Stream mitigation site assessments in Harford County

Peilin Chen

Mentored by Mrs. Yvonne Gabriel

Introduction

Anthropogenic activities, such as urban development, have detrimental impacts on the sustainability of ecosystems. For example, road construction causes higher levels of sedimentation in streams, reducing phytoplankton growth rates and fish population size (Gove et al., 2001). To compensate for these destructive impacts, the Environmental Protection Agency (EPA) established regulations under Section 404 of the Clean Water Act for restoration of wetlands and aquatic habitats (Van Longkhuyzen et al., 2004). The act utilizes total maximum daily load (TMDL), a measurement of pollutants in water, to determine targets of pollutant reduction. To fulfill TMDL mandates and restore impaired waterbodies, state and local governments have launched a series of stream mitigation projects.

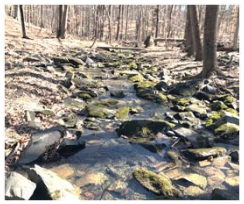


Figure 1 (above): Mill Brook (Site 10) depicts a low degree of bank incision.

The purpose of this study was to identify potential stream mitigation sites in Harford County via geospatial and physical field assessments (see Figure 1). A report was created and filed with the Harford County government for use in the next phase in mitigation project planning.

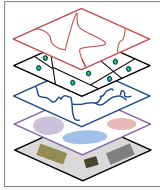
Materials and Methods

A habitat assessment model that integrates geospatial data and field assessments was developed using several resources. Map layers (Figure 2) were imported into ArcGIS Pro from the Maryland iMap website and used for several queries.

Geospatial data were collected from map queries, containing different attributes of a map layer, including land use, stream drainage, property ownership, and stream classification. Potential mitigation areas were traced into a shapefile using the polygon tool. Under the attributes table, geometry commands were implemented to calculate the mitigation area and restoration length of the stream site.

Field assessments were also conducted to prioritize the restoration potential of each site. A visual stream assessment rubric was used to score physical characteristics of the site such as land use, erosion status, floodplain access, and bank incision. A score out of 90 was generated. Comparing the scores between the 10 sites, a prioritization ranking of high, medium, or low was determined for each site. A final report was created revealing conditions and mitigation assessment scores for each site.

Figure 2 (right): Geographic information system (GIS) layers were placed on top of each other to generate a map.



Maryland SSURGO Soils
Maryland Property Data
Harford Stream Use Classes
Land Use Land Cover 2010
Imagery\MD_SixInchImagery

Materials and Methods (cont.)

Results

Stream restoration site attributes

Mitigation Potential	Land Use	Mitigation Area (ac)	Restoration Length (ft)	Site Opportunity*	Site ID
High	Forestry	0.53	466	Channel Restoration	3
High	Forestry	0.63	590	Channel Restoration	6
High	Agricultural	1.32	859	Habitat Enhancement	9
Medium	Institutional	1.04	600	Channel Restoration	4
Medium	Forestry	1.42	808	Habitat Enhancement	5
Medium	Agricultural	2.67	891	Riparian Buffer Planting	7
Medium	Forestry	0.48	893	Channel Restoration	8
Low	Forestry	2.88	1302	Habitat Enhancement	10
Low	Forestry	0.79	734	Fish Passage	1
Low	Residential	1.44	698	Riparian Buffer Planting	2

Table 1 (above): Sites were prioritized for their mitigation potential based upon the field assessment scores. *Recommended type of restoration that can be conducted.

Harford County potential stream restoration sites

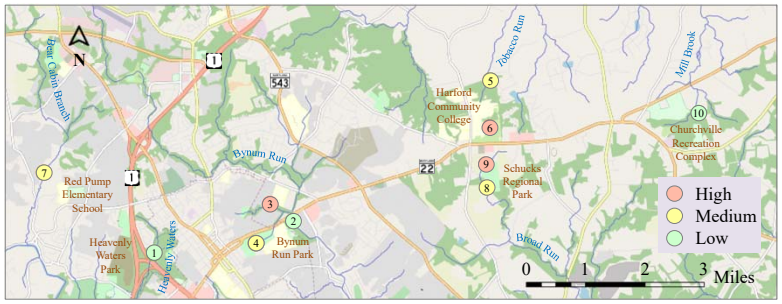


Figure 3 (above): Ten Harford County sites were evaluated and scored for potential restoration. The blue label closest to each site indicates its stream drainage area. Note that the three high mitigation potential sites are located along Maryland Route 22.

Results (cont.)

Figure 4 (above): Tobacco Run (Site 6) displays relatively high banks and severe erosion.

Assessment results in Table 1 show the mitigation potential, land use type adjacent to the stream, mitigation area, restoration length, site restoration opportunity, and site identification. Sites with higher mitigation scores displayed higher need and prioritization for restoration (see Figure 4). Site locations and restoration potential were plotted on a map of Harford County (Figure 3).

Discussion

The study accomplished phase 1 of a multi-step stream mitigation project by identifying and prioritizing potential restoration sites in Harford County. Results were compiled into a report and filed with the Harford County government. The report provides background for a more thorough analysis of the biological, chemical, and physical conditions of sites with high prioritization (phase 2). Additionally, the reported site conditions will guide decision makers on which preservation method is best for restoring each stream habitat (phase 3). The implementation of stream restoration will generate tax credits, compensate for degradation caused by anthropogenic activities, and enhance the biodiversity of ecosystems. It is recommended to pursue additional phase 1 mitigation assessments on private farmlands because they induce a greater impact on the water quality of streams.

References and Acknowledgements

Gove, N. E., Edwards, R. T., & Conquest, L. L. (2001). Effects of scale on land use and water quality relationships: a longitudinal basin-wide perspective. *Journal of the American Water Resources Association, 37*(6), 1721-1734. https://doi.org/10.1111/j.1752-1688.2001.tb03672.x

Van Longkhuyzen, R. A., Lagory, K. E., & Kuiper, J. A. (2004). Modeling the suitability of potential wetland mitigation sites with a geographic information system. *Environmental Management, 33*(3), 368-375. https://doi.org/10.1007/s00267-003-3017-3

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