

Assessing Large Woody Debris to Improve Stream Projects



Why is LWD important?

- **Habitat**
- **Cover/Refuge/Substrate**
- **Shading**
- **Grade Control**
- **Energy Dissipation**
- **Sediment Retention**
- **Bedform Diversity**
- **Organic Matter Retention**
- **Aesthetics**



- **Fishing**

LWD Assessment

- **Provide a consistent method**

- Application of the Large Woody Debris Index: A Field User Manual, V1
- Field Data Entry Form

- **Stream Quantification Tool (SQT)**

- Performance Standards
- Uplift

Functional Category	Function-Based Parameters
Hydrology	Catchment Hydrology
	Reach Runoff
Hydraulics	Floodplain Connectivity
Geomorphology	Large Woody Debris
	Lateral Stability
	Riparian Vegetation
	Bed Material
	Bed Form Diversity
Physicochemical	Sinuosity
	Temperature
	Bacteria
	Organic Matter
Biology	Nitrogen
	Phosphorus
	Macros
	Fish



LWD Assessment

Dead and fallen wood

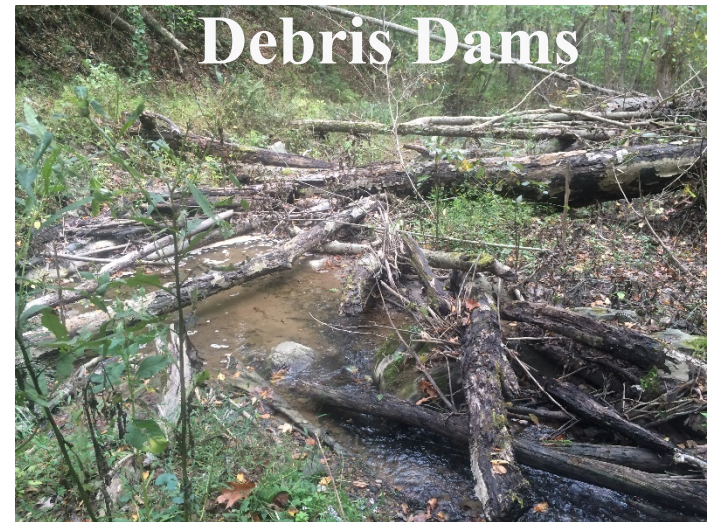
Length \geq 1 m (3.28 ft)

Diameter \geq 10 cm (3.96 in)

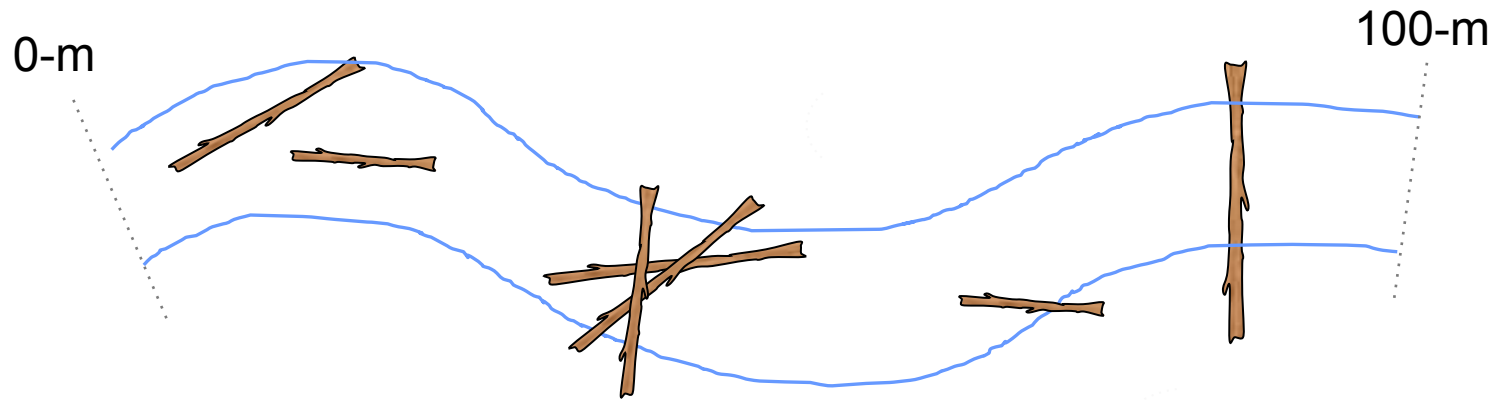
Specific zones

100 m reach

$$\text{LWDI} = \sum \text{PS} + 5 * \sum \text{DDS}$$



LWD Assessment Reach



LARGE WOODY DEBRIS FIELD FORM

Date Revised: 10/19/2016

Investigator(s)				State			Forest Type	Deciduous	Evergreen	Mixed	Other
Date				County			Forest Age (yrs)				
Stream Name				Phys. Province			Latitude (dd)				
Reach ID				Drainage Area (mi ²)			Longitude (dd)				
Watershed Name				Dominant Species							
Survey Length (ft)	328	Survey Length = 328 ft/100 m		BKF Width (ft)			Slope (ft/ft)				
Stream Classification	Ephemeral	Intermittent	Perennial	BKF Mean Depth (ft)			Bed material				
Stream Condition	Degraded	Restored	Reference	Managed	Floodprone Width (ft)			Rosgen Type			

Field Notes:

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										TOTAL PIECES
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8		0.8 to 1.0		> 1.0		
Diameter (cm)	10 to 20		20 to 30		30 to 40		40 to 50		>50		
Location	Zone 4 (Above BKF/Extending into Channel)				Zone 3 (Above BKF/Within Streambanks)		Zone 2 (Above WS/Below BKF)		Zone 1 (Below WS)		
Type	Bridge				Ramp		Submersed		Buried		
Structure	Plain		Plain/Int		Intermediate		Int/Sticky		Sticky		
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		
Orientation (deg)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 90		

**** DEBRIS DAMS ****

CATEGORY	** DEBRIS DAMS **										TOTAL DAMS
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		

* Pieces - Non-living wood that has a large end diameter ≥ 10 cm and has a length ≥ 1 m. ** Debris Dams - Three (3) or more pieces touching.

LWD Examples





UT to Still Creek
Clackamas County, OR

- Length/Wbkf: 10-ft / 35-ft = 0 – 0.4 (1 pt)
- Diameter: >50 cm (5 pts)
- Location: Zone 3 (4 pts)
- Type: Bridge (1 pts)
- Structure: Plain (1 pts)
- Stability: Secured (5 pts)
- Orientation: 80 – 90 (5 pt)
- **Total Piece Score = 22**

- Length/Wbkf: 10-ft / 35-ft = 0 – 0.4 (1 pt)
 - Diameter: 20 – 30 cm (2 pts)
 - Location: Zone 2 (4 pts)
 - Type: Ramp (3 pts)
 - Structure: Plain/Int. (2 pts)
 - Stability: Int. Secured (4 pts)
 - Orientation: 0 – 20 (1 pt)
- Total Piece Score = 17**

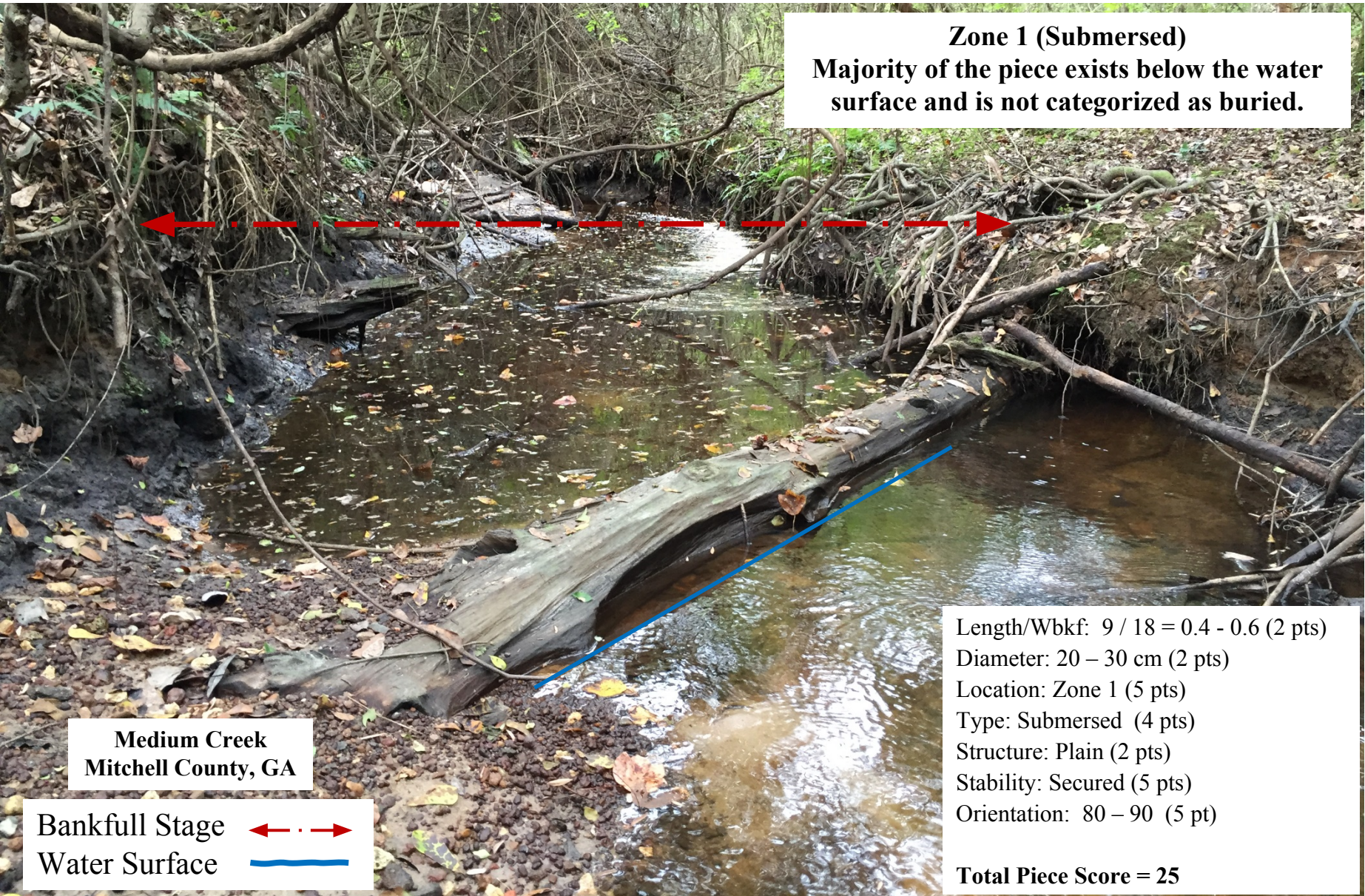


Reedy Creek
Wake County, NC

Bankfull Stage 
Water Surface 

Zone 2 (Ramp)
Majority of piece is above water surface and below bankfull. Piece extends from Zone 1 into Zone 2.

Zone 1 (Submersed)
Majority of the piece exists below the water surface and is not categorized as buried.



**Medium Creek
Mitchell County, GA**

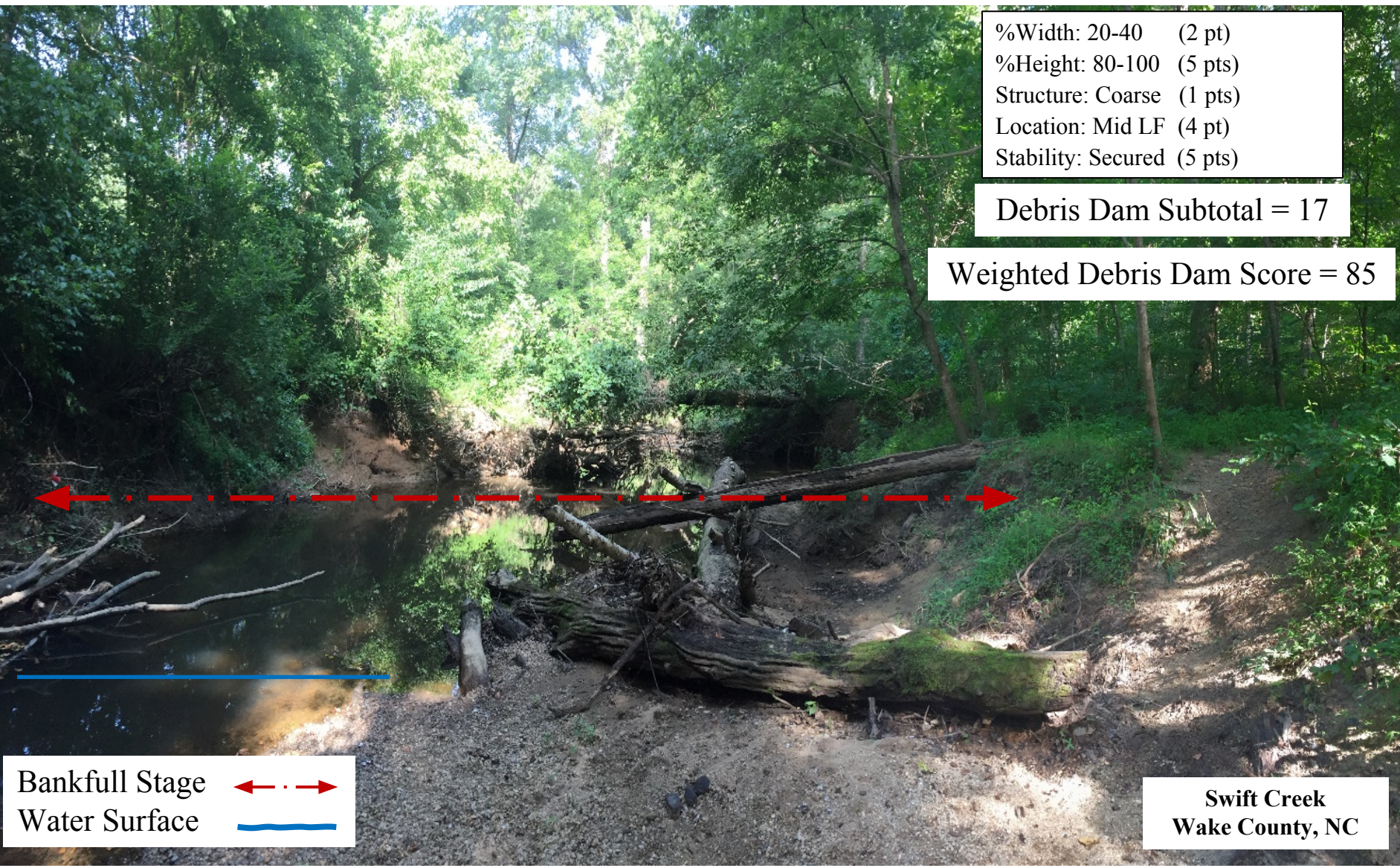
Bankfull Stage 
Water Surface 

Length/Wbkf: $9 / 18 = 0.4 - 0.6$ (2 pts)
Diameter: 20 – 30 cm (2 pts)
Location: Zone 1 (5 pts)
Type: Submersed (4 pts)
Structure: Plain (2 pts)
Stability: Secured (5 pts)
Orientation: 80 – 90 (5 pt)
Total Piece Score = 25

%Width: 20-40 (2 pt)
%Height: 80-100 (5 pts)
Structure: Coarse (1 pts)
Location: Mid LF (4 pt)
Stability: Secured (5 pts)

Debris Dam Subtotal = 17

Weighted Debris Dam Score = 85



Bankfull Stage 
Water Surface 

Swift Creek
Wake County, NC

Log Vane Structure



Piece Score
21 - 23 Pts

- Length/ Bankfull width is typically 0.8 – 1.0 or > 1.0 (Score = 4 or 5)
- Diameter: Typical minimum is 12” or 30cm (Score = 3)
- Location is typically Zone 1 and Zone 2 with the majority in Zone 2 (Score = 4).
- Type: Ramp (Score = 3)
- Structure: Plain (Score = 1)
- Stability: Secured (Score = 5)
- Orientation is typically around 20 degrees (Score = 1 or 2).

Toe-wood Structure



- Length is <20% of bankfull (Score = 1)
- Height varies but typically is < 50% of bankfull (Score = 1 – 3)
- Structure is between intermediate and coarse (Score = 4)
- Location: In low flow (Score = 1)
- Stability: Secured (Score = 5)

Debris Dam Subtotal

12 - 14 Pts

Weighted Debris Dam Score

60 - 70 Pts

Woody Riffle



Piece Score
27 - 29 Pts

Root-wad



Root wads – Not typically counted.
This one has failed and the stem is now visible

Piece Score

21 - 23 Pts

Other Structures

- Root Wad – Typically Not Counted
- Log sill – Piece
- Cover logs – Piece
- Engineered log jam – Debris Dam

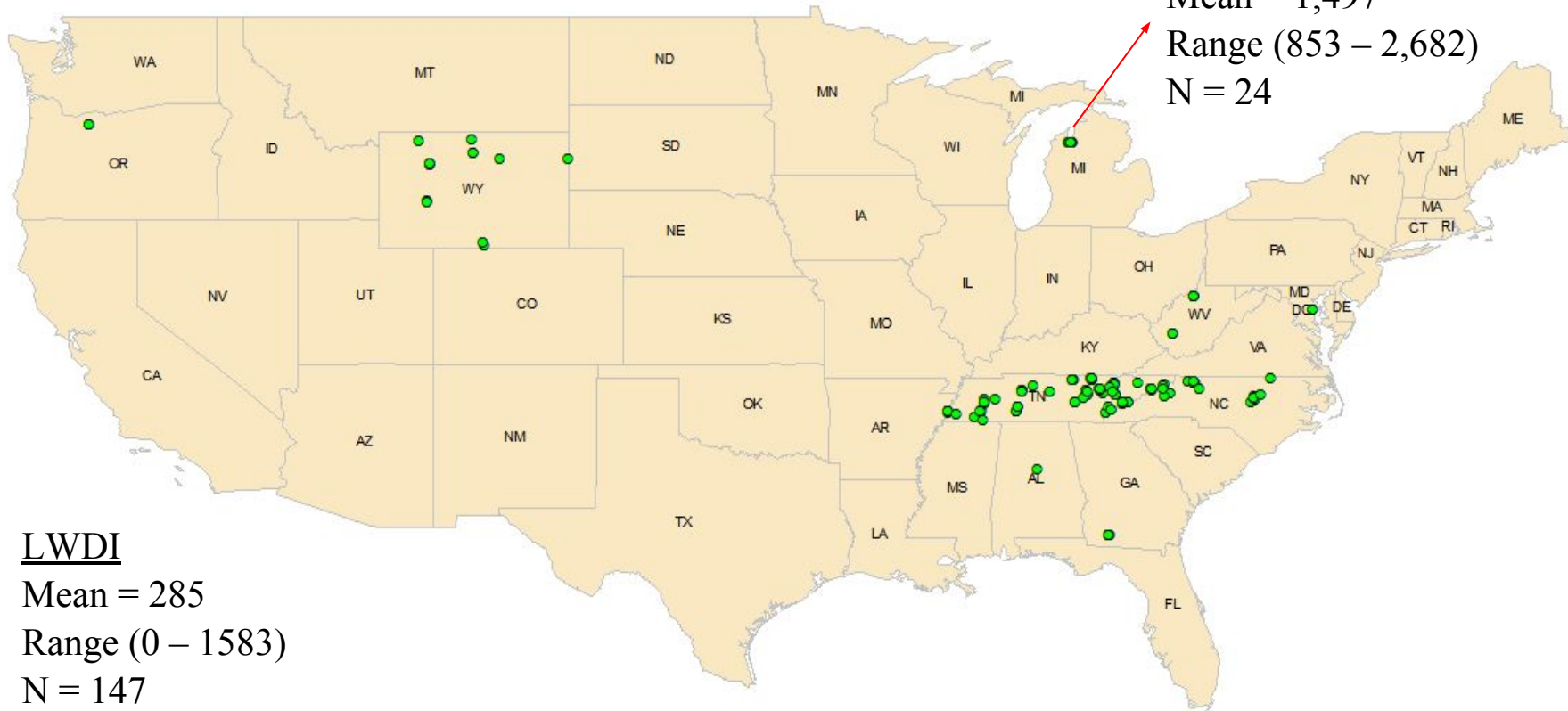
LWDI Sites

Michigan LWDI

Mean = 1,497

Range (853 – 2,682)

N = 24



LWDI

Mean = 285

Range (0 – 1583)

N = 147

* All sites except MI

Range of LWD Sites

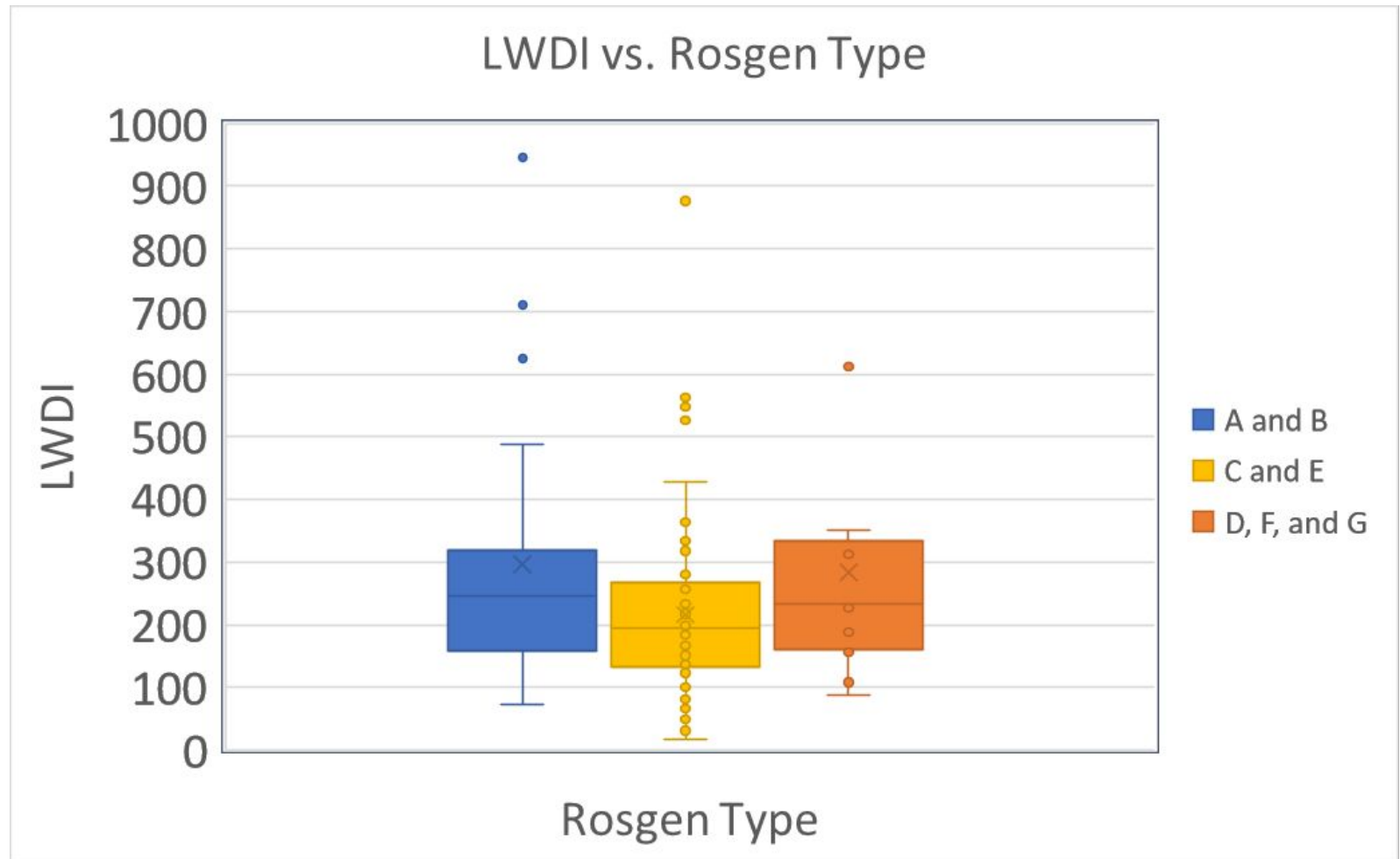
Channel / Substrate Stability



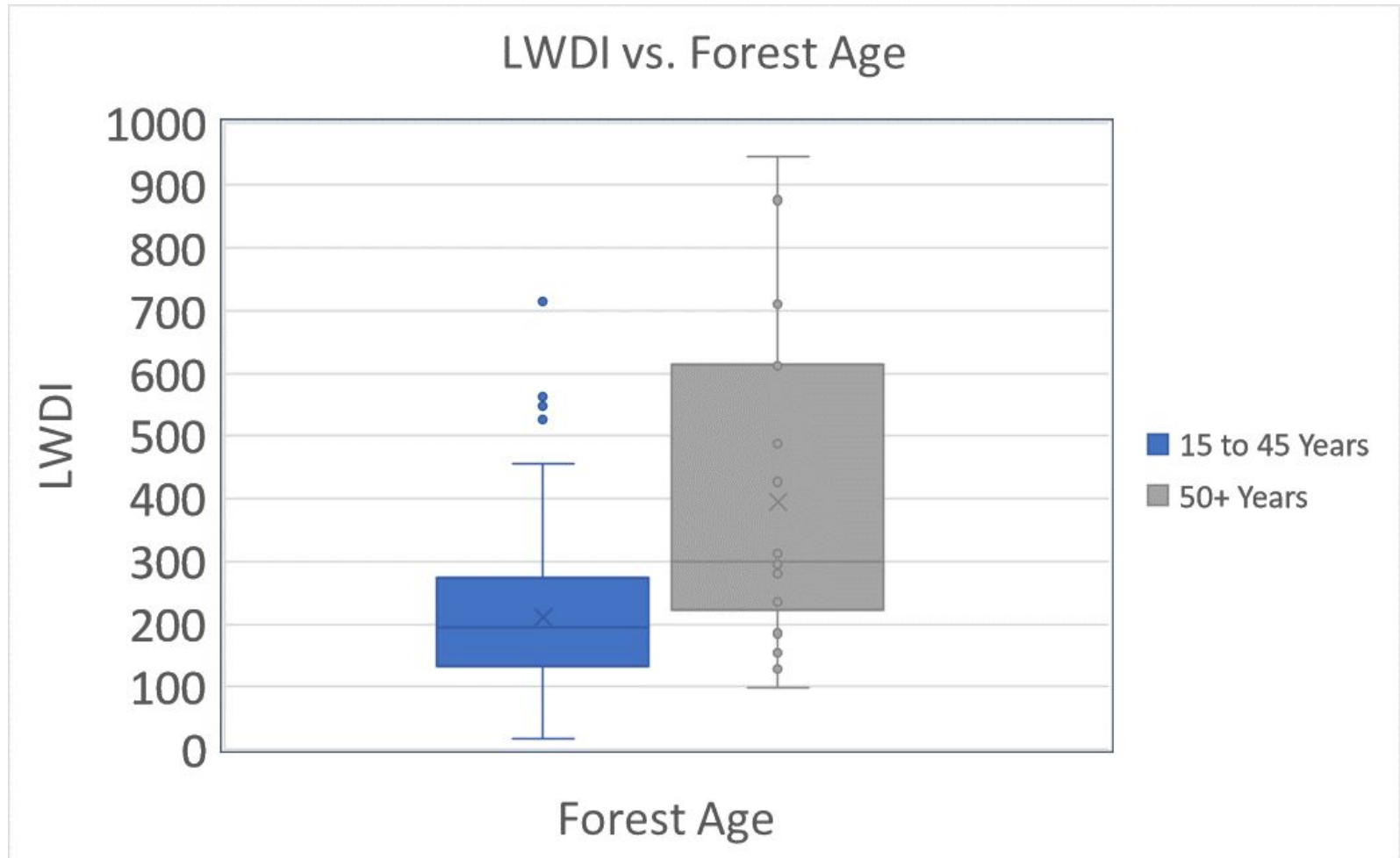
LWD Supply



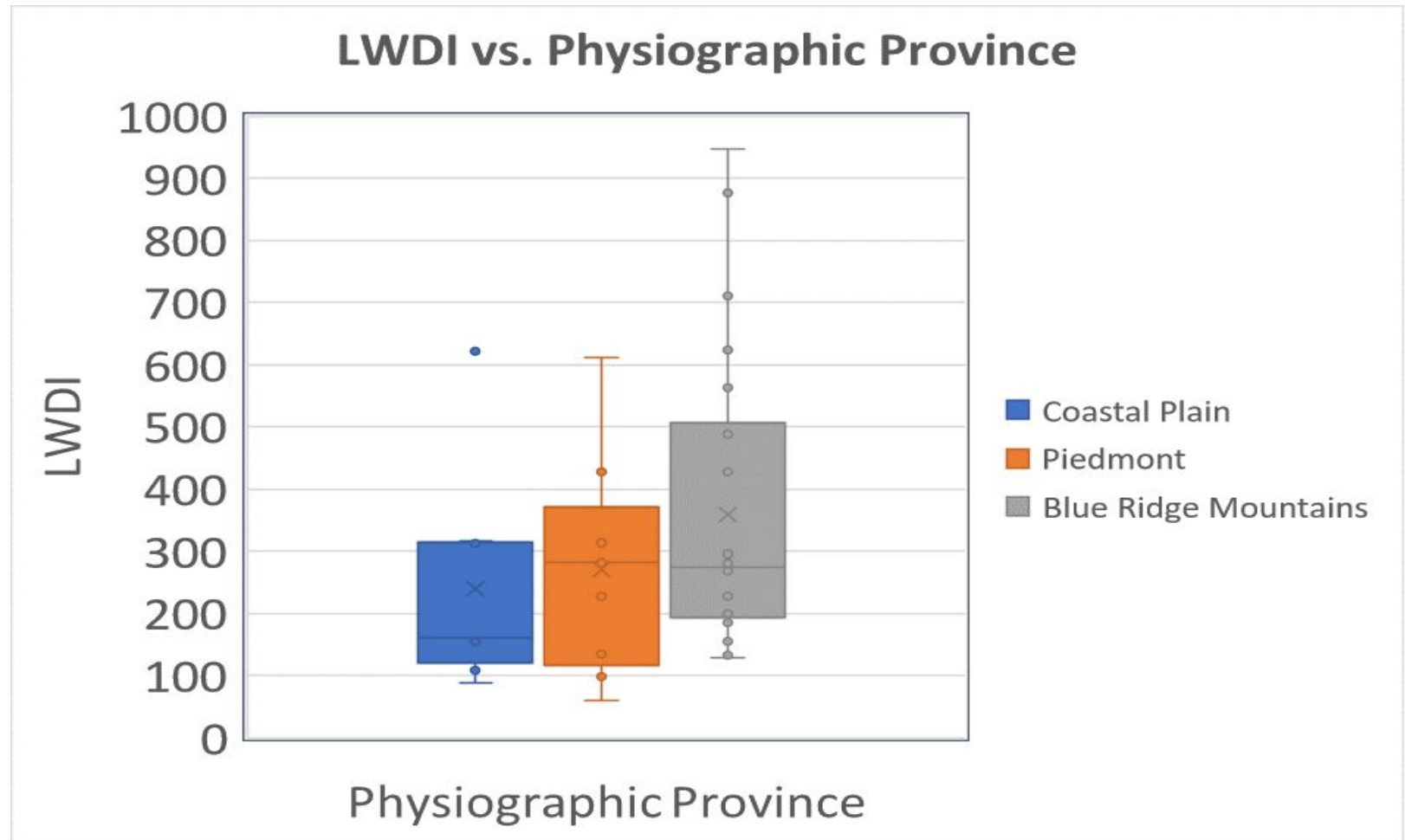
Southeast LWD Data



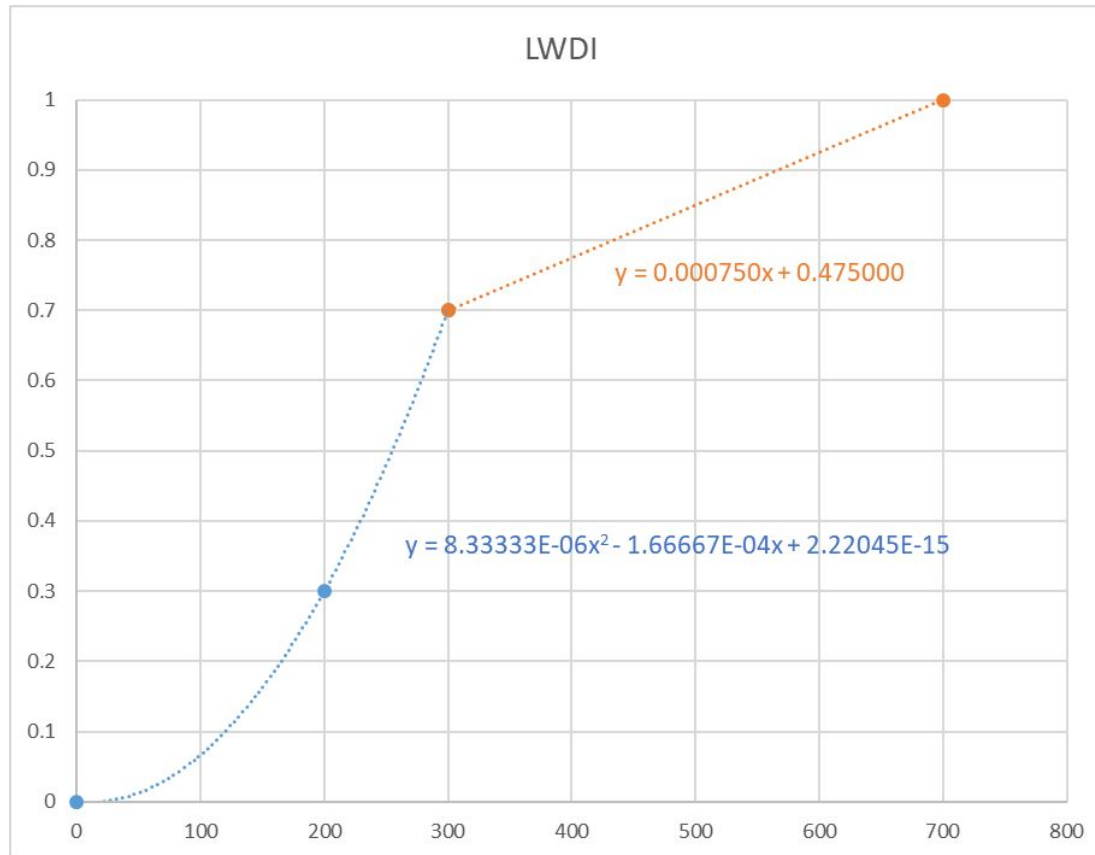
Southeast LWD Data



NC LWD Data



NC Performance Std Curve



	Not Functioning		Functioning-At-Risk		Functioning	
LWDI	0	198	199	299	300	≥ 694
No. Pieces	0	9	10	15	16	≥30

*LWDI Performance Standards
in the NC SQT v3.0*



Future Work

- **Assess Older, High Quality Forests**
 - Joyce Kilmer Forest
 - Congaree National Forest

- **Educational Training**

Acknowledgements



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<https://stream-mechanics.com/resources>



Questions

