Stream Function Assessment Method: Supporting Compensatory Mitigation Decisions in Oregon

Development and Implementation Challenges

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What are the Drivers for SFAM?

Core Issue: Mitigation for non-wetland waters is inconsistent

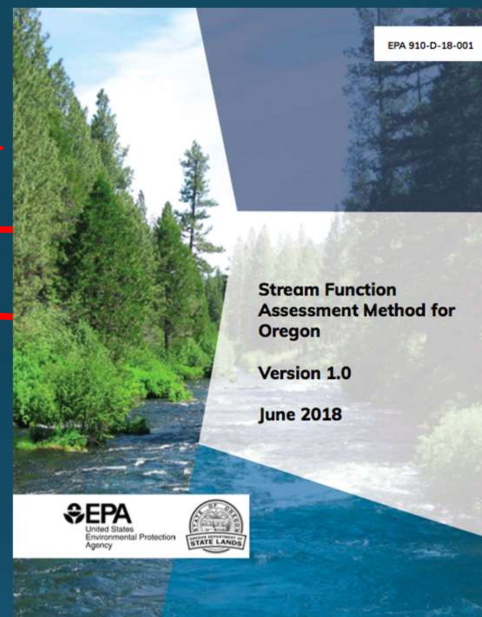
- Lack of a common language to talk about stream functions and values
- Difficult to understand the effects of stream projects (partial loss)
- Difficult to determine appropriate compensatory mitigation

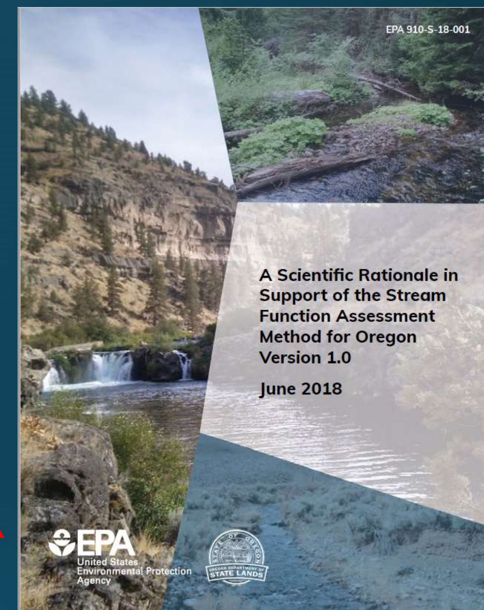
What are the Development and Regulatory Objectives?

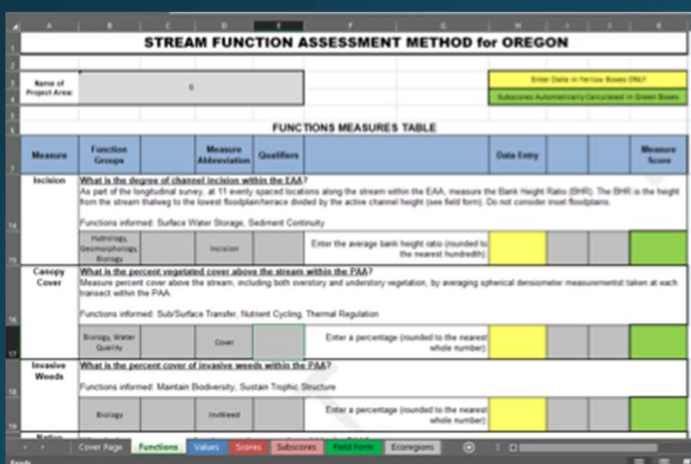
- Scientifically robust
- Repeatable and consistent
- Predictable and transparent
- Accurate and defensible
- Rapid

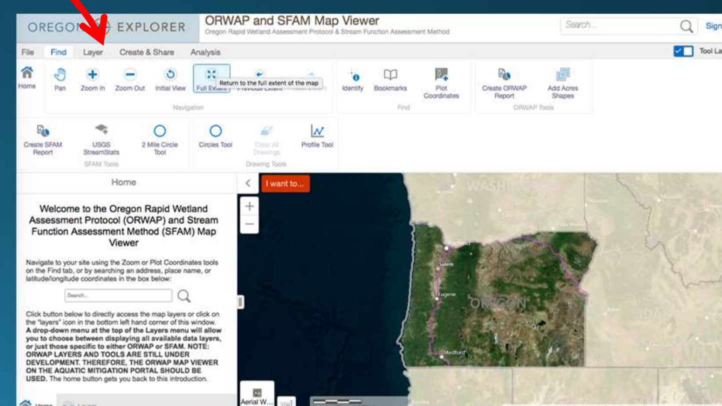
What are the Components of SFAM?

- Excel Workbook
- User Manual
- Scientific Rationale
- SFAM Map Viewer









SFAM Development History

2010-2013

Conceptual Development /Tech Working Group

Stream classification system development

Initial method produced

2013-2014

Initial field testing

2014-2015

Revisions & Draft method

2015-2016

External review

Statistical analysis

2016-2017

Revisions (models & measures)

Statistical analysis

2018

Standard performance index development

Pilot testing and V1.0 Release

All processes, revisions, decisions and outcomes have been documented.

➢ Defining Stream Functions & Values

Function = *the processes that create and support a stream ecosystem*

Value = *the ecological and societal benefits that riverine systems provide*

Function Group	Specific Functions/Values
Hydrologic	Surface Water Storage Sub/Surface Transfer Flow Variation
Geomorphic	Sediment Continuity Substrate Mobility
Biologic	Maintain Biodiversity Create and Maintain Habitat Sustain Trophic Structure
Water Quality	Nutrient Cycling Chemical Regulation Thermal Regulation

- 11 Functions were selected to represent the majority of stream and riparian processes necessary to sustain healthy stream ecosystems
- Each Function has an associated Value
- Functions and Values are categorized within 4 functional groups

Measuring Stream Functions

- Functions are difficult to directly measure within regulatory parameters; must be quantified using measures
- **17 measures** evaluate specific features characteristic of, or inherent to, the function and may indicate the extent to which a particular function is active

- ✓ Quantifiable
- ✓ Rapid
- ✓ Repeatable
- ✓ Sensitive

FUNCTION MEASURES:

- Natural cover
- Floodplain exclusion
- Wood
- Incision
- Embeddedness
- Fish Passage Barriers
- Overbank flow
- Wetland vegetation
- Plant composition (x3)
- Riparian buffer width
- Channel bed variability
- Lateral Migration
- Bank Erosion
- Bank Armoring
- Side Channels

Ecological Function

Sub/Surface Transfer

Ability to transfer water between surface and subsurface environments

Function Attributes

Overbank Flow Duration | Base Flow
Ground Water Flux | Hyporheic Flow

Function Measures

Side Channels

Variable Channel Bed

Overbank Flow

Wetland Vegetation

Defining Stream Functions

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What is a "Value"?

Values are determined by: 1) opportunity to provide a particular function, and 2) the local significance of that function

Value is the context of a function in the broader landscape.

Value measures often consider existing laws and designations (e.g. 303(d) listing, Wild and Scenic River designation), and rarity/local scarcity.

For many hydrologic and water quality values, opportunity is determined by what is upstream of a site (e.g., land use of the contributing basin, riparian buffers on the contributing streams) and significance is predicted partly by what is downstream (e.g., floodplains, water-quality limited water bodies, fish passage barriers).

Defining Stream Values

Value = *the ecological and societal benefits that riverine systems provide*

The opportunity and significance of a site to provide these ecological functions

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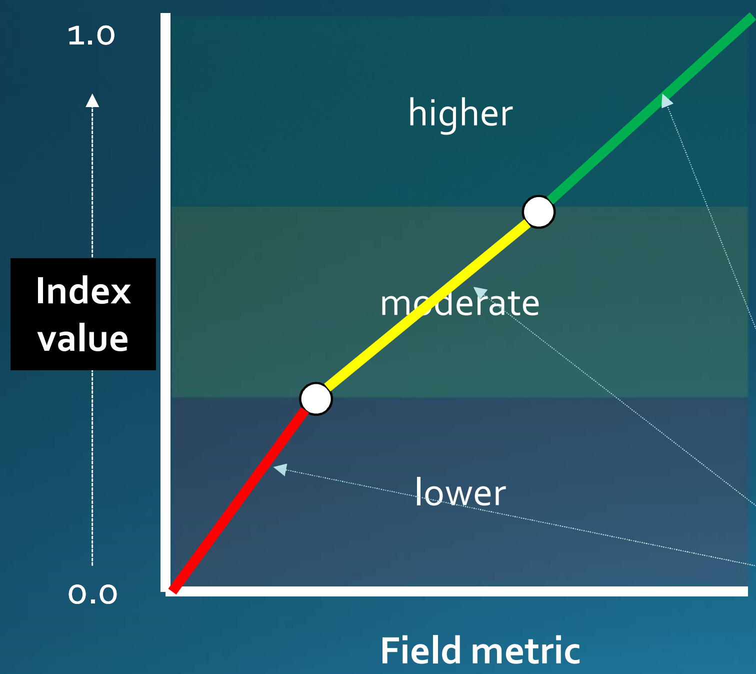
VALUE MEASURES (16):

- Rare Species
- Water quality impairments
- Protected areas
- Impervious area
- Riparian area
- Riparian continuity
- Downstream infrastructure
- Zoning
- Downstream flooding
- Impoundments
- Fish passage barriers
- Water source
- Land cover
- Watershed position
- Flow restoration needs
- Unique habitat features

How are function measures scored?

Standard performance indices were developed to translate measures' metrics (percentages, absolute values, ratios, etc.) into meaningful index values (scale of 0.0 – 1.0).



1. Set a standard index scale (give ecological meaning to the scores).
2. Look to literature, data and scientific understanding to determine the metric values that correspond with the set thresholds.
3. Draw linear models between thresholds.

How are function measures scored?

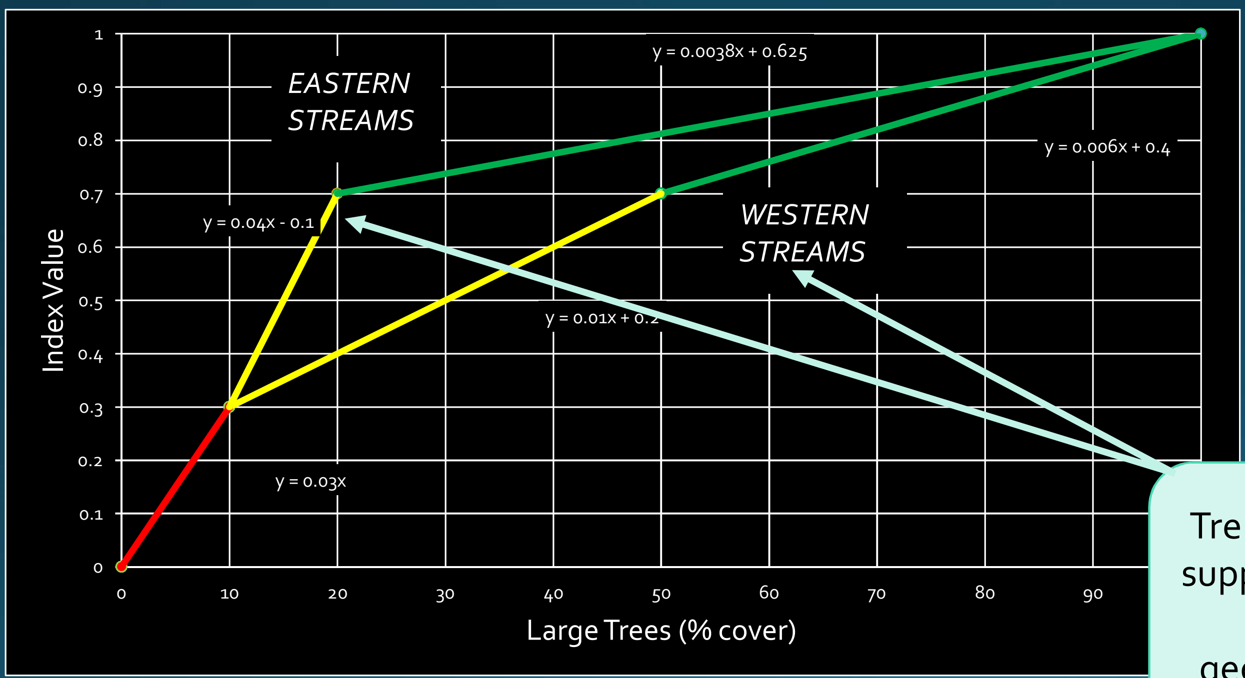
Standard performance indices were developed to translate measures' metrics (percentages, absolute values, ratios, etc.) into meaningful index values (scale of 0.0 – 1.0).

Development methods for the indices varied based on the quantity and type of information available:

METHOD 1	METHOD 2	METHOD 3
Substantial literature exists linking metrics to ecological functioning. Indices are based on trends and thresholds expressed in the literature. (6 measures)	In the absence of substantial literature, looked for an abundance of raw data (e.g. EPA NARS dataset) that could be used to set expectations. (5 measures)	In the absence of substantial literature or an abundance of raw data, relied on current scientific understanding of how metrics relate to functioning. (6 measures)

Example: Large Trees

What is the percent cover of large trees (dbh>20 inches) within the Proximal Assessment Area (PAA)?



Trends presented in the literature support stratifying expectations of large tree cover based on geographic position in the state.

Structure of Formulas

- Some measures are weighted more heavily than others (determined through iterative statistical analysis)
- Formulas for each specific function and value produce a numerical *score* between 0.0 and 10.0.

Functions:

→ 0.0 = negligible function is being provided by the stream

→ 10.0 = stream is providing maximum function given certain contextual factors (e.g. ecoregion, stream size)

Values:

→ 0.0 = low opportunity for a site to provide a specific ecological function and, even if it did, the specific function would not be of particular significance given the context of the site

→ 10.0 = site has the opportunity to provide a specific function and it would be highly significant in that particular location

Conducting an SFAM Assessment

Office Component → Field Component → Evaluate Results

2 hrs

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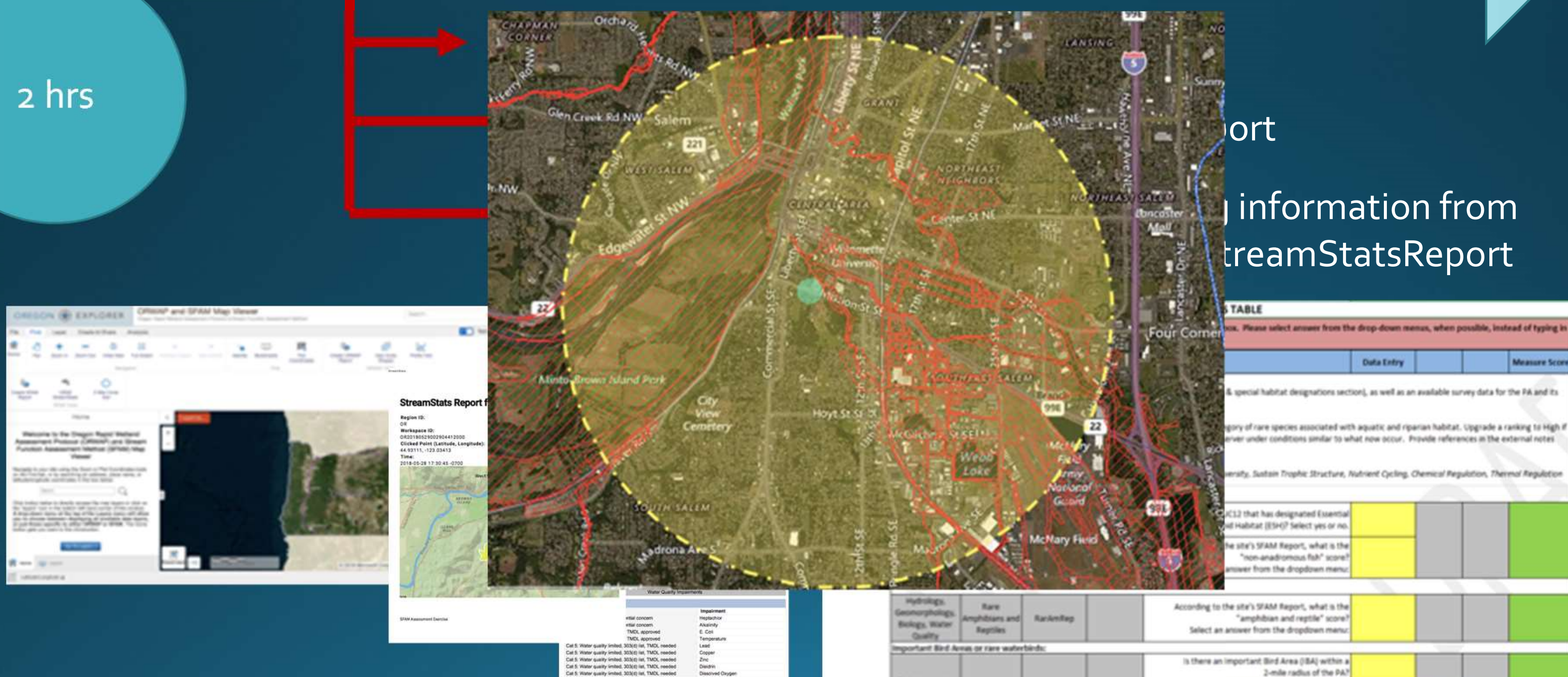
information from
treamStatsReport

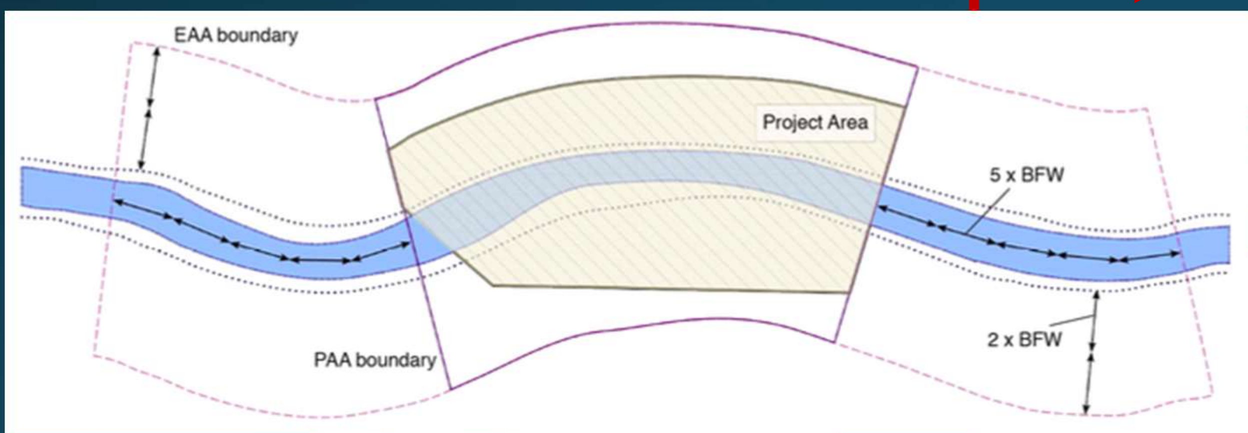


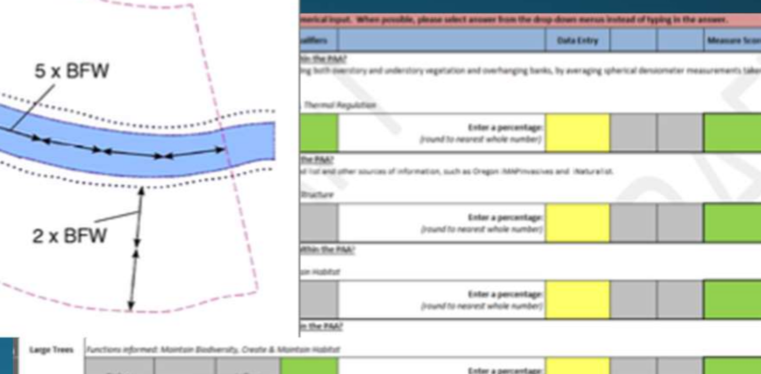
Conducting an SFAM Assessment

Office Component → **Field Component** → **Evaluate Results**

- Lay out assessment areas
- Complete 11 **PAA** *function* measures
- Complete 6 **EAA** *function* measures

4-8 hrs





Conducting an SFAM Assessment

Office Component → **Field Component** → **Evaluate Results**

STREAM ASSESSMENT SCORES SHEET version 1.0

Project Area Name:				
Investigator Name:				
Date of Field Assessment:				
Latitude (decimal degrees):		Longitude (decimal degrees):		

SPECIFIC FUNCTIONS	Function Score	Function Rating	Value Score	Value Rating
Suface Water Storage (SWS)				
Sub/Surface Water Transfer (SST)				
Flow Variation (FV)				
Sediment Continuity (SC)				
Sediment Mobility (SM)				
Maintain Biodiversity (MB)				
Create and Maintain Habitat (CMH)				
Sustain Trophic Structure (STS)				
Nutrient Cycling (NC)				
Chemical Regulation (CR)				
Thermal Regulation (TR)				

GROUPED FUNCTIONS	Function Group Score	Function Group Rating	Value Group Score	Value Group Rating
Hydrologic Function (SWS, SST, FV)				
Geomorphic Function (SC, SM)				
Biologic Function (MB, CMH, STS)				
Water Quality Function (NC, CR, TR)				

Each specific function is assigned a numerical score and a rating for both function and value

Groups are represented by the highest-functioning, highest-valued function in each thematic category.

1-2 hrs

How can SFAM Improve the Mitigation Process?

- Encourage applicants to strive for high degree of avoidance and minimizat … at compensa…
- Increase c…
- Assist in d…
- Inform mi…
- Improve m…
- Improve t…

SFAM V1.0 applicable to wadable, non-tidal streams.

Additional work is needed for non-wadable streams and tidal channels.

Implementation Challenges

- New assessment with overlapping regulation
- Understanding stream processes and assessment methods
- Internal procedures
- Credit/debit accounting
- Program effectiveness

Addressing Challenges

- Outreach and dialogue
- Training
- Prepare - SOPs, QA/QC practices
- Protocols translating SFAM scores & CM plan components into mitigation requirements
- Program effectiveness monitoring program for stream mitigation

Challenges for Stream Mitigation Assessment

- Unit of impact/compensation – acre? linear feet? other area-based unit?
- Accounting for partial impacts
- Concept of 'self-mitigating'
- Urbanizing streams and water quality functions
- Accounting for longitudinal/latitudinal aspects of stream function in project-based assessment
- Knowledge gaps/research needs in stream science, including more rapid assessment protocols for aspects of stream function
- Assessment of large rivers/tidally influenced rivers

Additional SFAM Development Team Members

- ODSL: *Dana Hicks, Charlotte Trowbridge*
- Willamette Partnership: *Nicole Maness*
- CSS-Dynamac: *Rob Coulombe*
- ESA; Wolf Water Resources: *Nicole Czarnomski*

Additional SFAM Map Viewer Development Team Members

- Institute for Natural Resources/OSU: *Myrica McCune, Marc Rempel, Jimmy Kagan*
- ODSL: *Charlotte Trowbridge, Dana Hicks*

More Information

DSL: http://www.oregon.gov/dsl/WW/Pages/Aquatic-Resources-Mitigation-Framework.aspx
Oregon Explorer: http://oregonexplorer.info/topics/aquatic-mitigation?ptopic=38

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