



Threats were attributed for areas of biodiversity significance that were nominated for the portfolios for 4 freshwater ecoregions in the SE United States. Information is presented for the Tennessee/Cumberland freshwater ecoregion as well all four ecoregions combined to show how ecoregional information can be summarized for regional analyses of threats. There were 69 areas defined in the Tennessee/Cumberland ecoregional portfolio, and 365 were defined among all 4 ecoregional portfolios. During the refinement of these portfolios, experts were asked to select the three most significant stresses and their sources from a list of common stresses and sources to freshwater biodiversity.

## Products/Outcomes

Table 1. Number and Proportions of areas of biodiversity significance with one of the dominant sources of stress. Tennessee Cumberland ecoregion (58 of 69 areas with information)

Agriculture	41	0.707
Residential development	24	0.414
Forestry	14	0.241
Water Management	13	0.224
Resource extraction	8	0.138
Commercial development	6	0.103
Dams	5	0.086
Gravel mining	5	0.086
Ditching/canals	4	0.069
Point-source water pollution	4	0.069
Recreation	3	0.052
Groundwater withdrawal	2	0.034
Introductions	1	0.017
Wastewater	1	0.017

Table 2. Number and Proportion of areas of biodiversity significance with one of the dominant stresses (58 of 69 had data).

Sedimentation	51	0.879
Toxins/contaminants	25	0.431
Nutrient loading	17	0.293
Habitat destruction or conversion	16	0.276
Groundwater depletion	9	0.155
Habitat disturbance	7	0.121
Habitat fragmentation	5	0.086
Modification of water levels or flow pattern	3	0.052
Altered hydrological regime (flow, quantity, etc.)	2	0.034
Water Management	2	0.034
Altered composition/structure	1	0.017
Biological	1	0.017

This analysis was carried out on 4 freshwater ecoregions throughout the SE to identify dominant regional patterns of sources and stresses. Results from a roll-up of information on areas of

biodiversity significance in the Tennessee/Cumberland, Mobile, Mid-Atlantic and Mississippi Embayment ecoregions is below:

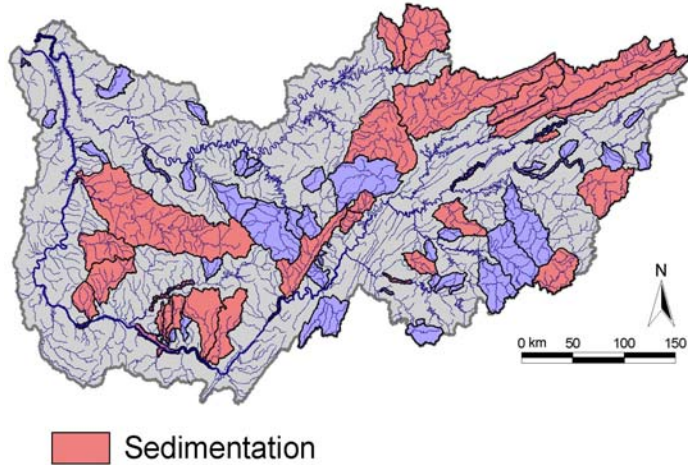
Table 3. Number and Proportions of areas of biodiversity significance with one of the dominant sources of stress across 4 freshwater ecoregions. (180 of 365 areas with information from experts).

<b>SOURCE OF STRESS</b>	<b># OF AREAS</b>	<b>% OF AREAS</b>
Agriculture	100	0.556
Residential development	64	0.356
Forestry	51	0.283
Water Management	46	0.256
Dams	22	0.122
Point-source water pollution	21	0.117
Resource extraction	17	0.094
Ditching/canals	16	0.089
Gravel mining	13	0.072
Biological	8	0.044
Recreation	8	0.044
Commercial development	7	0.039
Dredging	5	0.028
Diversions	4	0.022
Roads/road construction	4	0.022
Groundwater withdrawal	2	0.011
Industry	2	0.011
Wastewater	2	0.011
Commercial fishing	1	0.006
Direct exploitation (e.g., poaching)	1	0.006
Introductions	1	0.006
Invasive species (exotics)	1	0.006
Non-point source water pollution	1	0.006

Table 4. Number and Proportion of areas of biodiversity significance with one of the dominant stresses (172 of 365 with information from experts).

<b>STRESS</b>	<b># OF AREAS</b>	<b>% OF AREAS</b>
Sedimentation	140	0.814
Habitat destruction or conversion	52	0.302
Nutrient loading	45	0.262
Toxins/contaminants	45	0.262
Modification of water levels or flow pattern	33	0.192
Habitat fragmentation	24	0.140
Habitat disturbance	15	0.087
Altered hydrological regime (flow, quantity, etc.)	13	0.076
Groundwater depletion	13	0.076
Poor water quality (pollution, turbidity, etc.)	12	0.070
Altered composition/structure	2	0.012
Thermal alteration	2	0.012
Water Management	2	0.012

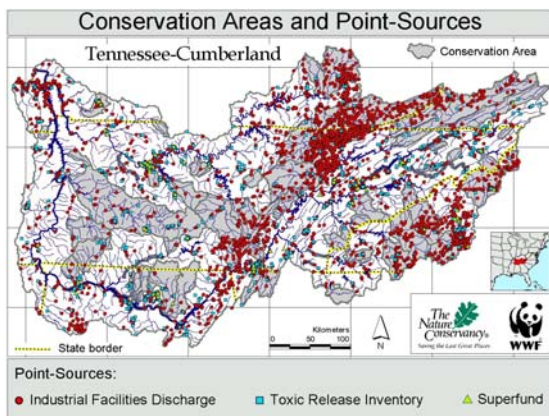
Figure 2. Distribution of sedimentation as a dominant threat identified from experts to areas of biodiversity significance in the portfolio of the Tennessee/Cumberland ecoregion.



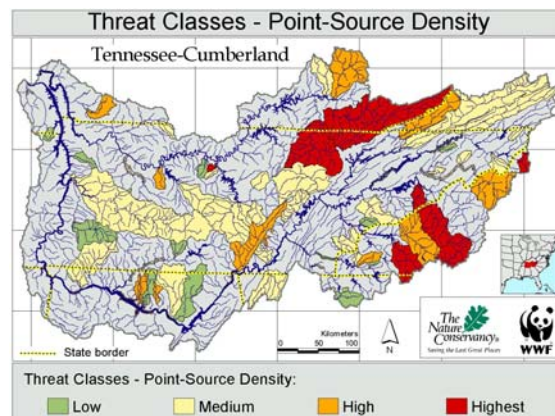
Agriculture, residential development, forestry and water management came up as significant sources of threats. Stresses that were most significant included sedimentation, habitat destruction or conversion, nutrient loading, toxins/contaminants and modification of water levels or flow patterns.

*Stage 2*

The relative severity of sources of threats from agricultural land use, urban areas, dams, and point sources of pollution were assessed and mapped for areas of biodiversity significance, as well as for all watersheds/ecological systems in the entire ecoregion. Relative severity was expressed in quartiles calculated as density of the source per area. Figures 3a and b show patterns of point sources across areas of biodiversity significance as an example.



**Figure 3a.**



**Figure 3b.**

Figure 3. a) The distribution of regulated point sources of pollution distributed across the ecoregion. b) Quartiles of point source density among areas of biodiversity significance.

Information from the analyses in stage 1 and stage 2, and information on biological patterns were used to develop strategies and identify priorities for actions in the Tennessee/Cumberland and Mobile Basin ecoregions (summarized in Buckner 2002).

### **Tools**

Access was used to track patterns of threats. Access is linked to Arcview in order to spatially display attributes of areas of biodiversity and patterns of threat sources and stresses.

### **Strengths and Weaknesses**

The original ecoregional and regional assessments of stresses and sources was completely expert driven. This approach provides insights that cannot necessarily be apparent from spatial analyses, but also subjectivity from the viewpoint of the source of information. Expert information is not geographically comprehensive. The spatial analyses are based on quartiles of spatial data that reflect patterns of sources. The cut-offs of the quartiles do not represent adequate thresholds of condition or integrity for the areas of biodiversity significance. They are best interpreted as doing a good job in showing the most and least impacted places from specific sources of threats. They were useful for identifying the threats with the greatest scope and severity. Further analyses of spatial patterns within areas of biodiversity significance will show proximity and scope of sources of threats to specific freshwater targets within areas.

### **References**

Smith, R. K., P. L. Freeman, J. V. Higgins, K. S. Wheaton, T. W. FitzHigh, A. A. Das, and K. J. Ernstrom. 2002. *Priority Areas for Freshwater Conservation Action: A Biodiversity Assessment of the Southeastern United States*. 2002. The Nature Conservancy. Arlington, VA. 68 pages.

Buckner, M. M., W. Smith, and J. A. Takas. 2002. *Tennessee, Cumberland and Mobile River Basins at Risk*. The World Wildlife Fund. Nashville, Tennessee, USA.

