, and low 72a is lower, more poorly-drained, and has a different natural vegetation than other parts of others are entirely devoid of fish. Macroinvertebrate and fish communities are similar to those in *J.R. MacGregor, USFS* Ecoregion 72. Today, some woodlands remain but livestock, alfalfa, corn, soybean, and wheat Ecoregion 72a but are less diverse than in the upland streams of Ecoregion 72h. The dissected **Caseyville Hills** ecoregion is dominated by forests and pastureland and is fauna. Channelization and drainage ditches are sense. fauna. Channelization and drainage ditches are common.

coal mining. Wide, poorly-drained, low gradient valleys filled with alluvial and lacustrine and Mississippian Chesterian limestones, sandstones, siltstones, and shales. These formations are deposits are extensive and low hills mantled with loess occur. Ecoregion 72c is largely underlain by absent from the lower, less rugged, and less wooded Ecoregions 72a and 72c. Limestone is much less

not exposed in the higher, more rugged, and more wooded Ecoregion 72h. Bottomland forests were forests remain common. Today, livestock and hay farming, logging, oil production, and coal mining once common and oak-hickory forests grew on the better-drained upland sites. Today, some forests are the dominant land uses. However, coal mining is less extensive than in Ecoregion 72c. Upland and wetlands remain but cropland, pastureland, and both underground and surface coal mining are perennial streams are cooler and have higher gradients, rockier substrates, better water quality, more now extensive. Siltation from mining and agriculture has increased flooding and prompted remedial diverse habitats, and more productive fish and macroinvertebrate communities than Ecoregion 72c.

Pennsylvanian carboniferous sedimentary rocks of the Sturgis and Carbondale formations that are common than in the Interior Plateau (71). Potential natural vegetation is oak-hickory forest and

while upland streams are rockier. Streams typically have lower nutrient, alkalinity, and hardness levels than Ecoregion 71. Fish assemblages are lowland in character and are rather similar to those found in

The level III and IV ecoregion map on this poster was compiled at a scale of 1:250,000 and depicts revisions and subdivisions of earlier level III ecoregions

The project is associated with an interagency effort to develop a common framework of ecological regions (McMahon and others, 2001). Reaching that objective requires recognition of the differences in the conceptual approaches and frameworks, including those developed by the USFS (Bailey and others, 1994), the USEPA (Omernik 1987, 1995), and the U.S. Department of Agriculture–Soil

> ounty boundary tate boundary — - — - — - —

120 km Projection

subregions of the United States (map): Washington, D.C., USFS, scale 1:7,500,000. Bryce, S.A., Omernik, J.M., and Larsen, D.P., 1999, Ecoregions—a geographic framework to guide risk characterization and ecosystem management: Environmental Practice, v. 1, no. n 141-155 Commission for Environmental Cooperation Working Group, 1997, Ecological regions of North America-toward a common perspective: Montreal, Commission for

Environmental Cooperation, 71 p. Gallant, A.L., Whittier, T.R., Larsen, D.P., Omernik, J.M., and Hughes, R.M., 1989, Regionalization as a tool for managing environmental resources: Corvallis, Oregon, U.S. ronmental Protection Agency, EPA/600/3-89/060, 152 p. The approach used to compile this map is based on the premise that ecological that were originally compiled at a smaller scale (USEPA, 2002; Omernik, 1987). Griffith, G., Omernik, J., Azevedo, S., 1998, Ecoregions of Tennessee (text, map, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, map scale 1:940,000.

> Rorick, A.H., and Keys, J.E., 2001, Developing a spatial framework of common ecological regions for the conterminous United States: Environmental Management, v. 28 no. 3, p. 293-316. Omernik, J.M., 1987, Ecoregions of the conterminous United States (map supplement)

> Annals of the Association of American Geographers, v. 77, p. 118-125, scale 1:7,500,000. Omernik. J.M., 1995. Ecoregions-a framework for environmental management, in Davis, W.S. and Simon, T.P., editors, Biological assessment and criteria-tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49-62. Omernik, J.M., Chapman, S.S., Lillie, R.A., and Dumke, R.T., 2000, Ecoregions o Wisconsin: Transactions of the Wisconsin Academy of Sciences, Arts, and Letters, v. 88,

U.S. Department of Agriculture-Soil Conservation Service, 1981, Land resource regions and major land resource areas of the United States: Agriculture Handbook 296, 156 p. U.S. Environmental Protection Agency, 2002, Level III ecoregions of the continental United States (revision of Omernik, 1987): Corvallis, Oregon, USEPA-National Health and Environmental Effects Research Laboratory, Map M-1, various scales. Wiken, E., 1986, Terrestrial ecozones of Canada: Ottawa, Environment Canada, Ecological Land Classification Series no. 19, 26 p. S.H., 1998, Ecoregions of Indiana and Ohio: Reston, USGS, map scale 1:500,000.

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71h The Outer Nashville Basin in Kentucky contains untillable steep ridges and bluffs and cultivated terraces and floodplains along the meandering, downcutting Cumberland River. geomorphically distinct Knobs–Norman Upland (71c). Discontinuous glacial outwash and leached, Springs occur in bluffs and feed waterfalls. Soluble limestone, dolomite, and weak shales of re-Wisconsinan till deposits occur in the north from Louisville to Covington. Glacial deposits do Mississippian-age through Ordovician-age are typically exposed. Potential natural vegetation is ot occur elsewhere in Kentucky. Ecoregion 71d is mostly underlain by Upper Ordovician limestone oak-hickory forest and, in moister areas, mixed mesophytic forest. Today, forests, pastures, and hay, tobacco, corn, soybean, and small grain farming occur. Cumberland River tributaries are productive, nutrient-rich, and mostly moderate in gradient. Macroinvertebrate communities more closely ettlement, open savanna woodlands were found on most uplands. On less fertile, more acidic soils resemble those of the Bluegrass (Ecoregions 71d, 71k, and 71l) than the adjacent Eastern Highland erived from Silurian dolomite, white oak stands occurred and had barren openings. Cane grew Rim (71g). However, fish assemblages are Cumberlandian and are similar to those of Ecoregion 71g long streams and was especially common in the east. Distinct vegetation grew in areas underlain by Flow on the Cumberland River in Ecoregion 71h is dam-controlled; cold reservoir discharge has

Upland (71c), Outer Bluegrass (71d), and Inner Bluegrass (711). Upland soils are fairly high in The weakly dissected Western Pennyroyal Karst Plain is underlain by Middle phosphorus, potassium, and lime but are not as naturally fertile as Ecoregions 71d and 711; they Mississippian limestones and is extensively farmed; it is both physiographically and support young, mixed forests rich in white oak, hickory, and cedar. The Hills of the Bluegrass (71k) thologically distinct from surrounding ecoregions. Sinkholes, ponds, springs, sinking streams, and has steeper terrain, droughtier soils, lower soil fertility, higher drainage density, and is more erosionhy valleys occur. Underground drainage is well developed, stream density is low, and soils are prone than Ecoregions 71d and 71l. As a result, less than ten percent of Ecoregion 71k is suited to quick to dry. Most upland streams have limited discharge or are intermittent or ephemeral; they row crop agriculture and the rest is wooded, pastureland, or hayland. Stream nutrient levels are become laden with suspended sediment after heavy rains. Deeper, more intense dissection occurs generally lower than in Ecoregions 71d and 711. Upland streams are often intermittent and have near incised master streams which are fed by cool, nitrate-rich groundwater. Fish assemblages vary cobble, boulder, or bedrock substrates. Gradients are steeper than in Ecoregion 711. Fish and among river systems. Potential natural vegetation is mapped as a mosaic of bluestem prairie and macroinvertebrate assemblages are similar to Ecoregions 71d and 71l but have elements that are

containing extensive karst, intermittent streams, and expanding urban-suburban areas that Cumberland River valleys. Ecoregion 71f is much more wooded and rugged than the nearby originally developed near major springs. Deep, forested gorges also occur along the Kentucky and agricultural plains of Ecoregions 71e and 74b. It is underlain by Mississippian limestone and shales Dix rivers. The Inner Bluegrass (711) is characteristically underlain by Middle Ordovician Lexington and, in the west, by Cretaceous-Paleocene shale, siltstone, and sandstone. Ridges and hills are often Limestone and is lithologically distinct from the rest of Ecoregion 71. Very fertile Alfisols and Highland Rim (71g) in Pulaski County. capped by cherty gravels and veneered by thin loess. Karst valleys underlain by limestone also Mollisols have developed from the residuum of underlying phosphatic limestone; natural soil fertility Pastureland occurs on lower slopes and in especially common where riparian tree occur. Ecoregion 71f is lithologically distinct from Ecoregions 71a, 71e, 72h, and 74b. Potential is greater than in Ecoregion 71k. The original open woodlands, savannas, and swamp forests have the valleys. *Photo: William H. Martin, EKU* cover has been removed. natural vegetation is oak-hickory forest; it lacks the barrens (i.e. bluestem prairies) of Ecoregions been largely replaced by agriculture and urban-suburban-industrial areas. However, deciduous forests 71e and 74b. Upland soils tend to be cherty, droughty, low in fertility, and are mostly covered by containing eastern redcedar still occur in ravines, along the Kentucky River, and near streams. ixed oak forests. Some agriculture occurs on flatter interfluves and in valleys. Recreation is an Thoroughbred horse farms, cattle grazing, tobacco, alfalfa, and hay farming are common land uses. nportant land use in the Land-Between-the-Lakes area. Streams are cool and clear. They have Some upland streams are very warm and have seasonally variable flows but others, fed by major noderate gradients and gravel and sand substrates. Stream alkalinity and hardness vary from east to springs, are colder and have plentiful perennial flow. In either case, they have moderate to low gradients, cobble or bedrock substrates, and fish assemblages that are similar to the Outer Bluegrass (71d) and the Hills of the Bluegrass (71k). Higher gradient streams draining into the Kentucky River gorge have macroinvertebrate and fish assemblages that are more typical of the Knobs–Norman Upland (71c) than the rest of Ecoregion 711. Agriculture contributes sediment, nutrients, pesticides, and pathogens to surface water; algal blooms and low concentrations of dissolved oxygen occur especially where the riparian tree canopy has been removed. Wastewater discharge and runoff downstream of urban areas release trace metals into some streams. Package waste treatment plants for small residential subdivisions often discharge into dry valleys, produce effluent-dominated streams, and have a high failure rate. The Kentucky River has some of the highest nitrite plus nitrate and phosphate concentrations in Kentucky. It has been impounded by a series of locks and dams, gradient. Riffle substrates are composed of cobble, gravel, or bedrock. Fish, macroinvertebrate, and causing the number of pool-inhabiting fish to increase at the expense of upland habitat species.



Some of the best cropland in Kentucky is Tobacco, corn, soybeans, and small grains

on the naturally fertile soils of the rolling are grown in the Western Pennyroyal Karst



Streams in Ecoregion 711's Kentucky River springs, and thoroughbred horse farms are gorge have moderate to high gradients and gravel, cobble, or bedrock bottoms. Fish and macroinvertebrate assemblages are more typical of the Knobs–Norman Upland 71c) than of the Inner Bluegrass (711). Photo: KDEP, Division of Water



communities are largely lentic in nature and Mississippian-type biotic assemblages occur. Undrained remaining swamps contain many southern species that are near their northern distributional limits areas are subject to seasonal flooding. Elsewhere, drainage canals and field drains are common. including bald cypress and tupelo. Water and marsh birds are abundant.

uplands than of nearby Ecoregions 73a and 74b. Intermittent and ephemeral streams are common Extensive corn, soybean, wheat, hay, tobacco, livestock, and poultry farming occurs. Agricultural Photo: J. Brumley, KDEP, Division of Water runoff has degraded surface water quality. High turbidity and siltation are common in the streams





Marshall County, have gravel and sand

The upland streams of the Loess Plains



The great blue heron is the most common wading bird in Kentucky and reaches its greatest breeding densities in Ecoregion 74. Photo: Beckham Bird Club