APPLICATION FOR VITICULTURAL AREA

PROPOSED NAME: OZARK MOUNTAIN; or OZARK MOUNTAIN REGION

The proposed Ozark Mountain viticultural area is known locally, nationally and internationally as a wine producing region.

Numerous articles written about Arkansas wines, wineries and winery related personalities evidence Ozark Mountain as the name by which the proposed area is known.

"In the early 1800's, Johan Andreas Wiederkehr made fine wine in Switzerland. In 1880, he settled in the backwoods of the Ozark Mountain Foothills . . ."[1]

"The art of wine making has been passed from generation to generation by the Post family since the founder, Jacob Post, came to the Ozark Mountains in 1872."[2]

Founder of Arkansas' Wiederkehr Wine Cellars "Johann Wiederkehr settled in Arkansas' Ozark Mountains in the 1880's . . ."[3]

"Arkansas. Arkansas wineries are scattered through the backwoods of the Ozark Mountains in the northern half of the state."[4]

". . . new vineyards of wine-grape varieties have been spreading through the Ozark backwoods . . . Most of this is taking place . . . in the Ozark (Mountain) Plateau Region . . ."[5]

"Arkansas. Small wine-producing region of the United States. The vineyards are centered around the northern sector, in the Ozark Mountains."[6]

"Like all of the other American wine regions, the Ozarks (Mountains) are quietly seething with new ideas, new personalities, new grape varieties and a new sense of direction."[7]

Further, the town situated within 5 miles of four Arkansas wineries that produce over 95% of the regions total wine, is named: Ozark.

Near the town of Ozark, and just across the Arkansas River in the Ozark Mountain Area is an Arkansas State Park named, Aux Arcs Park (meaning with Bows) -or- Ozark, as the French spelled it prior to its acquisition as part of the Louisiana Purchase.

The largest winery in the Ozark Mountain Area, Wiederkehr Wine Cellars, began identifying many of their wines using the BATF approved Appellation of "Ozark Mountain" in 1959.

It is upon such evidence as that presented above that Ozark Mountain is the appropriate, historic and current day name by which the proposed Viticultural Area should be called.

FOOTNOTES

[1]"The New American Wineries," Chicago Tribune Magazine. November 8, 1981. Page 20.

[2]"Family Tradition Lives On At Post's Winery in Ozark Mountains," Arkansas Gazette. (Author Ken Forrestor)

3"Dynamic Years", "The Other Wines of America", Page 51 November- December 1981.

4"The New York Times Book of Wines", Robards, Terry, Page 73

5" The Wines of America", Adams, Leon D., Page 148-9.

6"The New Encyclopedia of Wines and Spirits", New York, Alfred A. Knopf, 1974, Page 81, Author, Lichine, Alexis.

7"Restaurateurs' Guide to American Wines Part IV, The Wines and Wineries of the Ozarks", DINING, April- May 1973, page 58

GEOGRAPHICAL FEATURES WHICH DISTINGUISH THE AREA

The higher elevations of the Ozark Mountains of Northwest Arkansas give a cooler and dryer (lower humidity) climate during the main grape growing season than surrounding areas. The higher elevations also give winter protection against winterkill because the heavier cold air falls to the lower levels and displaces warmer air which elevates to the mountain tops and slopes. (This phenomenon is called thermal inversion.) There are numerous such thermal inversions throughout the Ozark Mountains, for example, on the last plateau of the Ozarks overlooking the Arkansas River Valley. (Often referred to as Micro Climates). The area definitely enjoys a unique climatic situation. Shielded on the north by the Boston Mountains, the Ozarks' highest range, and by Mount Magazine of the Ouachita range south of the Arkansas River, the vines benefit from a thermal inversion that protects them from the cold Canadian fronts bringing blankets of snow and subzero temperatures down the midwestern corridor. Natural rainfall and an abundant underground water table insure plenty of moisture for the vines year round. The altitude provides good drainage and a cool growing season comparable to that of Germany. The southerly slopes offer excellent exposure for the ripening grapes." [4]

"Climatic factors realistically would be expected to be different among geographical regions. Thus, to accomplish the objectives (of a study) more precisely, the primary study area was the 14 counties in Northwestern Arkansas in which 98 percent of the state's commercial grape plantings were reported in the 1976 Fruit Survey. Although information developed in this study will be useful in other parts of Arkansas and the United States, it was felt necessary to focus on a specific production area where seasonal factors could be analyzed."[3]

"Bunch Grapes grow better in the higher elevations of Northern Arkansas than anywhere else in the state."[1]

"Grapes do not tolerate wet feet. Thus the site chosen for the vineyard must be well-drained. Because of the frost hazards the vineyard should be set on high sites or sloping ground."[2]

Distinguishing between areas of Arkansas, National Geographic commented, "The state is about half mountainous and half Delta lands. Highlands, which hold the Ozark Plateau and the Ouachita Mountains and are split by the Arkansas River Valley, lie roughly in the Northwest half of the state." In the same article, National Geographic observed, "People in the two sections (Northwest Highlands compared with Lowlands of Southern Arkansas) are as diverse as the topography."[5]

To Topographical and climatic differences between the Ozark Mountain, Northwestern Region of Arkansas and other areas bordering the region, which are viticulturally beneficial, there are improtant distinctions in soil types.

Although diversity in soil types exist within the Northwest Arkansas Ozark Mountain Area, those types are categorically different from the soil types in the bottoms and Delta area of South, Southeastern, and far Northeastern Arkansas, and the drier more torrid areas of Eastern Oklahoma.

For example, the rich, dark moist soils of the Delta areas which are ideal for such crops as rice and soybeans are ill-suited to grape crops. By contrast the Ozark Mountain area soils have fine to gravelly texture, acidity which varies from slight to strong, are of sandy to silty loams, and mountainsides are interbedded sandstone and shale, and include outcrops of limestone in some areas, while others have sandy loams of high lime content.[6] While Ozark Mountain soils are diverse, the suitability to grape production is evidenced by vineyard expansions over the years. From 1910 an agricultural census of the area recorded approximately one million grapevines. By 1930 the number of grapes had increased to over five million grapevines.[7]

FOOTNOTES:

1"Growing Grapes" Dr. C.C. Schaller, University of Arkansas.

2 Ibid.

3"Northwest Arkansas Table Grape Production: The Relationship Between Machinery Cost and Acreage", Price, Carter and Joe F. Baldwin, Special Report 87.

4"The New York Times Book of Wine", Robards, Terry , page 73

5"Arkansas Rolls Up Its Sleeves", National Geographic Magazine, Author, Simpich, Fredrick, 1946, page 274.

6"Soil Survey ", USDA - Soil Conservation Service and Forest Service, issued February, 1971.

7"Census of Agriculture", U.S. Department of Commerce 1940 and 1964.

PROPOSED BOUNDARIES

Commencing at the Northwest corner of Arkansas, thence southward along the Arkansas-Oklahoma line to Interstate 40, thence in an easterly direction along the northern boundary of Interstate 40 to the Franklin County line, thence south to the Arkansas River, thence easterly along the northern banks of the Arkansas River to the Faulkner County line, thence north along the west Faulkner County line to Highway 124 near Martinville, Arkansas, thence in a northeasterly direction to Highway 65 at Damascus, Arkansas, thence north along Highway 65 to Clinton, thence northeasterly along Highway 9 to the White River, thence northerly along the western bank of the White River to the Baxter County line, thence northerly along the eastern county line of Baxter County to the Missouri line, thence west along the Arkansas-Missouri line to the northwest corner of Arkansas--the point of beginning.

Respectfully Submitted by:

Wiederkehr Wine Cellars, Inc.

by: Al Wiederkehr

Al Wiederkehr, Chairman of the Board &

Chief Executive Officer

WIEDERKEHR WINE CELLARS, INC.

ALTUS, ARKANSAS 72821

December 30, 1983

Rec 1-4-84

Mr. Richard Mascolo
Chief, Research and Regulation Branch
Bureau of Alcohol, Tobacco and Firearms
1200 Pennsylvania Avenue, N. W.
Washington, D.C. 20226

Dear Mr. Mascolo:

Enclosed you will find further information in regards to the Ozark Moutain Viticultural Area. This information includes:

1. U.S.G.S. maps showing amended boundaries of the proposed Ozark Mountain Viticultural Area.

2. A description of the specific boundaries of the proposed Ozark Mountain Viticultural Area according to features found on the enclosed U.S.G.S. map.

Mr. James Held of Stonehill Winery in Herman, Missouri told me that he didn't consider his area within the Ozark Mountain Region. A St. James Winery spokesperson indicated that they planned to apply for a different appellation. In the past the Bardenheier Winery acquired grapes in Southern Missouri near to Arkansas.

We appreciate your understanding and consideration.

Sincerely,

WIEDERKEHR WINE CELLARS, INC.

Al Wiederkehr

Al Wiederkehr
Chairman of the Board and
Chief Executive Officer

ACW/mjh

Enclosure

AMENDED BOUNDARIES FOR THE PROPOSED OZARK MOUNTAIN VITICULTURAL AREA:

Commencing in Siloam Springs, Arkansas (Denoted on the Tulsa Section Map with a large green arrow) on the Kansas City Southern railroad tracks where they cross Highway 59, thence in a southwesterly direction along said railroad tracks crossing from Arkansas into Oklahoma, thence in a meandering southerly direction along said railroad tracks to Ballard Creek, thence westward to Highway 59, thence south along Highway 59 through Stillwell, Oklahoma to a point where Highway 59 intersects Lee Creek, thence in a southeasterly direction following the meandering of Lee Creek around the west side of Monroe Mountain and on southeasterly to the most southerly Y on Lee Creek, thence northeasterly along the eastern fork of Lee Creek until it intersects Highway 220 in Arkansas north of Dripping Springs, thence southeasterly until 220 merges with Highway 59, thence southerly along Highway 59 to Highway 348 in the town of Figure Five, Arkansas, thence easterly along Highway 348 until it intersects Frog Bayou near Rudy, Arkansas, thence along Frog Bayou to the Arkansas River, thence southeasterly across the Arkansas River intersecting Highway 96 at the apex of the most westerly curve of said highway as it joins the river cliff directly north of the point that Onion Creek enters the Arkansas River, thence northeasterly along Highway 96 past Riverdale to the town of Cecil, thence south on Highway 41 to Highway 22, thence west to Branch, Arkansas, thence to a point due south of Branch one mile, thence east along a line which parallels Highway 22 one mile south of Highway 22 until it intersects Highway 309 south of Paris, Arkansas, thence north to the intersection of Highway 22 in Paris, thence east again along Highway 22 to big Shoal Creek, thence along the north shore of said creek and Shoalbay in a northeasterly direction to the Arkansas River, thence along the north bank of the Arkansas River to Cadron Creek, thence along the north bank of Caldron Creek to Highway 64, thence eastward along Highway 64 to Highway 65 at Conway, thence east and north along Highway 65 through Greenbrier to an intersection where Highway 25 branches to the right, thence along Highway 25, through Guy, Quitman, and Heber Springs to a point where Highway 25 crosses the Little Red River, thence westward along the meanderings of the Little Red River to the Devil's Fork of the Little Red River that leads to the northeast to Beech Fork, thence northwesterly along Beech Fork to Tomahawk Creek, thence northwesterly along Tomahawk Creek to Highway 9, thence northeasterly and north along Highway 9 to the White River, thence along the northerly meanderings of the White River to Norfork River, thence northeasterly to Norfork Lake, thence north along the meanderings of the east shore of Norfork Lake crossing the Missouri line and continuing to the point where the North Fork River empties into Norfork Lake, thence in a northerly direction along the North Fork River until it intersects Highway 14 at Twin Bridges, Missouri, thence east along Highway 14 to the junction of Highway 181, thence north along Highway 181 to the intersection of Highway 60 west of Cabool, Missouri, thence east on Highway 60 through Cabool to Highway 63, thence north on Highway 63 to the town of Simmons, thence due west on road YY through the town of Clara to the intersection of Highway 17, thence northwesterly along Highway 17 to the junction of Highway 38, thence westerly along Highway 38 to Road C junction before the town of High Prarie, thence due south on Road C to the intersection of Highway

AMENDED BOUNDARIES FOR THE PROPOSED OZARK MOUNTAIN VITICULTURAL AREA:

60 east of Seymour, Missouri, thence westerly along Highway 60 through Monett, thence through Granby, thence south on 60 at the junction of alternate Highway 71 and Highway 60 to the intersection with the Kansas City Southern Railway south of Neosho, Missouri, thence south along said Railway, through Goodman, Anderson, and Noel, Missouri, thence continuing south across the Arkansas line, through Sulphur Springs, Gravette, Decatur, and Gentry, Arkansas, and on south to the point of beginning in Siloam Springs.

WIEDERKEHR WINE CELLARS, INC.

ALTUS, ARKANSAS 72821

Rec'd 9.28.84

September 27, 1984

Mr. Richard A. Mascolo
Chief, FAA Wine & Beer Branch
Dept. of Treasury
Bureau of Alcohol, Tobacco, & Firearms
1200 Pennsylvania Ave. Northwest
Washington, D.C. 20226

Dear Mr. Mascolo:

I have enclosed further evidence supporting approval of the Ozark Mountain Viticultural Area. This evidence includes the appropriate U.S.G.S. maps showing amended boundaries of the proposed Ozark Mountain Viticultural Area and a description of the specific boundaries of the proposed Ozark Mountain Viticultural Area according to features found on the U.S.G.S. maps. The amended boundaries approximate the boundaries given for the Ozark mountains in the following references:

1. Hunt, C.B. 1974. Natural Regions of the United States and Canada. W. H. Freeman & Co. San Francisco, CA p. 12-13

2. Rhodes, R. 1974. The Ozarks. Time-Life Books New York, NY p. 18-33

In addition, I would like to quote extensively from the book by Mr. Rhodes because it provides evidence that the boundaries of the proposed Ozark Mountain Viticultural Area are as specified in the petition and that geographic features of the proposed area set it apart from the surrounding areas.

"Stretching from the forests of southern Missouri outside St. Louis through northern Arkansas to the Oklahoma plains near Tulsa, the 55,000 square miles of the Ozarks are bounded by five major rivers: the Mississippi, the Missouri, the Osage, the Neosho, and the Arkansas. The Ozark highlands, the only extensive elevated area in the United States between the Appalachian and the Rocky Mountains consist of low mountains and hills shaped by spring-fed streams and rivers cutting their way through elevated bed rock."

"These boundaries do not merely locate the Ozarks on the map, but also serve to isolate some of the regions plant and animal life. The Ozarks mark the fartherest western extension of the great deciduous forest that once covered the eastern United States. Their western border is the beginning of the prairie that runs from Western Missouri to the Rockies and from Texas to Colorado. Their northern border, the Missouri River, is about as far

south as the glacier of the ice age came. And the hot, lush alluvial lands of the Mississippi begin at the Ozarks abrupt southeastern edge, in the Missouri bootheel."

"With four different climatic regions pressing against them, the Ozarks serve as a santuary for a selection of plants and animals from all sides . . ."

Furthermore, I wish to submit additional evidence that the proposed Ozark Mountain Viticultural Area is nationally known as grape-growing region. Mr. Craig Goldwyn, a noted wine writer, states "Today the U.S. can be divided roughly into nine regions with a multiple of subregions and microclimates: the Atlantic Coast, the Pacific Coast, California's Central Valleys, the Inland Northwest, the Great Lakes, the Ozarks, the Plains, the Ohio River Basin, the the Sun Belt".

"In the foothills of Arkansas along the Arkansas River, and along the Missiouri River system . . . . , some surprising wines have been produced, especially Cabernet Sauvignon, Gewurztraminer, Moscato, and Fume Blanc." Goldwyn, C. 1984. Wine Regions of America. Vinifera Wine Growers Journal 11: 103-107.

Your careful consideration of this information will be appreciated.

Sincerely,

Keith Striegler

Keith Striegler
Viticulturist

RKS/mjh

Enclosure

AMENDED BOUNDARIES FOR THE PROPOSED
OZARK MOUNTAIN VITICULTURAL AREA

September 26, 1984

Commencing at the point at which the Missouri River intersects with the Mississippi River north of St. Louis, MO, thence westward following the Missouri River to the point at which it meets the Osage River, thence westerly along the Osage River to the point at which it intersects Missouri Highway 82 in Osceola, MO, thence following Missouri Highway 82 in a southwesterly direction until it intersects with U.S. Highway 54 in Eldorado Springs, MO, thence westward along U.S. Highway 54 to the point at which it intersects with U.S. Highway 71 in Nevada, MO, thence southward along U.S. Highway 71 until it intersects with Interstate Highway 44 south of Carthage, MO, thence southwesterly along Interstate Highway 44 into the state of Oklahoma to the point at which Interstate Highway 44 intersects the Neosho River near Miami, OK, thence following the Neosho River in a southeasterly direction to the point at which it flows into the Lake of the Cherokees, thence southwesterly along the Lake of the Cherokees to where it flows into Lake Hudson, thence southward along Lake Hudson to the point which it flows into Fort Gibson Lake, thence continuing to follow the Neosho River to the point at which it intersects the Arkansas River near Fort Gibson, OK, thence following the Arkansas River in a southeasterly direction to the point at which it flows into the Robert S. Kerr Lake, thence continuing to follow the Arkansas River from the Robert S. Kerr Lake in an easterly direction into the state of Arkansas to the point at which the Arkansas River intersects with Cadron Creek, thence northeasterly along Cadron Creek to the point at which it intersects with U.S. Highway 64 west of Conway, AR, thence eastward along U.S. Highway 64 to the point at which it intersects U.S. Highway 67 near Beebe, AR, thence along U.S. Highway 67 in a northeasterly direction into the state of Missouri to the point at which it intersects with U.S. Highway 60 in Poplar Bluff, MO, thence eastward along U.S. Highway 60 to the point at which it intersects Missouri Highway 51, thence northeasterly along Missouri Highway 51 to the point at which it intersects with Missouri Highway 91, thence in a southeasterly direction following Missouri Highway 91 to Advance, MO, thence following the Abandoned Missouri Pacific Railroad line from Advance, MO to Cape Girardeau, MO, thence northward following the Mississippi River from Cape Girardeau, MO to the point at which it intersects with the Missouri River north of St. Louis, MO.

Conaway on Wine

Arkansas Ways

INTEREST IN REGIONAL wines of the United States is growing. In the next few years the consumption of regional wines is expected to increase dramatically, due in part to a greater interest in wine, the power of chauvinism that leads local people to buy local products and an improvement in the quality of regional wines. For decades California and New York were considered the only worthy producers. Then Oregon, Washington and even Idaho began to market excellent wine. Virginia, Maryland and Pennsylvania proved that good wine could be made in the eastern United States, and not just from the French hybrid grapes that were once the mainstay of the industry. The classic European varieties of Vitis vinifera flourished in what was once considered impossible terrain, such as that of Ohio and even Arkansas.

"Wine in Arkansas?" says Al (Alcuin) Wiederkehr, owner of Wiederkehr Wine Cellars in Altus, Ark. "People used to say that to me all the time. I realized that to make them aware of our wine, I had to enter the competitions."

BY KATY KELLY

That was almost 10 years ago. Since then Wiederkehr has won more that 100 medals for his wines, mostly in industry-sponsored tastings. Some have included the best American and European wines. To say that Wiederkehr Wine Cellars now has a spot on the international map would be stretching it, since the wines can be bought only in the South. But good wine can be made there, just below the Ozarks in western Arkansas.

Wiederkehr's wines tend to be German in style, which means fruity and low in alcohol. Over the years he has done considerable research to determine which vines grow best here. About 600 acres are planted with an extraordinary array of vinifera and French hybrids, and the winery produces an astonishing number of wines and blends to compete for the local trade.

None of the wines could be described as great, but some are good accompaniment with food or aperitifs. One, the muscat dessert wine called Di Tanta Maria, is remarkable. Fragrant, complex and not too sweet, it conveys a wild, honeyed quality all its own and sells for only $7 a bottle.

Wiederkehr also produces a cabernet sauvignon, a sauvignon blanc that is on the sweet side, a pinot noir and a blanc de pinot noir that is quite refreshing, a chardonnay and a gewurztraminer, as well as a number of hybrids. The scope and diversity may detract some from the quality of the traditional wines, since money and effort must be rationed. The cabernet is aged in old barrels once used for bourbon, for instance. The barrels have been steam cleaned, but they imbue the cabernet with very little of the essence of oak that one expects. If the cabernet is left too long in these barrels, it loses its fruit without acquiring complexity.

"If I had the money for French oak or new American oak," Wiederkehr says, "people would be amazed at what we could do here."

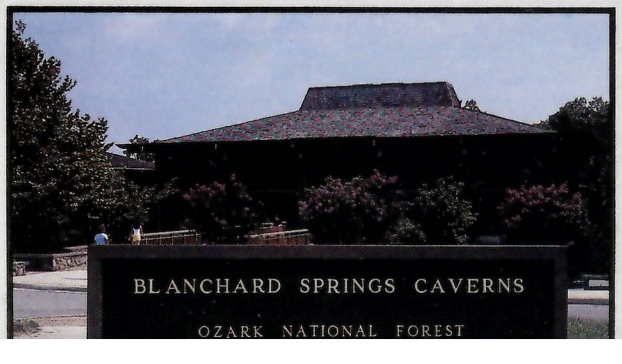
Whether or not Wiederkehr will further refine his vinifera offerings remains to be seen. He has big plans for attracting Ozark-bound tourists to his replica of a Swiss village, and that could be a further distraction. But the Wiederkehr family has proven that Arkansas wine is no anomaly.

—*James Conway*

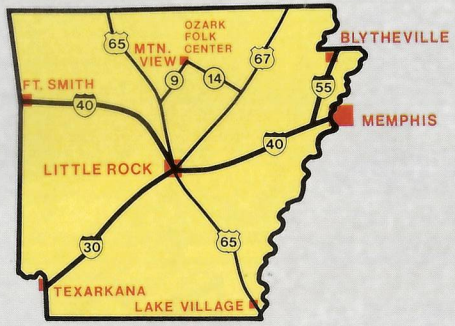
BLANCHARD SPRINGS CAVERNS

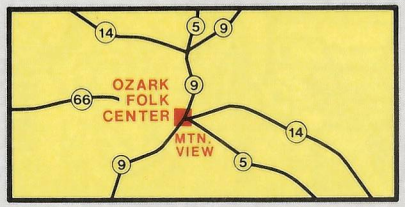
Blanchard Springs Caverns — "cave discovery of the century!" Experience the awesome beauty of the caverns from paved, lighted walkways in the company of Forest Service interpretive guides. Cave tours begin at the Visitor Center where an excellent movie and exhibit hall preview what awaits you below. The surrounding Ozark National Forest offers camping, picnicking, hiking, swimming, hunting and fishing. Though the caverns and other facilities are generally open year-round, we recommend you call or write before traveling.

U.S. Forest Service
P.O. Box I
Mountain View, AR 72560
501-757-2213



LOCATION & POINTS OF INTEREST





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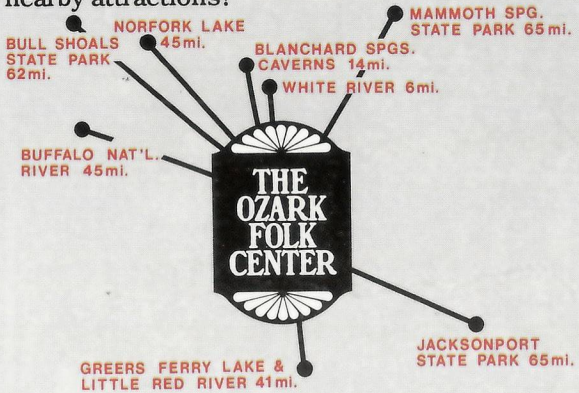
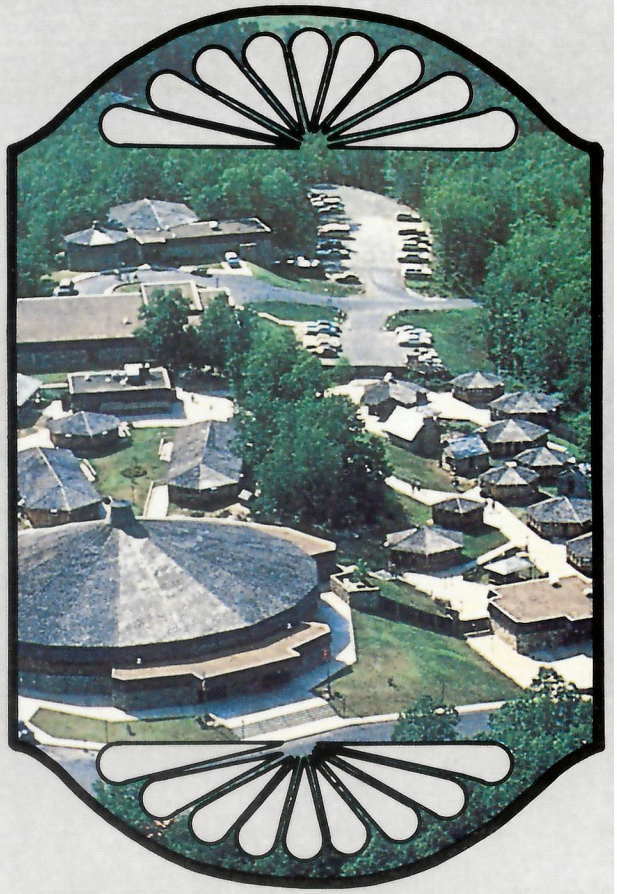


For further information, contact:

OZARK FOLK CENTER

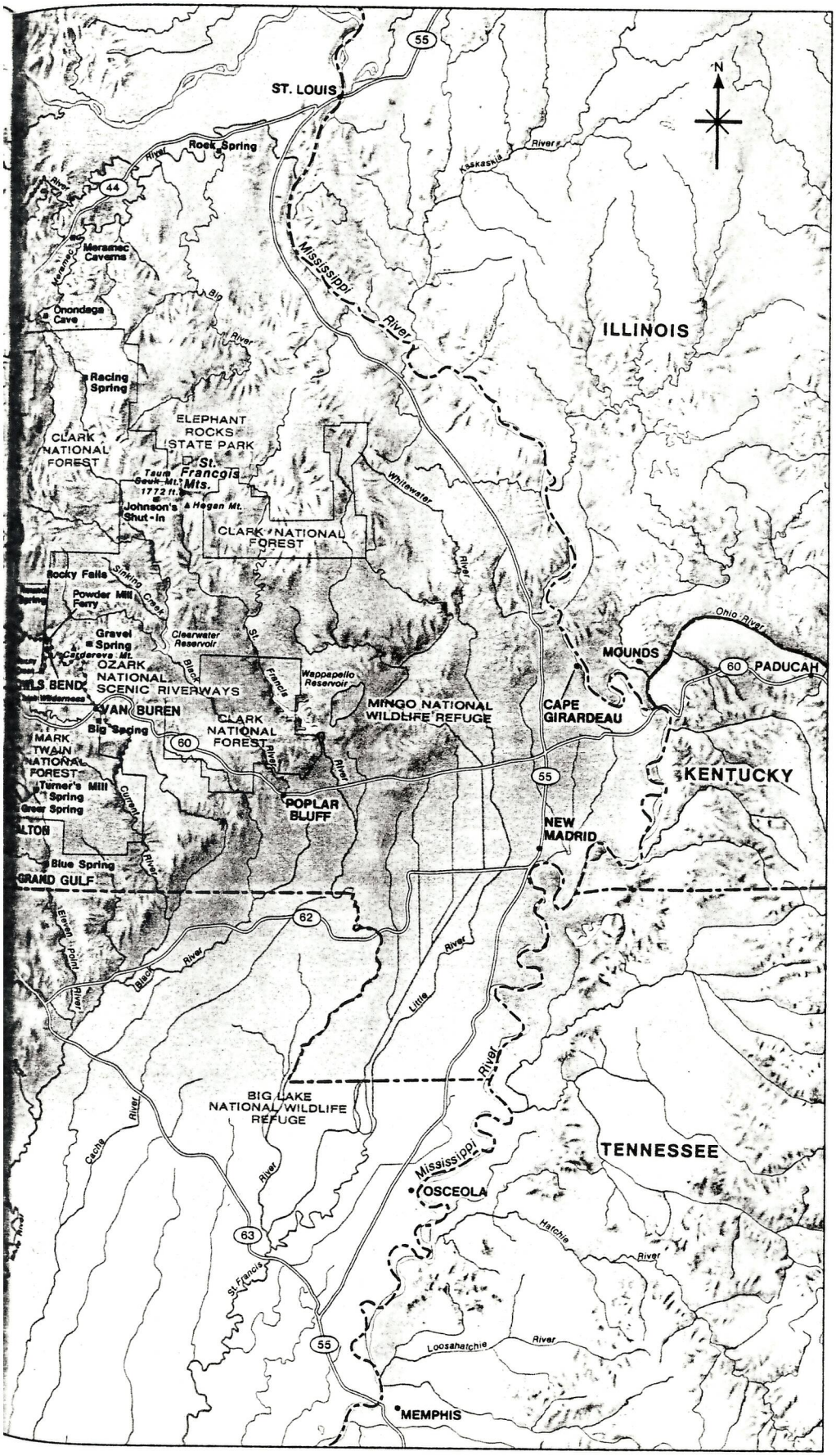
An Arkansas State Park



THE OZARKS

THE AMERICAN WILDERNESS/TIME-LIFE BOOKS/NEW YORK

BY RICHARD RHODES
AND THE EDITORS OF TIME-LIFE BOOKS



An Enclave of Old Hills and Spring-fed Rivers

Stretching from the forests of southern Missouri outside St. Louis through northern Arkansas to the Oklahoma plains near Tulsa, the 55,000 square miles of the Ozarks are bounded by five major rivers: the Mississippi, the Missouri, the Osage, the Neosho and the Arkansas. The Ozark highlands, the only extensive elevated area in the United States between the Appalachians and the Rocky Mountains, consist of low mountains and hills shaped by spring-fed streams and rivers (blue lines) cutting their way through the elevated bedrock. Lines of blue dots indicate unspoiled wild rivers that have been designated the Buffalo National River and the Ozark National Scenic Riverways. National Forest lands (outlined in red) are the primary public land areas, although smaller state parks and national wildlife refuges also exist. Points of special interest, including the Ozarks' numerous springs and caves, are represented by black squares.

1/ Another Kind of Wilderness

We stood a moment to contemplate the sublime and beautiful scene before us...of native fertility and barren magnificence. HENRY ROWE SCHOOLCRAFT/ *JOURNAL – 1818 AND 1819*

Say "Ozarks" and most people think of feuding hillbillies and clandestine stills, barefoot children and potatoes planted in the dark of the moon. Ozarkers have themselves to blame for their region's notoriety as a backward land; native chroniclers have built careers on its passing folkways, congealing them into cliché and fostering a tradition of condescension that is both misleading and damaging. It makes the Ozarks seem merely a quaint outcropping of the culture of Appalachia, and it forces the remarkable Ozark landscape to retreat behind a fictional screen of tumble-down cabins and leaning outhouses embellished with leering crescent moons.

Behind that legendary façade is a very special place: a wilderness intact in the middle of the continent where all around it are farm and town and industry; the only extensive elevated area between the Appalachians and the Rockies; a fair land that has kept its essential wildness despite three centuries of attempts to tame it for man's use.

I came late to the Ozarks, as we often do to regions of wilderness near our own backyards. As a boy I lived in Independence, Missouri, and I knew that some of my neighbors traveled the short distance to the Ozarks to fish and hunt and came back refreshed. But I walked beside mountain streams in New Mexico, Colorado and California before I walked a cool Ozark hollow on a hot summer day, before I swam a clear Ozark river, before I climbed over a miniature Manhattan skyline

of broken rhyolite columns at the top of an Ozark mountain. I wish I had known earlier what I discovered then: that there are places in the Ozarks that rival in beauty, if not often in scale, the most celebrated wilderness retreats in America.

Henry Rowe Schoolcraft, an articulate early explorer, traveled through the Ozarks on horseback and on foot in 1818 and 1819. He called it the semi-Alpine region, but he was being very grand in his description. Americans have a much homier term for the Ozarks' kind of land: hill country. Actually, in the Ozarks the hills are called mountains, and I suppose that a few of them might almost deserve the name —but only if the look of real mountains has slipped your mind. The highest point in the Missouri Ozarks, Taum Sauk Mountain, rises just 1,772 feet above sea level, and the highest point in the Arkansas Ozarks, in the Boston Mountains, rises to only 2,578 feet. Nor do the mountains of the Ozarks demonstrate the many different life zones of true mountains. Sometimes in rocky places where the sun is hot and the soil is thin, one finds a glade in the forest that hosts a miniature prairie. Or perhaps a northward-facing bluff cooled by the seeping of a spring shelters the cascading fern falls of a more northerly clime. But generally an undistinguished forest of oak, maple, hickory and pine covers all. On the other hand no plain hills ought to be so steep, nor so shot through with remarkable caves, nor so flush with even more remarkable crystal springs, some of them boiling out hundreds of millions of gallons of pure cold water every day. If the Ozarks are less than mountains, they are certainly more than hills.

The entire region, all 55,000 square miles of it, is a land tortuously dissected into precipitous ridges and shadowy hollows cut through by entrenched rivers carving out the bedrock. Unless you are a geologist, you aren't likely to guess the Ozarks' secret, though even an untrained eye will quickly notice that most of the hills are roughly level with one another at the top. The secret of the unmountainous Ozark mountains is that the region, though it was uplifted, was never subjected to the violent, distorting upheavals that more truly mountainous places endured. Its hills were not thrust up but carved down—the remains of layers of once-continuous sedimentary rocks that were dissected by the rivers and creeks that drained the area. These rocks had been deposited on the bottom of the vast inland seas that covered the Ozarks during the Paleozoic era, and were then exposed when the seas withdrew. And so the structure of the Ozark hills is mostly horizontal rock, sandstone and limestone laid down in layers; as the rivers ran across the rocks

seeking sea level, they wandered in loops, deepening their valleys —hence the meandering course of many Ozark streams.

That is why some older Ozark roads that are supposed to get somewhere stick pretty much to the ridge tops, winding back and forth but seldom changing elevation except where they descend into a river valley and climb to another ridge beyond. And that, in turn, is why you can learn relatively little about the Ozarks from a car—and so much on foot or in a canoe. By car you drive on the tree-hidden remnants of an ancient plain; on foot or by canoe you wander the valleys and channels exposed by moving water, and are able to detect the varieties of rock of different ages.

The Ozarks occupy most of the southern half of Missouri, the northwestern third of Arkansas and little bits of Oklahoma and Kansas. They are bounded by the Missouri River on the north, the Mississippi River on the east, the Arkansas River on the south, and parts of the Kansas and Oklahoma prairie on the west. These boundaries do not merely locate the Ozarks on the map. They also serve to isolate some of the region's plant and animal life. Thirteen species of fish, for example, are unique to the Ozarks. They have never dispersed from the clearwater creeks and rivers to a wider range because they could not survive in the surrounding muddy rivers.

Other boundaries affect the Ozarks. They mark the farthest western extension of the great deciduous forest that once covered the eastern United States. Their western border is the beginning of the prairie that runs from western Missouri to the Rockies and from Texas to Canada. Their northern border, the Missouri River, is about as far south as the glaciers of the ice age came; their frozen breath modified the Ozarks' climate but their crushing weight never scoured its hills. And the hot, lush alluvial lands of the Mississippi begin at the Ozarks' abrupt southeastern edge, in the Missouri bootheel.

With four different climatic regions pressing against them, the Ozarks serve as a sanctuary for a selection of plants and animals from all sides, plants and animals that really don't belong there any more, although once conditions must have been more to their liking over larger areas of the region than they are today. River birches, essentially northern trees, hide in cool hollows. Beech trees, whose principal range is the eastern United States, find a congenial habitat in moist valleys near creek beds. Scorpions, more often associated with southwestern deserts, make themselves at home among the rocks of scorched hillside glades. Lichens usually seen in the arctic tundra cling to weathered

A giant swallowtail, one of more than 100 species of butterfly found in the Ozarks, alights on a bed of chert, a common rock of the region. Chert is not so hospitable to a hiker's less delicate tread; harder than glass and sharp-edged, it was once prized by the Indians as a material for cutting tools.

NATURAL REGIONS OF THE UNITED STATES AND CANADA

Charles B. Hunt
The Johns Hopkins University

W. H. FREEMAN AND COMPANY
San Francisco

re 13.4 *Physiographic map of the central United States.*

CENTRAL LOWLAND

1. *Manitoba Plain:* southern part is bed of Lake Aggasiz. Underlain by Paleozoic and some Jurassic. Ends eastward against the Shield; ends westward at foot of the Manitoba Escarpment formed by Cretaceous formations. Altitude of the plain is about 800 feet.
2. *Saskatchewan Plain:* Underlain by Cretaceous formations. Ends eastward at rim of Manitoba Escarpment; westward at Missouri Coteau, the edge of the Tertiary formations. Lower and smoother than plains to west (Alberta Plains). Altitudes 1,500 to 2,600 feet. Streams entrenched about 300 feet in open valleys.

GREAT PLAINS

3. *Alberta Plains:* Underlain mostly by Cretaceous formations. Eocene near the foot of the mountains. Rougher than Saskatchewan Plain. Altitudes around 2,500 feet; Cypress Hills reach 4,700 feet and probably were not glaciated. Valleys entrenched 200 to 400 feet.
4. *Alberta Plateau:* Between Athabasca and Liard Rivers. Cretaceous formations in plateaus separated by broad valleys. Plateaus 2,500 to 3,200 feet in altitude. Lowlands along the Athabasca and Liard Rivers 1,000 to 1,500 feet lower. Near foot of Rocky Mountains altitudes are about 4,300 feet on the plateaus.

GREAT SLAVE AND GREAT BEAR PLAINS

5. *Great Slave Plain:* Underlain by Paleozoic formations. Altitude about 1,000 feet; little relief.
6. *Great Bear Plain:* Underlain by Mesozoic formations. Rolling surface generally lower than 1,000 feet altitude; a few hills up to 500 feet high. Ends at south-facing escarpment overlooking Great Slave Plain.

NORTHERN PROVINCES

7. *MacKenzie Plain, Franklin Mountains, and Colville Hills:* Altitudes near sea level along the MacKenzie River and more than 2,000 feet in the mountains which are ridges of Paleozoic formations.
8. *Arctic Slope, including the MacKenzie Delta:* Slope north from 2,000 feet to sea level. Western part largely covered by glacial drift and slightly lower than eastern part. Streams entrenched increasingly toward the south to about 400 feet.

Figure 13.2 *Interior plains and plateaus in Canada, in relation to those in the United States.*

the west-facing escarpment at the edge of the Appalachian Plateaus, a hilly belt referred to as The Knobs (Fig. 13.20). East of the Nashville Basin the Highland Rim is deeply dissected by valleys, some with steep headwalls attributable to solution.

The dissected plateaus west of the Lexington Plain and Nashville Basin slope slightly westward, but less steeply than the dip of the formations. As a result, the coal-bearing Pennsylvanian formations, which are in the Appalachian Plateaus east of the Cincinnati Arch, reappear at altitudes around 500 feet in western Kentucky. These form the western Kentucky coalfield and the coalfield in the southern Illinois structural basin.

Rivers crossing this dissected plateau are meandering and deeply entrenched. Some meanders are vigorously eroding laterally to produce *undercut walls, slip-off slopes,* and *cut-off meanders* (Fig. 13.21).

Other features of the Interior Low Plateaus are the

1. Temperate continental climate with rainy summer season.
2. Hardwood forests.
3. Residual deposits and Red and Yellow Podzolic Soils.
4. Ample water supplies.
5. Tobacco, corn, coal, bourbon, and, Kentucky Colonels.

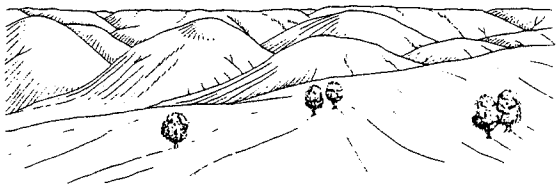


Figure 13.20 *The knobs in eastern Kentucky, along the boundary between the Lexington Plain (back of the observer) and the Appalachian Plateaus (distant skyline).*

OUACHITA PROVINCE AND OZARK PLATEAUS

Two other highland areas south of the glacial border are the Ouachita Province and the Ozark Plateaus, which together cover less than 100,000 square miles (Fig. 13.1). They resemble the Appalachian Provinces and Interior Low Plateaus in many ways. The Ouachita Mountains are fold mountains of thick Paleozoic formations deposited in a geosyncline. The folds and the mountains trend east-west (Figs. 13.22, 13.23). Northward under the Arkansas River Valley the formations thin in a structural basin containing coal measures of Pennsylvanian age, somewhat like those in the Appalachian Plateaus but more folded. North of this basin is a broad upwarp, the Ozark Plateaus, exposing early Paleozoic formations like those of the Cincinnati Arch and some Precambrian rocks. North of the Ozark Plateaus is the Illinois coal basin, which extends southeastward into Kentucky on the flank of the Cincinnati Arch.

Altitudes and local relief in the Ouachita Mountains and Ozark Plateaus average lower than in the Appalachian Mountains, but the landforms are similar. The Ouachita Mountains are composed of linear ridges and valleys (Fig. 13.24) that reach maximum altitudes of about 2,600 feet, about 1,500 feet above the adjoining valleys.

The Ozark Plateaus (Figs. 13.25, 13.26) consist of limestone. Altitudes reach 2,000 feet in the south in the Boston Mountains, and about 1,700 feet in the north. Between the Ozark Plateaus and the Ouachita Mountains is the valley of the Arkansas River, at an altitude of less than 500 feet.

As in the Appalachians, the sediments in the geosyncline under the Ouachita Province were derived from what is now the seaward side of the geosyncline. What was once their mountainous source now lies buried under the Coastal Plain and Continental Shelf. In both the Valley and Ridge and Ouachita provinces the thrust that folded and faulted the formations was directed toward the old Precambrian shield area in the interior of the continent.

The Paleozoic history of the geosyncline began with deposition of sands at the edges of the

Cambrian sea, forming sandstones of the Arbuckle and Ouachita mountains, and they overlap the Precambrian rocks in the St. Francois Mountains (Fig. 13.21) and Lake Superior region. In the fold mountains of southern Oklahoma these sandstones are overlain by the Cambro-Ordovician Arbuckle Limestone, which is a mile thick; correlative limestone, with some sandstone, in the upper Mississippi Valley (Prairie de Chien Group and St. Peter Sandstone) is about 250 feet thick. In the geosyncline this is overlain by the Ordovician Simpson Formation and Viola Limestone, which together are 3,000 feet thick; correlative formations of limestone and shale in the upper Mississippi Valley (Platteville Limestone, Decorah Shale, Galena Dolomite, Maquoketa Shale) are about 500 feet thick.

Silurian and Devonian formations in the middle west do not vary in composition or thickness as much as either the earlier or later Paleozoic formations. Both in the geosynclinal areas and on the shelf to the north these rocks are mostly shale and limestone and together are a few hundred feet thick.

In Mississippian time, however, sinking of the geosyncline appears to have accelerated again. In the north, on the shelf area, is shale and limestone less than 1,000 feet thick, but in southeastern Oklahoma and adjoining areas in Arkansas, the Mississippian System is mostly shale and sandstone (Stanley Shale and Jackfork Sandstone) and is 16,000 feet thick. The Pennsylvanian similarly is much thicker in the south than in the north; in southeastern Oklahoma it consists of 15,000 feet of beds. The generalized section is given in Table 13.1.

The tremendous thickness of Pennsylvanian formations in the south does not include the upper Pennsylvanian, which is not represented there. In the north, the entire Pennsylvanian System is only about 2,000 feet thick, and only the lower half of it correlates with the 15,000-foot section in the geosyncline. These Pennsylvanian formations have supplied much of the Middle West's coal.

The Permian is not well represented, but at the end of the Paleozoic, when the Appalachian Mountains were folded, the rocks that now form the Ouachita, Wichita, and Arbuckle mountains also were folded.

Table 13.1

Formations of Pennsylvania Age in Southeastern Oklahoma and Western Arkansas

Formation	*Description*
Thurman Sandstone	Sandstone with conglomerate and shale; top formation of the coal measures; 200 feet.
Boggy Shale	Alternating beds of shale and sandstone, with coal beds; 3,000 feet.
Savanna Sandstone	Mostly sandstone, some shale; 1,150 feet.
McAlester Shale	Shale and sandstone, with coal beds; 2,000 feet.
Hartshorne Sandstone	Sandstone; 200 feet.
Atoka Formation	Alternating beds of sandstone and shale; basal formation of the coal measures; 7,000 feet.
Wapanucka Limestone	Limestone; 200 feet.
Caney Shale	Upper part only; 250 feet?
Caney Shale	Lower part, and other Mississippian formations.

Other features of the Ouachita Province and Ozark Plateaus include their

1. Continental climate.
2. Residual deposits and Red and Yellow Podzolic Soils.
3. Hardwood forests.
4. Lack of many metropolitan areas.
5. Mules.

Climate

The climate of the Central Lowland, the plateaus south of it, and the Great Plains is continental. Temperature differences between seasons are extreme: winters are cold and blizzards frequent; summers are hot and subject to tornadoes. Yet

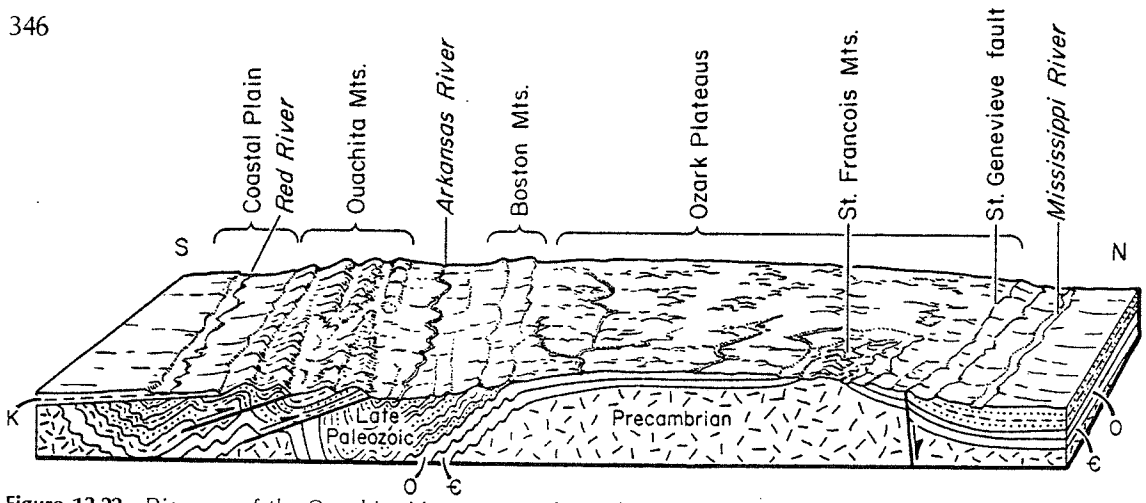


Figure 13.22 *Diagram of the Ouachita Mountains and Ozark Plateaus. The cross section extends from the Coastal Plain in north Texas to the Mississippi River below St. Louis, a distance of about 300 miles. The Ouachita Mountains, composed of Paleozoic formations in folds broken by thrust faults directed toward the core of the continent, developed over a Paleozoic geosyncline where the formations are very thick, as in the Valley and Ridge Province. The south flank of the geosynclinal belt is buried under Coastal Plain formations of Cretaceous age (K). Northward under the Arkansas River the Paleozoic formations thin and form a broad basin containing Pennsylvanian coal measures. The Ozark Plateaus consist of early Paleozoic formations (O, Ordovician; Є, Cambrian) and, in the St. Francois Mountains, Precambrian rocks.*

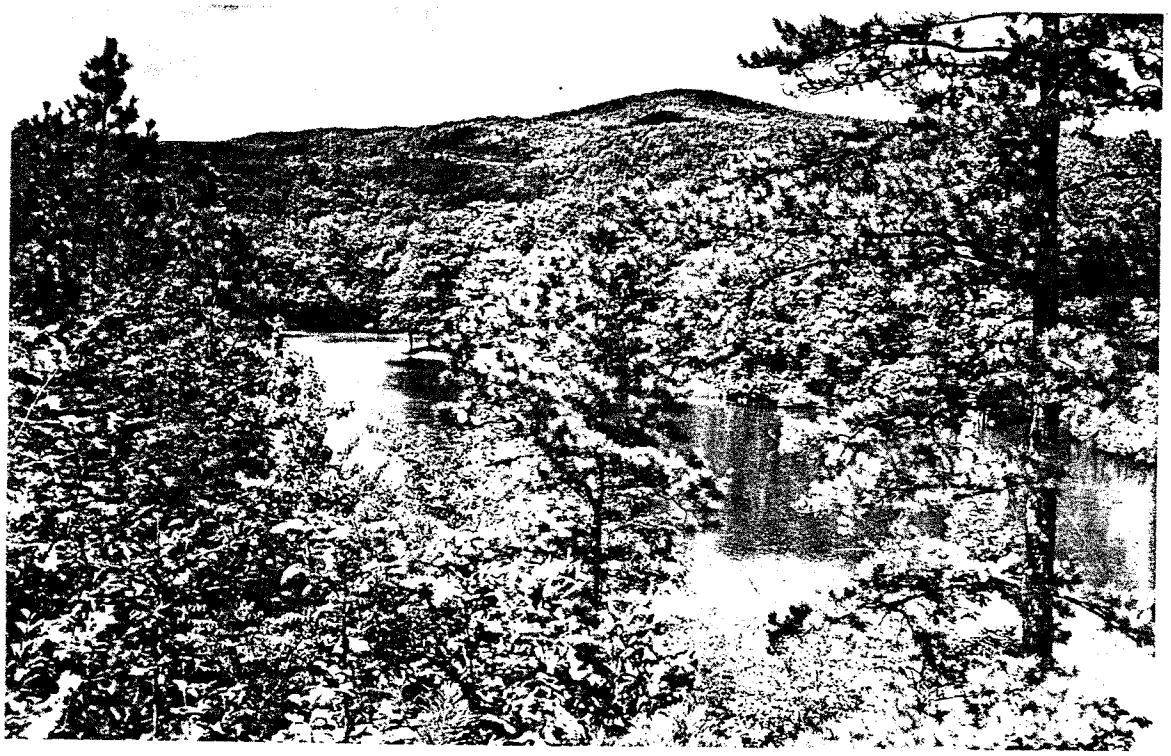


Figure 13.23 *Linear ridges and valleys of folded Paleozoic formations in the Ouachita Province are similar to those of the Valley and Ridge Province in the Appalachians, except that the valleys are generally narrow. The scene here is in Shady Lake State Park, southeast of the skyline drive that extends from near Mena, Arkansas, to Talhina, Oklahoma.* [Courtesy of Arkansas Dept. of Parks and Tourism.]

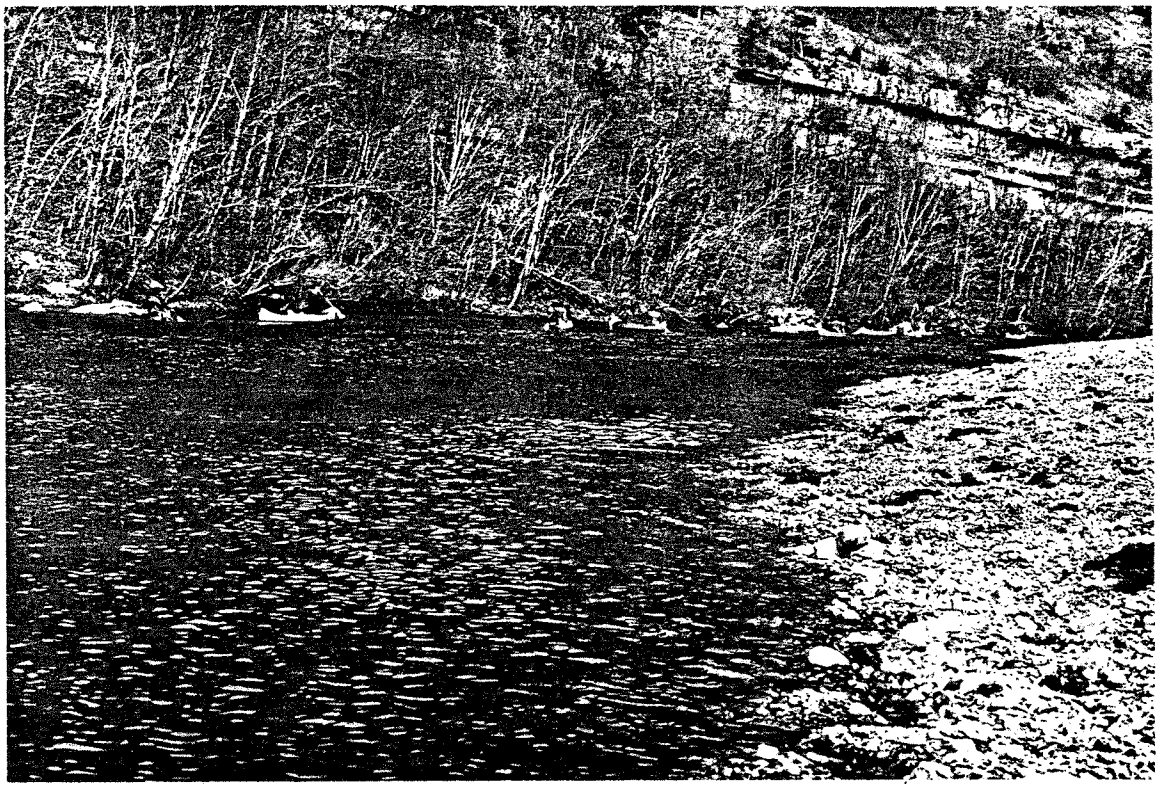
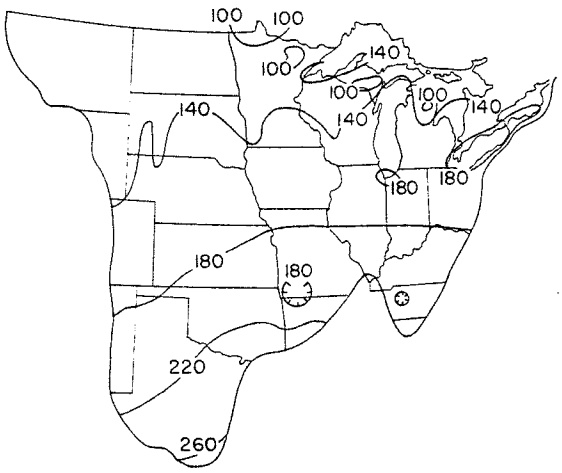


Figure 13.26 *Scene in the Ozark Plateau along the Buffalo River in northern Arkansas. Gently dipping early Paleozoic formations crop out in ledges along the valley sides. [Courtesy of Arkansas Dept. of Parks and Tourism.]*

Texas it is about one inch; at the Canadian border, more than four feet. Under snow the depth of freezing is much less. The northward increase in coldness also affects the natural vegetation, soils, agricultural activity, transportation, engineering problems concerned with foundations, and sales of heavy underwear.

A major climatic hazard in the central United States are the "twisters," or tornadoes, which have wind velocities estimated to be as great as 500 miles per hour. Where they touch ground, tornadoes commonly are about 1,000 feet wide. They extend upward into a funnel-shaped cloud darkened with dust sucked upward, and may reach to 20,000 feet. The storms move at speeds ranging from 5 to 60 miles per hour, and their tracks along the ground extend on the average for about a dozen miles. One tornado left a track more than 100 miles long.

Figure 13.27 *Average length of frost-free period (days) [Generalized from U.S.D.A.] in the central United States.*



Sedentary deposits

Residual

R_1 Clay from deeply weathered metamorphic rocks

R_2 Clay from deeply weathered, well consolidated sedimentary and deeply weathered volcanic rocks

Sand, silt, and clay from deeply weathered, poorly consolidated sedimentary rocks

Other

Evaporites, chemical precipitates at salt pans. (Travertine and caliche deposits too small to be shown)

Peat and other swamp and bog deposits

Eolian

Loess, wind-deposited silt

Wind-deposited sand (incompletely shown)

Stream

A Alluvium, deposits in floodplains (incompletely shown)

Valley fill, largely sand and gravel sloping to dry lake beds (many with salt pans) or alluvial bottoms

Gravity deposits

A variety of deposits, mostly stony and thin

Over·land \'ō-vər-lənd\ city E Mo. NW of St. Louis *pop* 22,763
Overland Park urban area NE Kans. *pop* 21,110
Ovie·do \ˌō-vē-'ā-(ˌ)thō\ **1** province NW Spain on Bay of Biscay *area* 4025, *pop* 1,011,350 — see ASTURIAS **2** city ✻ of Oviedo province *pop* 130,969
Owas·co \ō-'wäs-(ˌ)kō\ lake 11 *m* long *cen* N.Y.; one of the Finger lakes
Ow·en Falls \ˌō-ən-\ former waterfall 65 *ft* E Africa in Uganda in the Nile N of Lake Victoria; submerged when Owen Falls Dam was built
Ow·ens \'ō-ənz\ river E Calif. formerly flowing into **Owens Lake** (now dry), now supplying water to city of Los Angeles by way of Los Angeles Aqueduct
Ow·ens·boro \'ō-ənz-ˌbər-ə, -ˌbə-rə\ city NW Ky. *pop* 42,471
Owen Sound city Canada in SE Ont. on Georgian Bay *pop* 16,976
Owen Stan·ley \'stan-lē\ mountain range E New Guinea; highest peak Mt. Victoria 13,240 *ft*
Owos·so \ō-'wäs-(ˌ)ō\ city S *cen* Mich. W of Flint *pop* 17,006
Owy·hee \ō-'wī-(ˌ)(h)ē\ river 250 *m* SE Oreg. flowing NW into Snake river
Ox·ford \'äks-fərd\ **1** *or* **Ox·ford·shire** \-ˌshi(ə)r, -shər\ county *cen* England *area* 749, *pop* 275,765 **2** *or* ML **Ox·o·nia** \äk-'sō-nē-ə\ city & county borough, its ✻, on the Thames W NW of London *pop* 98,675 — **Ox·for·di·an** \äks-'fōrd-ē-ən, -'fōrd-\ *adj or n*
Ox·nard \'äk-ˌsnärd\ city S Calif. SE of Santa Barbara *pop* 40,265
Oxus — see AMU DARYA
Oxy·rhyn·chus \ˌäk-si-'riŋ-kəs\ *or* Ar **El Bah·na·sa** \el-'ban-ə-sə\ archaeological site Egypt N of Minya & S of Faiyūm
Ozark plateau \ˌō-ˌzärk-\ *or* **Ozark mountains** eroded tableland 1500–2500 *ft* high *cen* U.S. N of Arkansas river in N Ark., S Mo., & NE Okla. with E extension in S Ill. — **Ozark·er** \'ō-ˌzär-kər\ *n* — **Ozark·i·an** \ō-'zär-kē-ən\ *adj or n*
Ozarks, Lake of the reservoir 130 *m* long *cen* Mo. formed in Osage river by Bagnell Dam

Pa·bia·ni·ce \ˌpäb-yə-'nēt-sə\ commune *cen* Poland SSW of Lodz *pop* 53,100
Pa·chu·ca \pə-'chü-kə\ city *cen* Mexico NE of Mexico City ✻ of Hidalgo *pop* 53,400
Pa·cif·ic \pə-'sif-ik\ ocean extending from the arctic circle to the antarctic regions & from W No. America & W So. America to E Asia & Australia *area* 69,375,000
Pa·cif·i·ca \pə-'sif-i-kə\ city W Calif. S of San Francisco on the Pacific *pop* 20,995
Pacific Islands, Trust Territory of the islands in W Pacific under U.S. administration: the Marianas (except Guam), the Carolines (including the Palaus), & the Marshalls ✻ on Saipan I.; a Japanese mandate 1919–45, *land area* 687, *pop* 77,913
Pac·to·lus \pak-'tō-ləs\ river Asia Minor in ancient Lydia flowing into the Hermus (modern Gediz) near Sardis
Pa·dang \'päd-ˌäŋ\ city & port Indonesia in W Sumatra *pop* 116,300
Pad·ding·ton \'pad-iŋ-tən\ metropolitan borough NW London, England *pop* 125,281
Pa·dre \'päd-rē\ island 100 *m* long S Tex. between Laguna Madre & Gulf of Mexico
Pad·ua \'paj-ə-wə\ *or* It **Pa·do·va** \'päd-ə-və\ commune NE Italy W of Venice *pop* 173,354
Pa·du·cah \pə-'d(y)ü-kə\ city W Ky. on the Ohio *pop* 34,479
Padus — see PO
Paes·tum \'pes-təm, 'pē-stəm\ *or earlier* **Pos·ei·do·nia** \ˌpäs-ī-'dō-nē-ə, ˌpō-sī-\ ancient city S Italy in W Lucania on Gulf of Salerno (ancient **Bay of Paestum**)
Pa·go Pa·go \ˌpäŋ-(ˌ)(g)ō-'päŋ-(ˌ)(g)ō, ˌpäg-(ˌ)ō-'päg-(ˌ)ō\ *or* **Pan·go Pan·go** \ˌpäŋ-(ˌ)(g)ō-'päŋ-(ˌ)(g)ō\ town & port ✻ of American Samoa on Tutuila I. *pop* 1251
Pa·hang \pə-'haŋ\ state E Federation of Malaysia bordering on So. China sea ✻ Kuala Lipis *area* 13,873, *pop* 6,278,763
Pahsien — see CHUNGKING
Paines·ville \'pānz-ˌvil\ city NE Ohio *pop* 16,116
Painted desert region NE Ariz. E of the Little Colorado
Pais·ley \'pāz-lē\ burgh SW Scotland ✻ of Renfrew WSW of Glasgow *pop* 93,704
Pak·i·stan \ˌpak-i-'stan, ˌpäk-i-'stän\ country S Asia comprising an eastern division & a western division; a dominion 1947–56 & since 1956 a republic of the Brit. Commonwealth, formed from parts of former Brit. India; administrative ✻ Rawalpindi, legislative ✻ Dacca *area* 364,737, *pop* 93,720,613 — see EAST PAKISTAN, WEST PAKISTAN — **Pak·i·stani** \-'stan-ē, -'stän-ē\ *adj or n*
Pa·lat·i·nate \pə-'lat-ᵊn-ət\ *or* G **Pfalz** \'(p)fälts\ either of two districts SW Germany once ruled by counts palatine of the Holy Roman Empire: **Rhenish,** *or* **Rhine, Palatinate** *or* G **Rheinpfalz** \'rīn-ˌ(p)fälts\ (on the Rhine E of Saarland) & **Upper Palatinate** *or* G **Ober·pfalz** \'ō-bər-ˌ(p)fälts\ (on the Danube around Regensburg) — see RHINELAND-PALATINATE
Pal·a·tine \'pal-ə-ˌtīn\ hill in Rome, Italy, one of seven on which the ancient city was built — see AVENTINE
Pa·lau \pə-'laü\ *or* **Pe·lew** \pə-'lü\ **1** island group W Pacific SW of Yap; generally considered as part of the Carolines *area* 184 **2** — see BABELTHUAP
Pa·la·wan \pə-'lä-wən\ island 278 *m* long W Philippines W of the Visayans *area* 4550, *pop* (with adjacent islands) 93,700
Pa·lem·bang \ˌpäl-əm-'bäŋ\ city & port Indonesia in SE Sumatra on Musi river *pop* 282,900
Pa·len·cia \pə-'len-ch(ē-)ə\ **1** province N Spain *area* 3256, *pop* 240,707 **2** city, its ✻, NNE of Valladolid *pop* 47,413
Pa·len·que \pə-'leŋ-(ˌ)kā\ ruined Mayan city S Mexico in N Chiapas SW of present town of Palenque
Pa·ler·mo \pə-'lər-(ˌ)mō, -'le(ə)r-\ *or anc* **Pan·or·mus** \pa-'nór-məs\ *or* **Pan·hor·mus** \pan-'hór-\ city & port Italy ✻ of Sicily *pop* 503,137 — **Pa·ler·mi·tan** \pə-'lər-mət-ᵊn, -'ler-\ *adj or n*
Pal·es·tine \'pal-ə-ˌstīn, -ˌstēn\ *or* L **Pal·aes·ti·na** \ˌpal-ə-'stē-nə, -'stī-\ **1** ancient region SW Asia bordering on E coast of the Mediterranean & extending E of the Jordan **2** former country bordering on the Mediterranean on W & Dead sea on E; a part of the Ottoman Empire 1516–1917, a Brit. mandate 1923–48; now divided between Israel & Jordan, with Gaza Strip administered by Egypt — **Pal·es·tin·ian** \ˌpal-ə-'stin-ē-ən, -'stin-yən\ *adj or n*
Pal·i·sades \ˌpal-ə-'sādz\ line of cliffs 15 *m* long SE N.Y. & NE N.J. on W bank of the Hudson
Palk \'pȯ(l)k\ strait 40 *m* wide between N Ceylon & SE India connecting Gulf of Mannar & Bay of Bengal
Pal·ma *or* **Palma de Ma·llor·ca** \ˌpäl-mə-(ˌ)thā-mə(l)-'yór-kə\ commune & port Spain ✻ of Baleares province on Majorca *pop* 152,040
Pal·mas, Cape \'päl-məs\ cape Liberia on extreme S coast
Palmer archipelago, Palmer peninsula — see ANTARCTIC
Palm·er Land \'päm-ər, 'päl-mər\ the S section of Antarctic peninsula
Palm·er·ston \'päm-ər-stən, 'päl-mər-\ island (atoll) *cen* Pacific NW of Rarotonga I.; belongs to New Zealand *area* 1
Palmerston North city New Zealand on S North I. NE of Wellington *pop* 40,800
Pal·my·ra \pal-'mī-rə\ **1** island *cen* Pacific in Line islands *area* 1 **2** *or Bib* **Tad·mor** \'tad-ˌmó(ə)r\ *or* **Ta·mar** \'tā-ˌmär, -mər\ ancient city Syria on N edge of Syrian desert NE of Damascus
Palo Al·to \ˌpal-ə-'wal-(ˌ)tō\ city W Calif. SE of San Francisco on San Francisco Bay *pop* 52,287
Pal·o·mar, Mount \'pal-ə-ˌmär\ mountain 6126 *ft* S Calif. NNE of San Diego
Pa·los \'pä-(ˌ)lōs\ *or* **Palos de la Fron·te·ra** \-(ˌ)lōz-ˌdā-lə-ˌfrən-'ter-ə\ town & former port SW Spain on Tinto river SE of Huelva
Pa·louse \pə-'lüs\ **1** river 150 *m* NW Idaho & SE Wash. flowing W & S into the Snake **2** fertile hilly region E Wash. & NW Idaho N of Snake & Clearwater rivers
Pa·mirs \pə-'mi(ə)rz\ *or* **Pa·mir** \-'mi(ə)r\ mountain region *cen* Asia in Tadzhik Republic & on borders of Sinkiang, Kashmir, & Afghanistan from which radiate Tien Shan to N, Kunlun & Karakoram to E, & Hindu Kush to W; has many peaks over 20,000 *ft*, highest Kungur 25,146 *ft*
Pam·li·co \'pam-li-ˌkō\ river E N.C., estuary of Tar river, flowing E into **Pamlico Sound** (inlet of the Atlantic between the mainland & offshore islands)
Pam·pa \'pam-pə\ city NW Tex. ENE of Amarillo *pop* 24,664
Pam·phyl·ia \pam-'fil-ē-ə\ ancient district & Roman province S Asia Minor on coast S of Pisidia — **Pam·phyl·i·an** \-ē-ən\ *adj or n*
Pam·plo·na \pam-'plō-nə\ *or formerly* **Pam·pe·lu·na** \ˌpam-pə-'lü-nə\ city N Spain ✻ of Navarre province & once ✻ of Navarre kingdom *pop* 91,434
Pan·a·ma *or* Sp **Pa·na·má** \'pan-ə-ˌmä, -ˌmȯ, ˌpan-ə-'\ **1** country S Central America; a republic; before 1903 part of Colombia *area* (including Canal Zone) 29,129, *pop* 805,285 **2** *or* **Panama City** city & port, its ✻, on Gulf of Panama *pop* 200,000 **3** ship canal 51 *m* S Central America in the Canal Zone connecting the Atlantic (Caribbean sea) & the Pacific (Gulf of Panama) — **Pan·a·ma·ni·an** \ˌpan-ə-'mā-nē-ən\ *adj or n*
Panama, Gulf of inlet of the Pacific on S coast of Panama
Panama, Isthmus of *or formerly* **Isthmus of Dar·i·en** \-ˌdar-ē-'en, -ˌder-\ isthmus Central America connecting No. America & So. America & comprised in Republic of Panama
Panama Canal Zone — see CANAL ZONE
Panama City, 1 city & port NW Fla. on Gulf of Mexico *pop* 33,275 **2** — see PANAMA
Pan·a·mint \'pan-ə-ˌmint, -mənt\ mountains E Calif. W of Death valley — see TELESCOPE PEAK
Pa·nay \pə-'nī\ island Philippines in the Visayans; chief town Iloilo *area* 4446
Pan·gim *or* **Pan·jim** \pan-'jim\ *or* **New Goa** \'gō-ə\ town & port W India in Goa; former ✻ of Portuguese India
Pa·ni·pat \'pän-i-ˌpət\ city NW India in SE Punjab state NNW of Delhi *pop* 55,000
Panjab — see PUNJAB
Panj·nad \ˌpənj-'näd\ river 50 *m* W Pakistan, the combined stream of the Chenab & the Sutlej, flowing SW into the Indus
Pan·mun·jom \ˌpän-ˌmün-'jəm\ village S Korea SE of Kaesong
Pan·no·nia \pə-'nō-nē-ə\ Roman province SE Europe including territory W of the Danube in Hungary & Yugoslavia
Pantar — see ALOR
Pan·tel·le·ria \ˌpan-ˌtel-ə-'rē-ə\ island Italy in the Mediterranean between Sicily & Tunisia
Pá·nu·co \'pän-ə-ˌkō\ river 240 *m*, *cen* Mexico flowing from Hidalgo state NE into Gulf of Mexico
Pão de Açú·car \ˌpaùⁿ(n)-dē-ə-'sü-kər\ *or* E **Sugarloaf Mountain** peak 1280 *ft* SE Brazil in city of Rio de Janeiro on W side of entrance to Guanabara Bay
Pao·ki \'paù-'kē\ city N *cen* China in SW Shensi on Wei river W of Sian *pop* 130,100
Paoking — see SHAOYANG
Pao·ting \'baù-'diŋ\ *or formerly* **Tsing·yuan** \'chiŋ-yü-'än\ city NE China SW of Peking *pop* 197,000
Pao·tow \'baù-'dō\ city N China in SW Inner Mongolia on Yellow river W of Huhehot *pop* 650,000
Papal States — see STATES OF THE CHURCH
Pa·pe·e·te \ˌpäp-ē-'āt-ē, pə-'pēt-ē\ commune & port Society islands on Tahiti ✻ of French Polynesia *pop* 17,247
Paph·la·go·nia \ˌpaf-lə-'gō-nē-ə, -nyə\ ancient country & Roman province N Asia Minor bordering on Black sea — **Paph·la·go·nian** \-nē-ən, -nyən\ *adj or n*
Pa·phos \'pā-ˌfäs\ town SW Cyprus on coast 10 *m* WNW of site of ancient city of Paphos
Pap·ua \'pap-yə-wə\ **1** — see NEW GUINEA **2** the Territory of Papua
Papua, Gulf of arm of Coral sea SE New Guinea
Papua, Territory of territory comprising SE New Guinea & offshore islands; a UN trust territory administered jointly with the Territory of New Guinea by Australia ✻ Port Moresby *area* 90,600, *pop* 467,518
Pa·rá \pə-'rä\ **1** river 200 *m* N Brazil, the E mouth of the Amazon **2** state N Brazil S of the Amazon ✻ Belém *area* 470,752, *pop* 1,123,273 **3** — see BELÉM
Par·a·guay \'par-ə-ˌgwī, -ˌgwā\ **1** river 1500 *m*, *cen* So. America flowing from Mato Grosso plateau in Brazil S into the Paraná in Paraguay **2** country *cen* So. America traversed by Paraguay river; a republic ✻ Asunción *area* 157,006, *pop* 1,341,333 — **Par·a·guay·an** \ˌpar-ə-'gwī-ən, -'gwā-\ *adj or n*
Par·a·i·ba \ˌpar-ə-'ē-bə\ **1** *or* **Paraíba do Nor·te** \-də-'nórt-ē\ river 240 *m* NE Brazil flowing E into the Atlantic **2** *or* **Paraíba do Sul** \-'sül\ river 660 *m* SE Brazil flowing NE into the Atlantic **3** state NE Brazil bordering on the Atlantic ✻ João Pessoa *area* 21,591, *pop* 1,713,259 **4** — see JOÃO PESSOA
Par·a·mar·i·bo \ˌpar-ə-'mar-ə-ˌbō\ city & port ✻ of Surinam on Suriname river *pop* 107,000
Par·a·mount \'par-ə-ˌmaùnt\ city SW Calif. N of Long Beach *pop* 27,249

Pa·ram·us \pə-'ram
Pa·ra·ná \ˌpar-ə-'nä (ˌ)tō\ river 2040 *m* Río Grande & the P in Argentina **2** sta 82,741, *pop* 2,115,5
Pa·ra·na·i·ba *or for* 530 *m* S Brazil flowi the Paraná
Par·du·bi·ce \'pärd the Elbe E of Pragu
Pa·ria \'pär-ē-ə\ pen
Paria, Gulf of inlet
Pa·rí·cu·tin \pə-'rē Michoacán; first eru
Parida, La — see BO
Par·is \'par-əs\ **1** c \lü-'tē-sh(ē-)ə\ city \pə-'rizh-ən, -'rēsh-\
Par·kers·burg \'pär
Park Forest village
Park Ridge city NE
Park·ville \'pärk-ˌvil *pop* (with Carney)
Par·ma \'pär-mə\ **2** commune N Italy
Parma Heights city
Par·na·í·ba *or form* NE Brazil flowing
Par·nas·sus \pär-'n mountain 8060 *ft*, *ce*
Par·os \'par-ˌäs, 'pe in *cen* Cyclades W of
Par·ra·mat·ta \ˌpar Sydney, on Parramat
Par·ris \'par-əs\ isla
Par·ry \'par-ē\ islar Arctic ocean N of Vi
Parsnip — see FINLAY
Par·thia \'pär-thē-ə\
Pas·a·de·na \ˌpas-ə *pop* 116,407 **2** city
Pa·sar·ga·dae \pə-' Cyrus the Great; ruir
Pasay — see RIZAL
Pas·ca·gou·la \ˌpas-
Pasco, Cerro de — se
Pascua, Isla de — se
Pas de Calais — see
Pa·sig \'päs-ig\ river Laguna de Bay throu
Pas·sa·ic \pə-'sā-ik\ Bay **2** city NE N.J.
Pas·sa·ma·quod·dy Fundy between E Me
Pas·se·ro, Cape \'pä
Pas·sy \pa-'sē\ secti Seine near Bois de B
Pas·ta·za \pə-'stäz-ə, S into the Marañón
Pat·a·go·nia \ˌpat-ə- S Argentina & S Chi 40° S lat.; sometimes
Pat·a·go·nian \-nyə
Pa·tan \'pä-ˌtən\city
Pa·tap·sco \pə-'tap- into Chesapeake Bay
Pat·er·son \'pat-ər-sə
Pa·ti·a·la \ˌpət-ē-'äl- Punjab state **2** city,
Pat·mos \'pat-məs\
Pat·na \'pət-nə\ city *pop* 283,500
Pa·tos, La·goa dos S Brazil in Rio Gran
Pa·tras \pa-'tras, 'p
Pa·trae \'pā-(ˌ)trē\ Gulf of Patras *pop* 79
Patras, Gulf of *or* **G** of Ionian sea W Gre
Patrimony of St. Pet
Pa·tux·ent \pə-'tək-s into Chesapeake Bay
Pau \'pō\ **1** *or* F **G** France rising in the
— see GAVARNIE **2** c
Paumotu — see TUAM
Pa·via \pa-'vē-ə\ con
Pav·lof, Mount \'pa Alaska peninsula in
Paw·tuck·et \pə-'tək
Pay·san·dú \ˌpī-ˌsän river NW of Montevi
Pea·body \'pē-ˌbäd-ē,
Peace \'pēs\ river 94 & N Alta. into the Sla
Pearl \'par(-ə)l\ **1** r Gulf of Mexico **2** *or* Canton at E side of
Pearl Harbor inlet H
Pea·ry Land \'pi(ə)r-
Pe·chen·ga \pə-'cheŋ & port U.S.S.R. in N sea in district that be
Pe·cho·ra \pə-'chōr-ə Soviet Russia, Europe

ə abut; ᵊ kitten; ˌ
j joke; ŋ sing; ō
ᵊ F table; à F bac;

THE OZARKS

Land and Life

Milton D. Rafferty

University of Oklahoma Press : Norman

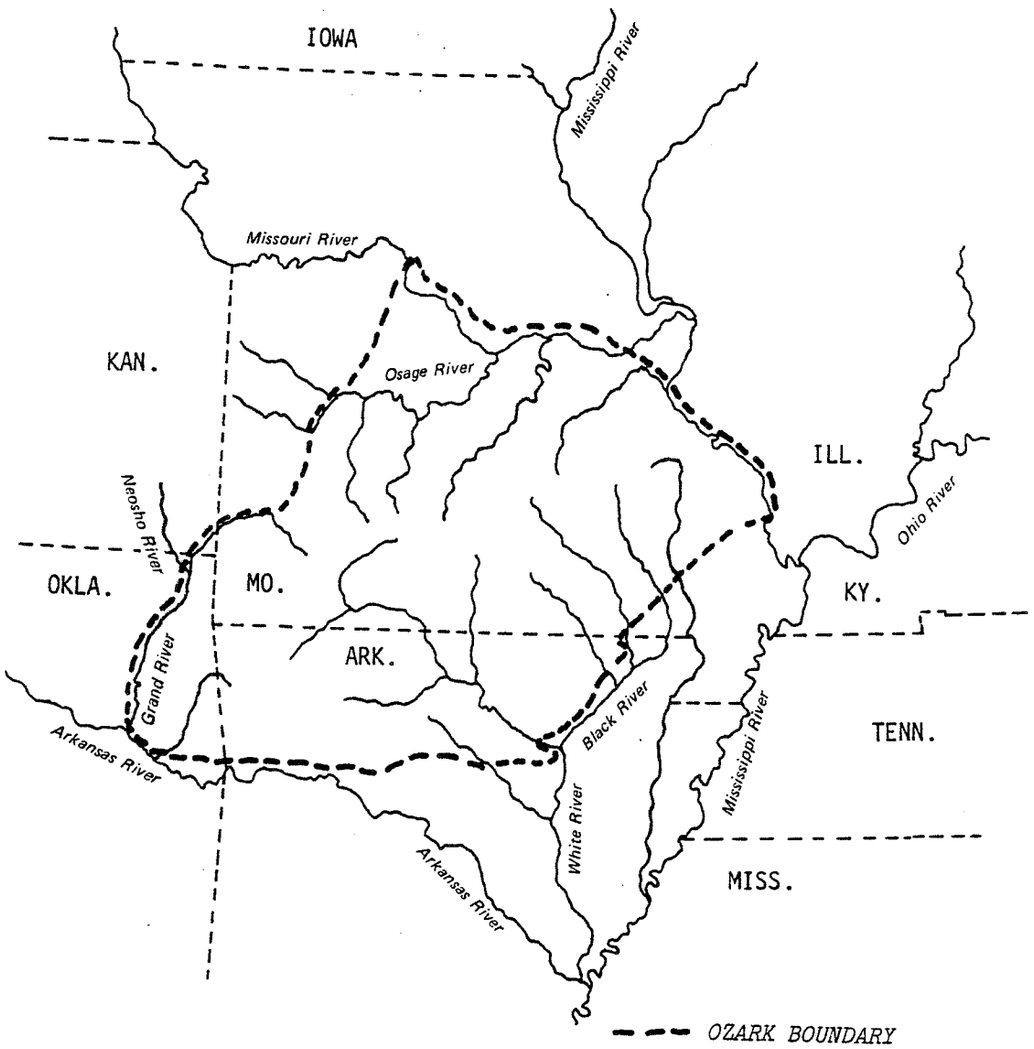


Figure 1-1. The Ozarks and bordering rivers.

1. The Ozarks: What and Where

As defined by geographers, a region is a portion of the earth's surface that has one or more elements of homogeneity distributed more or less throughout the area. The Ozarks is one of America's great regions, set apart physically by rugged terrain and sociologically by inhabitants who profess political conservatism, religious fundamentalism and sectarianism, and a strong belief in the values of rural living. This popular image of the Ozarks, though widely accepted, is poorly understood in geographic terms. In a word, the boundaries of the Ozarks are vague to most people and subject to interpretation and disagreement by the experts.

As delimited by geographers, the Ozarks are in four states: Missouri, Arkansas, Oklahoma, and Kansas (fig. 1-1). The total area may be estimated at 60,000 square miles, larger than Arkansas. Sometimes the Shawneetown Hills, which stretch across southern Illinois, are included in the Ozarks, but just as often they are linked to the limestone low-plateau country that extends through southern Indiana, central Kentucky, and into Tennessee.

The boundaries of the Ozarks are marked in a general way by major rivers (fig. 1-1). On the east is the Mississippi. Its significance as a boundary is enhanced because it forms the boundary between Illinois and Missouri. On the north the Ozarks extends just beyond the Missouri River to include a narrow strip of ravines and ridges that etch the north bluffs.

The Black River parallels the southeastern boundary of the Ozarks, collecting runoff from small Ozark streams as it finds its way across the alluvial flatlands to join the White River. The southern boundary follows along the low hills that parallel the north side of the fertile Arkansas River valley. The western boundary is not as well defined. In the southwest the Neosho River (sometimes Grand River) and its tributary, Spring River, form a visible boundary. The remainder of the western boundary, from a few miles north of Joplin to Howard County, follows the seam where Pennsylvanian-age rocks (formed 280–320 million years ago) overlap older Mississippian-age rocks. No striking changes in land-form features distinguish the Ozarks from territory to the west, but instead there is a gradual transition from forested hills to level, cultivated fields.

The unifying geographical criteria of the Ozark region include greater relief and steeper slopes than surrounding areas; surface rocks that are older than those exposed outside the Ozarks; the abundance of dolomite, as opposed to limestone (the two appear similar to the eye, but dolomite is formed by replacement of calcium in limestone by magnesium); the prevalence of the flinty, hard rock known as chert as nodules in limestone and

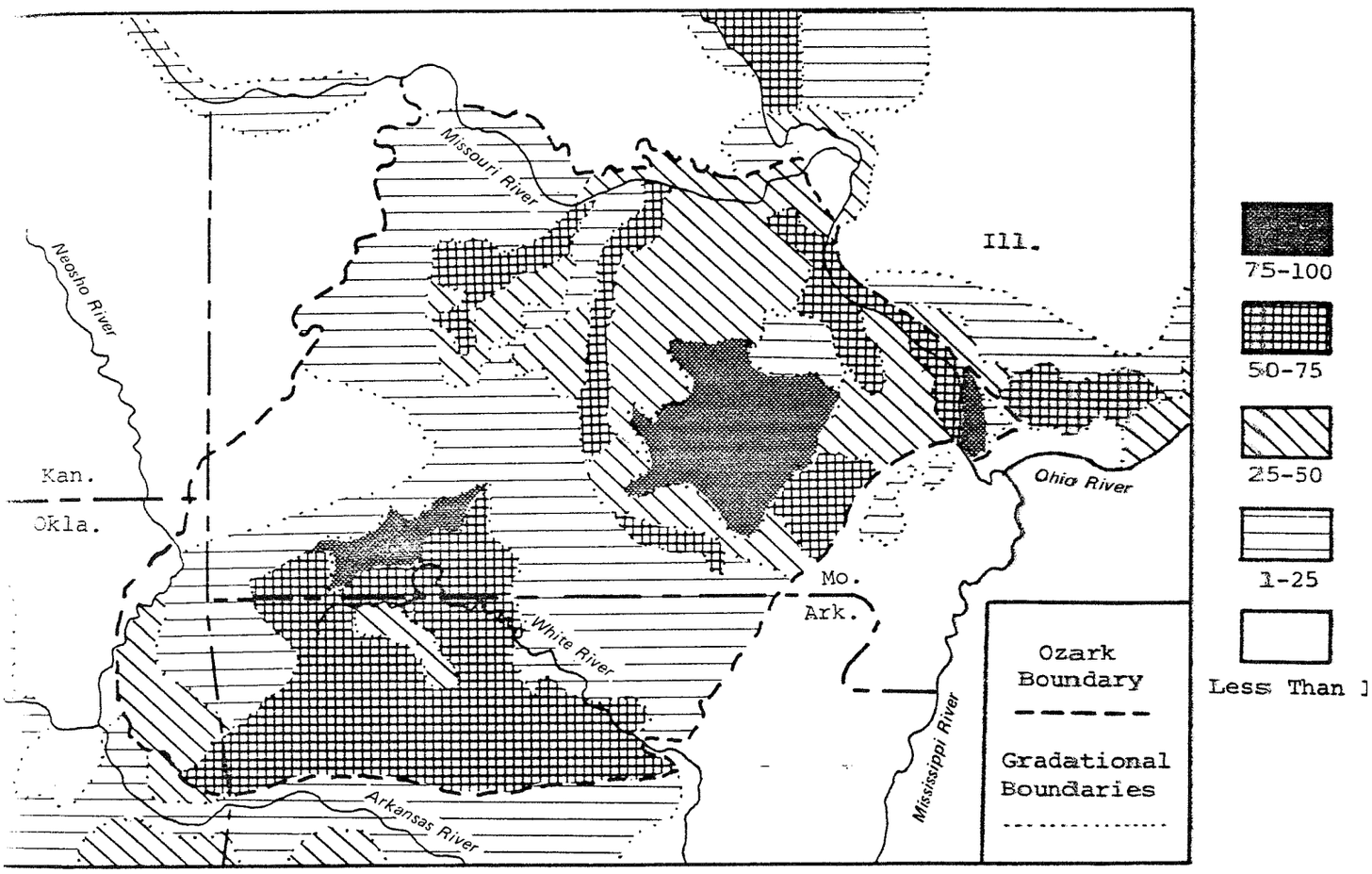


Figure 2-3. Percentage of land in slopes exceeding 14 per cent.

of most travelers. The greatest local relief (distance between valley bottoms and ridgetops) and steepest slopes are in the Boston Mountains, the St. Francis Mountains, and in the drainage basins of the White, Current, and Black rivers (fig. 2-3). Relief is especially pronounced where resistant strata form escarpments, the most striking of which is at the north front, or boundary, of the Boston Mountains, where sandstone beds stand as much as 800 to 900 feet above the limestone plains extending northward. Others are the Eureka Springs Escarpment, which outlines the headwaters of the White River and extends north of Springfield; the Avon Escarpment at the eastern border of the Farmington (Missouri) Basin; the Crystal Escarpment, which runs north to south from a point near Pacific, Missouri, through Ste. Genevieve County and Perry County; and the Burlington Escarpment, which parallels the Crystal Escarpment nearer the Mississippi River.

Geographic Regions

The Ozarks can be divided into geographic regions in such a way as to distinguish each area that has internal unity of geographic environment and contrasts with the surrounding areas. For this

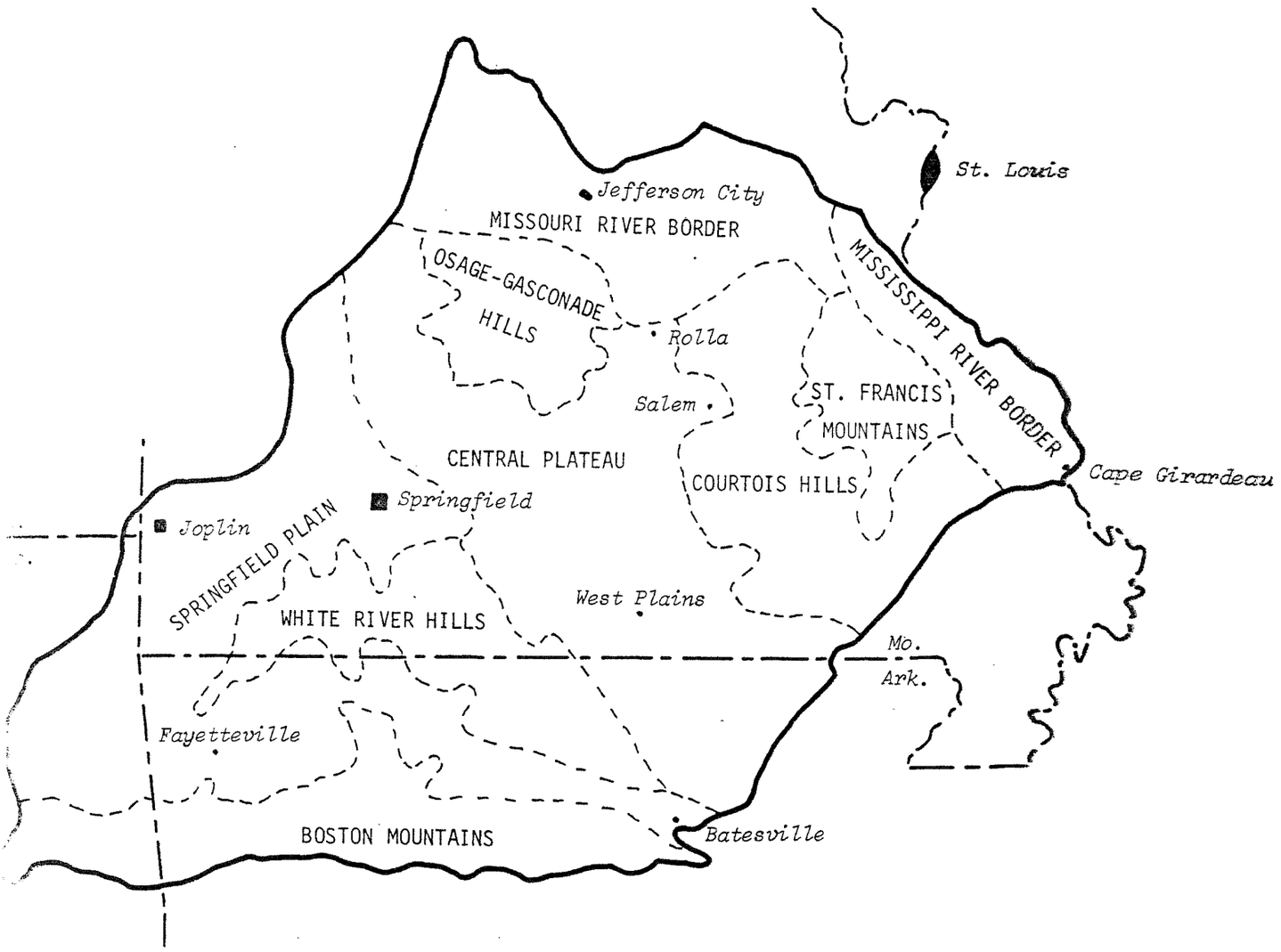


Figure 2-4. Geographic regions of the Ozarks.

Mountains. The general slope is eastward, and because elevations vary from 1,778 feet on Taum Sauk Mountain to 460 feet at Ste. Genevieve, the descent is rapid. Because the layers of limestone and sandstones are tilted steeply to the east, their eroded faces from west-facing escarpments. The most notable of these is Crystal Escarpment, where soft sandstones have been weathered and eroded, leaving the overlying limestones standing in bold relief.

Hilly belts extend back from the streams; an extensive hill belt in the drainage area of the River Aux Vases is known as the Becket Hills. The most extensive upland area is the Barrens in Perry County, where large sinkholes are more numerous than in any other section of the Ozarks. In

3. Weather and Climate

The first white settlers from Tennessee and Kentucky found few unfamiliar climate conditions in their new homeland. Since the Ozark region lies at about the same latitude as Kentucky and Tennessee, the temperatures are similar. Its more westward position in the continent of North America makes the Ozarks somewhat less humid and more subject to droughts.

Both the day-to-day fluctuations in temperature, precipitation, and humidity that determine weather conditions and the long-term averages and extremes of these elements that comprise the climate of the Ozarks are determined primarily by a midcontinent location in the middle latitudes. Certainly the altitudes and relief are not sufficient to affect, to any significant degree, the climate of the region.

The northern two-thirds of the Ozarks has a Humid Continental climate; in the Boston Mountains and a portion of southern Missouri the climate is Humid Subtropical. These climate boundaries are arbitrary and are convenient only for identifying broad climate types. In fact, the climate of the Ozarks is so variable that a person who has lived in the region only one year cannot make a true estimate of the kind of weather that might be expected during the next twelve months. A similar statement may be made concerning the seasons: the experience of one summer, or of one winter, will not give a correct idea of a general summer or of general winter conditions. The same may be said for any month of the year.

Winds and Storms

The winds are largely cyclonic and the weather is quite variable. The Ozarks are too far south for their temperatures to be affected for long periods by the strong winter high-pressure cells of the north-central states, but occasionally a strong high-pressure cell or two from high latitudes will bring prolonged and bitter cold temperatures. The extreme cold temperatures—reaching −10°F to −15°F—that occurred in January and February, 1977, were unusual for their severity and duration. Lesser lows and highs from the Great Plains region move across the Ozarks regularly.

The wind of maximum frequency is southerly or southeasterly. There is a slight increase in the frequency of northerly winds with increase in latitude, and northerly winds are more frequent throughout the region in the winter months. Summer winds are more noticeable during the day than at night; winter winds are as common at night as during the day. At Springfield the mean velocity is 10.1 miles per hour, being highest in

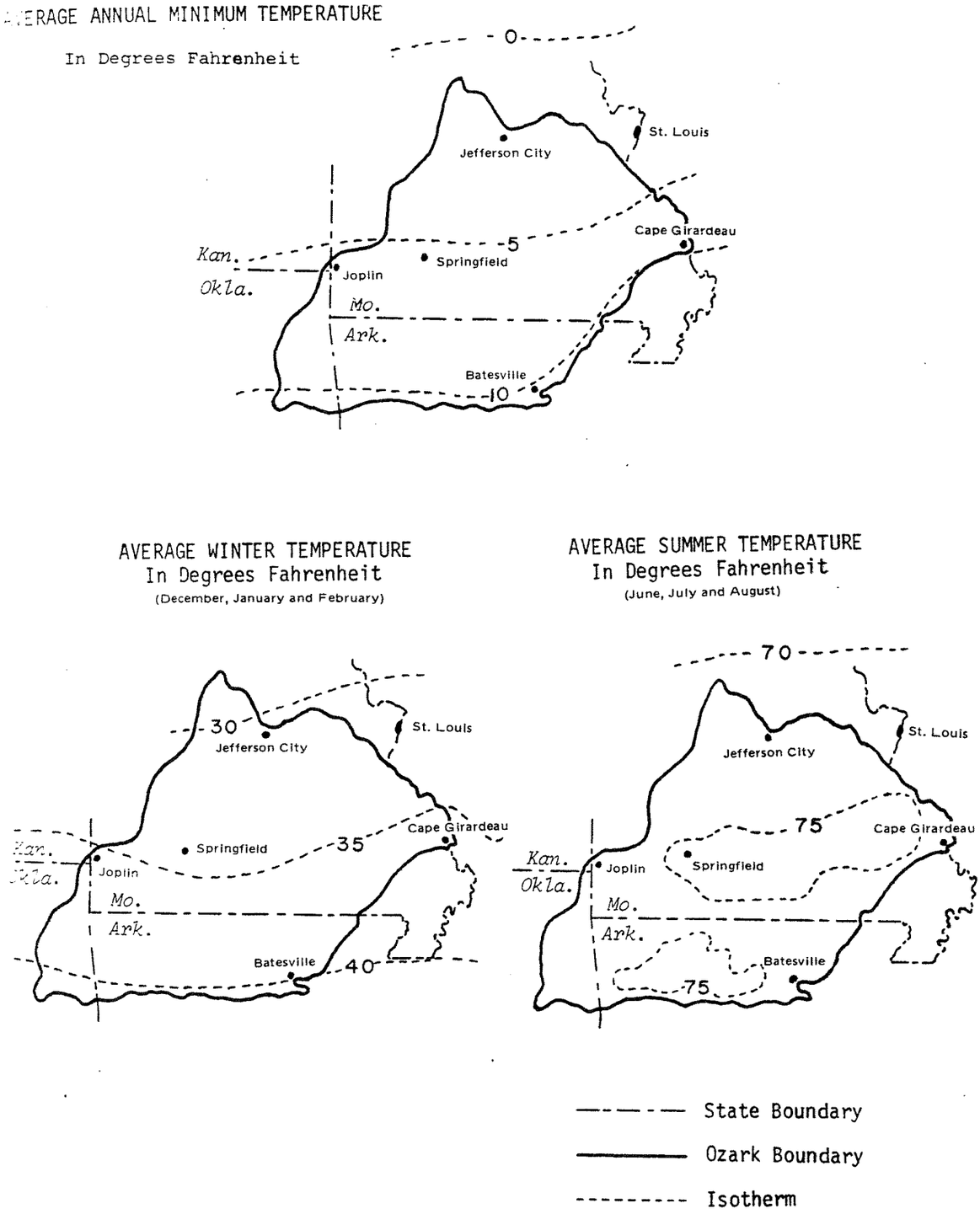


Figure 3-1. Temperature averages. Source: *Atlas of American Agriculture* (1936).

March (12.4 mph) and lowest in August (7.4 mph).

In midsummer a brisk wind from the southwest for a few days continuously is likely to become a hot wind, and much damage to growing crops may result. During late summer and early fall, for a period of several weeks, there is little wind, the sun seems as hot as in midsummer, and the sky takes on a hazy, purplish color, especially in the late afternoon; this is the renowned Indian Summer of the Ozarks, the time of storing away crops for winter, gathering nuts and apples, and greeting tourists, who come in large numbers to enjoy the Ozarks' finest season. In winter the winds often change direction quickly; cold, brisk winds may blow from the north for several days, sometimes accompanied by fine, dry snow. At other times during the winter the brisk wind of the day quiets down at the approach of sunset, and the night is calm.

Tornadoes are of annual occurrence in the region, although the likelihood of visitations for any one locality is very slight. Most of these storms invade the Ozarks from Oklahoma and Kansas, and the western border is most subject to them. Powerful twisters have struck in the vicinity of Springfield on at least five occasions: 1880, 1883, 1915, 1972, and 1975. The first destroyed the town of Marshfield and resulted in the death of at least a hundred persons. The storm of 1972 caused heavy damage in Republic and destroyed several airplanes and severely damaged buildings at Springfield Municipal Airport. Although tornadoes are most frequent in the period from April 1 to June 30, they occur in all months. The storm that hit Springfield's airport came in mid-December, 1972.

Tornado forecasting and storm warning systems have done much to reduce the number of deaths and injuries. The violent tornado that struck Neosho in April, 1975, at 5:00 P.M. caused severe property damage in residential areas and in a major shopping center, but because of advance warning, there were no casualties and the number of injuries was small.

The average annual temperature of the Ozark Upland is 55°F, which is the average for the city of Springfield. The coldest month of the year is January. This does not necessarily mean that the temperature during January is always lower than it is during the other winter months, but an average January has a few more cold days than either an average December or an average February. January is also the month in which the temperature contrasts among various parts of the Ozarks is greatest, amounting to a maximum of 12 degrees between the extreme north and south. In April there is only 4 degrees' difference between the north and south, and in the three summer months almost none (fig. 3-1).

Winter in the Ozarks usually sets in about the latter part of December and continues through January and February, with occasional cold outbursts in early March. Each of the winter months has twenty-five to thirty days when the temperature during the warmest part of the day is at 32°F or above and only one to three days when the temperature drops below zero. About three cold waves a season sweep over the region, the average length of each being about three days, but prolonged cold periods, such as those of January and February of 1977 and 1978, may occur. The mean daily range in temperature (day's maximum minus the day's minimum) throughout the year is 18.2 degrees; in winter 16.8 degrees, in spring 19.0 degrees, in summer 18.3 degrees, and in autumn 18.8 degrees.

Extreme temperatures of 100 degrees or above may be expected during an Ozarks summer. For the region as a whole, extremely high temperatures are likely to occur on one or two days in late June, three to five days during each of the months of July and August, and perhaps a day or two in early September.

Humidity and Precipitation

The average relative humidity at Springfield is 73 per cent; 77 during the winter months, 75 in summer, and 70 in spring. The average number of clear days per year is 150, partly cloudy 127, and cloudy 88. August, September, and October have the largest number of clear days; those with the most cloudy days are December and January, each with 11. May has an average of 12 rainy days, whereas October has only 7. In the eastern part of the Ozarks and on the south flank of the Boston Mountains, the humidity is slightly higher than at Springfield. On the whole the region is one of abundant sunshine. The maximum frequency of

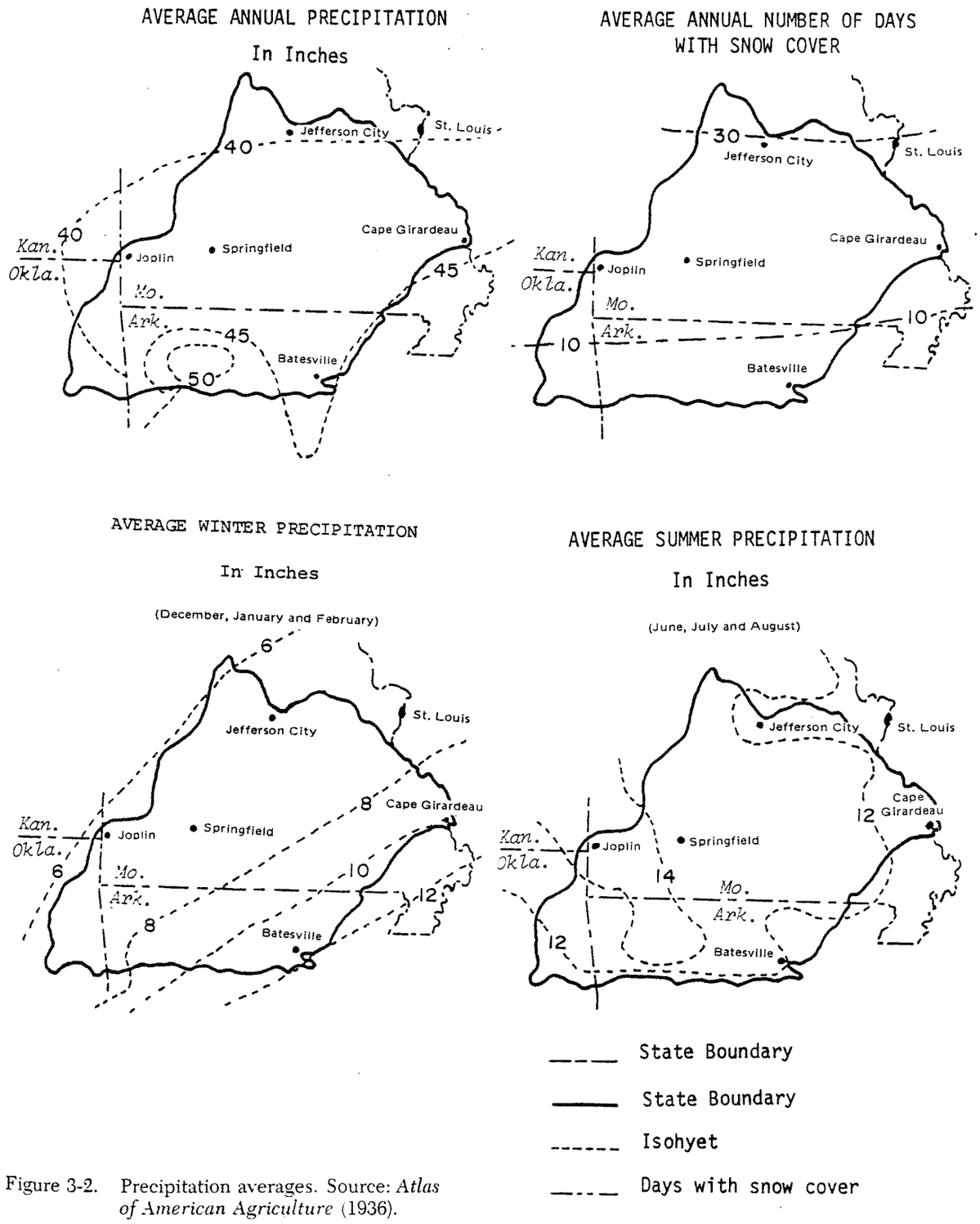


Figure 3-2. Precipitation averages. Source: *Atlas of American Agriculture* (1936).

rains in spring, and of sunny weather in late summer, is favorable for production of a variety of crops.

Precipitation is largely in the form of rain (fig. 3-2). The average totals range from 36 inches on the northern Missouri River Border to more than 50 inches near the Arkansas River. Annual amounts at representative stations: Jefferson City 36 inches, Springfield 41, Poplar Bluff 48, Eureka Springs 49, Fayetteville 45, Harrison 43, Marshall 50, Muskogee 42.

The average snowfall at Springfield is only 15.9 inches, or about 3.5 per cent of the total precipitation and less than half the snowfall at Chicago or New York. The amount of snow that falls is quite variable. Stations on the northern border have received no snow in January in some years, while very heavy snows of 20 or more inches are not infrequent. Snowfall can be heavy in the Boston Mountains, but averages are modest: Fayetteville 10 inches, Harrison 12, Muskogee 6, and Ozark 6. On the northern border, snow may remain on the ground a week or perhaps two, but in the Arkansas Ozarks it usually melts in a day or two. Nevertheless, because state and county highway crews are poorly equipped to handle heavy snow, roads are sometimes difficult to travel. Schools in the region usually allow two to five snow days in their schedules to make up for days when roads are impassable.

The latitudinal position of the Ozarks favors sleet storms and freezing rain. Freezing rain causes considerable damage to trees and wires and makes travel extremely hazardous for a day or two. In November, 1848, the western Ozarks experienced a big sleet that was extraordinarily destructive. In December, 1972, a heavy freezing rain in the same section brought down power lines and left farms and communities without electricity for several days. Dairymen were unable to milk until National Guard units brought in portable generators to supply power for the electric milking machines. Hail is most frequent in the western Ozarks, but the region as a whole normally experiences 15 to 20 damaging hailstorms in the period from May to September.

General Weather Variations

Ozarks weather is very changeable throughout the year, but more so during winter than any other season. The dry season usually sets in about the latter part of June or the first part of July and lasts forty to sixty days. During this period, widespread rains of more than one inch are not common, and the greater part of the rainfall comes in showers.

Droughts have done more damage than periods of excessive rain. They cover a larger area and are more prolonged, they affect both uplands and river bottomland, they cause permanent injury to field crops, and they affect farm and village alike by depleting water supplies as reservoirs are lowered and springs stop flowing. Severe droughts have occurred in 1881, 1911, 1913, 1914, 1935, 1936, 1955, 1956, 1975, and 1976. The one in 1975 persisted through the fall and winter months, and reservoir levels dropped to record lows. Many boat docks and marinas on Lake of the Ozarks, Table Rock Lake, and other Ozark lakes were stranded high and dry. Water levels on Beaver Lake dropped to expose the foundations, stone bridges, and amphitheater of Monte Ne, the popular resort constructed by the eccentric but nationally known Coin Harvey. People flocked to the site to take their first look at the well-known resort, which was inundated when Beaver Dam was completed in the early 1960's. Small communities and farms without reliable water supplies had to haul water as groundwater levels dropped and wells went dry.

Heavy downpours often are associated with squall lines, fronts, and isolated thunderstorms. Because of steep slopes, runoff is rapid, and flash floods are frequent. Such floods are of short duration but are destructive of property and farmland. It is recorded that in May, 1892, the Big Piney River rose 30 feet between 4:00 P.M. to midnight. During the same month, the Current River rose 27 feet in about the same length of time. On July 1, 1973, 19 inches of rain fell southwest of Springfield and sent torrents of water down small valleys that had been without even the semblance of a stream a few hours before. Chert washed from hillsides covered acres of bottomland along the Finley River, and roads in Stone County were closed for days by deposits of chert that in some places reached the second strand of wire on fences. Bridges were washed out, disrupting travel for several weeks. In 1961 an even more disastrous flash flood swept through Harrison,

Arkansas and destroyed four-fifths of the business district.

Temperature ranges are extreme at times. The highest temperature ever recorded in the Missouri Ozarks was 116°F at Marble Hill in 1901; the absolute high in the Arkansas Ozarks was 120°F at Ozark. Absolute minimum temperatures are by no means mild; both Fayetteville and Marshall in Arkansas have recorded −24°F. Springfield has recorded an absolute range of 135 degrees, with such anomalous temperatures as 74°F in January and 33°F in October and April.

Microclimate

Within the Ozarks, temperatures will vary widely with the orientation of slope, nature of surface materials, relief, and presence of water. South- and west-facing slopes receive the greatest amount of sunlight and are subject to higher rates of evaporation. Ferns, most mosses, and most wild flowers do not appear on south-facing slopes. Here also are the purest stands of oak and hickory. North-facing slopes generally have much more undergrowth. In winter, perhaps the most noticeable effect of temperature differences within a small area is the duration of snow and icicles on the north-facing slopes. The latter, often several feet long as they hang from cliffs, may not melt completely for many days after daytime temperatures have reached the 50's.

Air drainage creates the most readily observed temperature differences in summer. Nights are notable for the cool breeze that drains down the slopes, beginning an hour or two before sunset. The effects of daytime temperature variations are most easily felt in flying over the Ozarks in a light plane, which is easily affected by air currents.

Early-morning fog is common in the valleys in the hill and mountain districts because of the drainage of cool air into the valleys overnight. The fog usually dissipates by midmorning as temperatures climb in the valleys. Heavy fogs often hover over the large water bodies, such as Lake of the Ozarks, Beaver Lake, Pomme de Terre, Table Rock, and Bull Shoals. A bluish haze is characteristic in panoramic views in the hill districts, even in fair weather.

Hot summer temperatures are moderated by shade and cool spring water. Many of the early resorts were built close to large springs or caverns. At Welch's Cave and Spring on the Current River, Dr. C. H. Diehl constructed a rest home at the entrance to the cave in 1916 and benefited from the natural air conditioning. Pipes brought cool air from the cave to patients' rooms.[1]

The average length of the growing season for the Ozarks as a whole is nearly six months. The likelihood of unseasonable frost depends much more on topographic location than on latitude. As a rule, frosts occur in the valleys several weeks earlier in fall and later in spring than they do on the uplands, especially in the case of the larger valleys lying in the hill regions. The margins of the uplands have the best air drainage and are least subject to frosts.

On the whole the Ozarks has a humid climate reasonably free from severe drought in most years. It is well moderated, of the continental type, pleasant and healthful, and well suited to a large variety of crops.

Weather Lore

It is natural for agricultural people to be concerned about weather conditions. Before scientific forecasting was available, farmers had to depend upon their own observations, and there is no denying that some of them were extraordinarily skilled in making short-range predictions of rain and frost. For long-term forecasts, people depended on *The Farmer's Almanac*, folklore, and weather signs. Certain people were believed to be gifted with the ability to predict weather, and there are many Ozarkers who still take amateur weather predictions very seriously. Until recently the Springfield newspaper continued to publish a monthly forecast by a local weather prophet.

The most comprehensive list of Ozark weather signs was compiled by Vance Randolph, noted folklorist and authority on Ozark folk culture.[2] Many, if not most, of the weather signs and superstitions collected by Randolph were not unique to the Ozarks but were widely popular in rural

1. Margaret Ray Vickery, *Ozark Stories of the Upper Current River* (Salem, Mo.: The Salem News, n.d.)

2. Vance Randolph, *Ozark Magic and Folklore* (New York: Columbia University Press, 1964); see chapter 2, "Weather Signs," pp. 10–33.

America. A few of the signs have some basis in actual atmospheric changes or changes in organisms that are broadly predictive of weather trends. Many others have no apparent connection to weather.

A few of the popular Ozark weather signs serve to illustrate their general character. A strong wind in tall, dry grass is a sign of rain before nightfall. A cat's sneeze, a wolf's howl, the cock's crow, and livestock (of any type) turning their backs to the wind are sure signs of rain. It is believed that wild animals become more active before a storm. Other signs popular in the Ozarks and familiar to most readers include the groundhog, rainbow, fog, rings around the moon, early budding of trees, and the croaking of frogs.

Many of the weather superstitions have a rather humorous character. The dried blood of a murdered man will supposedly liquify when a big rain is approaching. One may assume that this forecast method is used only infrequently. The number of fogs in August is supposedly predictive of a like number of snows in winter. Every 100-degree day in July predicts a 20-below-zero day the following January. Long-range folk forecasters hold that the weather conditions for the first twelve days of January are predictive of the weather for the next twelve months. Thus, presumably, a dry January 4 produces a dry April and a snowy January 8 results in August snow flurries.

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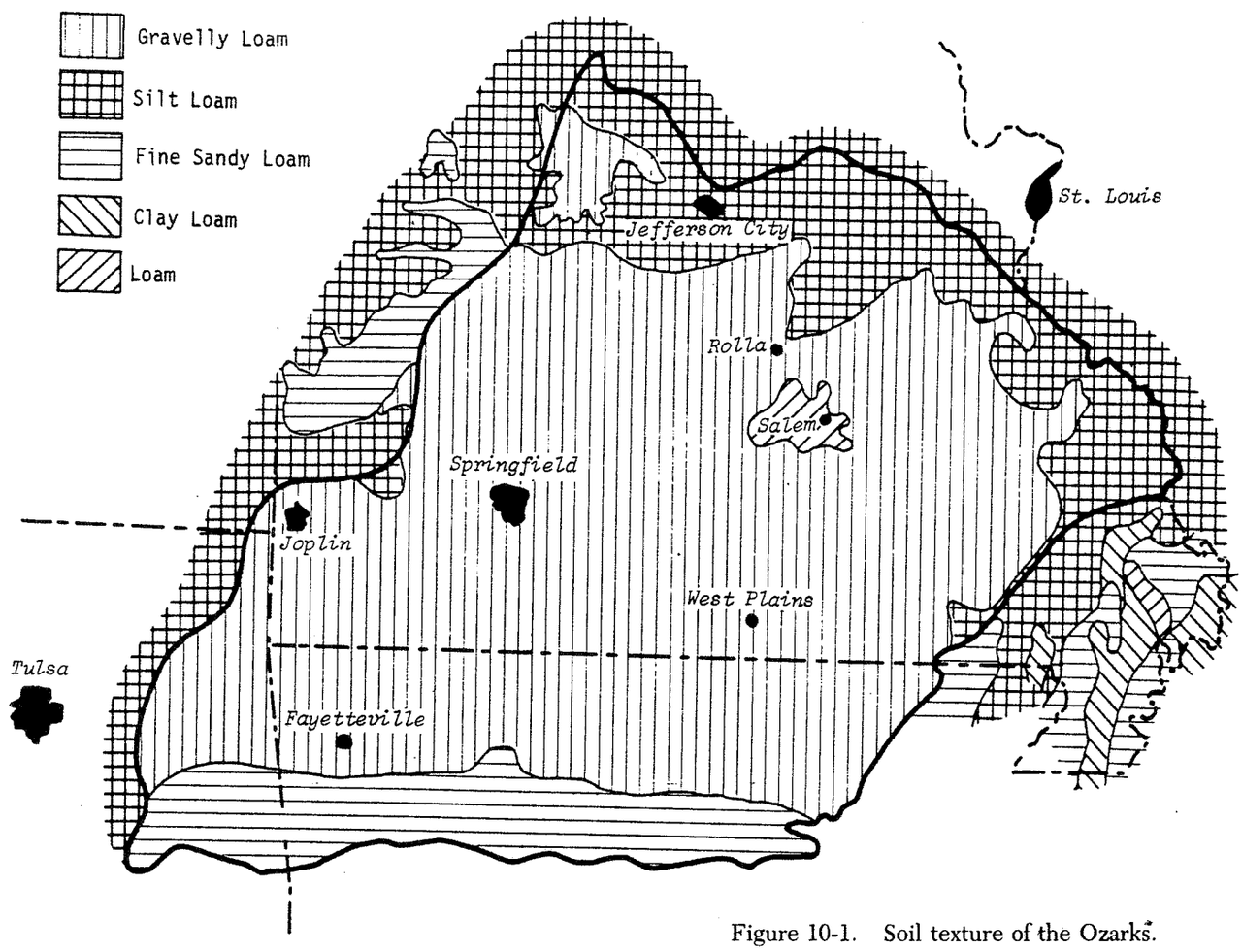

Figure 10-1. Soil texture of the Ozarks.

10. Ozark Agriculture: Patterns of Trial and Error

For the pioneers who settled the Ozarks, the single most important factor in the economic development of the region was the quality of soil resources. Today, after more than a century of agricultural settlement, the well-being and prosperity of the people is dependent on the continued use of the soil, although perhaps less so than in former times. Nevertheless, of the three groups of renewable natural resources—soils, plants, animals—used by man through the ages, soils are perhaps the least understood by the average person. The primary reason for this is that soils are covered by vegetation, and to examine a soil therefore requires special effort. The significance of the various soil features, such as color, depth, texture, structure, and tilth, is understood by few.

Soil is complex. It is composed of weathered rock material, decayed and partly decayed organic matter (humus), air, and water in various conditions. The soils of the Ozarks are diverse in physical properties and fertility. The variations result from the several factors that effect soil formation, including the parent, or geological, material from which the soils were derived, climate, topography, drainage, natural vegetation, and the length of time the soils have weathered. Physical features that give diversity to Ozark soils include color, topsoil depth, texture, subsoil, subsoil pans, underlying material, and tilth. Each is significant in identifying soils and interpreting their fertility levels. Soil profiles—the succession of layers, or horizons, in the soil—reflect the diversity of Ozark soils. The chief parent materials of Ozark soils are loess, limestone and dolomitic limestone, shales, and alluvial deposits. Sandstone and granite are of minor importance.

Most of the soil in the Ozarks was formed by the decay of rock formations (fig. 10-1). On upland flats and gentle slopes, most of the surface materials are derived from the underlying rock, and formation contacts commonly correspond with sharp differences in soils. On steep slopes, more-resistant beds of rock, particularly the cherty limestones and dolomites, dominate the soils as well as the topography. Because of their resistance, the cherty limestones form the summit elevations; accordingly, their weathered products mantle the lower slopes, which are occupied by less-resistant rocks. This, coupled with their extensive distribution, makes the soils derived from cherty limestones by far the most extensive type in the Ozarks.

In cherty soils, the residual chert (flint) is the most conspicuous feature. It is present in the topsoil, the subsoil, at the surface, or in all of these positions. In some localities fences are built with chert that has been taken from farm fields.

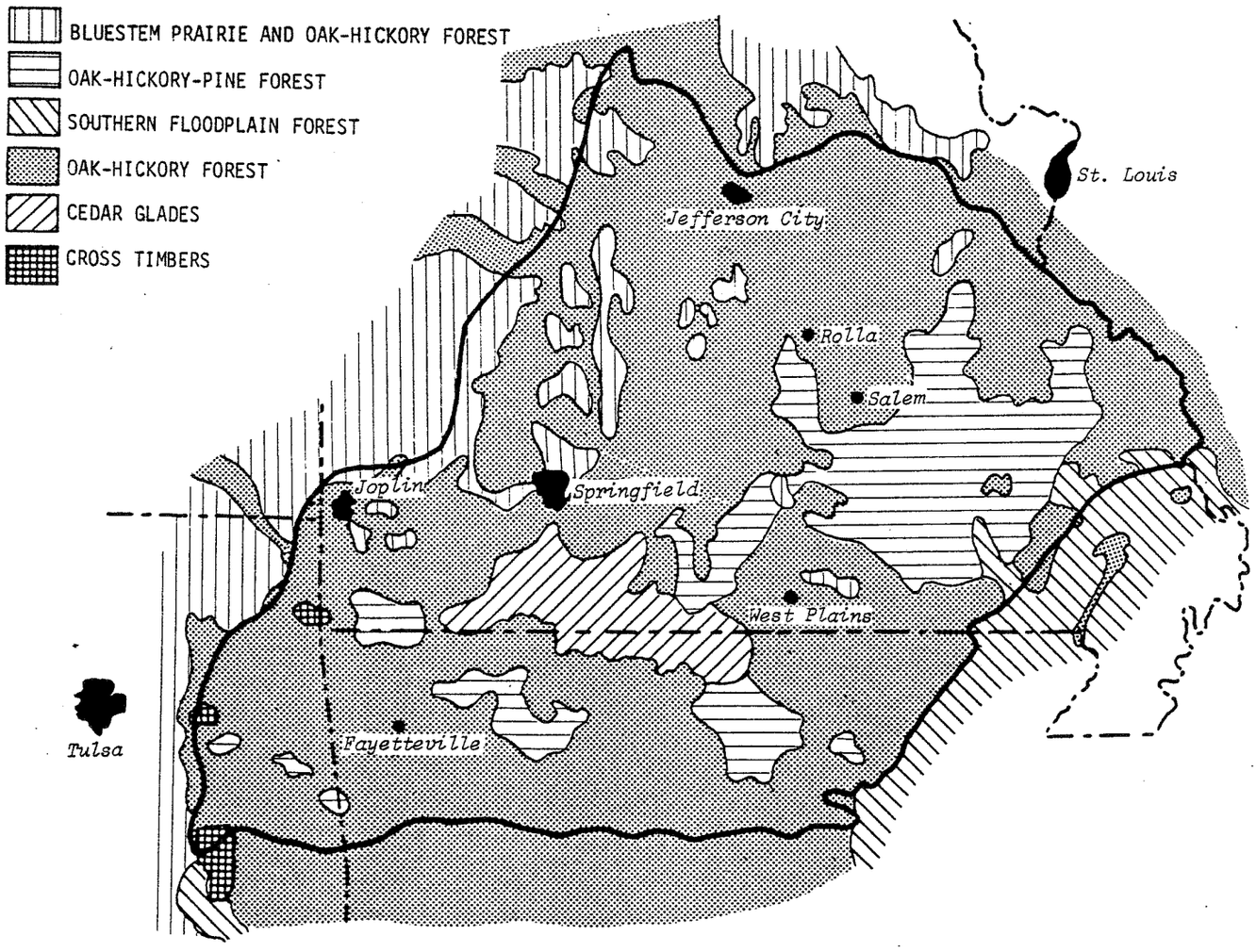

Figure 10-2. Generalized natural vegetation of the Ozarks.

the Mississippi embayment, cypress, gum, and birch are present.

The understory has great variety. Flowering redbuds and dogwoods are harbingers of spring, while blackberries, currants, dewberries, and huckleberries are gathered in season.

In the western Ozarks the Osage orange, also known as bois d'arc and hedge apple, has become widespread in pastures and fence rows. It is hardy, thorny, and resistant to drought. Posts made from the bois d'arc are nearly indestructible. In early days, Osage orange seeds were shipped from East Texas, Arkansas and western Missouri to Kansas and what is now Oklahoma, where they were planted as fences in the treeless plains. The seeds brought as much as forty dollars a bushel in the 1870's.

The prairies, even more than the forests, have been modified by man. Most of them, consisting of bluestem and other tall grasses, were plowed

of the hillsides; in fact, the stone covering in cherty soils provided an excellent mulch, holding frost in the ground in spring so that the plants did not bloom too early and providing a dry surface on which the berries could ripen free of mildew. Freshly cleared land was preferred because of the greater humus content. The care and harvesting of strawberries consumed much labor, a surplus commodity on the small Ozark farms of the early 1900's. Furthermore, strawberry farming required little in the way of land and capital outlay, and when they heard stories of sales exceeding five hundred dollars from patches of less than an acre, farmers quickly started setting out strawberries to bolster their income. Grown usually no more than ten miles from point of shipment, the berries were marketed through growers associations, which set up railside receiving and crating sheds at the main shipping points. Where rail facilities were not available, grocery or feed dealers purchased the berries and resold them at these points.

The picking season normally lasted five weeks, from the end of May to the first of July. Since most of the production came from family farms, where women and children could help with the harvest, little outside labor was used. In a few cases, where fields of fifty acres or more had been set out, outside laborers were brought in to help with the harvest.

During peak production in the 1920's, strawberry growing had spread throughout the area and several towns had become important shipping points. At Logan, Missouri, the most important of these, there were two large strawberry barns, and it was not unusual for 150 carloads to be shipped during a season. Ozark, Springfield, Marshfield, Aurora, and Monett were other important points of shipment in southwest Missouri. Springdale, Rogers, Bentonville, Farmington, Prairie Grove, and Van Buren were the most important shipping points in Arkansas, but many other towns shipped several carloads each season. Stillwell, Tahlequah, and Sallisaw were the chief shipping points in Oklahoma. Most of the strawberries were transported to St. Louis and other eastern cities.

The growth and decline of strawberry farming paralleled that of tomato production; the virtual cessation of strawberry growing for distant markets after World War II resulted from labor shortages. Only a few commercial growers remain today, and most of the production is in the vicinity of Stillwell, Oklahoma.

Viticulture

The growing of grapes is well suited to the climate and soils of the Ozarks. Viticulture was introduced early and was an important step toward the success of the German settlements at Hermann. In 1845 there were fifty-thousand vines in the vicinity of Hermann, and by 1849 the number had grown to seven hundred thousand. By 1850 the grape harvests rivaled hemp in value. The success of grapes at Hermann led to extensive plantings of vineyards at Ste. Genevieve and Boonville and in Franklin, Warren, and St. Charles counties. The vineyards were located on loess hillsides, which afforded warm soil, excellent drainage, and protection from unseasonable frosts. The climate was said to be better than that in the Rhine River country because of the sunny fall weather, which permitted the grapes to ripen with high flavor. Before the introduction of viticulture, Hermann had been losing population, but the excellent harvest of 1848 reversed this trend. In 1856 a yield of one-hundred-thousand gallons of wine was reported for Hermann at a profit of three-hundred dollars per acre. A large wine trade was built, the Stone Hill Winery became one of the sights of Missouri, and Hermann wines gained a wide reputation.

In the 1880's, Catholic Swiss-Germans settled near Altus, Arkansas, on the extreme southern border of the Ozarks. They planted grapes on limestone soils in the Boston Mountain foothills overlooking the Arkansas Valley. The wines became quite popular in central Arkansas, and in recent years, Wiederkehr Wine Cellars has gained a national reputation for its products.

Grapes also were grown by Italian immigrants who located in two widely separated Ozark communities. Both settlements, Tontitown in Washington County, Arkansas, and Rosati in eastern Phelps County, Missouri, were colonized in 1898 under the leadership of an Italian-born priest. The members of these colonies were fleeing from an ill-fated philanthropic colonization

venture in southeastern Arkansas, where malaria had decimated their ranks. One reason for selecting the Ozarks locations was their suitability for growing grapes. Then, too, the Ozarks reminded them of their homeland in Italy, and the region was free of malaria.

The rise of the grape industry at Tontitown was rapid. The place held no importance for vineyards in 1900, but by 1920, Washington County, with 150,000 vines, had become the chief vineyard county in Arkansas.[8] Similar expansion, albeit on a smaller scale, occurred at Rosati, and wineries flourished at the two colonies until Prohibition days.

Even before the Italian immigrants began planting vineyards, the western Ozarks was known as excellent grape country. Swiss immigrant Hermann Jaeger settled in Newton County, Missouri, where in 1867 he produced a hardy new grape by crossing Virginia grapes with the wild Ozark variety. Jaeger developed a large vineyard near Neosho with his hybrid, which proved to be very successful. Later, when he learned that grape lice were causing much damage in the vineyards of France, he suggested the adoption of cuttings from the wild Ozark grapes to give more resistance to the French vines. When his suggestions were received favorably, Jaeger sent seventeen carloads of cuttings to France. Jaeger's plan proved successful and won for him the Legion of Honor for his service to French agriculture.

During the 1920's the Welch Company established several large vineyards in Washington and Benton counties to supply its new grape-juice plant in Springdale. By 1923 the company had sponsored the planting of five thousand acres, of which one thousand were along the Kansas City Southern Railway between the Arkansas-Missouri line and Siloam Springs.

During the 1930's and 1940's, grape production declined throughout the Ozarks. This may be attributed to many of the same factors that caused reduction in orcharding and truck farming: labor shortages, drought, and marketing problems. In recent years, viticulture has received a boost from the increasing popularity of wines as opposed to more robust beverages. The Stone Hill Winery at Hermann, Missouri, has reopened and the Maifest and Oktoberfest celebrated there have attracted attention to the excellent wines of the district. Plantings of Catawba and other grapes have increased, and the winery buys surpluses from the Rosati district to meet the demand for wine. New wineries have been established at St. James and Rosati. Most of the grapes in southwest Missouri and northwest Arkansas are grown under contract with the Welch Company's grape-juice cannery at Springdale, Arkansas. Grapes are grown in the vicinity of Exeter, Missouri, and at other locations near the Arkansas line.

8. Leslie Hewes, "Tontitown: Ozark Vineyard Center," *Economic Geography* 29 (April 1953): 139.

Dairy Farming

The pioneers who settled the Ozarks usually led one or more cows to their new home. Most of these animals were nondescript, largely beef cattle, but a few had been crossed with dairy breeds. These cattle supplied both milk and meat; some were used as oxen. Good-quality livestock representing the various dairy breeds did not reach the Ozarks in great numbers until after 1900.

Only a small amount of trade in dairy products was carried on at an early date. About the turn of the century, Springfield began to develop as a major dairy center. With the end of the Civil War and the coming of the railroads, Springfield grew rapidly, so that a sizable local market developed for milk, cream, and farm-churned butter. By modern standards the early trade was conducted in an extremely crude and unsanitary manner. General stores maintained cream stations that purchased cream from farmers and sent it to market in Springfield every few days. The stores bought churned butter from area farmers and dumped it into a common tub; when the butter was ready for market, the lid was nailed on and it was shipped with other products. Tuberculosis and brucellosis testing was unheard of, and dairy items were produced under any number of unwholesome conditions.

Commercial dairying began shortly after 1900. By 1905, several Springfield cream and produce dealers shipped to markets in the East and South. At that time, four creameries were established in Webster County. Lawrence County also experi-

Post Familie
VINEYARDS & WINERY
POST WINERY • RT 1 BOX 1 • ALTUS, ARKANSAS 72821 • PHONE: (501)468-2741

January 8, 1985

Director
Bureau of A. T. & F.
Washington, D. C. 20226

RE: Comments on proposed "Ozark Mt. Viticultural area".

Dear Sir,

I would like to take the opportunity to add some comments and observations to the proposal of adding the Ozark Mt. Region to the list of appoved viticultural areas.

1. The climate throughout this suggested region is affected by the same weather conditions resulting in similiar harvest conditions. As an example, during the 1980 growing season the Ozark Mt. Region was affected by drought and extremely high temperatures resulting in poor yeild and vineyard damage. The same summer our neighbors in Ohio, Michigan, New York and California turned in bumper crops.

2. A boundary that more closely shows the true grape growning region rather than the political lines drawn by the states would better serve the consumer and the grape growers as well. If the Ozark Mt. Region was declared a viticultural area, Missouri and Oklahoma grape growers in the region could sell their grapes to Arkansas vintners and vice versa and avoid using the very general American appellation on the wine label. This would facilitate economic growth for all involved.

Presently, this ruling would not effect our business since we use only Arkansas grown fruit in our wines. In the future though, I believe as a vintner who was purchasing grapes, I would rather buy within the Ozark Mt. Region so as to use the regional appellation in labeling and promotion.

Sincerely,

Paul J. Post

Paul J. Post
Vice President of Marketing
PJP/pa

ARKANSAS WINE PRODUCERS ASSOCIATION

Rt 2 Box 110A, Paris, Arkansas 72855

December 26,1983

Rec'd 1-4-84

Mr. Richard A. Mascolo
Chief, FAA Wine & Beer Branch
Bureau of Alcohol, Tobacco, & Firearms
1200 Pennsylvania Ave. Northwest
Washington, D. C. 20226

Dear Mr. Mascolo,

I wish to advise you that the Arkansas Wine Producers Association is on record for being in favor of the approval of the applications for "Arkansas Mountain" and "Ozark Mountain".

If there is any additional information that we may firnish, please advise.

Sincerely,

Robert G. Cowie
Secretary Treasurer

[Original in Ark. Mtn. file]

COWIE WINE CELLARS

Rt. 2 Box 110A
Paris, Arkansas 72855
501/963-3990

Naturally the Finest

December 29, 1983

Rec'd 1-4-84

Mr. Richard A. Mascolo
Chief, FAA Wine & Beer Branch
Bureau of Alcohol, Tobacco, & Firearms
1200 Pennsylvania Ave. North West
Washington, D. C. 20226

Dear Mr. Mascolo,

We wish to let you know that we at Cowie Wine Cellars strongly urge that the applications for "Arkansas Mountain" and "Ozark Mountain" be approved.

Grapes have been raised in our area of the state for well over one hundred years. My great-great-uncle, Joseph Bachman won a silver medal and diploma at the Lousiana Purchase Exposition at St. Louis in 1904. Also in my grandmothers writings she stated that as a child she had to work in the vineyards. Our mountains are known thoughout the whole state as the best place to grow grapes.

Sincerely,
Bette Kay Cowie
Bette Kay Cowie
Secretary

[original in Ark. Mtn. file]