# Kentucky FARM AND HOME Science

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READ—

Doctors

Rainfall

Urbanization

# Kentucky FARM AND HOME Science

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KENTUCKY AGRICULTURAL EXPERIMENT STATION

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## *The Cover*

These Hampshire gilts and barrows are being used in the long-term Hampshire swine improvement project underway at UK's Coldstream Farm. The animals shown here are prospective replacements for the breeding herd. They were moved to Coldstream from the main Experiment Station Farm this summer.

**A declining number of doctors and a rising population are two factors in appraising**

# Kentucky's Medical Needs

By JOHN R. CHRISTIANSEN[1] and THOMAS R. FORD[2]

Findings from a study of the number and distribution of physicians in Kentucky appear to have special significance for Kentucky's rural residents.[3]

In brief, this study points out that: (1) Kentucky has relatively fewer medical doctors for its population than most other states, (2) the number of medical doctors in Kentucky is not keeping pace with the state's increasing population, and (3) rural residents of Kentucky are disadvantageously situated relative to the supply of physicians throughout the state.[4]

One measure of the availability of physicians' services is the number of persons within a locality for each physician. A standard of adequacy of one physician per 1,000 persons has been proposed as a practical bench mark.[5] When ranked among other states

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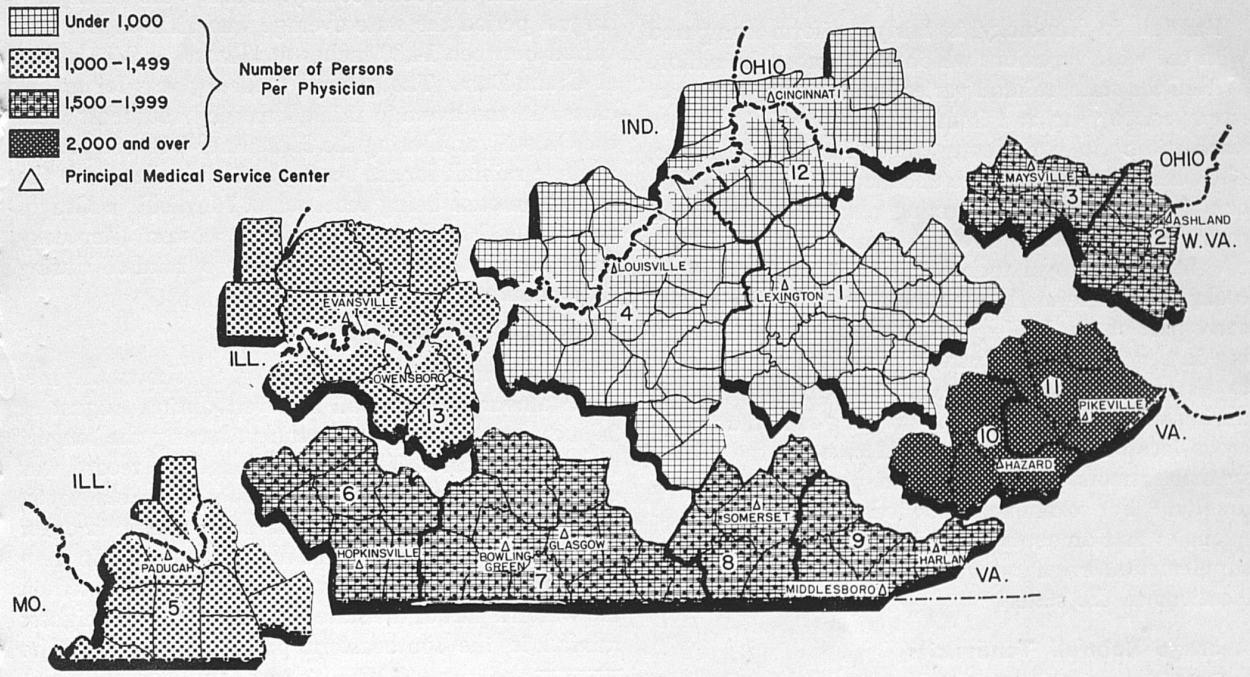
[2] Associate Rural Sociologist, University of Kentucky.

[3] This study is a cooperative endeavor of the Department of Rural Sociology, Kentucky Agricultural Experiment Station, University of Kentucky; and the Farm Population and Rural Life Branch, Agricultural Marketing Service, USDA.

[4] Most data used in this study were obtained from the 1912, 1921, 1931, 1938, 1950, and 1956 editions of the *American Medical Directory,* published by the American Medical Association, Chicago, Ill.; and publications of the U. S. Bureau of the Census.

[5] U. S. Public Health Service, Division of Public Health Methods, *Standards of Adequacy in the Supply of Medical and Public Health Personnel and Facilities* (Washington: 1942), processed; quoted in Frederick D. Mott and Milton I. Roemer, *Rural Health and Medical Care* (New York: McGraw-Hill Book Co., Inc., 1948), p. 155.




This map shows the division of the state and portions of adjoining states into "medical service" areas, as well as the ratio of the number of persons to each "active" doctor in each area in 1955. As a state, Kentucky's population-doctor ratio is 1,139.

Fig. 1.— More knowledge of Kentucky's rainfall characteristics may help to determine those areas where supplemental irrigation would likely be most profitable. Records are available for an average of 66 years.

## BETTER PLANNING OF CROP PRODUCTION MAY RESULT FROM

# Kentucky Rainfall Study

### Variation in amount and frequency during the growing season influences possible need for supplemental irrigation in various sections of the state

By GENE A. BRAMLETT and DANA G. CARD

Rainfall in Kentucky is fairly uniform compared with the wide variations which exist across the nation. Within the state, rainfall varies from season to season, from year to year, and from place to place. Moderate fluctuations do not greatly affect farming activities, but when the variations are unexpectedly extreme they can upset the best-laid farming plans. Such was the case recently, when three straight years of drouth caught farmers overstocked in several areas of Kentucky. Excess rainfall in western Kentucky during the early part of the 1957 growing season delayed planting in several areas. Current studies are attempting to discover just how much variation can be expected during various periods of the growing season at numerous locations in Kentucky, and to state the results so that farmers can use them in planning crop production. For example, knowledge of rainfall frequencies and amounts could help determine whether supplemental irrigation would be profitable at various locations in the state.

#### Average Rainfall Tendencies

During April and May, in a recent 22-year period, the state average rainfall was 7.85 inches and varied from 8.54 inches at Mt. Sterling to 6.50 inches at Grant Dam in Boone county. During the June-July-August period the state average was 12.19 inches and varied between 14.80 inches at Hazard to 9.55 inches at Grant Dam. The general tendency was for an increase in the average rainfall moving southeast from the Ohio River. During the September-October period, average rainfall for the state was 5.40 inches, with the largest amount being received at Mayfield in Graves county, 6.39 inches. In general, western Kentucky areas received the highest average rainfall during these months.

#### Difference in Location

The accompanying graph (Fig. 2) shows the median[1] amounts of rainfall received during August at 24 locations in or near Kentucky, having the longest periods of record. The average length of record was 66 years, ranging from 40 years at Mayfield to 94 years at Lexington. The stations are arranged in order of the median amount of rainfall in August. In general, stations with the lowest rainfall are located in the western part of the state and those with the highest rainfall in the southeastern part of Kentucky. The

[1] The median is a position average which divides the series of rainfall figures into two parts. One-half of the years had more rain than the median amount, and one-half of the years had less rainfall than the median.

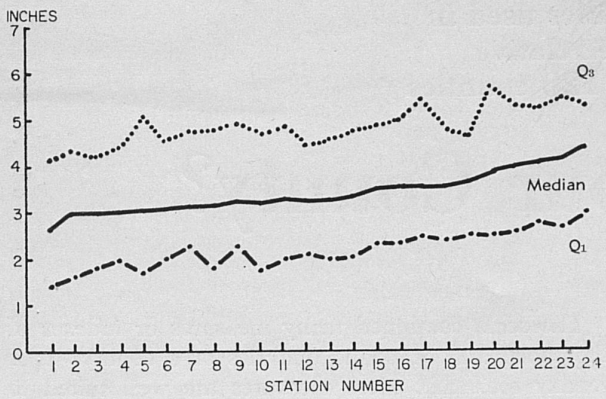



**Fig. 2.— Minimum and maximum amounts of rainfall received 25, 50 and 75 percent of the time at various locations in Kentucky during the month of August.**

**Location Identification: 1—Cairo, Ill.; 2—Evansville, Ind.; 3—Mayfield; 4—Louisville; 5—Franklin-Russellville; 6—Lexington; 7—Bowling Green; 8—Frankfort; 9—Shelbyville-Taylorville; 10—Hopkinsville; 11—Paducah; 12—Owensboro-Calhoun-Owensboro Dam 46; 13—Cincinnati; 14—Princeton; 15—Louisa-Catlettsburg; 16—Leitchfield-St. John; 17—Mt. Sterling; 18—Falmouth-Carrollton-Maysville-Williamstown; 19—Richmond; 20—Bardstown; 21—Pikeville; 22—Burnside-Greensburg-Eubank; 23—Williamsburg-Middlesboro; 24—Berea-Beattyville.**

median amount of rainfall received during August ranged from 2.64 inches at Cairo, Ill., to 4.30 inches in the Berea-Beattyville area.

Lines $Q_1$ and $Q_3$ represent the minimum amounts of rainfall received 75 and 25 percent of the time, respectively. In other words, of the total years of records at each location, 25 percent were below the values shown by line $Q_1$; 50 percent were below (or above) the values shown by the median line and 25 percent were larger than the values shown by the $Q_3$ line. For example, at Lexington (station 6) rainfall was less than 2.03 inches 25 percent of the time. Fifty percent of the time the amount of rainfall was between 2.03 and 4.50 inches. Twenty-five percent of the time Lexington received 4.50 inches or more during August. Similar readings may be made for each of the 24 areas studied.

To illustrate another use of the diagram, notice that Franklin-Russellville (station 5) has a wider range about the median line, as shown by its corresponding $Q_1$ and $Q_3$ values, as compared with Lexington (station 6). This indicates that August rainfall in the Franklin-Russellville area fluctuates more widely than at Lexington. In other words, dry years and wet years came less frequently at Lexington.

## Rainfall During Growing Season

Rainfall tendencies during August do not necessarily indicate what happens during other months of the growing season. In Table 1, the state is arbitrarily divided into four rather large areas. Average $Q_1$, median and $Q_3$ values have been determined from diagrams similar to that of Fig. 1, but for different months of the growing season. It should be noted that the $Q_1$, median and $Q_3$ figures in the table are rough averages of a few somewhat typical values in the area. Their interpretation is the same as the values in Fig. 1.

During May, June, July and August average rainfall, as shown by the median, was greatest in the southeastern part of the state. During April, September and October average rainfall was greatest in western Kentucky. However, average rainfall in western Kentucky declined from April through October. In Southeastern Kentucky average rainfall increased from April through June and then declined. Although western Kentucky received relatively larger amounts of rainfall during the early part of the growing season it soon lost its advantage as the season progressed.

The lower limit ($Q_1$), below which rainfall goes only 25 percent of the time, was highest in south-

*(Continued on Page 8)*

**Table 1.— Approximate median and quartile amounts of rainfall for selected groups of weather stations in or near Kentucky***

| Month | Median | | | | Quartiles | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | West | | North | | Central | | Southeast | |
| | West | North | Central | Southeast | $Q_1$ | $Q_3$ | $Q_1$ | $Q_3$ | $Q_1$ | $Q_3$ | $Q_1$ | $Q_3$ |
| April | 3.99 | 3.18 | 3.82 | 3.80 | 2.75 | 5.24 | 2.30 | 4.21 | 2.54 | 4.96 | 2.77 | 4.53 |
| May | 3.87 | 3.48 | 3.73 | 4.08 | 2.44 | 5.62 | 2.25 | 4.68 | 2.58 | 4.97 | 3.00 | 5.41 |
| June | 3.53 | 3.82 | 3.90 | 4.28 | 2.15 | 4.95 | 2.68 | 4.99 | 2.85 | 5.08 | 3.23 | 5.47 |
| July | 3.22 | 3.48 | 3.88 | 4.47 | 2.30 | 4.61 | 2.40 | 4.76 | 2.66 | 5.33 | 3.23 | 5.74 |
| August | 3.03 | 3.36 | 3.24 | 4.10 | 1.77 | 4.60 | 2.15 | 4.62 | 2.14 | 4.69 | 2.78 | 5.29 |
| September | 2.87 | 2.65 | 2.66 | 2.56 | 1.59 | 4.38 | 1.65 | 3.67 | 1.62 | 4.04 | 1.90 | 4.04 |
| October | 2.42 | 2.26 | 2.32 | 2.29 | 1.33 | 3.71 | 1.32 | 3.32 | 1.18 | 3.49 | 1.26 | 3.52 |

* Stations used to represent geographical areas are—Western Kentucky: Paducah, Cairo (Illinois), Franklin-Russellville, Princeton, and Mayfield; Central Kentucky: Shelbyville-Taylorsville, Lexington, Richmond, and Frankfort; Northern Kentucky: Carrollton-Falmouth-Maysville and Cincinnati (Ohio); and Southeastern Kentucky: Middlesboro-Williamsburg, Burnside-Greensburg-Eubank, and Berea-Beattyville.

**Many indexes of social and economic qualities used in setting up "measuring stick" to determine relative degree of urbanization among Kentucky's 120 counties**

# How Urban Is Your County?

By HOWARD W. BEERS and HERBERT A. AURBACH

All who know Kentucky know the great social and economic diversity within this Commonwealth. Among the 120 counties in the state there are some which are conspicuously rural in their chief social and economic features, and others that are quite urban. Throughout the state, however, there is a trend toward the development of urban characteristics.

In connection with a recent research project at the Kentucky Agricultural Experiment Station it was desirable to study the distribution of the counties along a range extending from "very rural" to "very urban."

A systematic mathematical technique was used—the Guttman Scalogram formula—to put the counties in order on what was called a "folk-urban continuum," with the rural "folk" as one extreme type and the urban, or city-type, at the other extreme.

The scale combined many measures or indexes of the social and economic qualities of a county. It is readily seen that these measures are well suited to separating rural from urban counties.

They were taken from several sources, such as the reports of the decennial Census of Population, Census of Housing, Census of Agriculture, State Highway Commission, State Department of Education, State Health Department, State Department of Revenue, and records of newspaper circulation.

The list of measures contains the following items:

**Percentage of persons 25 years old and over who completed high school, 1950**

**Percentage of employed persons engaged in professional and related services**

**Percentage of total population "urban," 1950**

**In contrast to much of Kentucky, which is predominantly rural, are the expanding urban areas, symbolized by this busy street scene. Throughout the state there is a trend toward the development of urban characteristics, as pointed out in this article.**

**(Photo: Lexington Herald-Leader)**

**Vehicles per mile of state-maintained road, 24 hour period, 1952**

**Instructional expenditures per pupil in average daily attendance at school, 1953**

**Percentage of total births delivered in hospital**

**Percentage of dwelling units with hot running water, with private toilet and bath, and not dilapidated, 1950**

**Full value of taxable real estate per capita, 1952**

**Population per physician, 1953**

**Residence telephones per 100 population**

**Percentage of school census children in average daily attendance at school, 1953**

**Daily newspapers circulated per 100 population, 1952**

**Effective fertility ratio (children under 5 per 1,000 females 20-44 years old, inclusive) 1950**

**Per capita income, 1952**

**Percentage of total births delivered by a physician, 1951**

**Percentage of dwelling units reporting central heating equipment, 1950**

**Percentage of employed persons engaged in service employment, 1950**

Below is the ranking of counties, beginning with those which are most urban, according to the composite index built from the merger of all the items on the list above. In reading the table notice that seven counties tie for the classification "most urban," so each is given a rank of 4; nine counties tie for "next most urban," so each gets a rank of 12. At the end of the distribution nine counties tie for "most rural" (or least urban), so each has a rank of 116.

**Ranking of Counties in Kentucky From the "Most Urban" to "Most Rural"**

| County | Rank | County | Rank |
|---|---|---|---|
| Bourbon | 4.0 | Union | 27.5 |
| Boyd | 4.0 | Calloway | 32.0 |
| Boyle | 4.0 | Garrard | 32.0 |
| Fayette | 4.0 | Anderson | 32.0 |
| Jefferson | 4.0 | Christian | 32.0 |
| McCracken | 4.0 | Barren | 32.0 |
| Scott | 4.0 | Simpson | 32.0 |
| Daviess | 12.0 | Caldwell | 32.0 |
| Franklin | 12.0 | Hardin | 37.5 |
| Clark | 12.0 | Henry | 37.5 |
| Warren | 12.0 | Grant | 37.5 |
| Madison | 12.0 | Bracken | 37.5 |
| Woodford | 12.0 | Trimble | 40.5 |
| Campbell | 12.0 | Graves | 40.5 |
| Henderson | 12.0 | Hickman | 44.0 |
| Kenton | 12.0 | Webster | 44.0 |
| Mercer | 17.0 | Ballard | 44.0 |
| Oldham | 19.0 | Crittenden | 44.0 |
| Jessamine | 19.0 | Washington | 44.0 |
| Mason | 19.0 | Nelson | 45.5 |
| Hopkins | 21.5 | Fulton | 45.5 |
| Harrison | 21.5 | Nicholas | 52.5 |
| Shelby | 23.5 | Fleming | 52.5 |
| Boone | 23.5 | Carlisle | 52.5 |
| Carroll | 25.5 | Ohio | 52.5 |
| Montgomery | 25.5 | Bullitt | 52.5 |
| Marshall | 27.5 | Pendleton | 52.5 |
| Todd | 52.5 | Pike | 88.5 |
| Muhlenberg | 52.5 | Letcher | 88.5 |
| Livingston | 59.5 | Green | 91.0 |
| Bell | 59.5 | Adair | 91.0 |
| Greenup | 59.5 | Carter | 91.0 |
| Taylor | 59.5 | Lawrence | 95.5 |
| Whitley | 59.5 | Knox | 95.5 |
| Logan | 59.5 | Laurel | 95.5 |
| Lyon | 64.5 | Cumberland | 95.5 |
| Spencer | 64.5 | Metcalfe | 95.5 |
| McLean | 64.5 | McCreary | 95.5 |
| Gallatin | 64.5 | Lee | 100.0 |
| Robertson | 68.0 | Powell | 100.0 |
| Marion | 68.0 | Lewis | 100.0 |
| Pulaski | 68.0 | Rockcastle | 103.0 |
| Owen | 73.0 | Menifee | 103.0 |
| Lincoln | 73.0 | Monroe | 103.0 |
| Floyd | 73.0 | Clinton | 103.0 |
| Larue | 73.0 | Breathitt | 106.0 |
| Bath | 73.0 | Wayne | 108.5 |
| Meade | 73.0 | Butler | 108.5 |
| Harlan | 73.0 | Clay | 108.5 |
| Trigg | 77.5 | Magoffin | 108.5 |
| Breckinridge | 77.5 | Wolfe | 111.0 |
| Allen | 79.5 | Casey | 116.0 |
| Hart | 79.5 | Edmonson | 116.0 |
| Hancock | 82.0 | Elliott | 116.0 |
| Estill | 82.0 | Jackson | 116.0 |
| Rowan | 82.0 | Knott | 116.0 |
| Johnson | 85.0 | Leslie | 116.0 |
| Russell | 85.0 | Martin | 116.0 |
| Perry | 85.0 | Morgan | 116.0 |
| Grayson | 87.0 | Owsley | 116.0 |

## The Medical Needs of Kentucky

*(Continued from Page 3)*

according to the number of persons per medical doctor in 1955, Kentucky ranked 40th in the United States, with a ratio of 1,139[6]. New York ranked 1st with 518 persons per doctor, and Mississippi ranked 48th with 1,351 persons per doctor. The U. S. population-to-physician ratio in 1955 was 757 to 1. To achieve this national standard, Kentucky would need 1,300 more physicians, or nearly 50 percent more than were actively practicing in 1955.

The number of medical doctors in Kentucky has declined significantly in every decade since 1910. Only since 1950 has there been an increase in the number of physicians, and this increase was slight. At the same time Kentucky's total population has been increasing, as has the number of medical doctors in the United States. Thus, it appears that the situation concerning the supply of medical doctors in

*(Continued on Page 8)*

[6] In computing this ratio, retired physicians and those not in practice were included. When such physicians were excluded the ratio for Kentucky increased to 1,209. All tabulations in this study exclude physicians in full-time government service.

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## The Medical Needs of Kentucky

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Kentucky has generally become more acute, and, judging from the trend, will continue to be so for some time. It should be mentioned, however, that better training of medical doctors, improved transportation, recent medical discoveries, and the establishment of clinics appear to counteract at least some of the disadvantages of having fewer physicians.

Throughout the United States, people usually travel to the most accessible place possible to obtain needed medical services. Those cities which provide fairly complete medical services quite consistently attract people from the same surrounding areas. Kentucky is no exception. The accompanying map (Fig. 1) shows the division of the state into medical service areas, each of which provides a relatively complete complement of medical services to the residents. This map is adapted from one developed in 1950 by Frank G. Dickinson and Charles E. Bradley for the American Medical Association.

The map also shows the ratio of the number of persons per "active" medical doctor[7] within each medical service area for 1956. The medical service areas which have Cincinnati, Lexington, and Louisville as the principal medical service centers (Areas 12, 1, and 4) have the most plentiful supply of medical doctors. Only in these three areas is the standard of 1,000 or less persons per physician maintained. In the two areas for which Pikeville and Hazard are the principal medical service centers (Areas 10 and 11), the ratio of persons per physician is over twice the acceptable standard. *None* of the 13 medical service areas had a population-physician ratio below the national average. The population load in the Hazard area was nearly 4 times the national average.

The problem concerning the number and distribution of medical doctors in Kentucky is seemingly associated with such other problems as education, health, resource utilization, and agriculture. A concerted attack on any one of these problems will likely involve and contribute to the solution of the others.

[7] Excludes those not in practice, retired, or in full-time government service.

## The Kentucky Rainfall Study

*(Continued from Page 5)*

eastern Kentucky every month of the growing season except October. This indicates that southeastern Kentucky is less likely to experience drouths than other parts of the state. Western and northern Kentucky appear to be areas of the state most likely to experience months of low rainfall. Furthermore, western Kentucky is also more subject to extremes in rainfall during the growing season, as shown by the relatively wide $Q_1$ and $Q_3$ limits.

A great deal is yet to be learned about rainfall characteristics in Kentucky before extensive application can be made of the above results. Topics such as the presence or absence of cycles in rainfall, and relationships between the amount of rainfall during different parts of the growing season and the probability of various amounts of rainfall occurring in selected periods, are currently being investigated.