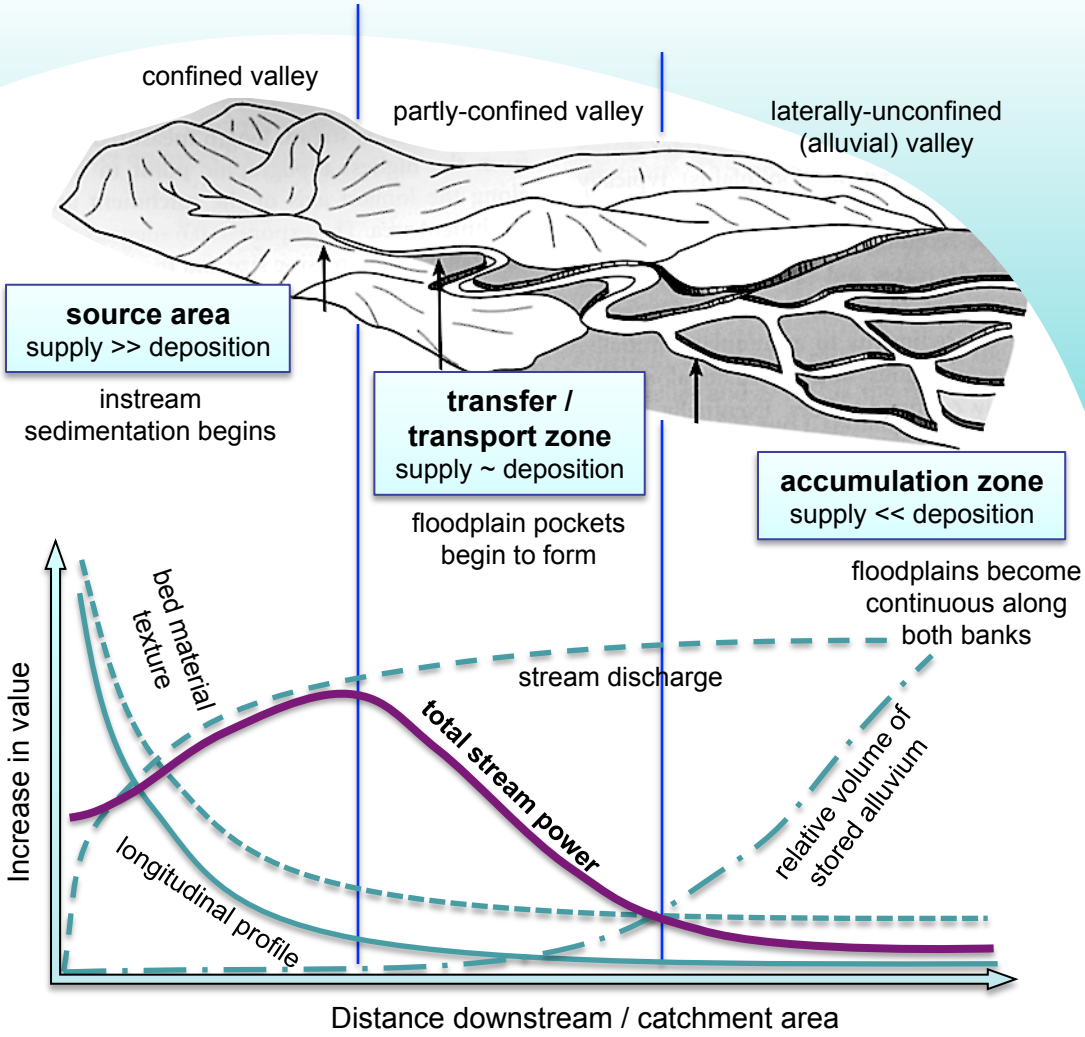
Stream Power
(and River Sensitivity Coarse Screening)

The ability of a stream to ***erode*** material from its bed and banks or ***aggrade (deposit)*** material on top of them is ultimately controlled by the available **power** of the system (stream discharge, slope of the bed, gravity and sediment supply) balanced by the **resistance** of the bed and bank materials (strength of geologic materials, size of particles and force required to move them). In a typical stream system, there is relatively lower power and greater sediment supply near the headwaters, high stream power in the middle transport reaches, and deposition on the broad, flat floodplains or deltas at the mouths of rivers. Many factors can alter this balance including short-term high-intensity storm events, or long-term cumulative effects of human land-use practices such as logging and mill dams. Determining the power of a stream along its length tells us something about the large-scale potential for deposition and erosion.



Schematic representation of the relationship between downsteam changes along a typical stream profile, and associated transitions in sediment process zones and valley setting (*Fryirs and Breirley, 2005 & 2013; Church 1992*)

(Total) Stream Power (Ω) is the rate of potential energy expenditure against the bed and banks of the channel per unit length, and is a function of:

- **specific weight of water (γ) [in N/m³]**
  γ = density (ρ) x gravity (g)
- **Stream discharge (Q) [m³/s],**
- **bed slope (s) [-]**

Specific Stream Power, SSP (ω) is total stream power per unit width (w), (usually bankfull width).

$$\Omega = \gamma Q s$$

$$\omega = \frac{\Omega}{w}$$

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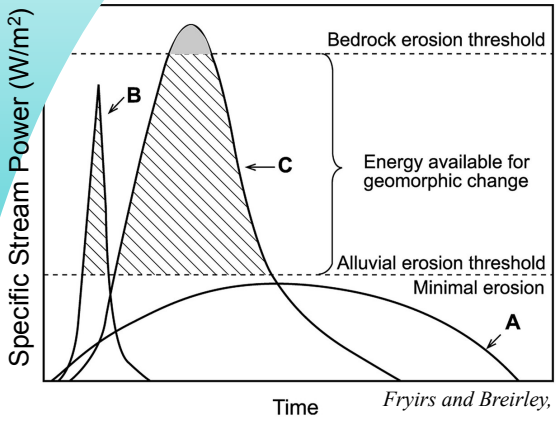
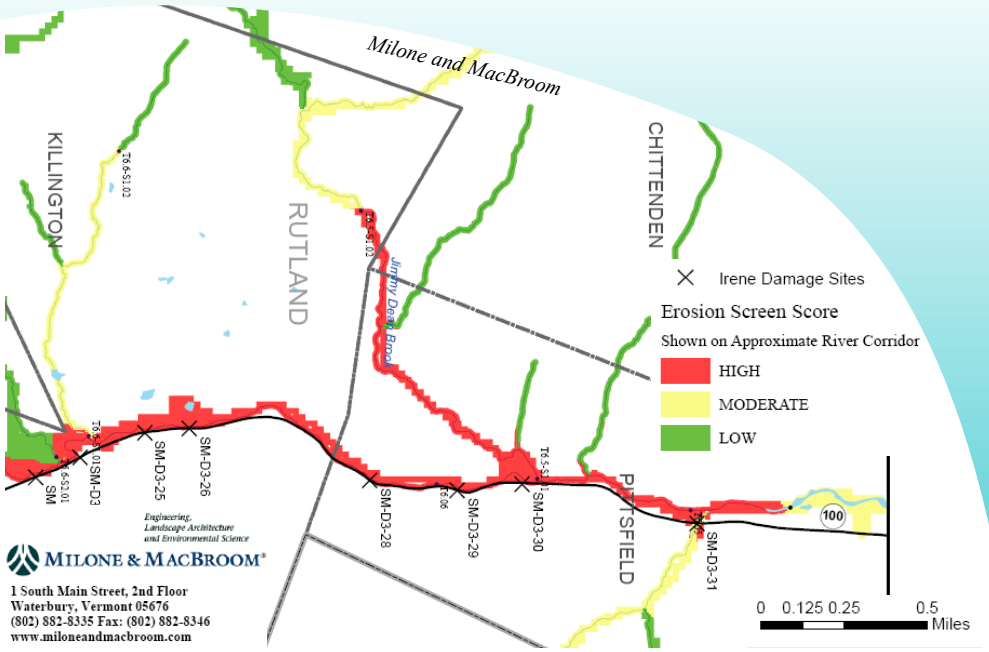
(Stream Power and) River Sensitivity Coarse Screening



Fryirs and Breirley, 2013



The Coarse Screen is a technique for assessing large watershed areas to target locations for further investigation. It is a desktop calculation of **specific stream power** applied in the valley and geomorphic context of the reach to **score relative risk** of **erosion** or **deposition** for that reach. Combined with other habitat or infrastructure prioritization scores, this powerful management tool has the potential for application to large areas for minimal cost.

<u>The Coarse Screen CAN be used to:</u>

- Initial site screening when no other data available.
- Obtain preliminary understanding of valley setting and risk of erosion/deposition at the valley scale.
- Determine the likely dominant river process in the valley.
- Help establish restoration and conservation projects.
- Provide a gateway to more detailed geomorphic data.
- Support findings of sediment departure analysis from existing field data.

<u>The Coarse Screen SHOULD NOT be used to:</u>

- Cannot identify site details that drive risk level.
- Do not use for specific damage site prediction.
- Do not use alone for planning.
- Cannot identify undersized bridges or culverts that can specifically determine the location of the most hazardous area or conservation target.

Risk of Erosion

Specific Stream Power (W/m²)	0-60	60-300	>300
Valley Confinement	>10	6-10	<6
Increase (%) in Confinement by Infrastructure	<10	10-25	>25
LEVEL OF RISK	**LOW**	**MODERATE**	**HIGH**

Risk of Aggradation (Deposition)

Specific Stream Power (W/m²)	>300	60-300	0-60
Number of slope decreases > 5%	0	1	≥2
Number of > 3rd order confluences	0	1	>1
Number of road crossings	0	1-2	>2
LEVEL OF RISK	**LOW**	**MODERATE**	**HIGH**

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