On the Diversity of Erosion Control Products: Implications for Snake Entanglement

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Introduction

After a road construction project, Texas Department of Transportation (TxDOT) mandates that erosion control products (ECPs) are installed to prevent soil loss and promote plant growth. However, their presence on the landscape pose negative consequences to wildlife via entanglement.

TxDOT provides an Approved Products List (APL) of ECPs meeting soil erosion prevention and plant growth standards. In Texas, multiple types of ECPs are produced with a range of materials and attributes to decrease the erosion potential on multiple soil types and slopes. Certain attributes are more likely to lead to snake entanglement (Ebert *et al.* 2019 *Wildl. Soc. Bull.*; **Fig. 1A & B**).

Fig. 1A: *Nerodia erythrogaster* entangled in Biomac SC (2 layer ECB with fused, polypropylene netting) during snake entanglement trials.

Fig. 1B: *Pantherophis obsoletus* discovered entangled on ECB S32 DB (2 layer ECB with fused, polypropylene netting) during field surveys.

The purpose of this study was to quantify the diversity of traits of the erosion control products to determine which products pose the least risk of snake entanglement to limit this additional source of mortality.

Methods

We reviewed the 146 erosion control products from the TxDOT's APL by quantifying the diversity of ECP attributes most associated with snake entanglement.

These traits include presence of mesh netting, mesh netting material, number of layers, mesh intersection type, aperture size, aperture shape, degradation type, time to degradation, matrix constitution, and application utilization.

For analysis, we constructed a frequency histogram for each trait described and utilized an Unweighted Pair Group Method With Arithmetic mean (UPGMA) cluster analysis with a Gower Similarity Index for 98 products on the APL for which we found all information.

Results

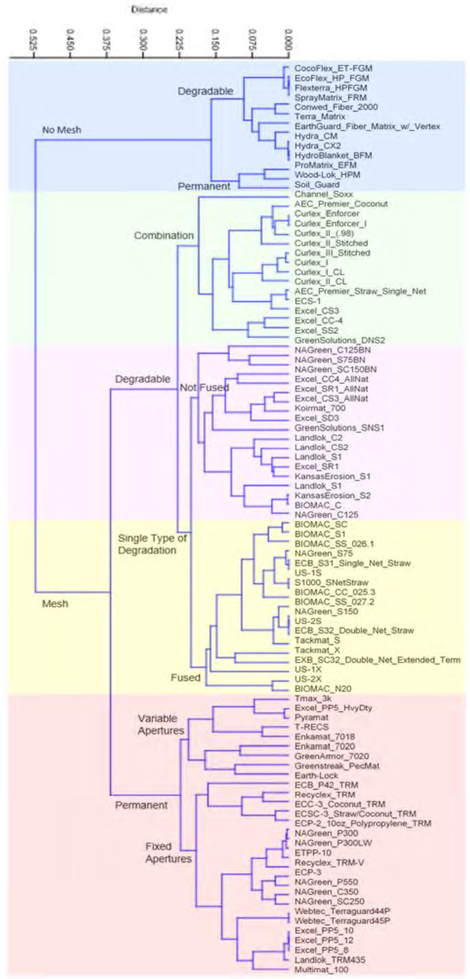

Fig. 2: UPGMA phenogram showing relationships between 98 ECPs on TxDOT's APL (Gower Similarity Index, cophenetic correlation = 0.8793). Differences in color defines the major breaks in ECP type..

Cluster Analysis:
The cluster analysis separated ECPs into two primary groupings based on presence/absence of mesh. These two main groups were further classified as either permanent or degradable.

Permanent ECPs were split as variable or fixed apertures. ECPs that were degradable were further classified by one or multiple types of degradation. Those with one type of degradation were split based on the presence of fused apertures (**Fig. 2**).

Histograms:
86% of ECPs contained mesh netting (**Fig. 3A**).

55% of ECPs exhibit fused apertures, 7% were woven, 21% were stitched, and 16% did not have apertures (**Fig. 3D**).

71% ECPs contained mesh netting composed of polypropylene (**Fig. 3E**).

34% of ECPs were permanent (**Fig. 3G**).

56% of the ECPs contained two or more layers of mesh (**Fig. 3B**).

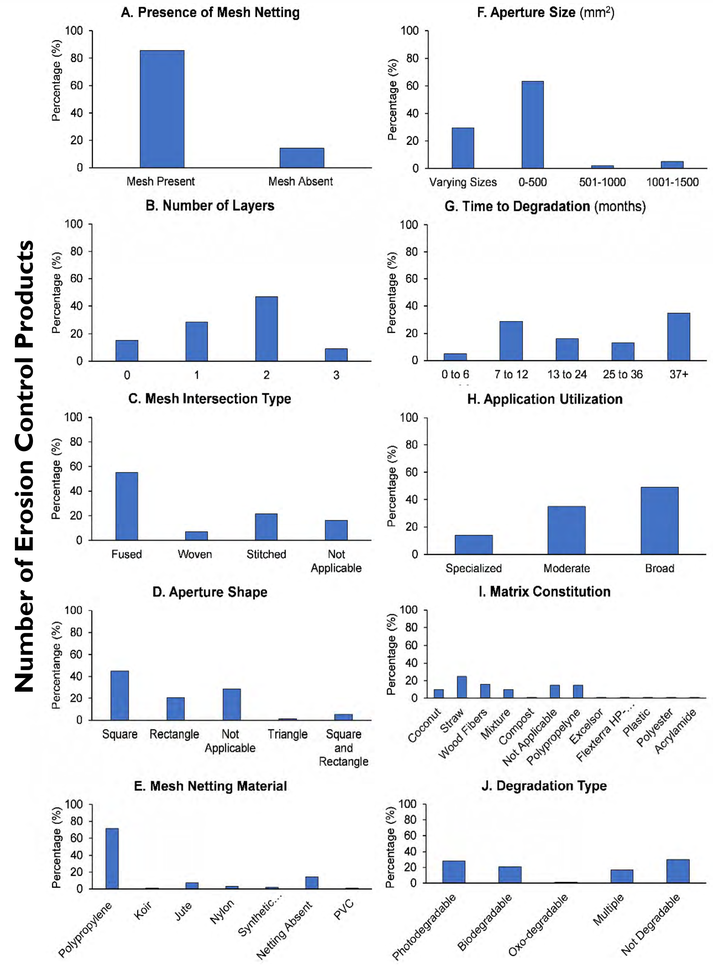

Fig. 3: Percentage of ECPs that exhibit A) Presence of mesh, B) Number of layers, C) Mesh intersection type, D) Aperture shape, E) Mesh netting material, F) Aperture size, G) Time to degradation, H) Application utilization, I) Matrix constitution, and J) Degradation Type.

Discussion

Wildlife, particularly snakes, are prone to becoming entangled in ECBs that contain fixed-intersection, small-diameter polypropylene mesh with multiple layers (Ebert *et al.* 2019 *Wildl. Soc. Bull.*). Our analysis found that a majority of ECPs possess these attributes which may pose a risk of entanglement and potential mortality for snakes.

However, our review included only 68% of the products on the APL as information on these products is not easily obtained or is unaccounted for. This lack of information and diversity of products with a multitude of traits makes it difficult for optimal product selection by contractors and state or federal agencies.

Increased awareness of these potentially harmful products benefits conservation efforts for wildlife. Our research could serve as a guide to aid contractors and other agencies in selecting products that fit their application needs while also minimizing risk on wildlife.

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