2023

Annual Membership Meeting

Today's Agenda

10:15 – 11:15am	GERA Updates and 2023 Initiatives – Tony Greco, Nutter & Associates, Inc.
11:15 – 11:45am	U.S. Army Corps of Engineers – Savannah District Updates – Justin Hammonds, USACE
11:45 – 12:30pm	Networking & Lunch Break
12:45 – 1:15pm	Waters of the United States – Eric Somerville, USEPA Region 4
1:15 – 1:45pm	Georgia In-lieu Fee Updates – Mike Heneghan, Georgia-Alabama Land Trust
1:45 – 2:00pm	BREAK
2:00 – 2:30pm	Georgia Department of Transportation Updates – Lisa Westberry, GDOT
2:30 – 3:00pm	Variability – Sean Miller, Nutter & Associates, Inc.
3:00 – 4:00pm	GERA Committee Meet & Greet / Engagement

A post-meeting reception will be held from 4:00 – 6:00pm

2023

Annual Membership Meeting

Thank You to Our Event Sponsors

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Georgia Power

ABIGAYLE'S FERRY
MITIGATION BANK

ecoterra®

Nutter & Associates
environmental consultants

GERA Mission

As an association, GERA seeks to promote:

(I) High quality ecosystem restoration through regulatory compliance, scientific principles, and professional standards and practices,

(II) A commercial mitigation banking sector that is both environmentally focused and financially viable

(III) Collaboration among stakeholders from all sectors working to restore and protect Georgia's natural resources on a watershed scale

(IV) Positive communication channels with local, state and Federal agencies whose policies and decisions affect ecosystem health, and

(V) Advancing local, State, and Federal legislation that is consistent with and critical to achieving these goals.

GERA 2023 Initiatives

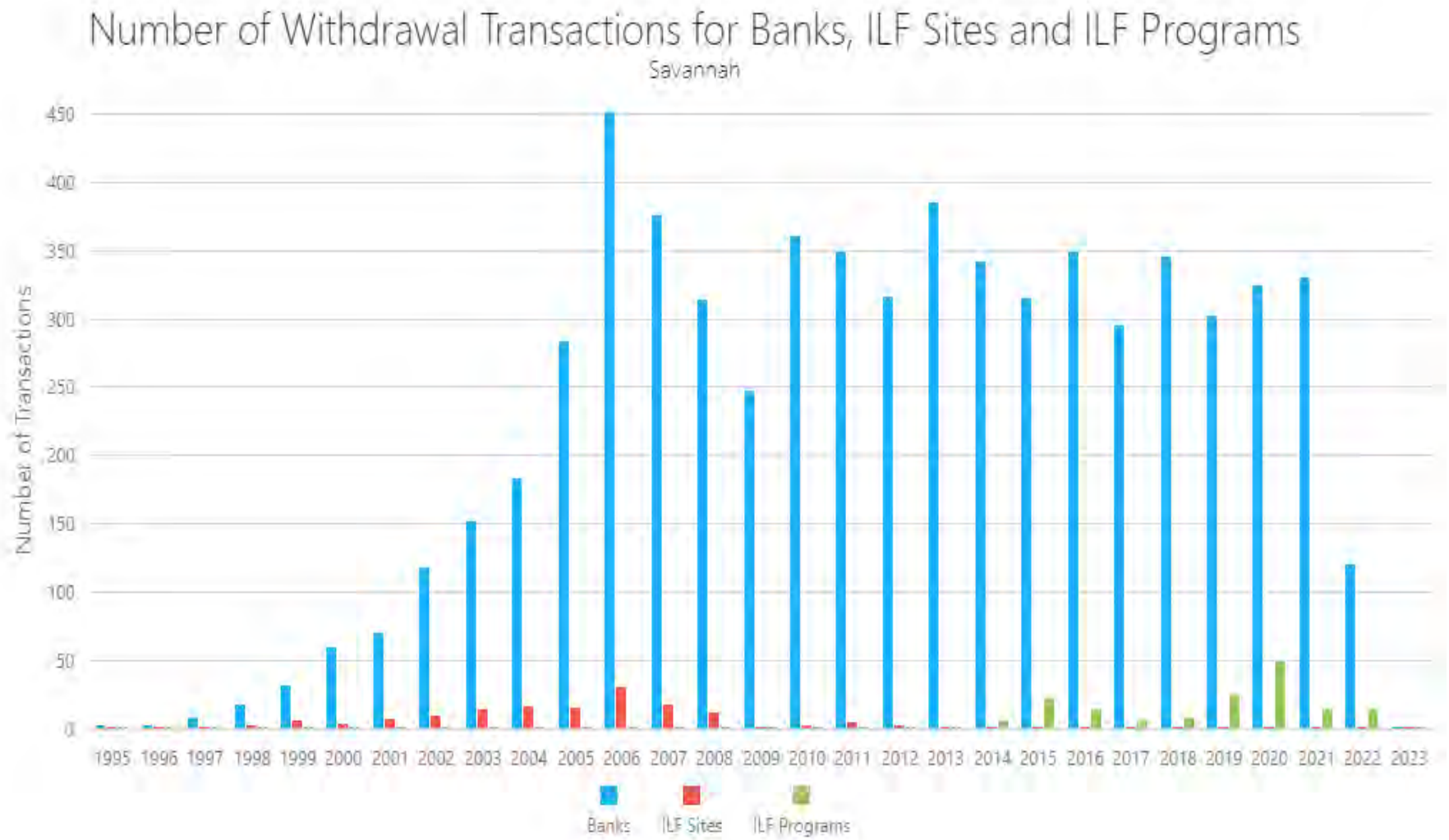
- Annual Membership Meeting re-initiation
- Engagement with the Interagency Review Team on the 2018 Mitigation Banking Standard Operating Procedure
- Development and consolidation of industry / stakeholder comments on agency actions
- Establishment of new, targeted committees and initiatives

GERA 2023 Initiatives

New Committees (2023 and beyond!)

1. Mitigation Banking	Forbes Buck
2. In-lieu Fee	Matt Hughes
3. GA Department of Transportation	Mike Eagan
4. Water Quality Trading	Laurie Hawks
5. Technical / Continuing Education	Sean Miller
6. Annual Membership Meeting	Phillip Todd

Compensatory Mitigation Status and Trends



Data Source: USACE RIBITS

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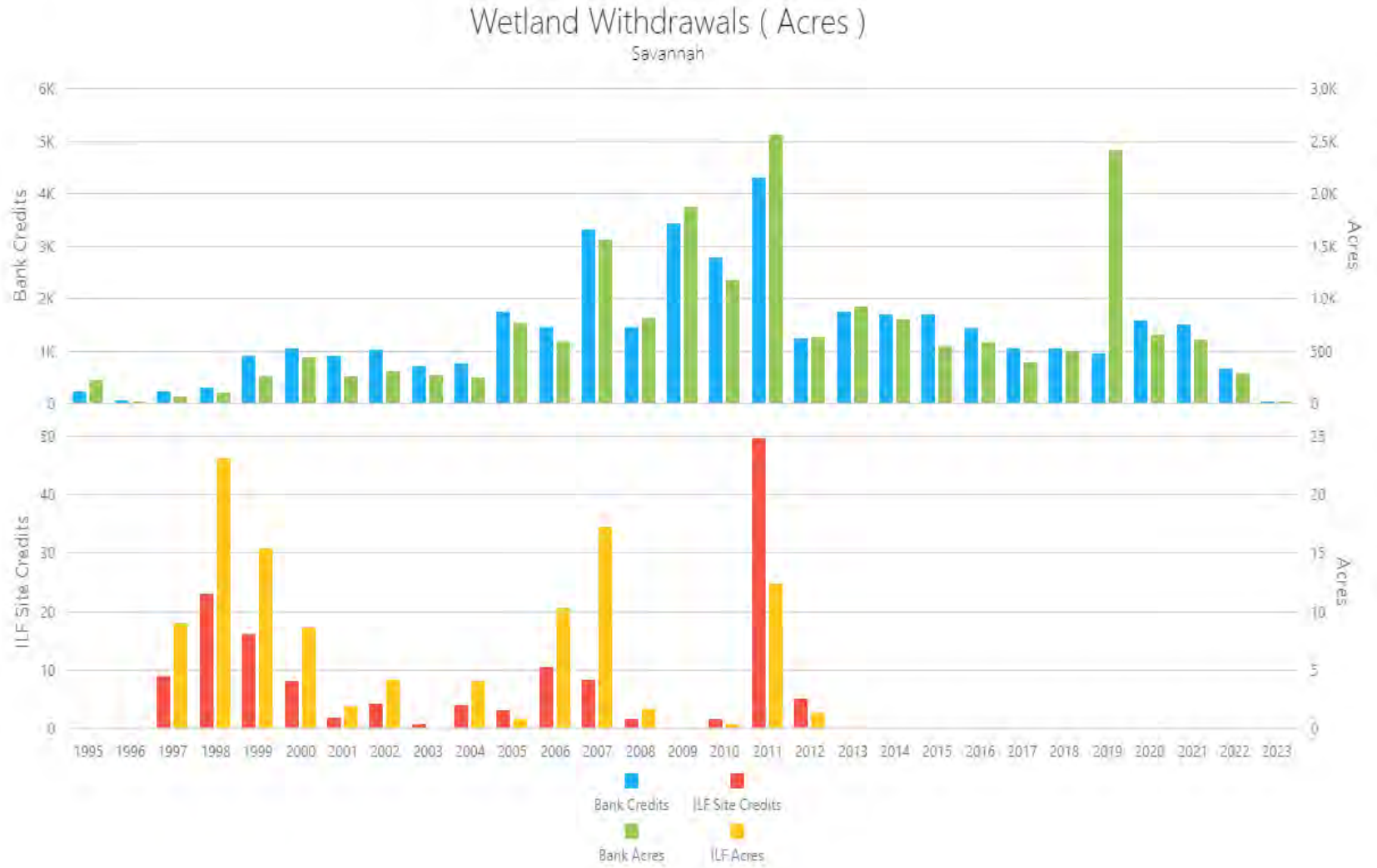

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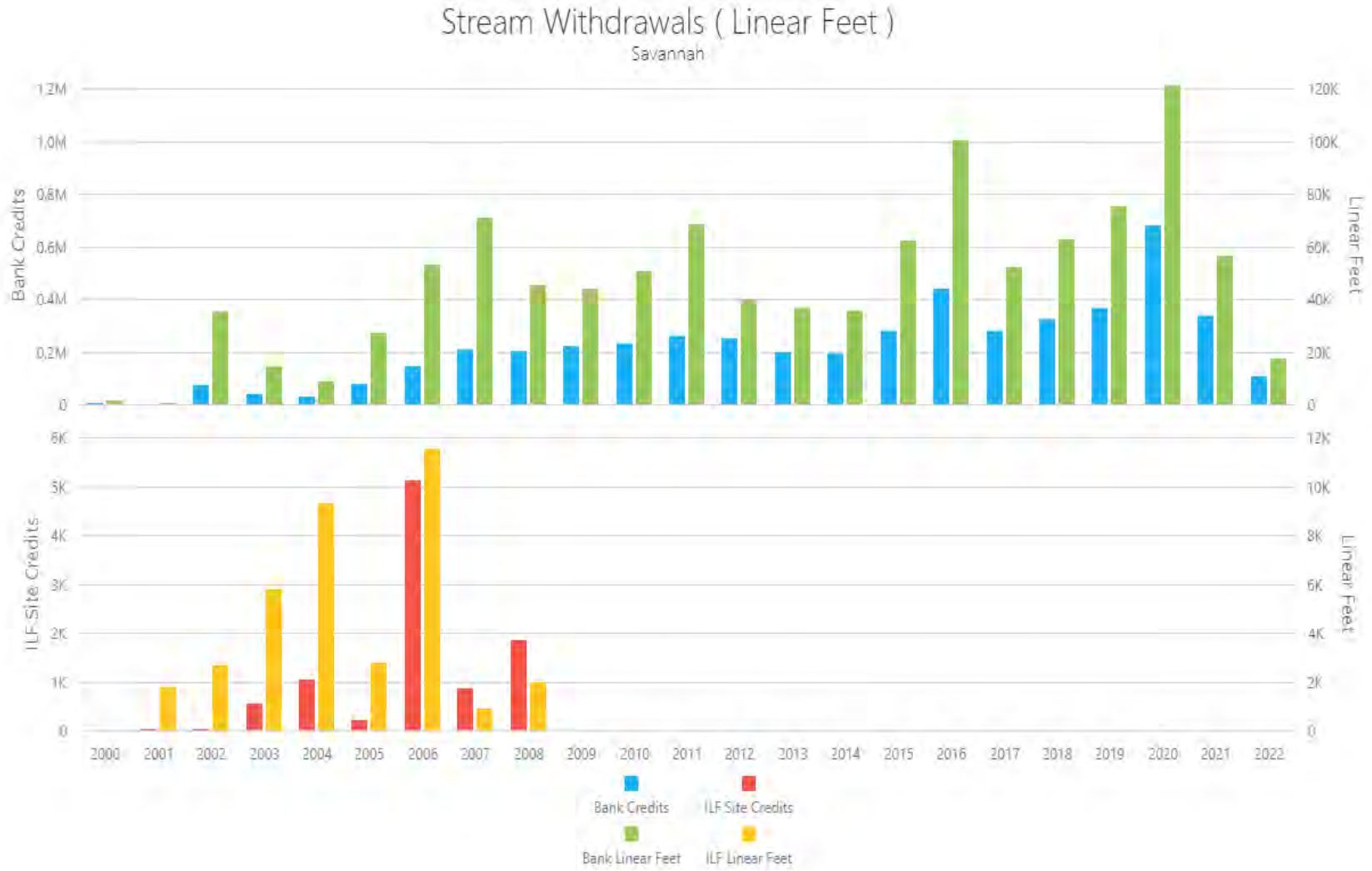

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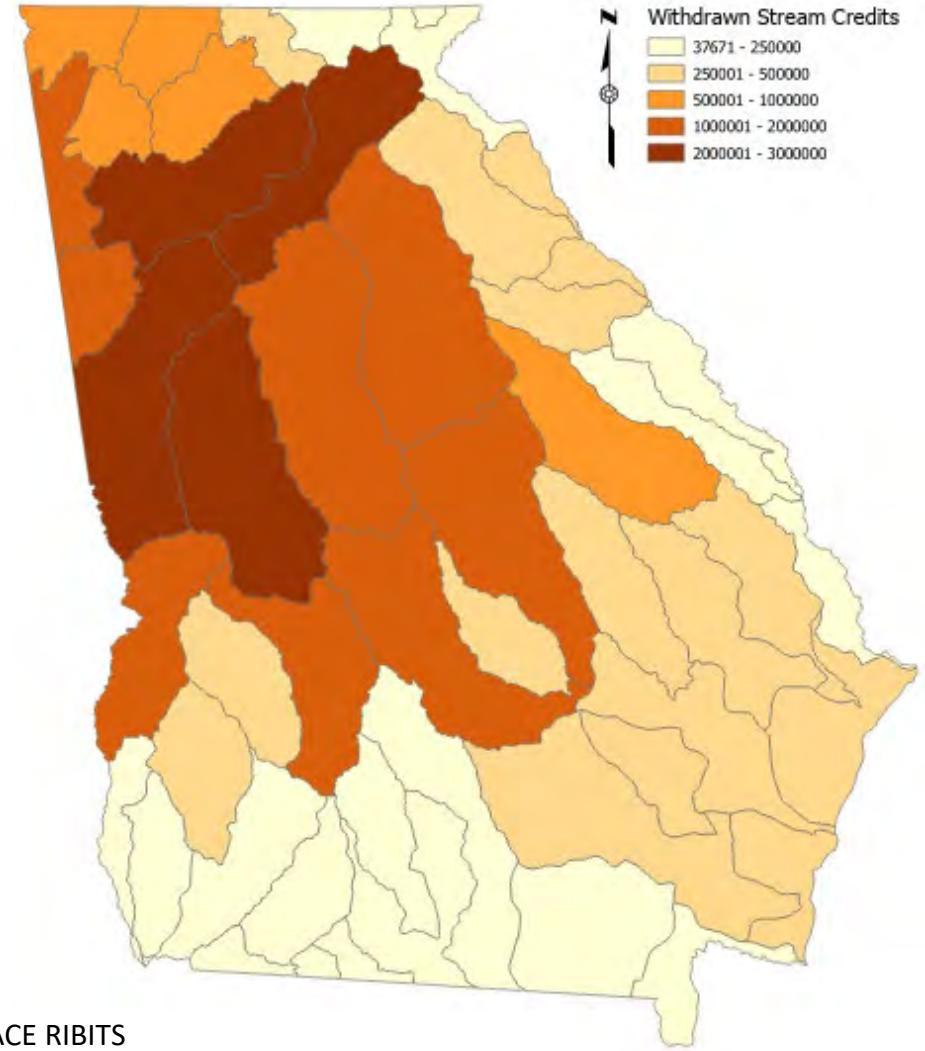
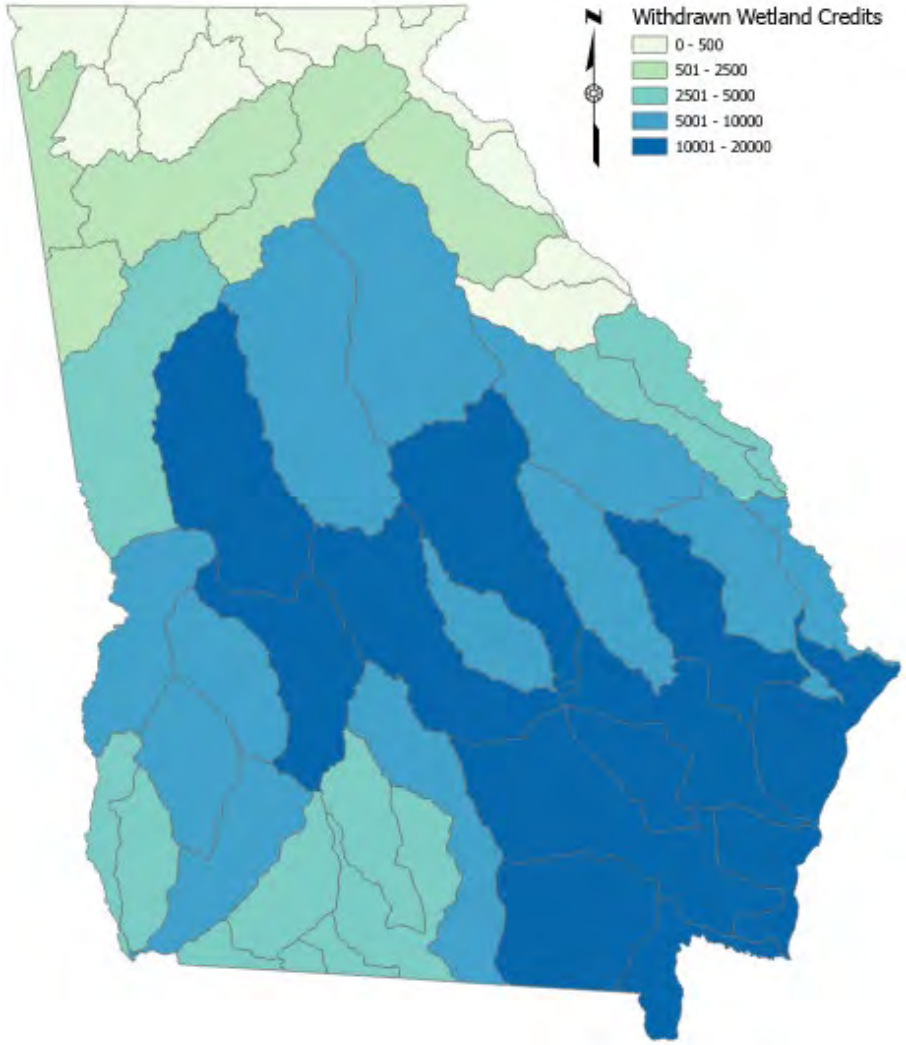
Compensatory Mitigation Withdrawals by HUC8





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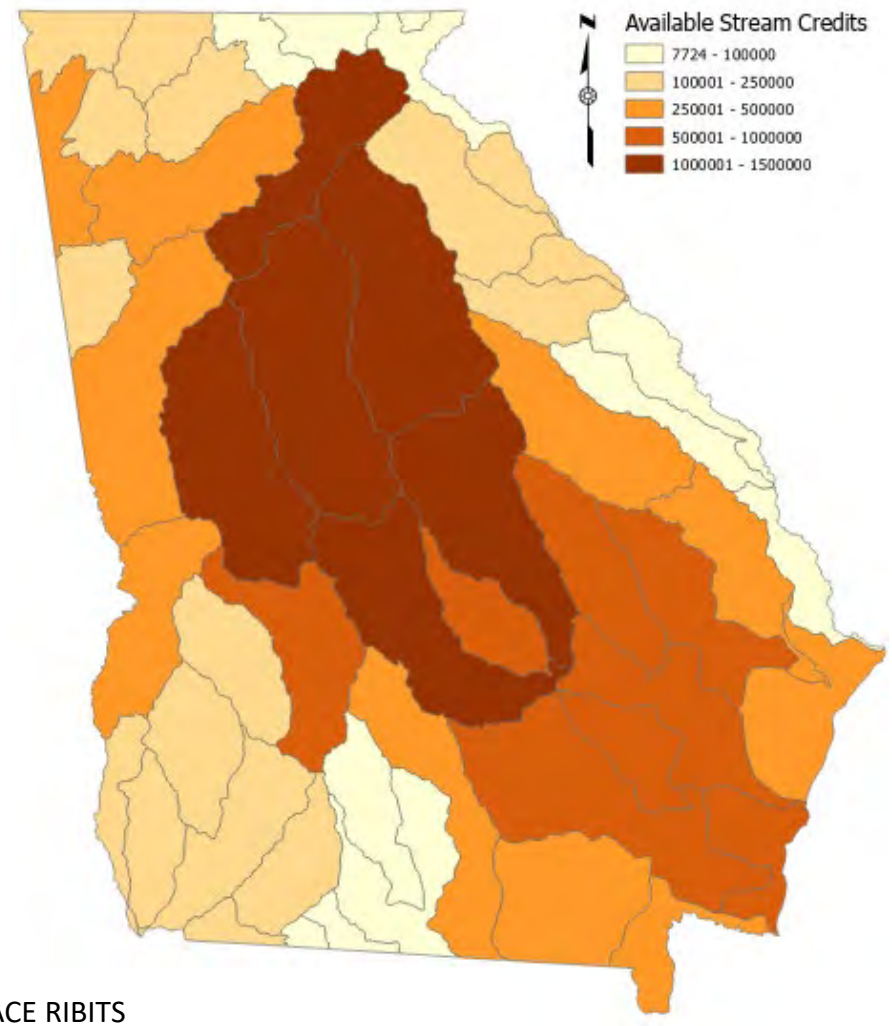
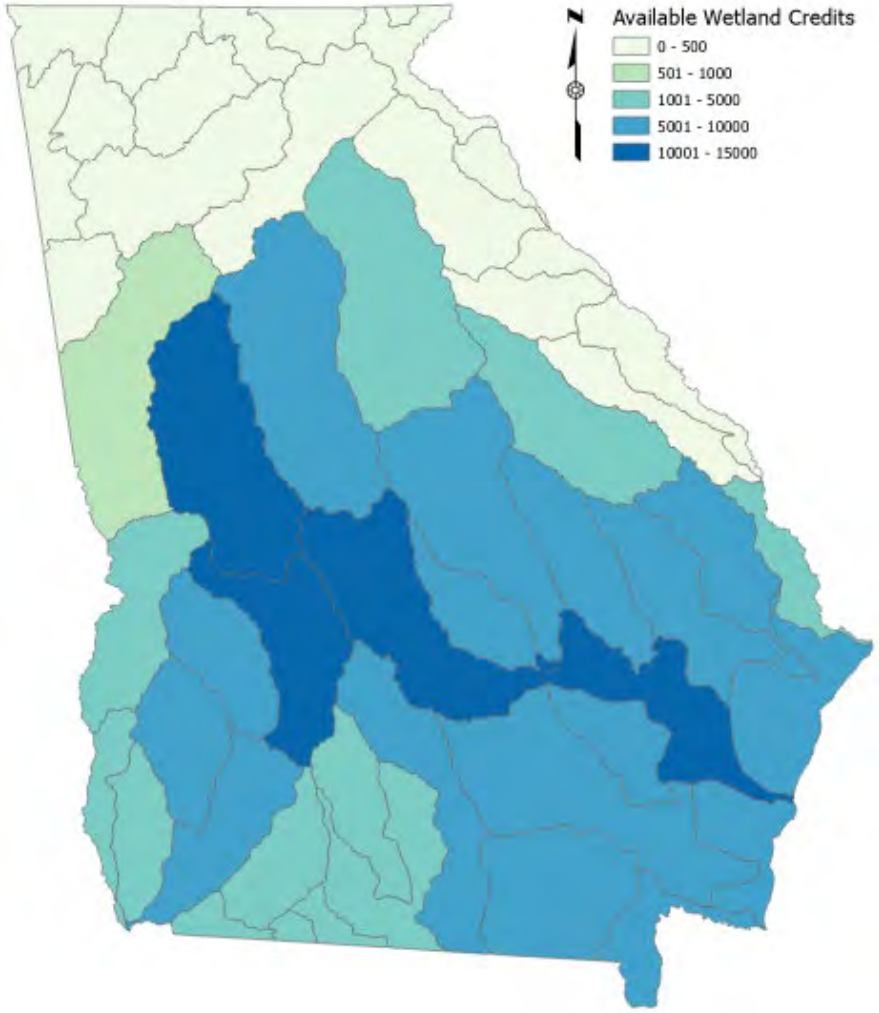
Compensatory Mitigation Credit Availability by HUC8





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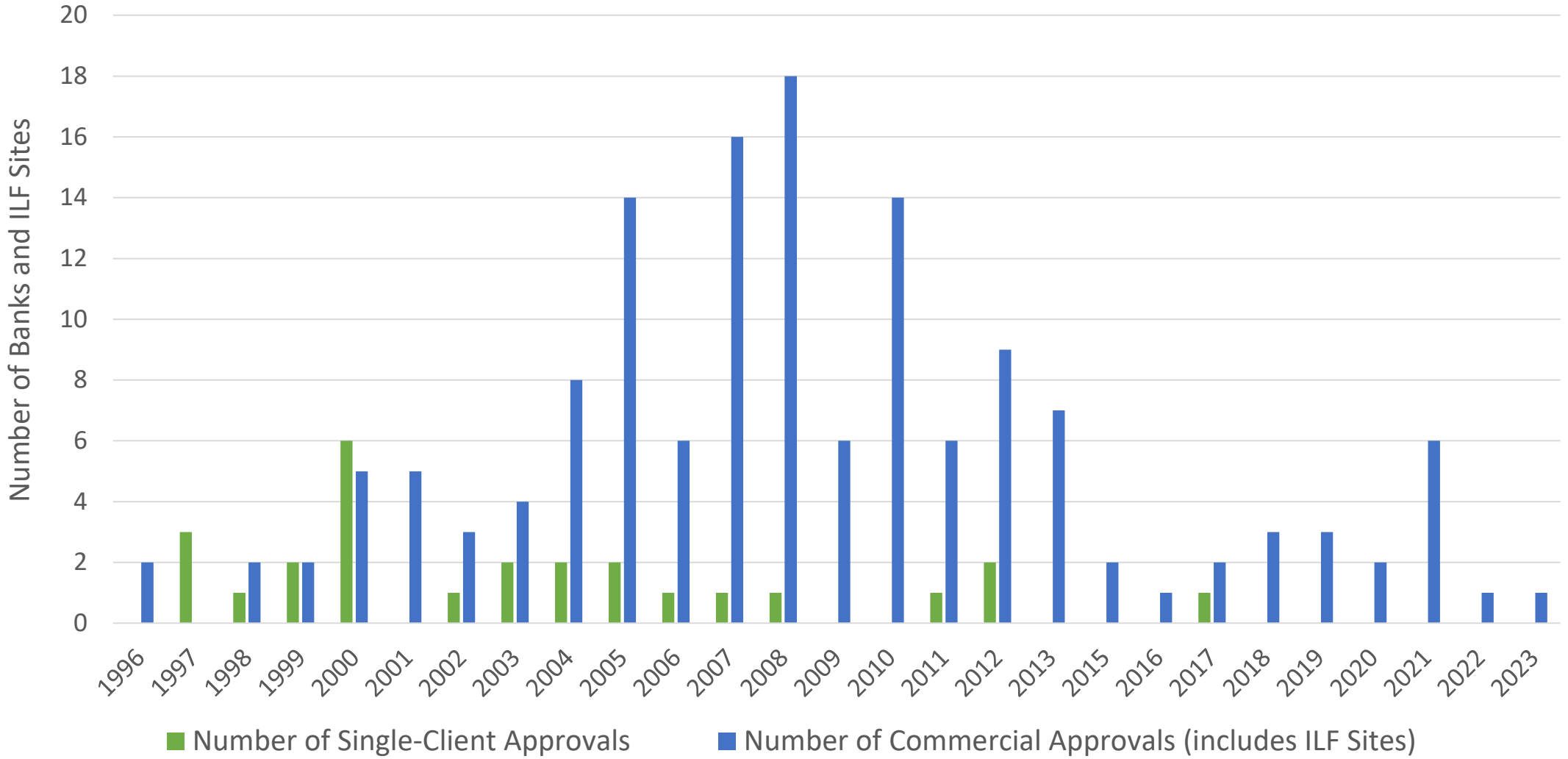
Compensatory Mitigation Bank / ILF Site Establishment



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2023 Trends and Coordination

- Mitigation Credit Availability
- Mitigation Credit Cost
- Commercial Mitigation Approval Timelines

REGULATORY DIVISION'S MITIGATION UPDATE

2023 GERA Annual Meeting

16 February 2023

Justin Hammonds
Mitigation Liaison
Regulatory Division, Management Branch

US Army Corps of Engineers®

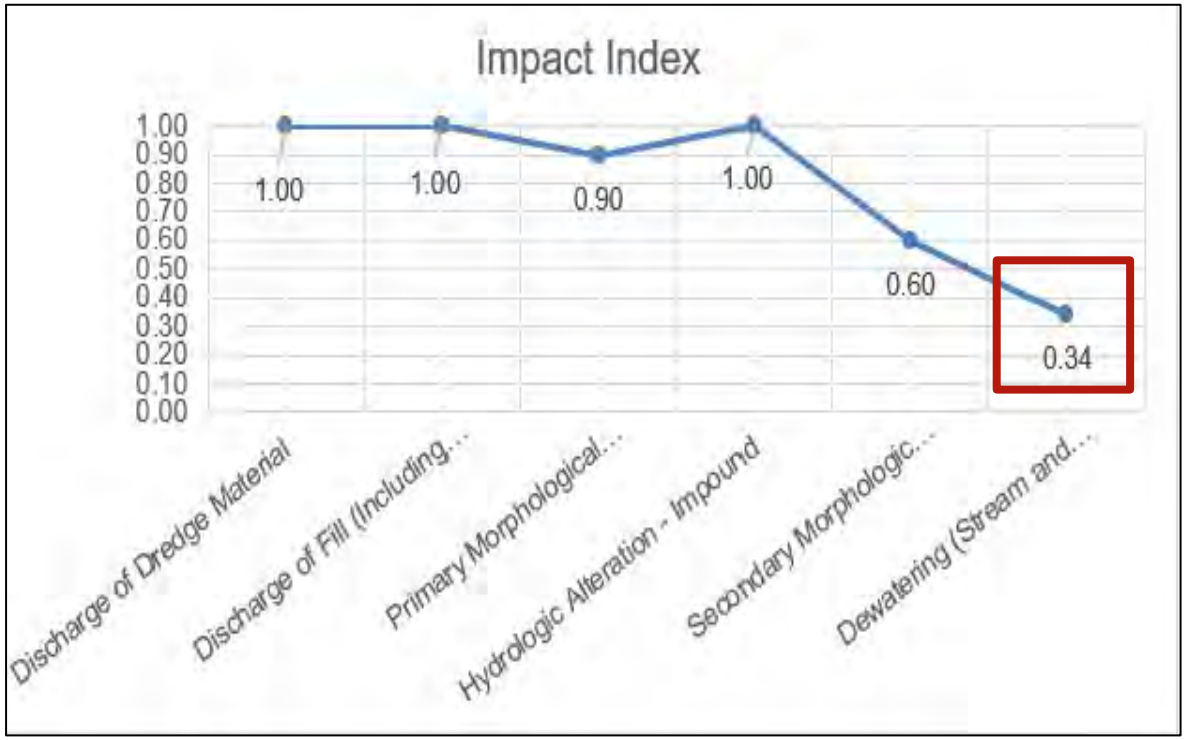
AGENDA

- 2021 SOP (Version 2.0) Updates
- Commercial Credit Supply Challenges
- RIBITS Credit Sale Validation
- Status of Pending Initiatives
- Future

WHAT IS NEW IN VERSION 2.0

- Dewatering Adverse Impact Factor for Stream Impacts
- Decrease in mitigation required for Non-perennial streams with ephemeral flows.
  - 50% proration for 2018 Stream Credits owed
  - 60% proration for Legacy Stream Credits owed
- Major changes in the SQT and HGM
  - SQT reference curves revised for the following: P-P, Riffle%, LWDI, Macros (Piedmont and Blue Ridge revised, and now includes three (3) new Level 4 eco-regions for the CP)
  - Soil Saturation (V_{hydro}) and Vegetation Structure (V_{struct}) Calculators in HGM revised
    - V_{hdyro} no longer includes falling arm of the performance curve, which has been replaced with a ponding assessment.
    - V_{struct} focuses solely on forested cover (trees get assessed if they are 2.54 cm in diameter).
      - Big 15 trees (was previously Big 3)

STREAM ADVERSE IMPACT INDICES



Dewatering (Stream and Pump Diversions) – Short-term/Temporary is defined as the alteration of stream flows from the existing channel for the purposes of constructing a structure (e.g., culvert) in the stream bed and/or banks. Dewatering shall only be used for temporary or short-term durations (e.g., less than or equal to 90 days, less than 1 year). As a general rule, mitigation will be required for dewatering of streams, where the alteration of stream flows meets or exceeds 60 days. Diversions may include the construction of coffer dams (and bypass pumps), piped diversions, or the construction of impervious lined temporary diversion channels. Dewatering for greater than or equal to 1 year is considered a permanent loss of stream function, and thus does not qualify under this impact type.

STREAM ADVERSE IMPACT - DEWATERING

Worksheet 1: Qualitative Worksheet for Stream Adverse Impacts

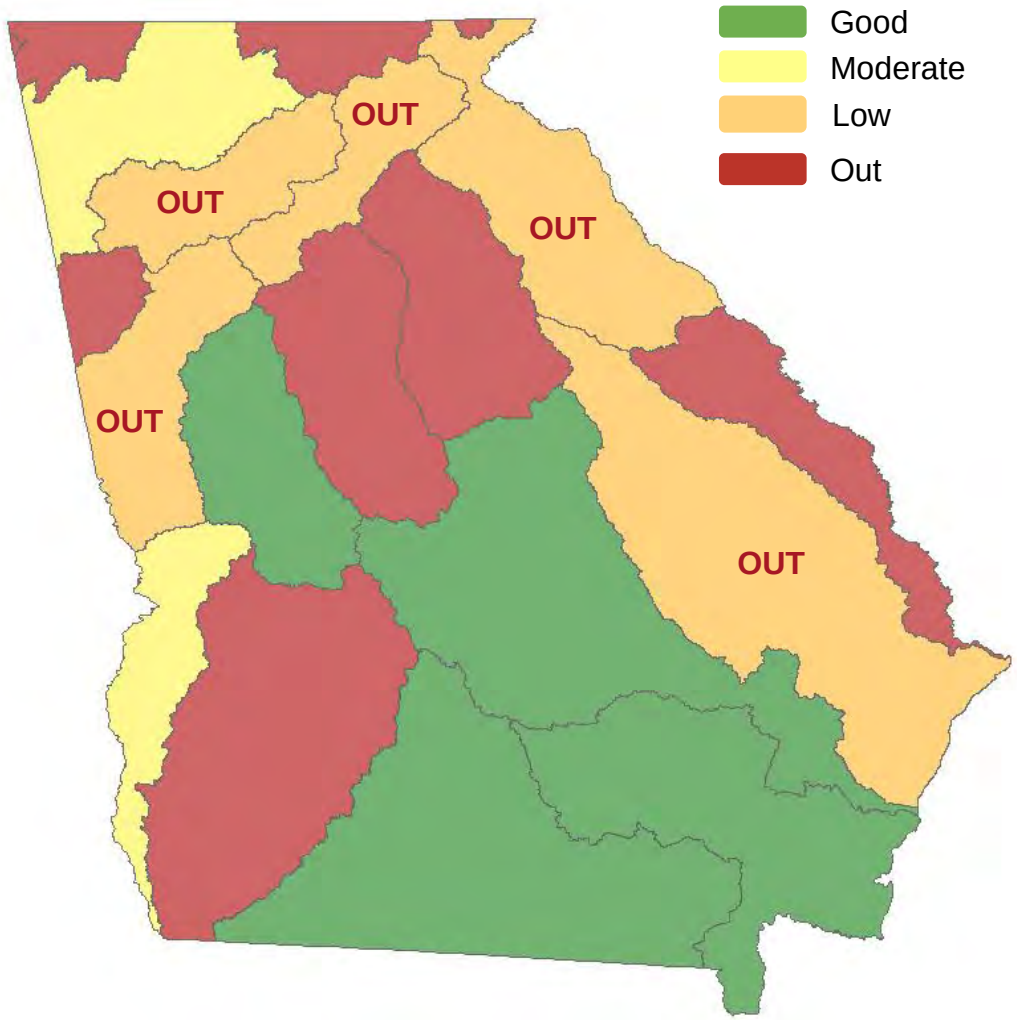
Project Name:	Commerce Business Center
Impact Reach Name:	P1 (Unnamed Tributary to Gravelly Creek)
Linear Feet of Impact (*Feet*):	25
Stream Type:	Perennial Streams (less than 3 square miles)
Non-Perennial Flow Regime:	
Date:	November 16, 2021

Impact Factors	**Index Description**	**Index Value**
1. Stream Qualitative Functional Capacity Score (*SQFC*)	Moderate	0.75
2. Type of Impact (*Impact*)	Dewatering (Stream and Pump Diversions) - Short Term/Temporary	0.34
3. Product of SQFC and Impact (*SQFC Impact*) =		0.26
4. Duration of Impact (*Duration*)	Temporary - Less than (or equal to) 90 Days	0.50
5. Product of SQFC Impact and Duration (*Total SQFC Impact*) =		0.13
6. Product of Total SQFC Impact and Linear Feet (***Total 2018 Stream Credits Owed***)[1] =		**3.19**
7. Conversion of Total 2018 Stream Credits to Legacy Credits (***Legacy Stream Credits Owed***)[2,3] =		**38.25**

Green Cells = User must manually input information.
Orange Cells = User must select the index choice from the drop-down list.
Grey Cells = The calculation of these cells is automated.
[1]Total 2018 Stream Credits Owed are prorated to 50% for Non-Perennial Streams with Ephemeral Flow.
[2]Legacy Stream Credits Owed are prorated to 60% for Non-Perennial Streams with Intermittent Flow.
[3]Legacy Stream Credits Owed are prorated to 60% for Non-Perennial Streams with Ephemeral Flow.

COMMERCIAL CREDIT SUPPLY CHALLENGES

Wetland Credit Availability at Mitigation Banks
(as of 08/21/22)

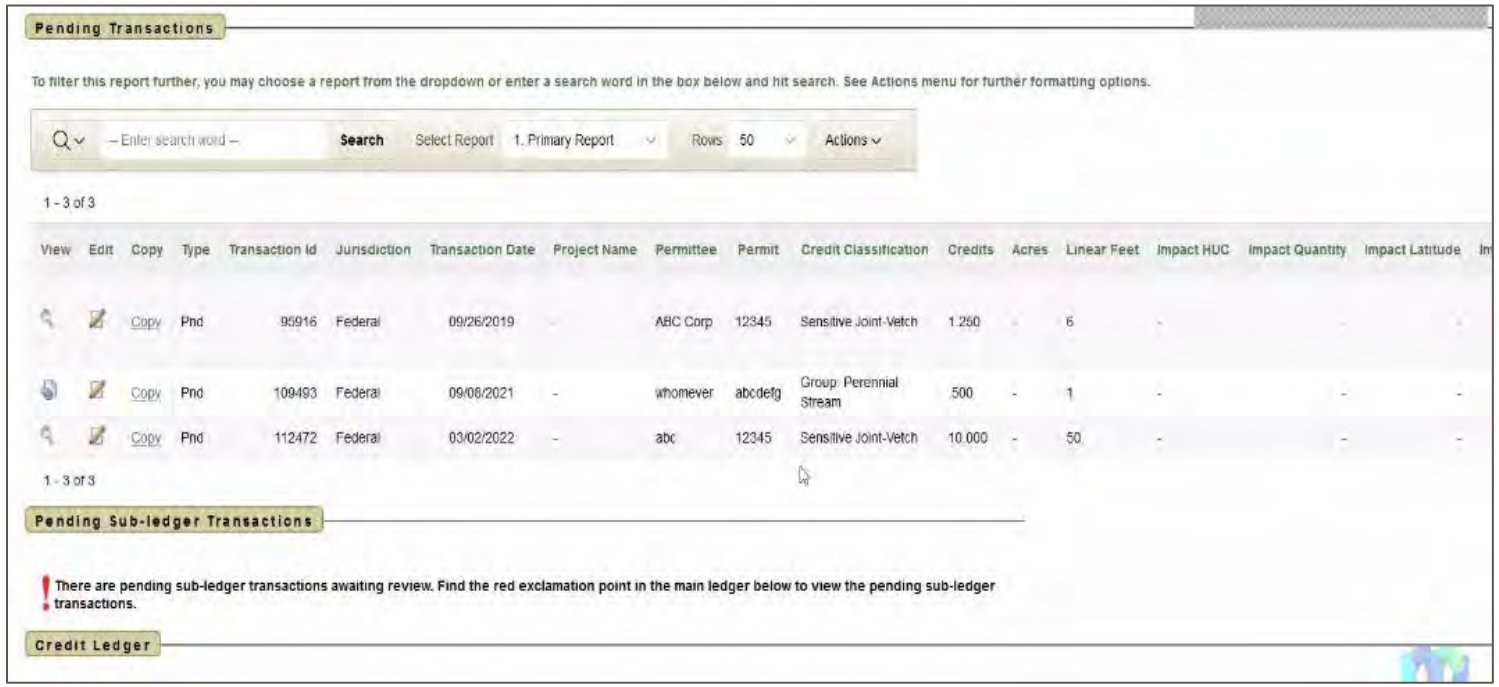


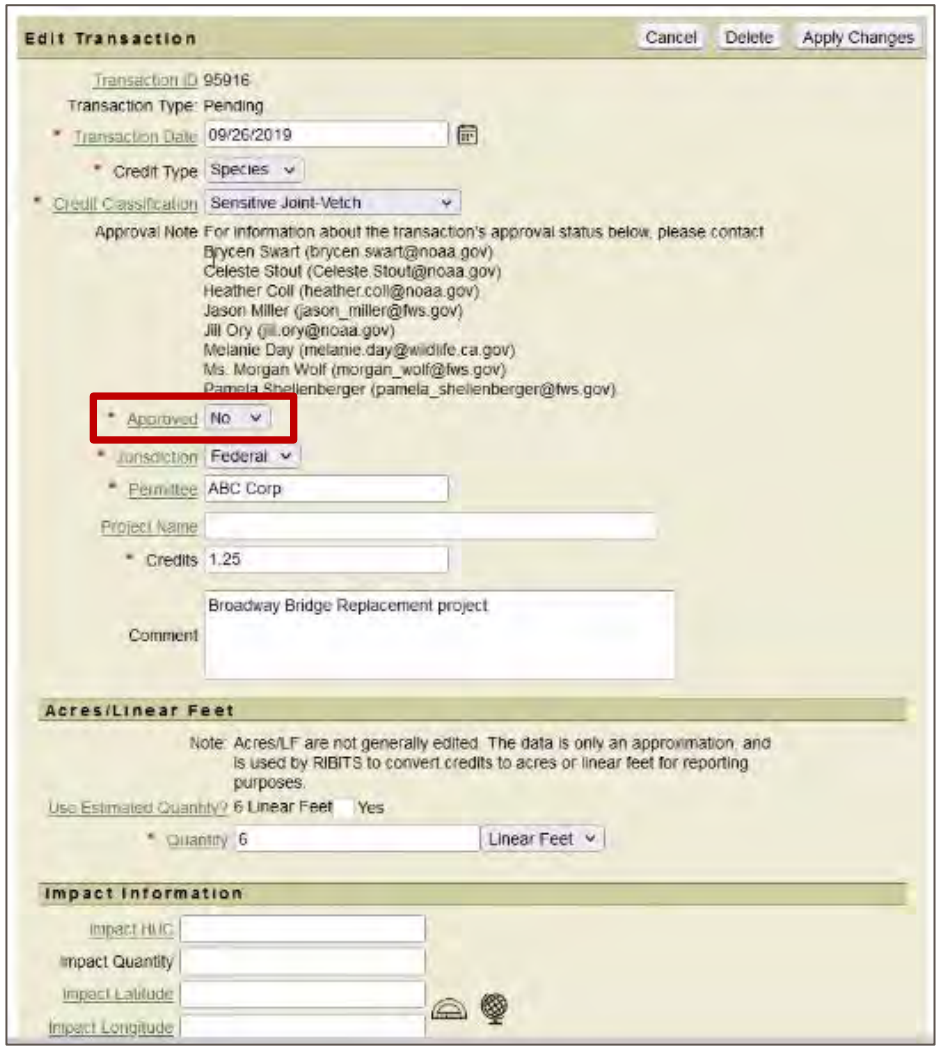
- Unprecedented growth in a number of our service areas (e.g., Lower Savannah and Ogeechee associated with SHEP and attendant infrastructure).
- Advance bulk credit sales and several large projects permitted over the last year have further diminished credit availability.
- Low supply and high demand challenges have influenced commercial credit pricing.
- Uncertainty of credit availability makes it difficult for applicants to forecast mitigation costs and plan the start of project construction.

COMMERCIAL CREDIT SUPPLY CHALLENGES (CONT.)

- In April of 2022, Georgia-Alabama Land Trust's (GALT) request for an ILF program modification to release advance mitigation credits was approved to meet the foreseeable (i.e., 2-year) commercial mitigation credit demand in the following Primary Service Areas (PSAs):
  - **Lower Savannah PSA** (2,000 non-perennial stream, 2,000 perennial stream (< 3 square miles), 1,300 perennial stream (>3 square miles), 80.00 riverine/lacustrine fringe wetland and 18.00 slope wetland credits)
  - **Lower Ogeechee PSA** (1,800 non-perennial stream, 1,800 perennial stream (< 3 square miles), 900 perennial stream (>3 square miles), 204.00 riverine/lacustrine fringe wetland and 49.00 slope wetland credits)
  - **Tennessee PSA** (1,455 non-perennial stream, 2,645 perennial stream (< 3 square miles), 754 perennial stream (>3 square miles), 1.00 riverine/lacustrine fringe wetland and 1.00 slope wetland credit)
  - **Ocmulgee PSA** (12.73 riverine/lacustrine fringe wetland, 0.40 slope wetland and 0.40 depressional wetland credit)
- Historically, GALT has established their base credit pricing from mitigation banking credit pricing in the respective service areas.
- GALT and the Corps are continuing to evaluate ILF credit pricing based upon analysis of full delivery mitigation cost data and traditional cost estimating.

RIBITS CREDIT SALE VALIDATION





- IWR and SAD Districts beta-tested validation functionality in October 2022.
- Video training for bankers/credit sales POCs was provided in January 2023.

STATUS OF RELEASE OF PENDING MITIGATION INITIATIVES

- Updated Restrictive Covenant (RC) Template and RC Amendments (Late February 2023)
- Performance Standards and Monitoring Metrics (March/April 2023)
- Service Areas (2nd Quarter 2023)

FUTURE MITIGATION INITIATIVES?

- Minimum Hydrologic Credit Concept
- Credit Release Schedule For Preservation
- Update Credit Purchase Guidance
- Provide Draft BI Template and Mitigation Plan Guidance

OPEN DISCUSSION/QUESTIONS

Waters of the United States Updates

Please see links below for official USEPA information

https://www.epa.gov/wotus/public-outreach-and-stakeholder-engagement-activities

https://www.epa.gov/wotus/revising-definition-waters-united-states

Georgia Department of Transportation

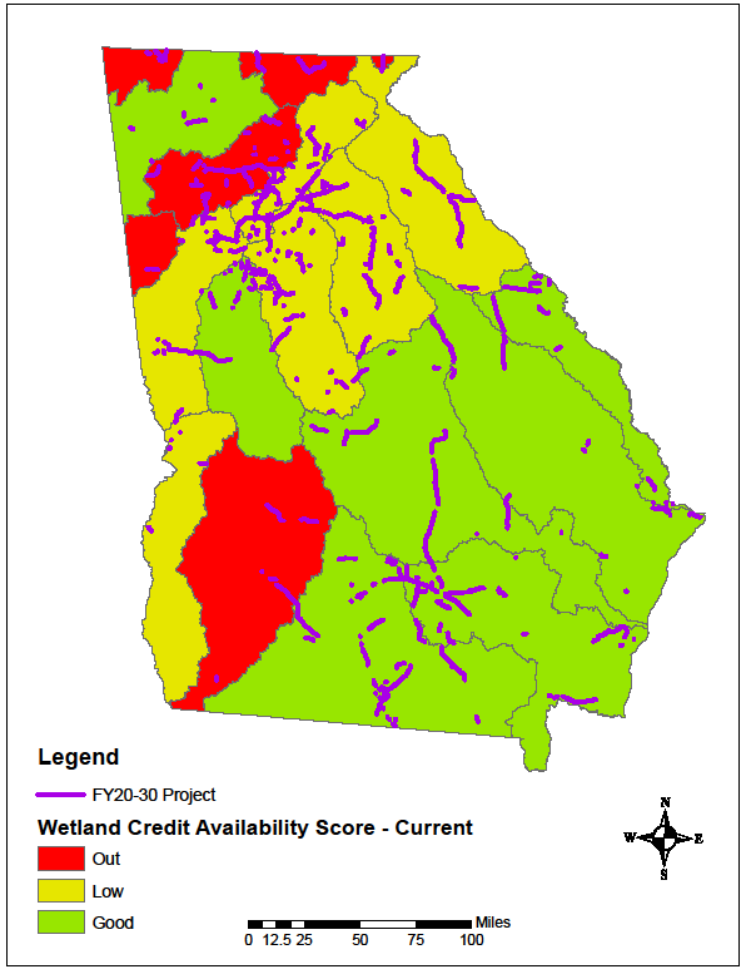
GDOT Mitigation Forecasting

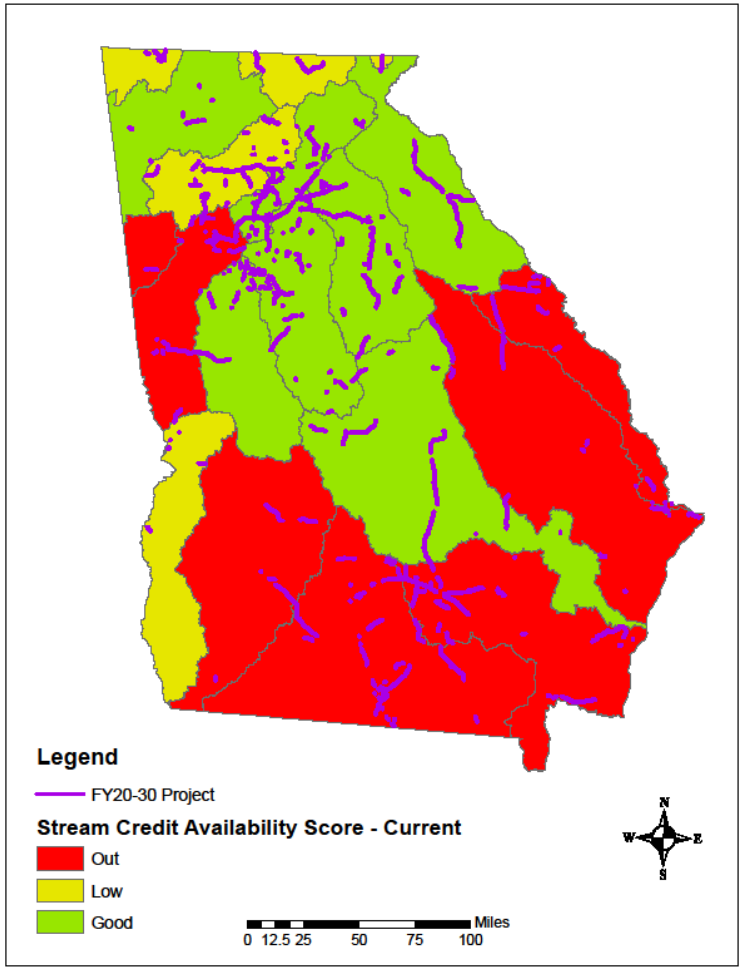
Introduction

- Current State of Mitigation Credit Availability in Georgia
- Geospatial Model – Overview
- Projected Mitigation Credit Availability for FY 20-30 Projects
- Mitigation Cost Trends and Projections for FY 20-30 Projects
- What does this mean for GDOT?
- Recommendations

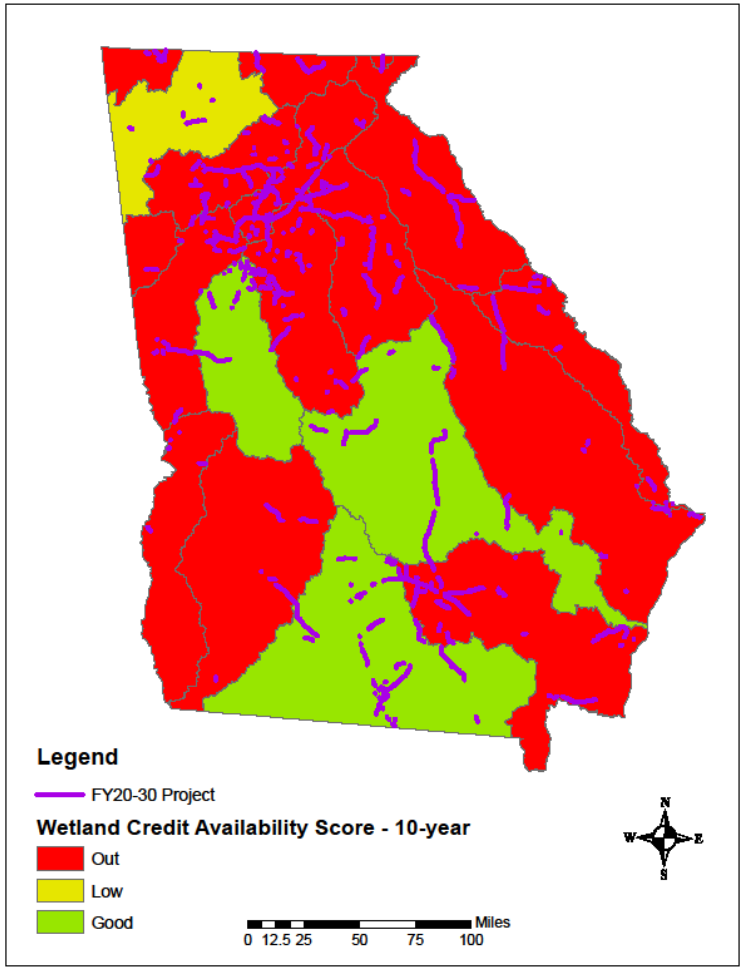
GDOT
Georgia Department
of Transportation

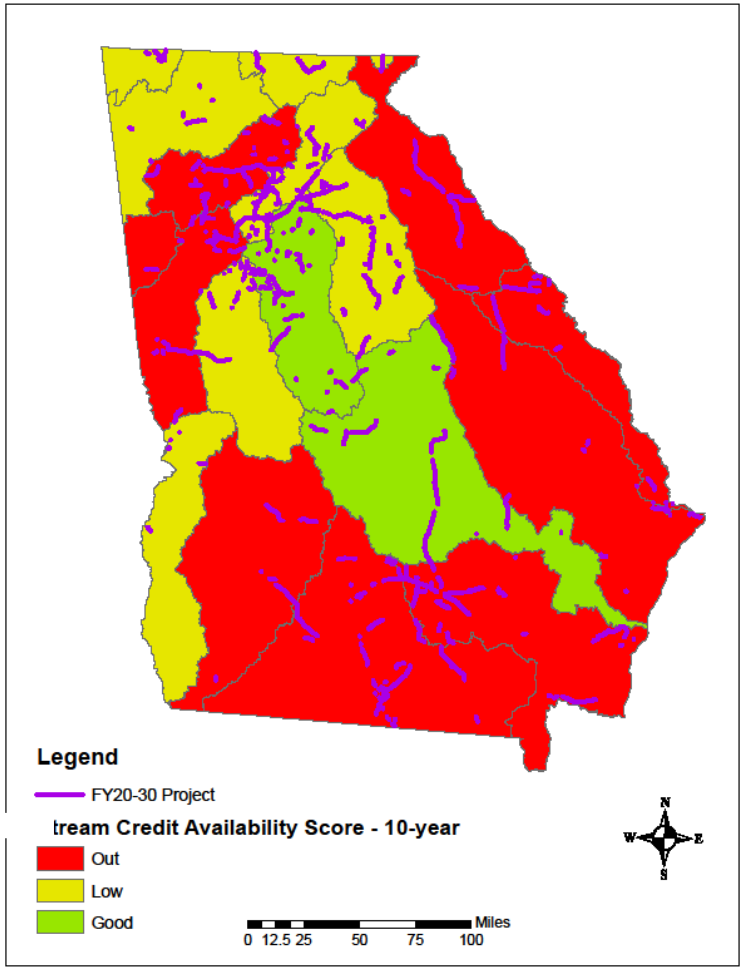
Current Credit Availability





Credit Availability in 10 Years





What Does This Mean for GDOT?

- Lack of available credits will continue to jeopardize project schedules
- Costs for mitigation credits in troubled basins are rising
- Looking beyond FY30

Recommendations

- Purchase credits in bulk in the green and yellow zones
- Provide mitigation banking community with our projected credits needs across the state to encourage establishment of new banks
- Utilize existing GDOT properties

GDOT
Georgia Department of Transportation

Questions?

Georgia-Alabama Land Trust

GEORGIA-ALABAMA
LAND TRUST

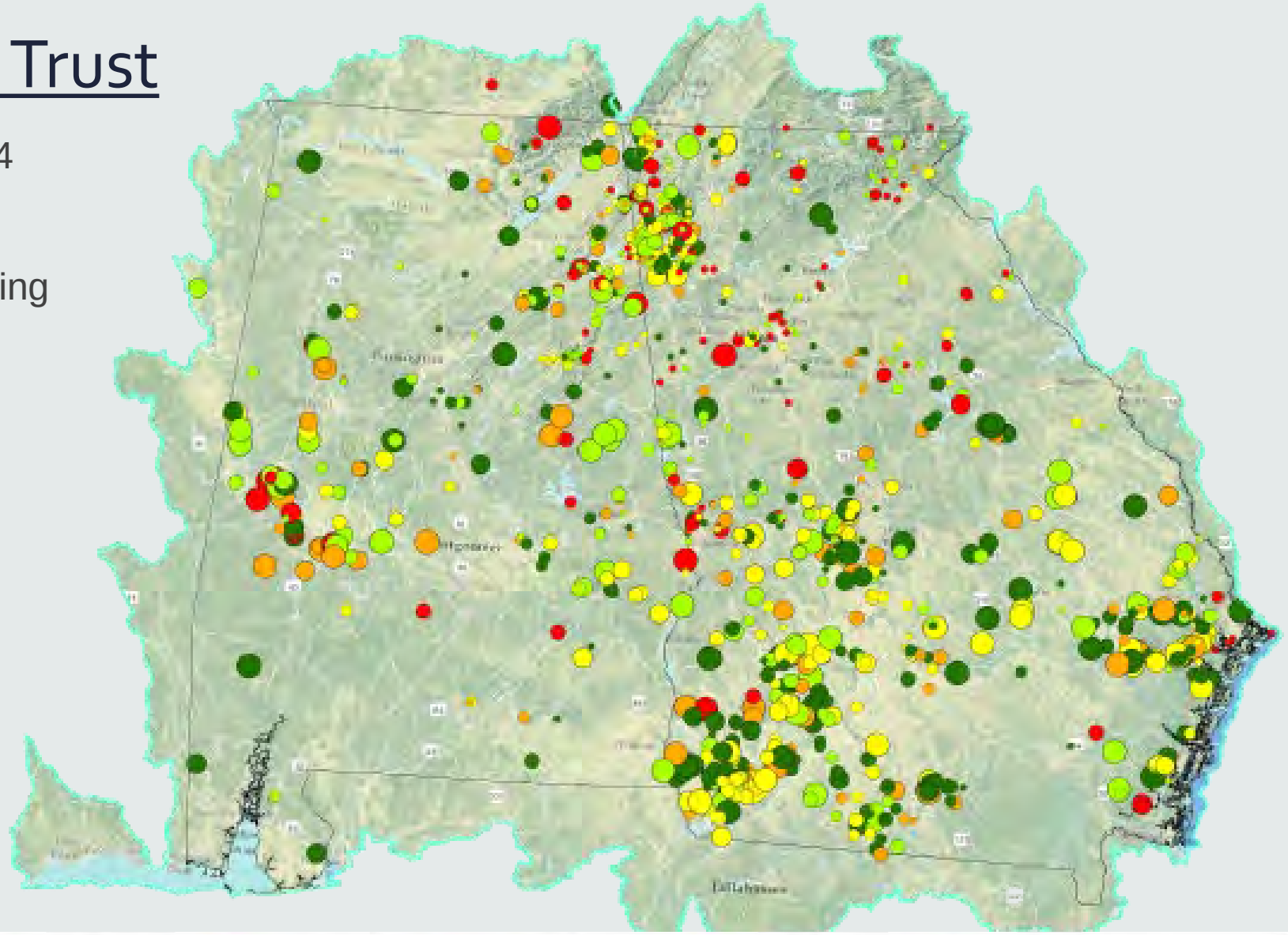
In Lieu Fee Program Update

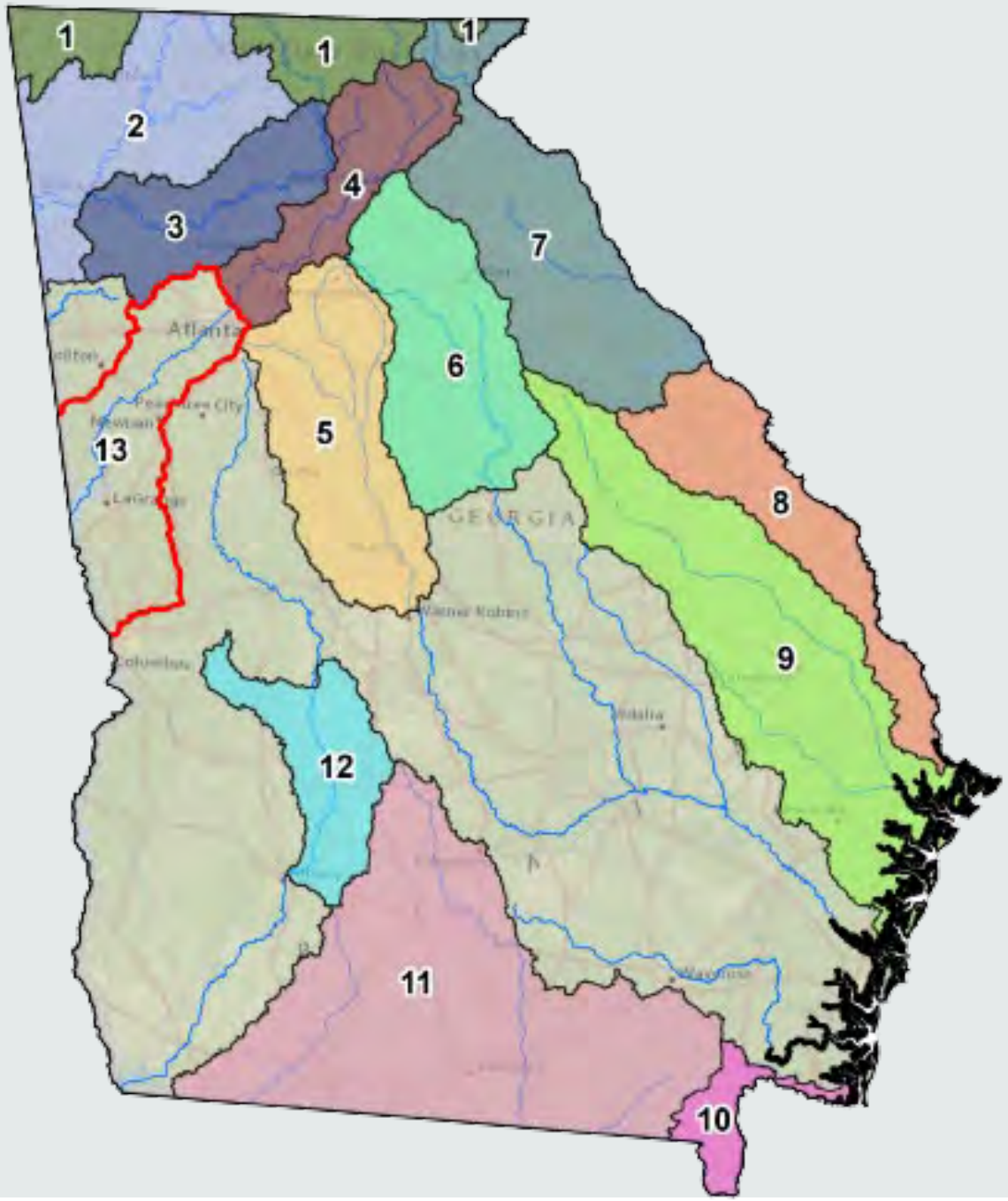
Michael Heneghan, ILF Program Director

ACCREDITED
LAND TRUST
ACCREDITATION COMMISSION

Georgia-Alabama Land Trust

- 501(c)(3) organization founded in 1994
  - Operate in 7 states
- Over 1,200 protected properties covering 440,000 acres
  - Primarily conservation easements (430,000 acres)
  - Small fee holdings (10,000 acres)
- Special Programs
  - Army Compatible Use Buffer (ACUB) – Fort Stewart
  - In Lieu Fee Program





Existing Service Areas

- 1 - Tennessee (Stream & Wetland)
- 2 - Upper Coosa (Wetland)
- 3 - Etowah (Wetland)
- 4 - Upper Chattahoochee (Wetland)
- 5 - Upper Ocmulgee (Wetland)
- 6 - Upper Oconee (Stream* & Wetland)
- 7 - Upper Savannah (Stream* & Wetland)
- 8 - Lower Savannah (Stream & Wetland)
- 9 - Lower Ogeechee (Stream & Wetland)
- 10 - Satilla (Stream)
- 11 - Withlacoochee (Stream)
- 12 - Lower Flint (Stream)

Proposed Service Areas

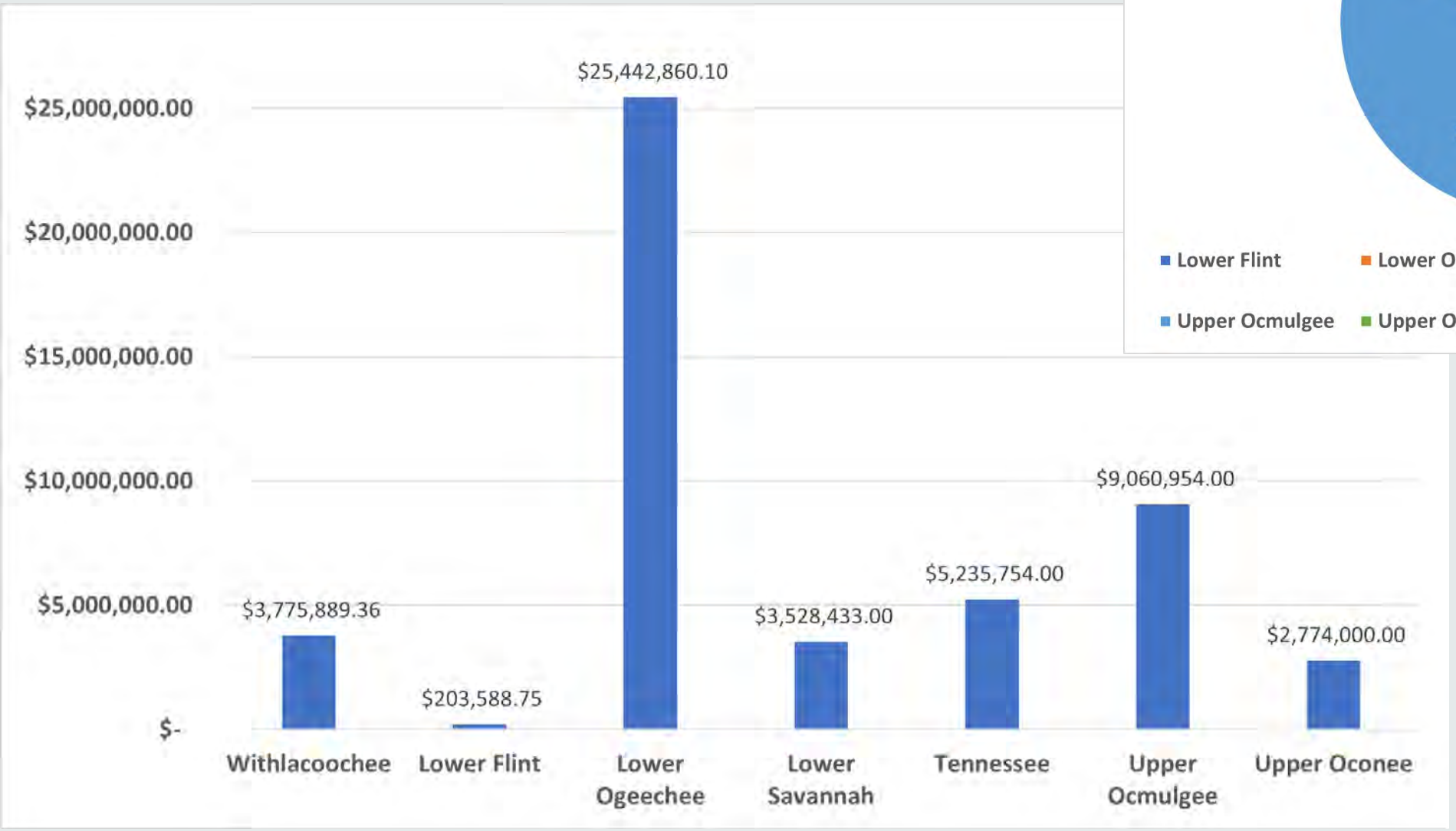
- Middle Chattahoochee (Stream)

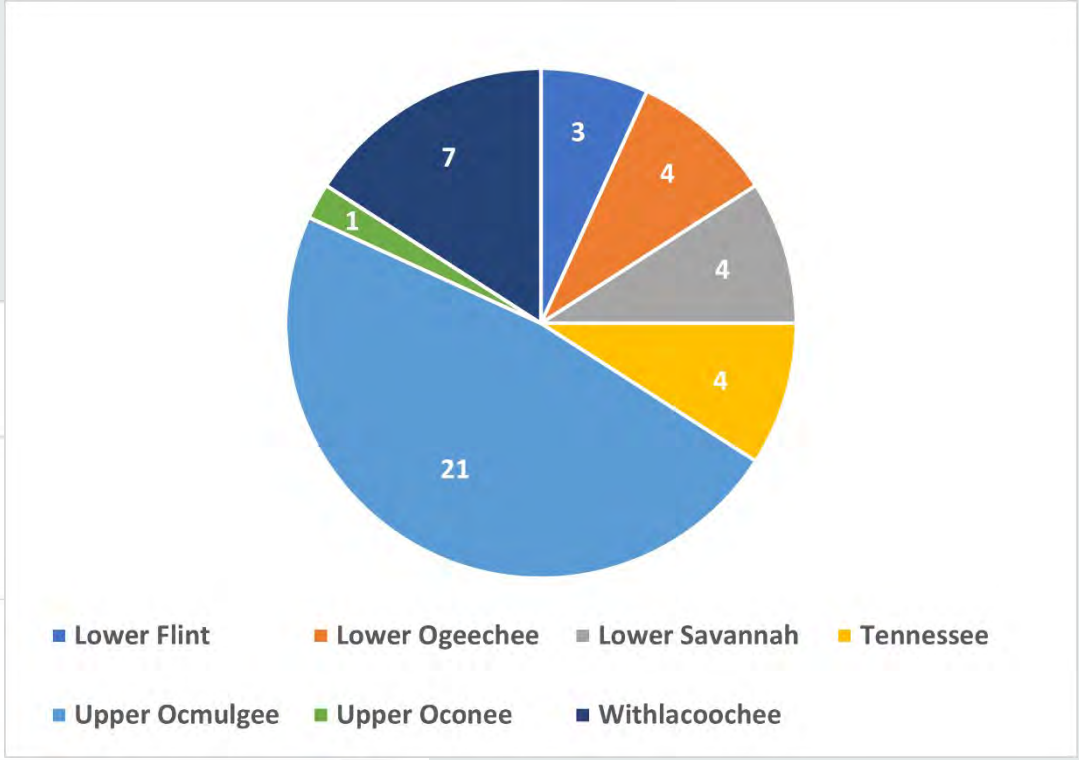
Service Area & Type	GALT-ILF Credits Sold	GSWTF Credits Sold	Total Credits Sold	Total Obligation	Credits Funded (Minimum)	Credits Funded (Potential)	Open Obligation (Max)	Open Obligation (Full Potential)	Unallocated Funds	Available Credits
Upper Savannah Wetland	5.32	0.00	5.32	5.59	6.65	10.50	-1.06	-4.91	$ -	2.66
Withlachoochee Stream	12872.10	33.75	12905.84	13551.14	11012.47	13758.50	2538.67	-207.36	**$ 4,779,208.18**	10398.80
Upper Chattahoochee Wetland	1.20	0.00	1.20	1.26	0.00	0.00	1.26	1.26	$ 392,246.00	6.69
Upper Coosa Wetland	9.35	5.20	14.55	15.28	16.00	22.40	-0.72	-7.12	$ -	35.42
Etowah Wetland	1.61	0.00	1.61	1.69	0.97	0.97	0.72	0.72	$ 115,747.74	14.36
Tennessee Stream	2991.00	144.36	3135.36	3292.13	0.00	0.00	3292.13	3292.13	**$ 3,707,832.13**	1934.17
Tennessee Wetland	2.44	2.75	5.19	5.44	0.00	0.00	5.44	5.44	**$ 1,852,130.91**	
Lower Flint Stream	881.64	110.56	992.20	1041.81	994.90	1000.00	46.91	41.81	$ 59,168.75	1927.11
Tallapoosa Wetland	0.00	4.02	4.02	4.22	0.00	0.00	4.22	4.22	$ 201,132.35	NA
Upper Oconee Wetland	5.55	0.00	5.55	5.82	0.00	0.00	5.82	5.82	**$ 3,203,282.00**	0.00
Upper Ocmulgee Wetland	14.44	0.00	14.44	15.16	5.77	14.00	9.39	1.16	**$ 8,869,931.00**	2.80
Lower Savannah Wetland	0.09	0.00	0.09	0.09	0.00	0.00	0.09	0.09	$ 83,362.50	88.58
Lower Savannah Stream	14.00	0.00	14.00	14.70	0.00	0.00	14.70	14.70	$ 20,748.00	5102.50
Lower Ogeechee Wetland	189.76	0.00	189.76	199.25	196.88	215.00	2.37	-15.75	$ 1,009,090.00	46.91
Lower Ogeechee Stream	409.44	0.00	409.44	429.91	0.00	0.00	429.91	429.91	$ 433,770.10	3876.06

Pending Modification Request:

Upper Chattahoochee: 10,000 (2018) Stream Credits
Upper Oconee: 5,000 (2018) Stream Credits & 5 (2018) Wetland Credits
Upper Ocmulgee: 20 (2018) Wetland Credits
Upper Savannah: 5,000 (2018) Stream Credits
Middle Chattahoochee: 20,000 (2018) Stream Credits

Completed Credit Sales Since 2021





Upcoming Requests for Proposals

Tennessee Service Area

- Next few weeks
- 5.44 (2018) Wetland Credits and 3,292 (2018 Stream Credits)
- $5.5 million

Lower Savannah Service Area

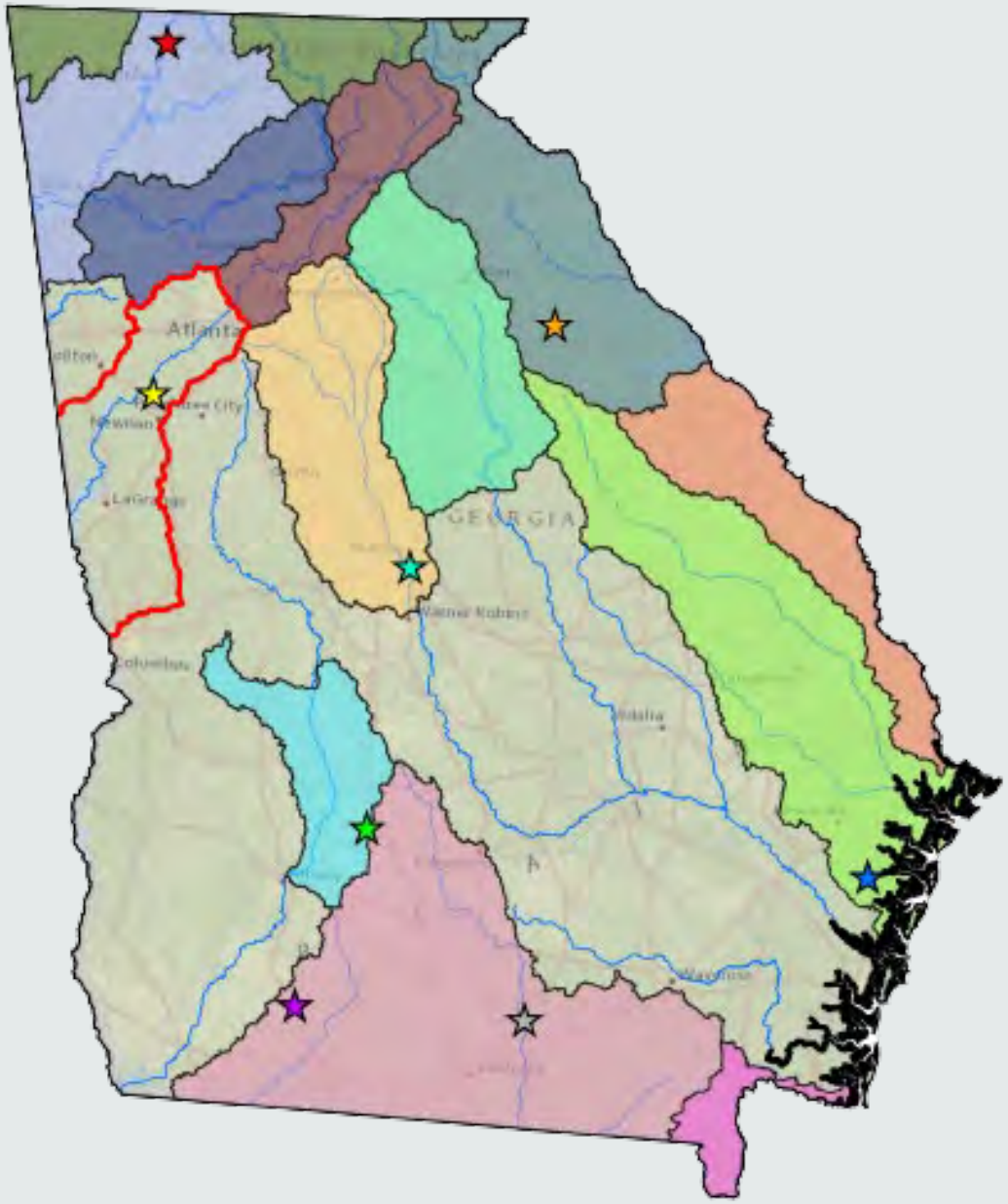
- Approximately 84 (2018) Wetland Credits
- First quarter of 2023

Upper Ocmulgee Service Area

- 9 (2018) Wetland Credits
- Multiple pending sales in this service area so number may increase
- Likely mid-2023

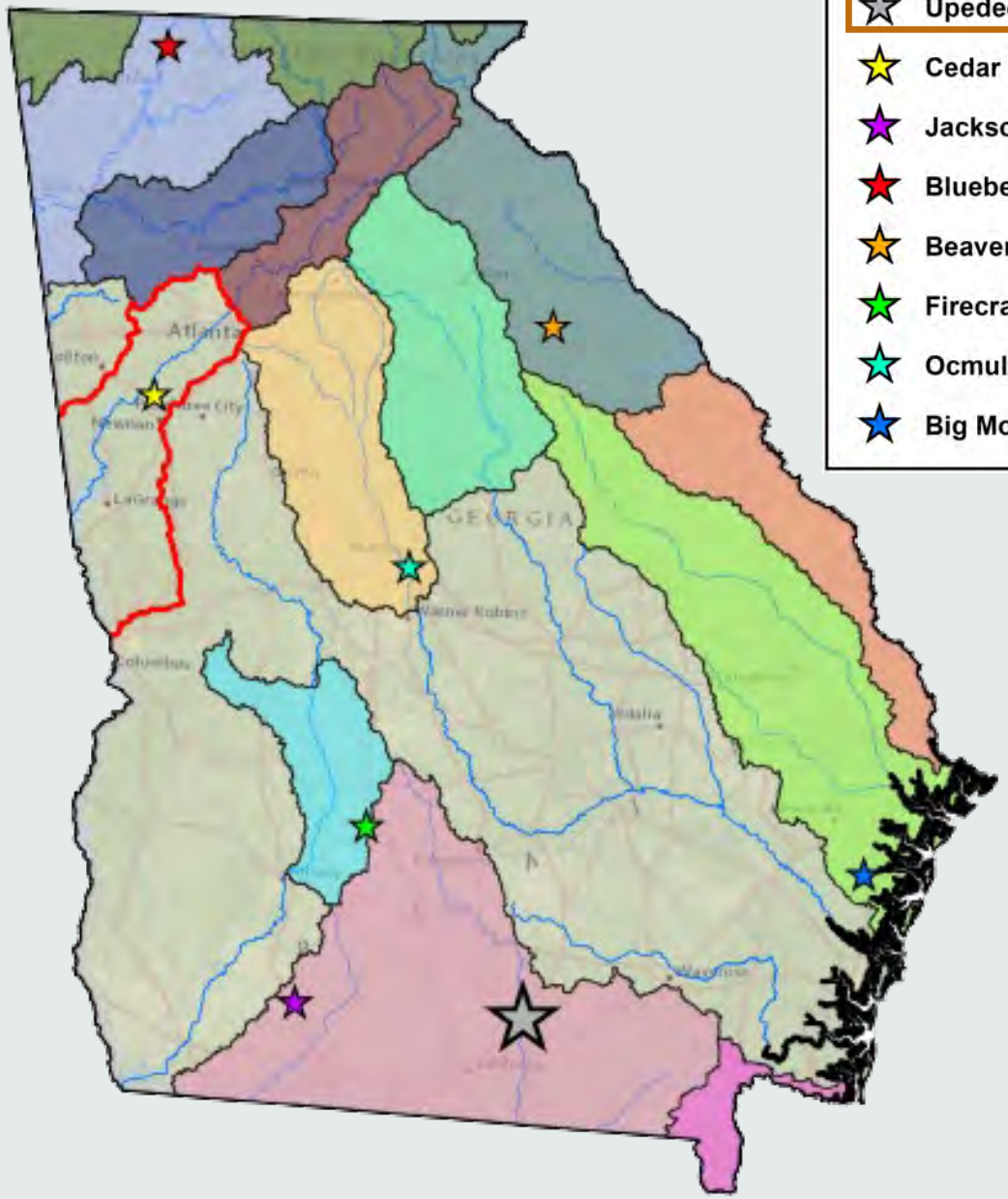
Project Selection

- GALT selects projects to be funded
  - Technical input from IRT considered
- Likelihood of success in generating requisite credits is #1 criteria
  - Siting model was created to give a **macro** level assessment of risk
- Preference for functional lift
- Credit type
- Extended open period and review period
  - On site visits for all proposed projects by GALT-ILF
  - 3rd party review and evaluation
- Process will remain open and competitive



GALT-ILF Projects

- Upedee Creek (S): Year 6 Monitoring Complete
- Cedar Creek (W): Year 5 Monitoring Complete
- Jackson Farms (S): Year 3 Montioring Complete
- Blueberry Farms (W): Second Milestone Met
- Beaverdam Creek (W): First Milestone Met
- Firecracker Creek (S): Working on MBI Approval
- Ocmulgee Mounds (W): MBI Submitted for Approval
- Big Mortar Swamp (W): Selected in Fall 2022



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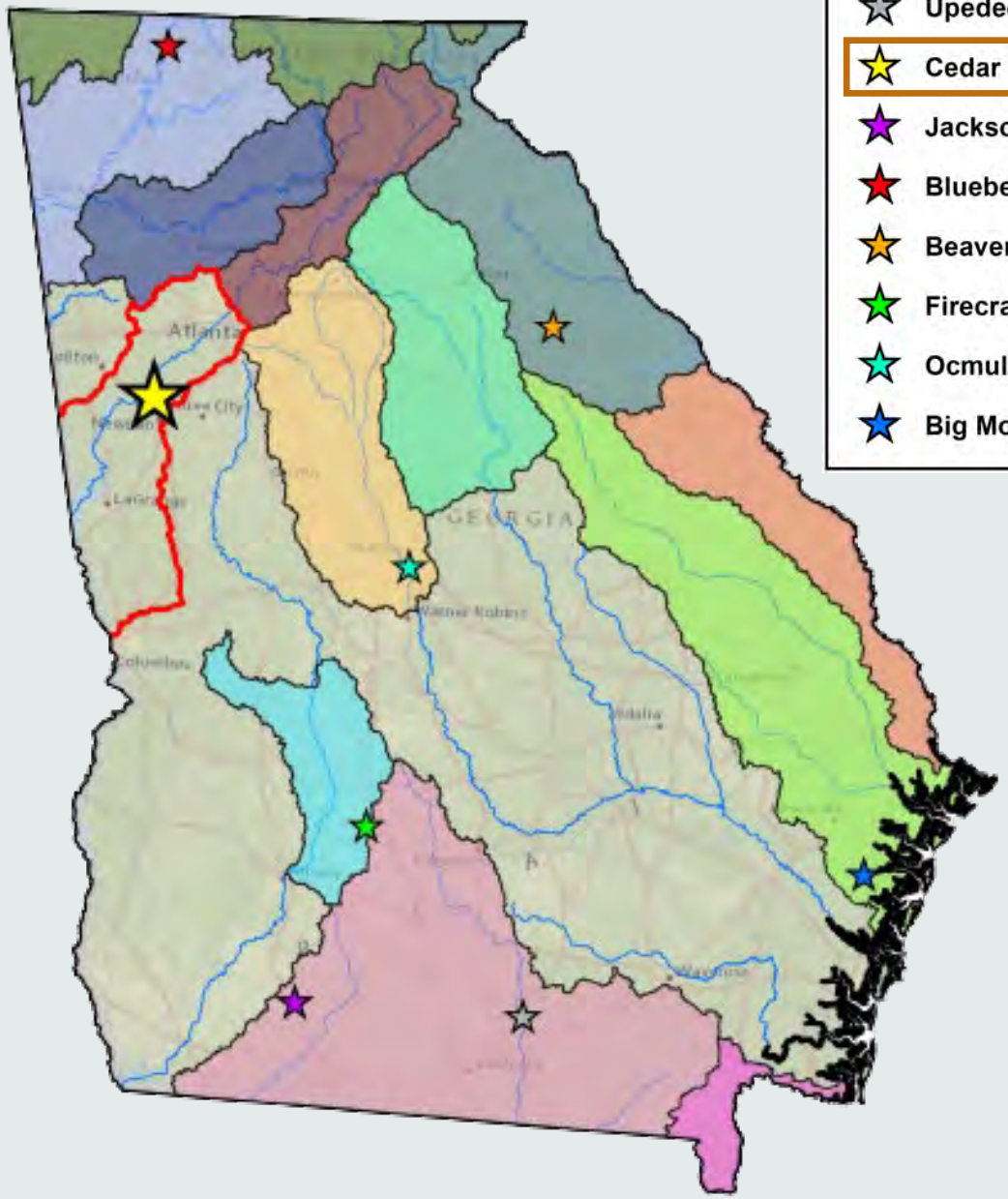
Withlacoochee Stream Project
Corblu
20,000 legacy credits
Year 6 monitoring complete



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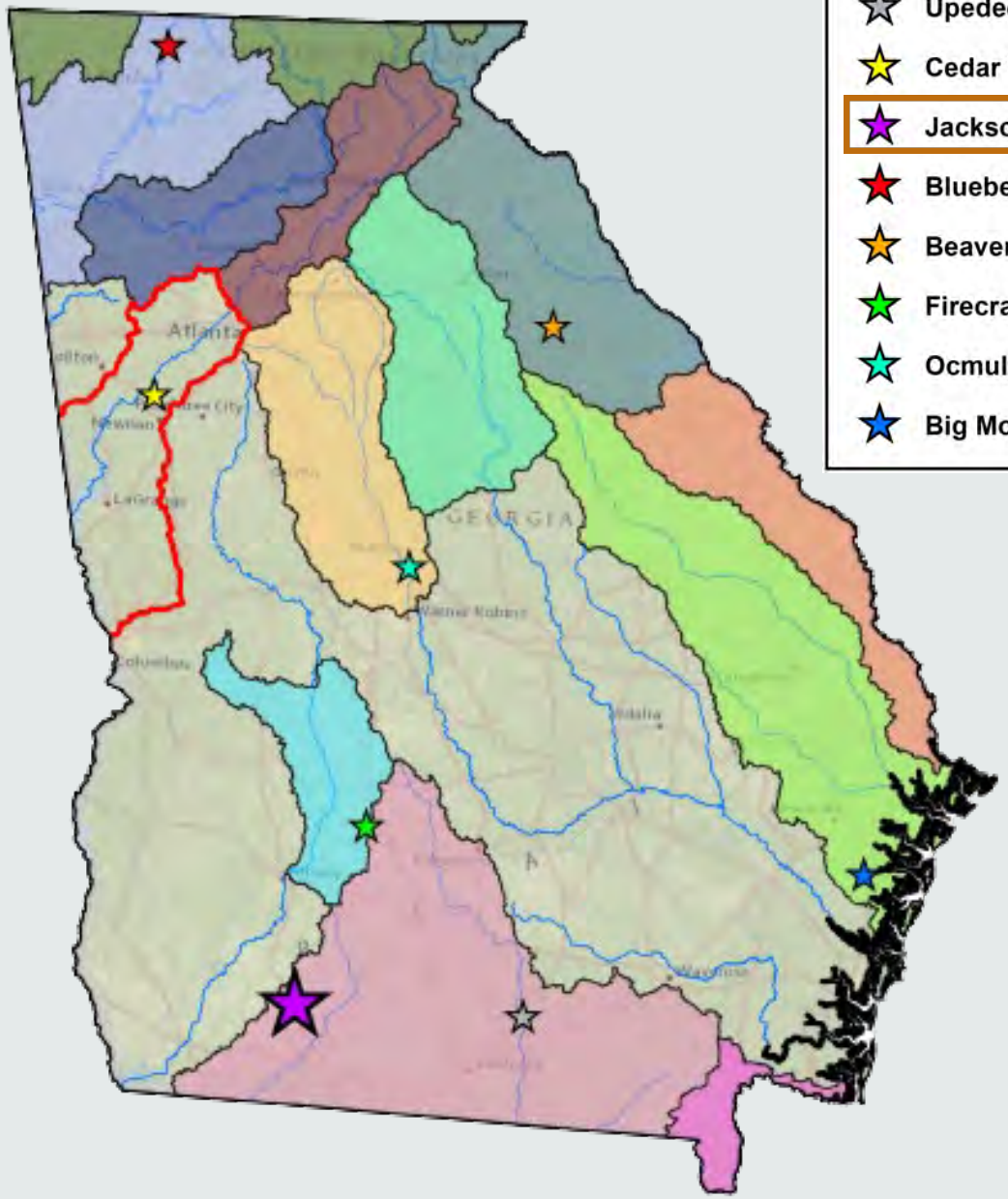
Middle Chattahoochee Wetland
Corblu
64 legacy wetland credits
Year 5 monitoring complete
Eligible for closeout



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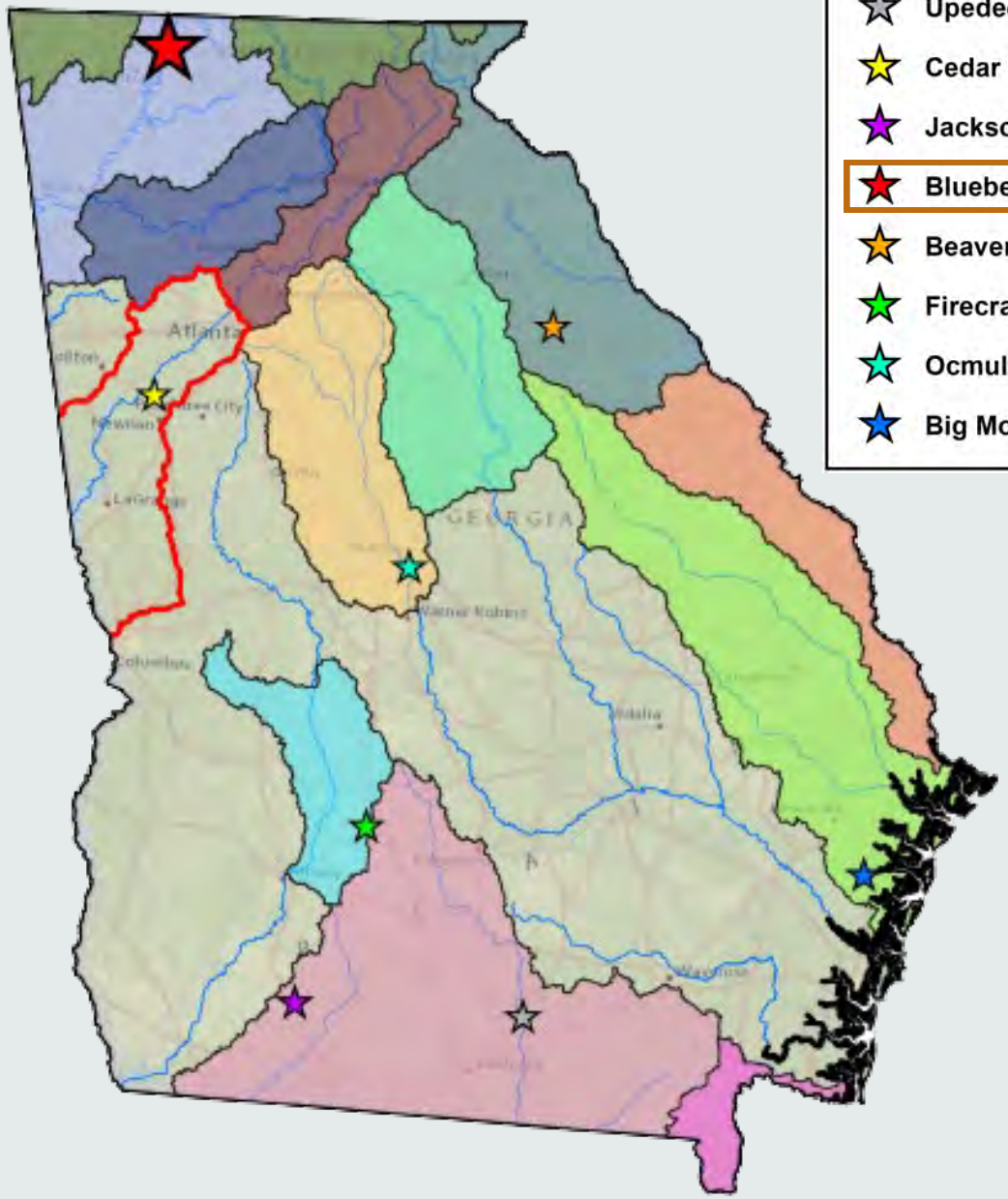
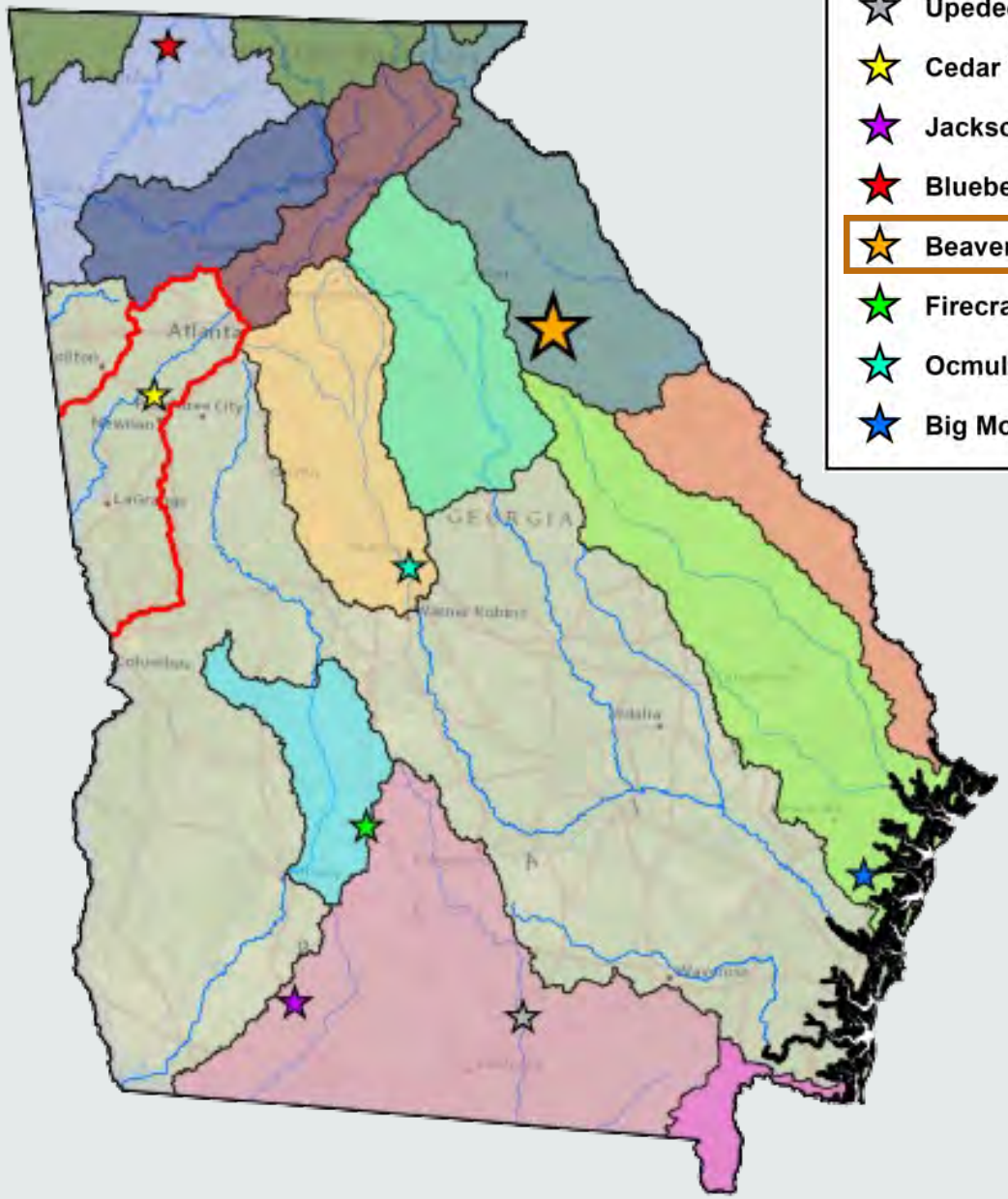
- Jackson Farms (S): Year 3 Montioring Complete
- Blueberry Farms (W): Second Milestone Met
- Beaverdam Creek (W): First Milestone Met
- Firecracker Creek (S): Working on MBI Approval
- Ocmulgee Mounds (W): MBI Submitted for Approval
- Big Mortar Swamp (W): Selected in Fall 2022

Withlacoochee Stream
RES
113,000 legacy stream credits
Year 3 monitoring complete



Upper Coosa* Wetlands
Corblu
16 2018 wetland credits
Second milestone met in 2022



GALT-ILF Projects

- Upedee Creek (S): Year 6 Monitoring Complete
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- Jackson Farms (S): Year 3 Montioring Complete
- Blueberry Farms (W): Second Milestone Met
- Beaverdam Creek (W): First Milestone Met
- Firecracker Creek (S): Working on MBI Approval
- Ocmulgee Mounds (W): MBI Submitted for Approval
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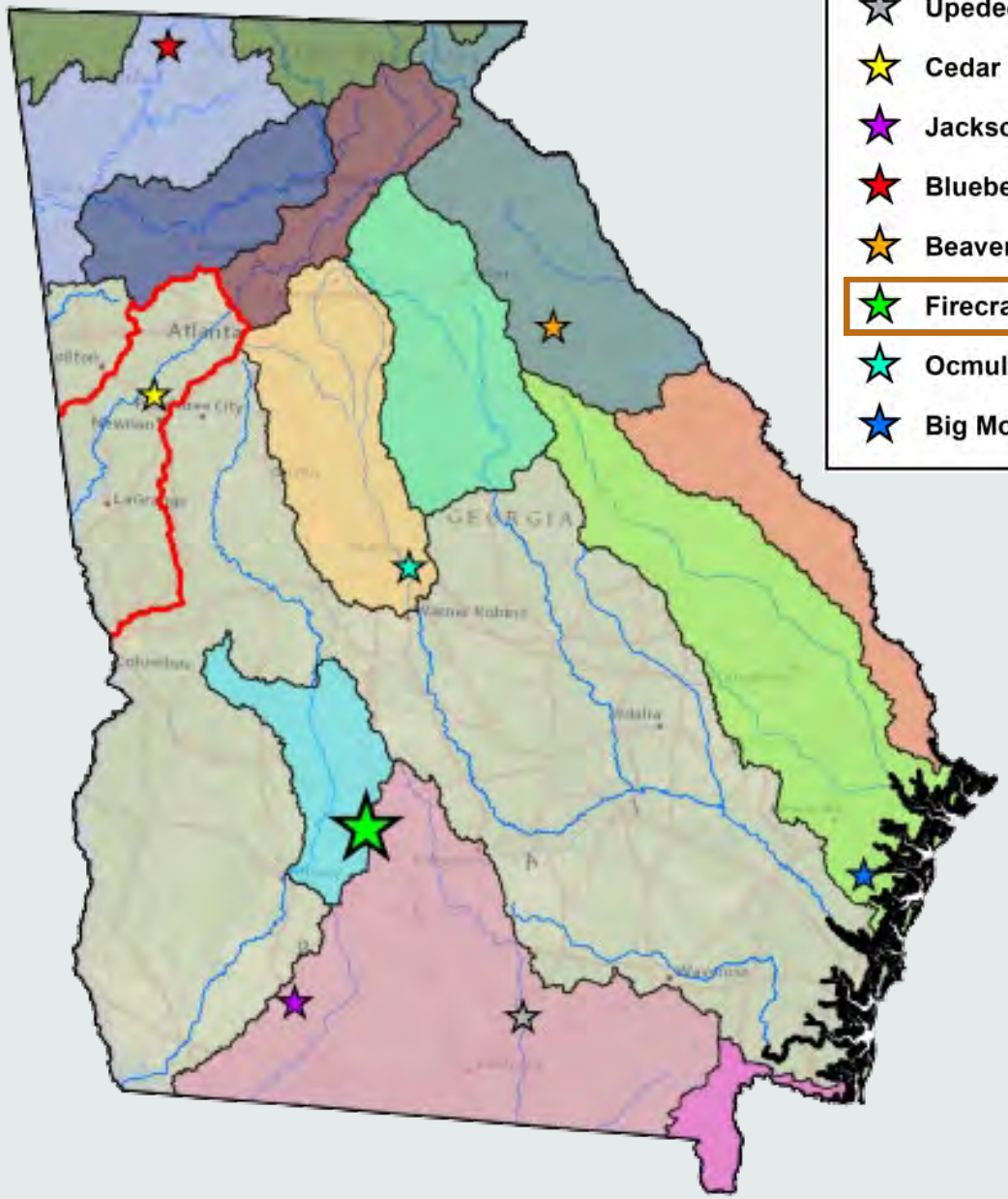
Upper Savannah* Wetland
Corblu
6.6 2018 wetland credits
First milestone met in 2022



GALT-ILF Projects

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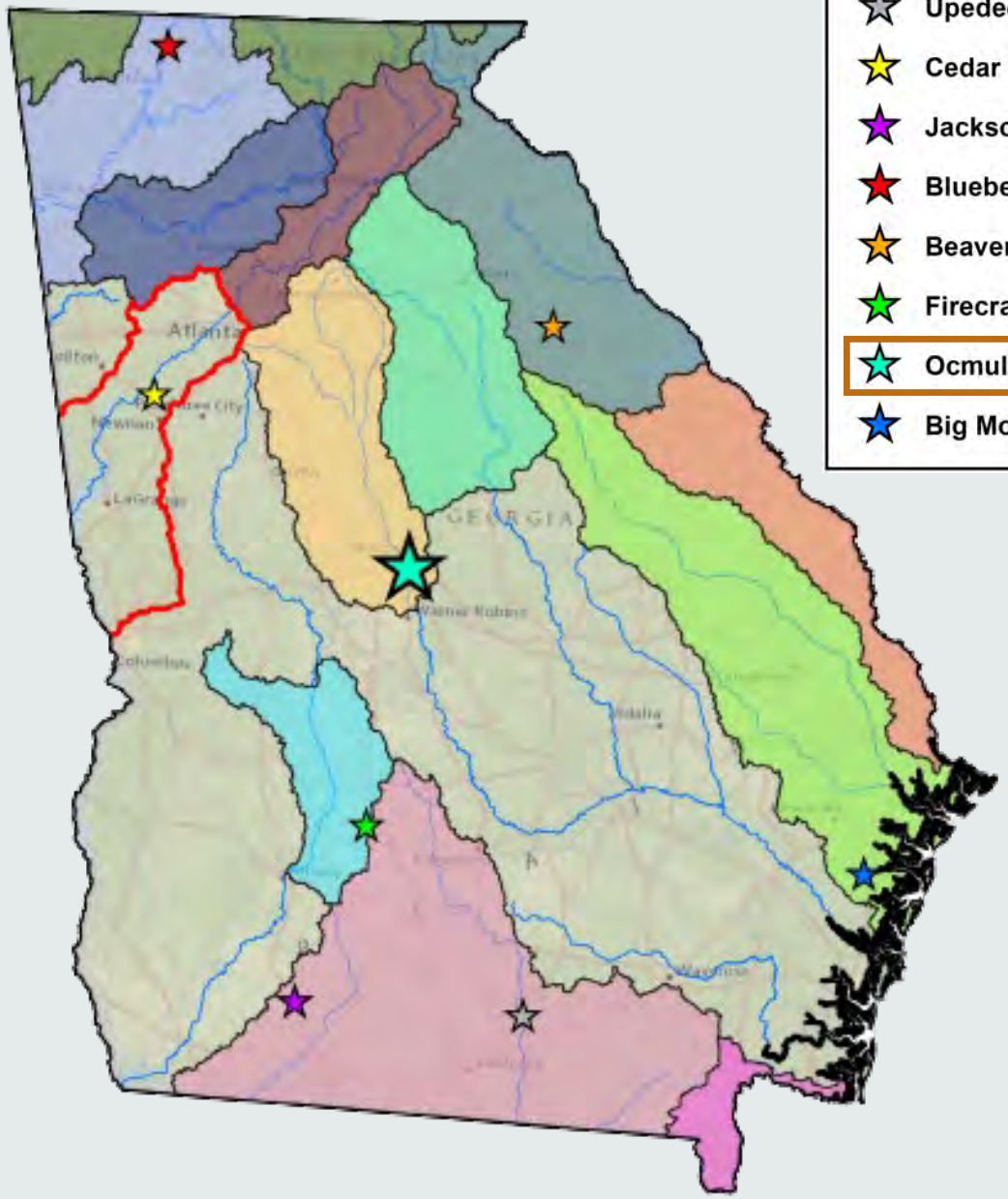
- Ocmulgee Mounds (W): MBI Submitted for Approval
- Big Mortar Swamp (W): Selected in Fall 2022

Lower Flint Stream Project
Wildlands Engineering
995 2018 Stream Credits
Draft Mitigation Plan submitted



GALT-ILF Projects

- Upedee Creek (S): Year 6 Monitoring Complete
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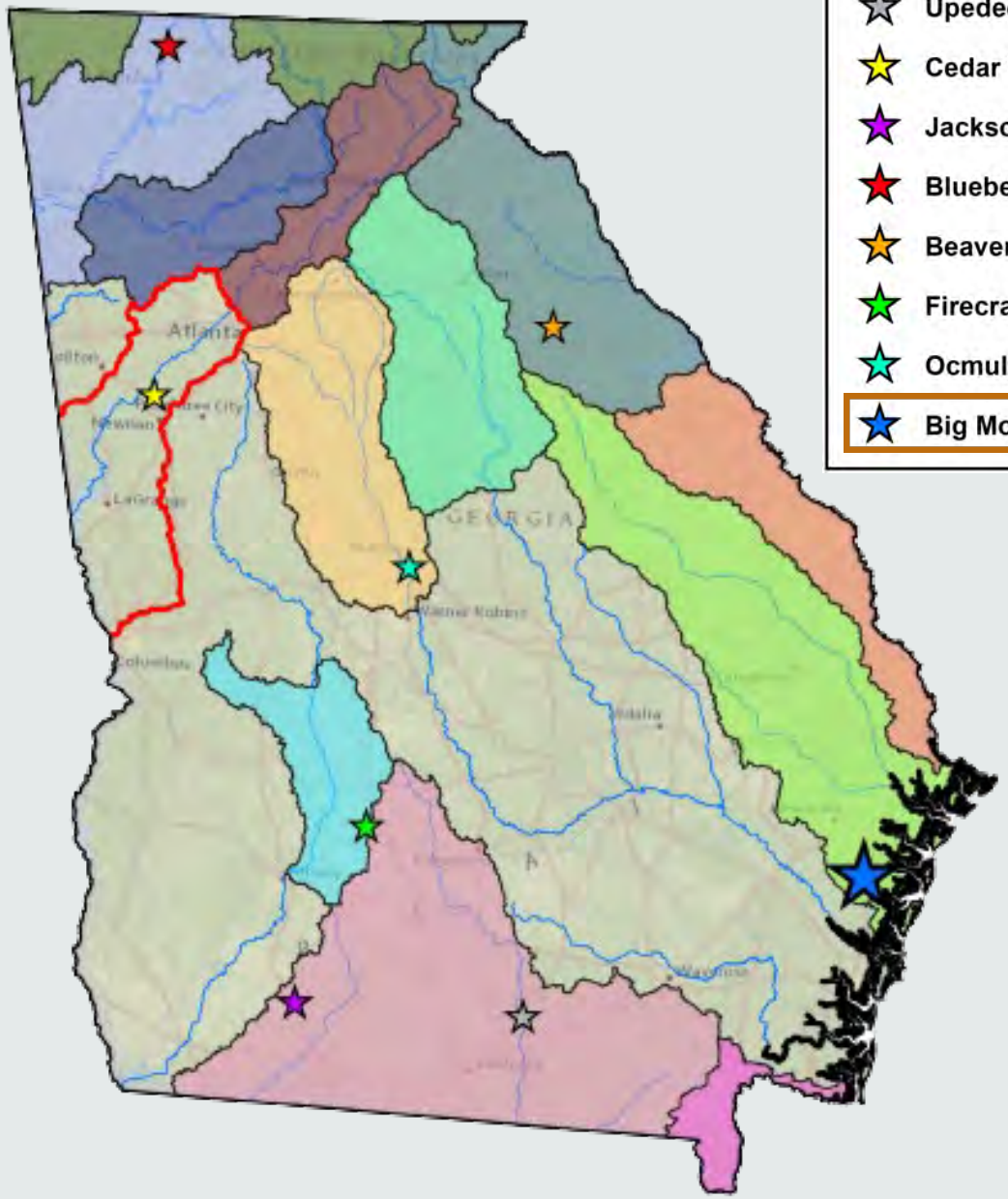
- Firecracker Creek (S): Working on MBI Approval
- Ocmulgee Mounds (W): MBI Submitted for Approval
- Big Mortar Swamp (W): Selected in Fall 2022

Upper Ocmulgee* Wetlands
Water and Land Solutions
6.8 2018 wetland Credits
Final Mitigation Plan submitted for approval



GALT-ILF Projects

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- Ocmulgee Mounds (W): MBI Submitted for Approval
- Big Mortar Swamp (W): Selected in Fall 2022

Lower Ogeechee Wetlands
Usher 412 Ministries
198 wetland credits
Early stages (Late 2022 selection)

Pricing

"All Cost Accounting"

Maintains ability to purchase credits

Forecasting for 3 years out

Reliant on available up-to-date sales data

GALT prefers price to reflect cost of project implementation

Biannual updates

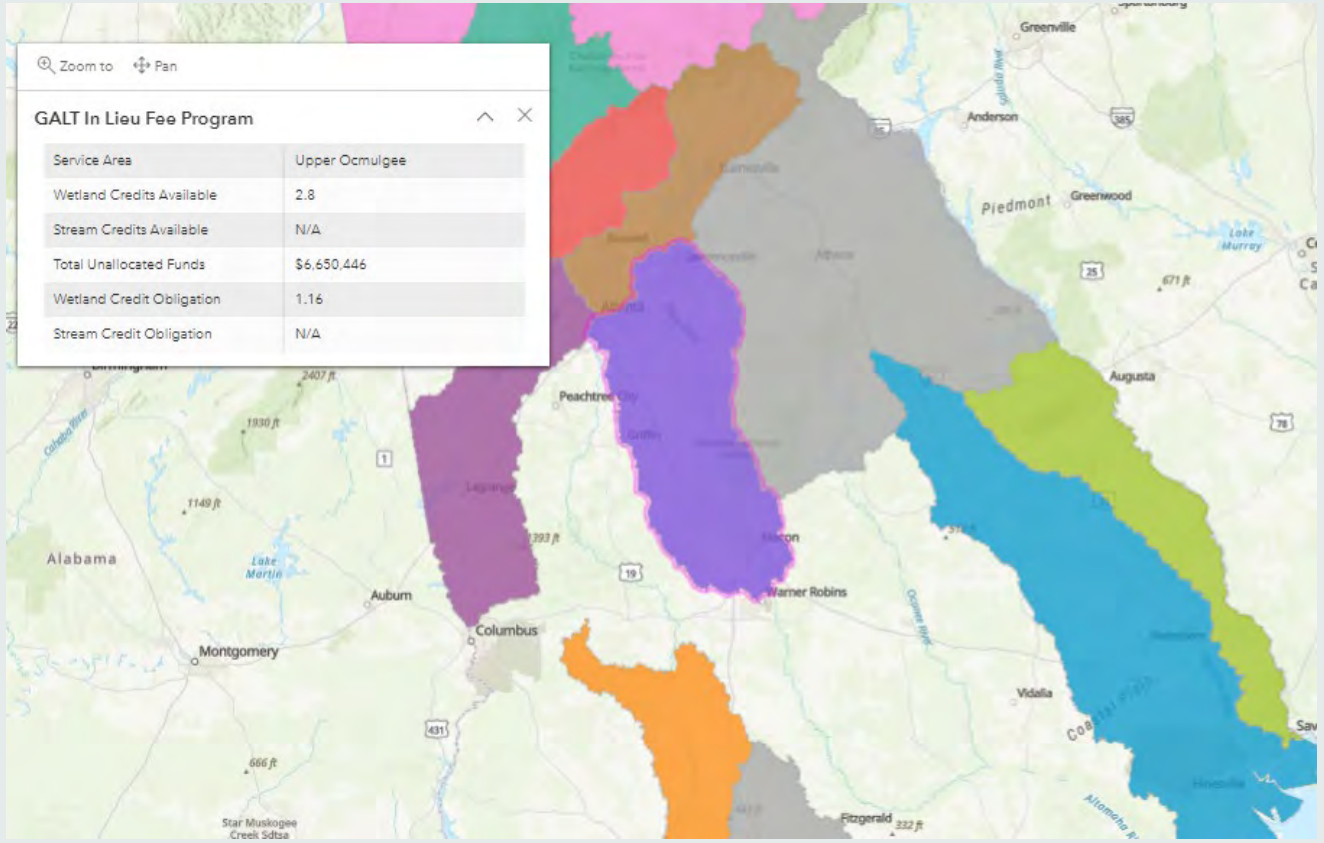
"Credit Price"

"Service Area Price"

Service Area	Legacy Price	2018 Price
Etowah Wetland	$ 108,000.00	
Lower Flint Stream	$ 48.00	$ 625.00
Lower Ogeechee Stream		$ 1,500.00
Lower Ogeechee Wetland		$ 500,000.00
Lower Savannah Stream		$ 1,500.00
Lower Savannah Wetland		$ 650,000.00
Middle Chattahoochee Stream		$ 1,800.00
Satilla Stream	$ 25.00	
Tennessee Stream	$ 108.00	$ 1,400.00
Tennessee Wetland	$ 100,000.00	$ 800,000.00
Upper Chattahoochee Stream		$ 1,800.00
Upper Chattahoochee Wetland	$ 108,000.00	
Upper Coosa Wetland	$ 80,000.00	
Upper Ocmulgee Wetland	$ 84,000.00	$ 730,000.00
Upper Oconee Stream		$ 1,800.00
Upper Oconee Wetland		$ 800,000.00
Upper Savannah Stream		$ 1,800.00
Upper Savannah Wetland	$ 88,000.00	
Withlacoochee Stream		$ 1,800.00

Upcoming

- Hiring new staff member
- Revision of pricing, price structure and price calculations
- Ribits update
- Updated website with credit availability, obligations and funding
- Changes to RFP schedules

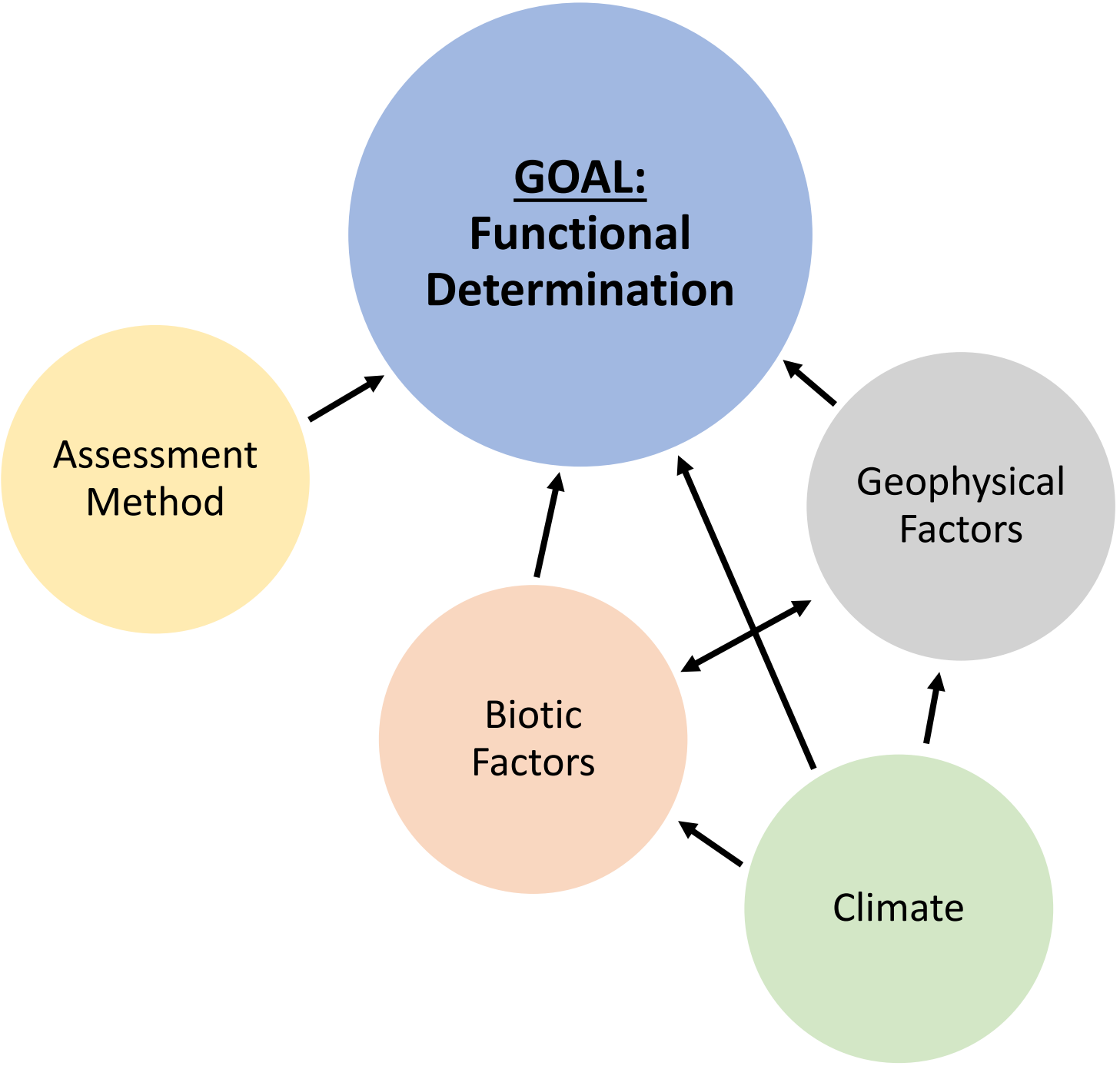


Thank You

Variability and Philosophical Wandering

GERA 2023 Annual Membership Meeting

February 16, 2023



Climate

- Precipitation
- Temperature
- Long- vs short-term conditions
- Climatic normals

Geophysical Factors

- Soils
- Topography / Geomorphic setting
- Hydrologic source(s)
- Land use
- Chemical
- Disturbance regime and type

Biotic Factors

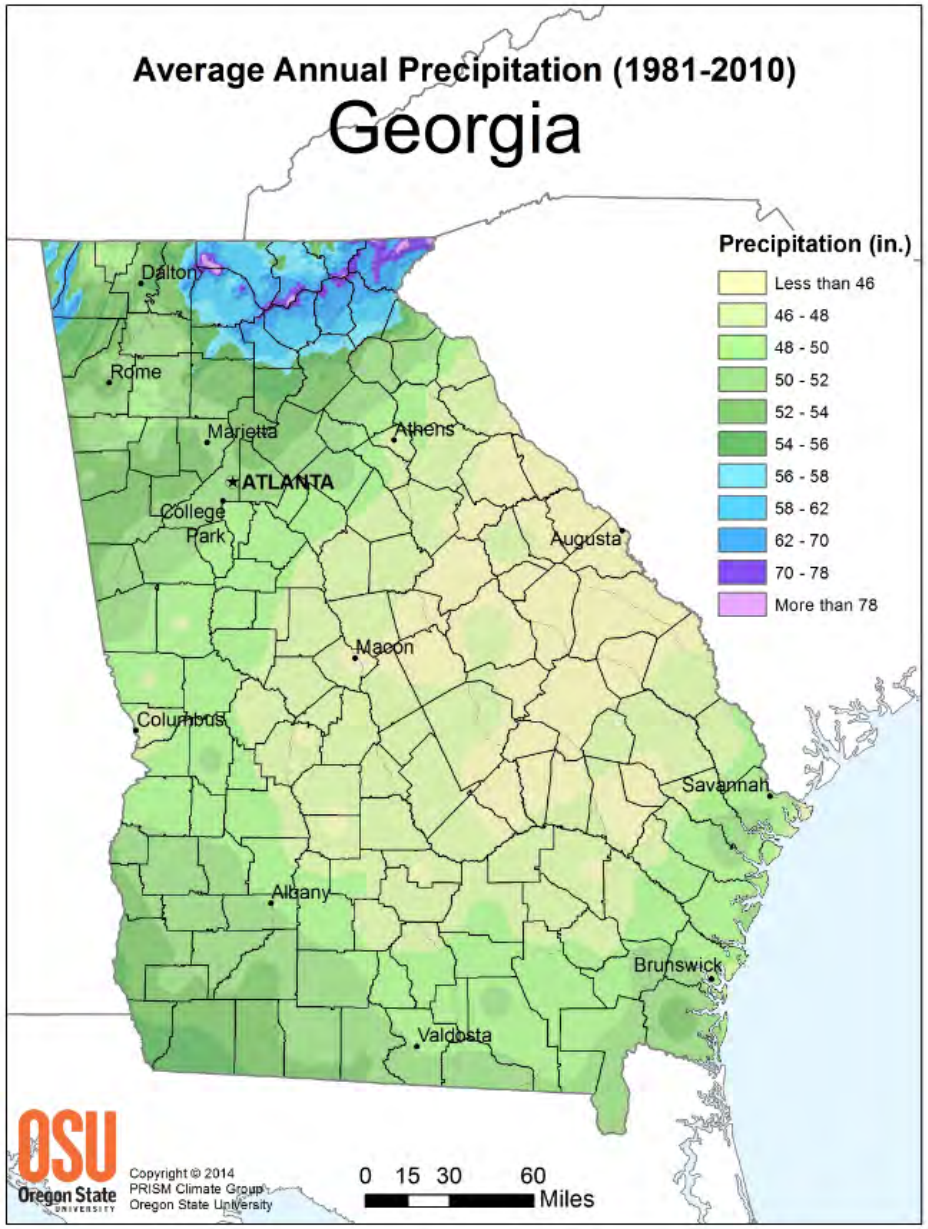
- Vegetative community type(s)
- Evapotranspiration
- Biological processes
- Land use

Assessment Method

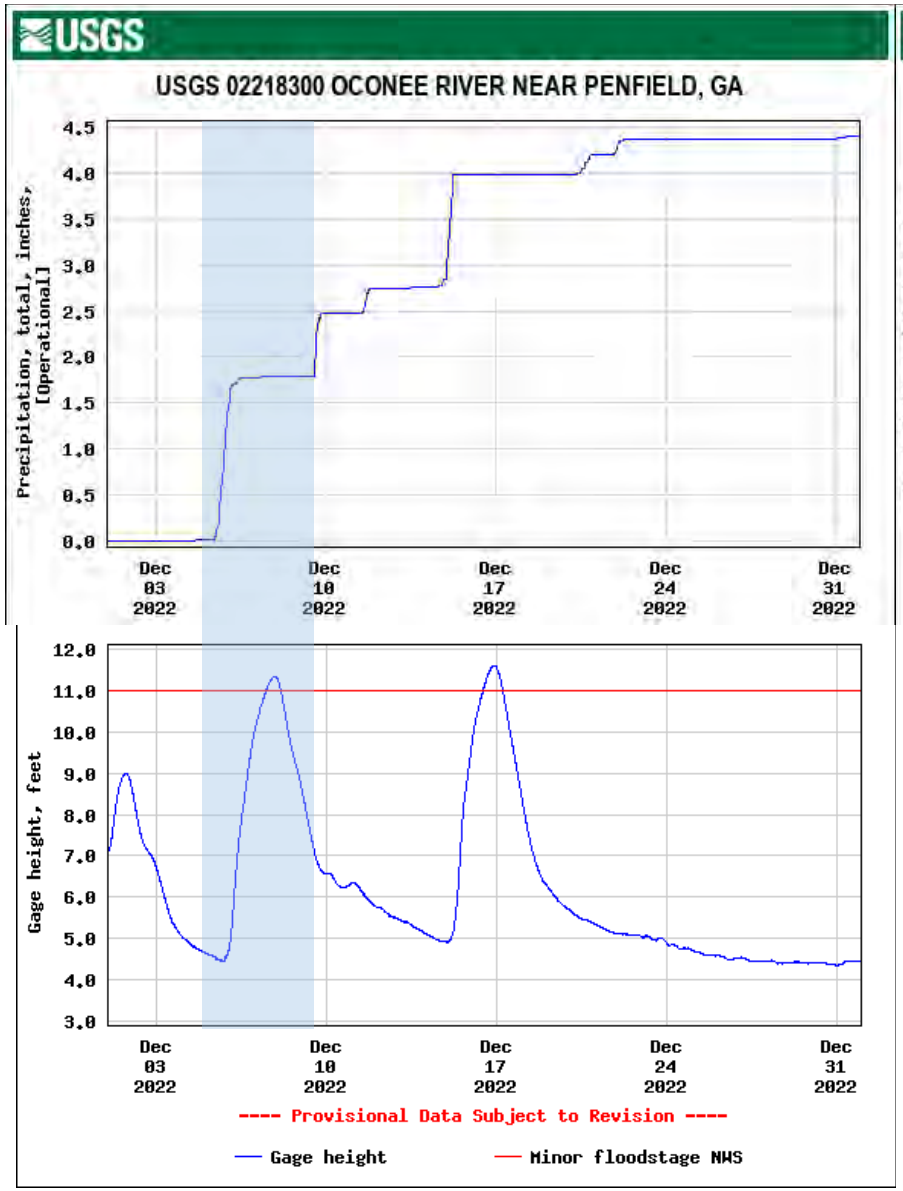
- Quantitative vs qualitative
- Indices of biotic integrity
- Ecological statistics

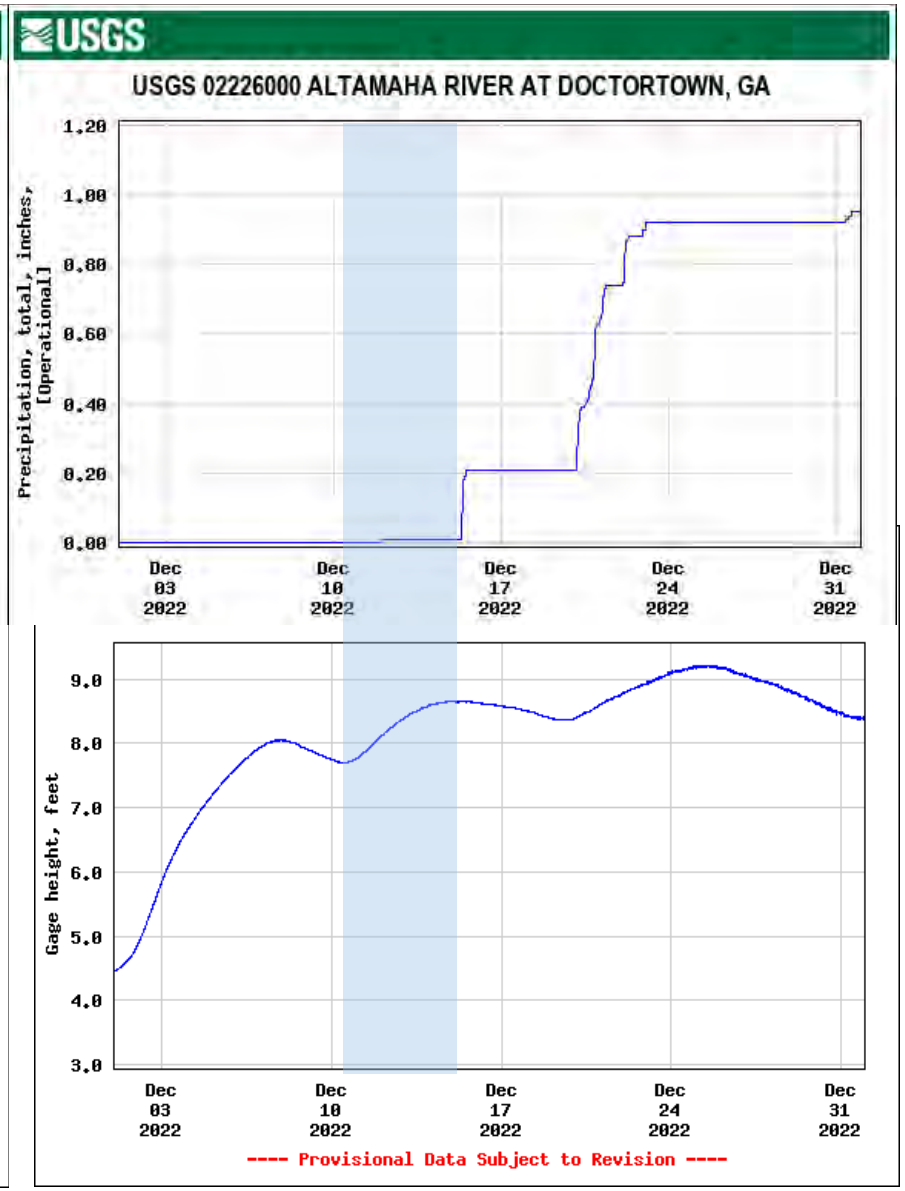
Climate

- Precipitation
  - Seasonal distribution patterns
  - Temporal variability
  - Intensity
  - Antecedent conditions
  - Geophysical and Biotic relationships
    - Soils - Infiltration / recharge / runoff
    - Geomorphic setting
    - Land use
    - Watershed position
    - Vegetation – evapotranspiration
- Temperature
  - Growing season
  - Evaporation and evapotranspiration
  - Geophysical and Biotic relationships
    - Vegetation – evapotranspiration
    - Biogeochemical processes

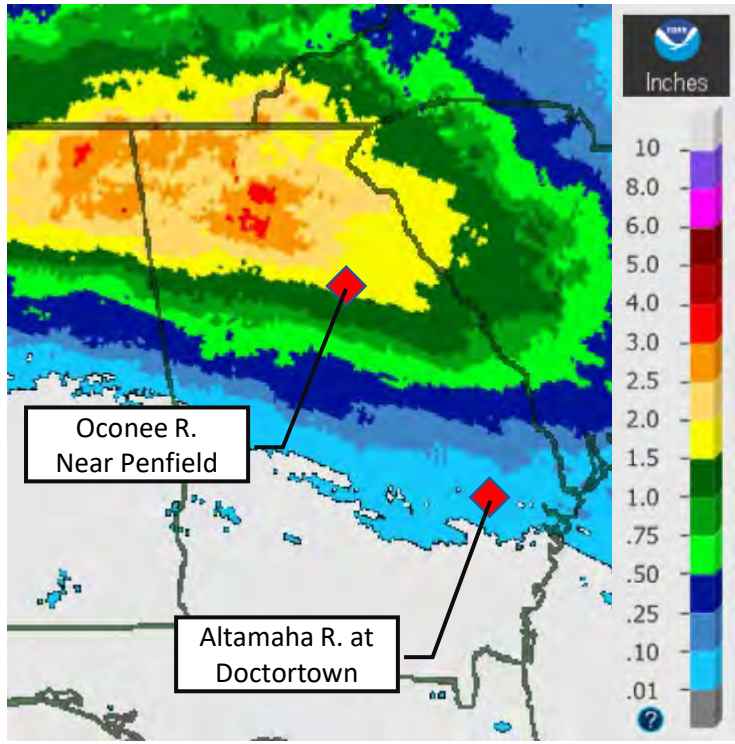


Climate – Geographic variability and distribution





December 6, 2022



Climate - Determining Normal

- Are normal conditions present?
  - USDA WETS Tables
  - USACE Antecedent Precipitation Tool
  - NRCS methods
  - USGS gage analysis

Table 1. Upper and Lower Percentile Thresholds for Middle Ranges of Precipitation Models.

Model	Lower Threshold	Upper Threshold
USDA National Water and Climate Center WETS Tables	30th percentile	70th percentile
National Climate Data Center Palmer drought indices	28th percentile	72nd percentile
National Drought Mitigation Center Standardized Precipitation Index	16th percentile[1]	84th percentile[1]
US Geological Survey Stream Gauge analyses	25th percentile	74th percentile

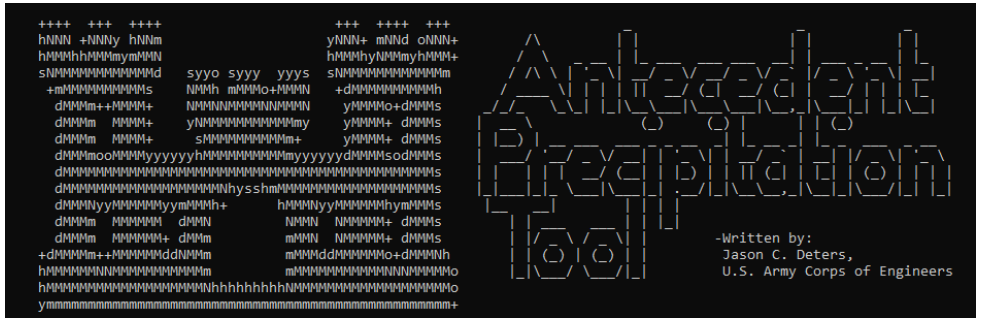
[1] The values of 26 and 74 found at the National Drought Center Web site are wrong (M. Svoboda, NDMC, personal communication, July 1999).

Sprecher and Warne, 2000

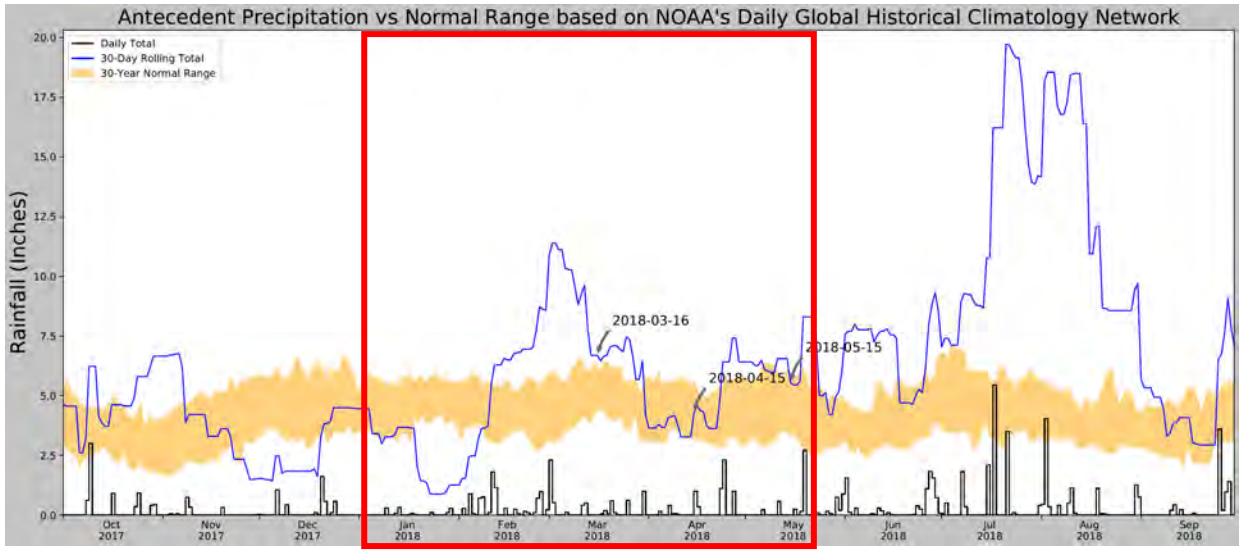
WETS Station: SAVANNAH/ HILTON HEAD INTL AIRPORT, GA

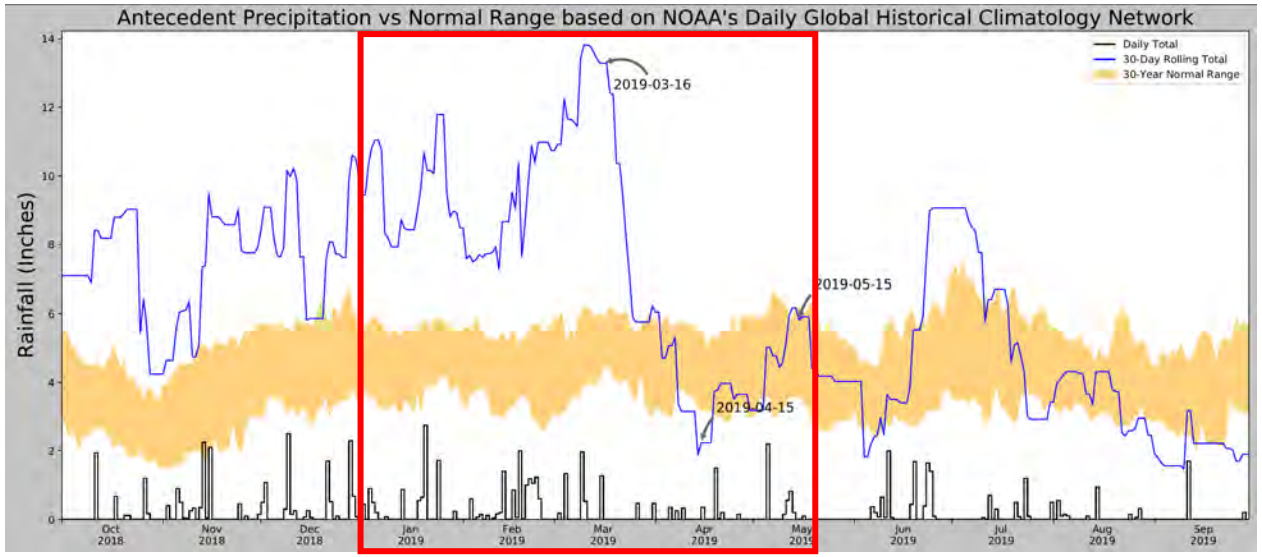
Requested years: 1981 - 2010

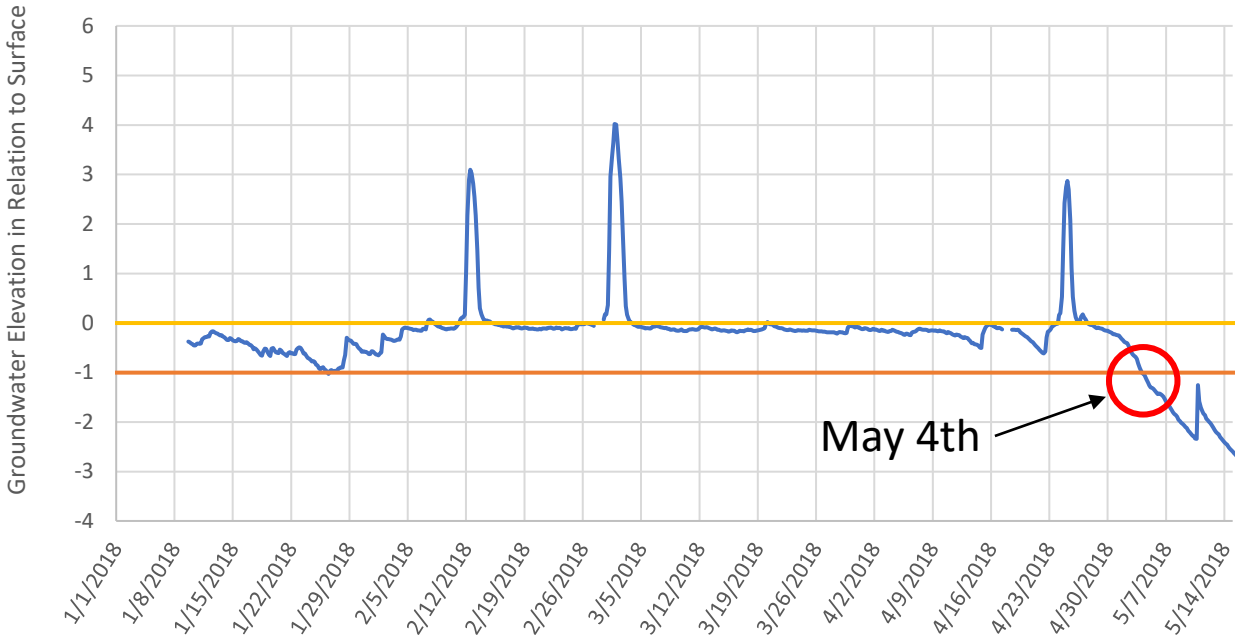
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than
Jan	60.4	39.0	49.7	3.69	2.01	4.50
Feb	64.3	42.0	53.2	2.79	1.71	3.38
Mar	70.9	48.0	59.4	3.73	1.90	4.56
Apr	77.6	53.9	65.8	3.07	1.51	3.75
May	84.6	62.4	73.5	2.98	1.70	3.63
Jun	89.9	70.1	80.0	5.94	3.85	7.15
Jul	92.4	73.1	82.8	5.59	3.93	6.64
Aug	90.6	72.7	81.7	6.56	4.64	7.77
Sep	86.0	68.1	77.0	4.58	2.45	5.59
Oct	78.4	57.8	68.1	3.69	1.62	4.40
Nov	70.6	48.2	59.4	2.37	1.03	2.89
Dec	62.5	41.1	51.8	2.95	1.52	3.60
Annual:					42.78	52.27
Average	77.4	56.4	66.9	-	-	-
Total	-	-	-	47.94		

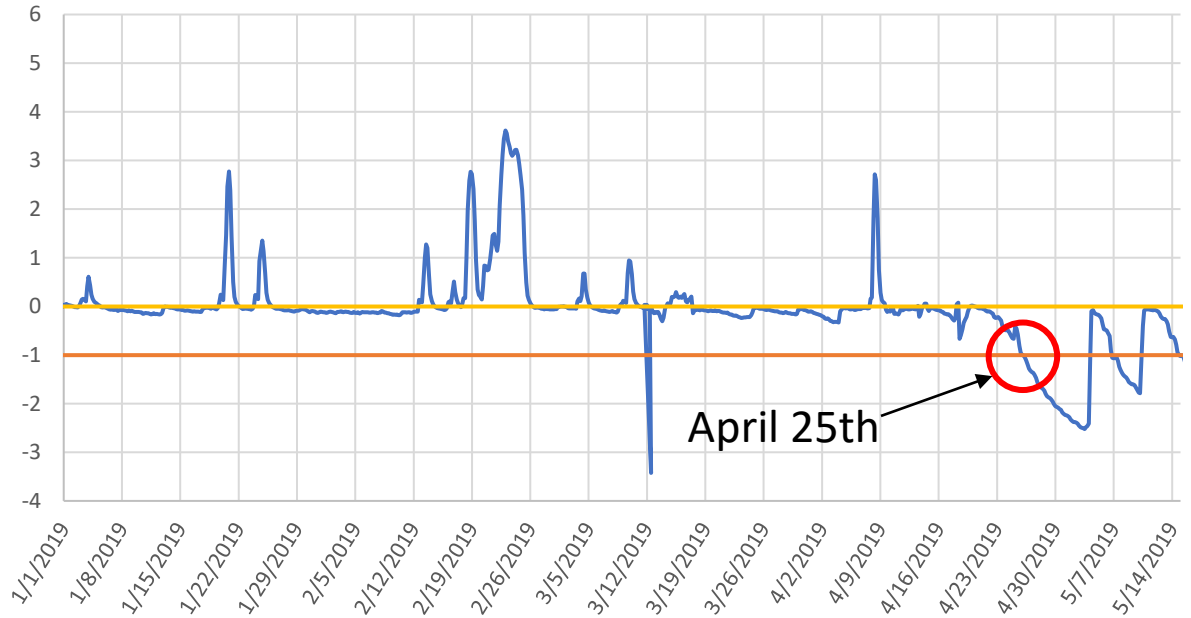


Climate – "Normal" Conditions Variability and Wetland Hydrology



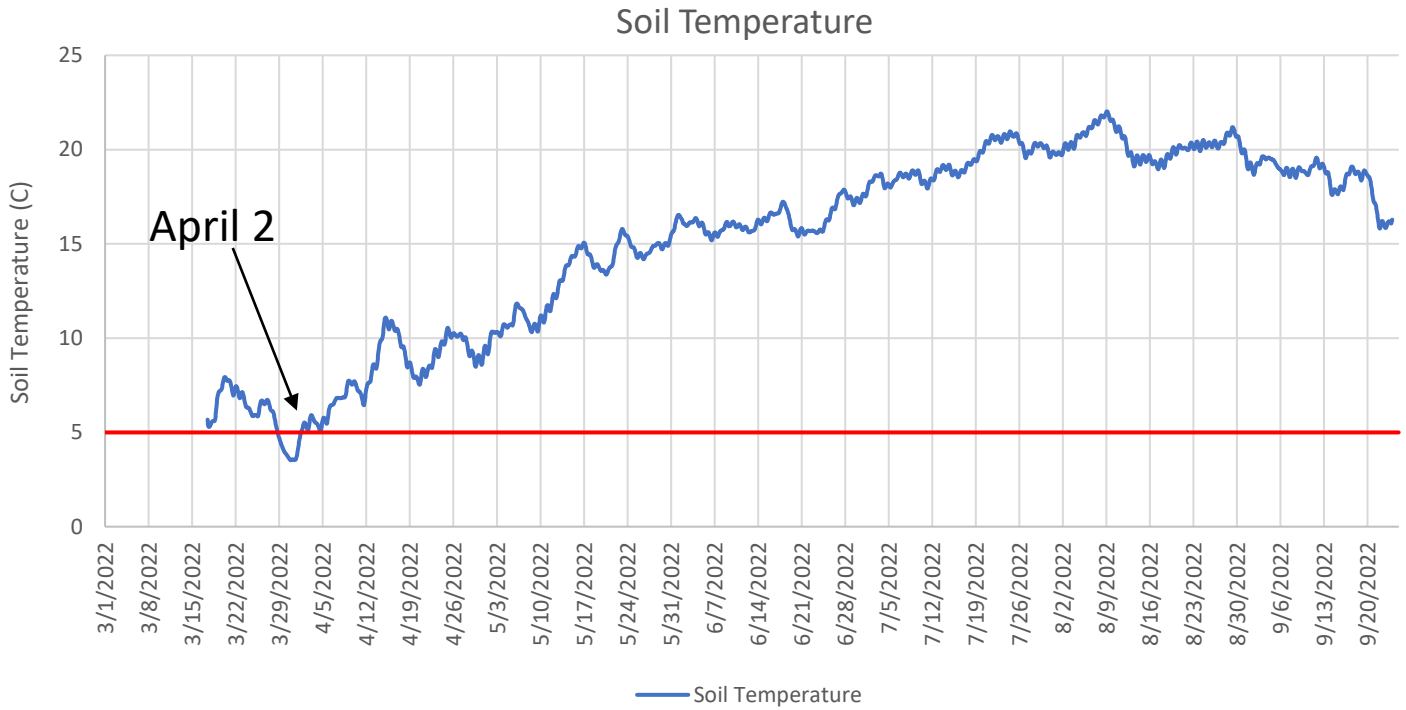






Climate – Growing Season

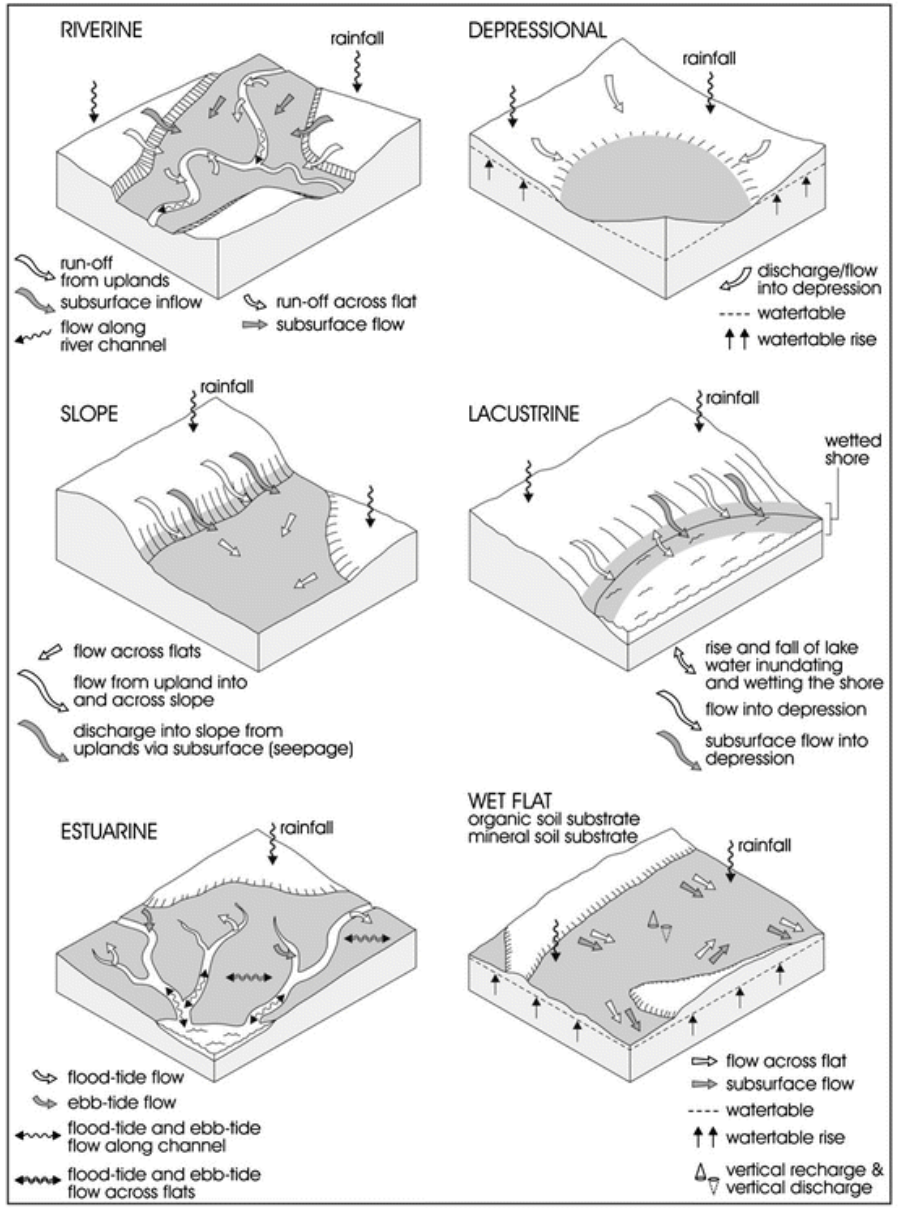
The growing season has begun in spring, and is still in progress, when soil temperature measured at the 12-in. (30-cm) depth is 41 °F (5 °C) or higher.



GROWING SEASON DATES			
Years with missing data:	24 deg = 1	28 deg = 1	32 deg = 1
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 29	28 deg = 29	32 deg = 29
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	4/3 to 11/9: 220 days	4/18 to 10/26: 191 days	5/6 to 10/11: 158 days
70 percent *	3/31 to 11/13: 227 days	4/14 to 10/30: 199 days	5/2 to 10/15: 166 days

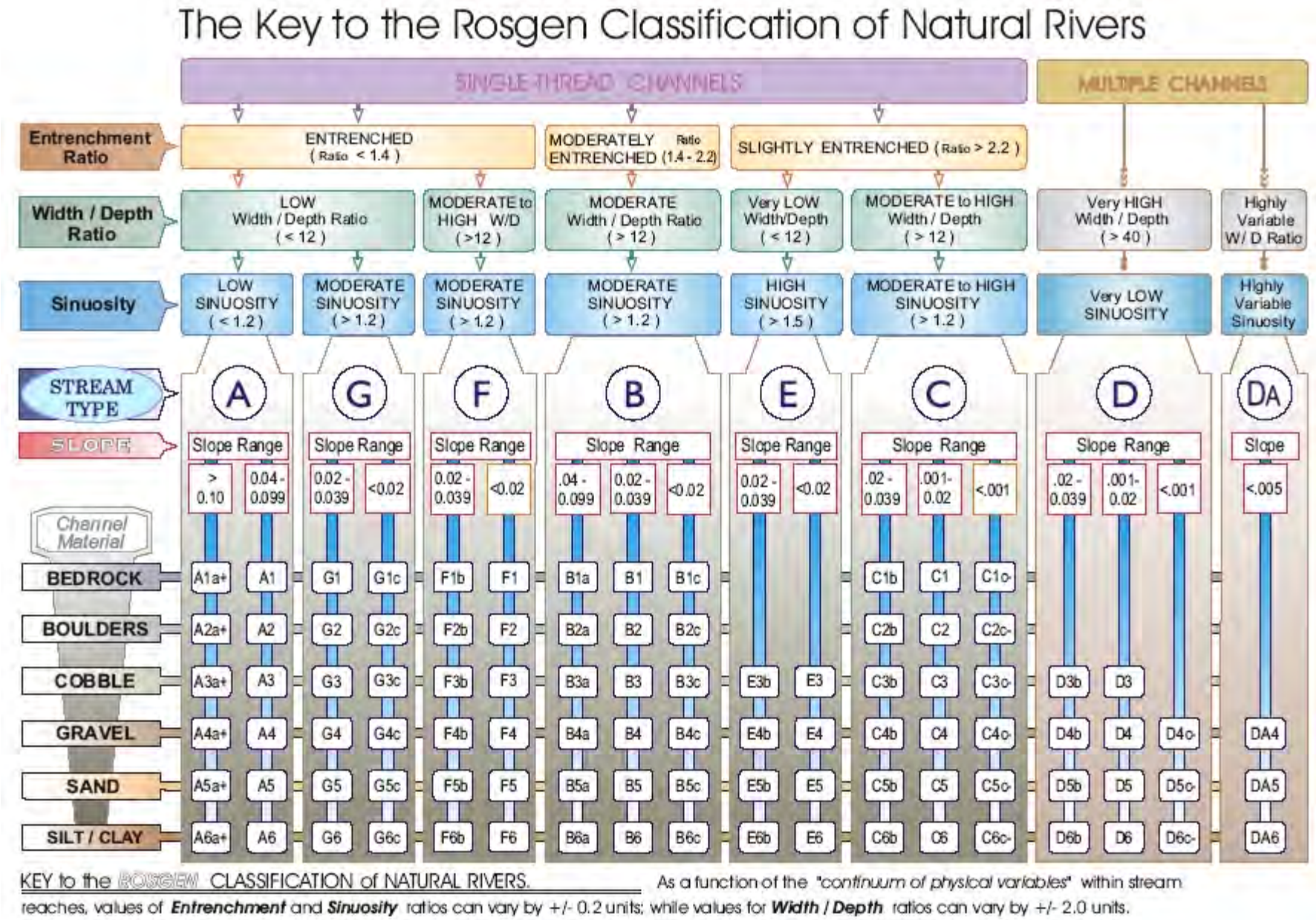
Geophysical

- Soils
  - Texture
  - Restrictive Horizons
  - Climatic and Biotic relationships
    - Organic matter accumulation / decomposition rates
    - Hydric soil development / maintenance
    - Evapotranspiration
- Topography / Geomorphology
  - Hydrology frequency, duration, and magnitude
  - Climatic and Biotic relationships
    - Biogeochemical processes
    - Vegetative communities
    - Depositional / Scour patterns
- Hydrologic Source(s)



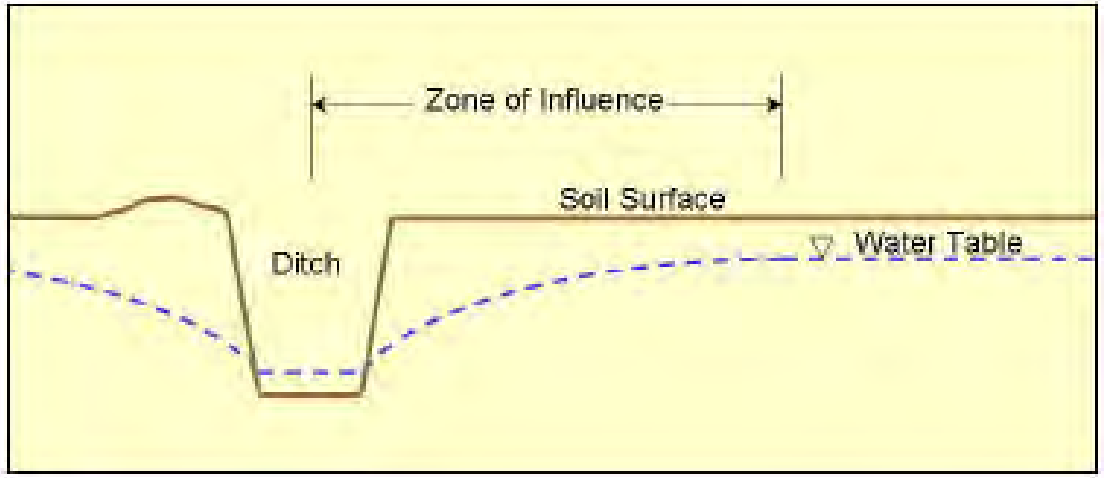
Semeniuk and Semeniuk, 2016

Geophysical – Stream Geomorphology



KEY to the ROSGEW CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

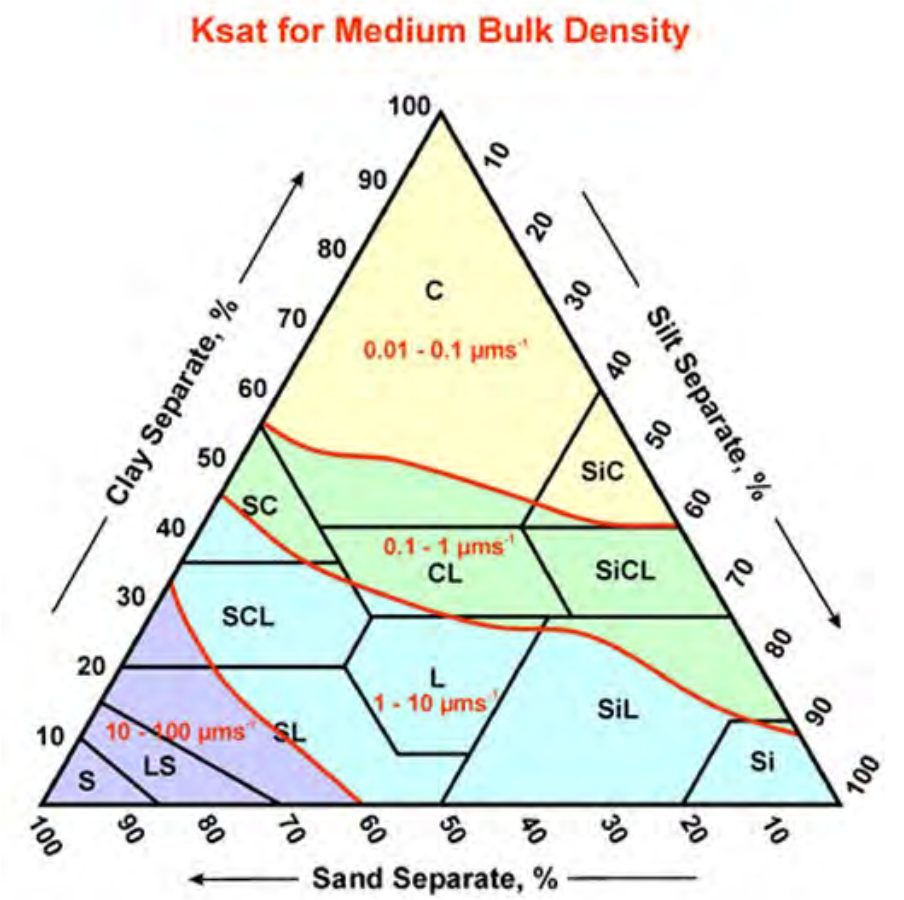
Geophysical – Soil Texture



USACE, 2012

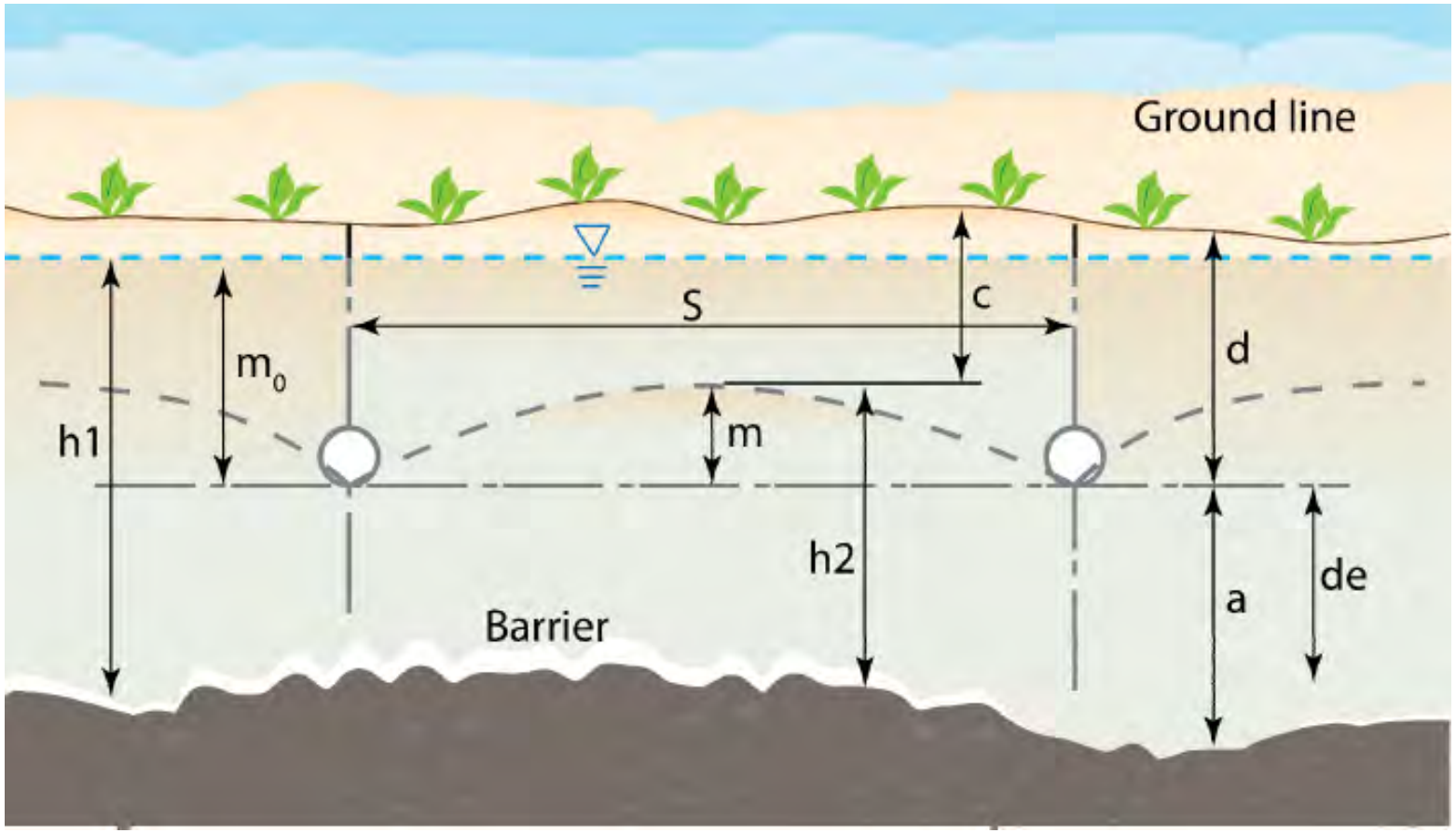
Soil Series	Saturated Hydraulic Conductivity (ft/day)	Lateral Effect of 3-ft deep ditch (ft)[1]
Leon sand	16.56	259
Bibb loam	10.97	221
Croatan muck	5.24	168
Wehadkee loam	4.77	163
Rains fine sandy loam	3.38	146
Pacolet sandy clay loam	2.53	134

[1] Lateral effect calculated using Van Schlifgaarde equation



NRCS, National Soil Survey Handbook

Geophysical – Understanding sub-surface hydrology

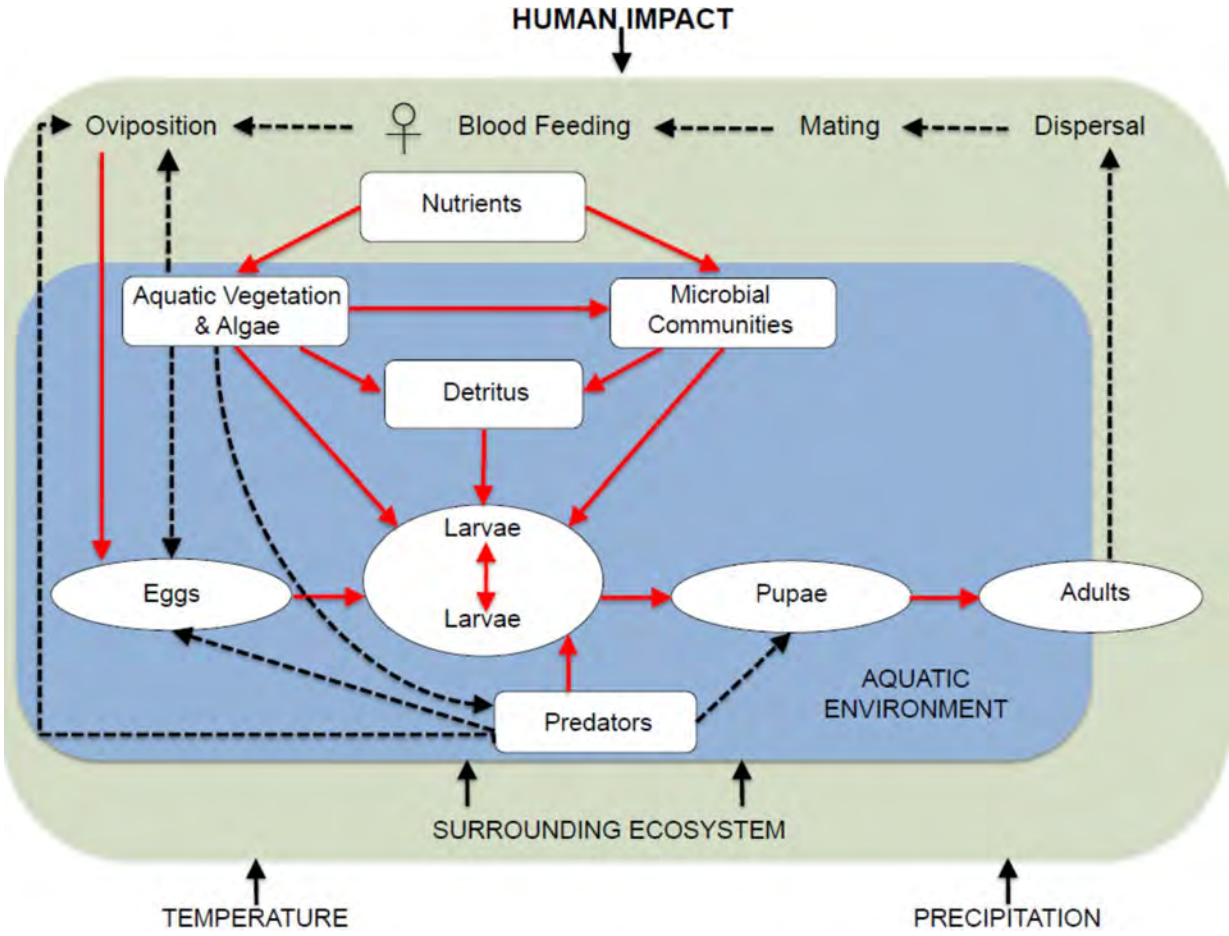


NDDRAIN, North Carolina

- Barrier depth (restrictive soil horizon)
- Drain depth from surface
- Drain height over barrier
- Surface storage
- Drain dimensions
- Drainable porosity
- Hydraulic conductivity above drain
- Hydraulic conductivity below drain
- Water table depth
- Hydraulic head
- Time

Biotic

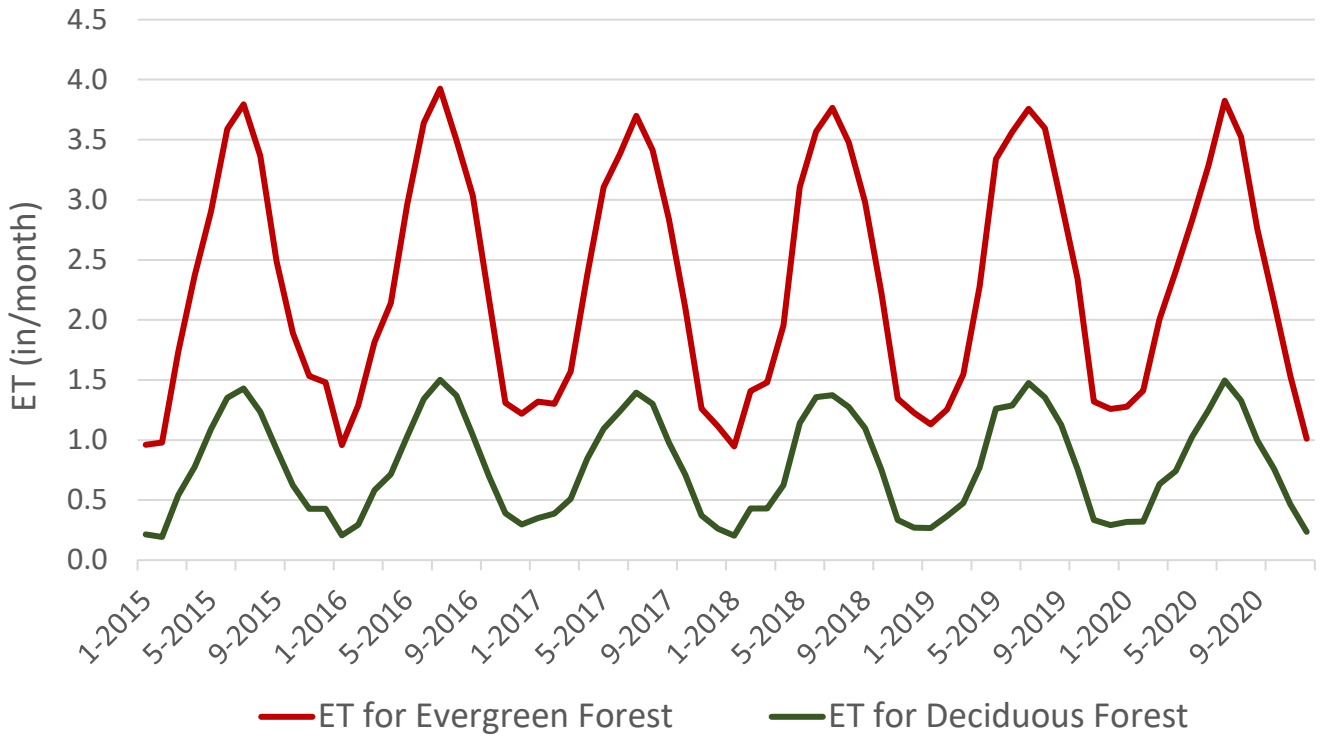
- Habitat
  - Community structure and strata
  - Habitat availability
  - Water balance
  - Climatic and Geophysical relationships
    - Rainfall – aquatic resource hydrologic dynamics
    - Geomorphic position (wetlands)
    - Geomorphic characteristics (streams)
    - Temperature and life cycle effects
    - Nutrient availability
    - Land use
- Community Dynamics
  - Life history traits
  - Life cycles
  - Climatic and Geophysical relationships
    - Temperature and life cycle effects
    - Climatic trends (short- and long-term)
    - Nutrient availability
    - Water quality

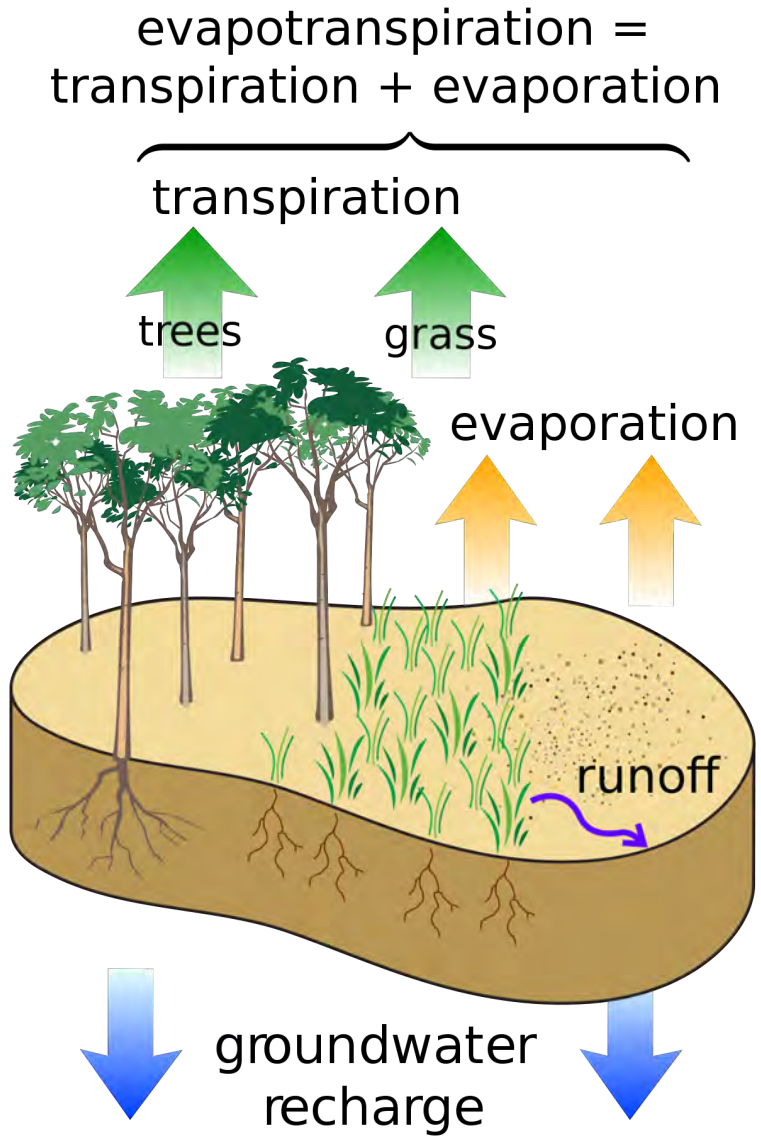


Rejmánková et al., 2013

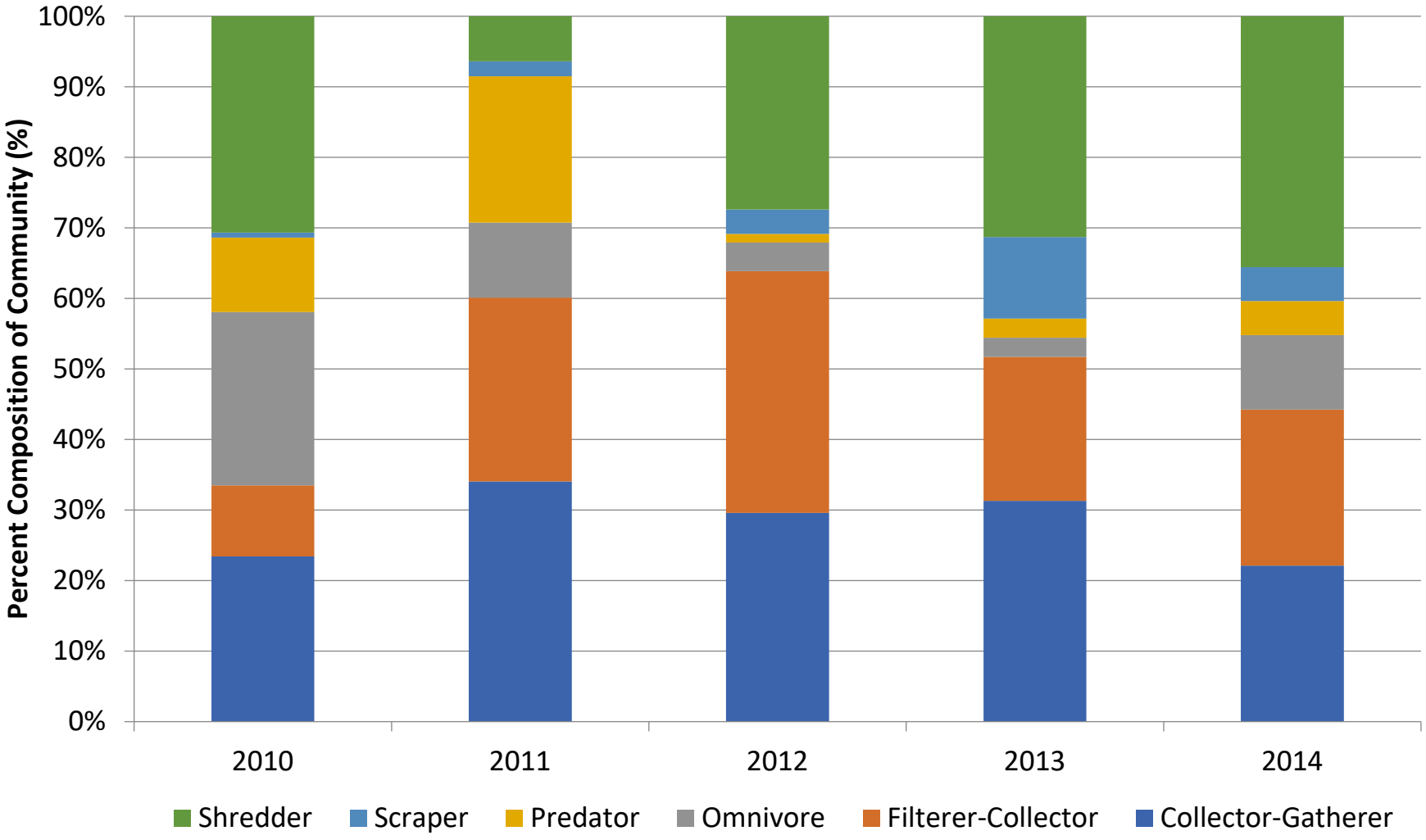
Biotic – Evapotranspiration and Community Structure

Forest Stand Type	Avg. ET (in/yr)	Precip. (in/yr)	Precip. lost to ET (%)
Pine	27.7	51.6	54%
Deciduous	9.5	51.6	18%





Biotic – Macroinvertebrates (temporal variability)



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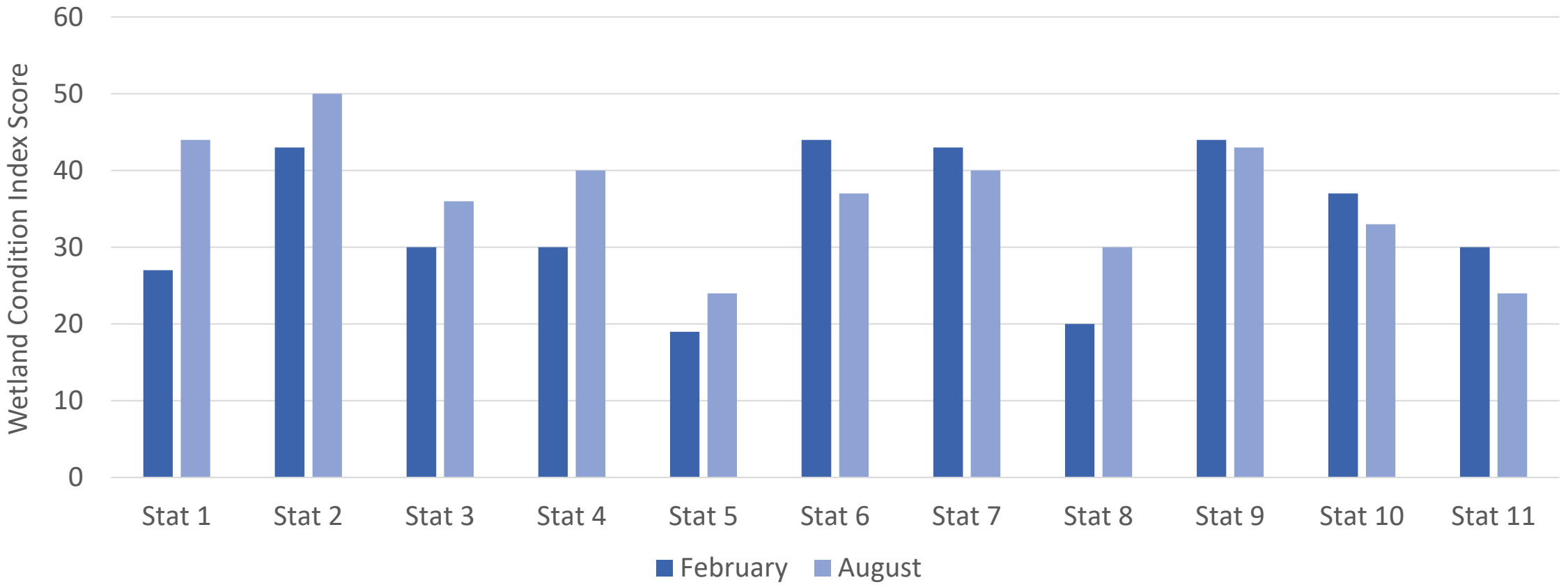
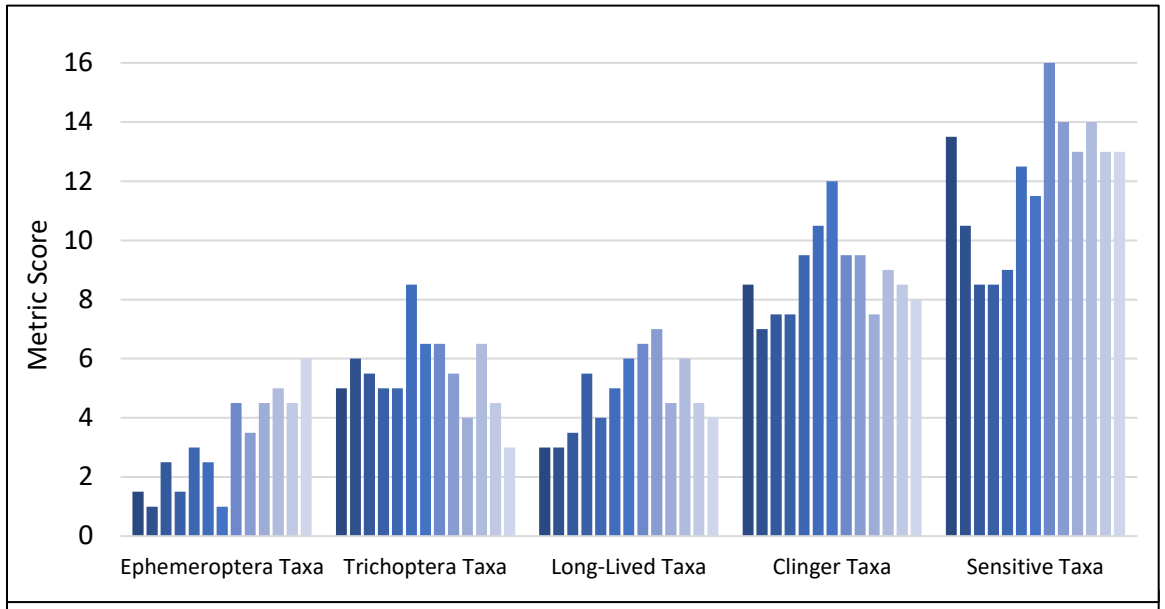
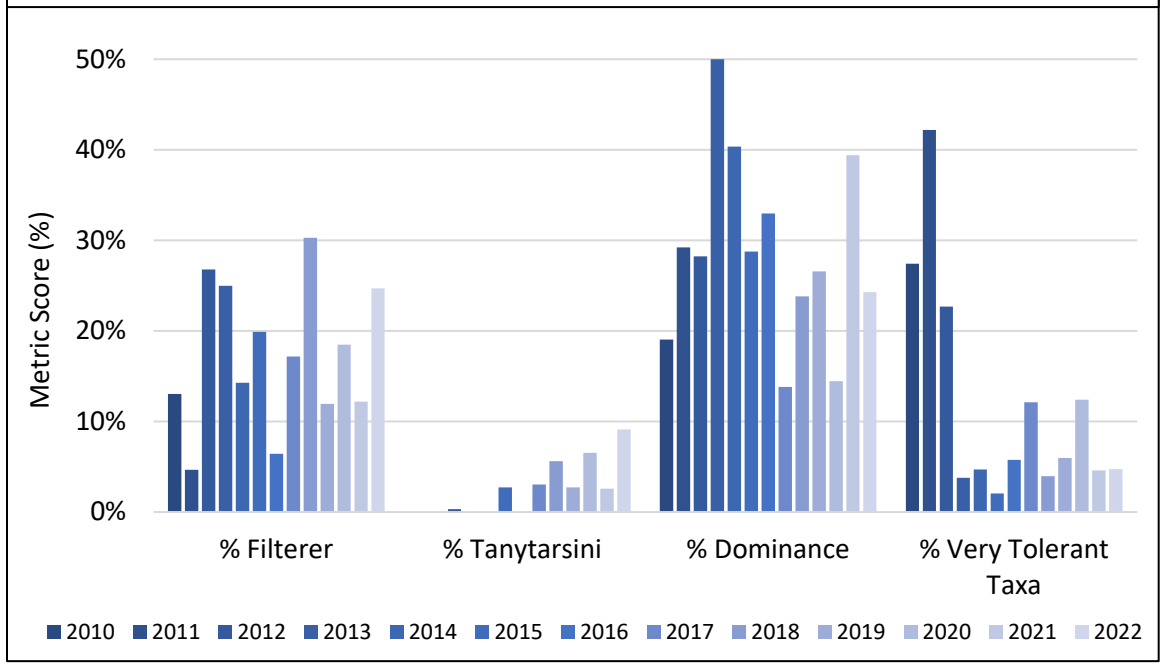
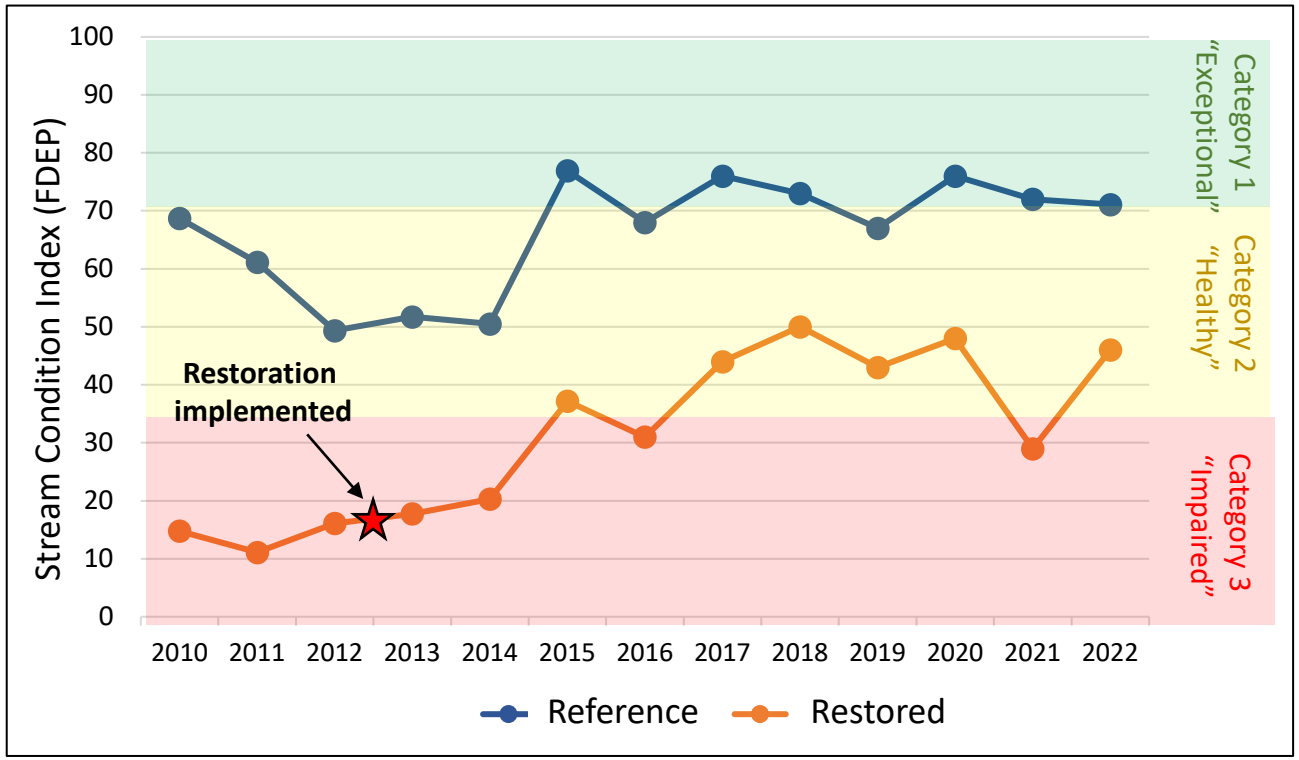


Biotic – Macroinvertebrates (Index of Biotic Integrity)







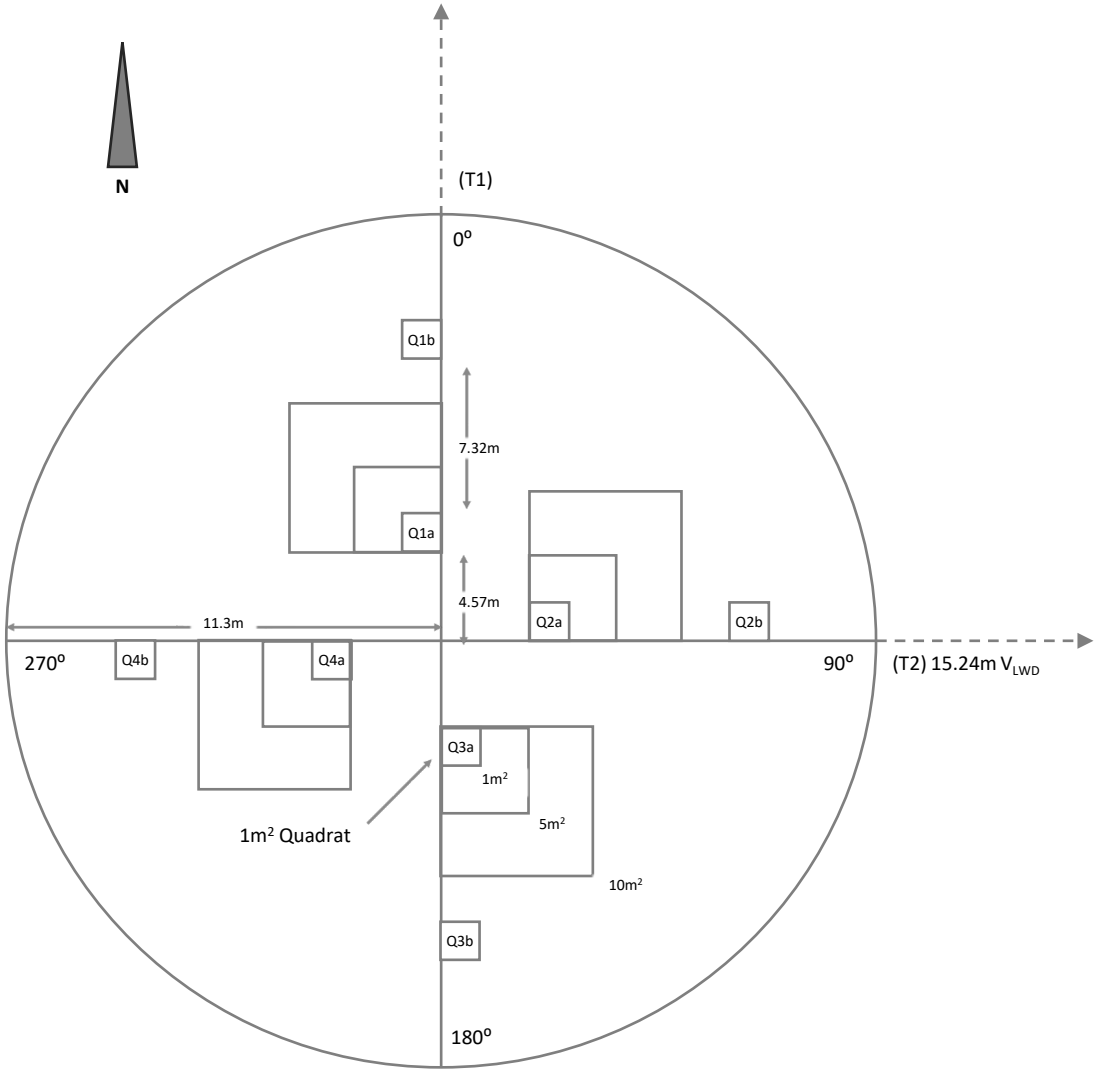
Biotic – Fish

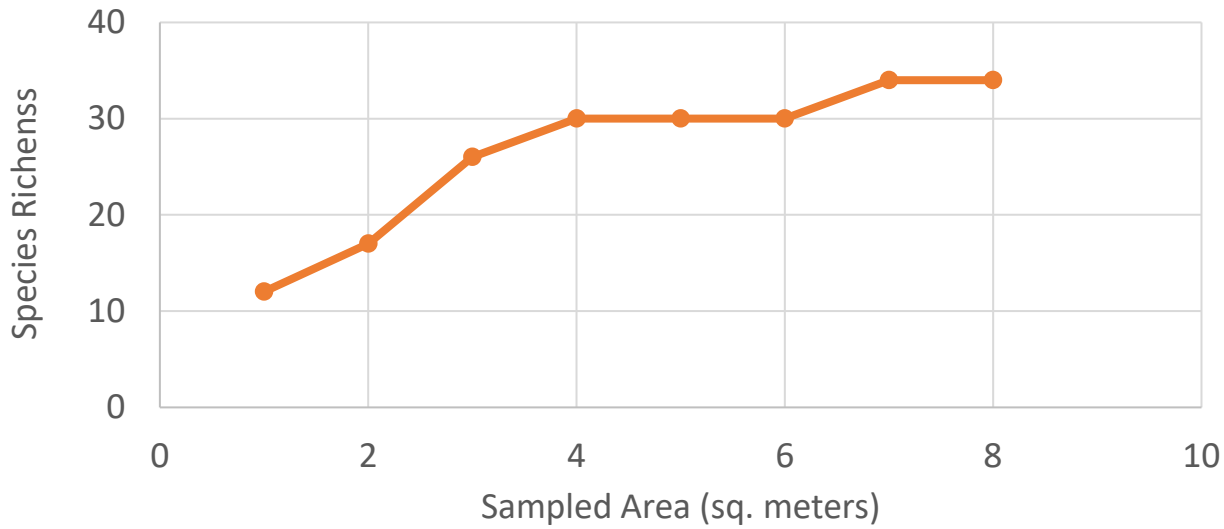
Monitoring Year	Total Individuals	Species Richness	Shannon Diversity	Habitat Assessment Score
2009	143	13	--	--
2013	76	10	1.71	98
2015	75	16	1.48	105
2017	97	7	1.32	133
2019	65	9	1.58	123
2022	93	8	1.50	103

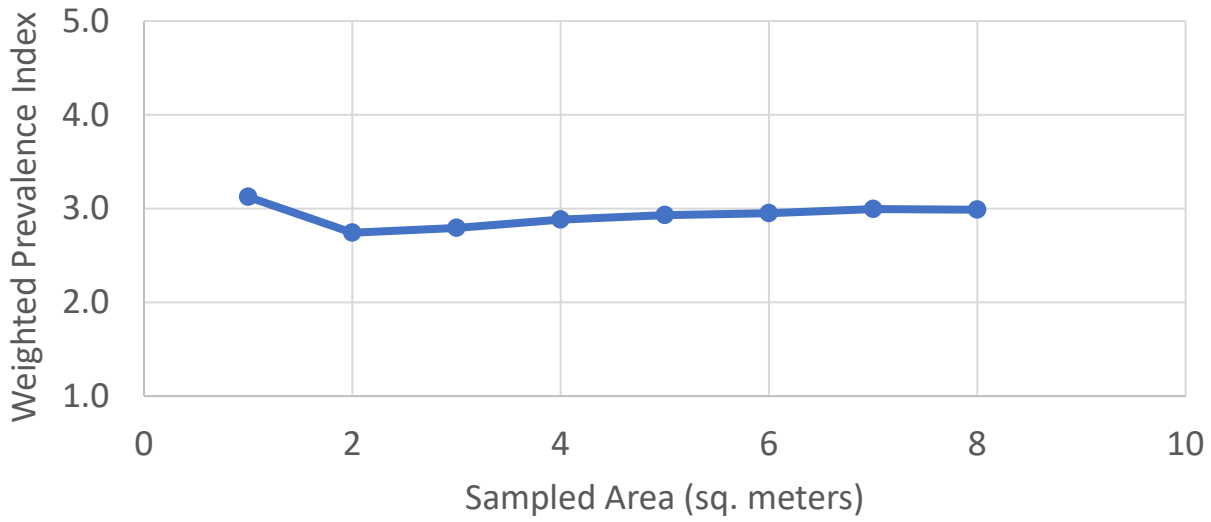
Assessment Method

- Field Data Collection
  - Sampling design
  - Sampling bias
  - Climatic, Geophysical, and Biotic relationships
    - Hydrologic condition
    - Habitat availability
- Data Summarization / Statistical Evaluation
  - Index bias
  - Sample size
  - Temporal variability

Assessment Method – Data Collection (vegetation)



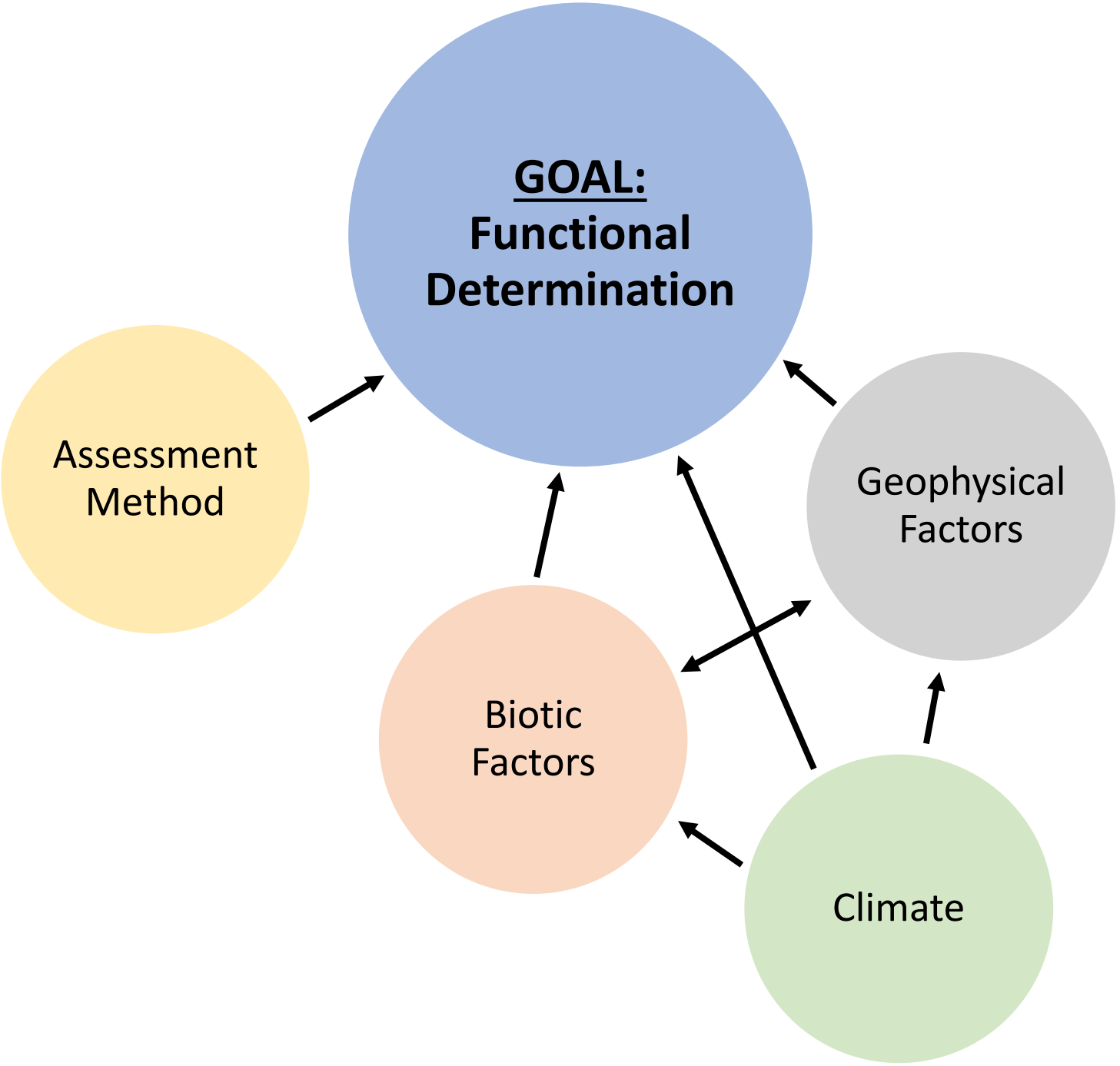




Assessment Method – Index of Biological Integrity

- Florida Wetland Condition Index
  - Requires 125-individual sub-sample for index calculation
  - High dominance of one or a few taxa can result in different biological interpretations

Order	Family	Taxon	125 Individual Sub-sample	Complete Sample
Arhynchobdellida	Erpobdellidae	Mooreobdella tetragon	--	Present
Amphipoda	Hyalellidae	Hyalella azteca complex LeCroy	62	Present
Basommatophora	Physidae	Physidae (LPIL)	--	Present
Decapoda	Cambaridae	Procambarus sp.	--	Present
Coleoptera	Chrysomelidae	Disonychia pensylvanica	--	Present
Coleoptera	Hydrophilidae	Enochrus sp.	1	Present
Coleoptera	Dytiscidae	Dytiscidae (LPIL)	--	Present
Coleoptera	Noteridae	Hydrocanthus atripennis	--	Present
Coleoptera	Noteridae	Suphisellus gibbulus	--	Present
Coleoptera	Noteridae	Suphisellus parsoni	5	Present
Coleoptera	Scirtidae	Ora sp.	--	Present
Diptera	Ceratopogonidae	Atrichopogon sp.	--	Present
Diptera	Ceratopogonidae	Palpomyia-Sphaeromias group Brigham	--	Present
Diptera	Chironomidae	Chironomus sp.	13	Present
Diptera	Chironomidae	Kiefferulus dux	15	Present
Diptera	Chironomidae	Labrundinia sp.	--	Present
Diptera	Chironomidae	Larsia decolorata	2	Present
Diptera	Chironomidae	Monopelopia boliekae	1	Present
Diptera	Chironomidae	Tanypus sp.	2	Present
Diptera	Chironomidae	Zavrelimyia sp.	1	Present
Diptera	Stratiomyidae	Odontomyia/Hedriodiscus group Merritt	--	Present
Diptera	Tabanidae	Chrysops sp.	--	Present
Diptera	Tipulidae	Helius sp.	--	Present
Ephemeroptera	Caenidae	Caenis punctata	--	Present
Haplotaxida	Naididae	Dero digitata complex Milligan	3	Present
Haplotaxida	Tubificoid Naididae	Limnodrilus hoffmeisteri	5	Present
Hemiptera	Belostomatidae	Belostoma lutarium	--	Present
Hemiptera	Mesoveliidae	Mesovelia sp.	--	Present
Lepidoptera	Crambidae	Elophila sp.	--	Present
Lepidoptera	Undetermined Family	Lepidoptera (LPIL)	--	Present
Odonata	Aeshnidae	Anax junius	1	Present
Odonata	Coenagrionidae	Ischnura sp.	7	Present
Odonata	Libellulidae	Libellula incesta	--	Present
Odonata	Libellulidae	Pachydiplax longipennis	--	Present
Tricladida	Tricladida	Tricladida (LPIL)	5	Present
		Total Taxa	**14**	**35**



Climate

- Precipitation
- Temperature
- Long- vs short-term conditions
- Climatic normals

Geophysical Factors

- Soils
- Topography / Geomorphic setting
- Hydrologic source(s)
- Land use
- Chemical
- Disturbance regime and type

Biotic Factors

- Vegetative community type(s)
- Evapotranspiration
- Biological processes
- Land use

Assessment Method

- Quantitative vs qualitative
- Indices of biotic integrity
- Ecological statistics

Functional Assessment

EXISTING CONDITION ASSESSMENT				
Functional Category	Function-Based Parameters	Measurement Method	Field Value	Index Value
Hydraulics	Floodplain Connectivity	Bank Height Ratio		
		Entrenchment Ratio		
Geomorphology	Riparian Vegetation	Left Buffer Width (ft)		
		Right Buffer Width (ft)		
	Bed Form Characterization	Pool Spacing Ratio		
		Percent Riffle		
		LWD Index		
Biology	Macros			

PROPOSED CONDITION ASSESSMENT				
Functional Category	Function-Based Parameters	Measurement Method	Field Value	Index Value
Hydraulics	Floodplain Connectivity	Bank Height Ratio		
		Entrenchment Ratio		
Geomorphology	Riparian Vegetation	Left Buffer Width (ft)		
		Right Buffer Width (ft)		
	Bed Form Characterization	Pool Spacing Ratio		
		Percent Riffle		
		LWD Index		
Biology	Macros			

Project Information and Existing Conditions Summary	
Project Name:	Super Awesome Mitigation Bank
Mitigation Wetland Name:	WA
Acres of Mitigation (*Acres*):	1,000.00
Wetland Type:	Depression
WAA Center Coordinates:	
Closest Weather Station:	
Date of Assessment:	February 2, 2023

Summary of Existing Wetland Function	
Existing Condition - V_{HYDRO} Index Score	0.00
Existing Condition - V_{COMP} Index Score	0.00
Existing Condition - V_{STRUCT} Index Score	0.00
Existing Condition - V_{WD} Index Score	0.00
Existing Condition - V_{UP} Index Score	0.00
Existing Condition Functional Score	0.00

Project Information and Proposed Conditions Summary	
Project Name:	Super Awesome Mitigation Bank
Mitigation Wetland Name:	WA
Acres of Mitigation (*Acres*):	1,000.00
Wetland Type:	Depression
Mitigation Potential:	
WAA Center Coordinates:	
Closest Weather Station:	
Date of Wetland Credit Assessment:	

Summary of Proposed Wetland Function	
Proposed Condition - V_{HYDRO} Index Score	0.00
Proposed Condition - V_{COMP} Index Score	0.00
Proposed Condition - V_{STRUCT} Index Score	0.00
Proposed Condition - V_{WD} Index Score	0.00
Proposed Condition - V_{UP} Index Score	0.00
Proposed Condition Functional Score	0.00
Net Functional Lift (Δ)	0.00
Total Wetland Credits Generated	**0.00**