

# Important Concepts for Riparian Recovery

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**F**ormulating a practical recovery plan for riparian systems requires understanding of hydrologic and geomorphic terms and an application of the concepts of fluvial dynamics.

**Stage** is the water-surface elevation of a stream above an established datum plane.

**Bankfull discharge** is the flow rate that occurs when the stage of a stream coincides with the uppermost bank level.

**Bankfull stage** is the water level at channel capacity, when bankflow discharge occurs. It is a geomorphic term requiring an interpretation of site-specific landforms.

**Flood plain** is a unique, identifiable geomorphic surface associated with alluvial stream channels.

Although bankfull stage can refer to various channel-bank levels, it generally applies to alluvial stream channels that are (1) adjusted to prevailing discharges, (2) principal conduits for streamflows through a length of alluvial bottomland, and (3) bounded by flood plains receiving water and sediment when discharge exceeds that of bankfull. In perennial streams, bankfull discharge is correlated to the mean annual flood (Wolman and Leopold, 1957). In dry regions with intermittent to ephemeral streams, bankfull discharge may correspond to floods with return periods of 100 years or more (Osterkamp, 2003).

Knowing the rate of bankfull discharge is of great importance to bottomland recovery efforts, as significant physical changes occur when flow surpasses bankfull discharge and transitions from in-channel to overbank conditions. The change in hydraulics as flow depth

increases controls the geomorphic processes related to flood-plain formation, regardless of any return period associated with the bankfull discharge (Petts and Foster, 1985). Channel designs for a recovery program must be compatible with this hydraulic change to maintain a stable reconstructed channel.

Bankfull stage, from which bankfull discharge is calculated, is recognized easily along channels with point-bar deposits, especially if recent overbank deposits overlie point-bar sediment. For channels lacking point bars, interpretation of bankfull stage necessitates observations of channel morphology and gradient, channel sediment, vegetation, root exposure, and indications of flood processes.

## Channel Characteristics

Channel characteristics of stream reach are a function of the fluxes of water and sediment (including discharge variability and the range and proportions of sediment sizes) conveyed to the reach from higher in the drainage basin. Vegetation is also a determinant of channel and near-channel characteristics, but it too is dependent on fluxes of water and sediment.

A wide range of flux conditions can produce similar channel conditions at a site. In addition, site conditions are variable in time, reflecting recent floods or flood sequences. Therefore, multiple evaluations of channel conditions should be conducted over time, as sediment released by one flood may not be representative of long-term, mean fluxes of water and sediment. The slope of the channel, or its gradient, is an

integration of water and sediment inputs to a reach over time, and thus should be regarded as a diagnostic of long-term conditions of the reach. The re-establishment of bottomland characteristics and habitat similar to those that persisted prior to modification depends on an approximate replication of the previous channel gradient.

## REFERENCES

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Photos: Apache-Sitgreaves National Forests, Arizona