Florida Department of Environmental Protection

Intermittent Streams
Stream Condition Index Expectations

May 17, 2017

Aquatic Ecology and Quality Assurance Section
Water Quality Standards Program





Overview

- Background
  - Hydrobiogeomorphic Classification System (HBG)
- Intermittent Streams - Questions and Objectives
- Findings by Region and Water Source
- Initial Summary
- Next Steps

Background

- John Kiefer, Ph.D. of AMEC, Inc. (2010*) developed a classification system for peninsular Florida streams that uses a combination of physical and biological factors that affect the structure and ecological function of natural streams.
- The Hydro-Bio-Geo-morphic (HBG) classification system.
- Key factors:
  - water source
  - hydrologic regime
  - fluvial geomorphology
  - channel dimension
  - in-stream habitat substrates
  - riparian corridor soils
  - riparian vegetation

*Kiefer, J.H. 2010. Hydrobiogeomorphology of Fluvial Systems in Peninsular Florida: Implications to Classification, Conservation, and Restoration. 436 pp.

Hydrobiogeomorphic Classification System (HBG)

- The HBG is a hierarchical system:
  - ➢ Regional Scale – how climate and geology influence streams
    - ➢ Watershed Scale - dominant water source and size of the watershed
      - ➢ Valley Scale – slope affects on channel dimensions & alluvial features
        - ➢ Reach Scale – channel size and shape, floodplain surfaces, in-stream and floodplain habitat

*This presentation focuses on only the first two.

Background - HBG

DEP contracted with AMEC (2013*) to expand the initial work to cover the following items:

- Classify several hundred DEP SCI sites.
- Describe how stream types potentially affect trophic status.
- Expand to include streams in NE and NW Florida.
- Quantitatively describe streams with perennial and intermittent flow regimes.

*[AMEC] Amec Environment and Infrastructure, Inc. 2013. Technical Support for Nutrient Concentration Sensitivities Associated with Different Types of Florida Freshwater Streams. Amec No. 14251.5. Prepared for Florida Department of Environmental Protection. February 2013. 191 pp

Background - HBG

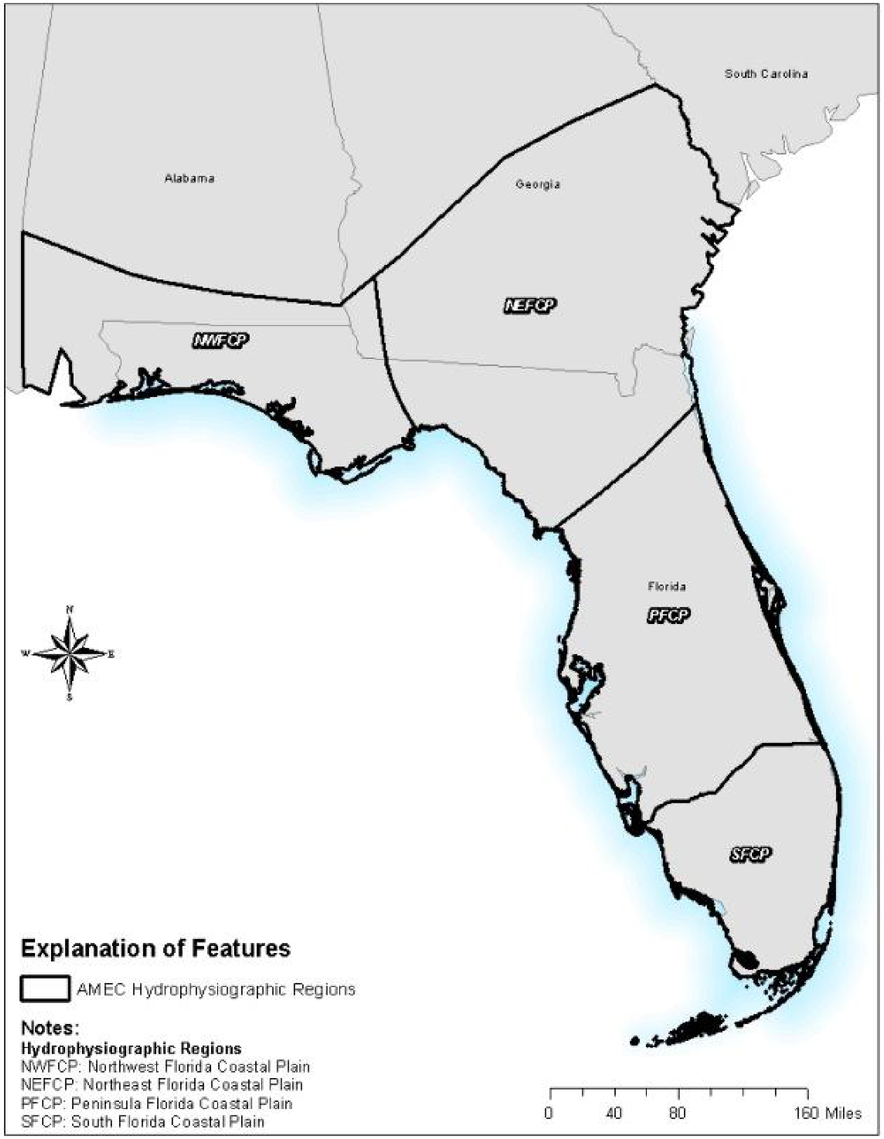
Conclusions:

- Three distinct regions with different thresholds for watershed size, stream channel, and soil drainage.
- Thresholds in watershed and stream channel associations are likely to affect trophic status differently in the three regions.
- Drainage area is valuable for assessing the potential of a flow regime suitable for the SCI.

Background - HBG

- Northwest Florida Coastal Plain (NWFCP)
- Northeast Florida Coastal Plain (NEFCP)
- Peninsula Florida Coastal Plain (PFCP)
  (South Florida Coastal Plain not included)

- Florida's geology results in three different water delivery systems:
  - Karst
  - Highlands
  - Flatwoods



SCI in Intermittent Streams

- Questions:
  - Do SCI scores differ by water source?
  - How do scores vary by drainage area and region?
  - Can we quantitatively identify these systems?
  - Do we need different recommendations based on region and water source?

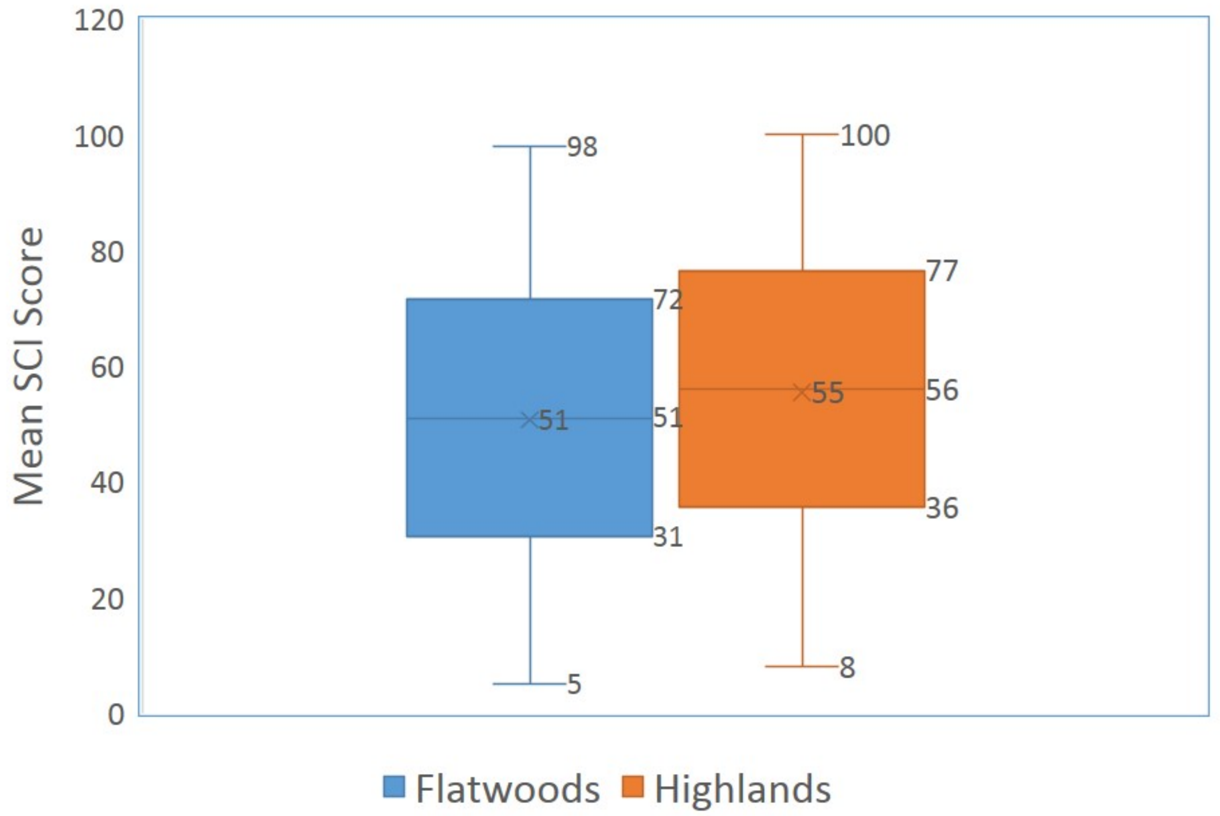
- Objectives:
  - Determine whether smaller systems score lower or fail more often than larger systems.
  - Analyze SCI scores by region, drainage area, and water source to test for a relationship with SCI.
  - Determine size thresholds for when the SCI can be used without any additional cautions, with extra cautions, and not at all.

Methods

- Test SCI scores by water source.
- Analyze SCI data by Stream Order as a measure of stream size.
  - (Order is readily available as a GIS coverage whereas drainage area has to be calculated on a site by site basis.)
- Test SCI against AMEC-defined perenniality thresholds for flatwoods and highlands sites.
- Analyze SCI data against watershed size, region, and water source.

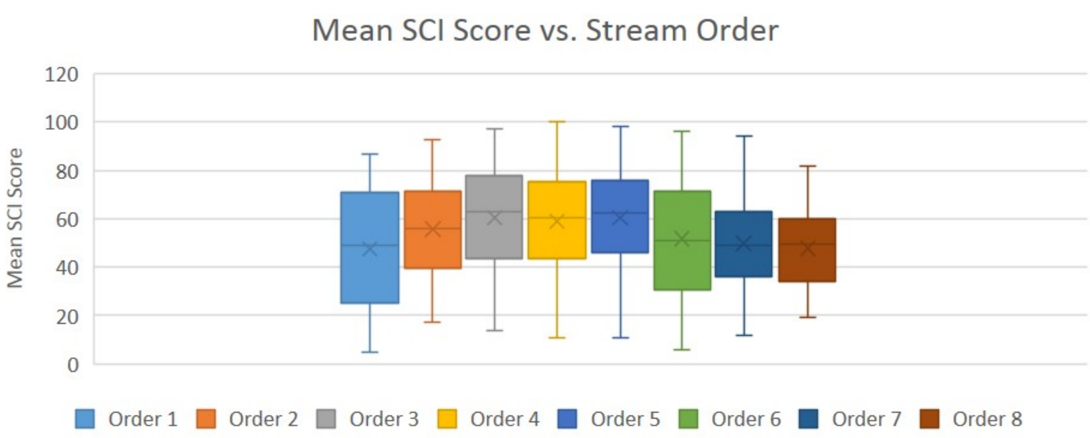
Mean SCI vs. Water Source

- Mean SCI scores are statistically higher in highlands sites compared to flatwoods sites (α> 0.05).
- Highlands have a higher median score (56 vs. 51).



Stream Order vs. SCI

- Smallest and largest streams tend to score lowest.
- 1st order was significantly different when compared to other sizes combined.
- Order can encompass a wide range of sizes, masking potential effects. Ex. Pith. River is 1st order/DA=180 sq. mi. Mormon Br. is 1st order/DA=1.6 sq. mi.

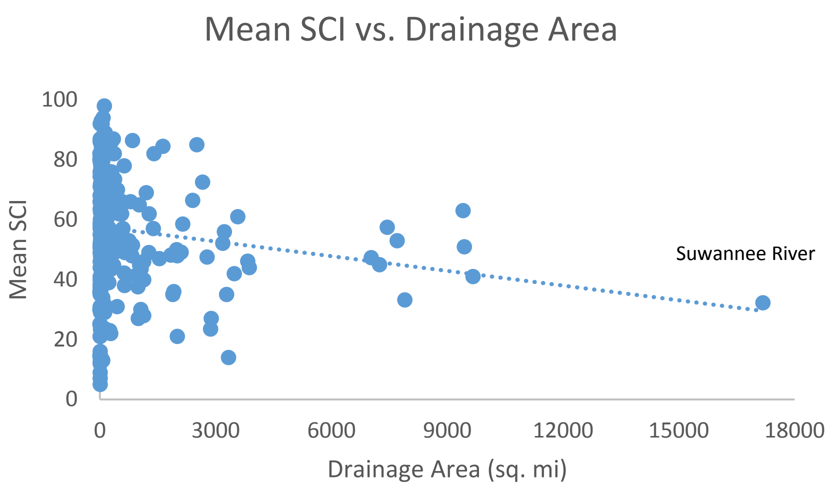


Order	N	Mean	Std Dev	Min	Median	75%
1	51	48	25.2	5	49	70
2	49	56	19.9	17	56	71
3	49	60	21.0	14	63	78
4	114	59	21.4	11	61	75
5	52	60	20.9	11	63	76
6	61	52	24.8	6	51	71
7	43	50	18.5	12	49	63
8	28	48	15.6	19	50	60

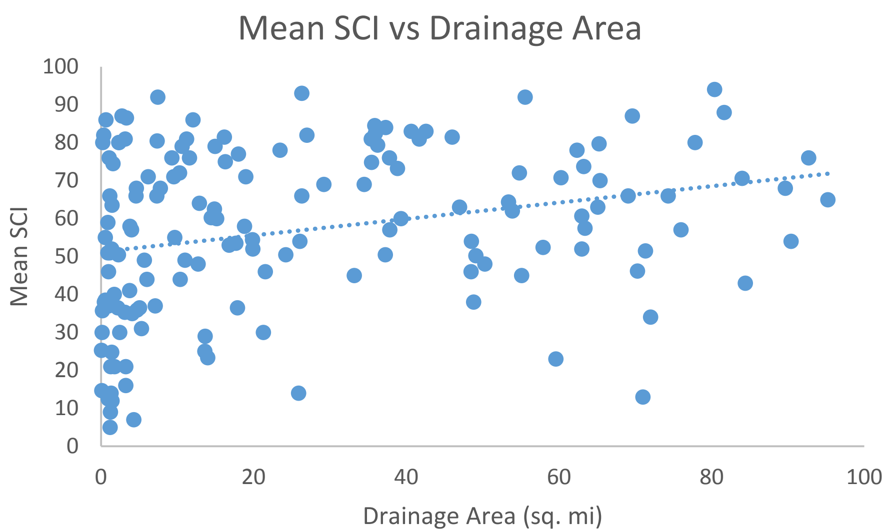
Drainage Area vs. SCI

- Overall relationship between drainage area and SCI is better than for order, but still weak.
- Smaller basins are the most variable in terms of SCI scores.

All sites

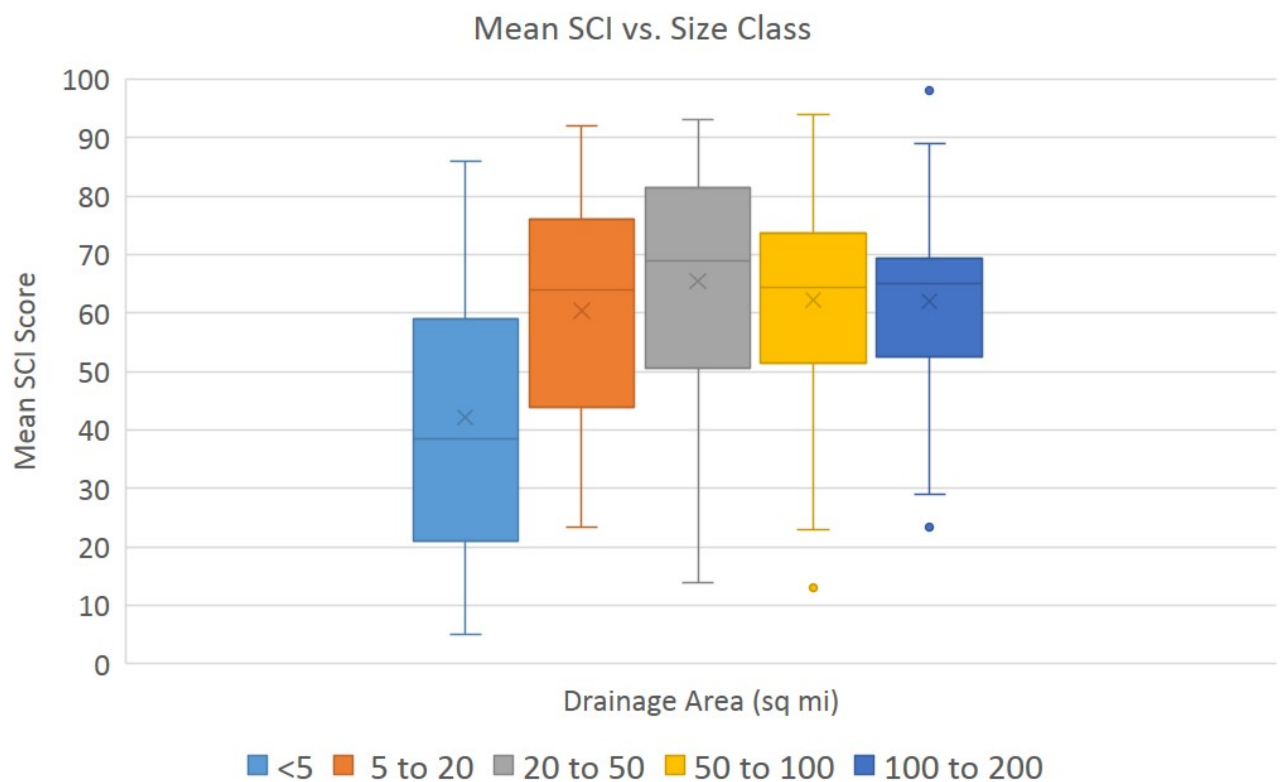


Watersheds <100 sq. mi.



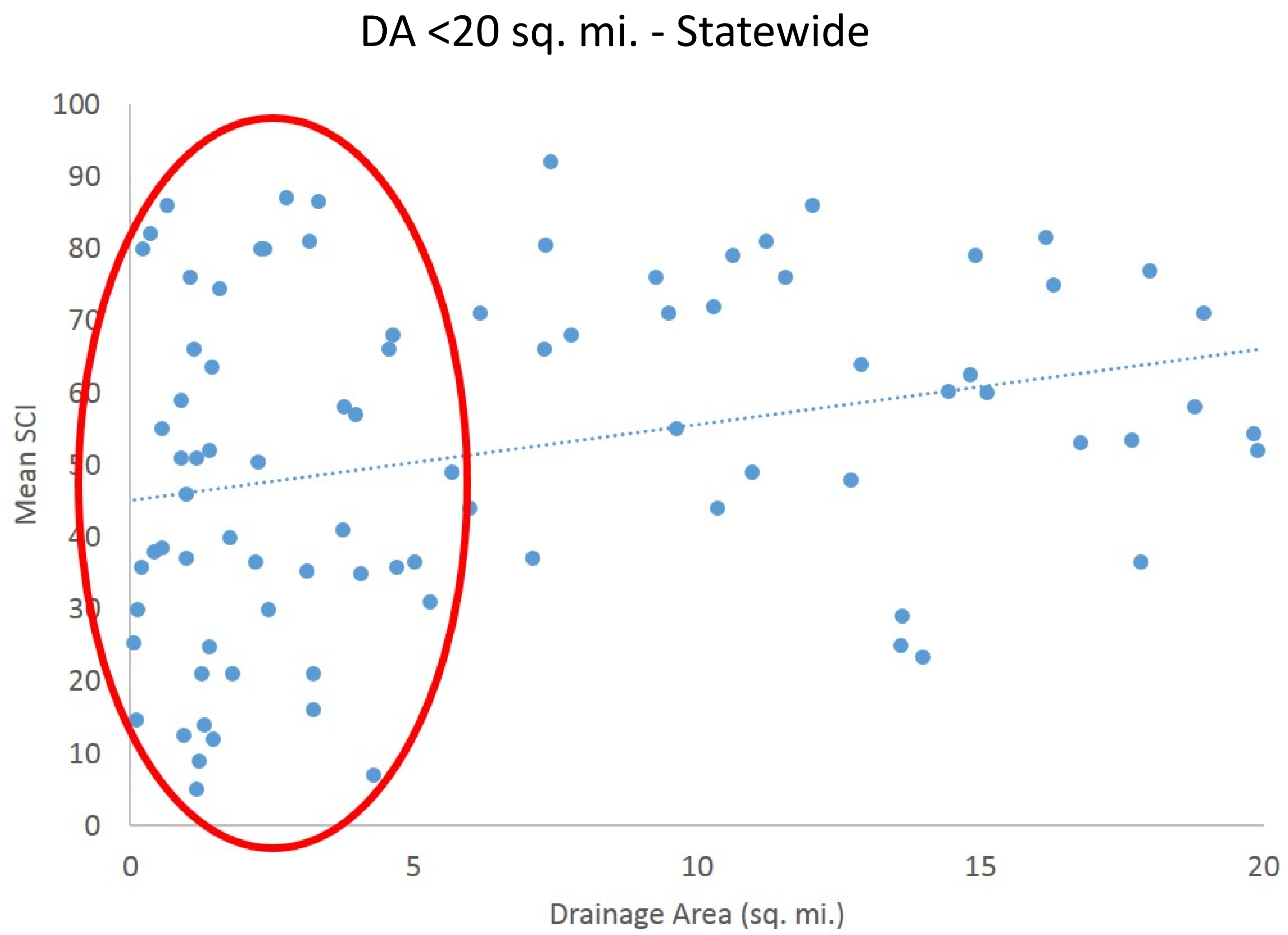
Drainage Area vs. SCI

- Basins <5 sq. miles have the lowest mean SCI scores and are the most variable (n = 30 sites for each size class).



SCI Class	<5	5 to 20	20 to 50	50 to 100	100 to 200
Mean SCI	42	60	65	62	62

Drainage Area vs. SCI



Peninsula - Flatwoods

- There's an overall negative trend due to large rivers.
- Up to ± 60 sq. mi. there's an increasing trend with high variability at sites under 10 sq. mi.

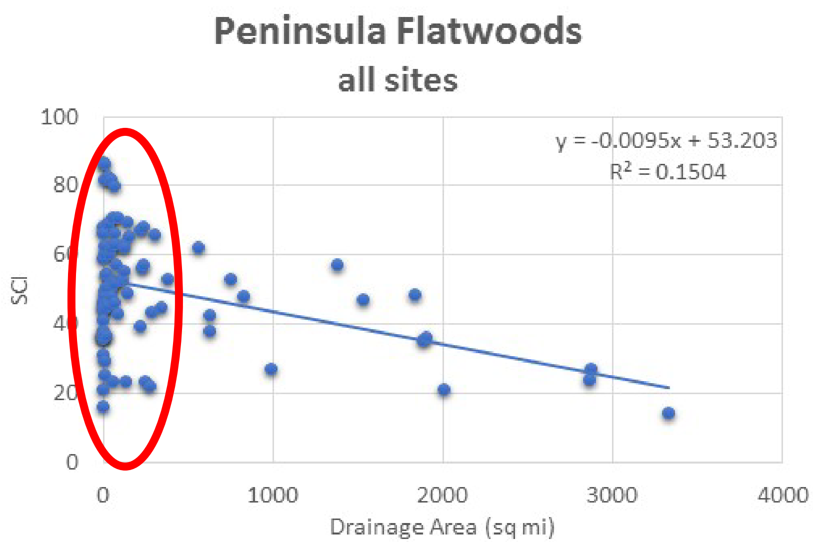


Figure 2. Relationship between SCI scores and drainage area for all peninsula flatwoods streams (n=231 samples, 84 sites).

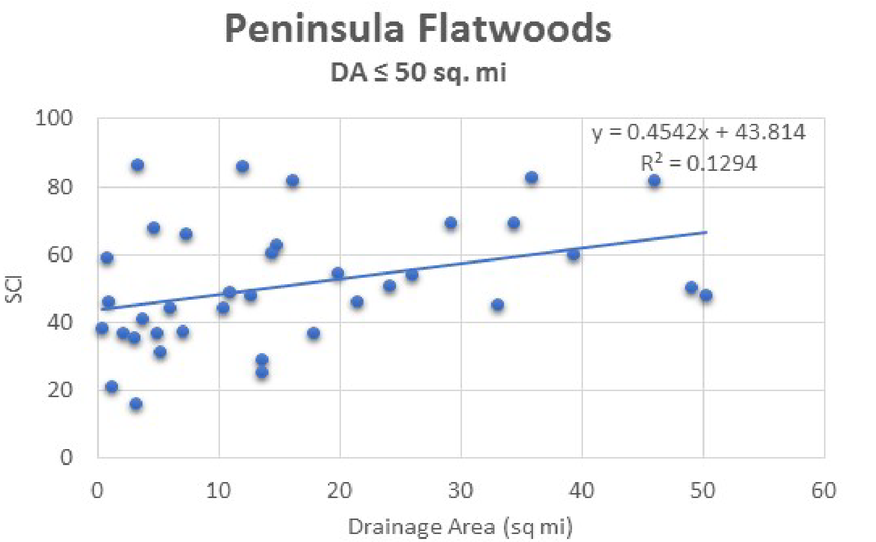


Figure 1. Relationship between SCI scores and peninsula flatwoods streams with a drainage area less than 50 sq. miles (n=84 samples, 37 sites).

Peninsula - Highlands

- Smallest basins are the most highly variable.

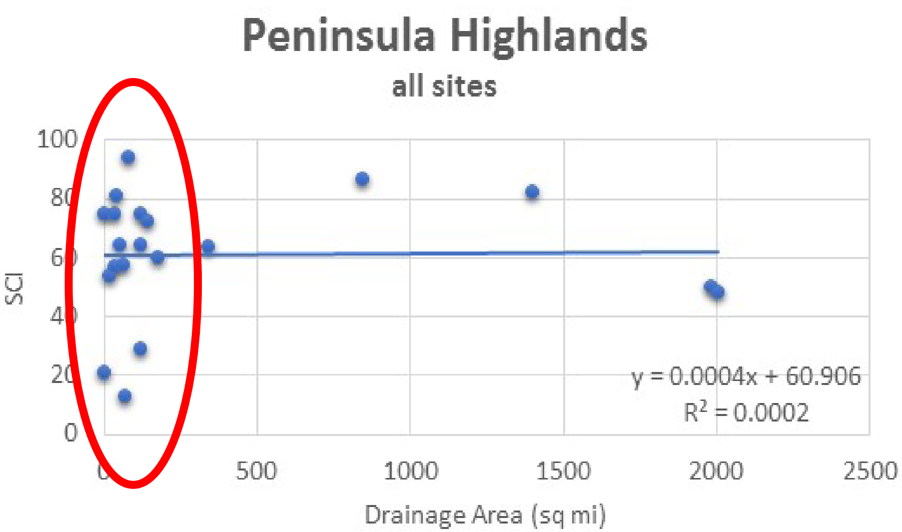


Figure 6 Relationship of SCI scores to the drainage area of peninsula highlands streams (n= 72samples, 22 sites).

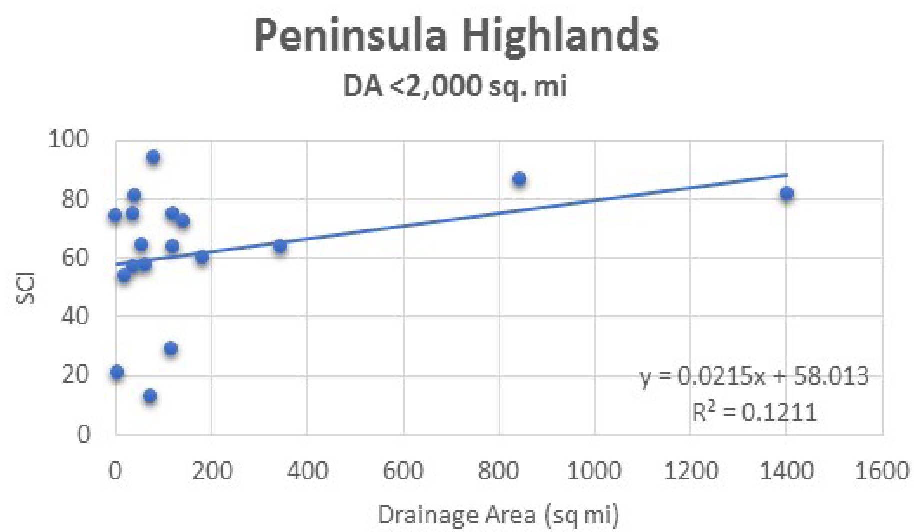


Figure 5. Relationship of SCI scores and peninsula highland streams less than 2,000 sq. miles (n=70 samples, 20 sites).

Northeast - Flatwoods

- Similar pattern to Peninsula streams. A large system is pulling the relationship down, but when those are removed, scores typically increase.

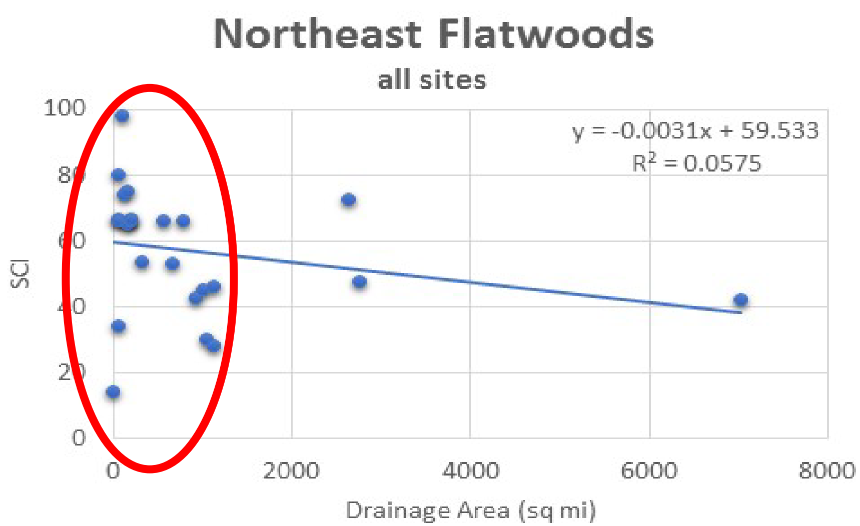


Figure 8. SCI scores in northeast flatwoods sites for all drainage sizes (n=64 samples, 24 sites).

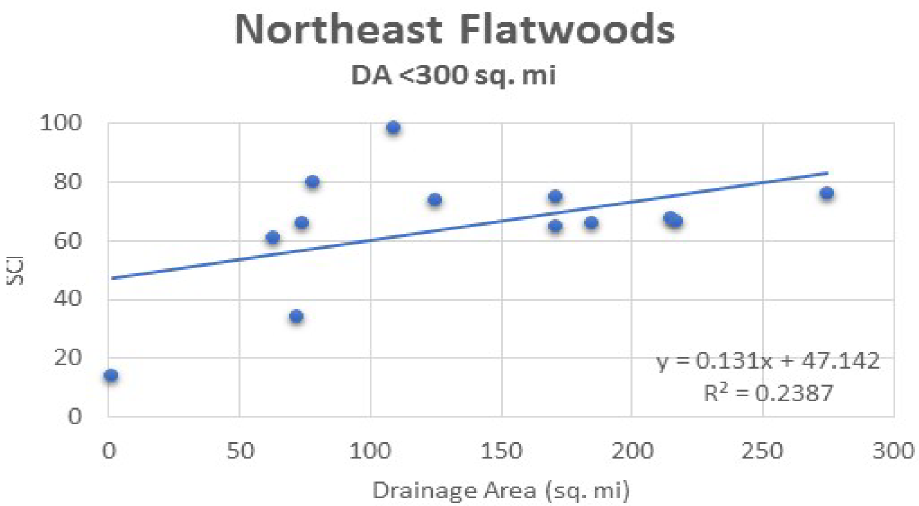


Figure 7. SCI scores in northeast flatwoods sites with drainage areas less than 300 sq. miles (n=25 samples, 13 sites).

Northeast - Highlands

- Similar pattern although few sites.

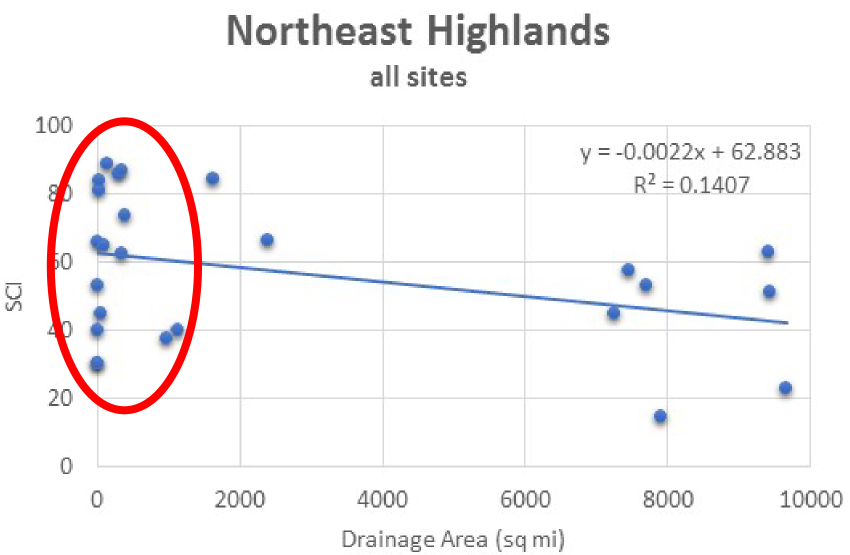


Figure 10. SCI scores in northeast highlands of all sizes (n=47 samples, 25 sites).

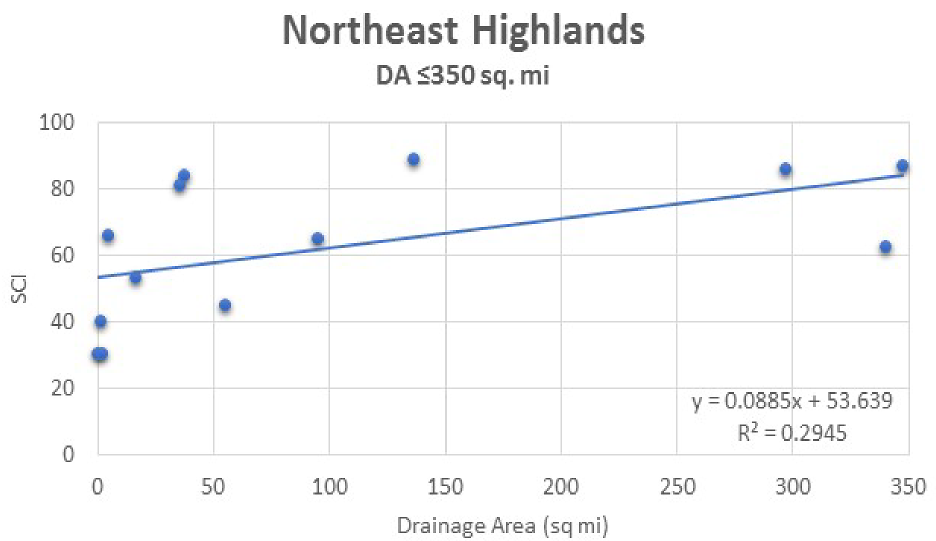


Figure 9. SCI scores in northeast highlands streams with drainage area less than 350 sq. miles (n=18 samples, 13 sites).

Northwest - Highlands

- Similar pattern.
- There weren’t enough flatwoods sites in the data set to plot.

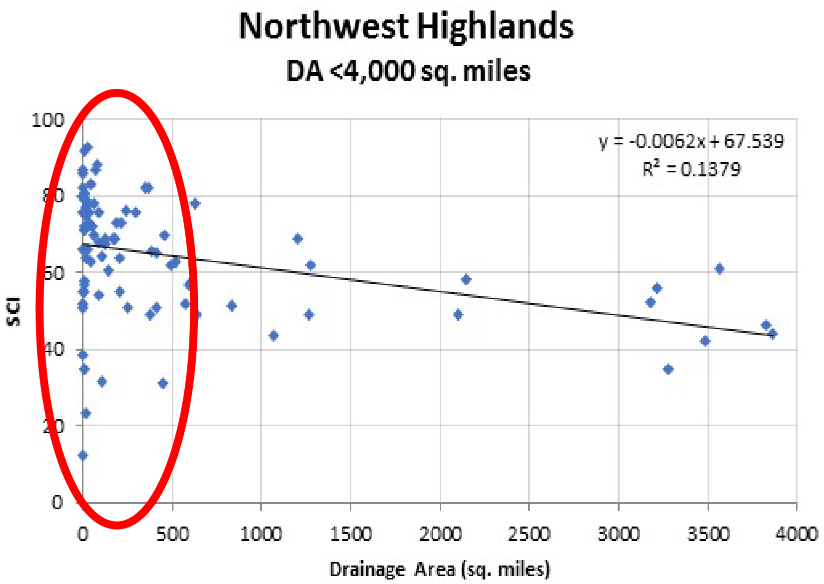


Figure 14. SCI scores in northwest highlands streams with drainage area less than 4,000 sq. miles (n=183 samples, 92 sites).

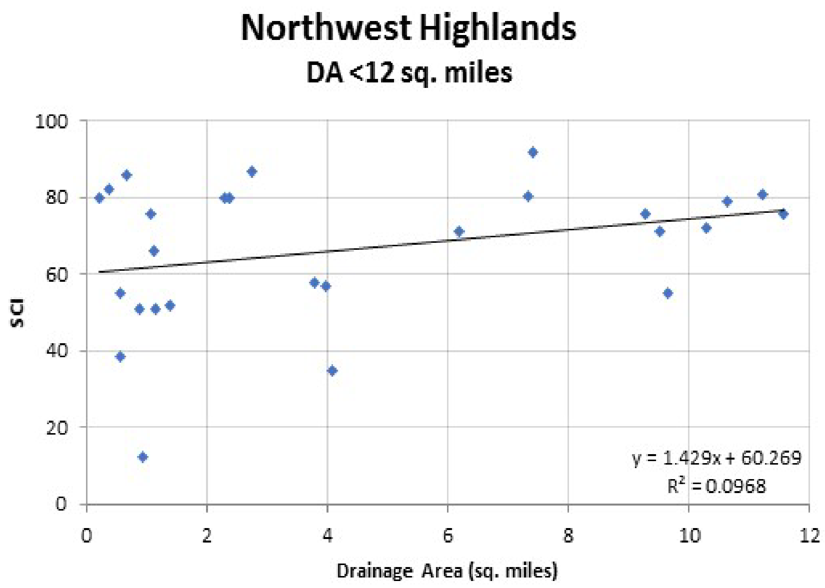
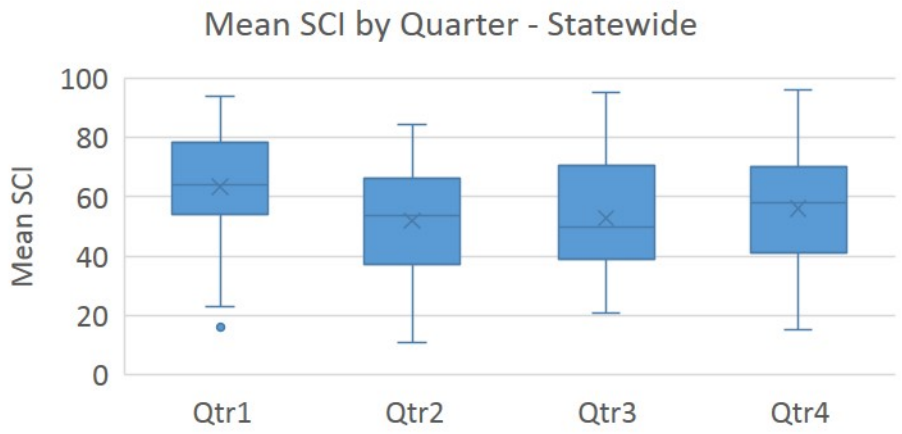
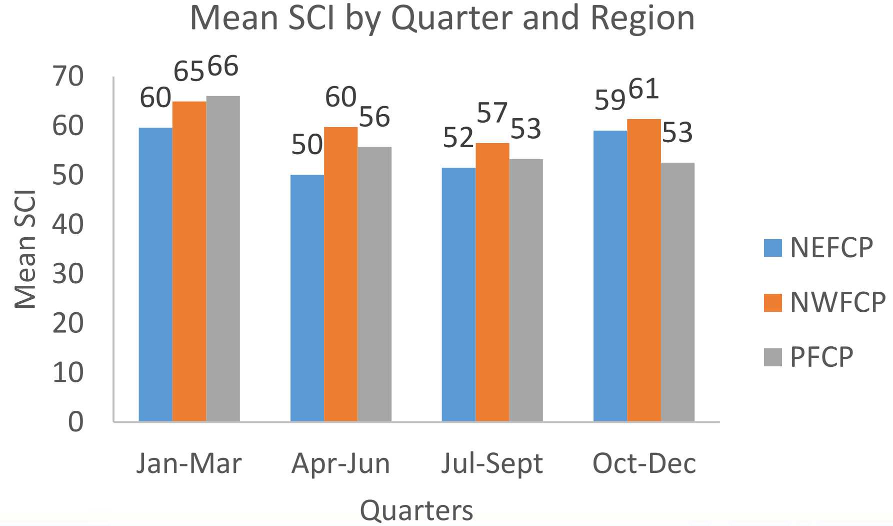


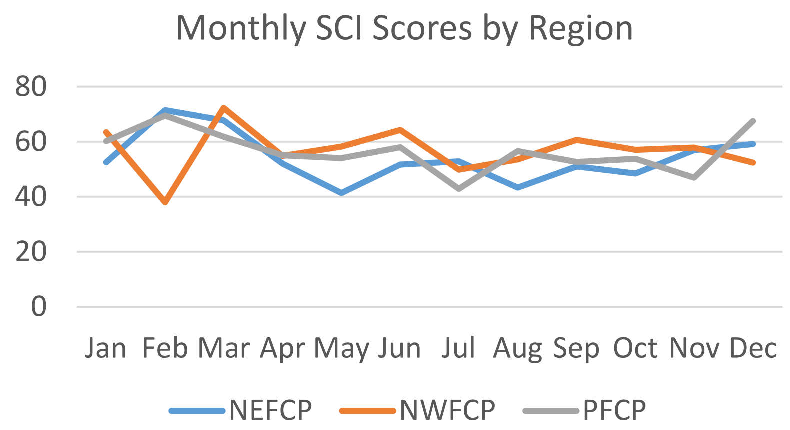
Figure 13. SCI scores in northwest highlands streams with drainage area less than 12 sq. miles (n=34 samples, 27 sites).

Time of Year

- Scores were significantly higher in January - March (n=306, α<.05).
- Greatest difference was in the Peninsula.







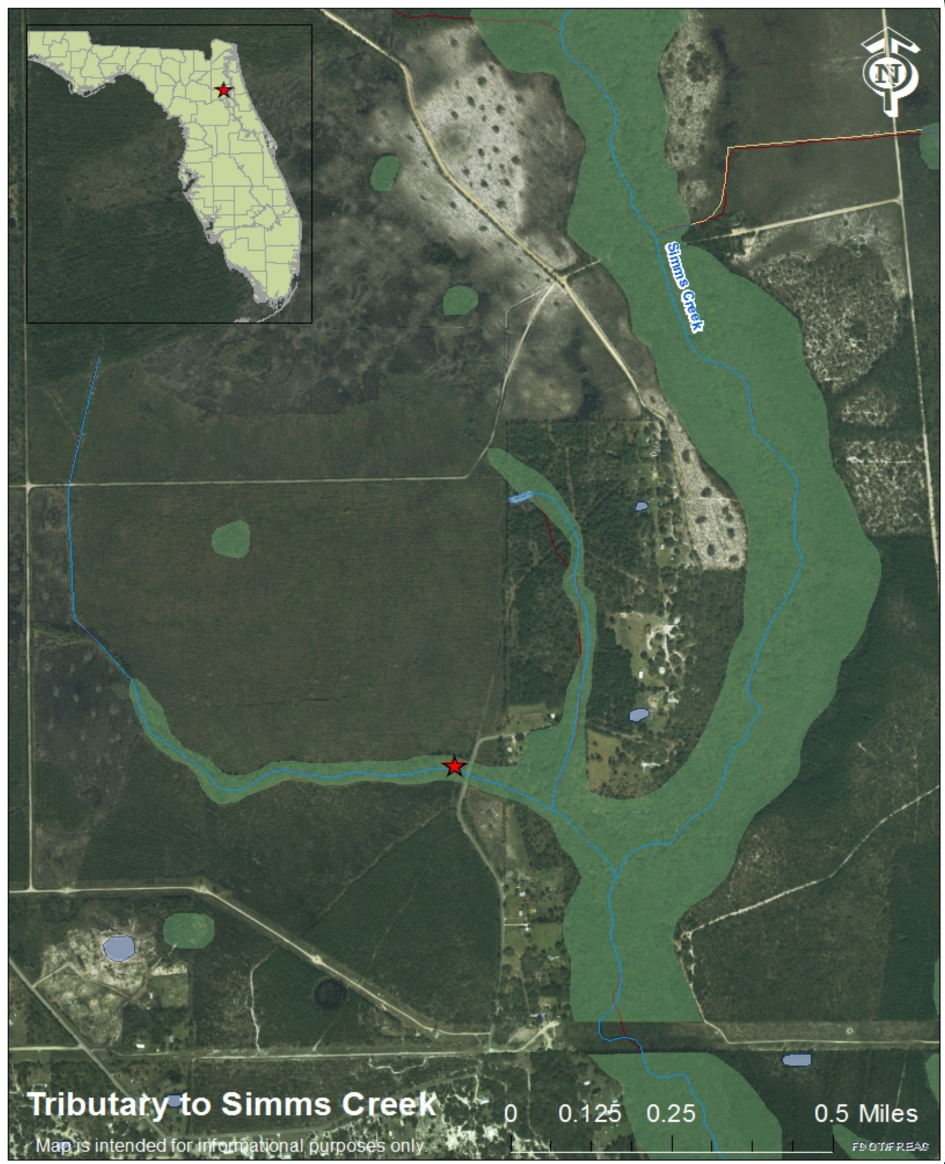
DRAFT – Table of Recommendations

- To simplify and err on the size of caution, recommendations could be based on the most conservative findings.

Water Source	Drainage Area (DA) sq. miles	Perenniality	SCI Recommendations
Flatwoods	DA <1	Intermittent	Do not sample SCI.
	≥1 DA <5	Likely Intermittent	Sample near end of rainy season.
	≥5 DA <50	Seasonally Perennial	Sample near end of rainy season.
	≥20 DA <50	Likely Perennial	Follow Primer. No additional restrictions.
	DA ≥50	Perennial	Large system. Use caution.
Highlands	DA <1	Intermittent	Do not sample SCI.
	≥1 DA <5	Likely Perennial	Follow Primer. No additional restrictions.
	DA ≥5	Perennial	Follow Primer. No additional restrictions.
	DA ≥300	Perennial	Large system. Use caution.

Example – PFCP Flatwoods

- Drainage area = 1.2 sq. mi.
- First Order
- LDI 1.6
- HA score = 137



Example – PFCP Flatwoods

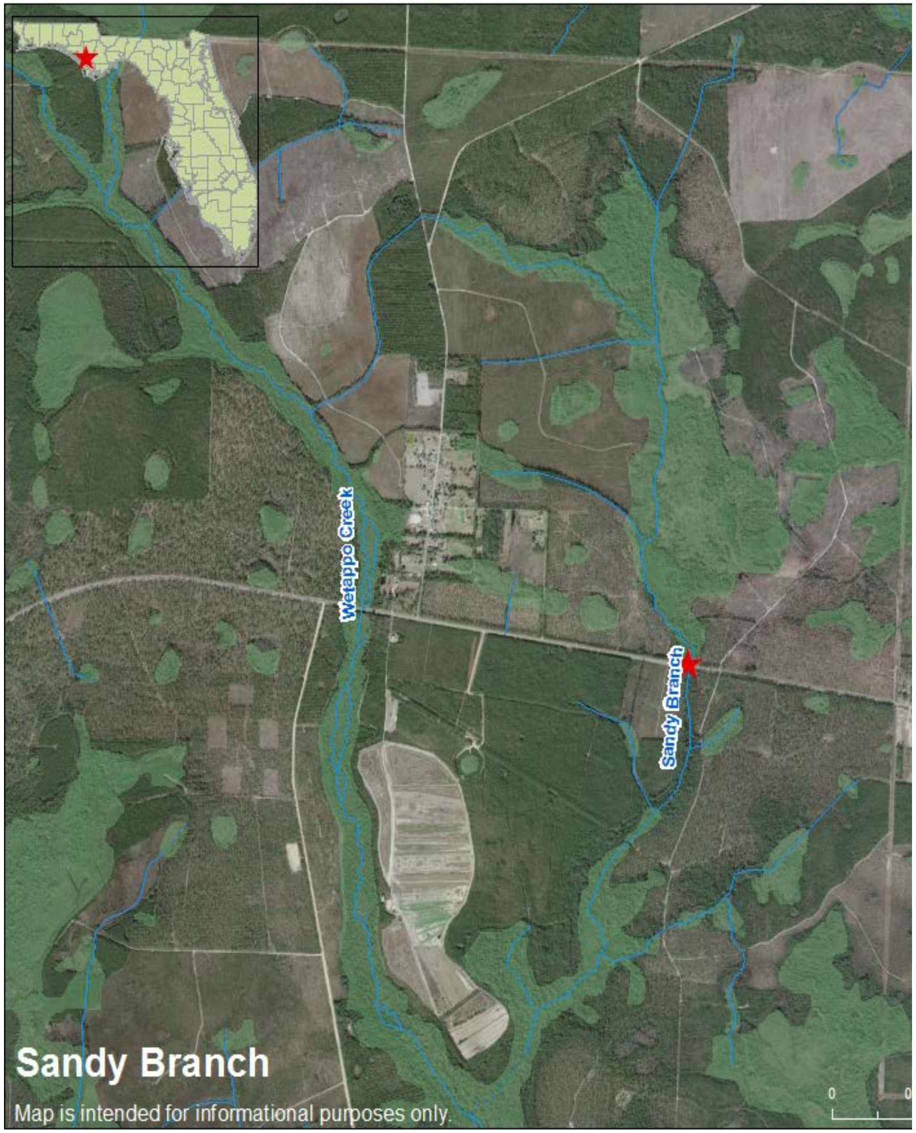
Photo 1. Tributary to Simms Creek, 2005. Very small stream ±1m wide. There appears to be emergent vegetation in the stream.

Photo 2. Taken at a different quarter in 2005. Shows the stream after receiving rain ± 3m wide.

- If site was sampled in newly wetted areas on the edges, it could potentially fail SCI.
- SCI ranged from 21-56 (35 pts) over a three year period. Typical range is to ±14 pts.

Example – NWFCP Flatwoods

- Drainage area = 2.5 sq. mi.
- Second Order
- LDI = 1.28
- HA score = 102



Example – NWFCP Flatwoods


c). Sandy Branch upstream of SR 22. 7-9-2014


d). Sandy Branch slightly upstream of SR 22. 1-28-2015

- If the site was sampled after it had been dry it would likely be dominated by semi-aquatic organisms or not have enough organisms to calculate the SCI.

- SCI scores were 10 and 34 in 2014 and 2015, respectively.

Summary

- SCI scores are more variable in the smallest systems.
- Different regions and water sources have different size thresholds for intermittent streams.
- Further guidance is warranted to ensure SCI is being used in systems for which it was developed.

Next Steps

- Continue to analyze the intermittent stream dataset.
- Design a study to test size thresholds.
- Refine recommendations based on results of study.

Do you know where your water is?