The Kansas School Naturalist

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Watersheds in Kansas

**What is a watershed?**

The dictionaries commonly give two definitions, as follow: 1. a ridge dividing one drainage area from another, 2. the drainage area contributing to the supply of a stream or body of water. The second definition, which is more practical in the study of conservation, is the one used in this issue of *The Kansas School Naturalist*. A watershed is, according to this definition, a valley with all of the streams which drain into it.

**How many watersheds are there in Kansas?**

At one extreme, we may say that all of Kansas lies within the Mississippi watershed, but the term is not often used in so broad a sense. At the other extreme, the number is almost limitless because the area draining into a tiny brook may be much less than an acre. More than 1500 Kansas streams have been named, but there are not this many different names, however, because of duplication. We have in Kansas 60 or more Spring Creeks, 30 Rock Creeks, 25 Walnut Creeks, as well as a half dozen Little Walnut Creeks and a Walnut River, 25 Elm Creeks, 25 Dry Creeks as well as several Dry Branches and Dry Runs, 20 Turkey Creeks, 20 Plum Creeks, and dozens of others with duplicate names.

It has been estimated that at least 50,000 streams in Kansas are as large as the smallest of the named streams. Each of these 50,000 streams may be thought of as a watershed.

**How large is a watershed?**

As defined above, a watershed may be the area occupied by an entire river system, for example the drainage area of the Mississippi River, the Columbia River, or the Hudson River. It may also be as small as a tiny creek that occupies only a fraction of an acre. For practical purposes a watershed is usually a small river or creek, or a group of small creeks, forming a convenient unit for community cooperation in an improvement program.

From the standpoint of conservation practices, a watershed is large enough so that some real improvement can be accomplished, and small enough to permit community organization with a minimum of red tape and without involving great travel distances. The famous Sandstone Creek watershed in Oklahoma includes 65,000 acres, or about 101 square miles, in an irregularly shaped area with the greatest east and west distance about 16 miles and the greatest north and south distance about 14 miles. A well known example in Kansas is the Little Delaware-Mission Creeks watershed in Brown County. It includes 28,240 acres and is approximately 6 miles wide and 9 miles long. The sizes of some other watersheds under treatment in Kansas are noted on pages 10 and 11.

**When is a watershed in good condition?**

This varies greatly according to the distribution of rain and the climate in the area involved. In gen-
eral, however, the characteristics of a good watershed are as follow: the plant cover on grassland and woodland is well distributed and vigorous; the soil contains humus and absorbs water readily; streams are clear and keep flowing for a long time after rainfall has stopped; the banks of streams are stable and only a little silt is carried along in the water; pools are clear and contain considerable plant and animal life; conservation practices are obvious, both on the cultivated land and in the pastures and meadows; grassed waterways discharge excess water in such a way as not to produce gullies nor wash out road ditches; road banks and slopes are well protected with grass or other plants.

**How does a good watershed operate?**

When a watershed is in good "working" condition, desirable plant growth is present on grassland, woodland, and wildlife areas. Soil that is necessarily exposed in the process of crop production is protected as much as possible and so cultivated as to minimize runoff and erosion. The trees, shrubs, grasses, and other plants growing on the watershed break the force of falling rain and lead the water into the soil without loosening soil particles and splashing them about. In such a watershed the soil contains large amounts of organic matter, such as plant roots, plowed-under plant materials, and the dead bodies and waste products of soil animals. This organic matter undergoes decay, thereby increasing the fertility of the soil and maintaining its spongy, porous condition. The roots of plants and the burrows made by insects and worms provide channels which carry water deeper and deeper into the soil, increasing the water intake rate and storage in the soil.

The watershed in good condition thus functions somewhat like a blotter, soaking up water from rain and melting snow. Part of this water is held in the soil for use by plants, and the rest of it moves downward slowly to emerge in springs or to provide water for wells. When heavy, repeated rains occur, the soil is not able to take in all the water that falls; and the excess water runs off, but vegetation, terraces, contour rows, ponds, and detention dams slow down the rate of runoff, thus preventing erosion.

**An example of a good watershed**

The following editorial appeared in *The Topeka Daily Capital* for August 11, 1958 under the title *Watershed Proves Worth*.

“Leaders in farm areas of Kansas plagued by crop-destroying flood-waters—and many sections of the state have had more than their share of trouble from high water this year—would be wise to investigate the highly successful Little Delaware-Mission Creek watershed project in Brown County.

Brown County’s project proved its worth during the downpours which flooded Northeast Kansas July 10 and 11. The almost-completed project was subjected to an unexpected and rigid test on those dates and it scored a Phi Beta Kappa rating in the examination.

The watershed received more than an inch of rainfall the night of July 10, saturating the soil and filling all the reservoirs so that water was flowing through the inlet tubes on the dams. Then came a heavy rain of at least 3.50 inches in the early hours of July 11.
Under normal conditions—that is, before the floodwater retarding and grade stabilization structures were built, along with the sub-watershed waterway improvements—these rains would have caused widespread and severe flooding in the bottomlands below.

But the Little Delaware-Mission Creek area escaped the onslaught.

In the words of Verne M. Bathurst, work unit conservationist of the Soil Conservation Service:

'With the watershed structures in place, the flooding was minor and occurred only where small side drains bring water onto the bottomlands below the watershed structures. None of the floodwater retarding structures was filled to capacity. Most of them lacked several feet of flowing through their auxiliary spillways. This would mean that considerable more runoff could have been handled before the capacity of the dams would be reached. In fact, less than half the available storage space was used. Grade stabilization structures, designed to control large gullies, handled the runoff as intended.'

Other unprotected watersheds in Brown County provided a handy comparison.

The same rains severely damaged croplands in the Upper Delaware watershed just west of the Little Delaware-Mission Creek project. Crops, fences and buildings were dealt heavy blows. Damage was due not only to high water, but also to silt carried down onto the floodplain from the fields above. The Walnut watershed, in the northern section of the county, also unprotected, received what some farmers claim was the worst flood in memory.'

**HOW CAN THE CONDITION OF A WATERSHED BE IMPROVED?**

A poorly managed watershed is usually characterized by a large percentage of unprotected soil. There is little growth of desirable plants, and little organic matter in the soil. Slopes are broken up by gullies, stream banks are bare, and stream channels loaded with silt and debris. Stream flow is intermittent, occurring only during and shortly after rains, or while snow is melting. The flowing water is muddy most of the time. Pastures show the effect of overgrazing, and roads show the effects of frequent erosion periods.

Improving a watershed is not always easy, but the main procedures are about the same in nearly all cases.

Improvement of a watershed is largely a matter of getting proper plant cover on the soil and of controlling the water that results from rain and snow. Such improvement usually involves two phases. One is to put needed conservation measures into practice on the cropland, grassland, woodland, and wildlife areas; this is called *land treatment.* The other is the building of certain structures to stabilize drainageways, to hold back water and slow down runoff, and to drain wet areas and improve stream channels; this is the *structural program.*

Land treatment may require the control of deep gullies. Planting of grasses to protect waterways, establishment of terraces and contouring, planting of trees and shrubs in critically eroded or steep areas, proper use of grazing of pastures—all of these are usually necessary. Planting of tame grasses and legumes in cropping systems, residue management, and reseeding native grasses are often important aspects of land treatment.

The structural program usually includes one or more flood control or detention dams. Such a dam is
an earth fill designed and built to impound water from rapid runoff and release this water slowly. The sketches on page 7 show the general plan and a section of a floodwater retarding structure. The restoration of a watershed in seriously damaged condition takes considerable time and money. Soil can be destroyed much more rapidly than it can be built up; however, restoration is possible and in many areas takes place surprisingly fast. The aerial photographs on pages 12 and 13 show the changes in 13 years in a part of the Little Delaware-Mission Creeks Watershed.

What is a Watershed Project?

A watershed project is a watershed area for which a program of improvement has been developed and is being carried out. Such a project arises from the desires of people in an area to work together to solve their problems and achieve common objectives.

Watershed problems may include soil erosion, excessive water runoff, flood damage, lack of water supply, excessive soil wetness in some areas, pollution of streams, inadequate fish and wildlife habitats, and inadequate recreational facilities. The people within the watershed may set as their objectives the solution of some or all of these problems.

The success of a watershed project depends upon the wise use of all available resources. These will include the soil, water, plants, wildlife, finances, interest, and participation of the people.

A plan for a watershed project outlines how the resources will be used to solve the problems and achieve the objectives of the people. It may involve only the informal activities of the people and their local resources, but outside assistance may be sought and formal organization effected through soil conservation districts, or through county, state or federal governments.

What Legislative Acts Help to Promote and Carry Out a Watershed Project?

I. Kansas Soil Conservation Districts Law of 1937. Farmers in Kansas have organized a Soil Conservation District in each county. The districts, with the cooperation of the United States Soil Conservation Service, furnish technical assistance in the application of land treatment.

II. Federal Soil Conservation and Domestic Allotment Act of 1935. This provides for technical assistance through the Soil Conservation Service and for sharing, through the Agricultural Conservation Program the cost of the farmer of approved conservation practices.

III. Kansas Watershed District Act, as amended in 1955 and 1957. This act, providing legal organization of a watershed area, gives the local people the authority to develop and carry out a watershed program, to levy taxes, to execute the power of eminent domain, to construct works of improvement, and to operate and maintain a watershed project. The primary purpose of organizing a watershed district is to secure the powers that local people need to operate their project and the legal status needed to secure assistance from outside sources.
Such dams temporarily store runoff water, and release it through the inlet structure at a rate slow enough so that no flooding occurs down stream. Only with exceptionally heavy and long continued rains does water go over the emergency spillway. Sediment is trapped in the sediment pool. This pool can be partly drained through the inlet filter. The core trench and anti-seep collars prevent water seepage through the dam. Such a dam should be located as near as possible to the flood area to be protected, and its capacity should be determined by the size of the drainage area and the probable maximum runoff during periods of heavy rainfall.

IV. Federal Watershed Protection and Flood Prevention Act, PL 566 (Hope-Aiken Act). This act makes available to people in approved watershed projects some of the necessary technical and financial assistance. Applications for assistance under this act must be approved by the Governor’s Watershed Review Committee in Kansas. Projects under this must be co-sponsored by soil conservation and watershed districts. The act is administered by the Soil Conservation Service, United States Department of Agriculture.
Watershed Projects that have received, are receiving, or are seeking assistance under various kinds of watershed legislation.

1. Little Delaware-Mission Creeks
2. Snipe Creek
3. Lost Creek
4. Switzler Creek
5. Aiken (Upper Bee) Creek
6. Cimarron
7. Thompsonville
8. Walnut Creek
9. North Otter Creek
10. Andale
11. Frog Creek
12. Clear Creek
13. Spring Creek
14. Upper Big Stranger Creek
15. Lower Big Stranger Creek
16. Gypsum Creek
17. Humbolt Creek
18. Bee Creek
19. Little Walnut-Hickory Creeks
20. Upper Verdigris River
21. Upper Fall River
22. Grant-Shanghai Creeks
23. Silver Creek
24. Upper Big Caney
25. Lower Big Caney
26. Five Creeks
27. Upper Delaware and Tributaries
28. Nebo Creek
29. Big Creek
30. Cherry-Plum Creeks
31. Twin Caney
32. White Water River
33. Muddy Creek
34. Timber Creek
35. Clarks Creek
36. Lyons Creek
37. Turkey Creek
38. Grasshopper-Coal Creeks
39. Elk Creek
40. Cow Creek
41. Upper Little Arkansas
42. Goose Creek
43. Buffalo Creek
44. Spring and Dry Creeks
45. Peats Creek
46. Upper Black Vermillion
47. Chapman Creek
48. Rock Creek
49. Holland Creek
WHERE ARE THE KANSAS WATERSHED PROJECTS?

Numerous watershed projects are in various stages of development in Kansas. Many are informal community projects, that is, the people within the watershed are cooperatively carrying out and operating the project on their own initiative and resources. These are often unknown, except to those who live in the immediate vicinity, or to those who make a study of watershed improvement. Thus B. K. Geraghty, Area Conservationist for Area 3, which includes eleven counties extending from Republic to Nemaha and southward to Saline and Dickinson, reported that (as of June 30, 1958) 296 floodwater retarding structures, with a total capacity of more than 10,000 acre-feet* had been built in this area alone. These were built largely in the past three years, and were concentrated in the "informal" community watershed projects. These are, of course, as important as the legally organized projects, even though they receive little or no publicity. Similar cooperative community work has been done in the other areas of Kansas, especially in the northeastern part of the state.

The following list includes watershed projects in Kansas that have received, are receiving, or are seeking assistance under the various kinds of watershed legislation. Those in which a Watershed District has been organized are shown in boldface type. Those in which a Watershed District is in process of organization (as of Aug. 15, 1958) are indicated by asterisk. In each case the number of the watershed is the same as that shown on the map on pages 8 and 9. The name of each watershed is followed by its area in acres and the county or counties in which it is located.

I. Pilot Watersheds set up under the Federal Pilot Watershed Act of 1953. (This act was not mentioned above since no further new projects will be established under it.)

1. Little Delaware-Mission Creeks watershed, 28,240 acres, Brown County
2. Snipe Creek, 16,425, Marshall
3. Lost Creek, 12,325, Lincoln
4. Switzer Creek, 19,900, Osage
5. Aiken (Upper Bee) Creek, 6,726, Chautauqua and Montgomery


PLANNED AND IN OPERATION

6. Cimarron, 6,500, Gray
7. Thompsonville, 4,600, Jefferson

IN PROCESS OF PLAN DEVELOPMENT

8. Walnut Creek, 79,053, Brown County, Kansas, and Richardson County, Nebraska
9. North Otter Creek, 13,500, Marshall, Riley, and Washington
10. Andale, 16,489, Reno and Sedgwick
11. Frog Creek, 21,525, Coffey and Osage
12. Clear Creek, 38,800, Sedgwick
13. Spring Creek, 27,840, Reno and Sedgwick
14. Upper Big Stranger Creek, 190,923, Atchison, Jefferson, and Leavenworth
15. Lower Big Stranger Creek, 156,671, Jefferson and Leavenworth

(Application for Planning Assistance Approved)

16. Gypsum Creek, 167,680, Dickinson, Marion, McPherson, and Saline
17. Humbolt Creek, 30,458, Geary and Morris
18. Bee Creek, 45,340, Chautauqua and Montgomery
19. Little Walnut-Hickory Creeks, 171,510, Butler and Greenwood

* An acre-foot of water is the amount of water which will cover an area of one acre to a depth of one foot. One inch of runoff from one square mile equals 53.3 acre-feet. One million gallons equal slightly more than three acre-feet.
20. Upper Verdigris River, 210,860, Chase, Coffey, Greenwood, Lyon, and Woodson
21. Upper Fall River, 200,000, Butler, Chase, and Greenwood

APPLICATION FOR PLANNING ASSISTANCE
SUBMITTED FOR APPROVAL, BUT NO ACTION TAKEN AS OF AUGUST 15, 1958

22. Grant-Shanghai Creeks, 25,200, Chautauqua
23. Silver Creek, 18,418, Chase
24. Upper Big Caney, 142,500, Chautauqua, Cowley, and Elk
25. Lower Big Caney, 130,380, Chautauqua and Cowley
26. Five Creeks, 74,000, Clay and Cloud
27. Upper Delaware and Tributaries, 179,306, Brown and Nemaha
28. Nebo Creek, 9,360, Atchinson, Jackson, and Jefferson
29. Big Creek, 70,972, Allen and Neosho
30. Cherry-Plum Creeks, 37,280, Woodson
31. Twin Caney, 190,260, Chautauqua, Elk, and Montgomery
32. White Water River, 325,000, Butler, Harvey, Marion, and Sedgwick
33. Muddy Creek, 29,860, Butler
34. Timber Creek, 104,320, Butler and Cowley
35. Clarks Creek, 125,380, Geary and Morris
36. Lyons Creek, 176,600, Dickinson, Geary, Marion, and Morris
37. Turkey Creek, 125,000, Dickinson and Marion
38. Grasshopper-Coal Creeks, 65,000, Atchinson and Jefferson
39. Elk Creek, 42,000, Jackson
40. Cow Creek, 450,000, Barton, Ellsworth, Reno, and Rice
41. Upper Little Arkansas, 130,000, McPherson and Rice
42. Goose Creek, 26,000, Kingman and Reno
43. Buffalo Creek, 95,000, Jewell
44. Spring and Dry Creeks, 30,000, Smith
45. Peats Creek, 65,000, Clay and Washington
46. Upper Black Vermillion, 190,000, Marshall, Nemaha, and Pottawatomie
47. Chapman Creek, 230,000, Clay, Cloud, Dickinson, and Ottawa
48. Rock Creek, 125,000, Pottawatomie
49. Holland Creek, 70,000, Dickinson and Marion

A WATERSHED SCORE SHEET

If you wish to score the watershed in which your school or home is located, the following score sheet may help. There are ten things to judge. Although these are not all of exactly equal importance, for present purposes they may be scored on the basis of 10 points each. The total possible score is thus 100. For example, in the first item, if all of the cultivated land is suitably terraced, contoured, or otherwise treated according to its needs, this point scores 10. If only half of it is, the score is 5, and if not any of the land is suitably treated, the score on item 1 is zero.

1. The cultivated land is suitably terraced, contoured, or otherwise treated according to its needs.
2. The pasture, woodland, and wildlife areas are well covered with desirable species of grasses, shrubs, or trees.
3. The grasses, trees, and shrubs of the area have a good appearance, indicating strength and health.
4. The pasture or grassland is used in such way as to promote reseeding and reproduction of grasses and other desirable vegetation.
5. There is a layer of grass, leaves, twigs, and other cover on the ground in grassland and woodland; no burning is practiced.
6. The soil contains humus, feels soft and takes in water rapidly.
Information on procedures for getting assistance under watershed legislation may be obtained at the following:

1. Any Soil Conservation Service Office. These are located in every county, in nearly all cases in the county seat.

2. Any County Agricultural Agent Office.

3. Any Agricultural Stabilization and Conservation Office.

4. Chief Engineer, Division of Water Resources, State Board of Agriculture, Topeka. This office administers the Watershed District Law.
The editorial staff is greatly indebted to Roy M. Davis, Area Conservationist, Soil Conservation Service, Emporia, Kansas, for assistance in the preparation of this issue of The Kansas School Naturalist. Mr. Davis supplied all the watershed data for the summary on pages 10 and 11 and for the map on pages 8 and 9, all the photographs, and the drawings on page 7. He also made many constructive suggestions in the writing of the text. The map was drawn by Robert F. Clarke, Department of Biology and member of editorial committee.
7. Where gullies or ditches are present they are protected from further erosion. Stream banks are protected from erosion and washing.

8. Streams are fairly clear during and immediately after rains, and continue to run for a long time after the rain stops.

9. Excess runoff is caught and stored temporarily in flood control reservoirs and let out slowly.

10. Streams are protected against pollution which might endanger the welfare of the people living downstream.

Total Score

Notes about a local watershed

The following notes will help to describe any given watershed. You can try these out on the watershed in which you live or in which your school is located.

1. Name of watershed
2. Location and area of watershed
3. Use of land, such as: kind of crops, pasture, grazing, or other use.
4. Types and conditions of soil
5. Evidences of erosion
6. Condition of trees, shrubs, native grasses
7. Condition of streams and stream banks
8. Condition of farm ponds and other bodies of water
9. Percentage of land under suitable conservation treatment
10. Kinds of conservation practices needed for complete watershed treatment

Things to do

1. Construct a model watershed.
2. Draw a map and make a survey of your own watershed.
3. Visit your local Soil Conservation Service office for watershed information applying to your county or area.
4. After a heavy rain, visit a detention dam, terraced field, grassed waterway, and other conservation projects.
5. Arrange to have local soil conservation persons come to your school for talks or field trips.

Future numbers of KSN

According to present plans, the remaining three numbers of The Kansas School Naturalist for 1958-1959 will probably deal with "how-to-do-its" for elementary science, the poisonous snakes of Kansas, and life in a stream. The "how-to-do-its" are prepared by Ina M. Borman and Helen M. Douglass, Department of Education, who also prepared the text for the two lists of children's books that have been published as numbers of KSN. The issue on the poisonous snakes of Kansas is under preparation by Robert F. Clarke, who was the author of the Turtles number of KSN. This will be our first venture into color photographs. Mr. Clarke is busy making paintings of all the species of poisonous snakes found in Kansas, as well as those harmless species which resemble the poisonous ones and are commonly confused with them. The number on life on a stream will correspond in format and arrangement to Life in a Pond, which was published in February, 1957, and is still available.

Plans are still rather nebulous for the 1959-60 numbers. Topics on which some work has been done are: Fossils (or perhaps Rocks and Fossils), Lizards in Kansas, Nature Hobbies, Wild Life Areas In
Kansas, and Wind Erosion in Kansas. Many readers have suggested an issue on birds, but no specific topics have been selected, although a good deal of material has been gathered. Every attempt is made to cover subjects in which the readers are interested, and therefore suggestions are always welcome. Among the many suggestions which have been made but which little or no work has been done as yet are Galls or Insect Homes, Historical Sites, and a general story of the Sunflower state.

DON'T OVERLOOK THE PAPERBACKS

An inexpensive library of science and nature study can be built up with paper-bound books, of which an ever wider selection is becoming available. Most of these books cost from 35 cents to one dollar. A few samples are listed below.


These and more than 300 other paper bound science books are listed in a bulletin entitled, An Inexpensive Science Library, published by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington 5, D.C. The price is 25 cents a copy, prepaid, no postage stamps please. Your local bookstore, or any college bookstore, will have many of these books in stock. They will be glad to order for you any which are not in stock.

IF YOU CHANGE YOUR ADDRESS, be sure to send us a letter or card telling us both your old address and your new one! The Kansas School Naturalist is sent by second-class mail, which cannot be forwarded.

WRITE TO PHILLIPS Petroleum Company, 466 Adams Building, Bartlesville, Oklahoma, for a copy of their "Pasture and Range Plants" booklet.

WRITE TO THE FORESTRY, FISH, AND GAME COMMISSION, Pratt, Kansas, for a copy of What Have I Caught? The fourth printing of this booklet is now available.

THE COVER PICTURE is a view of an area 2½ miles north, 2½ miles west of Easton, Leavenworth Co., Kansas, showing a grade control structure with ponds and terraces in background. The photograph was supplied by Hoy M. Davis.

PREVIOUS ISSUES


Those printed in boldface type are still available upon request. The others are out of print, but may be found in many school and public libraries in Kansas.
AUDUBON SCREEN TOUR SERIES

The Biology Department of the Kansas State Teachers College of Emporia is sponsoring its second Audubon Screen Tour Series during the school year, 1958-59. This series will consist of 5 all-color motion pictures of wildlife, scenics, plant science, and conservation personally narrated by leading naturalists. These pictures will be presented in Albert Taylor Hall at 8:00 p.m. on the dates listed below. Plan to attend with some of your students. Family season tickets, adult single season tickets, and single admission tickets are available. For additional information write to Carl Prophet, Biology Department, KSTC, Emporia.

ARTHUR A. ALLEN, East and West from Hudson Bay, Thursday, October 2.
EMERSON SCOTT, Rocky Mountain Rambles, Thursday, November 13.
ROGER TORY PETERSON, Wild America, Friday, January 23.
WILLIAM FERGUSON, This Curious World in Nature, Friday, May 15.

Screen Tour Series will also be presented at Topeka and Wichita, and with most of the same speakers. For information write L. B. Carson, 1306 Lincoln St., Topeka, Kansas, or Jennibelle Watson, 603 Everett Avenue, Wichita 12, Kansas.

IT IS NOT TOO EARLY to plan to attend the 1958 Workshop in Conservation, which will be a part of the 1958 Summer Session of the Kansas State Teachers College of Emporia, during June and July.

As in the past several years, the Workshop will cover water, soil, grassland, and wildlife conservation, with emphasis throughout on conservation teaching. Such topics as geography and climate of Kansas, water resources, soil erosion problems and control, grass as a resource, bird banding, wildflowers, conservation clubs, and conservation teaching in various grades will be discussed. There will be lectures, demonstrations, discussion groups, films, slides, field trips, projects, and individual and group reports. You may enroll for undergraduate or graduate credit.

Exact dates, fees, and other details will appear in later issues of The Kansas School Naturalist; for other information about the Workshop write Robert F. Clarke, Department of Biology, KSTC, Emporia, Kansas.