Determining Channel Type/Classification:

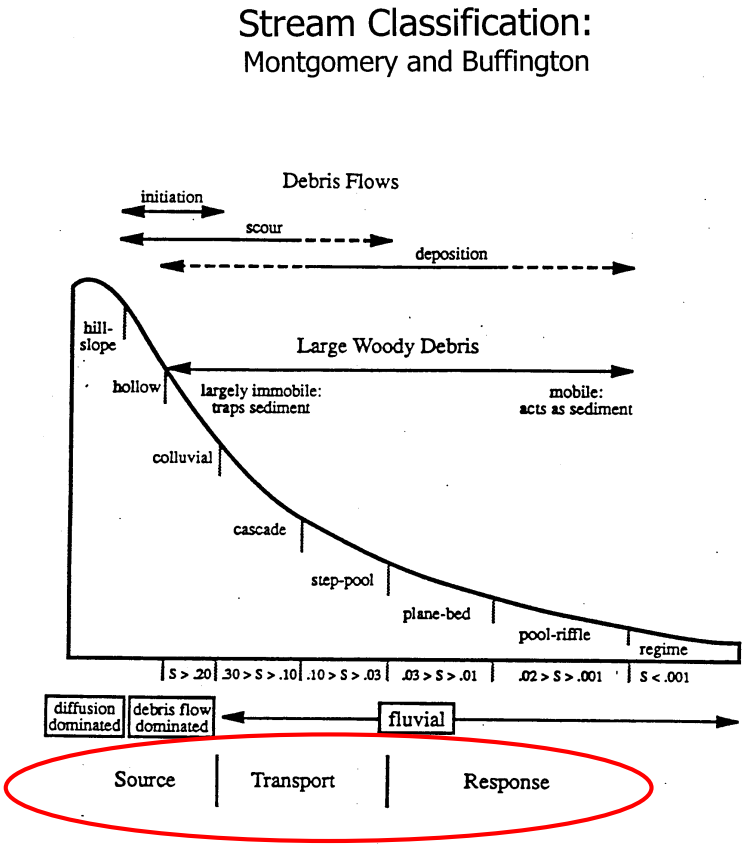
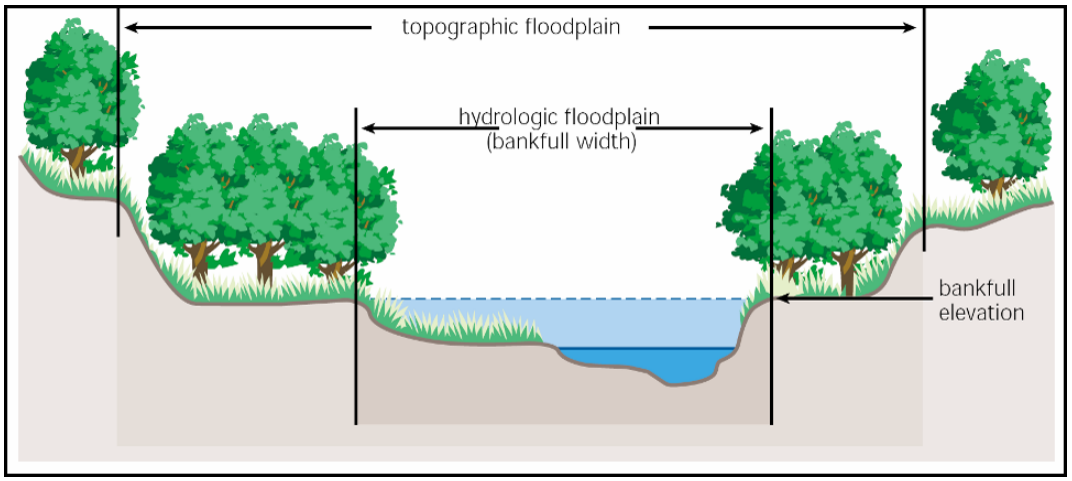


Figure 16 Illustration of idealized long profile from hill tops downslope through the channel network showing general distribution of channel types and controls on channel processes.

Montgomery and Buffington 1993

Determining Bankfull Width:



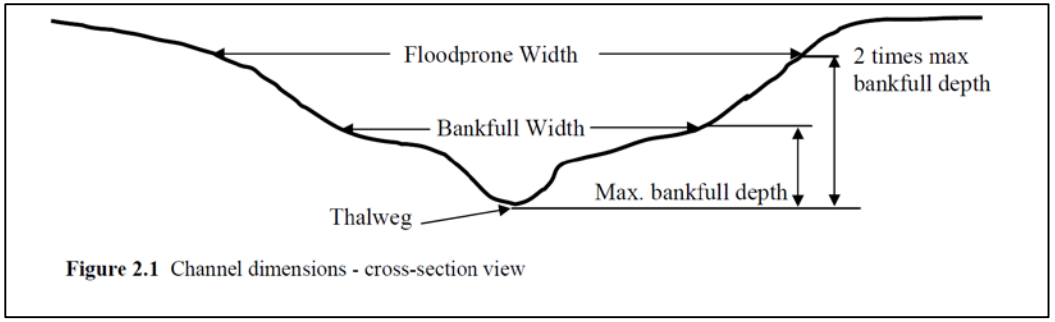


Figure 2.1 Channel dimensions - cross-section view

Bankfull Indicators

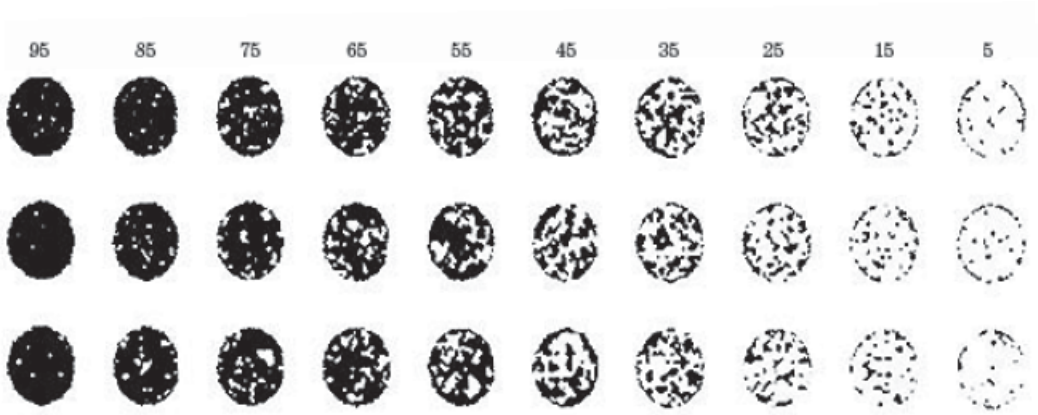
- Tops of depositional bars
- Break in bank slope
- Small inundation benches
- Staining on rocks
- Exposed root hairs

*Always try to measure just upstream of hydraulic controls; such as riffles, bedrock outcrops, waterfalls

**Hint for estimating floodplain width: 2 X bankfull depth, follow that height out across the floodplain and that is approximately your floodplain width.

Estimating Percent Canopy Cover:

Figure 25 Percent canopy cover. Numbers above the ovals refer to the percent black (= shade/cover). (USDA Forest Service FIA Manual, http://www.fia.fs.fed.us/library/)



Estimating Riffle Embeddedness:

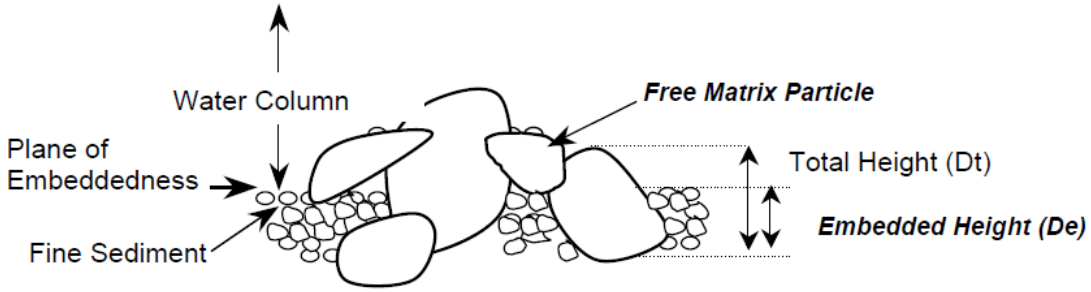
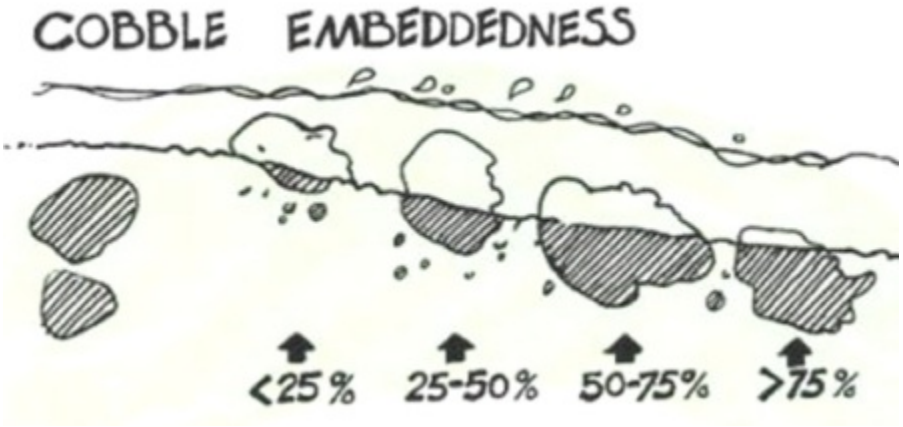


Figure 2. Schematic representation of embeddedness

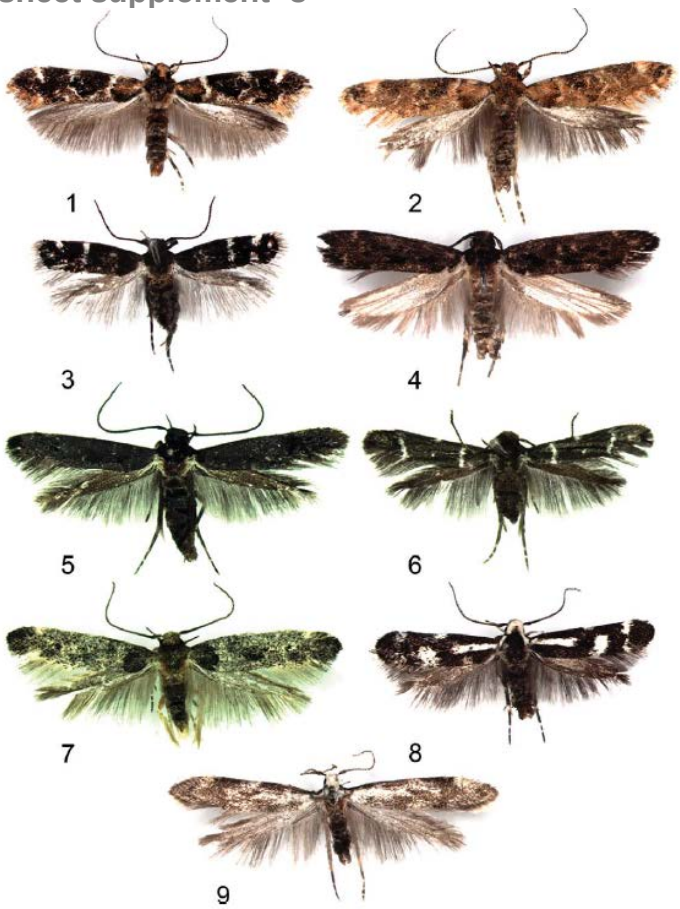
(USDA Forest Service, Stream Systems Technology Center, http://www.stream.fs.fed.us/news/streamnt/oct03/oct_03_01.htm)



(West Virginia Dept of Environmental Protection, http://www.dep.wv.gov/WWE/getinvolved/sos/Pages/SOPhabitat.aspx)

Hyposmocoma (endemic moth)

Above: Hyposmocoma larvae cases made of sand, pebbles, and/or plant fibers taken from their immediate environment and woven together with silk filaments. They are found in and around streams, attached to rocks and cobble. Right: Adult variations of Hyposmocoma, usually less than 1 cm across wing tip to wing tip. Found throughout the Hawaiian Islands.

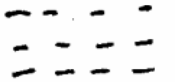


Schmitz, P. & Rubinoff, D. (2011), Ecologically and Morphologically Remarkable New Cosmet Moth Species of the Genus Hyposmocoma (Lepidoptera: Cosmopterigidae) Endemic to the Hawaiian Islands, With Reference to the Spectacular Diversity of Larval Cases. *Annals of the Entomological Society of America, 104(1):1-15.*

Native Hawaiian Damselflies and Dragonflies (examples)

Egg phase: Do you see Hawaiian damselfly egg patterns on the leaf surfaces of floating or emergent aquatic plants? (See example for the Orangeblack Hawaiian Damselfly, a lowland species.)

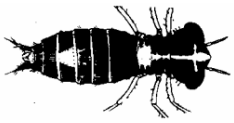
Damselfly egg pattern



Dragonfly egg pattern

Aquatic immature phase: Do you see Hawaiian damselfly exoskeletons (skin casts) on emergent plants, sticks, rocks, or shoreline?

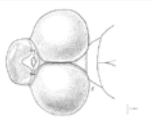
Damselfly cast



Dragonfly cast

Adult phase: Do you see Hawaiian damselfly adults resting on rocks or vegetation or flying? Damselflies are small and have slender bodies and dumbbell-shaped heads with eyes separated. Dragonflies are large and have plump bodies and round heads with contiguous eyes. Damselflies rest with their wings closed. Dragonflies rest with their wings open. Both are more active and likely to be seen in sunny weather.

Damselfly head



Dragonfly head

Megalagrion nigrohamatum – Blackline Hawaiian Damselfly: Found within the Koolau Mountain streams on Oahu. Breeds in the slow sections or pools along the mid-reach and headwater sections. Adults are often perched on streamside rocks and vegetation. Only species in HI with bright yellow & black coloration. ESA listed.

Megalagrion pacificum – Pacific Hawaiian Damselfly: Once widespread, now only found in streams on Molokai & Maui, & 1 site on the Big Island. Usually found in pools along overflow channels. Prefers quiet pools away from the main channel. ESA listed.

Megalagrion xanthomelas – Orange Black Damselfly: Formerly widespread, now scattered populatoins on Molokai, Lanai, Maui, Big Island and 1 site on Oahu. Occurs along slow stretches of stream or coastal wetlands. ESA candidate for listing.

Anax strenuous - Giant Hawaiian Dragonfly: Common in higher elevation areas on all islands, but sometimes can be seen close to sea level. Largest dragonfly in the U.S., can reach 6 inches. Not listed.

ESA listed:

- Megalagrion leptodemas – Crimson Hawaiian Damselfly
- Megalagrion nesiotes – Flying earwig Hawaiian Damselfly
- Megalagrion nigrohamatum – Blackline Hawaiian Damselfly
- Megalagrion oceanicum – Oceanic Hawaiian Damselfly
- Megalagrion pacificum – Pacific Hawaiian Damselfly
- Megalagrion xanthomelas – Orange Black Damselfly

*more information found in publication: Hawaiian damselflies: a field identification guide, Dan Polhemus, 1996.