THE STREAM TIERED ASSESSMENT FRAMEWORK (STAF)

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ABOUT STAF

What is STAF?

The Stream Tiered Assessment Framework (STAF) is a functions-based approach to evaluate stream ecosystem condition.

Who is the audience?

Staff on ecosystem assessment and restoration studies (CW planning)

What is the value?

Resource efficiency, cross-site and project comparison, flexible toolkit

Why is evaluating ecosystem condition using stream assessments so difficult?

A SITUATION YOU WILL RECOGNIZE



You're conducting a watershed study…

You have:

- 50 candidate sites
- A habitat model available that focuses on 1-2 species
- A rapid method available

You need:

- To identify which sites are worth field time and assessment costs
- To defend the method

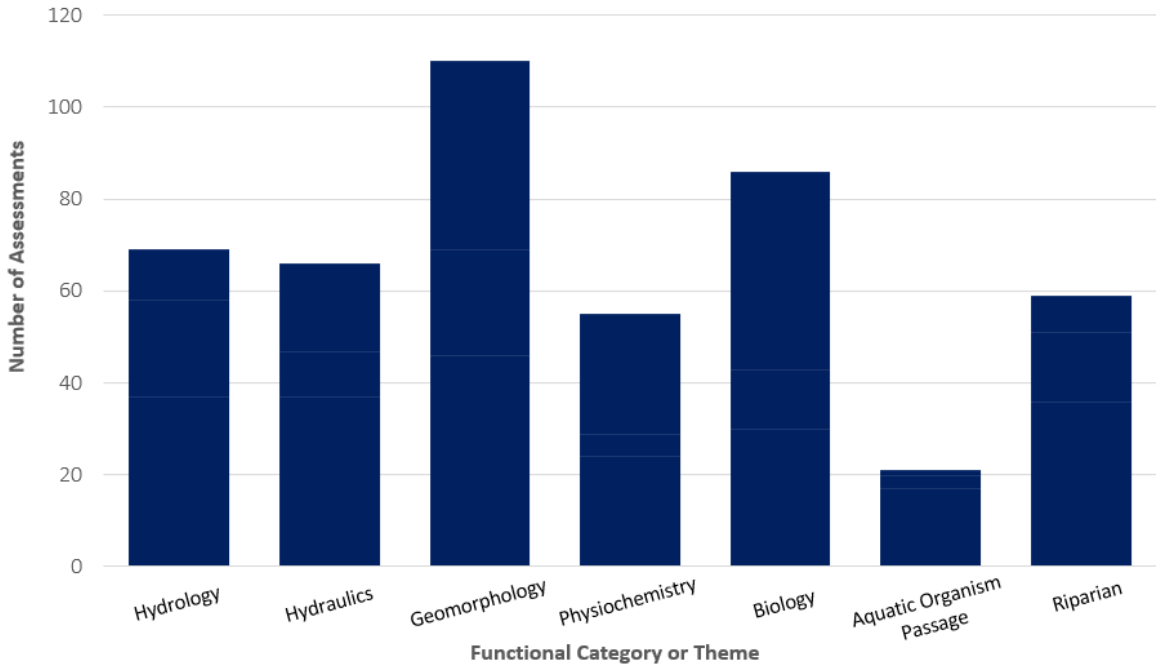
This is a common problem that identifies a gap in USACE's assessment toolbox.

WE LOOKED FOR A BETTER APPROACH

188 stream assessment methods compiled and analyzed

Key statistics on existing assessments:

- Only 5% cover the full range of ecosystem functions. Most only cover a portion
- 72% were built for one region or stream type. This makes the results hard to compare across sites or approaches
- 52% have no documented reference condition or performance standards for scoring



Geomorphology appeared in 59% of methods, and Biology in 46%. Water quality and fish passage showed up in less than 30%.

Stepchinski et al., 2025

CHALLENGES AND PROBLEMS

Finding an assessment method

Knowing what a method covers

Determining the effort

Comparing results

Stepchinski et al., 2025

KEY QUESTIONS

1

QUESTION 1

What stream functions are important in ecosystem assessment?

2

QUESTION 2

How do I compare results across sites, studies, and years?

3

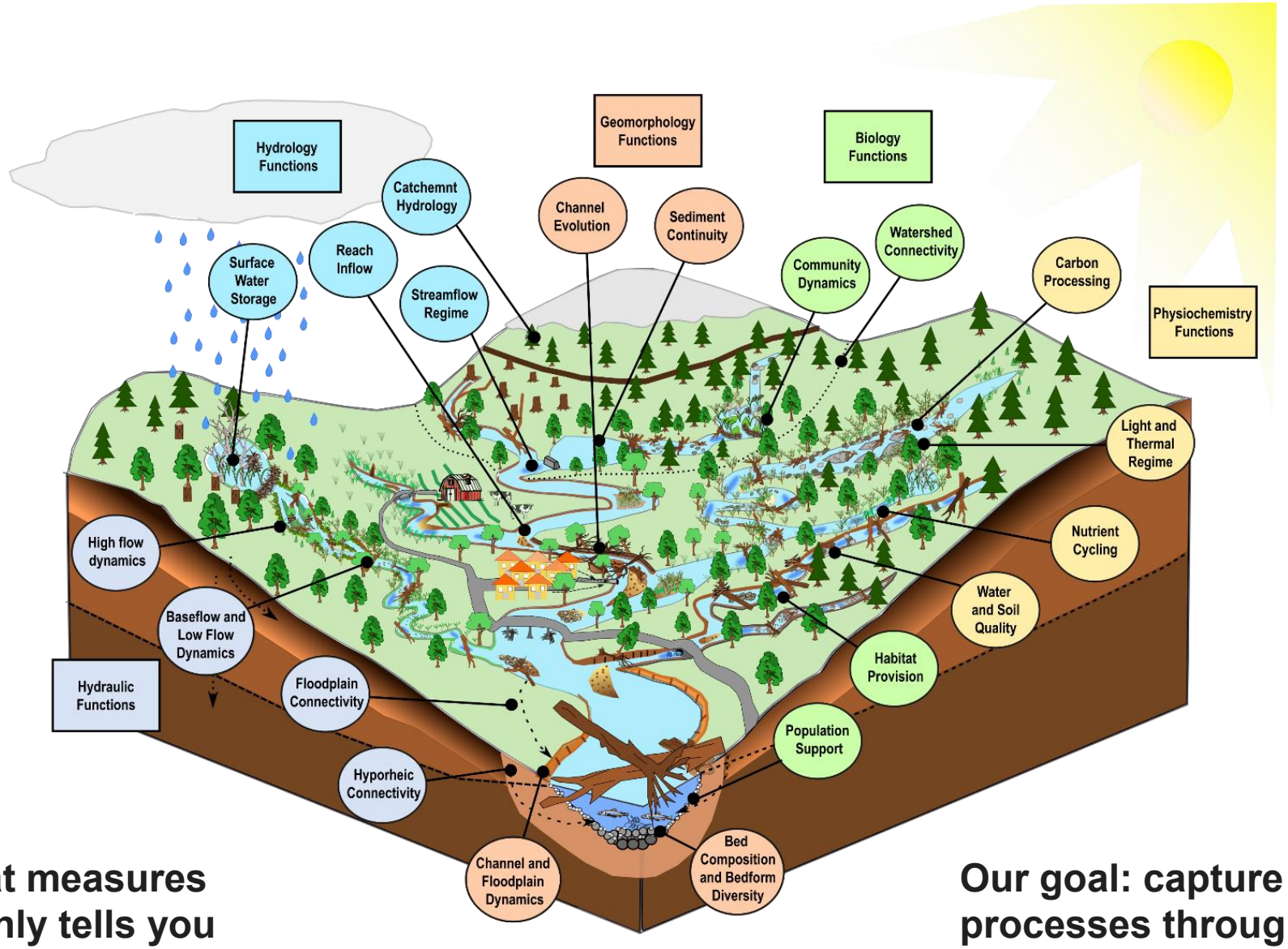
QUESTION 3

What assessments fit the time and data I have available?

STAF addresses all three questions

What stream functions should we assess?

A STREAM HAS MANY PROCESSES



An assessment that measures just one process only tells you about that one piece.

Our goal: capture full range of processes through our stream functions list

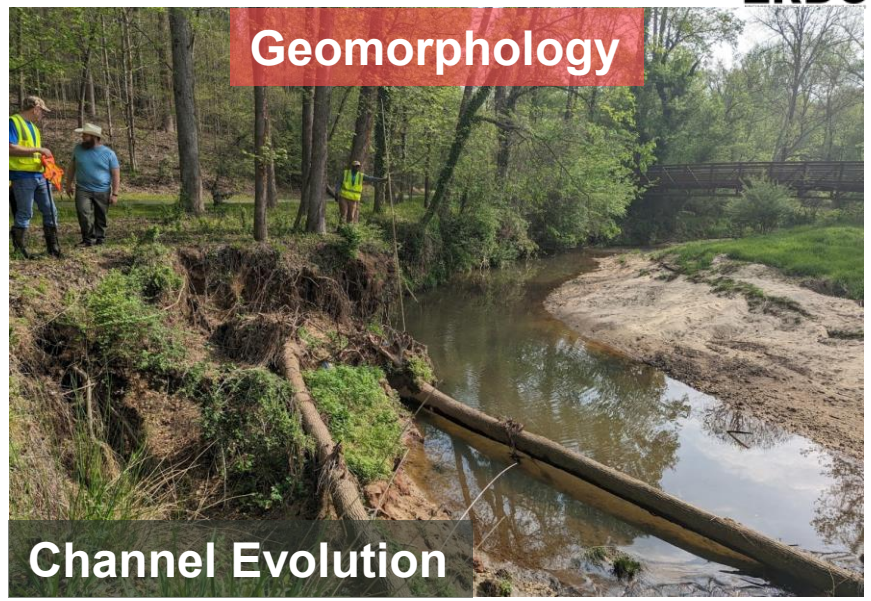
Hydrology	Hydraulics	Geomorphology	Physicochemistry	Biology
Catchment hydrology	Low flow and baseflow dynamics	Channel evolution	Light & thermal regime	Habitat provision
Surface water storage	High flow dynamics	Channel and floodplain dynamics	Carbon processing	Population support
Reach inflow	Floodplain connectivity	Sediment continuity	Nutrient cycling	Community dynamics
Streamflow regime	Hyporheic connectivity	Bed composition and large wood	Water & soil quality	Watershed connectivity

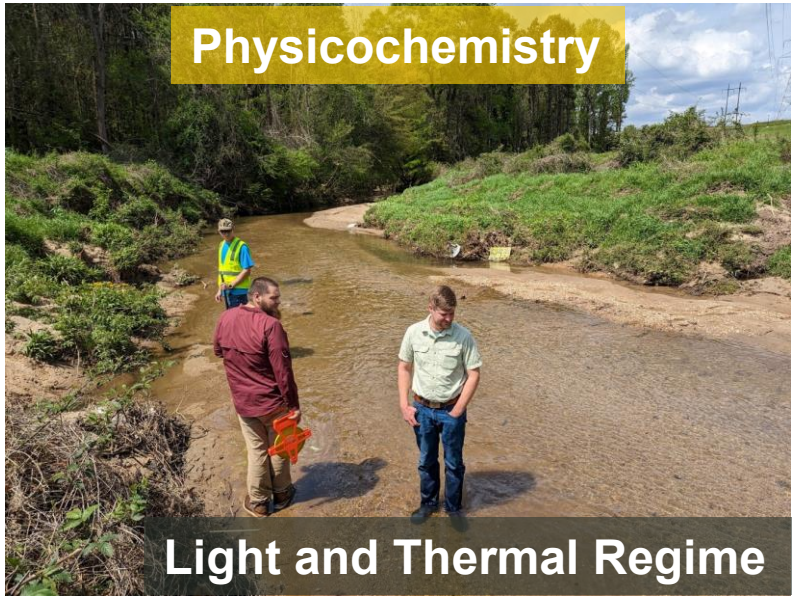
These 20 functions are evaluated in every assessment

SELECTED FUNCTIONS











FUNCTION LIST DOES NOT CHANGE

Phases of Planning Study for Ecosystem Restoration:

SITE SCREENING/SCOPING

Early in study. Quick and limited data.

RESTORATION ALTERNATIVES

Field exploration and development of restoration ideas

DESIGN

Detailed Design development. Final design/monitoring

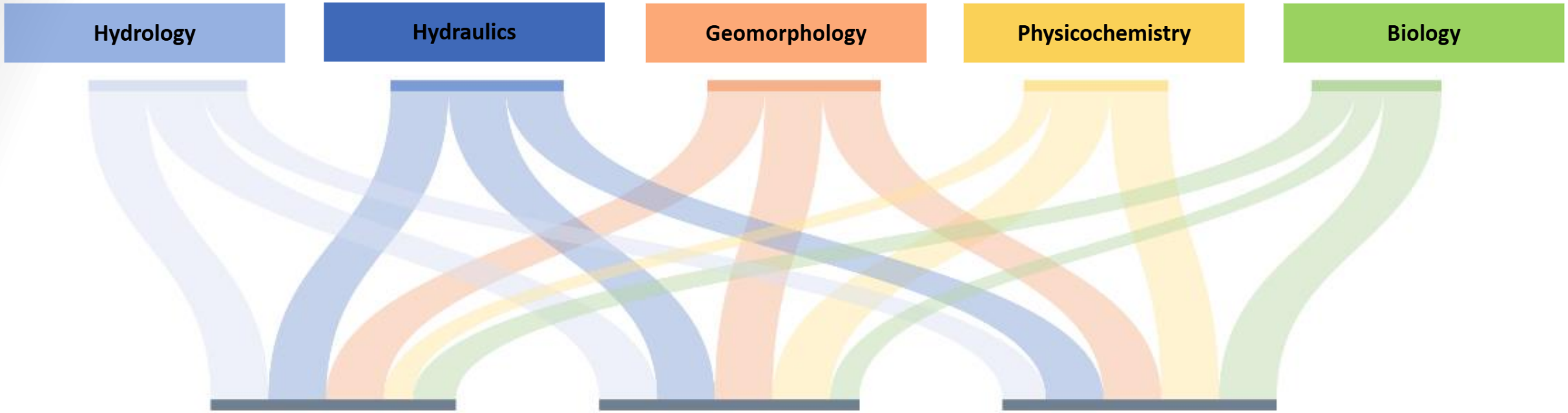
PROBLEM:
Different tools/assessments across phases

STAF:
The same 20 stream functions across phases

How do I compare results across sites, studies, and years?

ECOSYSTEM CONDITION INDEX

- STAF results one number, the Ecosystem Condition Index (ECI)
- Score indicating overall ecosystem condition of stream
- Reflects how functions affect physical, chemical, and biological condition
- Captures interdependence of stream processes



Ecosystem Condition Index

FROM EVIDENCE TO FUNCTION SCORE

Metric Scores

One of more measurements per function, chosen by tier

Function Scores

Value from 0 to 15

Condition Score

Functioning
Function scores 11 to 15

At Risk
Function scores 6 to 10

Non Functioning
Function scores 0 to 5

THE ECOSYSTEM CONDITION INDEX

Physical
outcome sub-index
0.0-1.0

+

Chemical
outcome sub-index
0.0-1.0

+

Biological
outcome sub-index
0.0-1.0

÷ 3

=

ECI
Ecosystem Condition Index
0.0-1.0

Functioning
0.70 to 1.0

At Risk
0.40 to 0.69

Non-Functioning
below 0.40

WHAT A SCORE LOOKS LIKE ON THE GROUND



Mink Brook
Hanover, NH

0.88 Functioning ECI



Sangamon River
Monticello, IL

0.52 At Risk ECI



Cowart Creek
Friendswood, TX

0.15 Not Functioning ECI

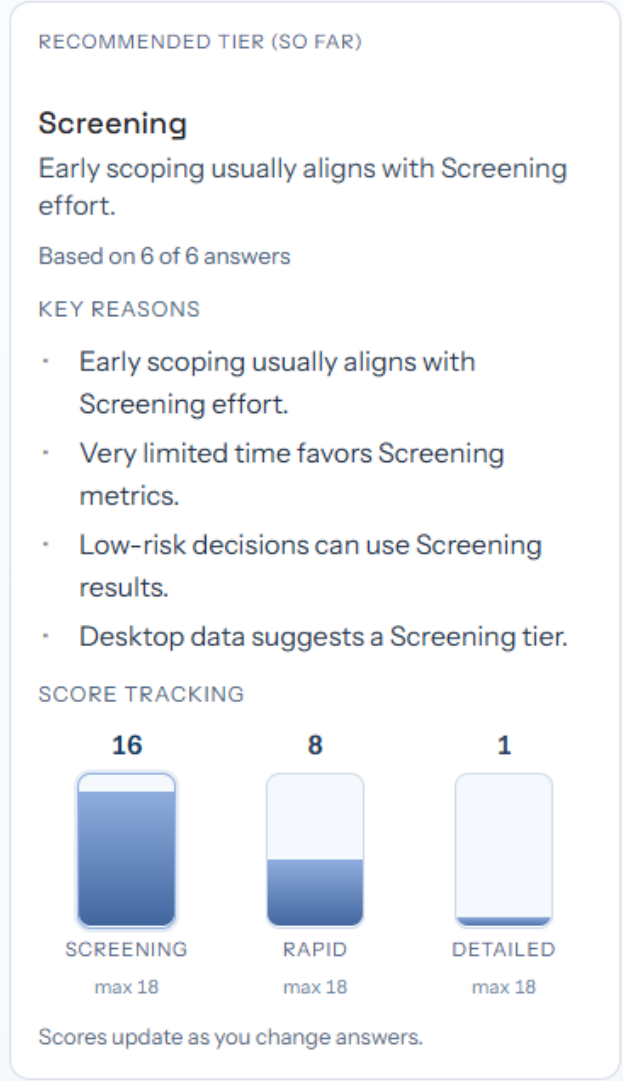
What assessments fit my study?

GM

QUESTIONS THAT POINT TO A TIER

1. What phase is the study in?
2. How many sites are you considering?
3. How much time do you have per site?
4. What is the decision risk at this point?
5. Do you need local calibration?

Tier Selector on STAF Website



TIERS FOR ASSESSMENT

	SCREENING	RAPID	DETAILED
Project phase	Scoping and site screening	Design and alternatives	Final design and monitoring
Score	Qualitative, good to poor	Semi-quantitative, lines of evidence	Quantitative, reference curves
Time per site	Minutes to hours	Hours to a day	Days to a week
Effort	GIS and existing data	Focused field work	Field work, modeling, lab
Training	Low	Low to moderate	Moderate to high

REACH INFLOW (HYDROLOGY)

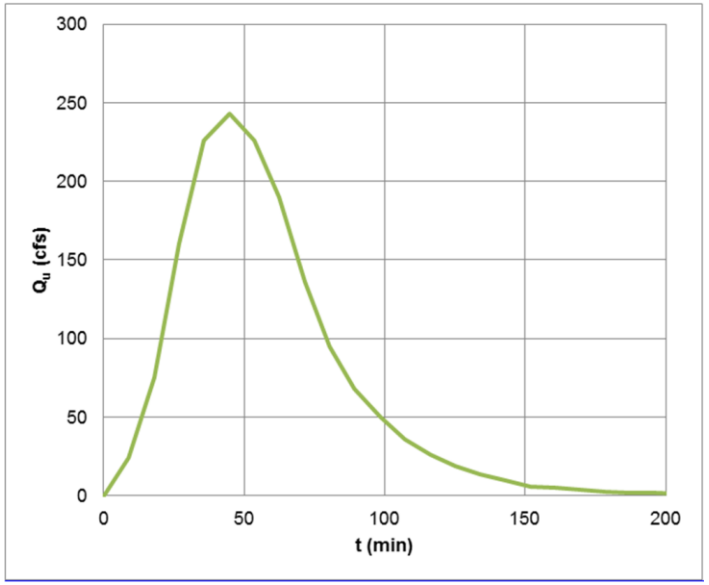
SCREENING	RAPID	DETAILED
Road density in contributing watershed	Number of stormwater pipes and tributary condition	Modeling inflow hydrographs to reach



Desktop GIS



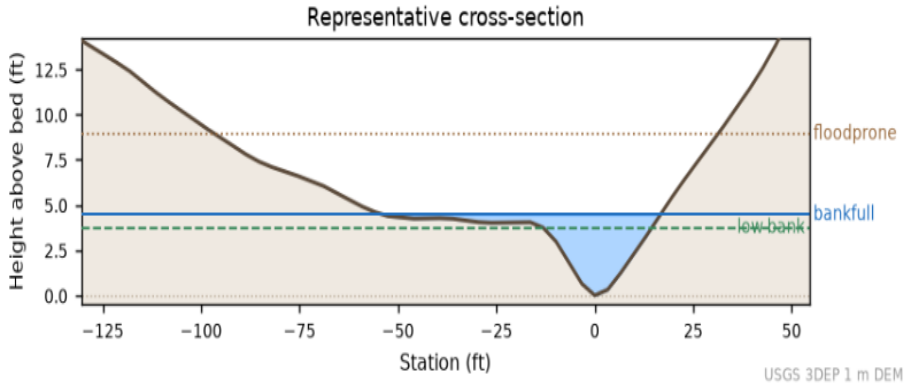
Field Work (Focused/Visual)



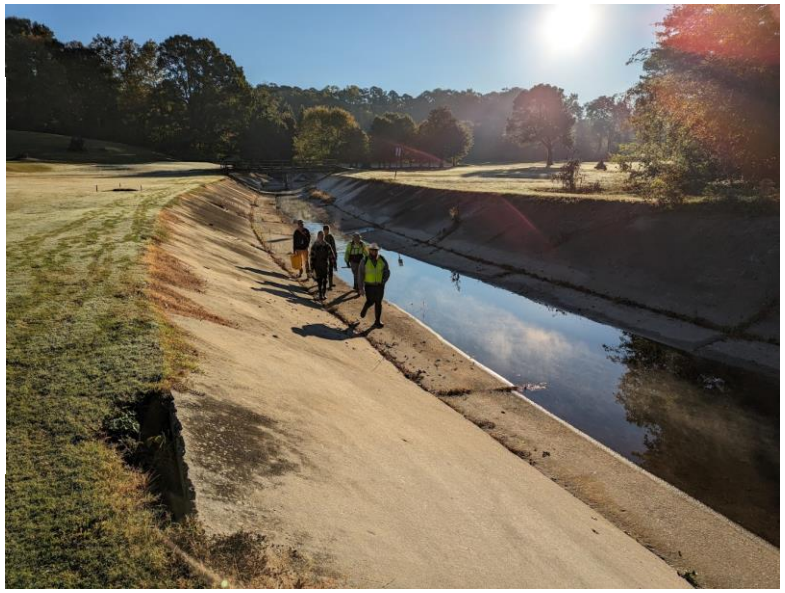
Field/Modeling Work (Detailed Analysis)

FLOODPLAIN CONNECTIVITY (HYDRAULICS)

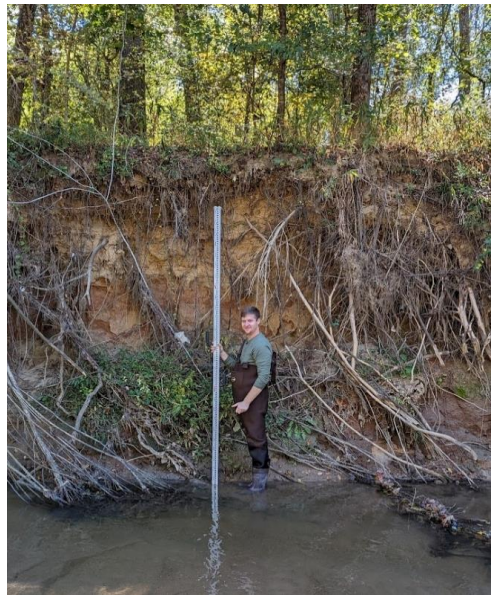
SCREENING	RAPID	DETAILED
Bank height from GIS LIDAR	Channel condition & Lateral Floodplain Inundation	Field-measured cross-sections and Entrenchment Ratio



Desktop GIS



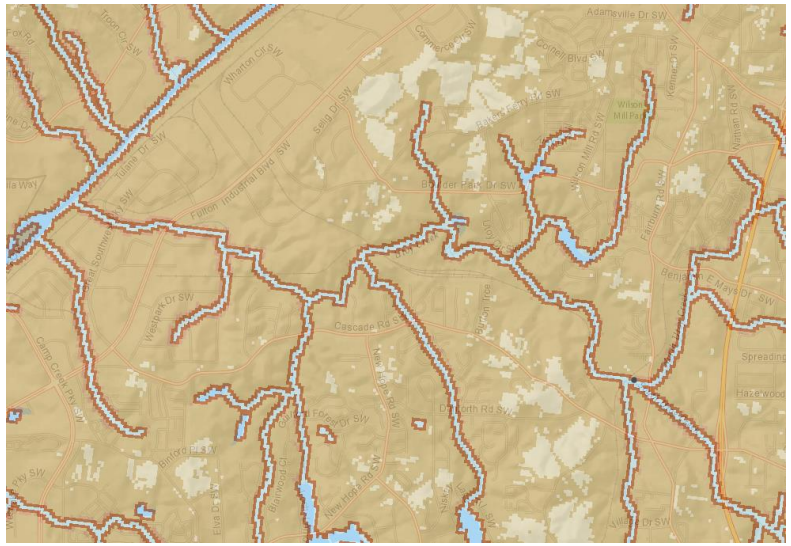
Field Work (Focused/Visual)



Field Work (Detailed data collection)

SEDIMENT CONTINUITY (GEOMORPHOLOGY)

SCREENING	RAPID	DETAILED
Watershed sediment supply potential	Sediment deposition patterns & Channel degradation	Percent fines and embeddedness

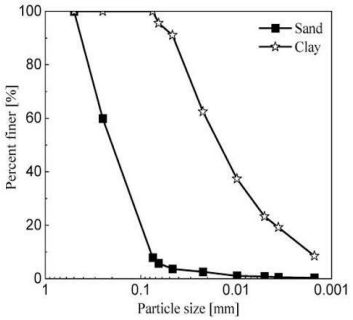


Desktop GIS



Field Work (Focused/Visual)





Field Work (Detailed data collection)

LIGHT & THERMAL REGIME (PHYSICOCHEMISTRY)

SCREENING	RAPID	DETAILED
Riparian zone vegetation presence and width	Riparian canopy cover %	Vegetation type and Canopy Density, mid-channel



Desktop GIS



Field Work (Focused/Visual)



Field Work (Detailed data collection)

WATERSHED CONNECTIVITY (BIOLOGY)

SCREENING

Mapped dams or impoundments on river or within miles



Desktop GIS

RAPID

Culvert and road-crossing passability



Field Work (Focused/Visual)

DETAILED

Road-stream crossing detailed count and passability quality



Field Work (Detailed data collection)

WHICH TIER YOU SHOULD PICK?

Pick the tier from that matches your project needs and phase.

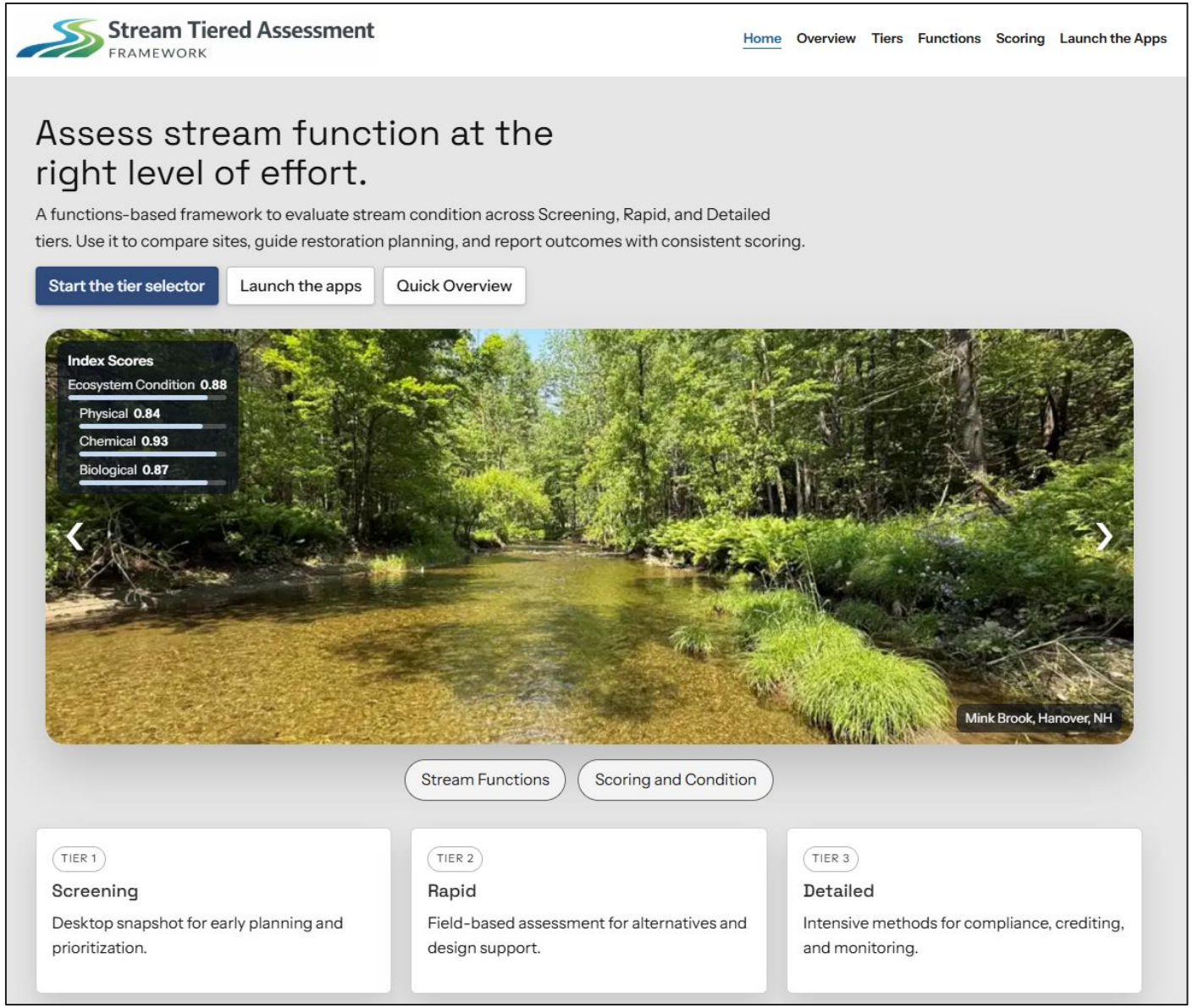
Consider:

- Time per site
- The data already in hand
- How much confidence you need in the results

STAF: The website and the toolkit

THE WEBSITE IS THE ENTRY POINT TO STAF

- Overview
- Tiers
- Functions
- Scoring
- Launch the Apps
  - We have one tool for each tier



TIER SELECTOR

Tier fit questions

Project phase	● ○ ○
Number of sites under consideration	○ ● ○
Time available per site	○ ○ ●
Decision risk and tolerance for uncertainty	○ ○ ●
Data needs and calibration	○ ○ ●
Budget and expertise availability	○ ○ ●

RECOMMENDED TIER SO FAR

Rapid

Key reasons

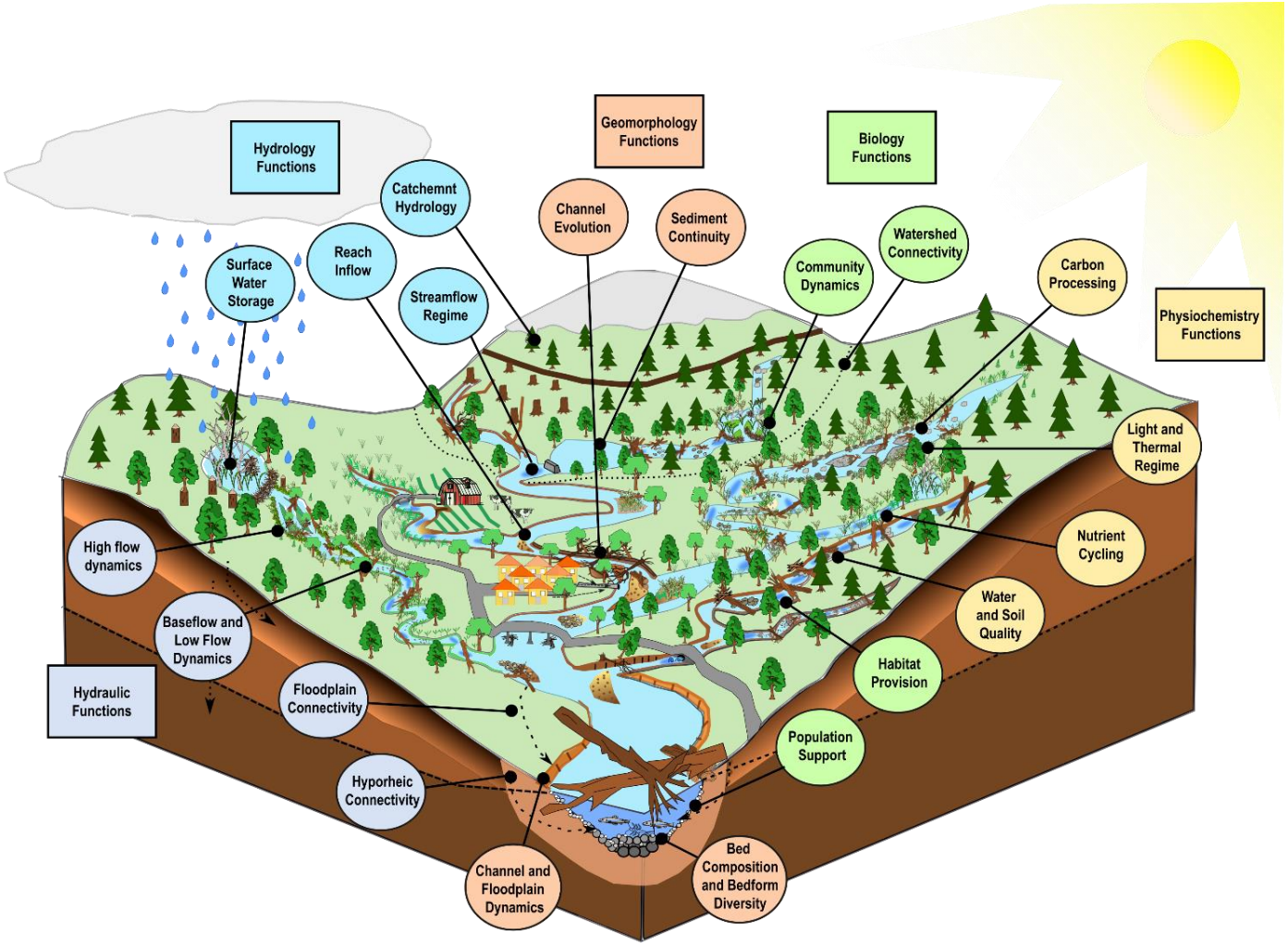
- Alternatives evaluation often needs rapid field evidence
- A shortlist of sites is a good fit for reach scale work
- Moderate decision risk tolerates moderate uncertainty

The recommendation updates as you answer, and it tells you why.

EXPLORE THE FUNCTIONS

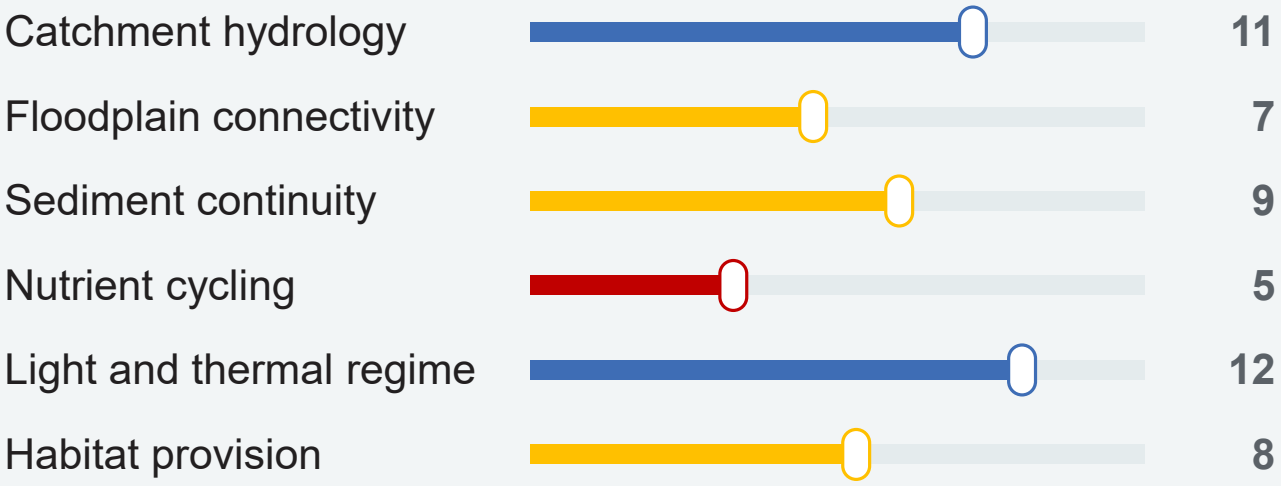
STAF website contains:

- Descriptions of every function and why it matters
- Example metrics for each function
- Use this to check which of the 20 your current assessment method covers. Identify any gaps.



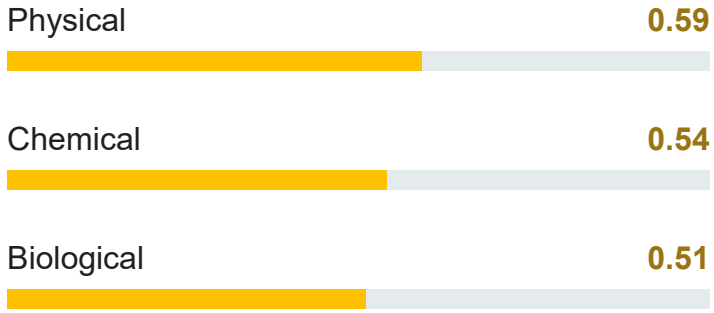
SCORING AND CONDITION

Function Scores



Functioning 11 to 15 **At risk** 6 to 10 **Non functioning** 0 to 5

SCORE ROLL-UP



Ecosystem Condition Index (ECI)

0.55 At risk

THREE APPLICATIONS IN TOOLKIT

Tier 1 · Screening

EASI

Ecosystem Assessment Screening Index

Automated desktop screening from nationally available data.

Effort: 15 minutes

Tier 2 · Rapid

SFARI

Stream Functions Assessment and Rapid Index

Rapid field assessment with desktop evidence.

Effort: 1 Day

Tier 3 · Detailed

DEEP

Detailed Evaluation of Ecosystem Processes

Detailed data collection scored by reference curves built for the region.

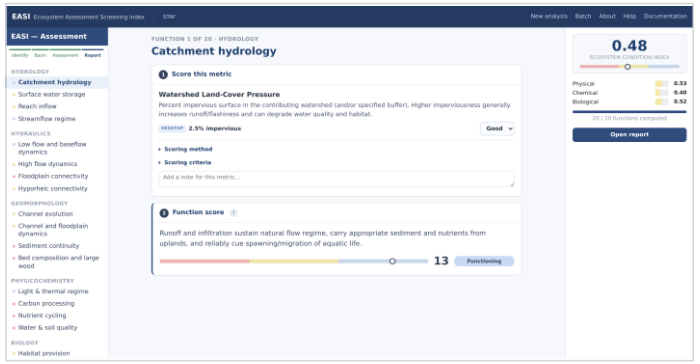
Effort: >1 Day

START WITH EASI



Drop a point

Search a stream, or click one on the map



Review the scores

All 20 functions, scored from national data



Open the report

Every metric and function used for scoring

OUTPUT

- A documented ECI for the reach
- The three sub indices behind it
- Report with each function & metric value



SANGAMON RIVER, ILLINOIS

0.48

At risk

Physical	**0.53**
Chemical	**0.40**
Biological	**0.52**

EASI VIDEO & TRY IT OUT

Watch the walkthrough

About 5 minutes

Video is on the website that walks through using the EASI web app.

Run one reach you know

About 15 minutes

Pick a stream you already have know about. See whether the score agrees and review results

Tell us what surprised you

Two minutes

Let us know how the score agreed or disagreed with your judgement.

https://usace-wrises.github.io/staf/tools

STAF SUMMARY AND BENEFITS

- STAF is a functions-based approach to evaluate stream ecosystem condition

- Audience: Civil Works planning teams on ecosystem assessment and restoration studies

<u>Benefits</u>

- Streamlined assessment with comprehensive functions
- Resource efficiency
- Cross-site and project comparison
- Flexible and widely applicable

TAKEAWAYS

1. **What stream functions are important in ecosystem assessment?**
   - **STAF uses 20 functions**

2. **How can I compare results across sites, studies, and years?**
   - **STAF uses Ecosystem Condition Index (ECI)**

3. **What assessments fit the time and data I have available?**
   - **Tiers (Screening vs Rapid vs Detailed)**
   - **Toolbox (EASI, SFARI, DEEP)**

UPCOMING IN THIS WEBINAR SERIES

- **EASI Walkthrough: Short Video (Online now)**
  - A screening assessment in 5 minutes
- **Rapid Assessment with SFARI (September 9)**
  - Desktop/Field application. Scoring metrics, weighing lines of evidence, and what a field day looks like.
- **Detailed Assessment with STAF (September 22)**
  - Using regionally tailored assessments, with worked two regional examples.



PUBLICATIONS

Stepchinski, L.M., McKay, S.K., and Menichino, G.T. 2025. **Review of Stream Assessments for Evaluating Ecological Impacts and Benefits**. U.S. Army Engineer Research and Development Center. https://dx.doi.org/10.21079/11681/49710

Stepchinski, L.M., McKay, S.K., Harris, A.E., and Menichino, G.T. **A Review of Stream Assessment Methods in the United States**. 2025. Journal of the American Water Resource Association. https://doi.org/10.1111/1752-1688.70056

Stepchinski, L.M., McKay, S.K., and Menichino, G.T. **A Tiered Approach to Developing Function-Based Stream Assessments**. JAWRA. In Review.

Stepchinski, L.M., McKay, S.K., and Menichino, G.T. **A Synthesis and Inventory of Stream Functions. River Research and Applications**. In Review.

Stepchinski, L.M., David, G.C., Wiest, S.R., Menichino, G.T. **Stream Functions Assessment and Rapid Index (SFARI)**. ERDC/TR. Vicksburg, MS: US Army Engineer Research and Development Center. In Review.

Stepchinski, L.M., David, G.C., Wiest, S.R., Menichino, G.T. **Ecosystem Assessment Screening Index (EASI)**. ERDC/TR. Vicksburg, MS: US Army Engineer Research and Development Center. In Review.

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- For information on EMRRP, please contact the program manager, Dr. Brook Herman (Brook.D.Herman@erdc.usace.army.mil), or consult https://emrrp.el.erdc.dren.mil/.



THANK YOU

Upcoming webinars:

Field application of the Stream Function Assessment and Rapid Index (SFARI): *September 9*

Detailed Stream Assessment using STAF: Developing and applying regionally tailored assessments: *September 22*

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Try out STAF:

https://usace-wrises.github.io/staf/

https://emrrp.el.erdc.dren.mil/