TENNESSEE

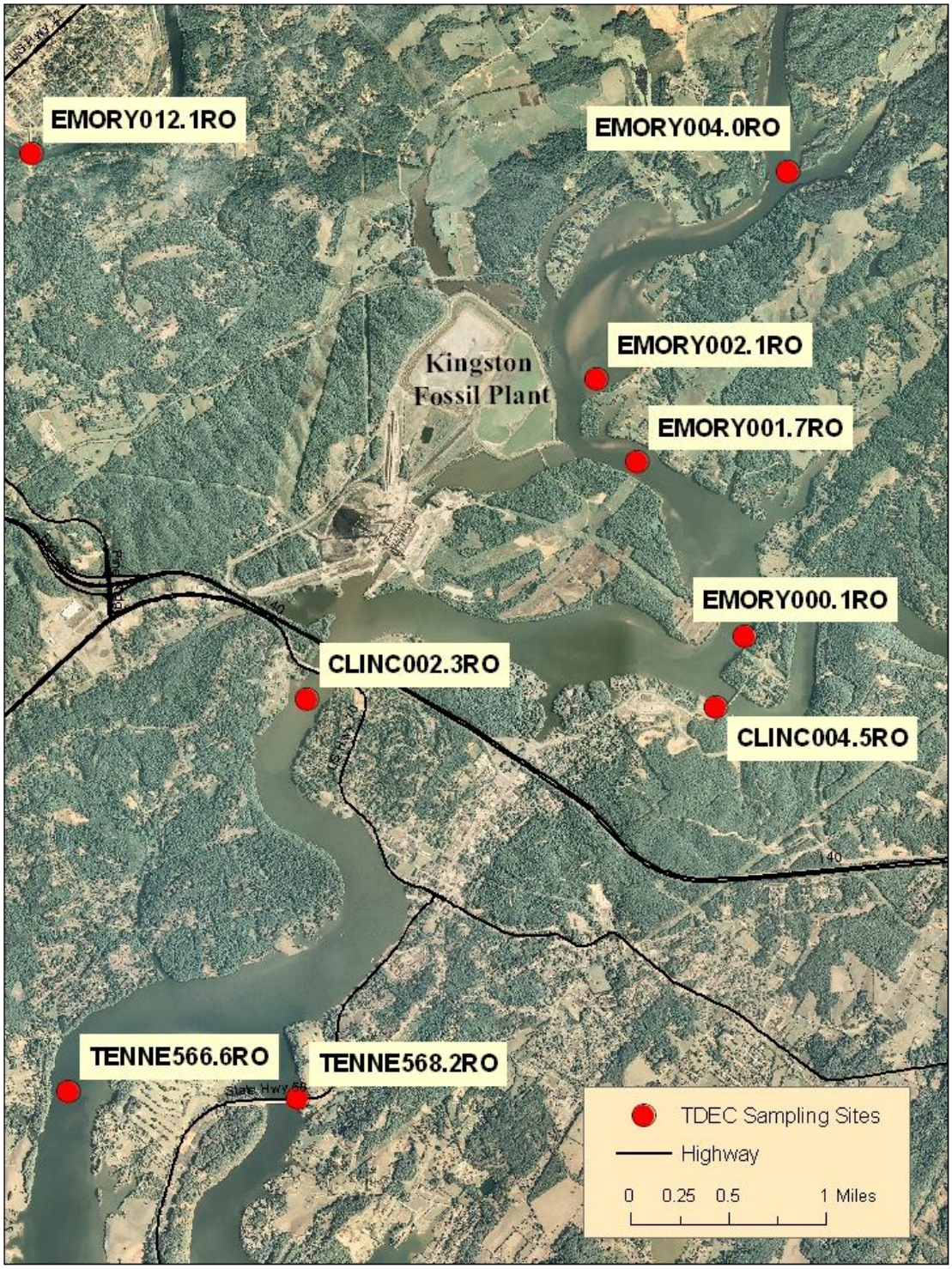
Updated March 2010

Kingston Ash Spill

Twas three days before Christmas and all through the state, most biologists were on leave and unaware of their fate…. Early morning on December 22, 2008 the ash landfill collapsed at the TVA Kingston Fossil Plant in Roane County, Tennessee. More than 5 million cubic yards of coal ash moved into the surrounding waterways. About half of the ash is blocking the main channel of the Emory River; the other half completely eliminated a shallow embayment area off the river. Ash was pushed as far as three miles upstream of the spill site on the Emory. Some ash moved downstream into the Clinch River and Tennessee Rivers.

On January 2, 2009, TDEC began bi-weekly sampling of multiple stations in the area. This was a new experience for some folks used to milder weather as temperatures in the single digits quickly froze gear, water and staff. Heavy metals are contained in fly ash and present the greatest potential for chemical contamination of waters. Specific metals that have violated Tennessee water quality criteria include thallium, arsenic, lead, aluminum, iron, copper, mercury and cadmium. Although metals are a concern, the physical properties of the ash are perhaps of greater impact to the aquatic life, clogging gills, smothering habitat and altering flow patterns.

A dike has been constructed to temporarily contain ash in the side embayment. Hydraulic dredging of the 2.5 million cubic yards of ash in the Emory River began in late March, 2009. Estimated completion of time critical ash removal is April 2010. Water, pond and dredge discharges, air (dust), fish and benthic communities, fish tissue and other wildlife effects including various toxicity tests are all being monitored heavily throughout the dredging. Metals are of concern, but a big issue is the physical magnitude of the project – cost, time, landfill space and general logistic difficulty. More information including data can be found at http://tn.gov/environment/kingston/results.shtml.


EMORY012.1RO
EMORY004.0RO
Kingston
Fossil Plant
EMORY002.1RO
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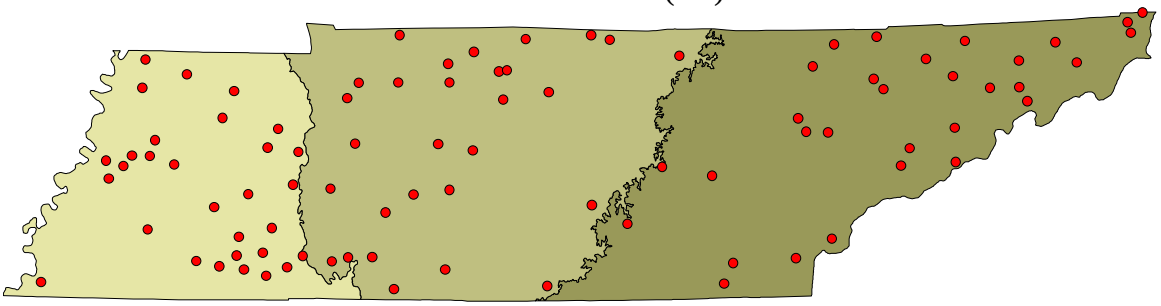
EMORY000.1RO
CLINC002.3RO
CLINC004.5RO
TENNE566.6RO
TENNE568.2RO
TDEC Sampling Sites
Highway
0 0.25 0.5 1 Miles

Probabilistic Wadeable Stream Studies

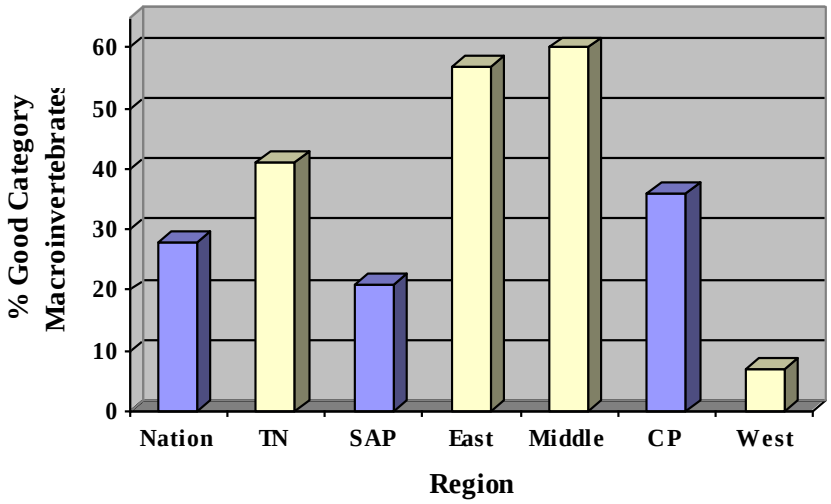
In 2007 and 2008, Tennessee conducted a statewide probabilistic monitoring survey of wadeable streams in Tennessee that built upon EPA's 2004 Wadeable Streams Assessment survey of the nation's streams (EPA 841-B-06-002). Macroinvertebrate, biological, physical and chemical data were collected from 90 streams. Reports are available on the department's website (www.tn.gov/environment). The report is divided into six volumes; Executive Summary, Study Design and Stream Characterization, Macroinvertebrates and Habitat, Water Chemistry, Pathogens and Periphyton (which will be published in June).

In the state study, Tennessee was divided into three broad categories (east, middle and west). East includes ecoregions 66, 67, 68 and 69. Middle is ecoregion 71 and west is ecoregions 65, 73 and 74. Tennessee fell into two assessment regions in the National Wadeable Streams Assessment. Middle and east Tennessee were included in the Southern Appalachians (SAP). West Tennessee was included in the Coastal Plains (CP).



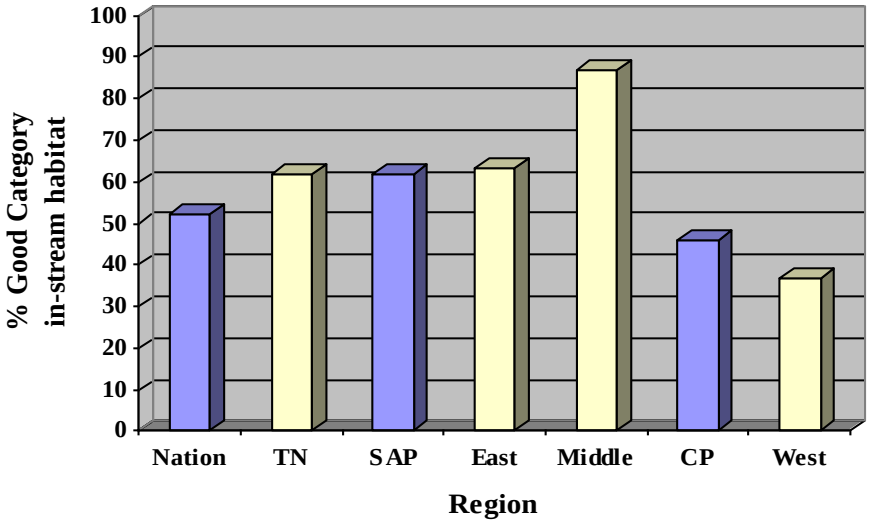
Macroinvertebrate condition assessments from the EPA report were very different from what was found during the statewide probabilistic study. The national study found only 28% of the macroinvertebrate populations to be in good condition as compared to 41% in the Tennessee study. In the Southern Appalachians, only 21% of the national study sites were found to be in good biological condition whereas 57 – 60% of the sites in middle and east Tennessee passed state biocriteria.

Conversely, biological communities in west Tennessee appeared to be in worse condition than those in the national Coastal Plains region. In the national study, the Coastal Plains fared better than the Southern Appalachians with 36% of the macroinvertebrate populations in the good condition category.

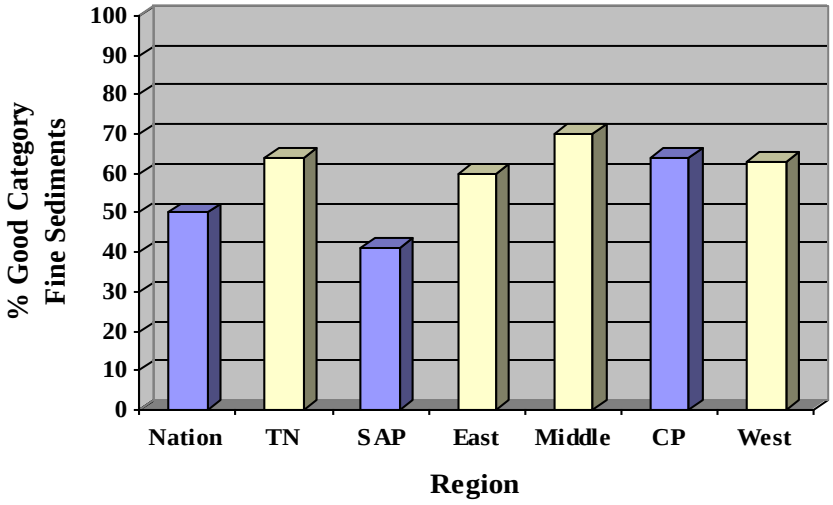


Only seven percent of the sites in west Tennessee passed biocriteria in the statewide study.

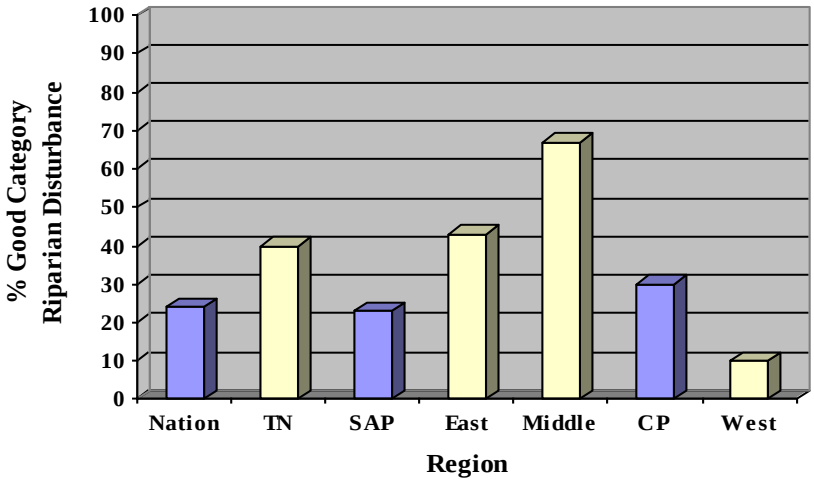
For the habitat category epifaunal substrate and available cover (in-stream habitat in the national study), Tennessee streams were slightly more likely to be in the good category than the nation as a whole. East Tennessee was comparable to other streams in the Southern Appalachian region while middle Tennessee had a higher percentage of sites where the complexity of substrate had not been compromised. It should be noted that this does not mean middle Tennessee streams have more variety of cover than those in east Tennessee as the scoring for each parameter is calibrated for typical streams in each region. For example, mountain streams are expected to have a higher degree of substrate complexity than those in the Interior Plateau. Streams in west Tennessee were slightly more likely to have disturbed cover compared to streams in the national Coastal Plains assessment region.



Sediment deposition (state study) was compared to streambed sediments in the national study. Although the national study used a much more comprehensive method, both surveys attempted to determine whether there was an increase in the amount of fine sediments over reference condition that resulted in changes to the natural stream substrate and flow patterns. Based on these methods, 20-30% more streams in east and middle Tennessee would fall in the good category than those in the EPA Southern Appalachians assessment region. The condition of west Tennessee streams was comparable to those in the Coastal Plains.

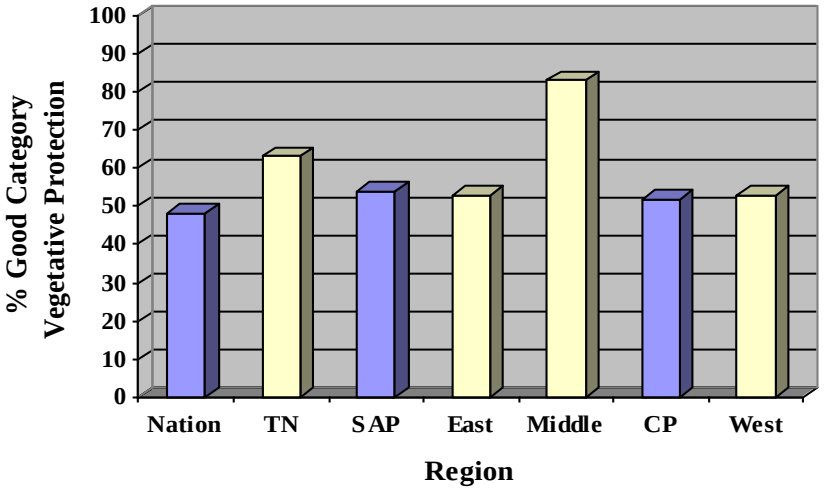


Riparian disturbance measures the proportion of riparian zone vegetation that has been disturbed by human activities. This vegetative zone serves to buffer pollutants entering a stream from runoff and controls erosion. The riparian zone also provides habitat and food to stream organisms.



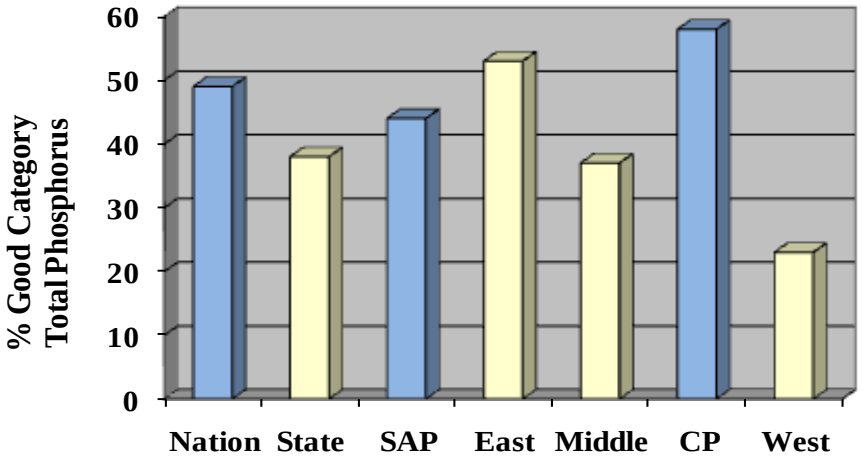
Although riparian disturbance was one of the most frequent habitat problems documented at east and middle Tennessee sites, streams were generally in better condition than those in EPA's Southern Appalachian assessment region. However, west Tennessee streams were more likely to have riparian disturbance than those in the Coastal Plains region.

Vegetative protection corresponds to the riparian vegetative cover in the national study. The parameter determines whether the streambank is covered by multiple layers of native vegetation. Undisturbed streambank riparian helps reduce pollutant runoff, stabilizes banks and reduces water temperatures through shading. Streambank vegetation also provides food and habitat for a variety of aquatic organisms. Ideally, the streambank should be covered by native vegetation including a mixture of large trees, understory and groundcover.



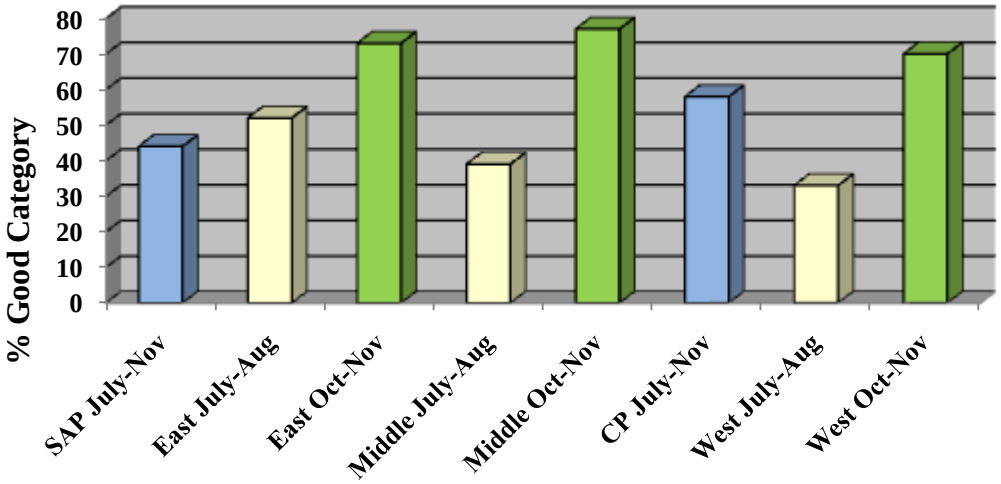
The condition of bank vegetation in east and west Tennessee was comparable to streams in the national study for their respective assessment regions. Middle Tennessee streams were more likely to have bank vegetation in the good category.

Nutrient samples were only collected once during the national study between July and November. This corresponds with summer and fall sampling during the state study, so only these seasons were used for comparison.



Statewide, when compairing to the national study, a lower percentage of sites fell in the good category for total phosphorus. Within the Southern Appalachian assessment region, east Tennessee scored better than the national study while middle Tennessee scored lower. Only half as many streams in west Tennessee met phosphorus guidelines when compared with the Coastal Plain assessment region.

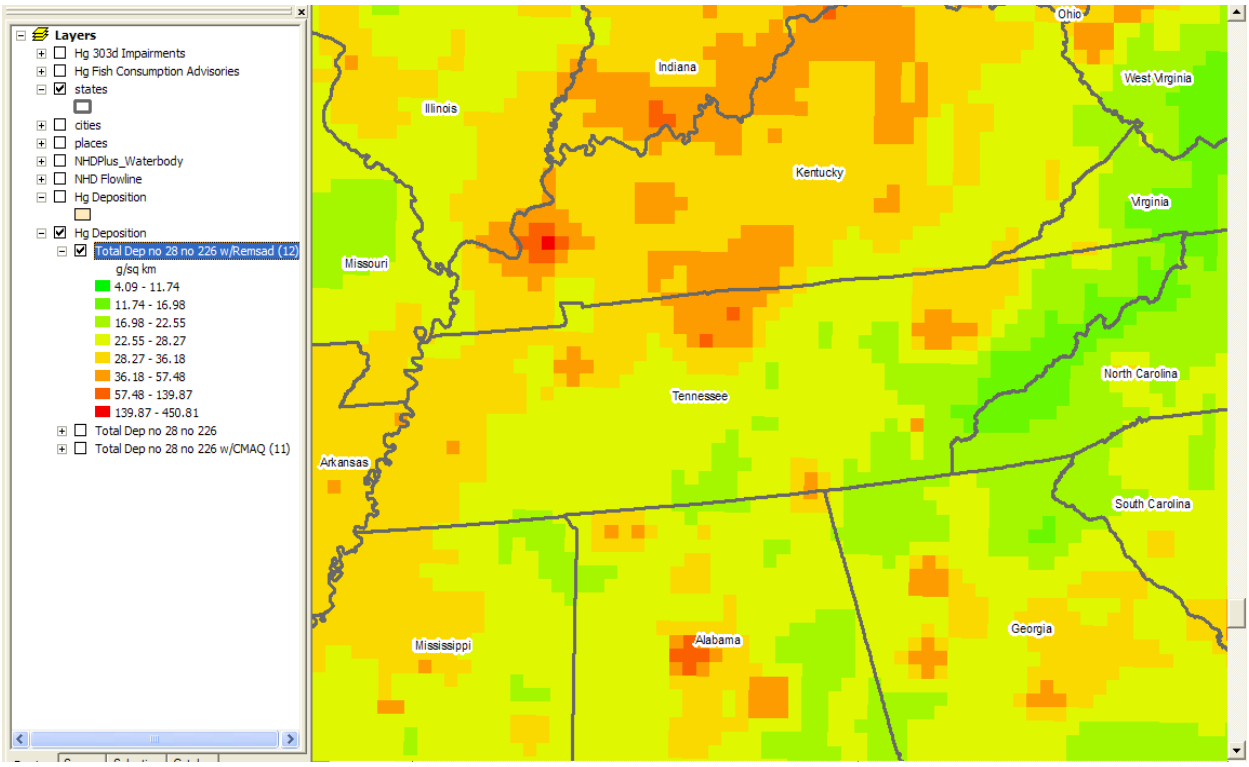
The state study found total phosphorus levels varied by season. The single sample collected at each site in the national study could have been collected either in summer or fall. If national trends in the Southern Appalachian and Coastal Plain assessment regions follow those in Tennessee streams, fall (October and November) TP levels are generally lower than summer (July and August). Depending on which season individual samples were collected during the national study, the results could have been shifted toward more or fewer streams falling in the good category.



The original plan was to resample sites every five years to facilitate trend analysis. However, since 2007-08 was a severe drought period, Tennessee is going to resample starting in July 2010. Metals will be added to this sample set although periphyton and pathogens will be dropped due to budget constraints.

Mercury Air Deposition

In summer 2009, TDEC conducted fish tissue and water column sampling to field test concentrated mercury deposition areas using the Regional Modeling System for Aerosols and Deposition (REMSAD). Sampling focused on small lakes and embayment areas that were targeted by the model as being areas of medium to high mercury deposition. Two species of game fish were collected from 30 waterbodies between July and November. Both fillets and whole fish as well as water samples were analyzed for mercury and selenium. Most of the fish tissue is still being processed at the lab. The final report should be completed by the end of the year.



Headwater Stream Study

Tennessee has established macroinvertebrate and nutrient guidelines for narrative criteria for assessing wadeable streams throughout the state based on reference stream monitoring in each of 25 ecoregions. The reference streams were generally 3rd order or larger and are not appropriate for comparison to headwater streams. In 2008, the division began a 7 year study to identify and monitor first and second order reference streams in 13 Tennessee bioregions to aid in development of biological and nutrient criteria guidelines in headwater streams.

These guidelines will be used to assess headwater streams for the 305(b) and 303(d) reports, locate exceptional headwater streams through the anti-degradation process, provide information for point-source discharge and aquatic resource alteration permits as well as provide information for TMDL studies. The study will also help Tennessee achieve three of its nutrient criteria workplan goals (develop nutrient criteria guidelines for headwater streams, develop associated biological criteria for headwater streams, add a second biological indicator group (periphyton) to nutrient and biological criteria.

Project Goals

1. Establish a minimum of 77 headwater reference streams in 13 Tennessee bioregions over a five-year period. Headwater streams are defined as less than 2 square mile drainage.

2. Collect and analyze nutrient, habitat, dissolved oxygen, pH, temperature, conductivity, flow, macroinvertebrate during two seasons at each station in accordance with the five year watershed cycle. Collect and analyze periphyton data once during the growing season.

3. Determine appropriate sampling seasons for headwater streams in various bioregions.

4. Determine appropriate biological metrics for assessment of headwater streams.

5. Develop macroinvertebrate and periphyton indices appropriate for assessment of headwater streams, thereby achieving two of the state's nutrient criteria development workplan goals.

Based on preliminary results from three ecoregions (65e, 66d and 71f):

- Taxa richness and EPT richness (genus level) is comparable between headwater and larger streams.

- EPT abundance is higher in headwater streams in the coastal plains (65e) and western highland rim (71f) but lower in the mountainous 66d.

- Larger streams are higher in abundance of oligochaetes and chironomids, especially in the coastal plains.

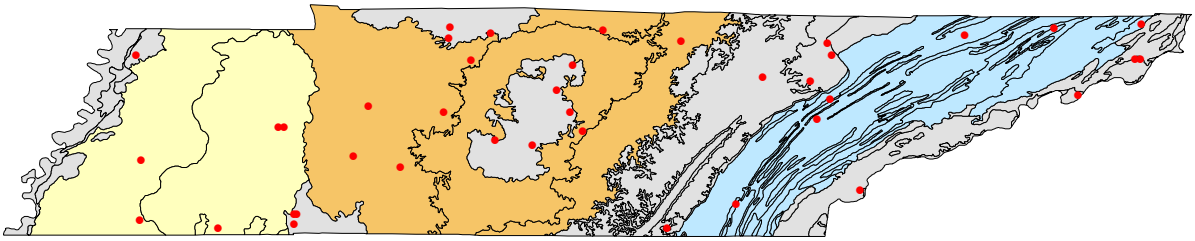
- Headwater streams generally have taxa less tolerant of pollution.

- There is little difference in abundance of clingers.

- The abundance of nutrient tolerant organisms is lower in headwater streams in the coastal plains and mountains but comparable to larger streams in the western highland rim.

- Headwater streams generally score higher on the Tennessee Macroinvertebrate Index than do larger streams.

It should be noted that this is based on reference data from only three ecoregions and additional metrics have not been tested. The data are from candidate reference sites. As more reference streams are established over the next five years, data will continue to be tested.



Candidate headwater reference sites as of March 2010.

Email Change

Please note that Tennessee email addresses have changed. (The old ones will still work for a short transition period). The first part (person's name) will be the same but please use @tn.gov instead of @state.tn.gov.