BANK EROSION HAZARD INDEX (BEHI)

The Bank Erosion Hazard Index (BEHI) is a fluvial geomorphic procedure measuring a stream bank's resistance to erosion. It allows researchers to distinguish between streams eroding at a natural pace and those that have the potential to erode at unnaturally high rates. Knowing the rate of erosion allows professionals to prioritize eroding banks for remedial actions like stream restoration. The type of erosion targeted in the BEHI is typically caused by stormwater runoff and the loss of riparian corridors, causing excess sedimentation and increased erosion.

EROSION:

Erosion is a type of weathering in which surface and rock materials by wind, water, and other materials. The normal rate of erosion can be quickened by mass wasting, fluvial entrainment, surface erosion, freeze-thaw movement, and ice scour as well as water table dynamics. In all, erosion can account for up to 80% of stream sediment loading.

The BEHI used by Cleveland Metroparks has been modified for time constraints, non-professionals, and non-alluvial stream conditions unlike those in Colorado where the BEHI was originally developed. Cleveland Metroparks structured the modified BEHI around the goals of identifying the volume, source, and rate of streambank erosion to assist in land management and restoration. Modifications include the addition of the pre-screening questionnaire, elimination of the bankfull/bank ratio, and expression of scores as percentages with an associated scores table.

Metric 1: Bank Composition
The materials description accounts for differential susceptibility to erosion among different substrates. Record all types of materials, and then up to 10 points can be added or subtracted to adjust for erodibility. For example, cobble has a very low rate of erosion, so 10 points would be subtracted. Sand is highly erodible, and so 10 points can be added. *This adjustment is not mandatory.*

Metric 2: Bank Stratification
This metric is measured as an adjustment if erosion is occurring due to stratified layers in the bank. If stratified, add 5 points for one layer of stratification and 10 points for multiple layers *only if at least one layer is erodible.* When making this adjustment, it is important to consider where the layers are in relation to the water. *This adjustment is not mandatory.*

Metric 3: Root Depth
This metric is expressed as the ratio between average root depths to the study bank height. The ratio is expressed as a percentage and does not include hanging roots without bank material. Roots on top of the bank are included, however. Estimate the depth from top to bottom vertically in several locations and then average the depths for the percentage.

CASE STUDY: HEMLOCK CREEK

Hemlock, or Wood, Creek is a tributary to Tinker's Creek that runs through Bedford, Walton Hills, and Maple Heights. Hemlock Creek has a drainage area of 3.6 square miles. Cleveland Metroparks has been monitoring Hemlock Creek using the BEHI because the creek has been experiencing in-stream erosion due to stream channel incising, lack of access to the floodplain, stream bank stabilization, and fallen trees due to under-cutting. 3626.8 feet (59.8%) of this creek were not ranked because they did not meet the requirements of the pre-questionnaire. The remaining segments of the creek scored as follows:

Low Erosion:	91.89 ft. (1.5%)
Moderate Erosion:	683.33 ft. (11.3%)
High Erosion:	1053.19 ft. (17.4%)
Very High Erosion:	345.01 ft. (5.7%)
Extreme Erosion:	262.62 ft. (4.3%)

Average Metric Scores for Hemlock Creek*			
Rating:	High	**Root Value:**	47.69
Score:	27.27	**Density Score:**	6.65
Segment Height:	5.45 ft.	**Density Value:**	24.52
Segment Length:	74.12 ft.	**Angle Score:**	68.81
Materials Score:	1.98	**Angle Value:**	5.39
Stratification Score:	2.75	**Surface Score:**	6.24
Root Score:	4.79	**Surface Value:**	32.69

This score indicates that Hemlock Creek is highly susceptible to erosion and may be at risk of bank failure as a result. Based on only humidity, Hemlock Creek would therefore be a priority area for remedial actions.