are also grateful to Dr. Patricia Coulson for supplying the prostaglandins, and to Ms. Gayle Porter for typing the manuscript. This study was supported by NIH grant HD-14505.

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Journal of the Tennessee Academy of Science
Volume 60, Number 4, October, 1985

CURRENT DISTRIBUTION OF THE NATIVE BROOK TROUT IN THE APPALACHIAN REGION OF TENNESSEE

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Abstract

Survey reports and field data of brook trout (*Salvelinus fontinalis*) inventories made from 1974 to 1984 were examined to determine the current distribution in Tennessee. Brook trout currently inhabit 275.6 kilometers in 135 streams of eight east Tennessee counties. Brook trout occur allopatrically in 195.7 kilometers and sympatrically with rainbow trout (*Salmo gairdneri*), and in some cases, brown trout (*Salmo trutta*), in another 79.9 kilometers. Thirty-two previously undocumented streams were found to have brook trout populations. Tennessee brook trout are generally found in small headwater streams above 925 meters elevation. These streams usually have soft water, low fertility, and are slightly acidic. Adult brook trout (>100 mm) collected in 1974-1984 from 41 streams had an overall mean total length of 151.5 mm, weight of 45.5 g, and condition factor (K) of 1.12.

Brook trout now occupy 20 to 30% of their estimated range in 1900. Habitat degradation from development projects, logging, forest fires, unregulated harvest, and introduction of exotic salmonid species have severely reduced the brook trout's range. Most of the loss probably occurred in the early 1900's, but recent surveys demonstrate that the process is ongoing. Current losses of brook trout populations are attributed mainly to the encroachment of rainbow trout as well as stream degradation. Only 33% of the current brook trout streams are known to have waterfall barriers that restrict the upstream movement of rainbow trout.

Introduction

The brook trout (*Salvelinus fontinalis*) is the only salmonid native to eastern North America and is near the southern limit of its natural range in Tennessee. Although its commonly accepted name is the brook trout, it is actually a member of the char genus, and often called the mountain or speckled trout. Brook trout populations have been declining in the southern Appalachians and especially in Tennessee since the early 1900's. Prehistorically, brook trout probably inhabited almost all streams on mountainous land throughout the Appalachian region of east Tennessee. Due to the influence of man, mainly through habitat degradation and the introduction of exotic trout species, the numbers and range of this southern trout have been severely reduced. King (1937) was among one of the first to note the change in distribution of this species in the Great Smoky Mountains National Park (GSMNP).

Due to its status as a prized game species and its importance to the native fish fauna of Tennessee, fisheries biologists and resource managers of various agencies began population inventories in the mid to late 1970's to determine the brook trout's current range and distribution. For

the most part, these inventory surveys were completed by 1980, but to date, they have remained disjunct and, in some cases, overlapping. Therefore, there was need for a comprehensive report on brook trout distribution in Tennessee. The objective of this report is to provide a complete, current range distribution in common format of all known brook trout populations in Tennessee thus providing baseline information for the future management of the species.

METHODS

Data used to compile the current range distribution in this study were based on a 10-year collection period, 1974 to 1984. Streams surveyed on Forest Service and private land were taken from a list compiled by the Tennessee Wildlife Resources Agency (TWRA) in 1968 and TWRA county inventories of streams from 1967 to 1970. Other streams checked were suggested by TWRA personnel, Forest Service personnel, or local residents. Forest Service inventories for the most part were completed in 1978 and 1979. Streams on private land outside the GSMNP and Forest Service holdings were also surveyed in 1978 and 1979. Additional surveys were made and updated information collected on both private and Forest Service streams in 1984 (Bivens 1984).

Beginning in 1972 and continuing through 1977, the United States Fish and Wildlife Service and National Park Service personnel conducted population surveys of all major trout streams and tributaries in the GSMNP. Except for a few streams that had updated surveys in 1984 (Bivens 1984), streams on the Tennessee side of the Park included in this report were surveyed in 1974 and 1975 (Kelly et al. 1980).

All survey reports, field data and notes, field information, and field survey maps from the surveys were reviewed. Also, the 1972 to 1977 brook trout distribution map on display at the National Park Headquarters in Gatlinburg, Tennessee was used. This information was compiled in a common format and an intensive effort was made to eliminate errors. All current information was reviewed on streams that had brook trout in the late 1960's, that currently have brook trout, or that are renovated brook trout streams.

Streams were surveyed with light-weight backpack electrofishing devices of various types. The electrofishing units were usually gas powered generators with output ranging from 125 to 750 volts A.C., although some D.C. battery powered units were also used. The standard procedure used by most biologists was to sample streams and tributaries from the mouth (or other points, e.g., National Park or Forest Service boundary lines, etc.) to the uppermost headwaters. Sampling took place at various intervals along the streams and sample sites were variable in length, however, they were usually from 100 to 200 meters. The approximate position of each sample site was located and recorded on standard Tennessee Valley Authority (TVA) and United States Geological Survey (USGS) 7.5 minute topographical maps, 1:24,000 scale.

Brook trout in Tennessee are usually found in small headwater streams and exist either allopatrically (one trout species) or sympatrically (co-occurring trout species) with rainbow trout (*Salmo gairdneri*) and in a few cases with brown trout (*Salmo trutta*). The location of the upper and lower limits of allopatric populations of both brook trout and rainbow trout were recorded on field maps by determining approximate elevations. In some cases, the worker only estimated the upper limit elevation. The upper and lower elevations of sympatric zones were also recorded in the same manner. Allopatric populations were generally defined as 90% or more of one species and 10% or less of the other (Whitworth and Strange 1979). The approximate length of allopatric and sympatric zones were later determined from the topographical maps using a map measuring wheel. The locations and heights of barrier waterfalls and cascades were also noted on field maps. A barrier falls was defined (Kelly et al. 1980) as having a vertical height of at least 2.4 meters. Most workers recorded information on length and weight of all trout collected. Generally, the fish were measured to the nearest millimeter for total length and weighed to the nearest gram. Fish species other than trout were also noted.

RESULTS

Almost all the major Appalachian trout streams in Tennessee have been surveyed to some extent over the past 10 years. Out of approximately 400 streams checked in 11 counties, only 135 currently have brook trout populations. These 135 streams are found in eight east Tennessee counties and brook trout occur in a total of 275.6 km. Brook trout occur allopatrically in 195.7 km and sympatrically with rainbow trout in 72.3 km, and in some cases, brown trout in another 7.6 km. Seventy-one streams (53%) have sympatric brook and rainbow trout populations and 64 of the streams have allopatric brook trout populations. Brook trout streams, along with their sympatric/allopatric distribution and elevations where brook trout were found, are listed in Table 1. Native brook trout populations in Tennessee are generally confined to higher elevation streams. The mean lower elevation where brook trout were found is 926 m with range of 439 to 1,430 m. The mean upper elevation where brook trout were found is 1,133 m with a range of 610 to 1,561 m.

Brook trout streams occur in eight east Tennessee counties under both federal and private ownership. Streamlength distribution of sympatric and allopatric populations are divided into Forest Service, National Park, and private land ownership and are presented in Table 2. Many of the brook trout streams in Tennessee occur on GSMNP land. Sixty-two streams in the Park have 124.7 km of brook trout water or about 45.2% of the total streamlength distribution of brook trout for the state. A total of 51 streams on Forest Service land have 102.2 km or 37.1% of the total streamlength distribution and the remaining 48.7 km or 17.7% of the total distribution occurs in 35 streams under private ownership (Table 3). Many of the streams under private land ownership have only small portions of brook trout water and occur on both federal and private land.

Sevier County has the most brook trout water, 98.0 km or 35.6% of total streamlength distribution for the state occurs in 49 streams, almost all of which are in the GSMNP. Carter County has 66.7 km or 24.2% of the total in 32 streams and Johnson County has 51.9 km or 18.8% of the total distribution in 25 streams. Cocke County has 27.2 km or 9.9% of the total distribution in 14 streams. All but two of the streams in Cocke County are in the GSMNP. Monroe County has 14.5 km or 5.3% of the total in six streams, all of which are on Forest Service land. Unicoi County has 7.9 km or 2.9% of the total in six

TABLE 1. *Current distribution of brook trout in Tennessee streams, elevation where found, and population stream-lengths*[a].

Stream Name	Elevation (Meters) Where Brook Trout Begin	Where Brook Trout End	Streamlength (Kilometers) Sympatric	Allopatric	Total
Bald River[b]	671	1036	0.3	3.5	3.8
Henderson Branch	628	719	1.9	1.0	2.9
Meadow Branch	988	1146	1.8	-	1.8
Roaring Branch	981	1134	0.2	0.8	1.0
Rough Ridge Creek	890	1158	1.0	1.3	2.3
Falls Branch	866	1140	1.4	1.3	2.7
Little River[b]	1268	1487	0.5	0.8	1.3
Spruce Flats Branch	512	610	-	1.9	1.9
Sams Creek	853	1280	1.6	1.8	3.4
Starkey Creek	965	1146	-	1.3	1.3
Lynn Camp Prong	975	1244	1.8	1.6	3.4
Marks Creek	744	933	1.8	0.5	2.3
Indian Flats Prong	884	1219	0.5	2.1	2.6
Ridge Branch[c]	956	1036	-	0.6	0.6
Seng Patch Branch	1032	1128	-	0.5	0.5
Davis Branch[c]	1035	1061	-	0.5	0.5
Meigs Creek	439	664	-	4.3	4.3
Laurel Branch	792	866	-	0.3	0.3
Tanager Branch	817	841	-	0.2	0.2
Huskey Branch	762	1000	-	1.9	1.9
Fish Camp Prong	1036	1305	2.4	1.1	3.5
Goshen Prong	1073	1341	0.6	1.9	2.5
Jenkins Creek[c]	1122	1402	-	2.4	2.4
Left Branch[c]	1208	1341	-	0.8	0.8
Double Spring Branch[c]	1241	1487	-	1.9	1.9
Silers Creek	1035	1353	1.0	1.8	2.8
Narrows Branch	1155	1317	-	1.3	1.3
Buckeye Gap Prong	1081	1305	1.4	1.0	2.4
Small Branch[c]	1114	1244	-	0.6	0.6
Shelter Spring Branch[c]	1122	1378	0.3	1.1	1.4
Meigs Post Prong	1116	1561	0.2	1.8	2.0
Sweet Creek	1128	1329	-	1.8	1.8
Grouse Creek	1026	1359	0.8	1.3	2.1
Spud Town Branch	1050	1341	-	1.8	1.8
Rattler Branch	1134	1463	-	1.6	1.6
Devil Branch	1196	1487	-	1.0	1.0
Snake Tongue	1247	1408	-	0.6	0.6
Kuwahi Branch	1074	1463	0.5	1.9	2.4
Love Branch[c]	1314	1463	-	1.0	1.0
Twin Creek	549	689	1.4	-	1.4
Bales Branch[c]	853	902	-	0.3	0.3
Road Prong	1061	1487	0.6	3.2	3.8
Walker Camp Prong	1128	1430	4.3	2.4	6.7
Alum Cave Creek	1161	1177	-	0.3	0.3
Kephart Branch[c]	1430	1524	-	0.8	0.8
Dunn Creek	567	1274	-	6.8	6.8
Middle Prong Little Pigeon River	732	988	3.1	0.2	3.3
Ramsay Prong	799	914	1.0	-	1.0
Buck Fork	866	1536	2.1	3.7	5.8
Eagle Rocks Prong	907	1378	0.2	4.2	4.4
Laurel Top Branch[c]	1164	1451	-	1.9	1.9
Copper Gap Branch[c]	1230	1402	-	1.4	1.4
Pecks Branch[c]	1248	1402	-	1.1	1.1
Lost Prong	988	1292	-	1.6	1.6
Chapman Prong	988	1402	-	2.6	2.6
Sequoyah Branch[c]	1244	1439	-	1.0	1.0
Cosby Creek[b]	616	1061	2.4	1.3	3.7
Indian Camp Creek	658	1353	0.3	4.3	4.6
Otter Creek	1012	1341	-	1.6	1.6
Copperhead Branch	1097	1280	-	0.8	0.8
Toms Creek	620	1073	0.2	3.1	3.3
Sunup Branch[c]	853	1073	-	0.6	0.6
Panther Branch	963	1067	-	0.5	0.5
Rock Creek	623	1183	0.2	2.6	2.8
Little Rock Creek	963	1329	-	1.4	1.4
Middle Branch[c]	1067	1353	-	0.8	0.8
Camel Hump Creek	828	1131	0.2	1.4	1.6
Dry Branch	829	1085	0.2	1.0	1.2
Middle Prong Gulf Creek	975	1109[d]	0.2	1.6[d]	1.8
Brown Gap Creek	927	1183[d]	0.2	2.3[c]	2.5
Clear Fork	1061	1094	0.3	-	0.3
Higgins Creek	841	1085	-	3.2	3.2
Birchfield Camp Branch	875	1210	-	1.9	1.9
Rocky Fork[b]	914	1119[d]	3.2[d]	-	3.2
Blockstand Creek	914	1012[d]	0.2	1.0[d]	1.2
Broad Branch	936	982[d]	0.5[d]	-	0.5
Fort Davie Creek	985	1061[d]	0.5[d]	-	0.5
Jones Branch	539	683	-	1.9	1.9
Doe River[b]	913	1036	1.9	0.8	2.7
Little Laurel Fork	872	1062	0.3[e]	2.9	3.2
Leonard Branch	875	1106	0.8[e]	2.7	3.5
Wagner Branch	887	1097	1.0[e]	1.9	2.9
Moreland Branch	908	1097	-	3.1	3.1
White Rocks Branch[c]	936	1024	0.6[e]	0.6	1.2
Cook Branch	965	1038	1.6[e]	-	1.6
Camp Fifteen Branch[c]	971	1041	0.8[e]	0.6	1.4
Bitter End Branch[c]	972	988	0.2[e]	-	0.2
Camp Ten Branch	981	1030	-	1.6	1.6
Clarke Creek	1030	1116	-	1.6	1.6
Tiger Creek	695	1134	7.2	1.4	8.6
Roberts Hollow[c]	928	1109	-	1.9	1.9
Bill Creek	963	1109	0.2	2.1	2.3
Fall Branch	974	1180	-	1.8	1.8
Ruins Branch[c]	988	1061	-	1.1	1.1
No-Name Creek[c]	1067	1085	-	1.1	1.1
George Creek	820	1164	0.5	4.2	4.7
Heaton Creek	1097	1219[d]	1.3[d]	-	1.3
Toms Branch	975	1195	0.5	1.6	2.1
Middle Branch	994	1256	0.3	1.9	2.2
Right Prong Middle Branch[c]	1158	1268	-	0.6	0.6
Panther Branch	977	1036	-	1.0	1.0
Cove Creek	988	1292	0.2	2.3	2.5
Little Cove Creek	1001	1146	-	1.3	1.3
Duck Branch	1000	1012	-	0.2	0.2
Stony Creek[b]	756	972	2.4	-	2.4
Little Stony Creek	588	817	1.4	2.1	3.5
North Fork Stony Creek	792	914	0.2	1.3	1.5
Pole Branch	792	866	-	0.5	0.5
Mill Creek	732	878[d]	-	2.1[d]	2.1
Vaught Creek	792	840	-	1.0	1.0
Furnace Creek	840	1012	-	1.9	1.9
East Fork	1009	1018	-	0.2	0.2
Corn Creek	850	1006	-	1.8	1.8
Cress Branch	869	939	-	1.0	1.0
Payne Hollow	853	963	-	0.8	0.8
Little Laurel Branch	628	817	0.2	1.6	1.8
Morgan Branch	792	914	-	1.3	1.3
Rockhouse Run	762	920	-	2.3	2.3
Tank Hollow	663	902	0.2	2.3	2.5
Chalk Branch	725	817	0.5	0.8	1.3
Maple Branch	692	853	1.9	-	1.9
Fagall Branch	725	942	2.3[f]	1.0	3.3
Birch Branch	820	1024	1.4	2.3	3.7
Parks Branch	817	1049	3.9	-	3.9
Heaberlin Branch	805	1055	0.5	1.9	2.4
Johnson Blevins Branch	914	1122	1.1	1.9	3.0
Jim Wright Branch	910	1012	0.5	0.6	1.1
East Fork Beaverdam Creek	890	1097	0.5	1.8	2.3
Valley Creek	975	1158	-	1.3	1.3
Richardson Branch	985	1000[d]	-	0.2[d]	0.2
Gentry Creek	878	1170	2.6	2.1	4.7
Grindstone Branch	850	978	1.0	0.8	1.8
Kate Branch	899	1149	0.6	1.8	2.4
Gilbert Branch	1090	1219	-	1.6	1.6
Hoot Owl Hollow	789	902	-	3.4	3.4
Total			79.9	195.7	275.6

[a]Based on stream survey data collected from 1974 to 1984.
[b]Headwaters only.
[c]Stream that has no name on the topographical map. See Bivens (1984) for description of location.
[d]Estimated value.
[e]Brook trout sympatric with brown trout.
[f]Brook trout sympatric with both brown trout and rainbow trout.

streams. Greene County and Blount County have the lowest amount of brook trout water. Greene County has 4.8 km or 1.7% of the total distribution in four streams. Blount County has only 4.6 km or 1.7% of the total in three streams, all of which are in the GSMNP.

Many native brook trout populations are protected from encroachment of exotic trout species by barriers to fish movement. These barriers are usually waterfalls that have at least 2.4 m vertical drop. Of the streams that currently have brook trout, only 33% have these barrier falls, 27% have no barriers at all, and no data were available for 40%.

The average total length, weight, and coefficient of condition (K) were examined for 41 native brook trout populations in east Tennessee. Adult brook trout (>100 mm) collected during this survey period had an overall mean total length of 151.5 mm, weight of 45.5 g, and condition factor of 1.12.

TABLE 2. *Tennessee distribution of native brook trout populations by county and land ownership.*

County	Number of Streams	Streamlength (Kilometers)						
		Forest Service		National Park		Private Land		
		Sympatric	Allopatric	Sympatric	Allopatric	Sympatric	Allopatric	Total
Monroe	6	6.6	7.9	-	-	-	-	14.5
Blount	3	-	-	-	4.6	-	-	4.6
Sevier	49	-	-	26.1	71.1	-	0.8	98.0
Cocke	14	-	-	3.5	19.4	0.4	3.9	27.2
Greene	4	-	-	-	-	4.0	0.8	4.8
Unicoi	6	0.3	1.9	-	-	0.4	5.3	7.9
Carter	32	10.3	34.5	-	-	11.3	10.6	66.7
Johnson	25	15.3	25.4	-	-	1.7	9.5	51.9
Total	a	32.5	69.7	29.6	95.1	17.8	30.9	275.6

[a]Total number of brook trout streams is 135, sections of some streams are in more than one county.

TABLE 3. *Current Tennessee distribution of native brook trout populations by land ownership.*

Land Ownership	Number of Streams	Streamlength (Kilometers)			Percent of Total Streamlength
		Sympatric	Allopatric	Total	
Forest Service	51	32.5	69.7	102.2	37.1
National Park	62	29.6	95.1	124.7	45.2
Private	35	17.8	30.9	48.7	17.7
Total	a	79.9	195.7	275.6	

[a]Total number of brook trout streams is 135, portions of some streams occur on both private and federal lands.

DISCUSSION

The demise of the brook trout in the southern part of its range, and specifically in Tennessee, can be attributed to the influence of man. Habitat degradation from past and present development projects and the introduction of exotic salmonid species have been implicated in severely reducing the native trout to its present range and distribution. Other factors such as acid rain, anchor ice, inbreeding, and flooding are probably affecting brook trout populations somehow but their impact is not clearly understood. In the early 1900's, prior to sound fisheries management practices, unregulated harvest of brook trout by use of nets and explosives may have also played an important role in the reduction of the native trout. However, stream degradation, most commonly siltation resulting in a reduction of spawning success coupled with the interaction of a suspected competitor, the rainbow trout, are considered the primary causes of range reduction.

Brook trout in Tennessee probably once inhabited all suitable trout streams in the Appalachian region of the state. They are currently found in only 275.6 km of the region's some 1,287 km of coldwater streams or about 21% of their former range. This represents not only a significant loss in streamlength distribution but also a greater loss in total habitat, because most of the current brook trout populations occur in the smaller headwater portions of streams. These headwater streams are generally less optimum habitat, typicaly small in size, soft and infertile, and slightly acidic.

Most of the change in distribution data comes from the GSMNP and the majority of this information comes from work by Powers (1929), King (1937), Lennon (1967), Jones (1978), and Kelly et al. (1980). Brook trout once occurred in nearly all headwater streams (Jones 1978) and were thought to occupy approximately 680 km of GSMNP streams in 1900 (Moore et al. 1981). An estimated 55% decline in brook trout range occurred in Park streams between 1900 and 1930 (Kelly et al. 1980). A further decline of about 15% occurred between 1930 and 1959 and brook trout were estimated to occur allopatrically in only 48 of 226 headwater streams and sympatrically with rainbow trout in 77 streams (Lennon 1967). By 1977, brook trout occupied approximately 198 km of streams in the GSMNP (Kelly et al. 1980) or about 29% of their original estimated range. About 124.7 km of brook trout water in the GSMNP occurs in 62 streams on the Tennessee side of the Park.

Early information on streams outside the Park is very limited. Brook trout south of the Park probably once occurred in all streams that now have rainbow trout, but with the exception of about six to seven streams, brook trout were apparently extirpated from the area by 1930 (Shields 1951).

North of the Park, the TWRA surveyed brook trout range on private and Forest Service lands in 1968. It was estimated at that time that approximately 230 km of brook trout water occurred in 68 streams found in six upper east Tennessee counties. These streams were surveyed again between 1978 and 1984. Out of these 68 streams, only 30 currently have brook trout populations, a decline of 56% in just a little over 10 years. Furthermore, our recent survey work found only 72.6 km of brook trout water in the 30 streams, a decline of 68% in the streamlength distribution described by the TWRA. These findings represent a significant loss (56 to 68%) in the brook trout range in upper east Tennessee over a short period of time.

During the course of recent surveys, an additional 32 previously undocumented streams were found to have brook trout populations. These streams represent an increase in the known distribution by about 49.6 km.

It is difficult to accurately assess the loss of brook trout distribution in Tennessee. But, based on the estimates described above, it is very likely that brook trout populations have dwindled to about 20 to 30% of their former range. Most of this loss probably occurred in the early 1900's, but in light of recent surveys, it is evident that the process is

ongoing.

If current trends prevail, the eventual extinction of the native brook trout from Tennessee streams may occur within the next 30 to 50 years. Habitat degradation is not so much the problem it once was, especially on federal lands with protected watersheds. However, encroachment on brook trout habitat by the more aggressive rainbow trout is cause for alarm. Wolfe et al. (1978) and Helfrich et al. (1982) studied agonistic behavior between brook and rainbow trout and generally concluded that brook trout can compete with equal size rainbow trout. However, native Appalachian brook trout tend to be small in size, especially when compared to stocked rainbow trout. Partial eradication of rainbow trout from brook trout streams by electrofishing has resulted in increased standing crops of brook trout (Moore et al. 1984). Whitworth (1980) found that rainbow trout move more than do brook trout and that their overall movement is generally upstream. Although this movement is small over a given period, it is probably consistent from year to year. This, coupled with the generally small size of native brook trout may give some insight as to why brook trout populations have been pushed further and further into their present headwater habitat.

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Journal of the Tennessee Academy of Science
Volume 60, Number 4, October, 1985

CRITICAL EROSION AREAS IN KNOXVILLE AND KNOX COUNTY, TENNESSEE

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Abstract

This study was designed to provide a spatial distribution of the critical erosion areas, measure their size and estimate the amount of soil lost in each watershed. Among the thiry-five studied watersheds in Knoxville and Knox County, farming activities predominate the critical area and amount of soil losses. Construction activities in the urbanized and suburbanized basins are the second most important source of erosion. Approximately 10% of the studied area (24,000 acres) can be classified as critical erosion area; 6% of the area represented by intense farming activities, 3% by construction and 1% by road right-of-ways.

Introduction

Excessive soil erosion can result in the loss of prime farm land and the degradation of water quality by causing the siltation of streams, reservoirs, sinkholes and drainage structures, the destruction of aquatic habitats by exclusion of sunlight, limitation of photosynthesis and alteration of the rate of temperature change. All of these affect the feeding, reproduction, movement and food supply of fish. As sediments settle to stream bottom, they contribute to algal blooms and the destruction of bottom-dwelling organisms that provide vital links in the food chain. Additionally, the sediments which result directly from soil erosion commonly have absorbed fertilizers, pesticides, heavy metals and other undesirable pollutants. These absorbed pollutants may be released into the water under certain conditions, contaminating water supplies and creating a danger to public health and aquatic life.

Because of the detrimental effects of sediment on water quality, there is considerable interest in determining the primary sediment sources. Sediments, of course, come from soil erosion which occurs on all natural land surfaces, but erosion can be accelerated when existing protective surface cover (vegetation) is removed or disturbed by man's activities. Areas in Knox County which have greatest soil erosion are generally associated with (1) farming activities; (2) road banks; and (3) construction activities on residential, commercial and industrial sites.

Intense farming may include cropping and grazing practices which alter soil cover, expose the soil and leave it