AN EVALUATION OF SELECTED CONSERVATION PRACTICES IN THE SNIPE CREEK WATERSHED, MARSHALL COUNTY, KANSAS.

by

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INTRODUCTION

Land damage resulting from water erosion was considered to be serious in the Snipe Creek Watershed. Some areas of land have been rendered totally unproductive or have descended to another use due to accelerated water erosion.

Sheet erosion has occured on a large percent of the sloping cultivated land. Gullies ranging from a few feet up to many feet in depth were not uncommon on steeply sloping land where water has a tendency to converge.

Runoff rates were increasing because of soil deterioration and have increasingly provided larger amounts of sediment deposition.

Infertile outwash in some areas has buried portions of the flood plain, resulting in decreased productivity of some of the most fertile soil. Drainage problems have become more prevalent in some areas where heavy deposition has been noted. The combined conditions described above have caused some areas of the flood plain to be reverted to lower value uses, for example, to woodland and brushy pasture.

Continued aggravation of flooding has occurred on the lower reaches of the main stream, due to increasing sediment deposits which reduce the carrying capacity of the channel. Flooding below the watershed has resulted in crop losses from inundation and damage to farmsteads and city properties located on the flood plain below the watershed.

Upon return of the drought years many cities have realized that reservoir water supplies have been rendered inadequate

due to tremendous deposition. An example of this was cited in the Sabetha Lake Watershed located in Nemaha County, Kansas. The dam for the Sabetha Lake was completed in 1936 as a project to provide water for the city of Sabetha. In 1951 measurements made by the Soil Conservation Service of sediment deposited in the Sabetha Lake produced the following information.

> It was determined that the reservoir had a storage capacity of 1,346 acre-feet when the storage began and 737 acre-feet at the date of the survey in 1951. Thus the original capacity had been reduced by 609 acre-feet of sediment below spillway elevation. This reduction amounts to about 45 percent of the original storage capacity and represents an average loss of 2.9 percent per year. The annual accumulation of sediment below spillway level has averaged 39.3 acre-feet or about 12,800,000 gallons. The surface area of the reservoir has been reduced from 115.0 acres originally to 99.5 acres at the date of the survey. [1]

The Pilot Watershed Program

The need for a study of soil and water conservation practices as illustrated in the preceeding situation led to the development of the pilot watershed program by the 83rd Congress 1st Session, 1953.

Pursuant to Public Law 156, 83rd Congress, 1st session, H. R. 5227, 65 watersheds in 27 states were designated for a "pilot plant" program for watershed protection. Congress appropriated $5,000,000 for use in fiscal 1954. The estimated Federal cost of these projects was $29,000,000, and it was expected that local people would contribute at least an equal

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[1] Louis M. Glymph, Jr., Advance Report on the Sedimentation Survey of Sabetha City Reservoir, Sabetha, Kansas. Unpublished USDA Advanced Report, Lincoln, Nebraska, August 1952.

amount in carrying out these projects. The project was to be completed within a period of five years, according to specifications set forth in the work plan.[1]

An excerpt from Public Law 156 read as follows:

> For expenses necessary to conduct surveys, investigations, and research and to carry out preventative measures, including, but not limited to, engineering operations, methods of cultivation, the growing of vegetation, and changes in use of land, in accordance with the provisions of Public Law 46, Seventy-fourth Congress; $5,000,000.[2]

The program was divided into two phases, the first was the application of conservation practices and measures; the second involved the evaluation of the applied conservation practices and measures.

The first phase had two major sections. One consisted of structures which were primarily for flood prevention, including floodwater retarding structures and stabilizing and sediment control structures. A second section included measures for the conservation of watershed land and flood prevention, including contour farming, diversion ditches, range conservation, pond construction, erosion control structures, crop rotations, etc.

The evaluation phase of the program included a physical evaluation of the practices and measures. This phase was conducted by the Soil Conservation Service. An economic

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[1] For each Pilot Watershed in Kansas a work plan was prepared by the USDA, Soil Conservation Service, Salina, Kansas.

[2] Public Law 156- 83rd Congress, 1st Session, H.R. 5227

evaluation was undertaken jointly by the Soil Conservation Service and the Kansas Agricultural Experiment Station.

A memorandum from Robert M. Salter, Chief, Soil Conservation Service interpreted the "pilot plant" objectives to mean:

> The Congress has indicated its intent that this shall be a pilot plant program. The projects are intended (1) to provide experience in developing sound procedures for local-State-Federal cooperation in achieving the watershed objectives of local people; and (2) to demonstrate the actual physical results of a planned watershed program by determining increased productivity, decreased erosion, decreased flood water and sediment damages, and other benefits resulting from the watershed improvements.[1]

The Snipe Creek Watershed

The Snipe Creek Watershed was an area of approximately 16,400 acres of 26 square miles located in East Central Marshall County, Kansas. It was a long and narrow watershed measuring about 12 miles in length and not exceeding four miles in width which extended in a general Southwesterly direction. Snipe Creek joined the Black Vermillion River which in turn flowed into the Blue River about midway between the towns of Irving and Clebourne, Kansas.

Agriculturally, the Snipe Creek area was classified as a diversified general farming and livestock-producing area.

> Approximately 67 percent (3,716 acres) is in grass. Woodlands occupy 833 acres; roads, railroads, farmsteads and school grounds, 770 acres. The principle cultivated crops are corn, wheat, and alfalfa. Major enterprises are dairy and range cattle, swine, poultry, and sheep.

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[1] Robert M. Salter, Chief, Soil Conservation Service, Memorandum to all Responsible Field Personnel, June 29, 1953.

Nearly all of the forage produced is fed to livestock on the farms. Wheat and corn are principal cash crops. [1]

The climate of the watershed was generally considered to be favorable to a relatively high yield for adapted farm crops.

> Average annual precipitation recorded at Oketo, Marshall County, Kansas, is 28.27 inches. The highest annual precipitation reported is 54.47, lowest 16.87. Approximately 80 percent falls during the growing season, April through October. The frost free growing season averages 170 days. [2]

The soils in the Snipe Creek Watershed were described as follows:

> The Loessial, or wind blown material, occurs mainly on the higher uplands in the northern part of the watershed or on the ridges forming the boundary of the watershed. Only one soil, Crete silt loam, has developed in this material. [3]
>
> The Crete silt loam soils cover about 39.5 percent of the area of the Watershed. They include soils with very dark usually thick, silt loam surface soils and black silty clay subsoils. They are underlain by Peorian loess. Native vegetation is predominantly big and little bluestems, indian grass and Canada wild rye.
>
> The Crete silt loam soils are blacker and not as reddish as the Pawnee silt loam and the subsoils have a more blocky structure. The Crete silt loam soils have developed in calcareous Peorian loess while the Pawnee silt loam has developed in acid glacial till.
>
> As one starts at the top of most hills in the watershed the first soil usually encountered is the loessial soil or Crete silt loam. In moving down the slope, glacial soils are usually found. The glacial soils cover about 53.5 percent of the watershed.

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1 Work Plan for Snipe Creek Watershed Marshall County, Kansas. USDA Soil Conservation Service, Salina, Kansas. June 1954. p.2-3

2 Loc. cit.

3 Crete soil is referred to as Grundy in this study.

The Pawnee series includes very dark brown soils developed from fine textured glacial till. In general, they occupy the lower portions of the gentle slopes below the Crete silt loam. The subsoils are dark brown silty clay loams that are underlain by massive glacial till. The soils are acid and low in phosphorus. Native vegetation consists mainly of big and little bluestems, indian grass, switch grass and wild legumes.

Soils of the Morrill series usually occur down the slope and just below the Pawnee silt loam.[1] This series includes dark reddish brown soils developed from acid glacial till, usually containing occasional glacial gravels and small rocks. The subsoils are moderately heavy silty clay loams with a well developed structure about 40 inches thick. The parent material is a brown to reddish brown silt loam glacial till. The Morrill soils are acid and low in available phosphorus. Native vegetation consists of the bluestems, indian grass, switch grass and wild legumes.

The soils of the Burchard series, like those of the Morrill series, occur on slopes below the Pawnee silt loam and usually on slightly steeper slopes than the Morrill soils.

The Burchard series includes dark-colored moderately heavy soils developed in calcareous glacial till. These soils have more friable subsoils than the Pawnee silt loam and differ from the Morrill silt loam in having slightly lighter textured subsoils and glacial till as parent material. They have thicker surface soils and more subsoil development than the Steinauer soils. Native vegetation includes the bluestems, indian grass, switch grass, and wild legumes.

In the southern half of the watershed, where early erosion exposed the limestone and associated shales, soils have developed on these residual materials. The soils occur below the glacial soils and border the valley floor or some of the tributaries. As they cover only 1.5 percent of the watershed, they are quite limited in extent.

Soils of the Sogn series have developed on limestone where it has been exposed in the southern part of the watershed. The only soil of this series mapped

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[1] Morrill soil is referred to as Carrington in this study.

in the watershed is the Sogn stony loam.

> The alluvial soils are found on the flood plain along Snipe Creek and its tributaries. These soils have developed in the material washed down from the hills and the higher lying areas. The residual soils cover about 15.5 percent of the area in the watershed and are some of the more productive of all the soils. [1]

The Problem

The problem of watershed development was to design a program which would permit the efficient reallocation of resources in a manner that would result in net benefits in terms of productivity, reduced soil loss, runoff, and flooding; a plan that would be economically feasible.

The portion of the above problem assailed in this study was divided into two parts. Part I was to measure net returns from the sample area under reported conditions for 1953-1954 and to compute the anticipated net returns for the same area under projected full treatment. A comparison of the two time periods would indicate the net gain or loss resulting from on-farm soil conservation measures. Part II was that of measuring soil losses which occurred under actual conditions in 1954 and for the same area under projected full treatment; comparing these findings to determine which program would provide a sustained yield over time with little or no loss to soil fertility.

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[1] Richard K. Jackson, Soil Survey of the Snipe Creek Watershed, Unpublished, Soil Conservation Service, USDA, p.1-12

The Objectives

Objectives of the study were (1) to determine the effects on net returns of on-farm soil conservation measures integrated in a fully implemented watershed program as specified under recommended Soil Conservation Service procedures for watershed development in a pilot watershed, and(2) to determine the amount of soil loss under the watershed program and to compare this loss with practices which were actually in operation in 1954.

The Scope

The scope of the thesis was limited to a study of the on-farm benefits accruing from a fully implemented watershed program as specified by the Soil Conservation Service. "On-farm" refers to benefits accruing on the land where conservation treatments are actually applied and practices followed. Benefits to land areas located below a treated field or farm are not included.

The condition of "full treatment" or "fully implemented" was defined to be (1) one in which the agricultural land has been terraced, contoured, fertilized, and has the necessary erosion control structures installed, and, (2) one in which the conservation practices have been applied or in operation a sufficient length of time so that maximum benefits relative to soil and water conservation and crop production have been realized. All practices, applications, and structures are

assumed to have been installed or applied in accordance to the Soil Conservation Service specifications for the Snipe Creek Watershed.

Due to resource limitations it was not possible to include the entire area, thus a sample of 24 eighty acre tracts was drawn to gather data on yields, land use and existing treatments.

Cost estimates compiled by the Production Economics Branch of the USDA and the Kansas Agricultural Experiment Station for a similar study in Brown County, Kansas, were utilized.

Projected yields were necessary to determine output under eventual full treatment conditions and for yields under varying degrees of treatment and different rotations for the various soils in the area. These estimates were provided by the Agronomy Department, Kansas Agricultural Experiment Station.

The accuracy of the net return computations rests upon the vaillidity of the data collected in the field and on the cost and yield estimates obtained from the above-mentioned sources.

It was further assumed that each of the tracts within the sample was operated as a complete unit and not as an integral part of a larger enterprise. Operators of the tracts were considered to have had average managerial ability and a common goal of profit maximization.

Soil loss computations were completed for the entire sample area. The validity of this computation was limited

to the accuracy of Browning's Formula and to the accuracy of available soils data.

The General Procedure

Of the five pilot watersheds that were located in Kansas, the Snipe Creek Watershed was chosen to study because of its similarity of soils and topography to a rather large adjoining area, thus increasing the possibility of utilizing procedures and conclusions in other areas of similar characteristics.

Since the financial resources allocated to the study were limited it was necessary to employ sampling techniques to acquire the necessary data. In consultation with the Kansas Agricultural Experiment Station Statistician a sample composed of 24 eighty-acre tracts was drawn from the Snipe Creek Watershed. Data pertaining to land uses, yields, and soil treatments were collected through personal interview.

Net returns were computed for each of the tracts within the sample using a budgetary type of analysis. Three computations were completed under different conditions. (1) Using 1953-1954 actual field data concerning land uses, yields, and treatments combined with estimated costs; (2) using actual land uses and treatments substituting estimated yields for the actual yields and estimated costs. (3) Assuming full treatment as recommended by the Soil Conservation Service estimated yields and costs were used.

Soil losses were computed for the entire sample utilizing

the Browning Formula. [1] Losses were determined for the sample under the conditions which existed at the time the data were collected and under projected conditions of full treatment.

A purposive sample was extracted from the original sample. Ten tracts were paired according to similar soil characteristics; resulting in five pairs of eighty acre plots; one member of each pair was fully treated and one was untreated.

Since soil losses were determined on a projected basis for each member of the original sample, it was possible to compute the differences in soil loss for the actual treated minus untreated tracts and for projected full treatment minus untreated tracts.

HYPOTHESES

The hypotheses tested were: (1) that on-farm treatments recommended by the Soil Conservation Service in the Snipe Creek Watershed will result in increased net returns, and (2) that the soil loss for the area placed under the Soil Conservation Service recommended treatment will be reduced and will result in a figure which will permit infinite cropping of Class III and IV land with no reduction in yields, assuming normal climatic conditions.

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[1] Table 16, Appendix

EMPIRICAL ANALYSIS

Acquisition of Data

The study of on-farm effects of soil and water conservation in the Snipe Creek Watershed was completed with cooperation from the Soil Conservation Service and various departments of the Kansas Agricultural Experiment Station.

Fletcher E. Riggs and Henry Tucker prepared the sample.[1] For the purpose of this study the "B" Branch (approximately 2,295 acres) was excluded from the watershed since development in this area was extremely limited due to lack of interest of the local people.[2] Thus all computations involving the total watershed area were based on 14,126 acres rather than 16,421 acres.

The sample represented an area of approximately 1,920 acres or nearly 12 percent of the total land area, excluding "B" Branch. Data were collected for the W_2 NW_4 of each section lying 50 percent or more within the watershed boundary. In cases where it was not possible to acquire data from the W_2 NW_4 the next 80 counter clockwise in the section was used. Due to differences in the size of sections and for other reasons it was not possible for each of the 24 tracts to be of equal size. The range in size was from 59 to 83 acres, with an

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[1] Fletcher E. Riggs, formerly, Agricultural Economist, Kansas Agricultural Experiment Station. Henry Tucker, formerly, Statistician, Kansas Agricultural Experiment Station.

[2] Figure 1 in Appendix

average of 77 acres.

Data on conservatinn practices, land use, yields, crop rotations, and fertilizers were collected for the years 1953 and 1954 from each area within the sample by personal interview. The person interviewed in each case was the operator, whether the individual was the actual owner or tenant.

The questionnaire used in gathering data was designed by Fletcher E. Riggs and the author. (For a copy of the questionnaire, see Appendix Form 1.)

For the purpose of measuring land acreages, locating fields, and sample tracts, aerial photographs of the entire sample were provided by the Soil Conservation Service. Acreages used in the study were computed from the photographs with a grid square acreage computer.

Budgets were prepared for each of the 24 sample areas to sompute net returns of on-farm conservation practices under the actual conditions which existed in 1953, 1954 and under projected conditions of full treatment.

Data for this study were gathered in April 1955, thus 1953 and 1954 represented the most current data available. No attempt has been made to determine the normality of the years regarding rainfall and other weather conditions.

Effects of Conservation Practices on Net Farm Income

In computing gross returns for the years 1953 and 1954, (Table 12 Appendix) total production was multiplied by the

assumed prices which are shown in Table 1.

Table 1 Price assumptions for agricultural commodities produced in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Commodity	Unit	Price
Corn	Bushel	$ 1.25
Wheat	Bushel	1.80
Oats	Bushel	.62
Clover	Ton	16.00
Alfalfa	Ton	16.00
Brome	Ton	11.00
Milo	Bushel	1.20
Permanent Pasture 2/	Ton	11.00
Silage	Ton	5.50

1/ H. C. Love, J. H. Collidge, R. D. McKinney. More Money From Your Farm. Kansas Agricultural Experiment Stations Circular No. 244.

2/ Native Pasture in each case was converted to hay equivalent.

Price assumptions used were not the current prices but those which have been recommended by the Extension Service for the budgeting of future farm operations. The prices were somewhat lower than the current prices offered for the commodities shown in Table 1.

In calculating gross returns for projected full treatment the process was the same as for the individual years 1953 and 1954 with the exception of classifying the soils and measuring the acreages of those soils in each field. The estimated

yields for the corresponding soils in Table 13 Appendix were used in the computation. A 1-1-1 or 1-2-1 (rowcrop-small grain-legume) rotation was used for the upland soils. Half of the bottom land soil was assumed to have been seeded to rowcrops and half to legumes, primarily alfalfa.

Upland crop acreage which was not terraced was reduced by six percent to allow for land area used in the construction of terraces when placed under projected full treatment.

The same procedure was followed as described above for computing total production on Class I land. Class V, VI, and VII land which was being used for crop production during 1953 and 1954 was assumed to have been reverted into pasture. Also, Class II, III, and IV land which was being used for pasture or some lower use was assumed to have been brought under cultivation, thus in many cases the cropland acres shown for 1953 and 1954 are not equal to cropland acreages listed for the projected. Thus one must be careful not to compare totals. The averages present a more accurate description of the situation.

To facilitate the gross returns computation a budget analysis sheet was used. (Form 2 Appendix).

Net returns were calculated by subtracting from gross returns the variable costs attributable to the production of various crops.

Variable costs (Table 2) included the cost of labor, fuel, lubrication, and seed. Harvest charges levied against permanent pasture were for mowing and fence repair. It was

assumed for the purpose of calculating variable costs that clover was drilled separately with no other field preparation and that the average life of alfalfa was four years with seed costs averaged over that period.

Table 2 Variable costs per acre of production for various crops in the Snipe Creek Watershed, Marshall County, Kansas.1/

Crop	Pre Harvest 2/		Harvest
	Fertilized	Unfertilized	
Corn	$8.12	$7.56	$2.26
Wheat	7.44	6.91	2.21
Oats	6.66	6.13	2.21
Clover 3/	5.19	5.19	4.48
Alfalfa 3/	3.39	3.39	7.40
Brome	1.05	1.05	.56
Milo	7.20	6.64	2.21
Permanent Pasture			.93
Retired Cropland	1.96	1.96	3.98
Silage	8.12	7.56	9.00
Waterway 4/			3.98

1/ Cost Estimates are based on data acquired from the Agricultural Research Service, USDA, Kansas Agricultural Experiment Station.

2/ Seed costs are included.

3/ Cost of $.12 per bale for custom baling.

4/ Pre-harvest costs are included in the cost of maintenance which was $7.50 per acre. A charge of $4.45 per acre was levied for interest on investment, rate of interest was 5 percent.

The variable cost table includes only the cost of applying

fertilizers; actual fertilizer costs are found in Table 3.

Table 3 Cost of fertilizer. 1/

Fertilizer	Price
Nitrogen	$ .129 lb.
P_2O_5	.0955 lb.
K_2O	.0955 lb.
Lime	3.00 ton

1/ Cost estimates were based on data secured from the Agricultural Research Service, USDA, Kansas State College.

Application rates of fertilizer were computed on the basis of recommendations listed in Table 4.

Three dominant upland soils existed in the Snipe Creek Watershed. Therefore the minority upland soils were grouped according to physical characteristics with one of the major soils in the following manner: Grundy, (150, 152), includes Summitt, (30), Labette, (32), and Butler, (140). Carrington, (221), includes Steinauer, (24), and Burchard, (21, 210). There were no minority soils with similar characteristics to Pawnee, (20, 200), the third major soil.

Soil numbers above were the mapping symbols used to denote soil types in the Snipe Creek Watershed. The numbers were grouped under soil names because the differences in physical characteristics were so slight as to make differentation unnecessary.

Fertilizer requirements for the bottom land soils, Wabash, (9, 900), Waukesha, (85), Judson-Wabash, (930), were the same

Table 4 Estimated fertilizer requirements for specific soils under different rotations.1/

Soil and rotation	Corn					Wheat				Oats		
	N			P_2O_5	K	N		P_2O_5	K	N	P_2O_5	K
	Lbs year 1	Lbs year 2	Lbs year 3	Lbs yearly	Lbs yearly	Lbs year 1	Lbs year 2	Lbs yearly	Lbs yearly	Lbs yearly	Lbs yearly	Lbs yearly
Grundy												
3-2-0	80	80	80	40	--	25	--	25	--	50	50	--
3-1-1	40	40	80	40	--	25	--	25	--	50	50	--
2-1-1	40	40	--	40	--	25	--	25	--	50	50	--
2-2-1	40	40	--	40	--	25	--	25	--	50	50	--
1-2-1	40	--	--	40	--	25	--	25	--	50	50	--
1-1-4	--	--	--	40	--	12	--	25	--	25	50	--
Pawnee												
3-2-0	80	80	80	40	--	25	--	25	--	35	40	--
3-1-1	40	40	80	40	--	25	--	25	--	35	40	--
2-1-1	40	40	--	40	--	25	--	25	--	35	40	--
2-2-1	40	40	--	40	--	25	--	25	--	35	40	--
1-2-1	40	--	--	40	--	25	--	25	--	35	40	--
1-1-4	--	--	--	40	--	12	--	25	--	15	40	--
Carrington												
3-2-0	80	80	80	40	40	50	20	25	25	50	25	25
3-1-1	60	80	80	40	40	50	--	25	25	50	25	25
2-1-1	60	80	--	40	40	50	--	25	25	50	25	25
2-2-1	60	80	--	40	40	50	20	25	25	50	25	25
1-2-1	60	--	--	40	40	25	20	25	25	50	25	25
1-1-4	20	--	--	40	40	25	--	25	25	25	25	25
Judson-Wabash 2/												
3-2-0	80	80	80	--	--	25	--	25	--	50	25	--
3-1-1	40	40	80	--	--	25	--	25	--	50	25	--
2-1-1	40	40	--	--	--	25	--	25	--	50	25	--
2-2-1	40	40	--	--	--	25	--	25	--	50	25	--
1-2-1	40	--	--	--	--	25	--	25	--	50	25	--
1-1-4	--	--	--	--	--	12	--	25	--	25	25	--

1/ Fertilizer estimates were produced by a committee of agronomists, Kansas Agricultural Experiment Station.

2/ Fertilizer requirements for Wabash soil are the same as for Judson-Wabash soil.

thus only one bottom soil was given in Table 4, Judson-Wabash.

Table 5 illustrates per acre costs charged against terraces, waterways and grade stabilization structures.

Table 5 Annual costs per acre for terraces, waterways, and grade stabilization structures. 1/

Soil	Terraces		Waterways		Grade Stabilization structures	
	Interest	Maintenance	Interest	Maintenance	Interest	Maintenance
Grundy	$ .43	$ .36	$4.45	$7.50	$ .17	$ .03
Carrington	.48	.40	4.45	7.50	.16	.03
Pawnee	.48	.40	4.45	7.50	.16	.03

1/ Cost estimates were based on data secured from the Agricultural Research Service, USDA, Kansas Agricultural Experiment Station.

Net returns per crop acre in Table 12, Appendix, represent returns from cropland only; pasture, woodland, wasteland, farmsteads, roads, etc. have been excluded.

Of the 24 sample areas represented in Table 12, Appendix, 9 were fully treated and 9 were untreated, the remaining 6 were under varying degrees of treatment and could not be classified in either of the two preceeding groups.

Average per acre net returns under projected full treatment in Tables 6 and 7 were $30.00 which indicates that the average fertility for both groups was equal or nearly so since the only variation possible under projected net returns was from differences in yields resulting from variation in soil fertility.

The projected minus average column in Table 6 represents the net gain or loss of projected full treatment over actual

full treatment which may or may not have been to the Soil Conservation Service specifications. Three of the 9 cases indicated a net loss, and the differences in net returns ranged from a $-18.00 to $18.00 or a $36.00 spread. An average net return of $2.00 per acre was shown for the projected full treatment over the average of 1953-1954.

Table 6 Net returns per crop acre from fully treated sample areas for 1953, 1954, and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Sample Number	1953	1954	Average of 1953 1954	Projected	Projected minus average
3	$16	$27	$22	$26	$ 4
5	30	58	44	30	-14
10	19	35	27	36	9
13	32	28	30	28	-2
14	22	33	28	28	0
18	28	24	26	30	4
22	46	50	48	30	-18
24	19	15	17	32	15
26	21	9	15	33	18
Average	26	31	29	30	2 2/

1/ Table 12, Appendix.

2/ It may be noted that $30.00-$29.00=$1.00, However, in dividing out the original numbers (before rounding) $2.00 was the correct result.

In Table 7 the same comparisons were made as in Table 6 except that the 9 sample areas represented were entirely un-

treated. The variation in the projected minus average column was considerably less than in Table 6. The reason for this inconsistency may be the result of different management techniques, rainfall, climatic conditions, and other variations which would normally or possibly occur even within the relatively small area of the Snipe Creek Watershed. The average per acre net return indicated a $3.00 advantage for projected over 1953-1954 average; $1.00 greater than the advantage over the fully treated 1953-1954 average shown in Table 6.

Table 7 Net returns per crop acre from untreated sample areas for 1953, 1954, and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Sample Number	1953	1954	Average of 1953 1954	Projected	Projected minus average
6	$24	$31	$28	$32	$ 4
8	21	19	20	28	8
9	20	47	34	28	-6
15	9	20	14	27	13
19	19	20	20	29	9
20	21	19	20	28	8
29	53	34	44	40	-4
33	20	20	20	22	2
35	36	40	38	37	-1
Average	27	28	27	30	3

1/ Table 12, Appendix

Table 8 Net returns from treated and untreated selected sample areas, Snipe Creek Watershed, Marshall County, Kansas. 1/

Sample Number 2/	Average 1953-1954	Estimated yield 1954	Projected	Projected minus estimated 1954	Projected minus average 1953-1954
3	$22	$15	$26	$11	$ 4
6	28	22	32	10	4
18	26	26	30	4	4
8	20	8	28	20	8
13	30	20	28	8	-2
15	14	17	27	10	13
24	17	22	32	10	15
19	20	22	29	7	9
26	15	40	33	-7	18
20	30	16	31	15	1
Treated average	22	25	30	5	8
Untreated average	22	17	30	13	7 3/

1/ Table 14, Appendix. Costs and returns from treated and untreated sample areas for 1953, 1954 and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas.

2/ The first member of each pair was fully treated.

3/ It may be noted that $30.00-$22.00=$8.00, however, in dividing out the original numbers (before rounding) $7.00 is the correct answer.

Ten selected sample areas were paired in Table 8 according to similar soil characteristics in an effort to eliminate much of the variation in fertility among the different tracts of land. One member of each of the pairs was fully treated and the other was completely untreated, this permitted a

comparison of total sample areas which under projected full treatment the average per acre net return is equal to $30.00 for both the treated and untreated samples; any variation in these figures would represent a variation in fertility between the two areas. [1]

Net returns for 1953 and 1954 were averaged in an attempt to remove some of the variation due to weather conditions, insect damages, inaccurate reports by farmers and other factors which cause yields to vary from year to year. However this average may or may not be representative of average long run yields and therefore must be accepted in this light. The substitution of estimated yields for the yields reported in 1954 was done to remove variation resulting from the above mentioned factors.

Average net returns for the averaged 1953-1954 period on treated and untreated samples were found to be equal. However, it may be noted that when estimated yields were substituted in 1954 that the average net return for the treated areas indicate an $8.00 per acre advantage over the untreated area.

A comparison of the average net returns from the treated averaged 1953-1954 area to the net returns from the projected full treatment area, indicated an $8.00 net gain per acre. The same comparison using the average of the estimated yield 1954 area yielded a $5.00 per acre net gain.

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[1] Sample areas were selected and paired by Oriville W. Saffry, Soil Scientist, Soil Conservation Service and the author.

A similar comparison of the two untreated areas resulted in the following findings, net gain per acre for the projected area over the Average 1953-1954 area of $7.00 and a $13.00 net gain per acre over the Estimated yield 1954 area.

The variation in per acre net gains for treated and untreated areas under the Average 1953-1954 was slight. The treated areas under the estimated yield 1954 showed considerable benefits in the form of net gains which would indicate that considerable fluctuation of yields were present, possibly due to weather conditi ns or erroneous yield reports.

Effects of Conservation Practices on Soil Loss

Per acre soil losses were computed for all Class III and IV upland soils in the Snipe Creek Watershed.

Browning's formula was used as a basis for estimating soil losses under varying management practices and topography. Calculations in this study were limited to the three major soils, Grundy, Carrington, and Pawnee; the minority soils were grouped with the major soils according to similar physical characteristics as described in the preceeding section. Browning's Formula utilizing the factors given in Table 9 were as follows: (Rotation X Treatment X Soil Factor X Percent Slope X Degree of Erosion X Length of Slope)8 equals tons per acre of soil loss.

For comparison, soil losses were computed for two different time periods on the total sample area. The first period was 1954 using practices which were in effect at that time. The

Table 9 Soil loss factors as derived from Browning's Formula, applied to the three major soils in the Snipe Creek Watershed, Marshall County, Kansas 1/

Variables	Soil loss factors		
	Grundy	Pawnee	Carrington
Rotation			
3-2-0	2.6	2.6	2.6
3-1-1	2.0	2.0	2.0
2-1-1	1.4	1.4	1.4
2-2-1	1.2	1.2	1.2
1-1-1, 1-2-1	1.0	1.0	1.0
0-2-1	.5	.5	.5
1-1-4	.3	.3	.3
Continuous corn	4.0	4.0	4.0
Continuous grain	.9	.9	.9
Continuous brome	.1	.1	.1
Treatment			
No treatment	1.0	1.0	1.0
Contoured	.25	.25	.25
Terraced and contoured	.15	.15	.15
Full treatment 2/	.128	.128	.128
Soil factor 3/	1.2	1.3	1.0
Percent slope 4/	.3	.3	.5
Degree of erosion 5/	1.1	1.1	1.1
Length of slope 6/	3.8	2.4	3.6
Conversion factor	8	8	8

1/ Kenneth K. Barnes, Richard K. Frevert, and Glenn O. Schwab. Manual of Soil and Water Conservation Engineering. Pages 214, 215, 216, 217.

2/ Full treatment includes terraces, contouring, fertilizer and lime.

3/ Soil factor represents the propensity toward erosion.

4/ Grundy 2-4 percent slope; Pawnee, 5-7 percent slope; Carrington, 5-7 percent slope.

5/ Soils were assumed to have had from 25-75 percent of the top soil removed.

6/ Length of slope, Grundy, 300 feet; Pawnee, 500 feet; Carrington, 600 feet.

second computation was based on projected full treatment using recommended Soil Conservation Service practices and treatments for the Snipe Creek area. No attempt was made to separate treated, untreated, and partially treated areas, the purpose was to compare the average per acre soil loss that was occurring in 1954 to the soil loss that could be expected when the sample area is placed under projected full treatment. The results of this computation are shown in Table 10.

Table 10 Tons per crop acre soil loss for Class III and IV soils from selected sample areas in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Sample number	Estimated soil loss in 1954 per crop acre	Projected soil loss per crop acre
3	3.2	1.2
5	5.0	2.5
10	3.7	1.5
13	6.3	1.3
14	4.9	2.2
18	3.7	1.3
22	3.7	2.1
24	1.2	1.4
26	6.6	1.7
6	18.0	1.3
8	34.3	1.3
9	35.0	2.0
15	35.0	1.2
19	48.0	1.3
20	29.4	1.6
29	25.0	2.0
33	16.3	3.1
35	72.2	4.2
1	2.0	1.6
2	5.2	3.6
4	49.6	2.1
7	59.7	1.4
12	35.7	2.0
32	14.3	2.3
Weighted average	20.4	1.7

1/ Table 15 Appendix.

The average soil loss per acre under projected full treatment was 1.7 tons per acre, and the average soil loss per acre for actual conditions, 1954, was 20.4 tons or 12 times greater than under projected full treatment.

To eliminate the difficulty in classifying partially treated samples with untreated and fully treated areas, the six partially treated samples were removed leaving 9 treated and 9 untreated sample areas as shown in Table 11.

Table 11 Tons per acre soil loss for ClassIII and IV soils of selected sample areas in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Treated			Untreated		
Sample number	1954 actual loss per acre	Projected loss per acre	Sample number	1954 actual loss per acre	Projected loss per acre
3	3.2	1.2	6	18.0	1.3
5	5.0	2.5	8	34.3	1.3
10	3.7	1.6	9	35.2	2.0
13	6.3	1.3	15	35.1	1.2
14	4.9	2.2	19	48.0	1.3
18	3.7	1.3	20	29.4	1.6
22	3.7	2.1	29	25.0	2.0
24	1.2	1.4	33	16.3	3.1
26	6.6	1.7	35	72.2	4.2
Weighted average	4.0	1.6		33.0	1.7

1/ Table 16, Appendix.

The difference in average soil loss between treated and

untreated areas under actual conditions, 1954 was 29 tons per acre or about eight times greater for the untreated tracts. In comparing the average soil loss for the untreated area to the projected average soil loss it was found to be about twenty times greater for the untreated areas while a similar comparison using the treated sample areas resulted in about 2 tons per acre difference or slightly more than two times greater for the treated in relation to the projected full treatment.

SUMMARY AND CONCLUSIONS

It was shown in Table 6 that the average net return per crop acre under projected full treatment, as recommended by the Soil Conservation Service, minus the average net returns per crop acre for the average of the 1953-1954 period resulted in a net benefit of $2.00 per crop acre for projected full treatment. The same comparison made in Table 6 was performed in Table 7 with the exception that the average 1953-1954 sample area was untreated. The result was a net gain of $3.00 per crop acre in favor of projected full treatment.

In an effort to remove some of the variation in soils ten selected samples were paired according to soil characteristics; five of the sample areas were treated and five were untreated. To reduce variation in yield resulting from erroneous reports, estimated yields were substituted for 1954 actual reported yields (Table 8). In subtracting the average

per acre net return for the estimated yield 1954 (untreated) the result was a $13.00 per crop acre net gain. When the average net returns per crop acre of the average 1953-1954 (fully treated) was subtracted from the projected full treatment an $8.00 per crop acre net gain resulted, however, performing the same comparison, substituting the untreated average 1953-1954 for the treated, the net gain per crop acre was $7.00 or $1.00 less than for the fully treated 1953-1954 group which is inconsistent with all previous findings.

Thus, from the evidence presented it is to be concluded in testing the first hypothesis (that on-farm treatments recommended by the Soil Conservation Service in the Snipe Creek Watershed will result in increased net returns) that on the average net returns will increase as a result of adopting the on-farm treatments recommended by the Soil Conservation Service, however, the variation in results were considerable which would indicate that perhaps the sample was not large enough, or that some of the data collected was inaccurate, or that management was too important a variable to assume constant, or perhaps weather conditions were abnormal for the relatively short period of 1953-1954 on which calculations were based.

It would appear that a more adequate and accurate approach to determining net returns from various conservation treatments would be to use controlled soil plots to eliminate such variables as management, soil fertility, rainfall, biased

yields, insect damage, etc. Perhaps this approach would have also been more economical over time.

Soil losses were computed for all Class III and IV upland soils in the Snipe Creek Watershed. Soil estimates were based on Browning's Formula. Table 9 illustrates the results of soil loss estimates for the entire sample area under two sets of conditions: (1) Actual soil loss per acre for 1954, and (2) Projected soil loss per acre under full treatment. The soil loss per acre under projected full treatment was 1.7 tons and the soil loss per acre under estimated 1954 was 20.4 tons or twelve times greater than under projected full treatment.

Six partially treated sample areas were removed and the remaining 18 sample areas were classed as half being treated and half being untreated. The per acre soil loss under the actual 1954 (treated) was 4.0 tons and 1.6 tons under projected full treatment. The soil loss under actual 1954 full treatment was only two times greater than under projected full treatment. Soil loss per acre for actual 1954 (untreated) was 33.0 tons as compared to 1.7 tons for projected full treatment.

In all cases whether under actual full treatment or projected full treatment per acre soil losses have been below or equal to the allowable of 4.0 tons per acre which will permit sustained cropping with no decrease in yield or soil fertility.[1] Thus, in testing of the second hypothesis (that the soil loss

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[1] Kenneth K. Barnes, Richard K. Frevert, and Glenn O. Schwab. Manual of Soil and Water Conservation Engineering. p. 217.

for the area placed under Soil Conservation Service recommended treatment will be reduced and will result in a figure which will permit infinite cropping of Class III and IV land with no reduction in yields, assuming normal climatic conditions) it can be concluded that based on Browning's Formula soil losses will be reduced and sustained cropping can continur with no reduction in yields. However, the calculation of soil losses involve a large number of estimates, thus it would have been more accurate and adequate to have had proper instrumentation in the Snipe Creek Watershed to measure soil losses or to have had soil plots which would eliminate most variables and estimates which may have influenced the accuracy of the findings in this study.

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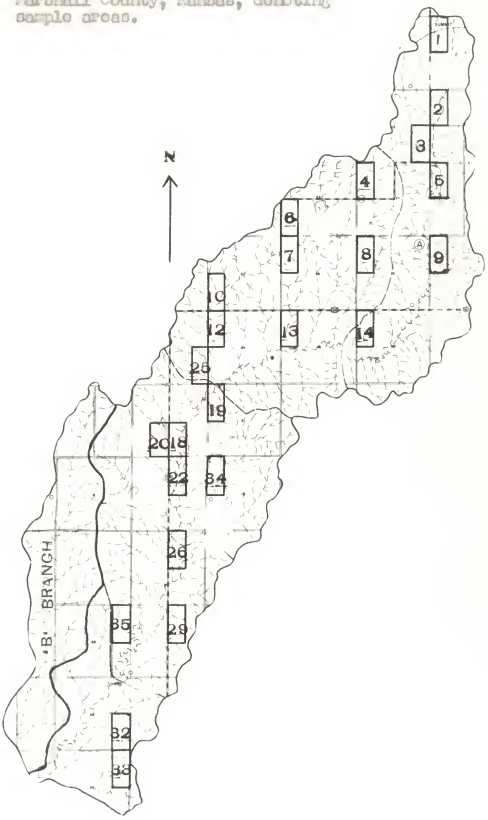
APPENDIX

Figure 1. Map of the Snipe Creek Watershed, Marshall County, Kansas, denoting sample areas.



Form I Pilot Watershed evaluation questionnaire.

Kansas Agricultural Experiment Station
Department of Agricultural Economics
and the
Soil Conservation Service

Pilot Watershed Evaluation

1. Farm operator_____ Address_____
   Location of farmstead_____ Total acreage operated_____
   Size of tract_____ Legal description_____
   Aerial photo No._____

II. Land use and conservation practices by fields.

A. 1. Field No._____ Acres_____ Owned or rented_____
   Year terraced_____
   2. Soil type_____ Slope_____ Erosion_____
   Land class_____ Acres_____
   3. Soil type_____ Slope_____ Erosion_____
   Land class_____ Acres_____

B. Crop history for this field.

Item	1954	1953	1952	1951	1950
1. Crop planted					
2. Yield per acre planted			XX	XX	XX
3. Variety					
4. Fertilizer (analysis)			XX	XX	XX
5. Fertilizer (lbs/acre)			XX	XX	XX
6. Fertilizer (analysis)			XX	XX	XX
7. Fertilizer (lbs/acre)			XX	XX	XX
8. Contour farmed					
9. Crop residue mgt.				XX	XX

10. Lime applied in 19___ at_____tons per acre.
11. Rock Phosphate applied in 19___ at___ tons per acre.
12. Have you a planned crop rotation?_____
    If yes, specify_____
13. If pasture, what were 1954 use dates? On_____
    Off_____ What classes and numbers of livestock were grazed?_____
14. If pasture, what conservation practices have been applied? Year_____ description_____
    Year_____ description_____

C. Have other conservation practices or structures been applied to this field? If yes, specify:
   Year applied_____ description_____
   Year applied_____ description_____
   Year applied_____ description_____

Table 12a Costs and returns from sample areas for 1953, 1954, and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas.

Sample Number	Crop acres			Gross returns			Variable costs		
	1953	1954	Projected	1953	1954	Projected	1953	1954	Projected
1	51.0	45.0	55.0	$1430	$ 788	$2851	$695	$630	$ 982
2	32.0	32.0	49.0	1875	1877	2294	413	610	863
3	70.0	70.0	70.0	1862	2786	3118	728	901	1264
4	52.5	52.5	72.5	2158	1536	3488	839	752	1361
5	29.5	29.5	47.5	1332	2162	2317	459	463	899
6	80.0	80.0	74.0	2332	3206	3605	437	713	1206
7	58.0	58.0	58.0	1514	2525	2783	665	973	1003
8	38.0	53.5	75.0	1170	1389	3452	365	389	1338
9	17.0	17.0	61.0	496	1078	2971	164	281	1238
10	49.5	49.5	54.5	1871	2457	2971	909	701	1021
12	31.0	39.0	52.0	1860	2916	2764	516	645	987
13	63.0	59.0	65.0	2938	2525	2965	918	878	1146
14	56.0	56.0	55.5	2067	2692	2626	863	845	1069
15	65.0	65.0	65.5	1157	1938	2966	561	639	1189
18	77.0	77.0	66.0	3080	2703	3130	888	873	1133
19	45.0	48.0	61.0	1288	1414	2799	434	445	1050
20	62.5	59.0	70.0	2655	1802	3271	466	407	1114
22	30.0	30.0	60.0	1989	2115	2933	594	622	1144
24	66.0	66.0	77.0	2057	1743	3797	823	749	1317
26	18.0	18.0	69.0	742	374	3532	357	208	1235
29	50.5	50.5	51.0	3177	2209	3017	486	477	963
32	52.0	52.0	53.0	3744	3276	3303	949	949	1056
33	10.0	10.0	37.5	400	440	1547	198	239	703
35	26.0	26.0	34.0	1250	1450	1869	304	398	613
Total	1129.5	1142.5	1433.0	44444	47401	70367	14032	14787	25894

Table 12b Costs and returns from sample areas for 1953, 1954, and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas.

Sample Number	Net returns			Net returns per crop acre		
	1953	1954	Projected	1953	1954	Projected
1	$ 735	$ 158	$1869	$14	$ 4	$34
2	1462	1267	1431	46	40	29
3	1134	1885	1854	16	27	26
4	1319	784	2127	25	15	29
5	873	1699	1418	30	58	30
6	1895	2493	2399	24	31	32
7	849	1552	1780	15	27	31
8	805	1000	2114	21	19	28
9	332	797	1733	20	47	28
10	962	1756	1950	19	35	36
12	1344	2270	1777	43	58	34
13	2020	1647	1819	32	28	28
14	1204	1847	1557	22	33	28
15	596	1299	1777	9	20	27
18	2192	1830	1997	28	24	30
19	854	969	1749	20	20	29
20	2189	1395	2157	35	24	31
22	1395	1495	1789	46	50	30
24	1234	994	2480	19	15	32
26	385	166	2297	21	9	33
29	2691	1732	2054	53	34	40
32	2795	2327	2247	54	45	42
33	202	201	844	20	20	22
35	946	1052	1256	36	40	37
Total	30413	32613	44475	668	723	746

Table 13 Estimated yields per acre from various soils under no treatment and under full treatment in the Snipe Creek Watershed, Marshall County, Kansas. 1/

Soil	Soil Number	No treatment					Full treatment				
		Corn: bus.	Wheat: bus.	Oats: bus.	Alfalfa: tons	Clover: tons	Corn: bus.	Wheat: bus.	Oats: bus.	Alfalfa: tons	Clover: tons
Burchard	21, 210	25.0	20.0	30.0	1.5	0.8	45.0	35.0	55.0	2.7	1.4
Summitt and Labette	30, 32	28.0	22.0	31.0	1.5	0.8	48.0	38.0	56.0	2.7	1.4
Grundy	140, 150, 152	36.0	30.0	38.0	1.0	0.5	52.0	39.0	50.0	2.6	1.3
Pawnee	20, 200	21.0	16.0	25.0	1.5	0.5	35.0	30.0	40.0	2.5	1.2
Carrington	221	28.0	24.0	30.0	1.6	0.8	43.0	38.5	58.0	2.7	1.4
Wabash-Judson 2/	9, 930	45.0	25.0	35.0	2.0	1.0	65.0	35.0	55.0	3.0	1.5
Wabash 2/	900	40.0	25.0	35.0	2.0	1.0	60.0	35.0	55.0	3.0	1.5

1/ Yields were estimated by a committee of Agronomists, Kansas Agricultural Experiment Station, Kansas State College.

2/ Wabash-Judson and Wabash are bottom land soils requiring no terracing or contouring thus fertilizer is the only treatment. A rotation of 1-1-4 is assumed for the bottom land soils rather than 1-1-1 which is assumed on the upland soils.

Form 2 Pilot watershed budget analysis sheet.

Watershed

Sample No._____ Total acres_____

Year Total crop and acres_____

Crop	Acres	Soil	Yield	Total production	Price	Total value
Corn						
Wheat						
Oats						
Alfalfa						
Clover						
Milo						
Sorghum						
Silage						
Brome Pasture						
Grass Waterways						
Permanent Pasture						
Waste						
Farmstead						
Total						

Table 14 Acreages, costs and returns from treated and untreated sample areas for 1953, 1954, and under projected full treatment in the Snipe Creek Watershed, Marshall County, Kansas.

	Sample numbers 1/										
	3*	6	18*	8	13*	15	24*	19	26*	20	Total
Crop acres											
1953	70.0	80.0	77.0	38.0	63.0	65.0	66.0	45.0	18.0	62.5	584.5
1954	70.0	80.0	77.0	53.5	59.0	65.0	66.0	48.0	18.0	59.0	595.5
Projected	70.0	74.0	66.0	75.0	65.0	65.5	77.0	61.0	69.0	70.0	692.5
Gross returns											
1953	$1862	$2332	$3080	$1170	$2938	$1157	$2057	$1288	$ 742	$2655	$19281
1954	2786	3206	2703	1389	2525	1938	1743	1414	374	1802	19880
Estimated 1954	2212	2553	3186	832	2904	1692	2652	1555	1135	1378	20099
Projected	3118	3605	3130	3452	2965	2966	3797	2799	3532	3271	32635
Variable costs											
1953	728	437	888	365	918	561	823	434	357	466	5977
1954	901	713	873	389	878	639	749	445	208	407	6202
Estimated 1954 2/	1139	823	1206	389	1614	619	1206	460	414	408	8278
Projected	1264	1206	1133	1338	1146	1189	1317	1050	1235	1114	11992
Net returns											
1953	1134	1895	2192	805	2020	596	1234	854	385	2189	13304
1954	1885	2493	1830	1000	1647	1299	994	969	166	1395	13678
Estimated 1954	1073	1730	1980	443	1290	1073	1446	1095	721	970	11821
Projected	1854	2399	1997	2114	1819	1777	2480	1749	2297	2157	20643
Net returns per crop acre											
1953	16	24	28	21	32	9	19	20	21	35	225
1954	27	31	24	19	28	20	15	20	9	24	217
Estimated 1954	15	22	26	8	20	17	22	22	40	16	208
Projected	26	32	30	28	28	27	29	29	33	31	296

1/ Sample areas are grouped in pairs according to soil characteristics; the starred member of each pair is fully treated.

2/ Estimated yields were substituted for reported crop yields in 1954.

Table 15 Total, per acre, and average per acre soil losses under actual conditi ns, 1954, and under projected full treatment for Class III and IV soils in the Snipe Creek Watershed, Marshall County, Kansas.

	Actual			Projected		
Sample number	Crop acres	Total soil loss	Soil loss per crop acre	Crop acres	Total soil loss	Soil loss per crop acre
3	66	210	3.2	62	75	1.2
5	30	149	5.0	26	65	2.5
10	31	115	3.7	34	50	1.5
13	56	352	6.3	58	73	1.3
14	56	274	4.9	56	126	2.2
18	77	288	3.7	66	89	1.3
22	30	111	3.7	32	66	2.1
24	60	74	1.2	77	109	1.4
26	18	119	6.6	69	119	1.7
6	74	1331	18.0	74	99	1.3
8	54	1851	34.3	75	97	1.3
9	28	985	35.0	55	113	2.0
15	59	2072	35.0	59	72	1.2
19	49	2351	48.0	58	74	1.3
20	47	1383	29.4	62	100	1.6
29	9	225	25.0	14	28	2.0
33	10	163	16.3	38	119	3.1
35	12	867	72.2	12	50	4.2
1	45	90	2.0	55	90	1.6
2	32	166	5.2	38	137	3.6
4	52	2581	49.6	72	155	2.1
7	48	2864	59.7	48	65	1.4
12	40	1429	35.7	38	77	2.0
32	6	86	14.3	7	16	2.3
Total	989	20136	518.0	1185	2064	46.2
Weighted average			20.4			1.7

Table 16 Total, per acre, and average per acre soil losses for selected sample areas located in the Snipe Creek Watershed, Marshall County, Kansas.

Sample Number	Treated Samples: Actual (1954) Crop acres	Total soil loss	Loss per acre	Projected Crop acres	Total soil loss	Loss per acre	Sample Number	Untreated Samples: Actual (1954) Crop acres	Total soil loss	Loss per acre	Projected Crop acres	Total soil loss	Loss per acre
3	66	210	3.2	62	75	1.2	6	74	1331	18.0	74	99	1.3
5	30	149	5.0	26	65	2.5	8	54	1851	34.3	75	97	1.3
10	31	115	3.7	34	50	1.5	9	28	985	35.2	55	113	2.0
13	56	352	6.3	58	73	1.3	15	59	2072	35.1	59	72	1.2
14	56	274	4.9	56	126	2.2	19	49	2351	48.0	58	74	1.3
18	77	288	3.7	66	89	1.3	20	47	1383	29.4	62	100	1.6
22	30	111	3.7	32	66	2.1	29	9	225	25.0	14	28	2.0
24	60	74	1.2	77	109	1.4	33	10	163	16.3	38	119	3.1
26	18	119	6.6	69	118	1.7	35	12	867	72.2	12	50	4.2
Total	424	1692	38.3	480	771	15.2		342	11228	315.8	447	752	18.0
Weighted Average			4.0			1.6				33.0			1.7

AN EVALUATION OF SELECTED CONSERVATION PRACTICES IN THE SNIPE CREEK WATERSHED, MARSHALL COUNTY, KANSAS.

by

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The primary purpose of this thesis was to determine the on-farm income effects of soil conservation measures integrated in a fully implemented watershed program as specified under recommended Soil Conservation Service procedures for the Snipe Creek Watershed, Marshall County, Kansas. A second purpose was to determine the amount of soil loss for the area under the watershed program and to compare this loss with the loss resulting from practices that were being used in 1954.

A sample composed of 24 tracts approximately 80 acres in size representing nearly 12 percent of the total watershed area was drawn for the purpose of testing the above mentioned objectives. Data concerning conservation practices, land use, yields, crop rotations and fertilizers were collected from the farm operators through personal interview for the years of 1953 and 1954.

Per acre net returns were computed for the sample area using a budgetary type of analysis, (gross returns minus variable costs equal net returns). Of the 24 sample areas 9 were under full treatment and 9 were untreated. A comparison of the per acre net returns of the fully treated area to projected full treatment for the same area indicated that a $2.00 annual net return per acre resulted in favor of the projected full treatment. A similar comparison involving the untreated area rather than the fully treated area resulted in a $3.00 annual per acre net gain.

To remove some of the variation in soils ten selected

samples were paired according to soils characteristics; five of the sample areas were treated and five were untreated. To reduce variation in yield resulting from erroneous reports, estimated yields were substituted for 1954 actual reported yields. In subtracting the average per acre net return for the estimated yield 1954 (untreated) the result was a $13.00 annual per crop acre net gain. When the average net returns per crop acre of the average 1953-1954 (fully treated) was subtracted from the projected full treatment an $8.00 annual per crop acre net gain resulted, however, performing the same comparison, substituting the untreated average 1953-1954 for the treated, the annual net gain per crop acre was $7.00 or $1.00 less than for the fully treated 1953-1954 group which is inconsistent with all previous findings.

Thus from the evidence presented it was concluded that the average annual net returns will increase as a result of adopting the on-farm treatments recommended by the Soil Conservation Service, however, since the variation in results were considerable it would indicate that the sample was not large enough or that if possible some variables which were assumed constant should have been measured in this study.

Soil losses based on Browning's Formula were computed for all Class III and IV upland soils in the Snipe Creek Watershed. These were completed under two sets of conditions: (1) estimated soil loss per acre for 1954 and (2) projected soil loss per acre under full treatment. The soil loss per acre under projected full treatment was 1.7 tons and the

soil loss per acre under estimated 1954 was 20.4 tons or 12 times greater than under projected full treatment.

Soil losses for 18 sample areas, 9 of which were fully treated and 9 of which were untreated were as follows; soil loss for 1954 (treated) was 4.0 tons and 1.6 tons under projected full treatment. The soil loss under actual 1954 full treatment was only 2 times greater than under projected full treatment. Soil loss per acre for actual 1954 (untreated) was 33.0 tons as compared to 1.7 tons for projected full treatment.

In all cases whether under actual full treatment or projected full treatment per acre soil losses have been below or equal to the allowable of 4.0 tons per acre which will permit sustained cropping with no decrease in yield or soil fertility. Thus it may be concluded from the evidence presented above that the soil loss for the area placed under Soil Conservation Service recommended treatment will be reduced and will result in a figure which will permit infinite cropping of Class III and IV land with no reduction in yields. However, it must be noted that the calculation of soil losses involve a large number of estimates and depend entirely upon the validity of Browning's Formula.