

Elk River Watershed Assessment: Preliminary Report



2009

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1.0 Elk River Watershed Assessment

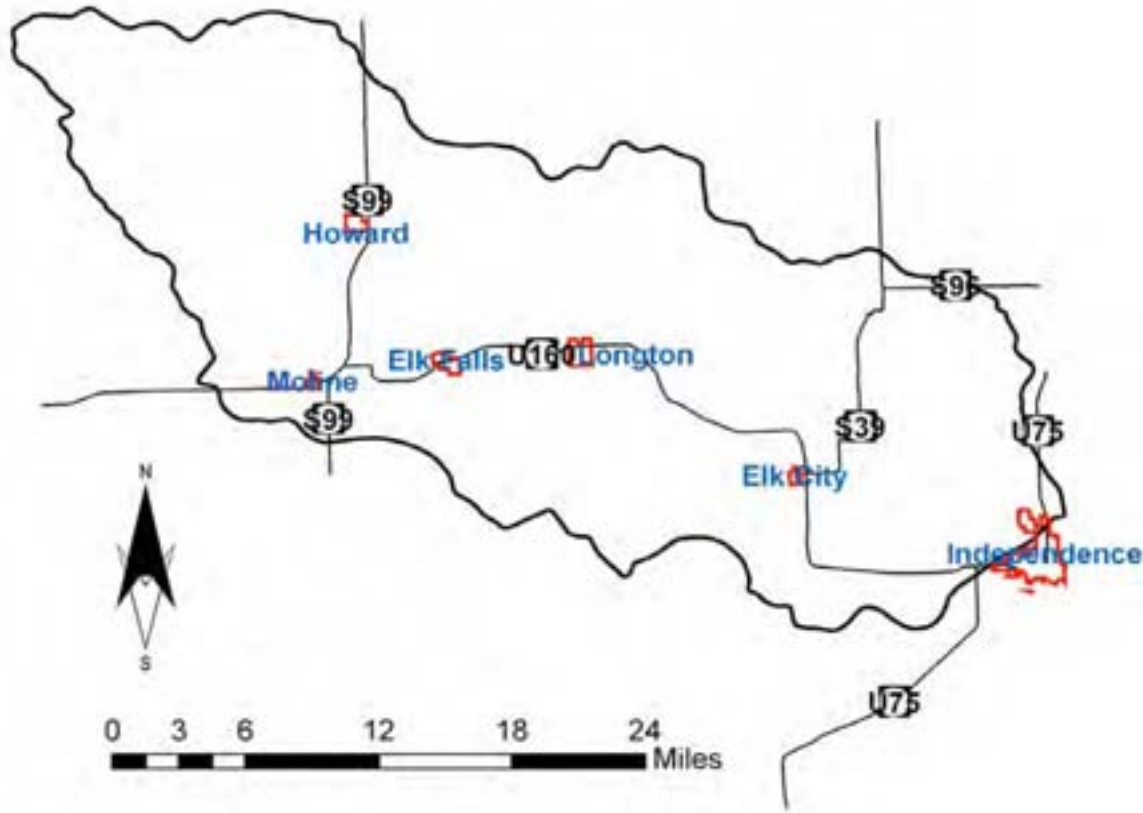


Figure 1. Major roads and cities – Elk River Watershed

1.1 Watershed Summary

Elk River Watershed is located in southeastern Kansas and drains areas of Elk and Montgomery counties with small drainage areas originating in Butler, Greenwood, Wilson, and Chatauqua counties. The primary waterway is the Elk River which includes numerous creeks and tributaries that flow into the river. One major lake, Elk City Lake, is located in the watershed. The prominent feature of the lakeside landscape is the precipitous limestone bluff known as Table Mound. Elk City Lake, which is a public drinking water source, impounds 4,500 acres of water. The Elk River Watershed is a portion of the larger Verdigris Basin that includes the Verdigris River and supplies water to Lake Oologah in Oklahoma. The Elk River Watershed has been issued a Category I designation by the Kansas Department of Health and Environment (KDHE) indicating that the watershed is in need of restoration and protection to sustain water quality, and is rated 61st out of 92 watersheds in need of restoration.

Grassland in Elk River Watershed is the predominant land usage covering 48 percent of land area. The grazing density is considered average (42-44 animal units/sq. mile) as compared to the entire Verdigris Basin. Cropland covers 36 percent of the land area and is concentrated along the river, creeks and streams. Woodland, water and urban areas constitute the remaining 16 percent of land cover. The watershed's population density is low when compared to densities across the Verdigris Basin (2-6 persons/sq. mile¹).

1.2 Overview of Water Quality Issues and Potential Pollution Sources

When river segments or lakes that are monitored by Kansas Department of Health and Environment (KDHE) have experienced poor quality, a Total Maximum Daily Load (commonly referred to as a TMDL) is established. A TMDL is the maximum amount of pollution that a surface water body can receive and still meet water quality standards.

Fecal Coliform Bacteria (FCB) is present in the digestive tract of all warm blooded animals including humans and animals (domestic and wild). FCB detection in water is a sign that the water has become contaminated with waste. While FCB is not itself harmful to humans, its presence indicates that disease causing organisms, or pathogens, may also be present. A few of these are Giardia, Hepatitis, and cryptosporidium. FCB is listed as a TMDL in Elk River. Potential sources of fecal coliform bacteria include failing septic systems, runoff from livestock production areas, close proximity of animals in riparian areas, and manure application to land if it is applied before a rainfall event or on frozen

ground. TMDLs for fecal coliform bacteria have an upper limit of 200 cfu (colony forming units)/100ml of water for primary contact recreation, such as swimming, and an upper limit of 2,000 cfu/100ml of water for secondary, non-contact recreation, such as boating and fishing.

Low dissolved oxygen is an impairment in Elk River. This has resulted in a TMDL aimed at increasing dissolved oxygen concentrations to provide full support of aquatic life. Riparian vegetation restoration, grass buffer strips along streams, proper manure storage and distribution, adequately functioning septic systems, and proper chemical fertilizer rates should help improve water quality and raise dissolved oxygen rates².

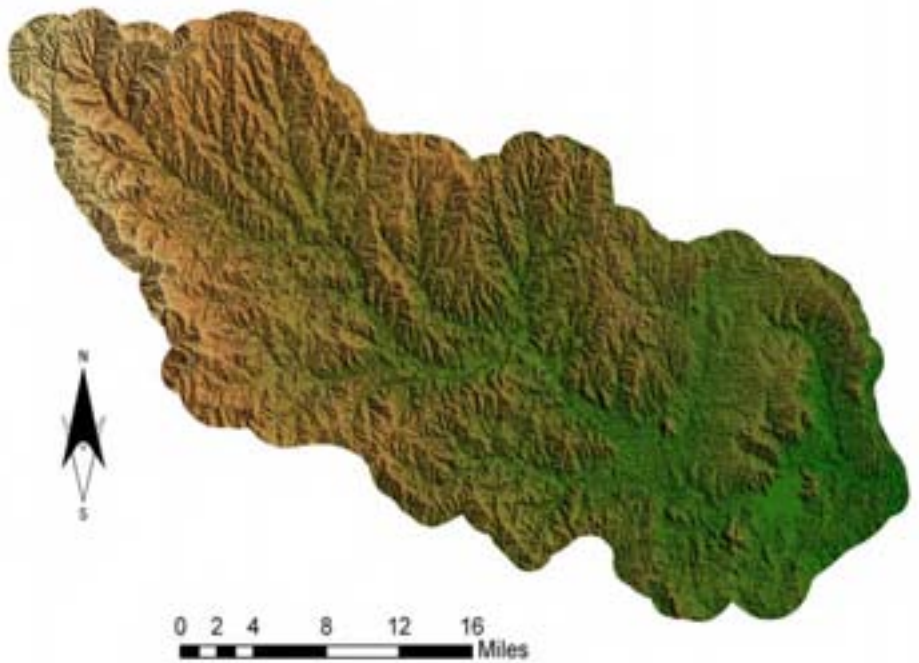


Figure 2. Relief Maps – Elk River Watershed³

2.0 Climate Mapping System

2.1 Precipitation Map⁴

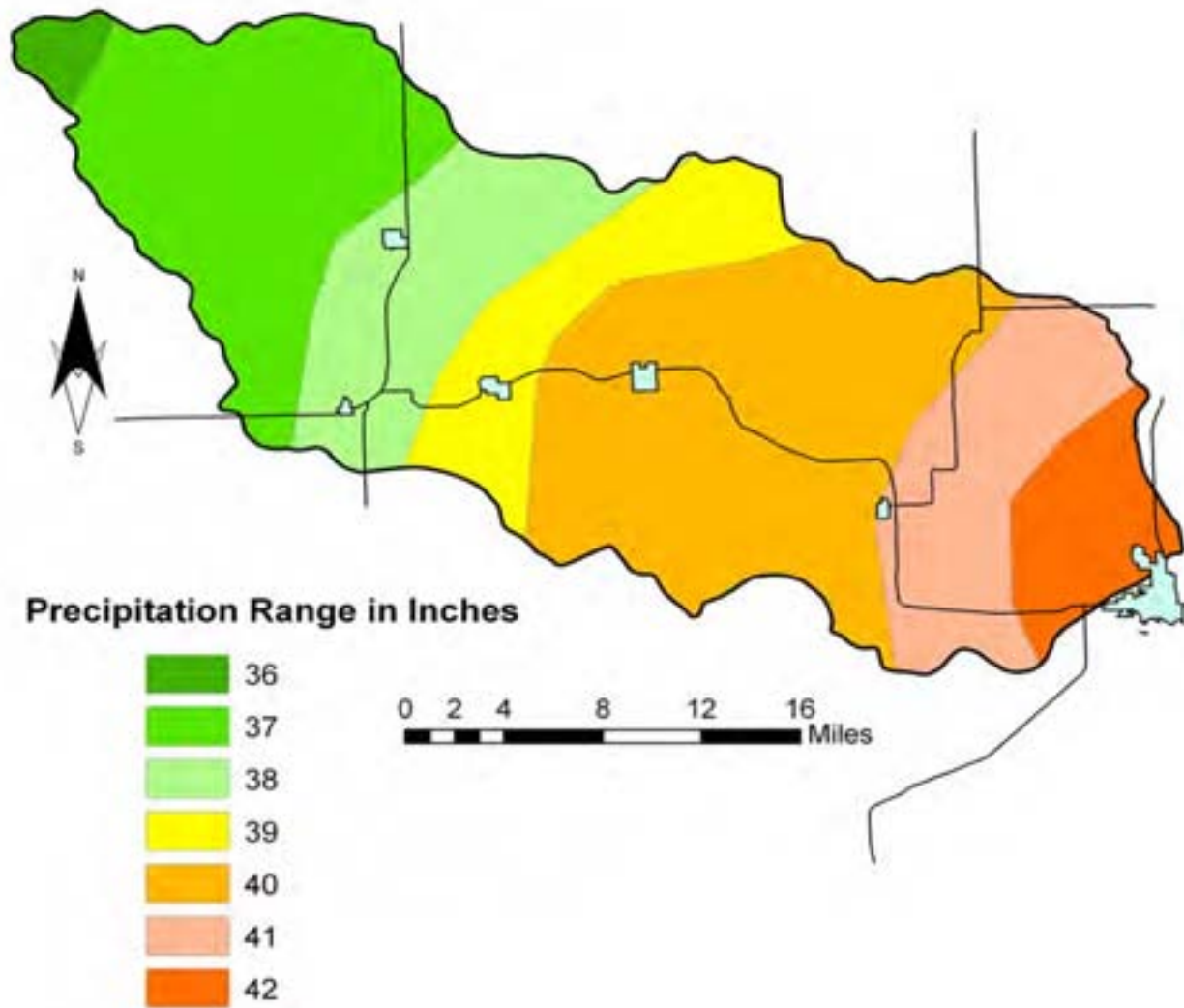


Figure3. 30-year average annual precipitation in inches, 1971 – 2000.

2.2 30-Year Average Daily Maximum Temperature Map⁵

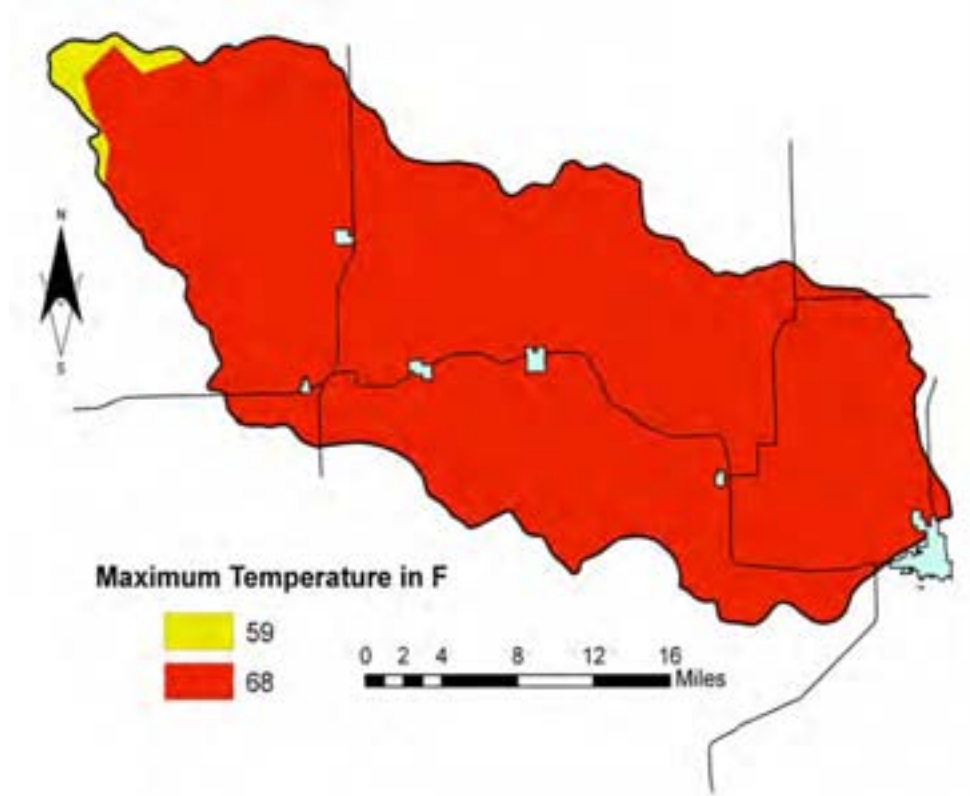


Figure 4. 30-year average daily maximum temperature in degrees Fahrenheit, 1971 – 2000

2.3 30-Year Average Daily Minimum Temperature Map⁶

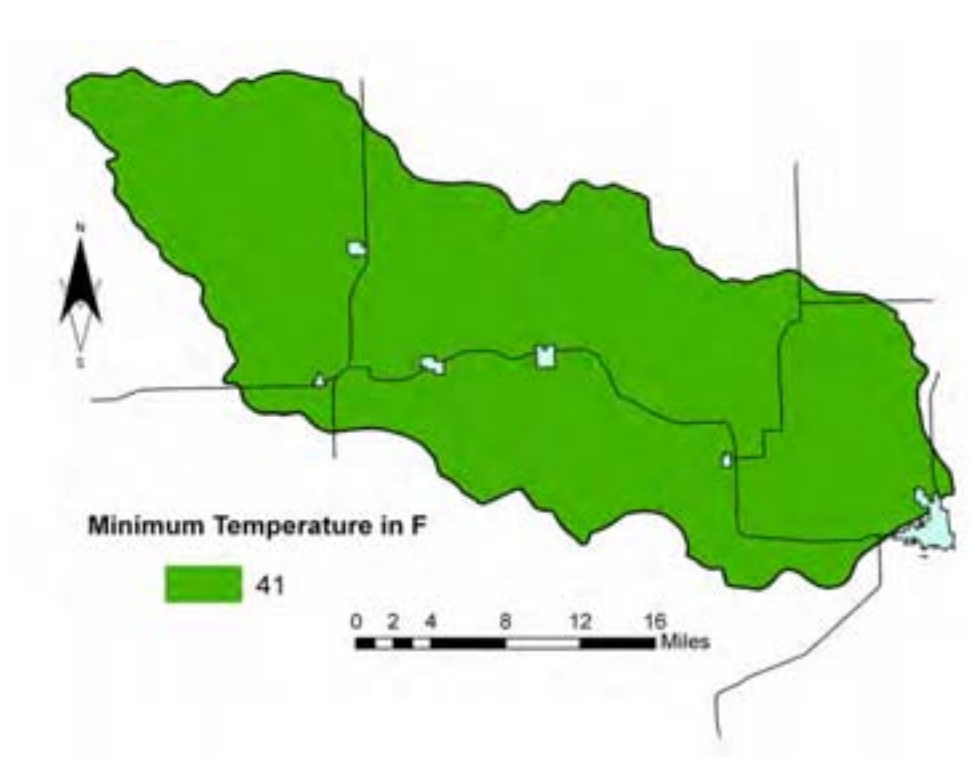


Figure 5. 30-year average daily minimum temperature in degrees Fahrenheit, 1971 – 2000

3.0 Land Use/ Land Cover

3.1 Land Use (GIRAS 1980s)⁷

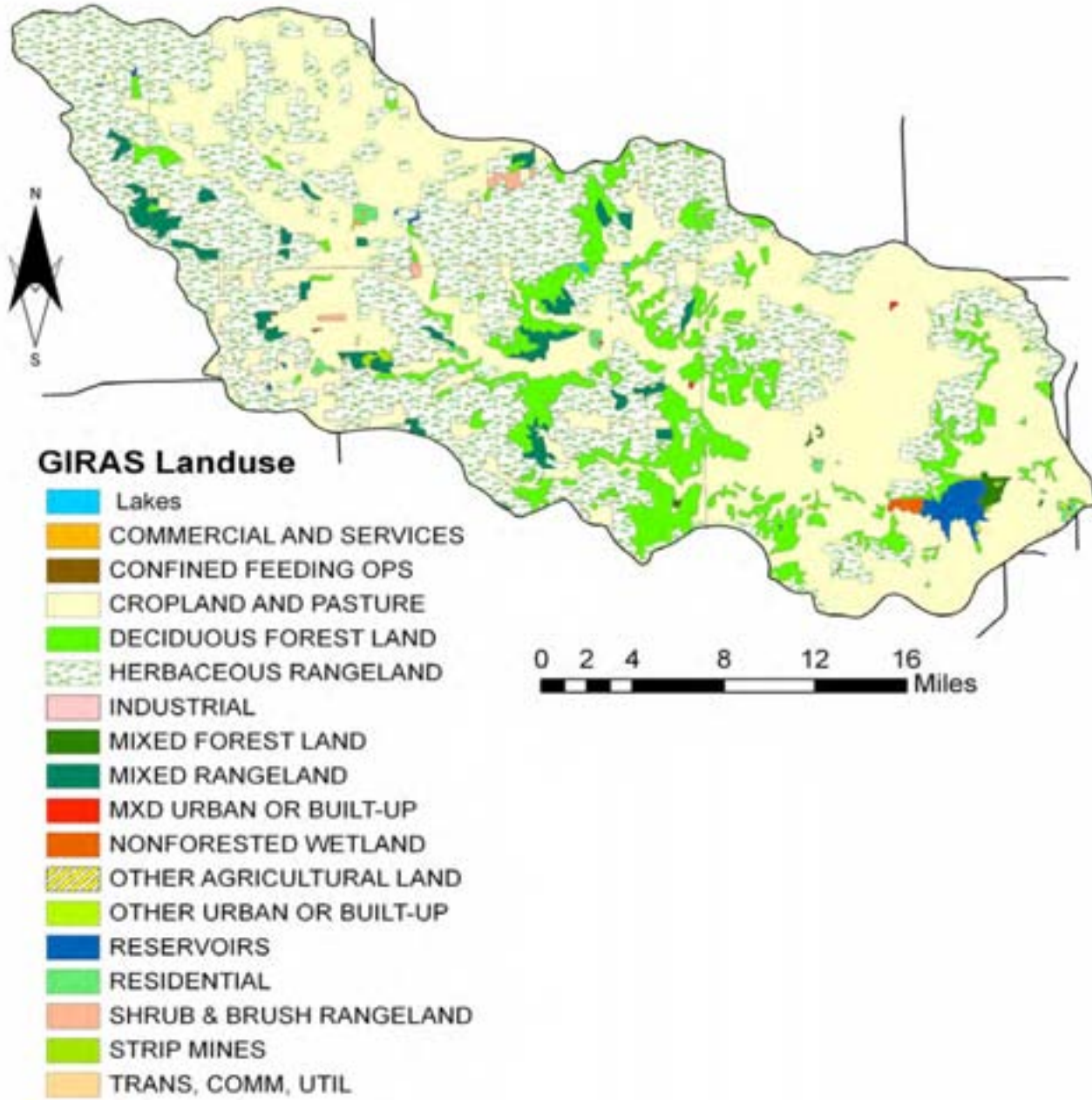


Figure 6. GIRAS 1980s land use classification.

3.2 Land Use (NLCD 1992)⁸

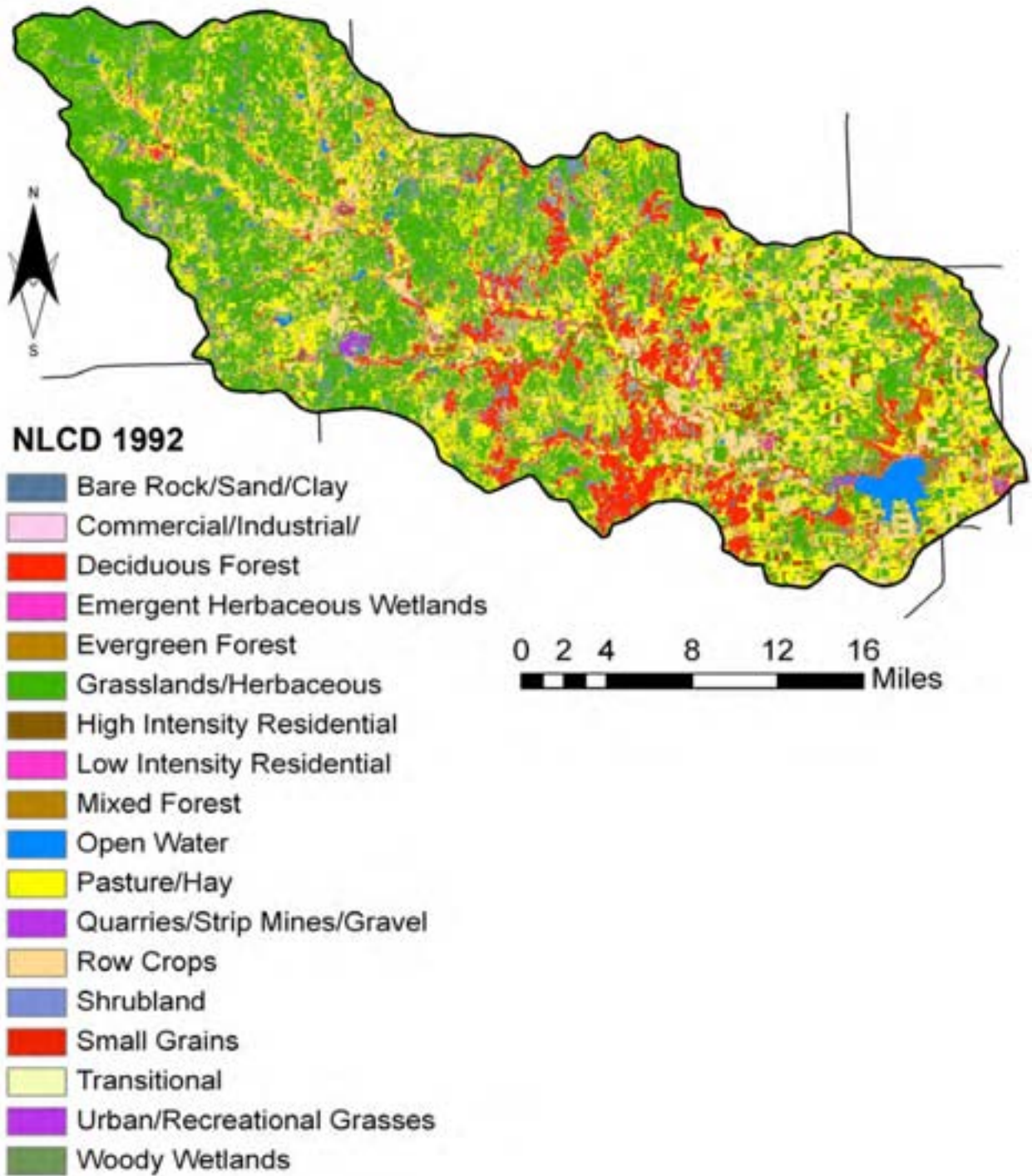


Figure 7. NLCD 1992 land use classification.

3.2.1 NLCD 1992 Land Cover Class Definitions³⁶

The following definitions are from the EPA's National Land Cover Database, found at: <http://www.epa.gov/mrlc/definitions.html#1992>

11. **Open Water** – all areas of open water, generally with less than 25 percent cover of vegetation/land cover.
21. **Low Intensity Residential** – Includes areas with a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas.
22. **High Intensity Residential** – Includes highly developed areas where people reside in high numbers. Examples include apartment complexes and row houses. Vegetation accounts for less than 20 percent of the cover. Constructed materials account for 80 to 100 percent of the cover.
23. **Commercial/Industrial/Transportation** – Includes infrastructure (e.g. roads, railroads, etc.) and all highly developed areas not classified as High Intensity Residential.
31. **Bare Rock/Sand/Clay** – Perennially barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, beaches, and other accumulations of earthen material.
32. **Quarries/Strip Mines/Gravel Pits** – Areas of extractive mining activities with significant surface expression.
33. **Transitional** – Areas of sparse vegetative cover (less than 25 percent of cover) that are dynamically changing from one land cover to another, often because of land use activities. Examples include forest clearcuts, a transition phase between forest and agricultural land, the temporary clearing of vegetation, and changes due to natural causes (e.g. fire, flood, etc.)
41. **Deciduous Forest** – Areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change.
42. **Evergreen Forest** – Areas dominated by trees where 75 percent or more of the tree species maintain their leaves all year. Canopy is never without green foliage.
43. **Mixed Forest** – Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present.
51. **Shrubland** – Areas dominated by shrubs; shrub canopy accounts for 25-100 percent of the cover. Shrub cover is generally greater than 25 percent when tree cover is less than 25 percent. Shrub cover may be less than 25 percent in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25 percent and shrubs cover exceeds the cover of the other life forms.
71. **Grasslands/Herbaceous** – Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.
81. **Pasture/Hay** – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
82. **Row Crops** – Areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.
83. **Small Grains** – Areas used for the production of graminoid crops such as wheat, barley, oats, and rice.
85. **Urban/Recreational Grasses** – Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
91. **Woody Wetlands** – Areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.
92. **Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

3.3 Land Use (NLCD 2001)¹

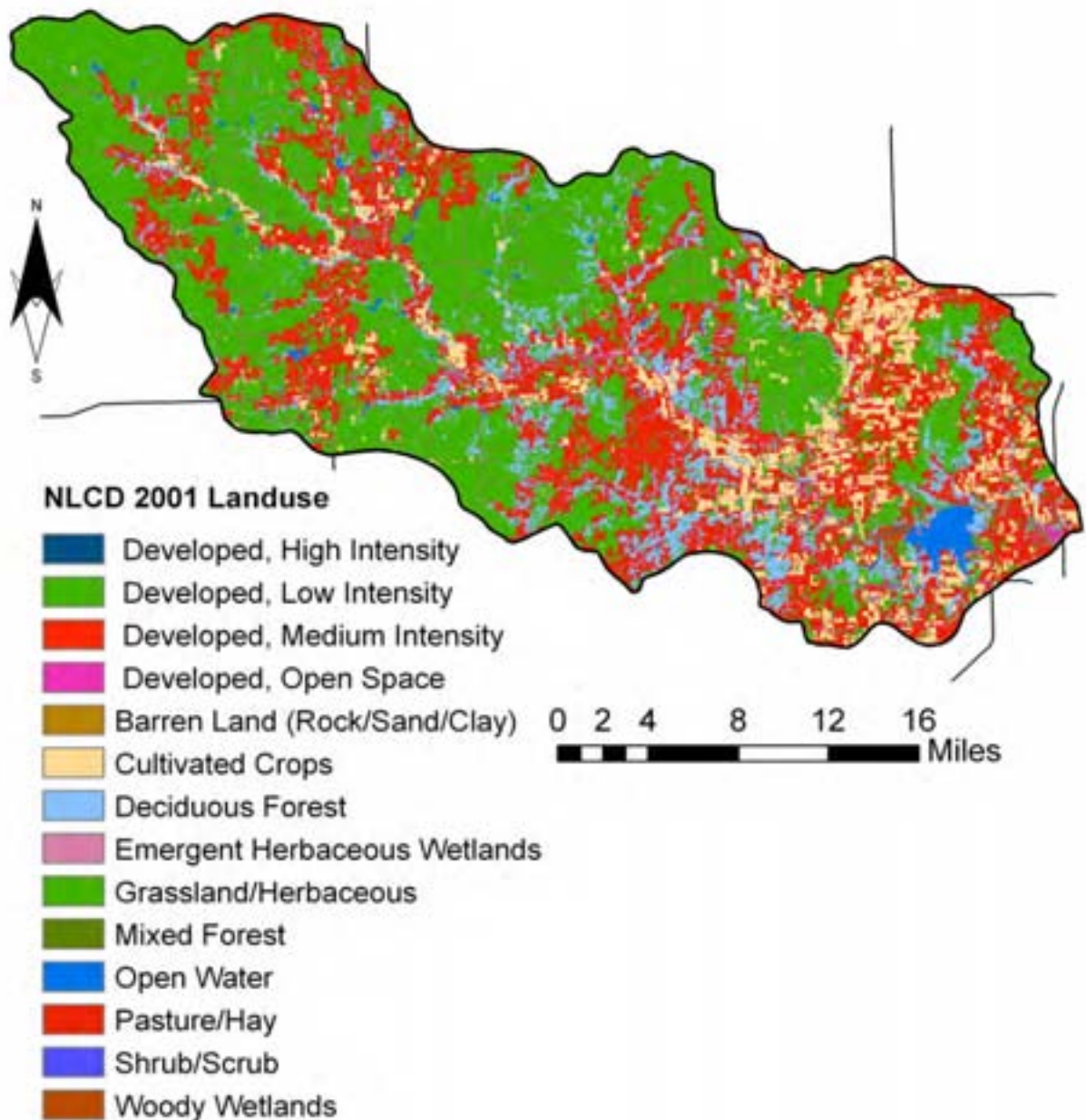


Figure 8. NLCD 2001 land use classification.

3.3.1 NLCD 2001 Land Cover Class Definitions³⁷

The following definitions are from the EPA's National Land Cover Database, found at: <http://www.epa.gov/mrlc/definitions.html#2001>

- 11. Open Water** – All areas of open water, generally with less than 25% cover of vegetation or soil.
- 21. Developed, Open Space** – Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- 22. Developed, Low Intensity** – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49 percent of total cover. These areas most commonly include single-family housing units.

- 23. Developed, Medium Intensity** – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
- 24. Developed, High Intensity** – Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.
- 31. Barren Land (Rock/Sand/Clay)** – Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
- 41. Deciduous Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- 43. Mixed Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
- 52. Shrub/Scrub** – Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
- 71. Grassland/Herbaceous** – Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- 81. Pasture/Hay** – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- 82. Cultivated Crops** – Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
- 90. Woody Wetlands** – Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- 92. Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

Table 1. Summary of land use covers

Land Use Type	Agriculture			Barren Land	Forest Land	Grassland	Urban	Wetlands/Water	Shrub	Total
	Cropland	Pasture	Total							
GIRAS 1980s	199040		199040	453	48293	190249	2256	3747	0	444204
NLCD 1992	49693	118620	168313	649	48805	183325	2610	16225	24273	444200
NLCD 2001	40588	119189	159777	407	45191	211484	16143	10511	133	443646

4.0 River Network⁹

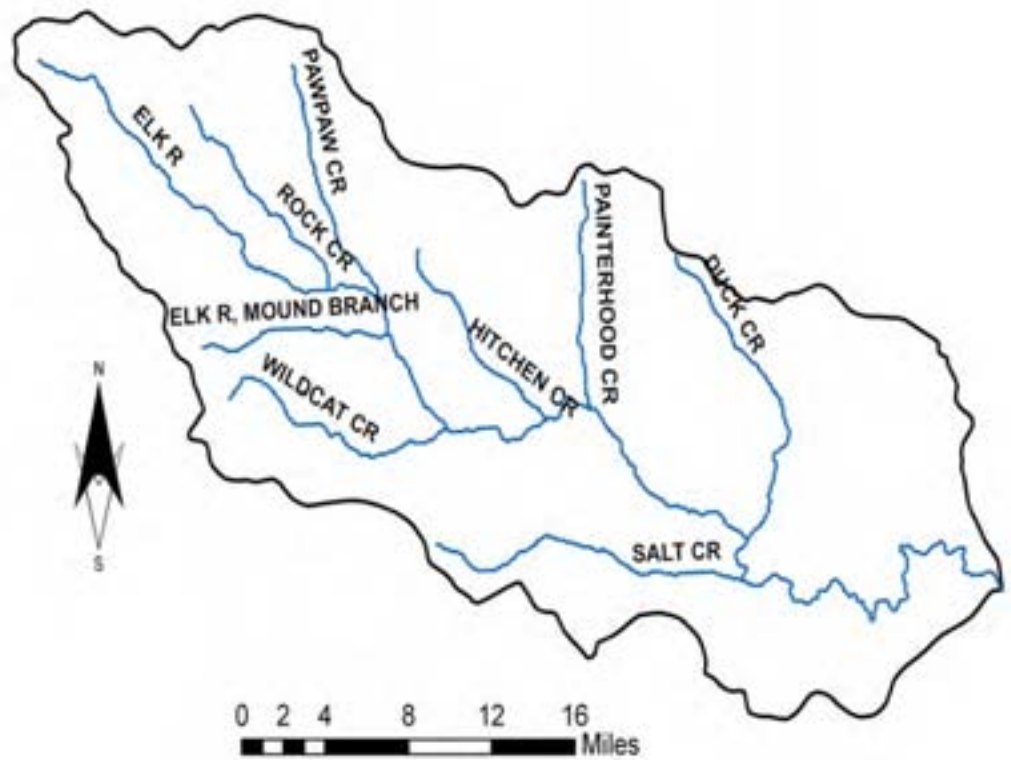


Figure 9. River network – Elk River Watershed

5.0 Hydrologic Soil Groups¹⁰

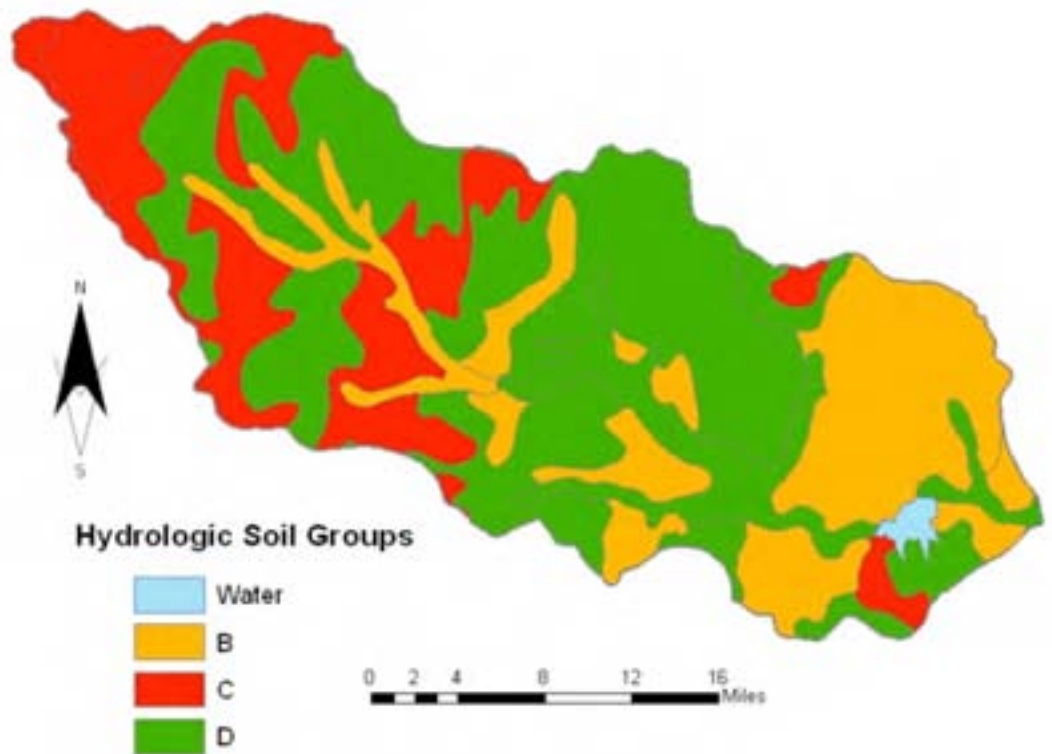


Figure 10. Hydrologic Soil Groups – SSURGO Database – Elk River Watershed

6.0 Water Quality Conditions

6.1 The 303d List of Impaired Waterbodies²

This map shows all impaired streams that are not meeting their designated uses (impaired waters) because of excess pollutants as defined in Section 303(d) of the Clean Water Act. The list of impaired waterways is updated by the states every two years. This can be used to identify specific stream segments and lakes for which, in accordance with their priority ranking, TMDLs may need to be developed.

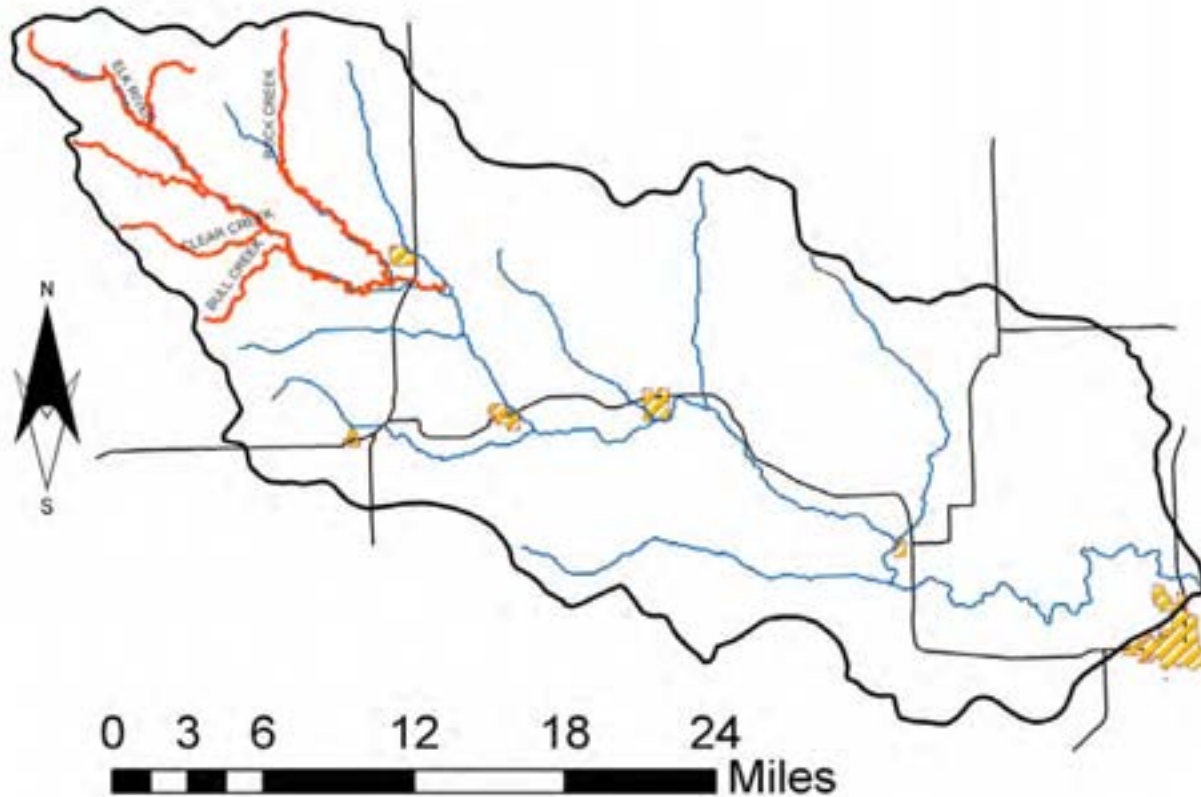


Figure 11. Impaired Waterbodies based on the 303d list – Elk River Watershed.

Table 2. The 303d List of Impaired Waterbodies

State	Waterbody Name	EPA Impairment	State Impairment
KS	Elk River	Pathogens, organic enrichment/low DO	Fecal Coliform, Low DO
KS	Elk River, South Branch	Organic enrichment/low DO	Low Dissolved Oxygen
KS	Elk River, Rowe Branch	Organic enrichment/low DO	Low Dissolved Oxygen
KS	Clear Creek	Organic enrichment/low DO	Low Dissolved Oxygen
KS	Rock Creek	Organic enrichment/low DO	Low Dissolved Oxygen
KS	Bull Creek	Organic enrichment/low DO	Low Dissolved Oxygen

6.2 Water Quality Observation Stations¹¹

USEPA Observation-level water quality monitoring data is useful for identifying the location of water quality data in a given watershed.

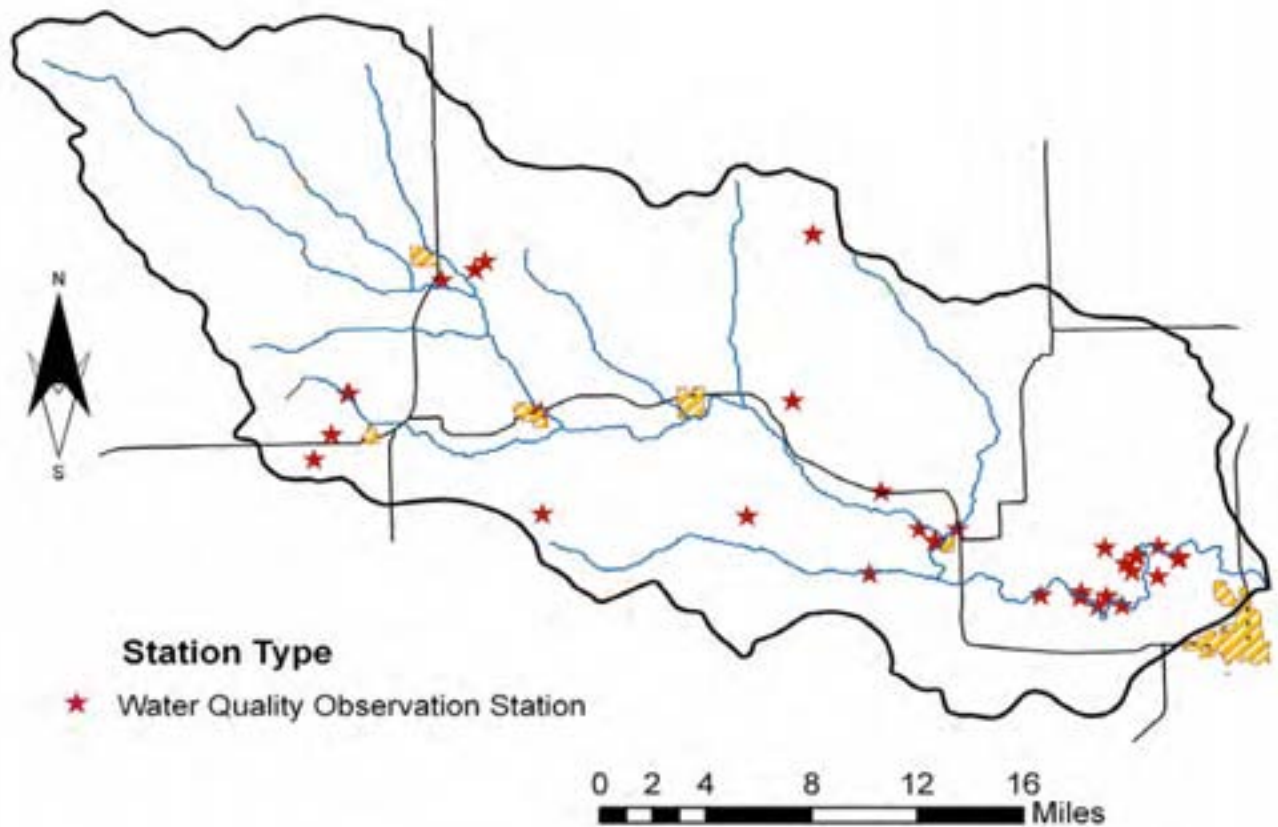


Figure 12. Lakes and Streams Water Quality Observation Stations – Elk River Watershed.

Table 3. Water Quality Observation Station

State	Agency	Station ID	Station Name
KS	USGS	06882510	Elk City Lake
KS	USGS	06885490	Elk City Lake
KS	USGS	06885500	Elk City Lake
KS	USGS	06887000	Elk City Lake
KS	KDHE	000233	Elk City 1
KS	KDHE	000240	Elk City 04
KS	KDHE	000261	Elk River
KS	USGS	06882400	Elk River
KS	USGS	06884700	Salt Creek
KS	USGS	06884900	Duck Creek
KS	USGS	06886000	Elk City
KS	USGS	06886500	Elk City
KS	USGS	06886900	East Painterhood Creek
KS	USGS	06887200	Elk R At Elk Falls, KS
KS	USGS	391136096314601	Elk R BI Elk City Lk, KS
KS	USGS	391209096312901	31S 12E 36Bda 01
KS	USGS	391209096321001	31S 11E 34Aba 01
KS	USGS	391209096332601	31S 13E 26Acc 01

State	Agency	Station ID	Station Name
KS	USGS	391215096312101	Moline Reservoir, KS
KS	USGS	391215096312102	Polk Daniels Lake, KS
KS	USGS	391216096325901	Elk R. Bl Elk City Dam, KS.
KS	USGS	391301096323501	Elk River Near Elk City
KS	USGS	391308096331601	Elk River Near Howard
KS	USGS	391311096302901	Elk River Below Elk City Res
KS	USGS	391337096302901	Elk River Above Elk City Res
KS	USGS	391347096332701	Elk Co State Lake (Polk Daniels) Sta 1
KS	USGS	391347096345101	Elk Co State Lake (Polk Daniels) Sta 2
KS	USGS	391354096343701	Elk City Reservoir Sta 1
KS	USGS	391407096335501	Elk City Reservoir Sta 2
KS	USGS	391413096334101	Elk City Reservoir Sta 3
KS	USGS	391440096343701	Elk City Reservoir Sta 4
KS	USGS	391446096335501	Elk City Lake Inflow Station
KS	USGS	391529096361000	Moline City Lake No. 2 Sta. No. 1
KS	USGS	391539096354300	Moline City Sf Lake Sta. No. 1
KS	USGS	391547096353500	Moline Reservoir Sta. No. 1

6.3. USGS Gage Stations¹²

USGS inventory of surface water gaging station data including 7Q10 low and monthly mean stream flow.

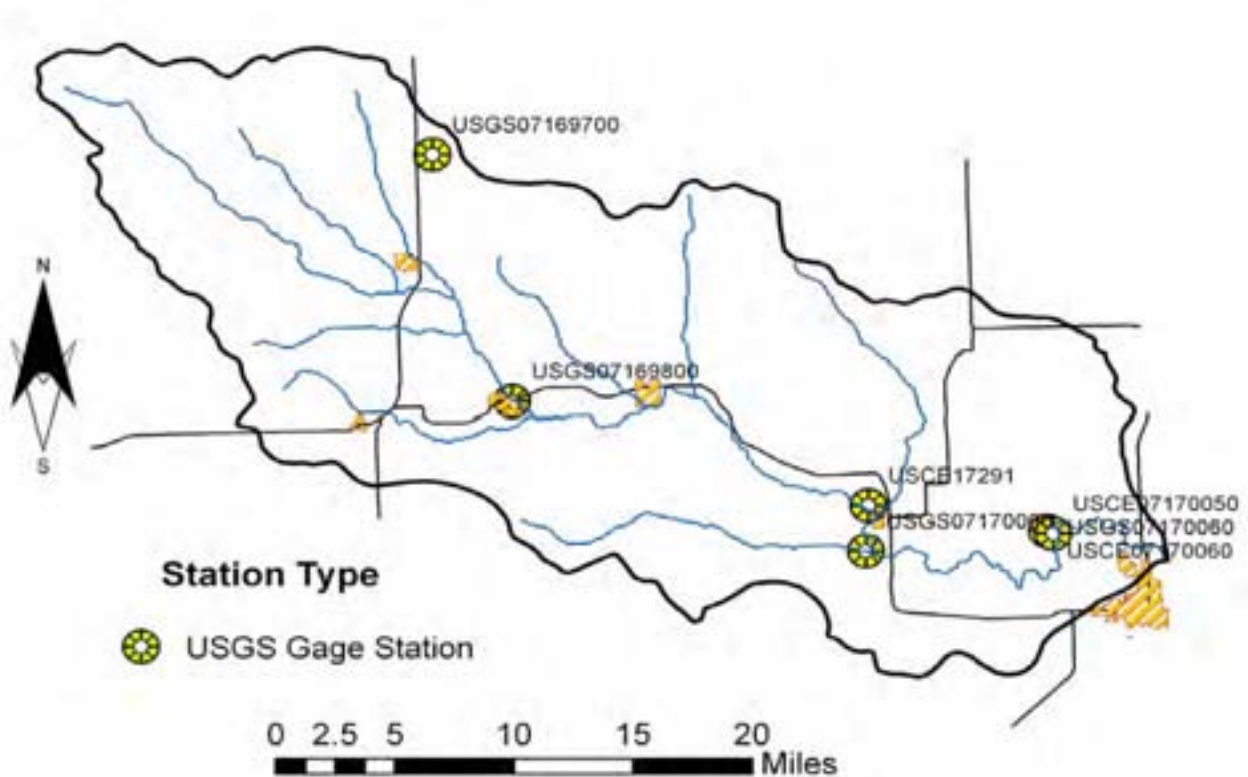


Figure 13. USGS Gage Stations – Elk River Watershed.

Table 4. USGS Gage Station¹²

Gage ID	Stream Flow (cfs)												
	Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
USGS07169700	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07169800	168.86	10740	11828	282.53	227.69	242.39	296.57	228.68	31.56	62.43	117.28	197.39	107.05
USCE17291	-	-	-	-	-	-	-	-	-	-	-	-	-
USCE07170060	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07170060	330.23	34.25	623.53	486.93	659.30	748.77	646.85	81.46	113.60	113.60	224.50	606.84	361.91
USCE07170050	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07170000	312.39	123.16	153.71	339.91	636.43	663.64	556.90	315.56	54.47	340.97	228.45	206.04	108.74

Table 5. Estimated peak-streamflow frequencies for selected gaging stations with at least 10 years of annual peak-discharge data for unregulated, rural streams in Kansas¹³

USGS ID	Station Name	Drainage Area (mi ²)	2-year ft ³ /s	5-year ft ³ /s	10-year ft ³ /s	25-year ft ³ /s	50-year ft ³ /s	100-year ft ³ /s	200-year ft ³ /s
07169700	Snake Creek near Howard	1.84	497	969	1360	1920	2390	2890	3440
07169800	Elk River at Elk Falls	220	9000	21300	33300	53400	72200	94600	121000
07170000	Elk River near Elk City	575	12600	30400	47000	73800	97900	125000	157000

Table 6. USGS gaging stations period of record for Elk River Watershed¹²

USGS ID	Drainage Area (mi ²)	Period of record	
		Begin	End
07169800	220	12/31/1966	present
07170000	575	09/30/1938	09/30/1969
07170060	634	09/30/1965	09/30/2002

6.4 Permitted Point Source Facilities¹⁴

NPDES permit-holding facility information; contains parameter-specific loadings to surface waters computed using the EPA Effluent Decision Support System (EDSS) for 1990-1999. The summary of discharge concentrations and loads allows the user to perform a planning-level assessment of the magnitude and severity of point source contributions. Analyzing the data for different years can provide information to evaluate changes in contributions from various point sources over time and support trend analysis.

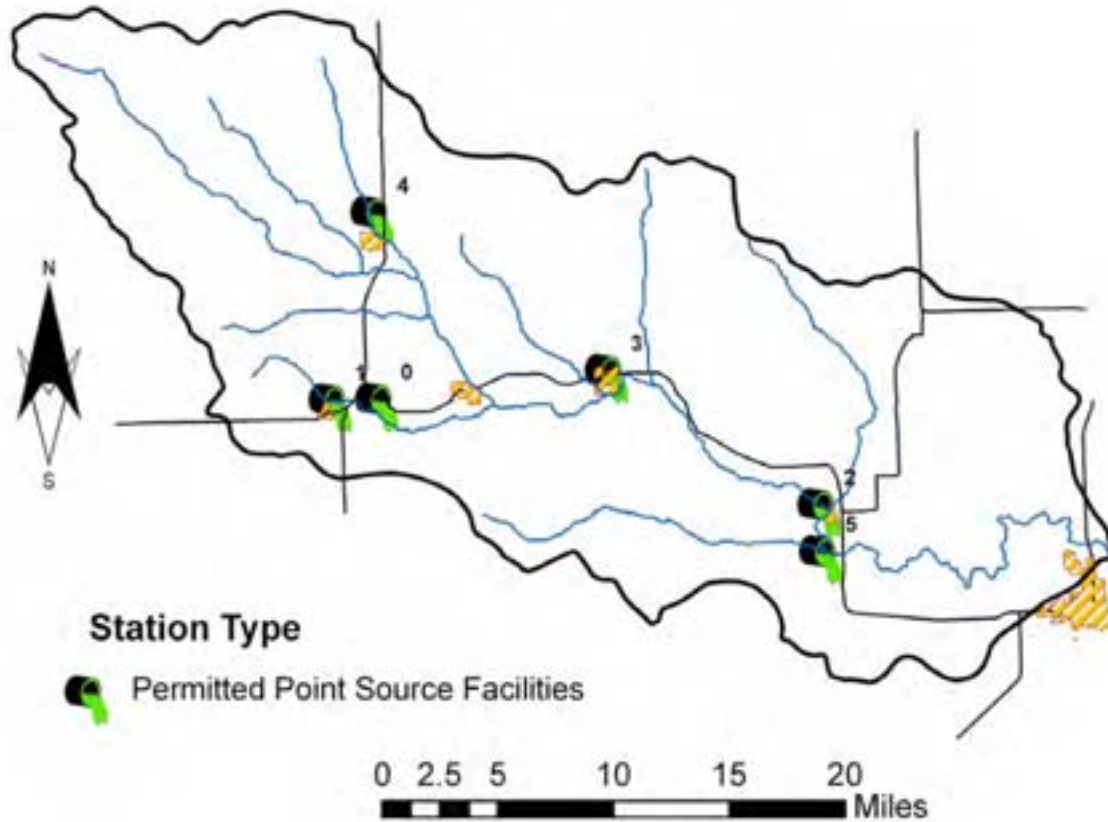


Figure 14. NPDES permit-holding facilities – Elk River Watershed.

Table 7. Permitted Point Source Facilities¹⁴

ID	NPDES	Facility Name	Ownership	Description	Industrial Classification	City	County	Flow Rate (million gallons/day)
0	KS0020311	Martin Marietta Aggregates Mo	Private	Crushed & Broken Limestone	ON Elg	Moline	Elk	0.00000
1	KS0027162	Moline City Of Stp	Public	Sewerage Systems	Municipal	Moline	Elk	0.10000
2	KS0045969	Elk City-City Of Wwtp	Public	Sewerage Systems	Municipal	Elk City	Montgomery	0.00000
3	KS0046019	Longton City Of Stp	Public	Sewerage Systems	Municipal	Longton	Elk	0.00000
4	KS0081116	Howard City Of Wwtp New Plant	Public	Sewerage Systems	Municipal	Howard	Elk	0.00000
5	KS0115461	Midwest Minerals Inc Quarry 23	Private	Crushed & Broken Limestone	ON Elg	Elk City	Montgomery	0.00000

6.5 Confined Animal Feeding Operations (CAFOs)¹⁵

Animal feeding operations classified as large or presenting a high risk to discharge can be classified as CAFOs and are likely required to have an NPDES permit. This map shows the locations and permit numbers for these sites in the Elk River Watershed.

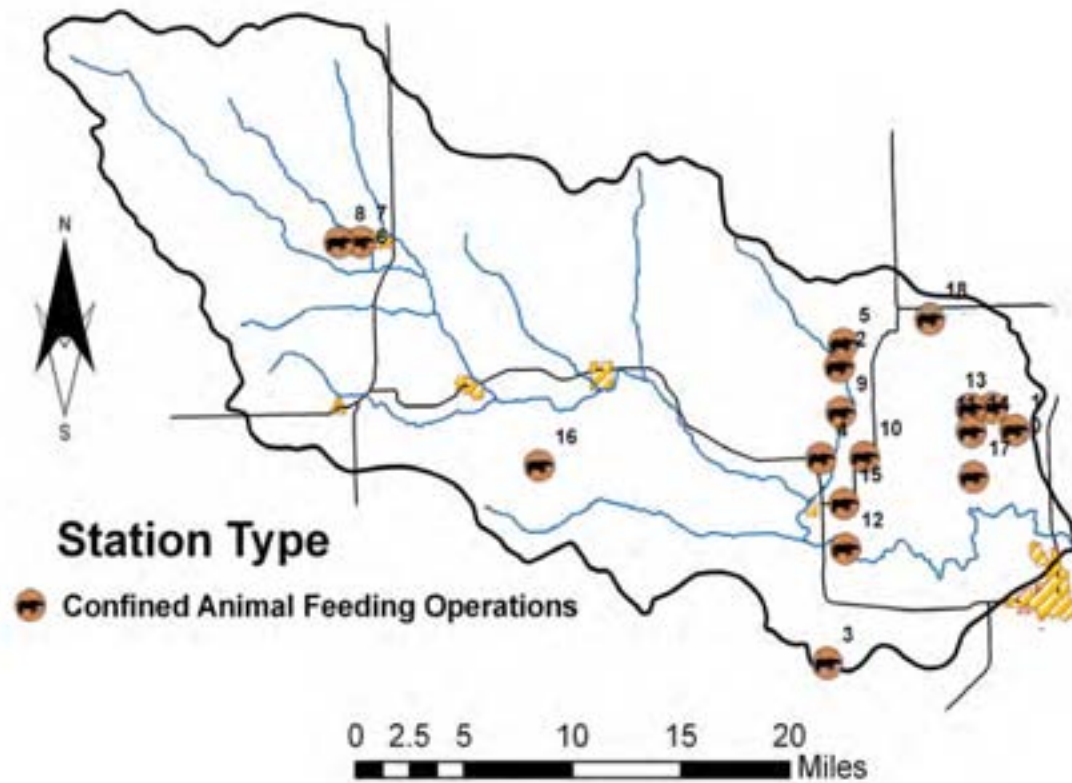


Figure 15. Confined Animal Feeding Operations facilities – Elk River Watershed.

Table 8. Confined Animal Feeding Operations¹⁵

ID	Permit No.	Total Head	Fed AUS	Kansas AUS	Animal Type
0	A-VEMG-H009	8882	2252	2577	Swine
1	A-VEMG-H002	8700	2280	2580	Swine
2	A-VEMG-H010	8224	2106	2402	Swine
3	A-VEMG-H007	8980	3272	3352	Swine
4	A-VEMG-MA05	40	56	56	Dairy
5	A-VEWL-BA01	275	275	275	Beef
6	A-VEEK-S010	1000	200	250	Swine
7	A-VEEK-S004	2400	960	960	Swine
8	A-VEEK-S011	620	120	152	Swine
9	A-VEMG-S025	1500	600	600	Swine
10	A-VEMG-S039	1880	448	524	Swine
11	A-VEMG-S042	2400	960	960	Swine
12	A-VEMG-S037	2920	856	934	Swine
13	A-VEMG-S041	3810	704	909	Swine
14	A-VEMG-S040	3110	540	716	Swine
15	A-VEMG-M009	40	56	56	Dairy
16	A-VEEK-E001	200	0	0	Exotic
17	A-VEMG-S036	526	114	138	Swine
18	A-VEWL-S022	692	200	219	Swine

* Animal System Unit

6.6 1990 Population and Sewerage by Census Tract¹⁶

The 1990 Population and Sewerage by Census Tract can be used to examine specific areas for population density and the prevalence of septic systems, which can be significant sources of pathogens, household chemicals, and nutrients (especially nitrate) escaping into groundwater and nearby receiving water bodies.



Figure 16. Population and Sewerage by Census – Elk River Watershed.

Table 9. 1990 Population and Sewerage by Census Tract¹⁶

ID	TRACT	Population	House Units	Sewerage Public	Sewerage Septic	Sewerage Other
0	0201	4602	1898	878	944	76
1	9958	1995	1192	406	766	20
2	9972	1620	894	48	808	38
3	9951	3327	1743	1061	629	53
4	9501	1991	850	204	630	16
5	9946	4407	2249	1380	800	69
6	9503	4000	1706	1420	286	0
7	9507	4154	1757	507	1193	57
8	9505	1755	991	949	42	0

7.0. Agricultural Economy

7.1 Corn Cost-Return Budget¹⁷

Table 10. Cost-return projections for corn crops in the Elk River Watershed, 2006.

Corn	Yield Level (bu)		
	80	110	140
Income Per Acre			
A. Yield per acre	80	110	140
B. Price per bushel	\$2.70	\$2.70	\$2.70
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$226.48	\$308.39	\$390.30
Costs Per Acre			
1. Seed	\$32.43	\$32.43	\$36.66
2. Herbicide	33.85	33.85	33.85
3. Insecticide/Fungicide	0.27	0.27	0.27
4. Fertilizer and Lime	37.48	45.40	53.32
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	90.16	98.83	107.50
10. Non-machinery Labor	10.19	11.17	12.15
11. Irrigation			
12. Land Charge/Rent	34.40	43.00	51.60
G. Sub Total	\$245.77	\$271.94	\$302.34
13. Interest on ½ Nonland Costs	9.51	10.30	11.28
H. Total Costs	\$255.28	\$282.25	\$313.63
I. Returns Over Costs (F-H)	-\$28.81	\$26.14	\$76.68
J. Total Costs/bushel (H/A)	\$3.19	\$2.57	\$2.24
K. Return To Annual Cost (I+13)/G	-7.85%	13.40%	29.09%

Table 11. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average and 2006 Nonirrigated Corn.²⁶

	2001-2005 Average			2006		
Number of Farms	55			38		
Crop Acres	402			529		
Acres Owned	121			155		
Acres Rented	281			374		
Yield / Acre	109			95		
Bushels	36,359			40,404		
Operator Percentage	83.15%			80.47%		
Gross Income / Acre	\$233.40			\$242.68		
Variable Costs / Acre	\$180.45			\$178.68		
Total Expense / Acre	\$230.79			\$248.23		
Gross Income / Bushel	\$2.58			\$3.18		
Total Expense / Bushel	\$2.55			\$3.25		
	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Corn (Operator's Share)	\$80,290.82	\$2.21	\$199.63	\$120,532.52	\$2.98	\$227.85
Patronage Refunds	\$266.75	0.01	0.66	\$673.05	0.02	1.27
Government Payments	\$12,131.76	0.33	30.16	\$6,674.57	0.17	12.62
Miscellaneous Income	\$20.08	0.00	0.05	(\$147.10)	(0.00)	(0.28)
Crop Insurance Proceeds	\$1,163.31	0.03	2.89	\$645.18	0.02	1.22
OTHER INCOME	\$13,581.80	\$0.37	\$33.77	\$7,845.68	\$0.19	\$14.83
GROSS INCOME	\$83,872.72	\$2.58	\$233.40	\$128,378.20	\$3.18	\$242.68
EXPENSES:						
Labor Hired	\$3,453.01	\$0.09	\$8.59	\$4,657.12	\$0.12	\$8.80
General Machinery Repairs	\$6,156.94	0.17	15.31	\$8,142.53	0.20	15.39
Interest Paid	\$3,812.10	0.10	9.48	\$6,394.41	0.16	12.09
Seed / Other Crop Expense	\$12,012.77	0.33	29.87	\$18,201.43	0.45	34.41
Crop Insurance	\$2,119.32	0.06	5.27	\$3,501.80	0.09	6.62
Fertilizer / Lime	\$16,167.67	0.44	40.20	\$25,235.64	0.62	47.70
Machine Hire - Lease	\$2,389.04	0.07	5.94	\$2,745.59	0.07	5.19
Farm Org Fees / Travel / Publ	\$655.82	0.02	1.63	\$877.00	0.02	1.66
Gas / Fuel / Oil	\$4,069.75	0.11	10.12	\$7,761.81	0.19	14.67
Crop Storage & Marketing	\$498.96	0.01	1.24	\$551.75	0.01	1.04
Personal Property Tax	\$282.99	0.01	0.73	\$331.64	0.01	0.83
General Farm Insurance	\$1,099.50	0.03	2.73	\$1,398.60	0.03	2.64
Utilities	\$843.34	0.02	2.10	\$974.85	0.02	1.84
Cash Farm Rent	\$3,252.51	0.09	8.09	\$2,491.15	0.06	4.71
Herbicide / Insecticide	\$7,424.28	0.20	18.46	\$10,987.88	0.27	20.77
Conservation	\$42.18	0.00	0.10	\$0.58	0.00	0.00
Auto Expense	\$241.21	0.01	0.60	\$265.72	0.01	0.50
TOTAL VARIABLE COSTS	\$84,531.50	\$1.77	\$180.45	\$94,519.08	\$2.34	\$178.68
RETURN ABOVE VARIABLE COSTS	\$29,341.23	\$0.81	\$72.95	\$33,859.12	\$0.84	\$64.01
Depreciation	\$8,551.91	0.24	21.26	\$11,757.89	0.29	22.23
Real Estate Tax	\$1,014.99	0.03	2.52	\$1,207.60	0.03	2.28
Unpaid Operator Labor	\$6,259.53	0.17	15.56	\$6,654.67	0.16	12.58
Interest Charge *	\$2,730.39	0.08	6.79	\$2,664.72	0.07	5.04
TOTAL FIXED COSTS	\$18,556.82	\$0.51	\$46.14	\$22,284.88	\$0.55	\$42.13
Land Charge **	\$9,735.65	\$0.27	\$24.21	\$14,510.87	\$0.36	\$27.43
TOTAL EXPENSE	\$92,823.97	\$2.55	\$230.79	\$131,314.83	\$3.25	\$248.23
NET RETURN TO MANAGEMENT	\$1,048.75	\$0.03	\$2.61	(\$2,938.63)	(\$0.07)	(\$5.55)
NET RETURN TO LABOR-MGT	\$10,761.29	\$0.30	\$26.76	\$8,375.16	\$0.21	\$15.83

* Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

** Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.2 Soybean Cost-Return Budget¹⁷

Table 12. Cost-return projections for soybean crops in the Elk River Watershed, 2006.

Soybeans	Yield Level (bu)		
	25	35	45
Income Per Acre			
A. Yield per acre	25	35	45
B. Price per bushel	\$6.08	\$6.08	\$6.08
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$162.48	\$224.19	\$285.90
Costs Per Acre			
1. Seed	\$30.60	\$30.60	\$32.95
2. Herbicide	8.86	8.86	8.86
3. Insecticide/Fungicide			
4. Fertilizer and Lime	16.41	17.70	21.20
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	73.03	77.25	80.22
10. Non-machinery Labor	8.25	8.75	9.06
11. Irrigation			
12. Land Charge/Rent	34.40	43.00	51.60
G. Sub Total	\$178.55	\$193.14	\$210.89
13. Interest on ½ Nonland Costs	6.49	6.76	7.17
H. Total Costs	\$185.03	\$199.89	\$218.06
I. Returns Over Costs (F-H)	-\$22.56	\$24.30	\$67.84
J. Total Costs/bushel (H/A)	\$7.40	\$5.71	\$4.85
K. Return To Annual Cost (I+13)/G	-9.00%	16.08%	35.57%

Table 13. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average and 2006 Nonirrigated Soybeans.²⁶

	2001-2005 Average			2006		
Number of Farms	71			49		
Crop Acres	476			442		
Acres Owned	113			101		
Acres Rented	362			342		
Yield / Acre	26			26		
Bushels	10,662			8,906		
Operator Percentage	80.73%			78.77%		
Gross Income / Acre	\$149.07			\$148.18		
Variable Costs / Acre	\$94.54			\$105.63		
Total Expense / Acre	\$145.78			\$154.47		
Gross Income / Bushel	\$8.65			\$7.35		
Total Expense / Bushel	\$6.50			\$7.67		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Soybeans (Operator's Share)	\$58,623.37	\$5.52	\$123.68	\$56,216.35	\$6.31	\$127.19
Patronage Refunds	\$300.71	0.03	0.63	\$402.25	0.05	0.91
Government Payments	\$9,645.70	0.90	20.28	\$5,941.08	0.67	13.44
Miscellaneous Income	\$23.47	0.00	0.05	(\$1.98)	(0.00)	(0.00)
Crop Insurance Proceeds	\$2,103.68	0.20	4.42	\$2,937.50	0.33	6.65
OTHER INCOME	\$12,073.55	\$1.13	\$25.39	\$9,278.85	\$1.04	\$20.99
GROSS INCOME	\$70,896.91	\$6.65	\$149.07	\$65,495.20	\$7.35	\$148.18
EXPENSES:						
Labor Hired	\$2,364.92	\$0.22	\$4.97	\$3,016.89	\$0.34	\$6.83
General Machinery Repairs	\$5,957.40	0.56	12.53	\$5,633.38	0.63	12.75
Interest Paid	\$4,288.15	0.40	9.02	\$4,077.73	0.46	9.23
Seed / Other Crop Expense	\$8,987.19	0.84	18.90	\$10,131.36	1.14	22.92
Crop Insurance	\$2,024.04	0.19	4.26	\$2,890.62	0.32	6.54
Fertilizer / Lime	\$1,917.37	0.18	4.03	\$2,658.14	0.30	6.01
Machine Hire - Lease	\$2,164.97	0.20	4.55	\$1,534.20	0.17	3.47
Farm Org Fees / Travel / Publ	\$859.88	0.06	1.39	\$795.70	0.09	1.80
Gas / Fuel / Oil	\$3,999.51	0.38	8.41	\$5,529.03	0.62	12.51
Crop Storage & Marketing	\$343.58	0.03	0.72	\$290.45	0.03	0.66
Personal Property Tax	\$283.04	0.03	0.60	\$305.12	0.03	0.69
General Farm Insurance	\$1,112.99	0.10	2.34	\$1,079.54	0.12	2.44
Utilities	\$932.69	0.09	1.96	\$797.39	0.09	1.80
Cash Farm Rent	\$3,457.04	0.32	7.27	\$2,897.97	0.33	6.56
Herbicide / Insecticide	\$6,090.26	0.57	12.81	\$4,872.54	0.55	11.02
Conservation	\$44.19	0.00	0.09	\$0.20	0.00	0.00
Auto Expense	\$334.90	0.03	0.70	\$177.81	0.02	0.40
TOTAL VARIABLE COSTS	\$44,962.11	\$4.22	\$94.54	\$46,688.07	\$5.24	\$105.63
RETURN ABOVE VARIABLE COSTS	\$25,934.80	\$2.43	\$54.53	\$18,807.13	\$2.11	\$42.55
FIXED COSTS:						
Depreciation	\$8,254.98	0.77	17.36	\$8,348.84	0.94	18.89
Real Estate Tax	\$1,057.10	0.10	2.22	\$922.51	0.10	2.09
Unpaid Operator Labor	\$8,002.74	0.75	16.83	\$8,059.39	0.88	13.71
Interest Charge *	\$894.65	0.09	2.09	\$1,152.23	0.13	2.61
TOTAL FIXED COSTS	\$18,309.47	\$1.72	\$38.50	\$16,482.97	\$1.85	\$37.29
Land Charge **	\$6,060.95	\$0.57	\$12.74	\$5,103.12	\$0.57	\$11.55
TOTAL EXPENSE	\$69,332.53	\$6.50	\$145.78	\$68,274.16	\$7.67	\$154.47
NET RETURN TO MANAGEMENT	\$1,564.38	\$0.15	\$3.29	(\$2,778.96)	(\$0.31)	(\$6.29)
NET RETURN TO LABOR-MGT	\$11,932.05	\$1.12	\$25.09	\$6,297.32	\$0.71	\$14.25

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.3 Wheat Cost-Return Budget¹⁷

Table 14. Cost-return projections for wheat crops in the Elk River Watershed, 2006.

Wheat	Yield Level (bu)		
	35	45	55
Income Per Acre			
A. Yield per acre	35	45	55
B. Price per bushel	\$4.41	\$4.41	\$4.41
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$164.83	\$209.84	\$254.85
Costs Per Acre			
1. Seed	\$9.90	\$9.90	\$9.90
2. Herbicide	2.75	2.75	2.75
3. Insecticide/Fungicide			
4. Fertilizer and Lime	36.65	43.71	52.06
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	60.61	63.62	66.63
10. Non-machinery Labor	6.85	7.19	7.53
11. Irrigation			
12. Land Charge/Rent	34.40	43.00	51.60
G. Sub Total	\$158.16	\$177.17	\$197.47
13. Interest on ½ Nonland Costs	5.57	6.04	6.56
H. Total Costs	\$163.73	\$183.20	\$204.04
I. Returns Over Costs (F-H)	\$1.10	\$26.64	\$50.81
J. Total Costs/bushel (H/A)	\$4.68	\$4.07	\$3.71
K. Return To Annual Cost (I+13)/G	4.22%	18.44%	29.06%

Table 15. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average and 2006 Nonirrigated Wheat.²⁶

	2001-2005 Average			2006		
Number of Farms	73			48		
Crop Acres	429			524		
Acres Owned	93			126		
Acres Rented	337			398		
Yield / Acre	45			40		
Bushels	15,355			18,758		
Operator Percentage	79.19%			80.78%		
Gross Income / Acre	\$136.15			\$157.92		
Variable Costs / Acre	\$88.81			\$106.21		
Total Expense / Acre	\$133.82			\$156.76		
Gross Income / Bushel	\$3.81			\$4.94		
Total Expense / Bushel	\$3.74			\$4.90		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Wheat (Operator's Share)	\$50,409.65	\$3.28	\$117.45	\$73,816.79	\$4.40	\$140.87
Patronage Refunds	\$398.25	0.03	0.93	\$692.50	0.04	1.32
Government Payments	\$6,980.10	0.45	16.26	\$8,865.51	0.41	13.10
Miscellaneous Income	\$37.94	0.00	0.09	\$24.76	0.00	0.05
Crop Insurance Proceeds	\$610.26	0.04	1.42	\$1,349.38	0.08	2.58
OTHER INCOME	\$8,026.55	\$0.52	\$18.70	\$8,932.15	\$0.53	\$17.05
GROSS INCOME	\$58,436.20	\$3.81	\$136.15	\$82,748.94	\$4.94	\$157.92
EXPENSES:						
Labor Hired	\$2,586.56	\$0.17	\$5.98	\$3,476.58	\$0.21	\$6.63
General Machinery Repairs	\$5,037.99	0.33	11.74	\$6,209.33	0.37	11.85
Interest Paid	\$3,870.05	0.25	9.02	\$5,123.84	0.31	9.78
Seed / Other Crop Expense	\$2,889.10	0.17	6.22	\$4,401.92	0.26	8.40
Crop Insurance	\$1,180.39	0.08	2.75	\$2,280.47	0.14	4.35
Fertilizer / Lime	\$11,256.34	0.73	26.23	\$18,173.35	1.08	34.68
Machine Hire - Lease	\$1,570.07	0.10	3.66	\$852.43	0.05	1.63
Farm Org Fees / Travel / Publ	\$528.11	0.03	1.23	\$628.46	0.04	1.20
Gas / Fuel / Oil	\$3,361.19	0.22	7.83	\$5,860.11	0.35	11.18
Crop Storage & Marketing	\$286.55	0.02	0.67	\$383.48	0.02	0.73
Personal Property Tax	\$219.98	0.01	0.51	\$282.79	0.02	0.54
General Farm Insurance	\$985.82	0.06	2.30	\$1,416.01	0.08	2.70
Utilities	\$748.60	0.05	1.74	\$778.21	0.05	1.49
Cash Farm Rent	\$2,512.88	0.16	5.85	\$2,920.36	0.17	5.57
Herbicide / Insecticide	\$1,088.84	0.07	2.54	\$2,669.37	0.16	5.09
Conservation	\$46.99	0.00	0.11	\$0.39	0.00	0.00
Auto Expense	\$185.99	0.01	0.43	\$198.85	0.01	0.38
TOTAL VARIABLE COSTS	\$38,115.46	\$2.48	\$88.81	\$55,655.75	\$3.32	\$106.21
RETURN ABOVE VARIABLE COSTS	\$20,320.74	\$1.32	\$47.35	\$27,093.19	\$1.62	\$51.70
Depreciation	\$7,038.32	0.46	16.40	\$9,641.06	0.58	18.40
Real Estate Tax	\$745.82	0.05	1.74	\$1,177.16	0.07	2.25
Unpaid Operator Labor	\$6,218.48	0.40	14.49	\$6,997.50	0.42	13.35
Interest Charge *	\$683.69	0.04	1.55	\$994.86	0.06	1.90
TOTAL FIXED COSTS	\$14,686.31	\$0.96	\$34.17	\$18,810.58	\$1.12	\$35.90
Land Charge **	\$4,654.48	\$0.30	\$10.84	\$7,675.82	\$0.46	\$14.65
TOTAL EXPENSE	\$57,436.25	\$3.74	\$133.82	\$82,142.15	\$4.90	\$156.76
NET RETURN TO MANAGEMENT	\$999.95	\$0.07	\$2.33	\$606.79	\$0.04	\$1.16
NET RETURN TO LABOR-MGT	\$9,785.00	\$0.64	\$22.80	\$11,080.87	\$0.66	\$21.15

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.4 Grain Sorghum Cost-Return Budget¹⁷

Table 16. Cost-return projections for grain sorghum crops in the Elk River Watershed, 2006.

Grain Sorghum	Yield Level (bu)		
	70	85	110
Income Per Acre			
A. Yield per acre	70	85	110
B. Price per bushel	\$2.82	\$2.82	\$2.82
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$207.88	\$207.88	\$207.88
Costs Per Acre			
1. Seed	\$12.29	\$12.29	\$12.29
2. Herbicide	20.34	20.34	20.34
3. Insecticide/Fungicide	5.90	5.90	5.90
4. Fertilizer and Lime	39.68	43.64	50.24
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	82.39	86.92	94.47
10. Non-machinery Labor	9.31	9.82	10.68
11. Irrigation			
12. Land Charge/Rent	34.40	43.00	51.60
G. Sub Total	\$211.30	\$228.90	\$252.51
13. Interest on ½ Nonland Costs	7.96	8.37	9.04
H. Total Costs	\$219.26	\$237.27	\$261.55
I. Returns Over Costs (F-H)	-\$11.38	\$13.82	\$60.95
J. Total Costs/bushel (H/A)	\$3.13	\$2.79	\$2.38
K. Return To Annual Cost (I+13)/G	-1.62%	9.69%	27.72%

Table 17. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average and 2006 Nonirrigated Sorghum.²⁶

	2001-2005 Average			2006		
Number of Farms	50			20		
Crop Acres	231			206		
Acres Owned	46			20		
Acres Rented	185			186		
Yield / Acre	80			63		
Bushels	14,154			9,948		
Operator Percentage	76.56%			77.01%		
Gross Income / Acre	\$147.94			\$162.55		
Variable Costs / Acre	\$109.23			\$123.03		
Total Expense / Acre	\$161.11			\$169.51		
Gross Income / Bushel	\$2.42			\$3.37		
Total Expense / Bushel	\$2.63			\$3.51		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Grain Sorghum (Operator's Share)	\$26,484.90	\$2.01	\$123.10	\$28,576.75	\$2.87	\$138.72
Patronage Refunds	\$183.45	0.01	0.79	\$244.77	0.02	1.19
Government Payments	\$5,171.17	0.37	22.35	\$3,028.68	0.30	14.70
Miscellaneous Income	\$15.62	0.00	0.07	(\$5.39)	(0.00)	(0.03)
Crop Insurance Proceeds	\$377.57	0.03	1.63	\$1,841.25	0.16	7.97
OTHER INCOME	\$5,747.80	\$0.41	\$24.84	\$4,909.31	\$0.49	\$23.83
GROSS INCOME	\$34,232.69	\$2.42	\$147.94	\$33,486.06	\$3.37	\$162.55
EXPENSES:						
Labor Hired	\$776.03	\$0.05	\$3.35	\$1,020.45	\$0.10	\$4.95
General Machinery Repairs	\$2,973.93	0.21	12.85	\$2,416.47	0.24	11.73
Interest Paid	\$1,990.96	0.14	8.60	\$1,830.30	0.18	8.88
Seed / Other Crop Expense	\$2,291.49	0.16	9.90	\$2,124.92	0.21	10.32
Crop Insurance	\$755.85	0.05	3.27	\$892.81	0.09	4.33
Fertilizer / Lime	\$6,805.97	0.48	29.41	\$7,084.17	0.71	34.39
Machine Hire - Lease	\$887.87	0.06	3.75	\$349.53	0.04	1.70
Farm Org Fees / Travel / Publ	\$300.03	0.02	1.30	\$232.82	0.02	1.13
Gas / Fuel / Oil	\$1,957.06	0.14	8.46	\$2,555.35	0.26	12.40
Crop Storage & Marketing	\$159.04	0.01	0.69	\$238.19	0.02	1.16
Personal Property Tax	\$138.23	0.01	0.60	\$156.67	0.02	0.76
General Farm Insurance	\$555.12	0.04	2.40	\$480.42	0.05	2.38
Utilities	\$416.80	0.03	1.80	\$306.05	0.03	1.49
Cash Farm Rent	\$1,021.00	0.07	4.41	\$1,759.59	0.18	8.54
Herbicide / Insecticide	\$4,093.49	0.29	17.69	\$3,824.34	0.38	18.56
Conservation	\$23.29	0.00	0.10	\$0.00	-	-
Auto Expense	\$148.86	0.01	0.64	\$63.88	0.01	0.31
TOTAL VARIABLE COSTS	\$25,275.01	\$1.79	\$109.23	\$25,344.96	\$2.55	\$123.03
RETURN ABOVE VARIABLE COSTS	\$8,957.68	\$0.63	\$38.71	\$8,141.10	\$0.82	\$39.52
Depreciation	\$4,067.83	0.29	17.58	\$3,728.53	0.37	18.10
Real Estate Tax	\$417.68	0.03	1.81	\$335.16	0.03	1.63
Unpaid Operator Labor	\$4,148.64	0.29	17.93	\$3,421.13	0.34	16.61
Interest Charge *	\$809.19	0.06	3.50	\$775.81	0.08	3.77
TOTAL FIXED COSTS	\$9,443.33	\$0.67	\$40.81	\$8,260.63	\$0.83	\$40.10
Land Charge **	\$2,562.55	\$0.18	\$11.07	\$1,313.88	\$0.13	\$6.38
TOTAL EXPENSE	\$37,280.89	\$2.63	\$161.11	\$34,919.47	\$3.51	\$169.51
NET RETURN TO MANAGEMENT	(\$3,048.20)	(\$0.22)	(\$13.17)	(\$1,433.41)	(\$0.14)	(\$6.96)
NET RETURN TO LABOR-MGT	\$1,876.47	\$0.13	\$8.11	\$3,008.17	\$0.30	\$14.60

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.5 Alfalfa Cost-Return Budget¹⁷

Table 18. Cost-return projections for alfalfa crops in the Elk River Watershed, 2006.

Alfalfa	Yield Level (ton)		
	3.0	3.5	4.0
Income Per Acre			
A. Yield per acre	3.0	3.5	4.0
B. Price per bushel	\$101.00	\$101.00	\$101.00
C. Net government payment	\$12.30	\$13.37	\$14.44
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$315.30	\$366.87	\$418.44
Costs Per Acre			
1. Seed	\$10.17	\$10.17	\$10.17
2. Herbicide	2.51	2.51	2.51
3. Insecticide/Fungicide	7.08	7.08	7.08
4. Fertilizer and Lime	19.90	26.89	33.88
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	6.38	6.38	6.38
9. Custom Hire / Machinery Expense	109.42	118.08	126.61
10. Non-machinery Labor	12.36	13.34	14.31
11. Irrigation			
12. Land Charge/Rent	31.60	39.50	47.40
G. Sub Total	\$199.43	\$223.96	\$248.34
13. Interest on ½ Nonland Costs	7.55	8.30	9.04
H. Total Costs	\$206.98	\$232.26	\$257.38
I. Returns Over Costs (F-H)	\$108.32	\$134.61	\$161.06
J. Total Costs/bushel (H/A)	\$68.99	\$66.36	\$64.35
K. Return To Annual Cost (I+13)/G	58.10%	63.81%	68.50%

Table 19. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average and 2006 Nonirrigated Alfalfa.²⁶

	2001-2005 Average			2006		
Number of Farms	13			10		
Crop Acres	141			158		
Acres Owned	31			10		
Acres Rented	110			148		
Yield / Acre	3.3			2.4		
Tons	400			317		
Operator Percentage	84.86%			83.95%		
Gross Income / Acre	\$233.47			\$246.44		
Variable Costs / Acre	\$157.84			\$169.51		
Total Expense / Acre	\$227.09			\$226.92		
Gross Income / Ton	\$82.37			\$122.83		
Total Expense / Ton	\$80.12			\$113.10		
	Total Dollars	\$/Ton	\$/Acre	Total Dollars	\$/Ton	\$/Acre
INCOME:						
Alfalfa (Operator's Share)	\$30,468.04	\$78.10	\$215.69	\$38,468.80	\$115.04	\$230.82
Patronage Refunds	\$146.31	0.37	1.04	\$81.22	0.26	0.51
Government Payments	\$2,240.67	5.60	15.87	\$2,558.32	8.07	16.19
Miscellaneous Income	\$122.68	0.31	0.87	(\$171.53)	(0.54)	(1.09)
OTHER INCOME	\$2,509.66	\$6.27	\$17.77	\$2,468.01	\$7.79	\$15.62
GROSS INCOME	\$32,965.70	\$82.37	\$233.47	\$38,936.81	\$122.83	\$246.44
EXPENSES:						
Labor Hired	\$1,925.16	\$4.81	\$13.63	\$2,991.95	\$9.34	\$18.75
General Machinery Repairs	\$2,812.30	7.28	20.63	\$2,898.55	9.14	18.35
Interest Paid	\$2,045.40	5.11	14.49	\$2,090.90	6.60	13.23
Seed / Other Crop Expense	\$1,719.19	4.30	12.18	\$2,812.50	8.87	17.80
Crop Insurance	\$371.29	0.93	2.63	\$80.00	0.19	0.38
Fertilizer / Lime	\$2,595.20	6.48	18.38	\$2,223.55	7.01	14.07
Machine Hire - Lease	\$3,508.54	8.77	24.86	\$4,540.56	14.32	28.74
Farm Org Fees / Travel / Publ	\$639.87	1.60	4.53	\$306.15	0.97	1.94
Gas / Fuel / Oil	\$1,209.12	3.02	8.59	\$1,786.21	5.63	11.31
Crop Storage & Marketing	\$180.84	0.45	1.28	\$147.76	0.47	0.94
Personal Property Tax	\$185.47	0.48	1.31	\$167.51	0.59	1.19
General Farm Insurance	\$539.39	1.35	3.82	\$825.63	2.60	5.23
Utilities	\$796.46	1.99	5.64	\$204.08	0.64	1.29
Cash Farm Rent	\$1,851.47	4.63	13.11	\$3,112.69	9.82	19.70
Herbicide / Insecticide	\$1,683.03	4.21	11.92	\$2,497.13	7.88	15.80
Conservation	\$24.43	0.06	0.17	\$0.13	0.00	0.00
Auto Expense	\$99.50	0.25	0.70	\$126.75	0.40	0.80
TOTAL VARIABLE COSTS	\$22,287.65	\$55.69	\$157.84	\$26,782.25	\$84.49	\$169.51
RETURN ABOVE VARIABLE COSTS	\$10,678.05	\$26.68	\$75.62	\$12,154.56	\$38.34	\$76.93
Depreciation	\$3,138.56	7.84	22.23	\$4,010.39	12.65	25.38
Real Estate Tax	\$373.53	0.93	2.65	\$278.01	0.88	1.77
Unpaid Operator Labor	\$3,236.12	8.09	22.92	\$2,916.00	9.20	18.46
Interest Charge *	\$314.16	0.79	2.22	\$687.45	2.17	4.35
TOTAL FIXED COSTS	\$7,062.36	\$17.65	\$50.02	\$7,892.85	\$24.90	\$49.95
Land Charge **	\$2,715.60	\$6.79	\$19.23	\$1,178.81	\$3.72	\$7.46
TOTAL EXPENSE	\$32,065.61	\$80.12	\$227.09	\$35,853.91	\$113.10	\$226.92
NET RETURN TO MANAGEMENT	\$900.09	\$2.25	\$6.37	\$3,082.90	\$9.73	\$19.51
NET RETURN TO LABOR-MGT	\$6,061.36	\$15.15	\$42.93	\$8,990.65	\$28.27	\$56.71

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.6 Common Cropland BMPs in Elk River Watershed

BMPs help reduce the amount of soil and nutrients that run off of cropland fields. Keeping these valuable inputs (soil and nutrients) in the field can be of benefit to both the landowner/producer and to society as a whole. Here are just a couple of the benefits:

1. Top soil savings can result in higher yields and lower fertilizer costs.
2. Certain BMPs can offer both water quality protection and wildlife habitat.

Below are some of the more popular BMPs in use throughout the state of Kansas and in the Elk River Watershed.

Contour farming²⁴ is farming the land, tillage and planting of the crop, on the level around the hill. By doing this, each furrow or ridge left by the different implements acts as a miniature dam, trapping water, allowing more to soak into the ground. Each row of crop also slows the water. Combined, less water runs off. Soil is erosion reduced. Crop yields are increased in arid areas.

Grassed waterways²⁵ are used as outlets to prevent silt and gully formation. The vegetation cover slows the water flow and minimizes channel surface erosion. They can also be used as outlets for water from terraces.

Vegetative buffers²⁵ are areas of land that are maintained in permanent vegetation to help reduce nutrient and sediment loss from agricultural fields, improve runoff water quality, and provide habitat for wildlife. Because of these societal benefits, there are several federal and state programs that encourage the installation and maintenance of vegetative buffers.

No-till²⁵ is a form of conservation tillage in which chemicals are used in place of tillage for weed control and seedbed preparation. In other words, the soil surface is never disturbed except for planting or drilling operations in a 100 percent no-till system. Two other forms of tillage, **reduced tillage** and **rotational no-till**, involve a light to moderate use of tillage equipment. These forms of tillage also control erosion and nutrient runoff, but are not as effective as 100 percent no-till.

Terraces²⁵ are embankments constructed perpendicular to the slope of the field and are designed to reduce the length of a field slope and catch water flowing off the slope. Terraces reduce the rate of runoff and allow soil particles to settle out.

Streambank stabilization²⁵ projects can reduce the amount of streambank erosion and help prevent the loss of valuable cropland. Stabilization techniques reduce streambank erosion through diverting and/or slowing the movement of water in a stream channel. Some methods that can be employed include bendway-weirs, stone toes, pools and riffles, stream barbs, and willow post plantings.

The following pages contain typical BMP budgets and economic analyses for vegetative buffers and streambank stabilization projects in the Elk River Watershed. These reports were generated using the KSU-Vegetative Buffer and KSU-Streambank Stabilization Decision-Making Tools²⁷.

7.6.1 Vegetative Buffer: Economic Analysis

Your project area is located in Elk County, Kansas. Your project area (buffer size) is 1.0 acres.

The results are based upon the following assumptions:

One time Costs: \$187.28	One time Cost-Share Payments: \$268.55	Time Period Selected: 10 years
Annual Costs: \$6.67	Annual Incentive Payments: \$69.52	Opportunity Cost of Your Money: 5.00%

The first year out-of-pocket costs of the vegetative buffer would be **\$0.00** this accounts for any cost-share payments you may receive.

Based on the information you have provided, a vegetative buffer on the project area would **return \$72.16** per acre annually.

Based on the information you have provided, a vegetative buffer on the project area would **return \$72.16** annually.

Based on the information you have provided, cropland on the project area would return **\$47.97** per acre annually.

Based on the information you have provided, cropland on the project area would return **\$47.97** annually.

Take Home Message:

You would be **\$24.19** per year **better off** installing this area to a vegetative buffer versus using it for crop production.

Discussion

In order to effectively compare scenarios which occur over multiple years (10 to 15 years), we must convert all costs and returns to today's dollars (e.g., 2008 dollars).

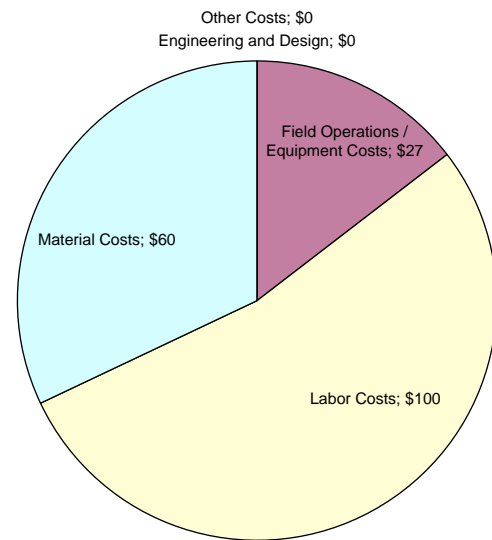
Net Present Value calculations convert future values into today's dollars. The net present value analysis uses a discount factor to equate a series of future cash flows into an equivalent amount of cash today. For example, if you are considering enrolling land into a 15 year Continuous Conservation Reserve Program (CRP) program, the projected net income in years 2 through 15 is discounted back to its equivalent value in today's dollars. Because a dollar today can earn interest until next year, it will be valued more highly than a dollar received in the future

For more information regarding the economics of vegetative buffers, check out K-State Research and Extension publication MF-2536 "Using Conservation Buffers to Protect Water Quality and Enhance Agricultural Profitability." <http://www.oznet.ksu.edu/library/h20ql2/mf2536.pdf>

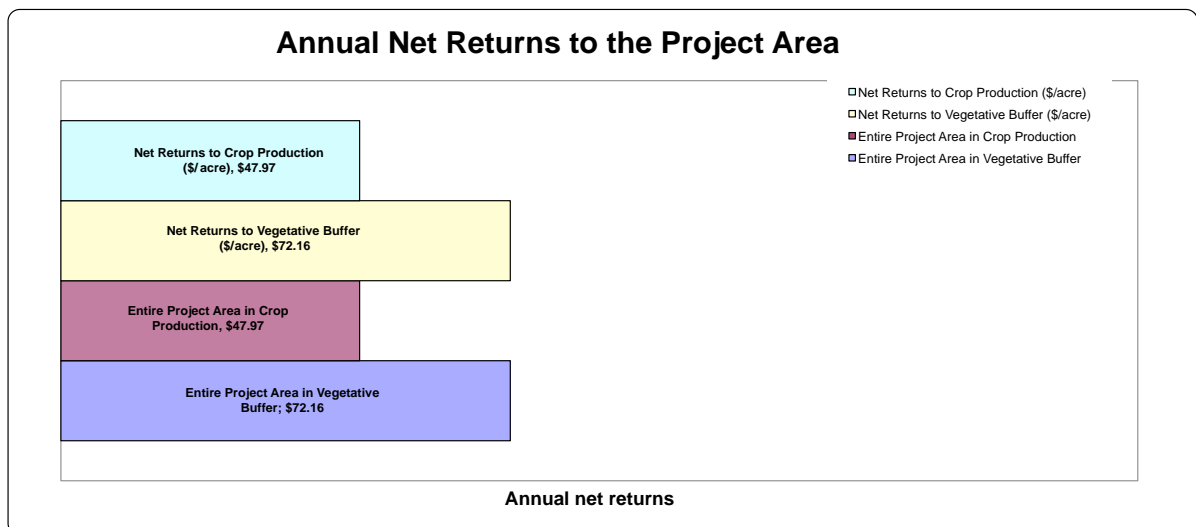
For vegetative buffer assistance, be sure to contact your local county conservation district. A Kansas Conservation District Directory can be found at: http://scc.ks.gov/index.php?option=com_content&task=view&id=779&Itemid=178

If you have any questions regarding this decision-making tool, please contact:
 Craig Smith
 Ph.D. Graduate Student
 Kansas State University
craigsmith@agecon.ksu.edu

One Time Costs of the Vegetative Buffer



Annual Net Returns to the Project Area



Budget information for the vegetative buffer project

General Data For Vegetative Buffer			
Discount Rate	5.00%		
Cropland Rental Rate - not CCRP rental rate	\$42.22	per acre/year	
Annual Cropland Rental Growth Rate	3.07%		
Total Annual Costs	\$6.67	per acre/year	
Inflation Rate of Annual Costs	4.00%		
Project Length (feet)	660		
Project Width (feet)	66		
Acres (length x width/43,560)	1.00		
Length of analysis (years)	10		
Cropland Property Tax (\$/acre)	\$5.00		
Tame Grass Property Tax (\$/acre)	\$5.00		
Costs		Payments Received	
Total one-time	\$187.28	Total one-time	\$268.55
Total annual	\$6.67	Total annual	\$69.52

Net Present Value Table: Vegetative Buffer (per acre)					
Year	One Time Costs	Annual Costs	One Time Payments	Annual Payments	Net Property Tax Impact
0	\$187.28	\$0.00	\$268.55	\$0.00	\$0.00
1	\$0.00	\$6.67	\$0.00	\$69.52	\$0.00
2	\$0.00	\$6.94	\$0.00	\$69.52	\$0.00
3	\$0.00	\$7.21	\$0.00	\$69.52	\$0.00
4	\$0.00	\$7.50	\$0.00	\$69.52	\$0.00
5	\$0.00	\$7.80	\$0.00	\$69.52	\$0.00
6	\$0.00	\$8.12	\$0.00	\$69.52	\$0.00
7	\$0.00	\$8.44	\$0.00	\$69.52	\$0.00
8	\$0.00	\$8.78	\$0.00	\$69.52	\$0.00
9	\$0.00	\$9.13	\$0.00	\$69.52	\$0.00
10	\$0.00	\$9.49	\$0.00	\$69.52	\$0.00
11	\$0.00	-	\$0.00	-	\$0.00
12	\$0.00	-	\$0.00	-	\$0.00
13	\$0.00	-	\$0.00	-	\$0.00
14	\$0.00	-	\$0.00	-	\$0.00
15	\$0.00	-	\$0.00	-	\$0.00
Sum totals	\$187.28	\$80.08	\$268.55	\$695.20	\$0.00
Present Value	\$187.28	\$60.87	\$268.55	\$536.82	\$0.00
Net Present Value	\$557.22				
Annualized Value	\$72.16				

NPV Table: Cropland Rent (per acre)	
Year	Rent
0	\$0.00
1	\$42.22
2	\$43.52
3	\$44.85
4	\$46.23
5	\$47.65
6	\$49.11
7	\$50.62
8	\$52.17
9	\$53.77
10	\$55.43
11	-
12	-
13	-
14	-
15	-
Sum totals	\$485.57
Present Value	\$370.42
Net Present Value	\$370.42
Annualized Value	\$47.97

Net Present Value Table: Vegetative Buffer (total project area)					
Year	One Time Costs	Annual Costs	One Time Payments	Annual Payments	Net Property Tax Impact
0	\$187.28	\$0.00	\$268.55	\$0.00	\$0.00
1	\$0.00	\$6.67	\$0.00	\$69.52	\$0.00
2	\$0.00	\$6.94	\$0.00	\$69.52	\$0.00
3	\$0.00	\$7.21	\$0.00	\$69.52	\$0.00
4	\$0.00	\$7.50	\$0.00	\$69.52	\$0.00
5	\$0.00	\$7.80	\$0.00	\$69.52	\$0.00
6	\$0.00	\$8.12	\$0.00	\$69.52	\$0.00
7	\$0.00	\$8.44	\$0.00	\$69.52	\$0.00
8	\$0.00	\$8.78	\$0.00	\$69.52	\$0.00
9	\$0.00	\$9.13	\$0.00	\$69.52	\$0.00
10	\$0.00	\$9.49	\$0.00	\$69.52	\$0.00
11	\$0.00	-	\$0.00	-	\$0.00
12	\$0.00	-	\$0.00	-	\$0.00
13	\$0.00	-	\$0.00	-	\$0.00
14	\$0.00	-	\$0.00	-	\$0.00
15	\$0.00	-	\$0.00	-	\$0.00
Sum totals	\$187.28	\$80.08	\$268.55	\$695.20	\$0.00
Present Value	\$187.28	\$60.87	\$268.55	\$536.82	\$0.00
Net Present Value	\$557.22				
Annualized Value	\$72.16				

NPV Table: Cropland Rental Rate (total project area)	
Year	Rent
0	\$0.00
1	\$42.22
2	\$43.52
3	\$44.85
4	\$46.23
5	\$47.65
6	\$49.11
7	\$50.62
8	\$52.17
9	\$53.77
10	\$55.43
11	-
12	-
13	-
14	-
15	-
Sum totals	\$485.57
Present Value	\$370.42
Net Present Value	\$370.42
Annualized Value	\$47.97

7.6.2 Streambank Stabilization: Economic Analysis

Your project area is located in Elk County, Kansas on a 80 acre field. Your project area is: 4.55 acres in size.

The results are based upon the following assumptions:

One time Costs: **\$18,495.60** One time Cost-Share Payments: **\$9,702.30** Time Period Selected: **10 years**
Annual Costs: **\$30.32** Annual Incentive Payments: **\$316.00** Opportunity Cost of Your Money: **5.00%**

The first year out-of-pocket costs of the streambank project would be **\$8,793.30**. This accounts for any cost-share payments you may receive.

Based on the information you have provided, a streambank stabilization project could potentially save **2.00** acres annually.

Take Home Message:

If you consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

You would be **\$1,776.09** per year **better off** by stabilizing this streambank versus doing nothing.

A streambank project would **return \$13,714.49** in total over the 10 year time period you have selected.

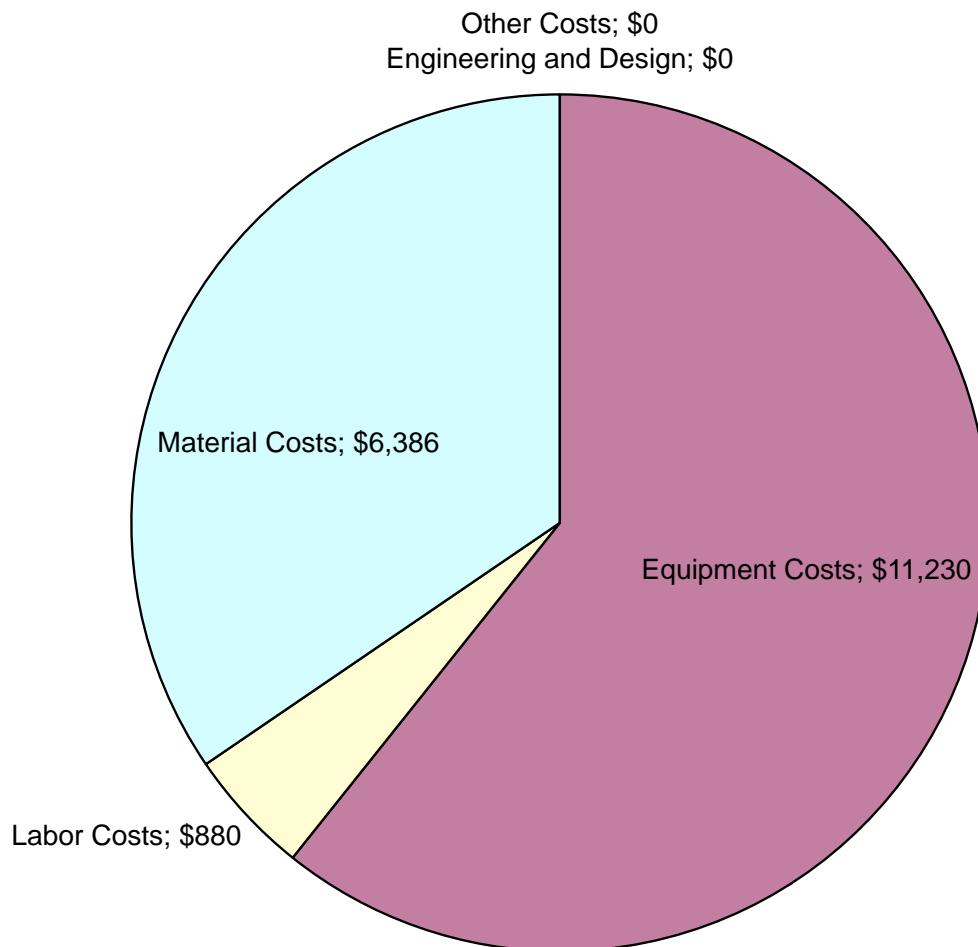
If you DO NOT consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

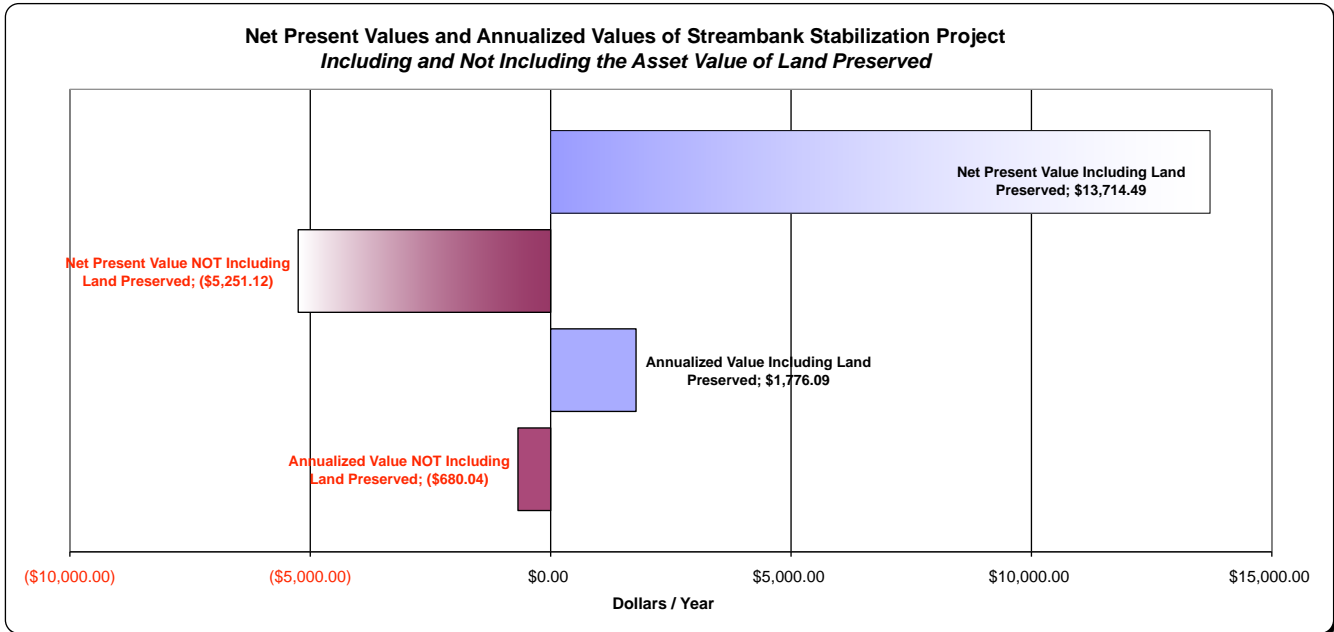
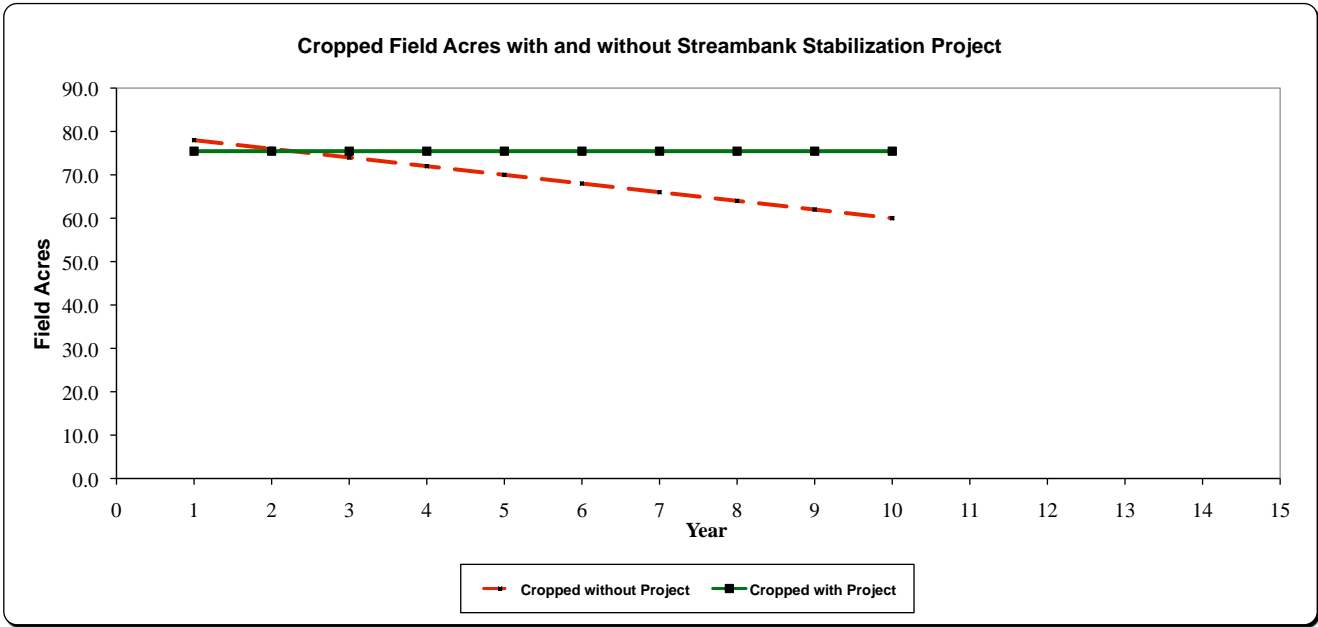
You would be **(\$680.04)** per year **worse off** by stabilizing this streambank versus doing nothing.

A streambank project would **lose (\$5,251.12)** in total over the 10 year time period you have selected.

The asset value of the land that is preserved by the project is a real value that should probably be considered in your decision-making. It is, however, a value that would not be realized as cash until the property is sold.

One Time Costs of the Streambank Stabilization Project





Discussion

In general, the **benefits** of a streambank stabilization project come in the form of: value of acres not lost to erosion, income from being able to crop the preserved acres not in CCRP acres, cost-share and incentive payments, and tax breaks from the reclassification of ag land.

The **costs** of a streambank stabilization project come in the form of: one time installation costs, annual maintenance costs, and the initial loss of cropping income from cropland being taken out of production and enrolled into CCRP.

In order to effectively compare scenarios which occur over multiple years (10 to 15 years), we must convert all costs and returns to today's dollars (e.g., 2008 dollars).

Net Present Value calculations convert future values into today's dollars. The net present value analysis uses a discount factor to equate a series of future cash flows into an equivalent amount of cash today. For example, if you are considering enrolling land into a 15 year Continuous Conservation Reserve Program (CRP) program, the projected net income in years 2 through 15 is discounted back to its equivalent value in today's dollars. Because a dollar today can earn interest until next year, it will be valued more highly than a dollar received in the future

For streambank stabilization assistance, be sure to contact your local county conservation district. A Kansas Conservation District Directory can be found at: http://scc.ks.gov/index.php?option=com_content&task=view&id=779&Itemid=178

If you have any questions regarding this Decision-Making Tool, please contact:
 Craig Smith
 Ph.D. Graduate Student Kansas State University
 craigsmith@agecon.ksu.edu

Budget information for the streambank stabilization project

General Data For Streambank Stabilization			
Discount Rate	5.00%		
Cropland Value	\$1,010.00	per acre	
Annual Cropland Value Growth Rate	4.34%		
Cropland Rental Rate - not CCRP rental rate	\$42.22	per acre / year	
Annual Cropland Rental Growth Rate	3.07%		
Total Annual Costs	\$6.67	per acre / year	
Inflation Rate of Annual Costs	4.00%		
Project Length (feet)			1,980
Project Width (feet)			100
Acres (length x width/43,560)			4.55
Estimated acreage lost over time period			20.00
Value of estimated acreage lost	20 acres	@ \$1,010.00 per acre	\$20,200.00
Estimated average annual acreage lost over period of	10 yr.		2.00
Estimated acreage preserved over	10 yr.		20.00
Value of estimated acres preserved	20.00 acres	@ \$1,544.65 per acre	\$30,892.97
Cropland Property Tax (\$/acre)			\$9.88
Tame Grass Property Tax (\$/acre)			\$9.88
Costs		Payments	
Total one-time	\$18,495.60	Total one-time	\$9,702.30
Total annual	\$30.32	Total annual	\$316.00

Land Effects

Year	Net Acres for Income	Rental Rate \$/Ac	Rental Rate Effect	Total Acres Preserved	Land Value \$/Ac	Total Additional Value	Property Tax Cropland \$/Ac	Property Tax Tame Grass \$/Ac	With Project			Without Project			Net Property Tax Impact	CCRP Acres	Net Cropland Preserved	Total Saved
									CCRP Acres	Crop Acres	Property Tax	Crop Acres	Property Tax					
0	(4.55)	\$42.22	(\$191.91)	-	\$1,010.00		\$9.88	\$9.88	4.55	15.45	\$197.60	20.00	\$197.60	\$0.00	4.55	-	4.55	
1	(2.55)	\$43.52	(\$110.77)	2.00	\$1,053.83	\$0.00	\$10.18	\$10.18	4.55	15.45	\$203.67	20.00	\$203.67	\$0.00	4.55	-	4.55	
2	(0.55)	\$44.85	(\$24.46)	4.00	\$1,099.57	\$0.00	\$10.50	\$10.50	4.55	15.45	\$209.92	18.00	\$188.93	\$20.99	4.55	-	4.55	
3	1.45	\$46.23	\$67.24	6.00	\$1,147.29	\$0.00	\$10.82	\$10.82	4.55	15.45	\$216.36	16.00	\$173.09	\$43.27	4.55	1.45	6.00	
4	3.45	\$47.65	\$164.60	8.00	\$1,197.08	\$0.00	\$11.15	\$11.15	4.55	15.45	\$223.01	14.00	\$156.10	\$66.90	4.55	3.45	8.00	
5	5.45	\$49.11	\$267.88	10.00	\$1,249.04	\$0.00	\$11.49	\$11.49	4.55	15.45	\$229.85	12.00	\$137.91	\$91.94	4.55	5.45	10.00	
6	7.45	\$50.62	\$377.34	12.00	\$1,303.25	\$0.00	\$11.85	\$11.85	4.55	15.45	\$236.91	10.00	\$118.45	\$118.45	4.55	7.45	12.00	
7	9.45	\$52.17	\$493.27	14.00	\$1,359.81	\$0.00	\$12.21	\$12.21	4.55	15.45	\$244.18	8.00	\$97.67	\$146.51	4.55	9.45	14.00	
8	11.45	\$53.77	\$615.96	16.00	\$1,418.82	\$0.00	\$12.58	\$12.58	4.55	15.45	\$251.68	6.00	\$75.50	\$176.17	4.55	11.45	16.00	
9	13.45	\$55.43	\$745.72	18.00	\$1,480.40	\$0.00	\$12.97	\$12.97	4.55	15.45	\$259.40	4.00	\$51.88	\$207.52	4.55	13.45	18.00	
10	15.45	\$57.13	\$882.87	20.00	\$1,544.65	\$30,892.97	\$13.37	\$13.37	4.55	15.45	\$267.37	2.00	\$26.74	\$240.63	4.55	15.45	20.00	
11	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-	

7.7 Economic Contributions of Recreation at Elk City Lake^{28, 29, 30, 31, 32, 33, 34, 35}

This study estimated the regional economic effects arising from recreation at Elk City Lake (Figure 17). This analysis can help local Watershed Restoration & Protection Strategies leaders and others appreciate the value of preserving recreational amenities at Elk City Lake.

Elk City Lake is a 4,118 acre impoundment located in southeastern Kansas in the Verdigris River Basin. The watershed consists of 634 square miles in Butler, Chautauqua, Elk, Greenwood, Montgomery, and Wilson counties. Elk City Lake was built in 1966 by the U.S. Army Corps of Engineers (COE) for flood control, water supply, water quality, recreation, and fish and wildlife.

This analysis estimated two types of regional recreation effects associated with Elk City Lake. The first type includes the economic impact to the region arising from direct recreation expenditures in the area and the associated indirect effects which occur as the money “ripples” throughout the region. This impact is modeled using an economic accounting system that charts the financial connections between businesses, governments and households in the region.

In 2007, the Army COE reported 120,493 visits to Elk City Lake for a total of 1,482,006 visitor-hours from 10/2006 to 9/2007. Using this data (together with visitor-type and expenditure profiles shown in Tables 20 and 21 and Figure 18) and accounting for imported purchases, it was estimated that visitor expenditures generated \$1.08 million (2007\$) in direct economic activity (sales) within the regional economy, \$0.48 million in all types of income associated with the production of economic activities, and 24 area full- and part-time jobs. After calculating the indirect economic impacts, it was estimated that visitor expenditures were closely associated with \$1.41 million (2007\$) in overall economic activity, \$0.66 million in total income, and 28 jobs in the region. The total economic contributions to the local region are displayed in Table 22.

Not all of the economic effects of recreation are captured by observable market transactions. A second type of economic effect considered here includes certain non-market benefits derived through the self-reported value of participation in recreation activities. This notion acknowledges the value of benefit an individual experiences through participation in an activity exceeds what it actually costs, thereby motivating participation. These benefits are estimated through a process known as non-market valuation. Through surveys, economists have developed general estimates of what people report being willing to pay over and above what they actually are required to spend. This net willingness-to-pay value represents the additional incremental value of benefits afforded to the recreation participant. Net willingness-to-pay has been acknowledged by a U.S. governmental interagency committee as an appropriate measure of the economic benefits associated with outdoor recreation programs. Accepting the legitimacy of purported and generalized willingness-to-pay values and applying them to Elk City Lake recreation, it was estimated that Elk City Lake visitors receive up to \$3.71 million (2007\$) in additional non-market recreation benefits annually. The values by recreation activity are reported in Table 23.

On average, the annual visitation rates for Elk City Lake has remained stable from 1996-2007 (Figure 19). Among the 17 Army COE Lakes in Kansas, Elk City Lake ranked 16th in number of visits and 13th in terms of visitor-hours in 2007. A graphical comparison of visits and visitor-hours for all 17 Army COE reservoirs in Kansas can be found in Figures 20 and 21.

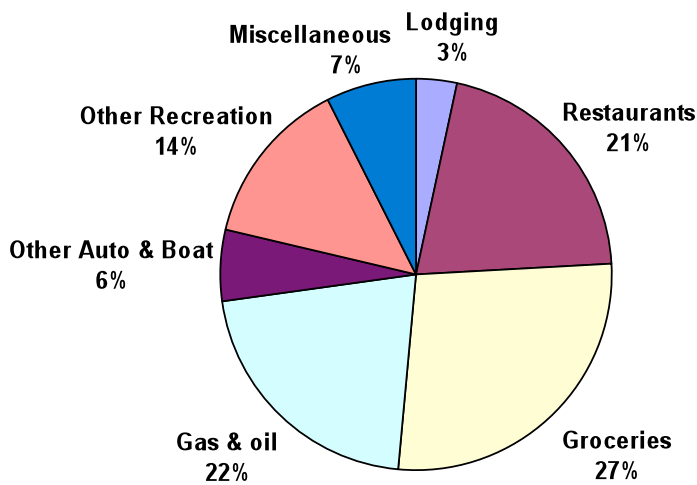


Figure 18. Trip spending by category

Table 22. Elk City Lake total economic contributions

Impact Measure	Direct	Indirect	Total
Output	\$1,079,216	\$332,057	\$1,411,273
Total Value Added	\$482,602	\$178,340	\$660,942
Employment	24	4	28

Table 23. Non-market benefits of Elk City Lake recreation, 2007\$

Activity	Days Spent in Activity	Activity Value per Day (2007\$)	Total Value per Year
Fish	52,117	\$38.58	\$2,010,730
Swim	28,158	\$19.75	\$556,064
Camp	15,067	\$29.54	\$445,061
Boat	10,127	\$27.45	\$277,962
Picnic	5,805	\$30.42	\$176,562
Other	12,227	\$19.94	\$243,773
Total	123,501	-----	\$3,710,152

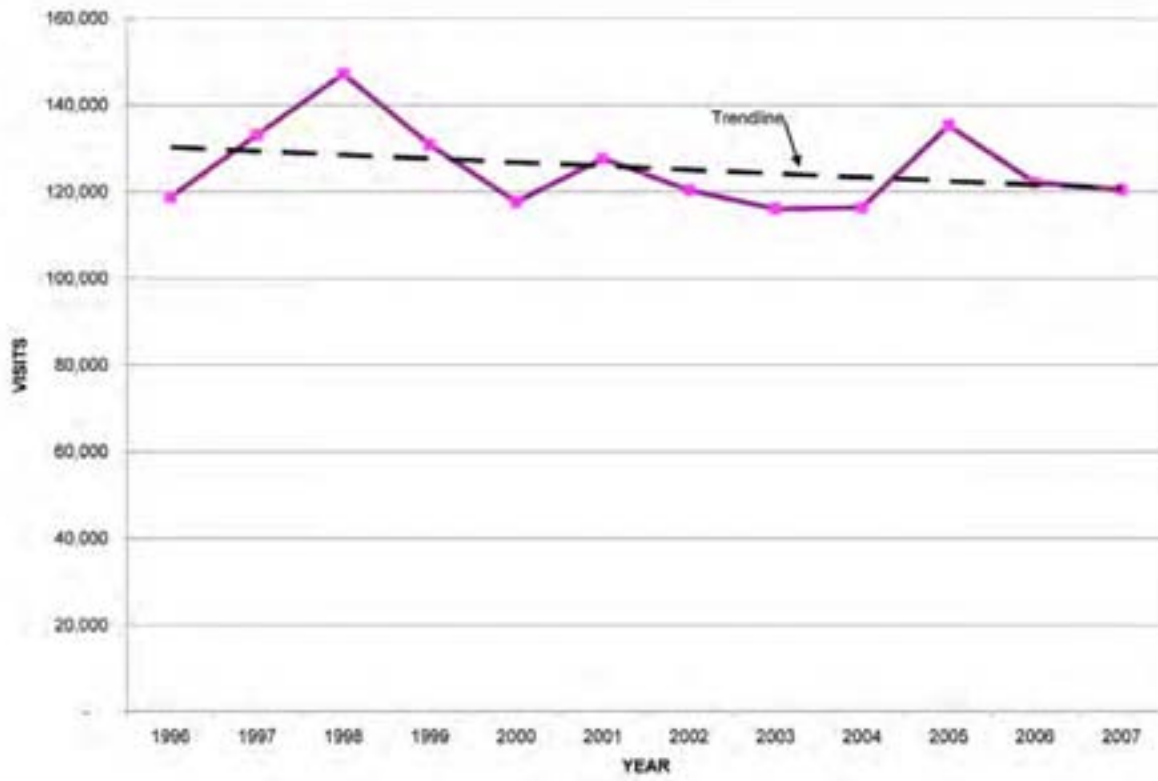


Figure 19. Trends in Elk River visitation

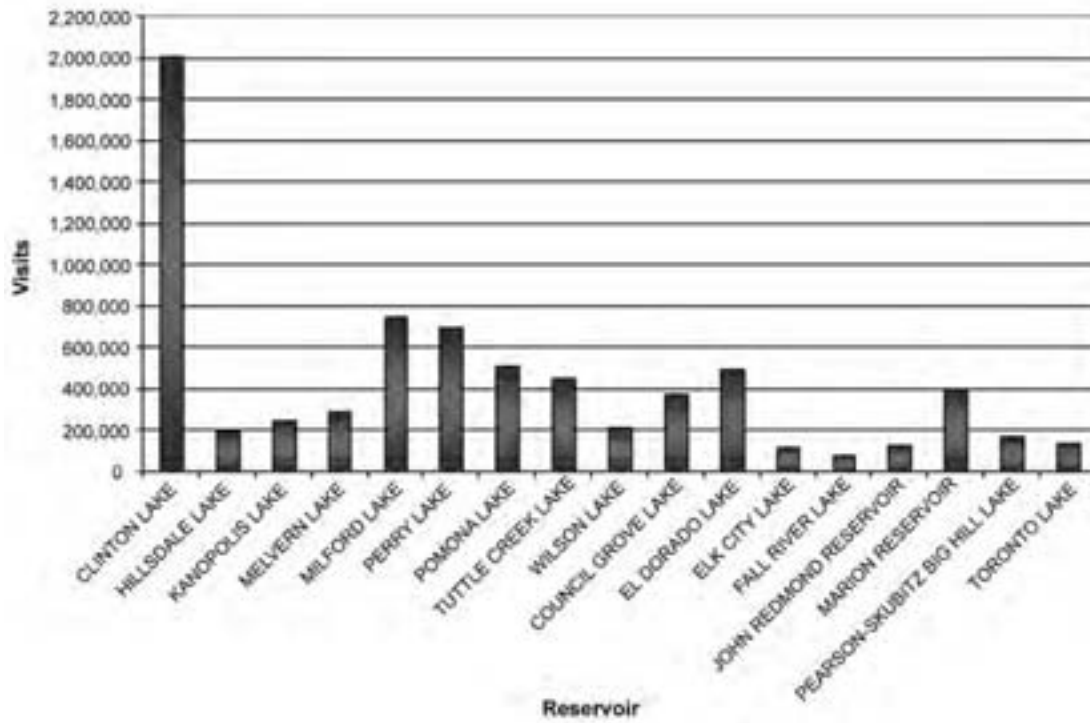


Figure 20. Visits to Kansas Reservoirs in 2007

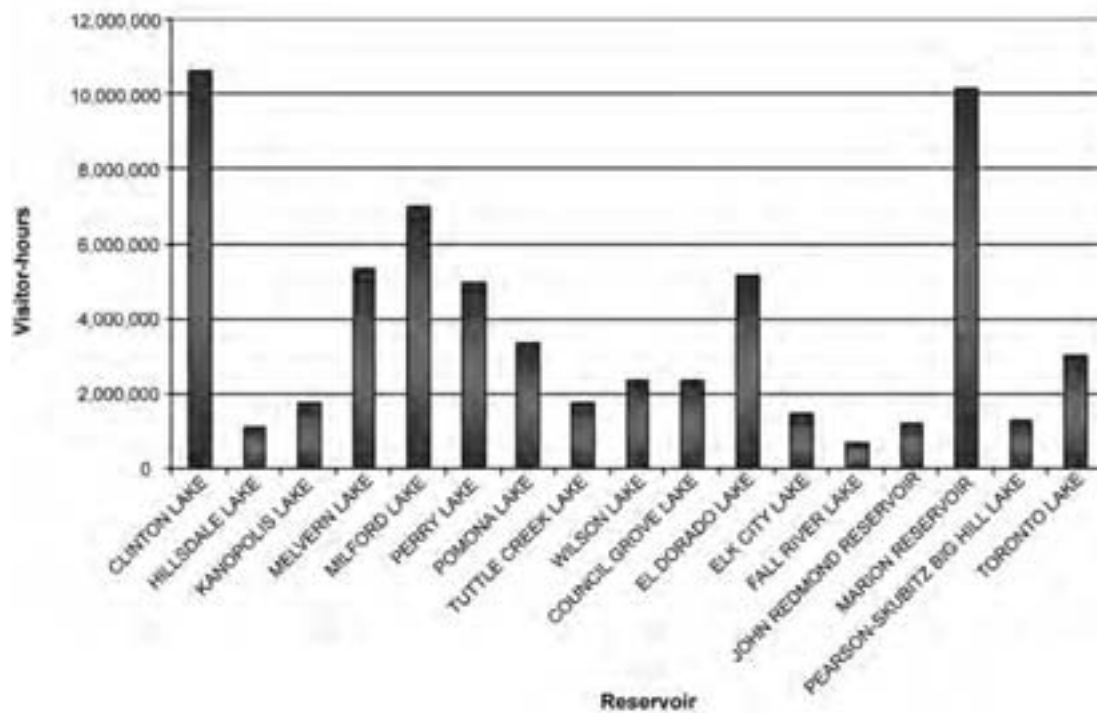


Figure 21: Visitor-hours at Kansas Reservoirs in 2007

7.8 Census Data¹⁸

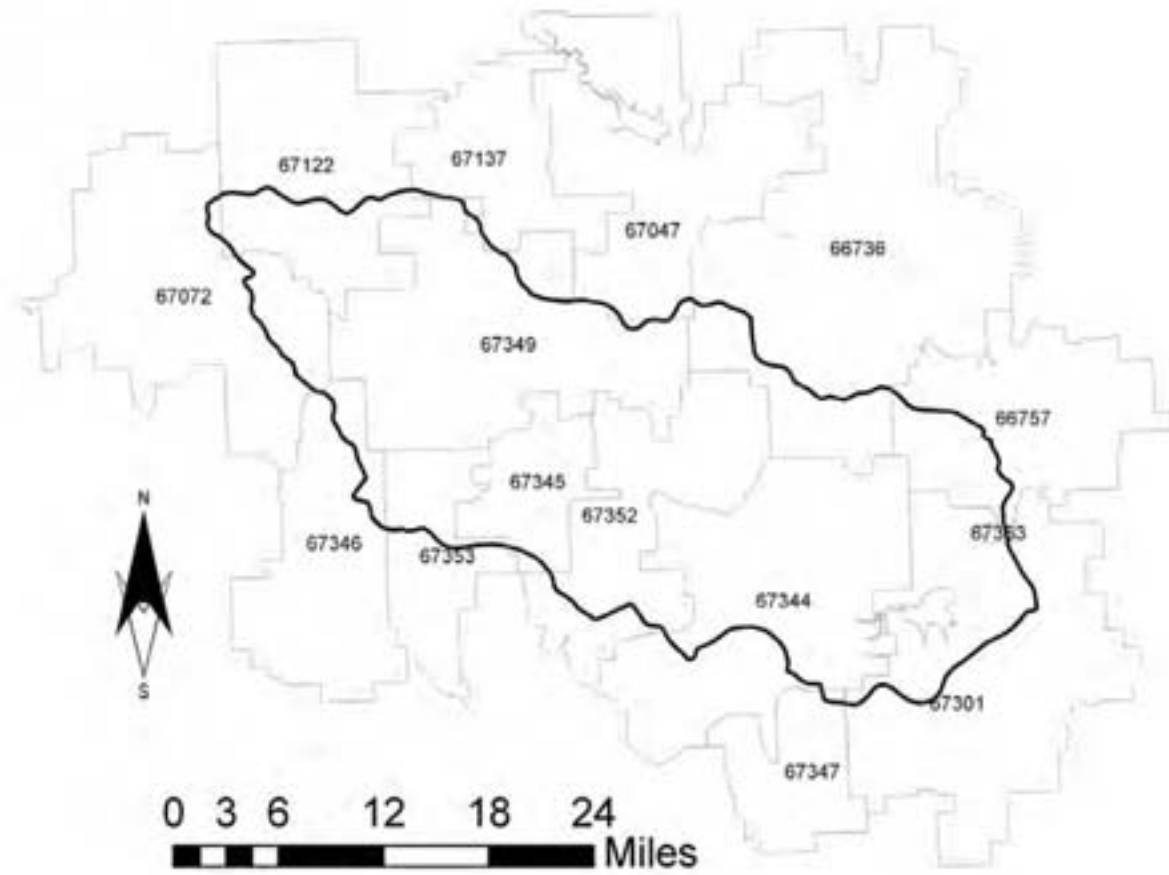


Figure 22. Zip Code Boundary Map.

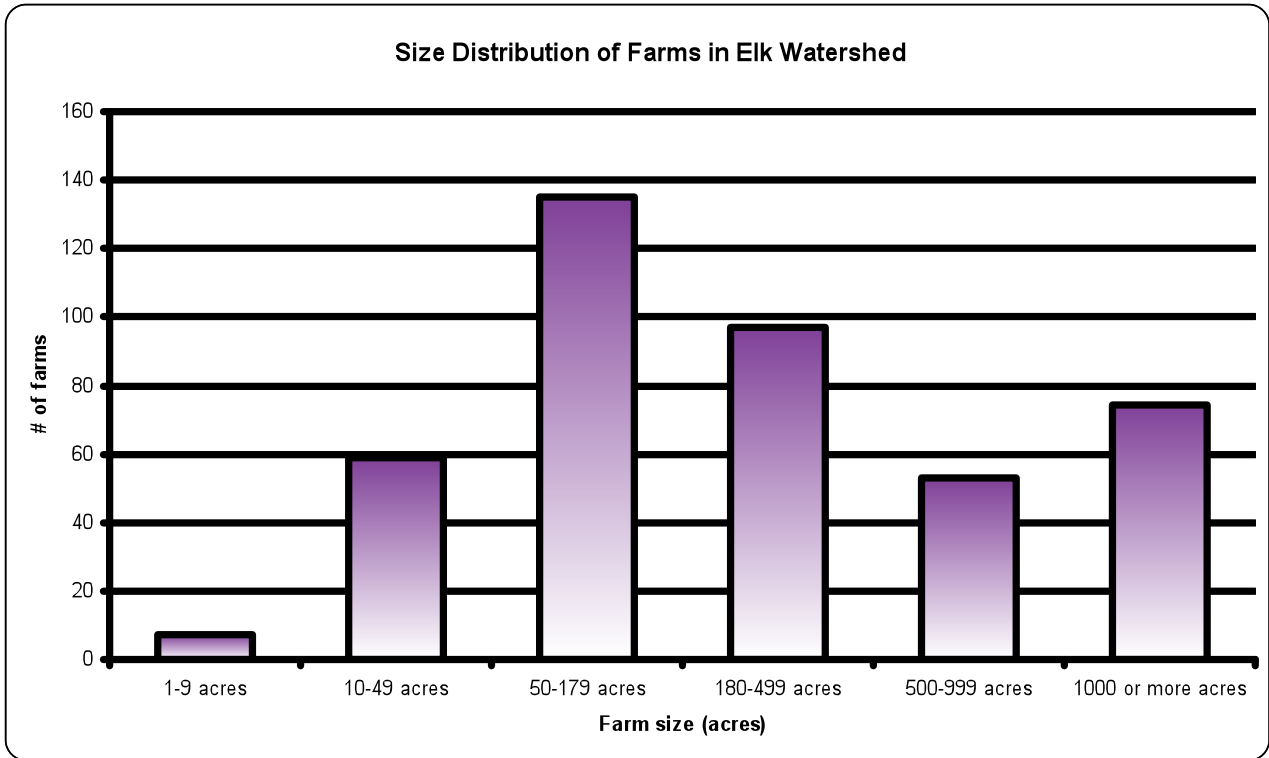


Figure 23. Size Distribution of Farms in Elk River Watershed, 2002¹⁸

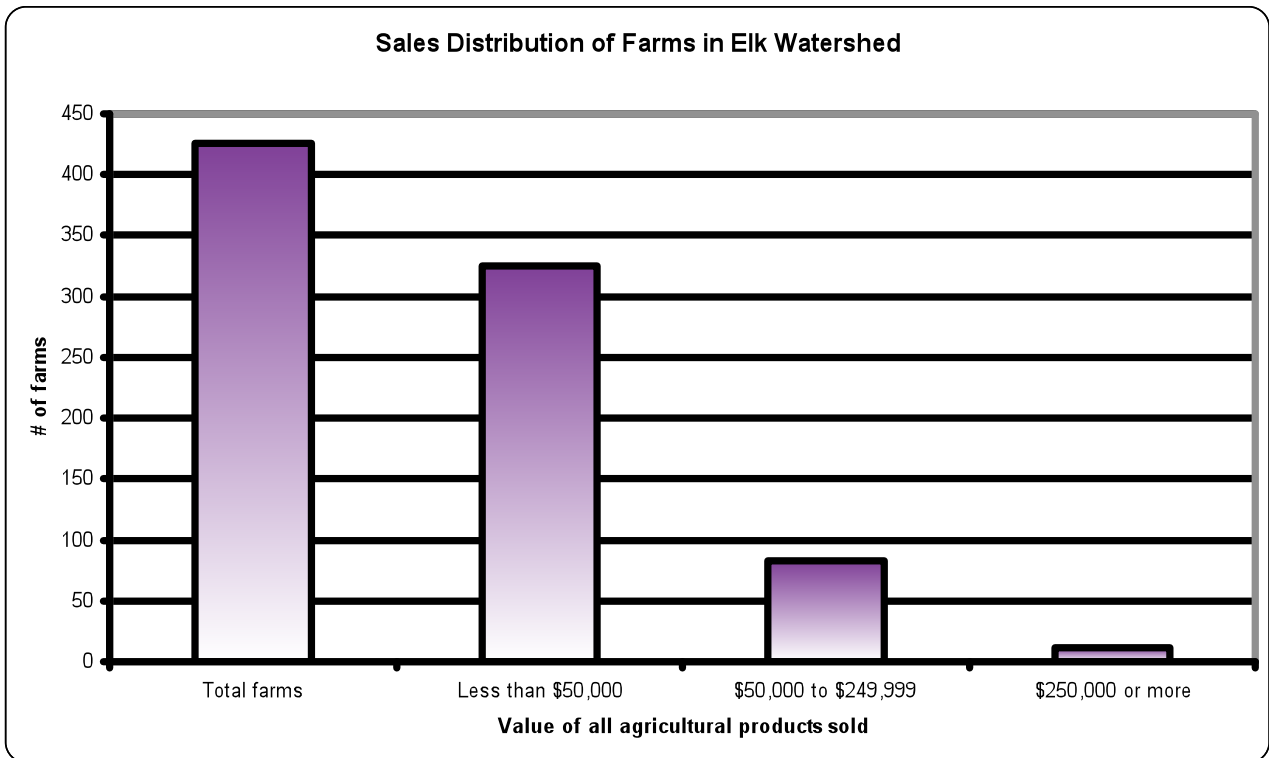


Figure 24. Sales Distribution of Farms in Elk River Watershed, 2002¹⁸

Harvested Crop Acreage in Elk Watershed

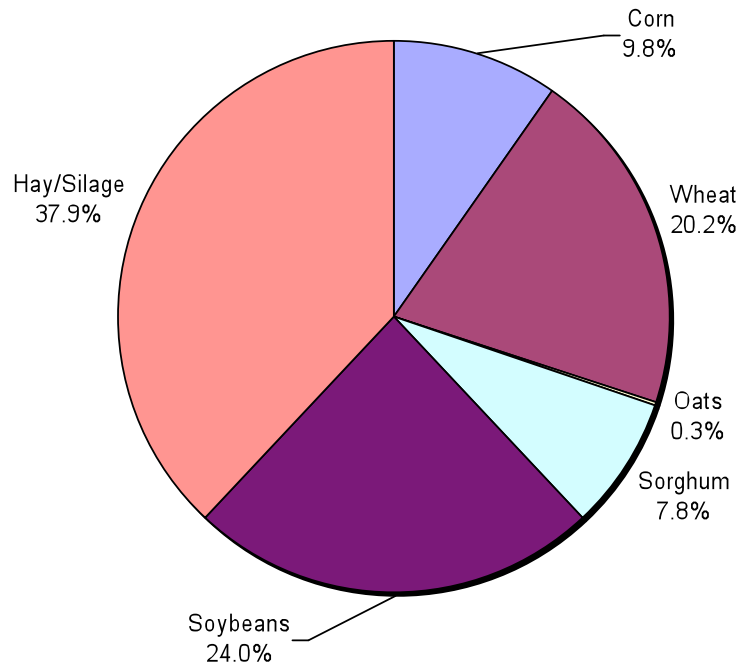


Figure 25. Harvested Crop Acreage in Elk River Watershed, 2002¹⁸

Livestock Number Distribution in Elk Watershed

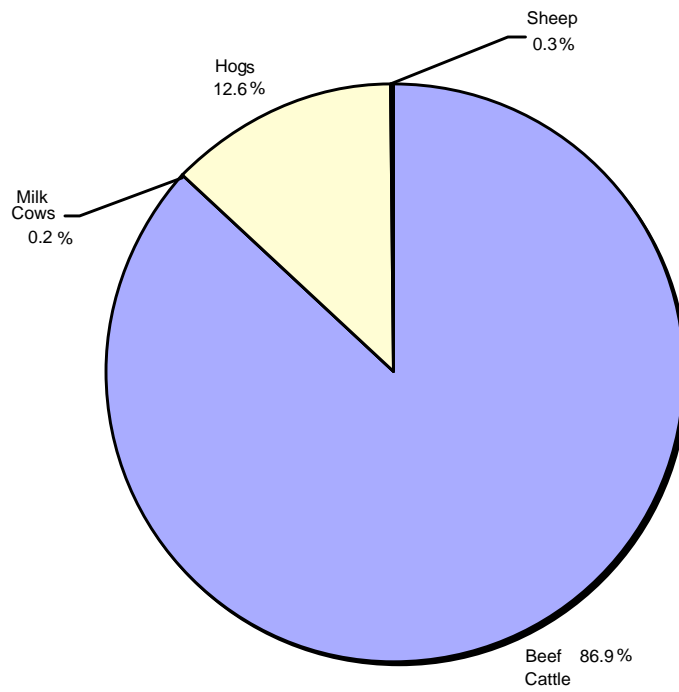


Figure 26. Livestock Number Distribution in Elk River Watershed, 2002¹⁸

8.0 Modeling

8.1 Subbasin Map¹⁹

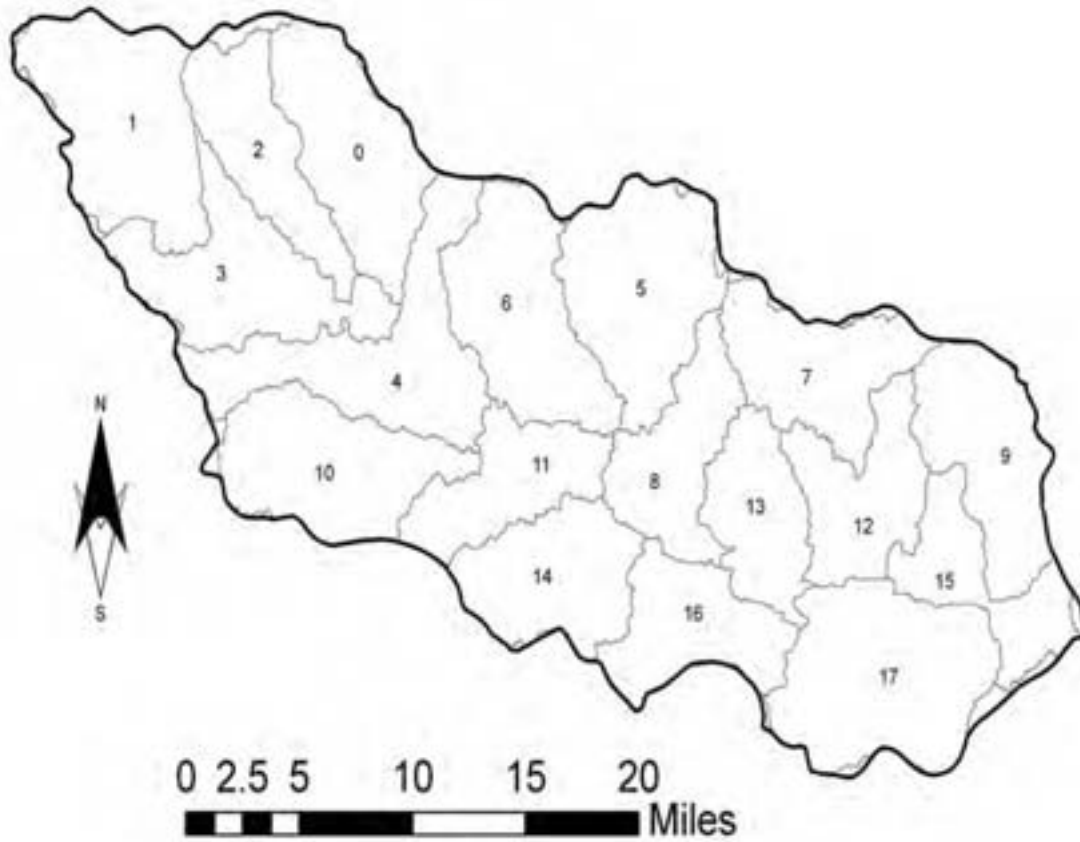


Figure 27. Subbasin Map – Lower Elk River Watershed.

Table 24. Elk River Watershed Subbasin Area

Subbasin	State	HUC ID	Area (acres)
0	KS	11070104010040	28172
1	KS	11070104010010	34047
2	KS	11070104010020	20870
3	KS	11070104010030	29686
4	KS	11070104010050	34028
5	KS	11070104020040	32156
6	KS	11070104020030	30095
7	KS	11070104030010	23808
8	KS	11070104020050	20442
9	KS	11070104030070	25476
10	KS	11070104020010	29352
11	KS	11070104020020	19596
12	KS	11070104030020	20695
13	KS	11070104030030	18178
14	KS	11070104030040	23759
15	KS	11070104030080	17821
16	KS	11070104030050	20870
17	KS	11070104030060	14596
Total			443646

8.2 Input Data

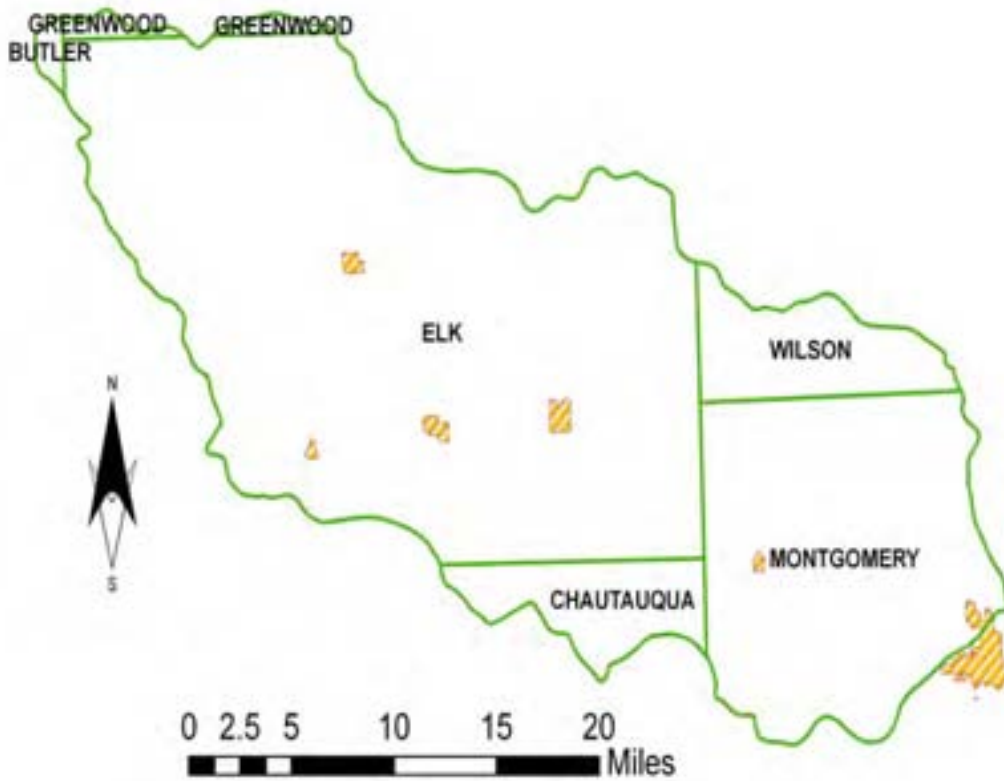


Figure 28. County Map – Elk River Watershed.

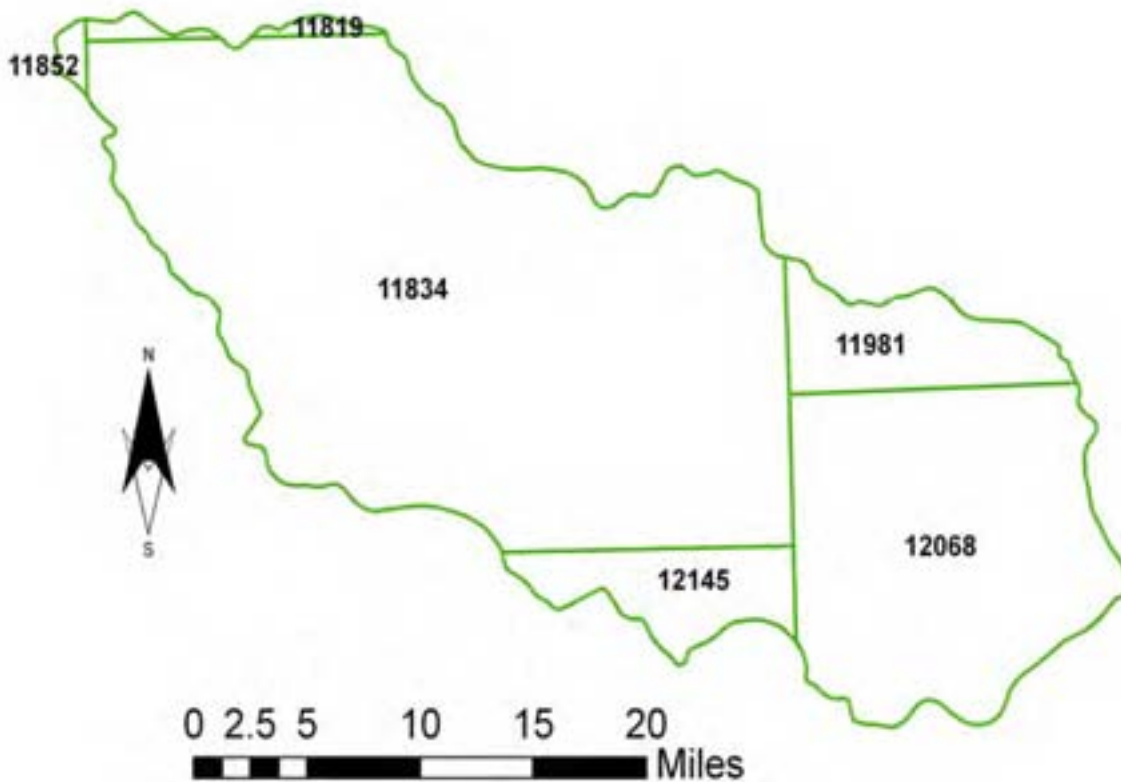


Figure 29. HUCO Map (overlay of county and 8-digit hydrologic unit boundary) – Elk River Watershed²³

Table 25. Elk River Watershed Summary²³

Polygon ID	County Name	State	HUC	Area (acre)	% in County	% in HUC
11819	Greenwood	KS	11070104	7619.44	1.04	1.76
11834	Elk	KS	11070104	283778.38	68.71	65.55
11852	Butler	KS	11070104	7.49	0.00	0.00
11981	Wilson	KS	11070104	28486.07	7.83	6.58
12068	Montgomery	KS	11070104	95536.37	22.96	22.07
12145	Chautauqua	KS	11070104	17471.58	4.30	4.04

Table 26. Landuse Area (acre)²⁰

Polygon ID	Urban/ Transportation	Cropland	Pasture/ Rangeland	Forest	Feedlots	Water	Others
11819	100.00	0.00	7600.00	0.00	0.18	100.00	0.00
11834	3800.00	27500.00	200500.00	23000.00	9.28	4000.00	8500.00
11852	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11981	400.00	18700.00	8500.00	0.00	0.94	200.00	100.00
12068	2700.00	53300.00	21500.00	9900.00	5.84	4400.00	12800.00
12145	100.00	2600.00	11300.00	7900.00	0.05	300.00	0.00
Total	7100.00	102100.00	249400.00	40800.00	16.29	9000.00	21400.00

Table 27. Agricultural Animals¹⁸

Polygon ID	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck
11819	273	5	17	4	9	4	D	0
11834	15086	10	146	70	518	504	7	8
11852	0	0	0	0	0	0	0	0
11981	1347	22	436	D	0	48	D	0
12068	5350	66	6734	84	359	146	12	5
12145	D	D	27	14	36	9	0	0
Total	22056	103	7360	172	922	711	19	13

D = data withheld to avoid disclosing information for individual farms

Table 28. Septic System²¹

Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate,%
11819	15	1.85	0.93
11834	432	1.91	0.93
11852	0	2.52	0.93
11981	142	2.02	0.93
12068	848	2.17	0.93
12145	34	1.92	0.93
Total	1471	2.07	0.93

Table 29. Hydrological Soil Group²²

Polygon ID	Hydrological Group
11819	B
11834	B
11852	B
11981	C
12068	C
12145	C

A = well to excessively drained soil

B = moderately-well to well drained soil

C = poorly drained soil

D = very poorly drained soil

Table 30. Modify the Universal Soil Loss Equation (USLE) parameters²³

Polygon ID	Land Cover	R	K	LS	C	P
11819	Crop land	225.00	0.35	0.166	0.24	0.95
11834	Crop land	250.00	0.38	0.297	0.26	0.92
11852	Crop land	225.00	0.33	0.208	0.23	0.91
11981	Crop land	250.00	0.37	0.202	0.24	0.92
12068	Crop land	250.00	0.37	0.214	0.24	0.88
12145	Crop land	250.00	0.34	0.159	0.23	0.96
11819	Pasture Land	225.00	0.36	0.341	0.02	1.00
11834	Pasture Land	250.00	0.38	0.345	0.03	1.00
11852	Pasture Land	225.00	0.35	0.208	0.02	1.00
11981	Pasture Land	250.00	0.36	0.299	0.02	1.00
12068	Pasture Land	250.00	0.34	0.318	0.04	1.00
12145	Pasture Land	250.00	0.36	0.327	0.01	1.00
11819	Forest	225.00	0.32	0.586	0.003	1.000
11834	Forest	250.00	0.26	0.606	0.003	1.000
11852	Forest	225.00	0.32	0.285	0.003	1.000
11981	Forest	250.00	0.29	0.341	0.003	1.000
12068	Forest	250.00	0.30	0.346	0.003	1.000
12145	Forest	250.00	0.25	0.838	0.003	1.000

8.3 Model Outputs

Table 31. Total Pollution Load²³

Polygon ID	N Load (lb/year)	P Load (lb/year)	BOD Load (lb/year)	Sediment Load (t/year)
11819	39200.0	3252.9	125974.5	215.8
11834	1193240.0	122445.1	3657695.4	19071.6
11852	0.0	0.0	0.0	0.0
11981	168932.2	24409.9	429726.6	3998.5
12068	486540.1	73883.5	1226482.9	12322.7
12145	101152.3	10230.3	310913.8	609.6
Total	1989065	234222	5750793	36218

Table 32. Total Load by Land Uses²³

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	46252.38	7134.83	179388.76	1061.56
Cropland	518443.58	99112.98	1083463.19	23741.01
Pastureland	1367656.04	113672.68	4400130.23	11187.98
Forest	9909.96	4871.22	24410.71	227.62
Feedlots	46440.19	9288.04	61920.26	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	362.47	141.97	1480.10	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	0.00	0.00	0.00	0.00
Groundwater	0.00	0.00	0.00	0.00
Total	1989065	234222	5750793	36218

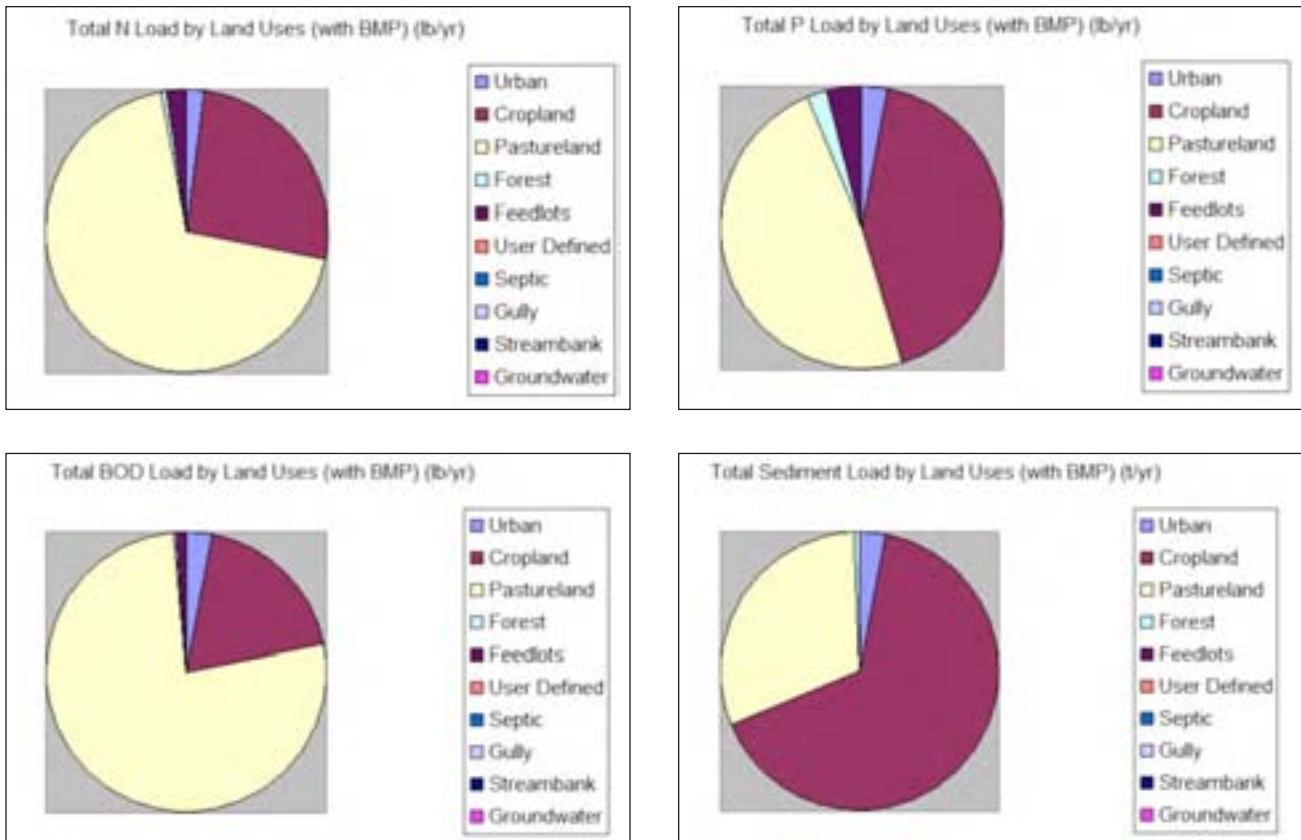


Figure 30. Total Load by Land Uses – Elk River Watershed.

9.0 Acknowledgment

The authors would like to acknowledge Dr. William Hargrove, Dr. Danny Rogers, Ms. Judy Willingham, and Mr. Don Snethen for their help and comments.

Funding for this project was provided in part by Kansas Water Plan Funds, and EPA 319 funds through Kansas Department of Health and Environment, Watershed Management Section.

10.0 Footnotes/Bibliography

1. *National Land Cover Database 2001 (NLCD 2001)*: “NLCD 2001 products include 21 classes of Land Cover, Percent Tree Canopy and Percent Urban Imperviousness at 30 m cell resolution.”
Online reference information available at: http://www.mrlc.gov/mrlc2k_nlcd.asp
2. *TMDLs for the Verdigris Basin*: “The Section 303(d) list submitted to and approved by EPA in 1998, identifies 48 river segments and 5 lakes in the Verdigris River Basin as water quality impaired. Among the streams, the greatest number of impairments was caused by excessive levels of fecal coliform bacteria and dissolved oxygen depletion.” Online reference information available at:
http://www.kdheks.gov/tmdl/ve/ElkR_DO.pdf
http://www.kdheks.gov/tmdl/ve/ElkR_FCB.pdf
3. *National Elevation Dataset*: “The USGS National Elevation Dataset (NED) has been developed by merging the highest-resolution, best quality elevation data available across the United States into a seamless raster format. NED is the result of the maturation of the USGS effort to provide 1:24,000-scale Digital Elevation Model (DEM) data for the conterminous US.” Online reference information available at: <http://ned.usgs.gov/>
4. *Precipitation Map*: “Point estimates of precipitation originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 0) Canadian stations, 10) Upper air stations, and 11) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”
Online reference information available at: http://prism.oregonstate.edu/docs/meta/ppt_30s_meta.htm#7
5. *Maximum Temperature Map*: “Point estimates of temperature originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 0) Canadian stations, 10) Upper air stations, and 11) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”
Online reference information available at: http://prism.oregonstate.edu/docs/meta/tmax_30s_meta.htm
6. *Minimum Temperature Map*: “Point estimates of temperature originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 0) Canadian stations, 10) Upper air stations, and 11) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”
Online reference information available at: http://prism.oregonstate.edu/docs/meta/tmin_30s_meta.htm
7. *Land Use (GIRAS 1980s)*: “This is land use/land cover digital data collected by USGS and converted to ARC/INFO by the EPA. This data which resides in EPA’s Spatial Data Library (ESDLs), is useful for environmental assessment of land use patterns with respect to water quality analysis, growth management, and other types of environmental impact assessment. GIRAS LU/LC is being used in EPA’s, Office of Water/OST BASINS water quality assessment model.”
Online reference information available at: <http://www.epa.gov/waterscience/basins/metadata/giras.htm>

8. *National Land Cover Database 1992 (NLCD 1992)*: “Derived from the early to mid-1990s Landsat Thematic Mapper satellite data, the National Land Cover Data (NLCD) is a 21-class land cover classification scheme applied consistently over the United States. The spatial resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, NAD 83. The NLCD are provided on a state-by-state basis. The state data sets were cut out from larger “regional” data sets that are mosaics of Landsat TM scenes. At this time, all of the NLCD state files are available for free download as 8-bit binary files and some states are also available on CD-ROM as a Geo-TIFF.”

Online reference information available at: http://landcover.usgs.gov/us_map.php

9. *River Network*: “The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells. The NHD is based upon the content of USGS Digital Line Graph (DLG) hydrography data integrated with reach-related information from the EPA Reach File Version 3 (RF3). The stream network was generated based on the USEPA Reach File, Version 1 and National Hydrography Dataset (NHD).”

Online reference information available at: <http://nhd.usgs.gov/>

USEPA Reach File, Version 1.0.

Online reference information available at: <http://www.epa.gov/>

10. *Hydrologic Soil Groups*: “Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. Mapping scales generally range from 1:12,000 to 1:63,360; SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS). SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships, and county natural resource planning and management. The user should be knowledgeable of soils data and their characteristics.”

Online reference information available at: <http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/>

11. *Water Quality Observations Stations*: “Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. Mapping scales generally range from 1:12,000 to 1:63,360; SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS). SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships, and county natural resource planning and management. The user should be knowledgeable of soils data and their characteristics.”

Online reference information available at: <http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/>

12. *USGS Gage Stations*: “Inventory of surface water gaging station data including 7Q10 low and monthly mean stream flow. Better Assessment Science Integrating Point & Nonpoint Sources (BASIN v. 4.0).”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

13. *Estimated Peak-Streamflow Frequencies*: “Estimated peak-streamflow frequencies for selected gaging stations with at least 10 years of annual peak-discharge data for unregulated, rural streams in Kansas.”

Online reference information available at: <http://ks.water.usgs.gov/Kansas/waterwatch/flood/flood-freq.html>

14. *Permitted Point Source Facilities*: “BASINS also includes information on pollutant loading from point source discharges. The location, type of facility, and estimated loading are provided. These loadings are also used to support evaluation of watershed-based loading summaries combining point and nonpoint sources.”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

15. *Confined Animal Feeding Operations*: Obtained from Watershed Planning Section -Kansas Department of Health and Environment.

16. *The 1990 Population and Sewerage by Census Tract*: “Summarizes the selected area by census tract ID. For each census tract, the report lists the population, number of housing units, type of residential sewer system, and spatial percentage of that tract located within the subject watershed area.”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

17. *Cost-Return Budget*: Data acquired from Sarah L. Fogleman and Stewart R. Duncan, for *Different Crop Cost-Return Budget in Southeast Kansas*, Kansas State University.

18. *Census Data*: Data was derived from the 2002 Census of Agriculture. The data presented here serves only as an estimate for agricultural activity in the Elk River watershed. Since watersheds do not follow political boundaries, the estimates were made based on proportion assumptions of county and zip code census data. Online reference information available at: http://www.nass.usda.gov/Census_of_Agriculture/index.asp
19. *Subbasin Map*: "This map was provided based on USGS Hydrologic Unit Level 14 Code Boundaries. United States Department of Agriculture/Natural Resources Conservation Service." Online reference information available at: <http://www.kansasgis.org/catalog/catalog.cfm>
20. *USDA Natural Resources Conservation Service 1997 National Resources Inventory*.
21. *National Environmental Service Center*: 1992 and 1998 summary of the status of onsite wastewater treatment systems in the United States.
22. *USDA State Soil Geographic (STATSGO) database*.
23. *STEPL v4 model default values*
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