Assessing Stream Functions and Conditions – Challenges and Solutions

Overview and a North Carolina example

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Introduction

- Purpose of Rapid Assessment Methods (RAMs) – conduct rapid evaluations during one site visit to estimate the condition of wetlands or streams.
- Note that most information for this talk taken from :
  - Dorney, Savage, Tiner, and Adamus, eds. "**Wetland and Stream Rapid Assessments: Development, Validation, and Application**", August 2018, Elsevier Publishing
- Definition of RAMs
  - RAMs – standardized procedures that generate a score, index, or rating for the ecological status of an individual site or its individual ecosystem services.
  - Either field-based or landscape-based.
  - Rapid - defined as minutes or hours rather than days (for field-based)

Introduction (cont.)

- **Wetland versus Stream RAMS**
  - Stream RAMs are less common than wetland RAMs.
- **Types of Stream RAMs**
  - Flow duration – ephemeral, intermittent, or perennial.
  - Condition Assessment
    - Overall condition.
    - Condition for various attributes (hydrology, water quality, aquatic life).

History of RAMs

- **Wetlands**
  - Landscape-based from the 1960's.
    More recent advances with much better GIS – Ralph Tiner, etc.
  - Field-based from 1980 –
    - Earliest - Federal Highway Administration, then Wetland Evaluation Technique (WET) by Corps of Engineers in 1987 (Paul Adamus, etc.).
    - Many state/provincial or regional wetland RAMs since then. Efforts continue.
    - Hydrogeomorphic Method (HGM) in the late 1990's.
- **Streams**
  - Earliest method 1999 (North Carolina).
  - Then Chesapeake Bay method and Oregon Method.
  - Others encouraged by 2008 Mitigation of the EPA and Corps of Engineers.
  - Still much less common than wetland RAMs.

General Process of Developing/Adapting RAMs

- Mostly from Adamus, 2018 - Chapter 3 of recent Elsevier book.
- **Outline of process to use**
  - Delimiting the assessment area.
  - Selecting Indicators.
  - Creating models.
  - Collection of calibration data.
  - Conversion of scores to ratings.
  - Conversion to overall score.

General Process of Developing/Adapting RAMs (cont.)

- Mostly from Adamus, 2018 - Chapter 3 of recent Elsevier book
  - Repeatability and sensitivity analysis.
  - Accuracy analysis.
  - Training.
  - Statistical testing.

General Process of Developing/Adapting RAMs (cont.)

- **Verification** – comparison of results to expected results. Often done by team who developed method.
- **Validation**- comparison based on long-term (at least three years) of monitoring data.
- **Calibration**- mathematical conversion and adjustment of scores based on long-term monitoring data.

NC Stream Assessment Method (NC SAM) as example

- **General Structure**
  - Three main functions – hydrology, water quality, habitat.
- **Development Process**
  - Developed by interagency team (federal and state) over a five year period.
  - Consultants helped with the process but interagency team made all decisions.
  - Adoption by agencies after public notice and comment.
  - Implementation process still taking shape.

Examples of NC streams

Important considerations with NC SAM

- "Rapid" method defined as taking no more than 15 minutes per site after training
- Observation-based but requires aquatic life sampling.
- NC SAM is reference based
  - Compare stream site to its appropriate suite of reference sites as built into method
- Does not replace Best Professional Judgment
  - Rapid assessment method
  - There can be a different conclusion if supported by evidence
  - Results subject to regulatory approval

What is NC SAM? - General considerations

- **High**, **Medium** and **Low** values – by separate function and overall.
- Comparisons within stream category.
- Condition – compare to reference for same stream category.
- Stressors – important consideration.
- NC SAM is **not** a delineation method – jurisdictional status determined by state and federal regulatory agencies.
  - Method not designed to be used on non-jurisdictional channels.

Three Primary Functions

- Hydrology
- Water Quality
- Habitat

Hydrology Function

- Baseflow
- Flood flow
- Streamside/Intertidal zone interaction
- Longitudinal tidal flow
- Tidal marsh stream stability

Base flow versus Flood flow

Water Quality Function

- Baseflow
- Streamside area vegetation
- Indicators of stressors
- Aquatic life tolerance
- Intertidal zone filtration

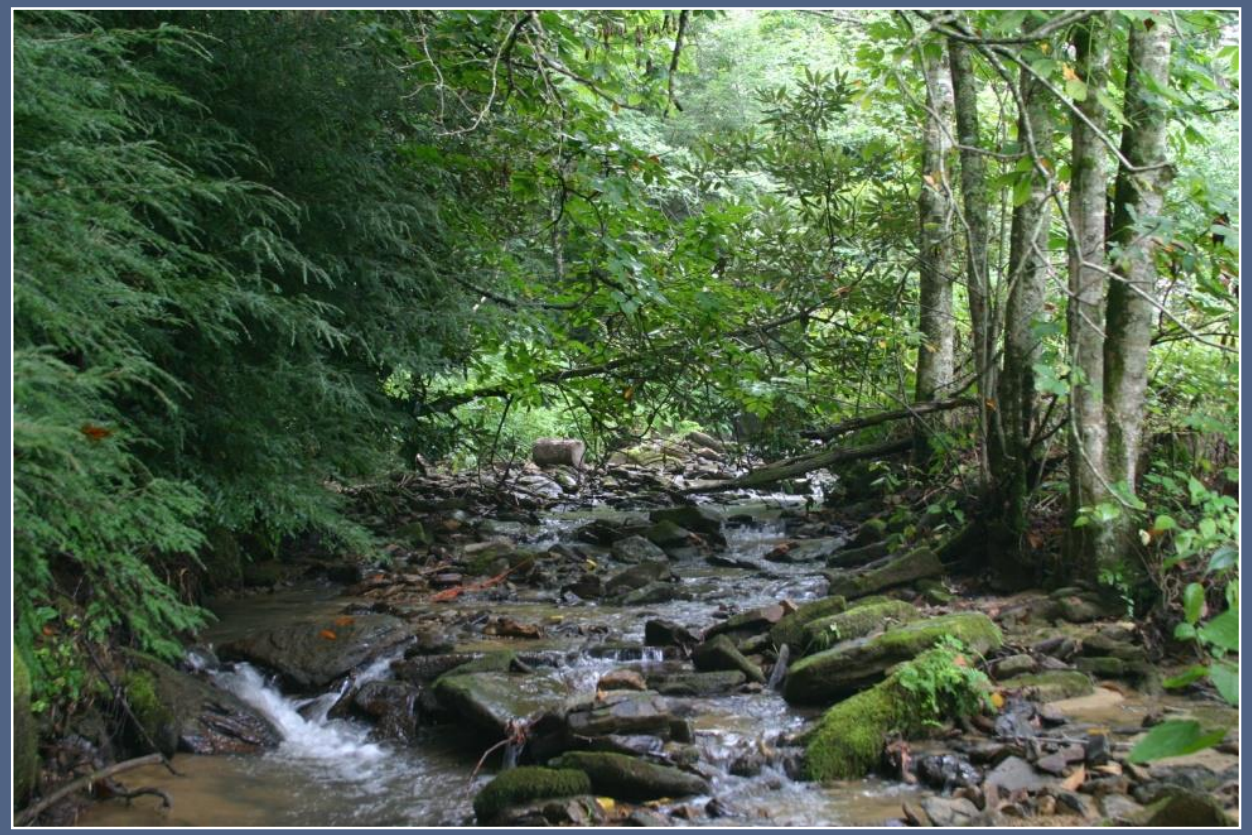
Aquatic Life Sampling

Habitat Function

- In-stream habitat
- Streamside habitat
- Tidal marsh in-stream habitat
- Intertidal zone

Stream-side Habitat and Thermoregulation

Good



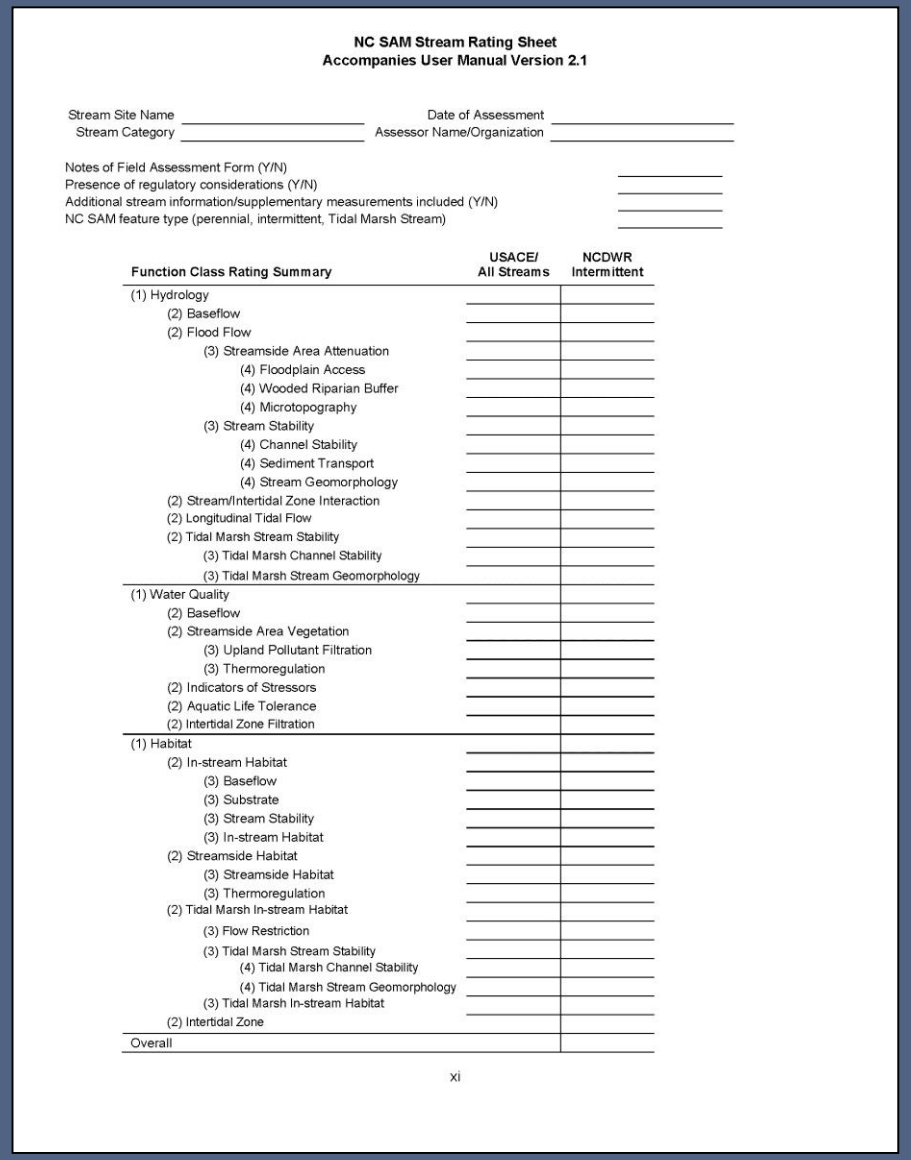
Not so good

Overall Evaluation Process

- One Field Assessment Form (four pages) with all metrics.
- Form completed in field with some office map work.
- Evaluate with Rating Calculator (computer program)
  - Rating Calculator reflects Team's relative weighting of each metric via Boolean logic.
  - "Boolean logic" is a systematic combination of evaluated metrics, sub-functions, and functions.
- Generates rating of High, Medium, or Low.

Overall Results from Assessment

- The four page Field Assessment form yields the following Rating Summary after entering the results into the Rating Calculator.



NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name _____ Date of Assessment _____
Stream Category _____ Assessor Name/Organization _____

Notes of Field Assessment Form (Y/N) _____
Presence of regulatory considerations (Y/N) _____
Additional stream information/supplementary measurements included (Y/N) _____
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream) _____

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology		
(2) Baseflow		
(2) Flood Flow		
(3) Streamside Area Attenuation		
(4) Floodplain Access		
(4) Wooded Riparian Buffer		
(4) Microtopography		
(3) Stream Stability		
(4) Channel Stability		
(4) Sediment Transport		
(4) Stream Geomorphology		
(2) Stream/Intertidal Zone Interaction		
(2) Longitudinal Tidal Flow		
(2) Tidal Marsh Stream Stability		
(3) Tidal Marsh Channel Stability		
(3) Tidal Marsh Stream Geomorphology		
(1) Water Quality		
(2) Baseflow		
(2) Streamside Area Vegetation		
(3) Upland Pollutant Filtration		
(3) Thermoregulation		
(2) Indicators of Stressors		
(2) Aquatic Life Tolerance		
(2) Intertidal Zone Filtration		
(1) Habitat		
(2) In-stream Habitat		
(3) Baseflow		
(3) Substrate		
(3) Stream Stability		
(3) In-stream Habitat		
(2) Streamside Habitat		
(3) Streamside Habitat		
(3) Thermoregulation		
(2) Tidal Marsh In-stream Habitat		
(3) Flow Restriction		
(3) Tidal Marsh Stream Stability		
(4) Tidal Marsh Channel Stability		
(4) Tidal Marsh Stream Geomorphology		
(3) Tidal Marsh In-stream Habitat		
(2) Intertidal Zone		
Overall		

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NC Stream Assessment Method (NC SAM)- Other issues

- **Verification-**
  - Done by team.
  - Compared results to expectations –statistical test
  - Compared results of water quality to percent impervious surface – statistical test.
- **Calibration (to come)**
- **Training**
  - Four day class taught by consultants and agency staff at two locations in NC.
  - Next class in Raleigh from September 11-14, 2018. Then class in Charlotte, NC in the spring. Sponsored by the NC Association of Environmental Professionals.

Implementation

In general, NC SAM will be used for

- **Environmental documentation**
- **Avoidance and minimization for permitting**
- **Compliance and enforcement**
- **Watershed assessments**
- **Training**
- **Site evaluation**
- **Case-by-case basis**

Implementation (cont.)

Regulatory - *Section 404 Permitting by US Army Corps of Engineers (and States/Tribes)*

- **USACE Wilmington District guidance issued – April 21, 2015**
- **In general, lower quality will have lower mitigation requirements and higher quality will have higher mitigation requirement**
- **Currently, benefit has been realized on projects with multiple alternatives during avoidance and minimization measures**
- **Also, NC SAM provides a common language accepted by all regulatory agencies**

Questions?