# DMS (formerly EEP) Watershed Prioritization Tool

## Objectives/overview:

Using publicly available and up-to-date data, we are developing a tool for the NC Department of Mitigation Services (DMS) to prioritize HUC12s within a HUC8 for mitigation activities. In the broader scope, prioritization is based on a weighted mixture of species habitat, water quality, hydrology, and geomorphology; however, this repository is specific to species habitat.

The ultimate goal of this toolkit is to provide DMS with a table of HUC12s and the following attributes:

* Indication of **current habitat status**: "OK as is", "Restorable", or "Beyond repair"
* For those HUC6s that are classified "OK as is":
  + What is the level of threat to it remaining "OK", i.e. its "conservation demand"? and
  + What conservation activities might alleviate these threats?
* For those that are "Restorable":
  + What is the **Habitat Uplift Potential** for a given management strategy?

## Calculating current habitat status (HUC 12)

Current habitat status of a catchment is classified as either “Good”, “Restorable”, or “Beyond Repair”.

* A catchment is deemed “Good” if it has either high known taxonomic richness, high expected taxonomic richness, or high habitat likelihood for key indicator species.
* If a catchment is not deemed “Good”, it is classified as “Restorable” if it as many of the habitat characteristics correlated with known taxonomic richness or with presence of an indicator species, and those characteristics that it is missing can be corrected through mitigation.
* If a catchment is not deemed “Good” and the habitat factors it is lacking cannot be corrected through mitigation, it is classified as “Beyond Repair”.

### Calculating known taxonomic richness

Using occurrence data collected by Mark Endries, we tabulate the number of observations of a given taxonomic group (fish, mussels, etc.) found within each NHD+ catchment. We tally both raw observations and also rarity-weighted observations, i.e., scoring species with a lower G-ranking higher.

The result – a table of catchments with columns for each taxa listing raw and rarity-weighted richness – indicates where species have been observed. However, little can be inferred about the catchments with zero richness as those simply may not have been visited.

### Calculating expected taxonomic richness

We calculate the correlations between known taxonomic richness scores and a suite of catchment characteristics tabulated for each NHD Catchment (Table X) to identify which characteristics (from a suite of > 100 measured attributes) typify a catchment with high taxonomic richness. We then assign expected richness scores to each catchment based on whether it shares these characteristics.

Catchments with high known taxonomic richness should overlap well with those with high expected richness. However, those with high expected but low known richness are explained in one of two ways: first is that many species occur there but were never observed; second is that many species *could* occur there, but don’t. The latter can result from disturbance, barriers to dispersal, or simply poor modeling performance.

### Calculating habitat likelihood

Similar to expected taxonomic richness, we determine which catchment characteristics are correlated with observed occurrences of a specific indicator species. Those catchments sharing these characteristics are assigned a habitat likelihood score for that species.

### Classifying current status

Catchments with an expected taxonomic richness score in the top quartile are assigned a current status of “Good”; these catchments likely have the conditions to support many species as is and require no remediation. The remaining catchments are examined in more detail to determine whether they should be classified as “restorable” or “beyond repair”. Specifically, we examine the attributes of these catchments to determine why they fell short of supporting high diversity. If the critical attributes can be altered by management, they are deemed restorable; if they fall mostly into immutable characteristics (e.g. drainage area or slope), then they are classified as beyond repair.

## Calculating Potential Uplift (in *Restorable* catchments)

For catchments classified as Restorable, we determine the potential impact a given management action might have in restoring that catchment to a “Good” classification. We have two approaches.

#### Approach 1: Linking variable importance to management actions and catchments where management actions are viable.

The first approach is simply to relate the correlation strength of each variable to species presence. For example, MaxEnt produces a table of each habitat variable’s *contribution* and *permutation importance*; high values indicate the variable is important in predicting habitat likelihood. We then identify catchments where management actions can have a big change on this/these variables.

To do this, we require a table listing catchments and the potential for a given management activity to occur. For example, a catchment that already has 100% of its streams adequately buffered could not sustain more buffering, whereas one where buffering could take place [cheaply] would represent high uplift potential.

The product of this approach would be a table listing the Maxent calculated variable contributions for each habitat variable, for each species, as well as an average of all the species modeled in the catchment. This table would be linked with a second table listing the management hooks associated with each variable.

The second approach is to generate an alternative landscape reflecting implementation of the management activity within the entire region. For example, we could simulate the conversion of all riparian areas to forest. This change would be reflected in the catchment characteristics

## Calculating Conservation Potential (in *Good* catchments)

These values at the HUC12 scale are derived by aggregating NHD+ catchment scale attributes. For each catchment