riversmart communities

supporting ecologically restorative flood prevention and remediation in New England

Stream Classification

Categorizing streams creates a language for communication between managers, comparison across watersheds, and prediction of future river behavior.

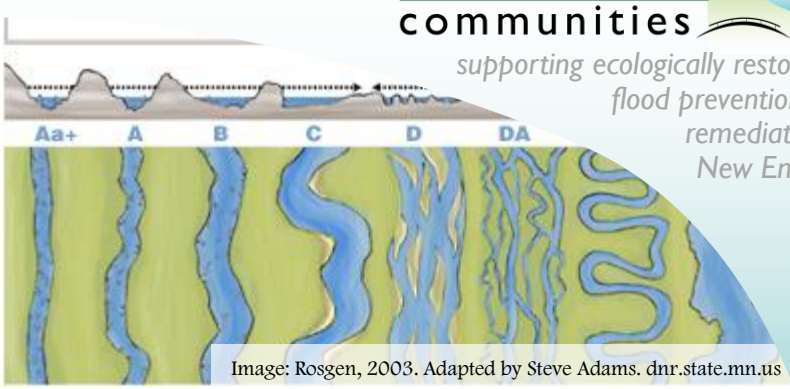


Image: Rosgen, 2003. Adapted by Steve Adams. dnr.state.mn.us

Approaches to stream classification vary depending on the aspect of interest, (habitat, sediment transport, hydrology), scale of application (site, reach, watershed), and approach. There are two main approaches:

- Descriptive: based on physical shapes, dimensions, and features. Relatively straightforward and easy to apply. Useful for communication and comparison between sites.
- Process-based: incorporate water and sediment flow processes directly. Integrating multiple temporal and spatial scales.

This table presents a number of classification scheme types. More detailed examples on back of sheet.

Scheme	Approach	Description	Strengths	Weaknesses	Example Sources
Stream Order	Descriptive	Number reaches based on distance from headwaters	• Widely Used • Easily Applied • Correlates to reach length, slope, x-section	• Sensitive to network definition • Forms, processes, are not correlated	Horton, 1945 Strahler, 1957
Process Domains	Process Based	Defines segments as sediment source, transfer, or deposition zone	• Process units are fundamental to shaping river behavior	• Coarse filter, lumping many channel types	Schumm, 1977 Mont. & Buff., 1997 Montgomery, 1999
Channel Pattern	Descriptive	Relationships between a variety o FGM factors and planform pattern	• Quantitative • Predict disturbance response	• Empirical • Only applicable to some stream types	Lane, 1957 Leopold&Wolman'57 Rosgen, 1996
Channel-Floodplain Interaction	Process Based	Classifies by floodplain-formation mechanism.	• Reflect many processes • Consider human actions	• Only applicable to some stream types	Melton, 1936 Nanson & Croke, '92
Bed Material Mobility	Process Based	Divides by likelihood of migration, mode of sediment transport.	• Reflect many processes • More thorough than "Process Domains"	• High data input • Only applicable to some stream types	Henderson, 1963 Whiting&Bradley 93 Church, 2006
Channel Units	Descriptive	Identifies sub-reach bedforms and flow types	• Relates FGM to habitat • Reflects sedimentology	• Does not scale up for watershed application	Bisson et al, 1982 Church & Jones, '82 Buffington, 1996
Hierarchy-Based	Process & Descriptive	Considers relationships between multiple scales and factors.	• Based on multi-scale, hierarchical processes • Thorough and robust	• High complexity and data requirements	Frissel et al, 1986

Stream Classification

Three important examples:

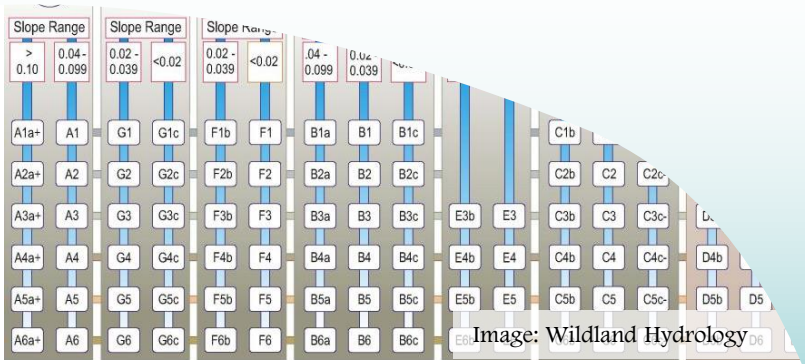
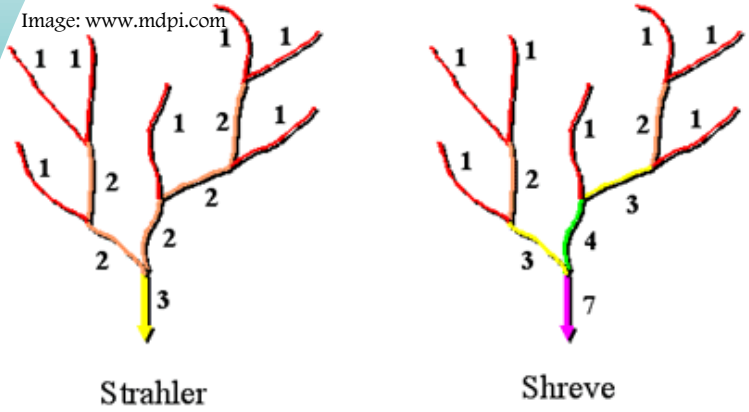


Image: Wildland Hydrology

Image: www.mdpi.com



Stream Order – Descriptive Approach
Horton, 1945; Strahler, 1957, Shreve 1966

Numbers reaches based on their locations within the network. Headwaters are assigned a "1", and reach values increase moving downstream. Order is easy to calculate, and correlates with reach length, drainage area, and channel slope and size. However, reaches of the same order often exhibit very different geomorphic suites and processes.

Channel Pattern - Descriptive
Schumm, '85; Montgomery & Buffington, '97; Rosgen, '96; Brierley & Fryirs, '05
Reaches are categorized by their planform (bird's-eye-view) shapes. Shape can be empirically related to variables like slope, discharge, and sediment load, allowing for stability rating and channel evolution prediction.

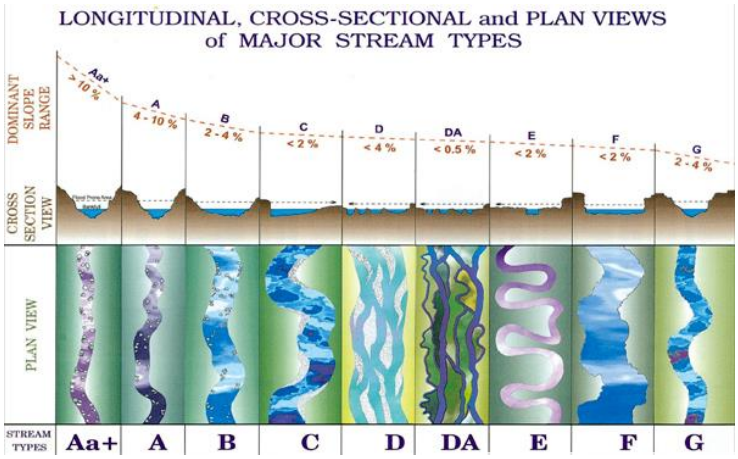


Image: Rosgen, 1998

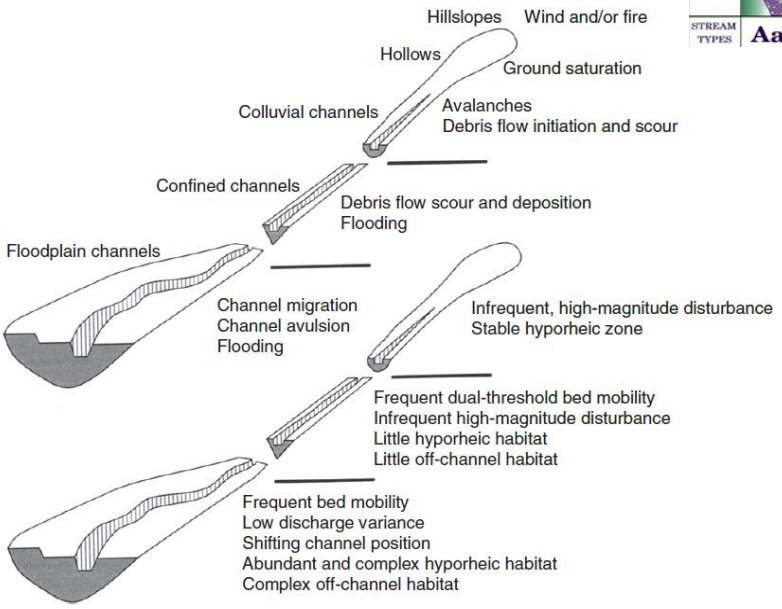


Image: Montgomery, 1999

Process Domains – Process-Based
Schumm, 1977; Montgomery, 1999
Categorizes reaches into "source," "transport," and "deposition" based on sediment dynamics. Addresses some processes, but over-simplifies river behaviors. Relatively easy application for process-based scheme.