Rapid Geomorphic Assessment Picture Key

Note: Portions of this document have been modified/removed by the WV Save Our Streams Coordinator. Visit the web page below to download the full version.

http://www.maine.gov/dep/blwq/docstream/team/stream_survey_manual/vol_1/appJ-3.pdf

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Acknowledgements

This picture key is intended to compliment the Rapid Geomorphic Assessment (RGA) technique. We thankfully acknowledge the following source for the RGA technique currently being promoted by the Maine Stream Team Program (Maine Department of Environmental Protection) and Fisheries Research Section (Maine Department of Inland Fisheries & Wildlife):

Parish Geomorphic Ltd. (Georgetown, Ontario, Canada). 2003. Rapid Geomorphic Assessment (RGA). *Adapted from the RGA method described in*:

Ontario (Canada) Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario; Ontario, Canada.

Section heading text was adapted from parts of *The Streamside Sentinel* (1999) and the *Vermont Stream Geomorphic Assessment Protocols* (2004), publications of the Vermont Agency of Natural Resources — < http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassess.htm >.

We also would like to thank John Field (Field Geology Services, Farmington, Maine) for assistance in editing this picture key.

Tips for Use

This picture key is meant to accompany the rapid geomorphic assessment (RGA) portion of the datasheets and instructions in Appendix J (Stream Corridor Survey [Level 1] Field Sheets) of the MDEP/MDIFW guidance document entitled "Stream Survey Manual (Volume 1): A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds" (2008). It is designed to help translate the scientific jargon in the RGA into practical information that you can apply in the field.

This document should in no means be considered a replacement for training, and is not intended to produce the same caliber of results you would obtain from a professional fluvial geomorphologist. It should, however, help you to gain a basic understanding of the underlying water– and sediment-transport issues affecting your stream of interest, and help you identify stream reaches that may be abnormally unstable.

You can share this information with stream specialists to determine whether your stream may have significant instability issues. Information gleaned from these stream corridor surveys, including the RGA component, can help identify possible good or poor fisheries habitats as well as where simple best management practices (BMPs) such as riparian (shoreland) tree plantings, or ATV or cattle exclusion projects, ought to be focused. This information may also help you prioritize regions of the stream watershed where soil erosion BMPs ought to be focused to reduce impacts on the stream. More complex problems, especially those associated with actual streambank or channel features, require the guidance of stream specialists (e.g., geomorphologists, biologists, natural resource engineers, etc.), more intensive studies and, possibly, engineering designs and appropriate DEP permits.

If you are interested in more information about the Rapid Geomorphic Assessment (Level I), or other volunteer stream surveying techniques within the State of Maine, please contact the Maine Department of Inland Fisheries and Wildlife, Fishery Research Station, 650 State Street; Bangor, ME 04401; or the Maine Department of Environmental Protection, c/o Maine Stream Team Program, 312 Canco Rd., Portland, ME 04103 or by emailing < mstp@maine.gov >.

If you are interested in more comprehensive geomorphic assessment techniques, we suggest checking out the geomorphology protocol guidance documents and other materials produced by the Vermont Agency of Natural resources at < http://www.vtwaterquality.org/rivers/htm/rv_geoassess.htm >.

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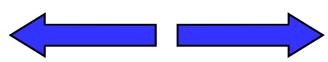
9. Photo © Richard Harwood, Black Hawk College
10. Image obtained from Maine Office of Geographic Information Systems (GIS).
11. Image supplied by Field Geology Services (Farmington, ME).

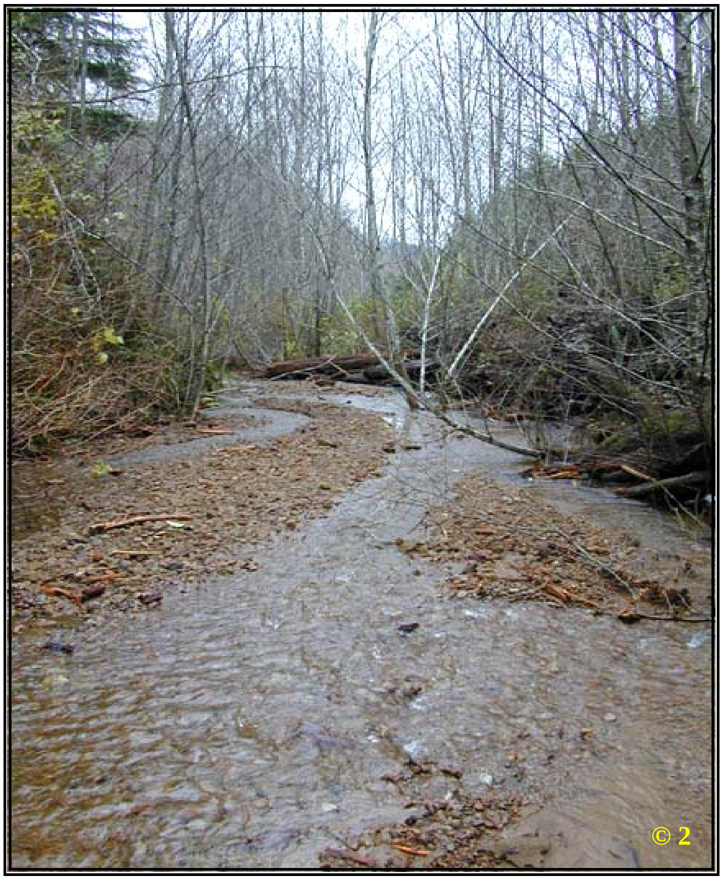
Photographs and Direction of Water Flow

Many of the principles described in this picture key are demonstrated with photographs and diagrams. For the sake of consistency, all **blue** arrows represent direction of water flow within a river or stream channel. Arrows of any other color will have an associated text box describing the feature of interest.

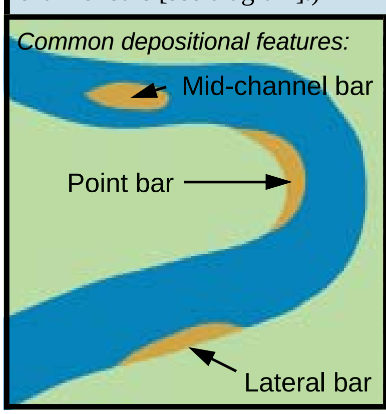


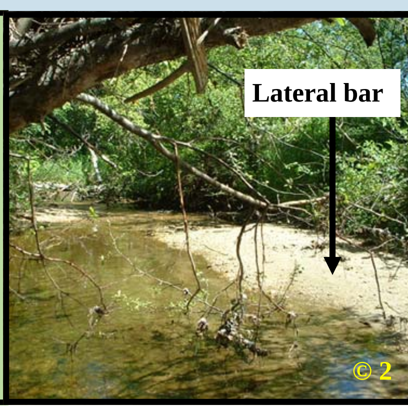
EVIDENCE OF AGGRADATION

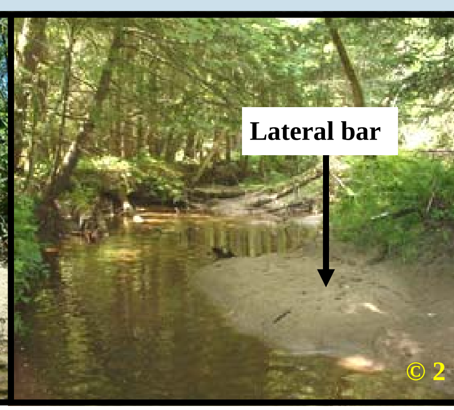
Sediment loads pile up in the river. This happens when the sediment load to the river increases (due to natural processes or human activities) and it lacks the capacity to transport it. Piles of sediment in a river can re-direct flow against the banks, causing yet more erosion.



1. Lateral bars—Sediment bars located on the side of a river channel. (Do not confuse lateral bars with point bars or mid-channel bars [see diagram].)



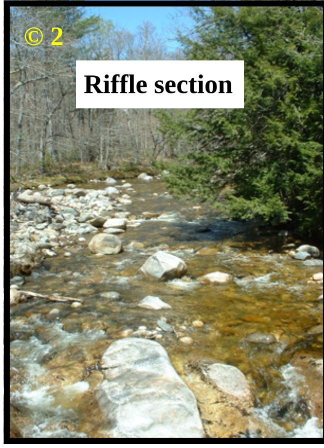


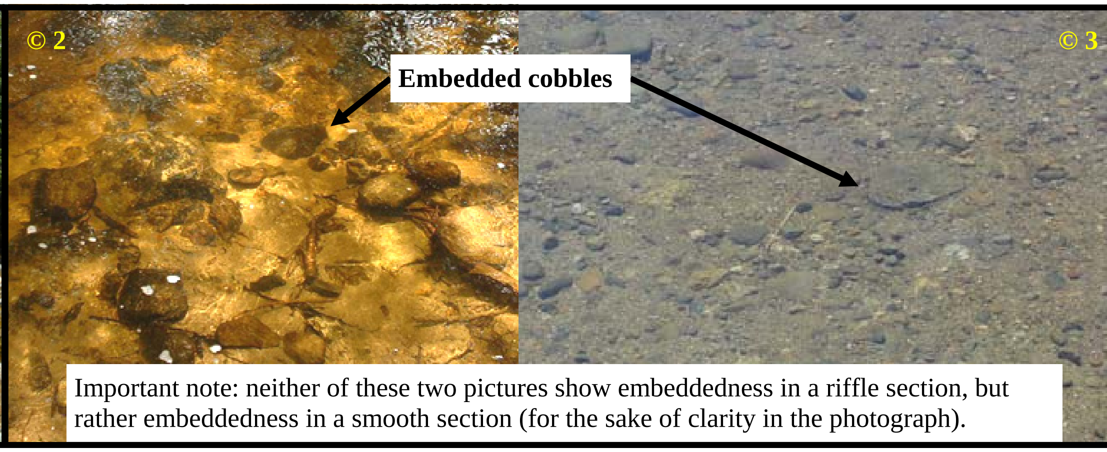


EVIDENCE OF AGGRADATION

2. Coarse materials in riffles embedded—Are rocks (fist-sized and bigger) partially or entirely buried by fine sediments (sands, silts, muds) in riffles? If you pick up a cobble, is there a hollow left in the sediment? Is it difficult to pry cobbles out of the sediments?

***Riffle:** n. Shallow, turbulent area in stream where water flows swiftly over gravel and rocks.*

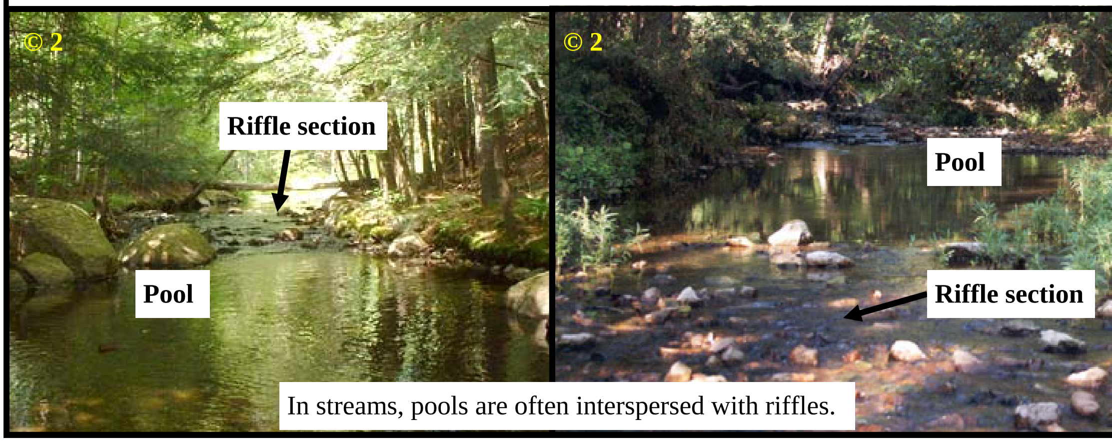




Important note: neither of these two pictures show embeddedness in a riffle section, but rather embeddedness in a smooth section (for the sake of clarity in the photograph).

3. Siltation in pools—Are fine sediments being deposited in pools?

***Pool:** n. Deeper portion of stream where water flows more slowly.*

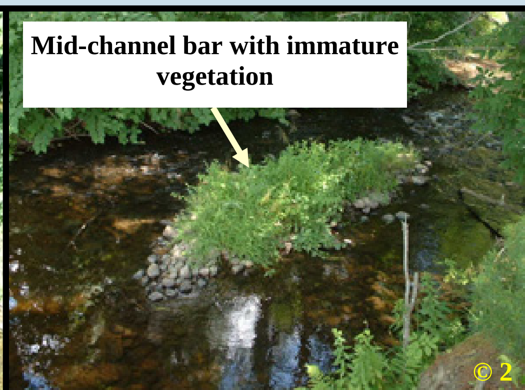


In streams, pools are often interspersed with riffles.

IMPORTANT NOTE:
You are looking for evidence of fresh deposition of fine sediments that will have buried any organic material (leaves/etc.)

LONG-TERM TIP:
If you were to drop a large white stone into the pool and return to the pool after the next storm, would the stone be covered?

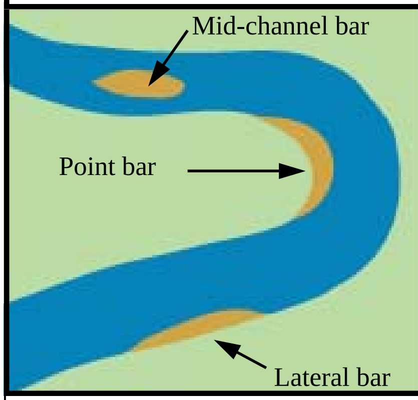
4. Mid-channel bars—Bars formed in the mid-channel zone, not extending completely across the channel, and lacking mature vegetation (trees, etc.).

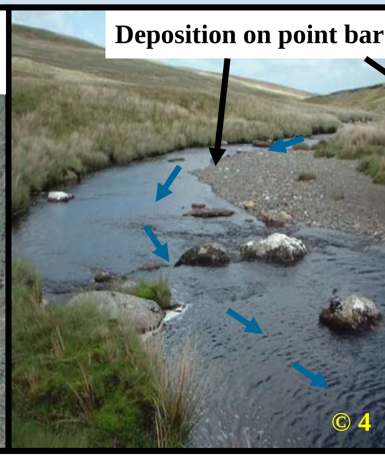


EVIDENCE OF AGGRADATION

5. Deposition on point bars—Is new, fresh material being deposited on the inside of meander bends?

Common depositional features:

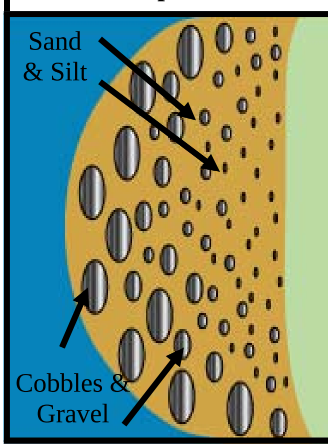




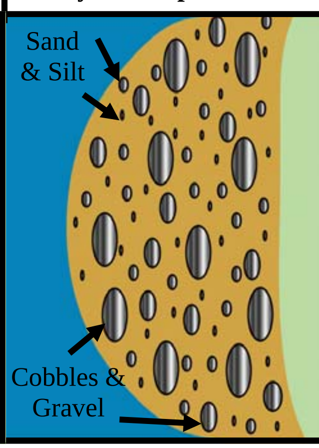
CAUTION: Point bars are natural features. You are not looking for the existence of point bars, but rather, evidence of fresh deposition on the point bar. This will appear as fine- to coarse- grained sediment, and is often unconsolidated (it has not had time to compact).

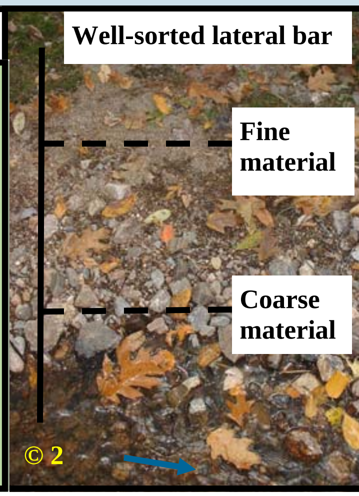
6. Poor lateral sorting of bed materials—Typically, larger materials are deposited on bars and banks at lower heights than smaller materials. This results in a "layering" effect with cobble and rubble being deposited at the toes of depositional features whereas silts and sands are deposited higher up (see drawing). If these patterns are not discernable, then longitudinal sorting is poor.

Well-sorted point bar



Poorly-sorted point bar





Poorly-sorted lateral bar:
no sorting evident along transect

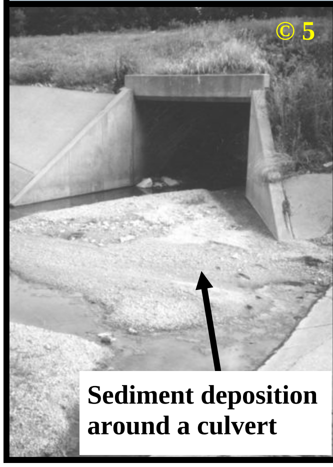
7. Soft, unconsolidated bed—Sediment surface materials are loose and easily suspended or moveable. "Mucky" sediments can be considered soft and unconsolidated.

Boots often stir up clouds of muck as you walk in fine-grained unconsolidated beds.

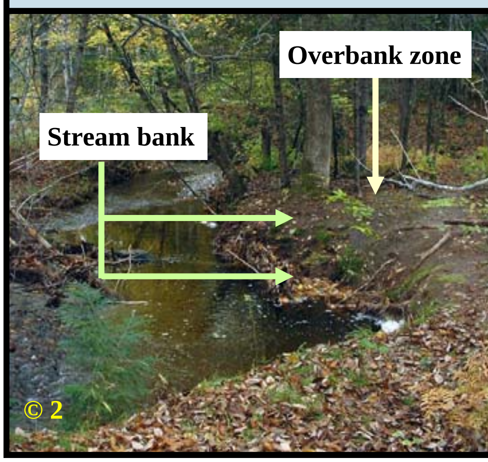
QUICK TIP:
The best way to test for unconsolidated beds is to walk the channel. If you sink in, the bed is unconsolidated.

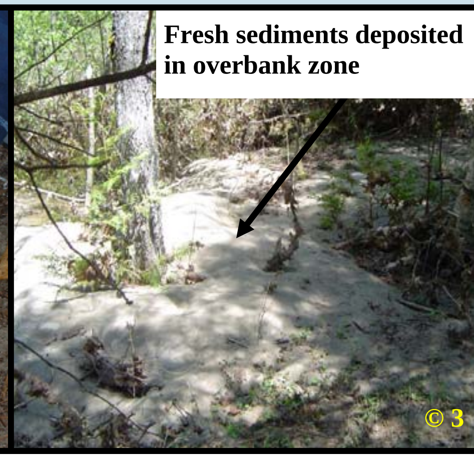
EVIDENCE OF AGGRADATION

8. Evidence of deposition in/around structures—Are sediments being deposited around or in conjunction with larger, more sedentary features such as boulders, culverts, bridge abutments, or in-stream woody debris?



9. Deposition in the overbank zone—Evidence of stream deposited materials above the banks (i.e. on the flood-plain, where the permanent vegetation starts).



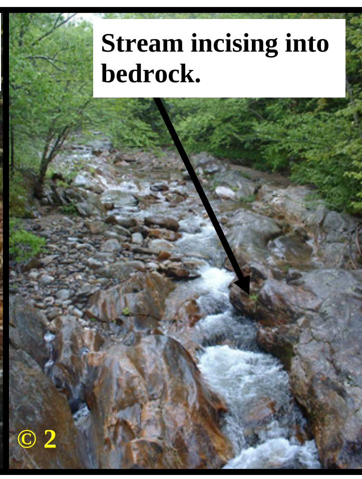


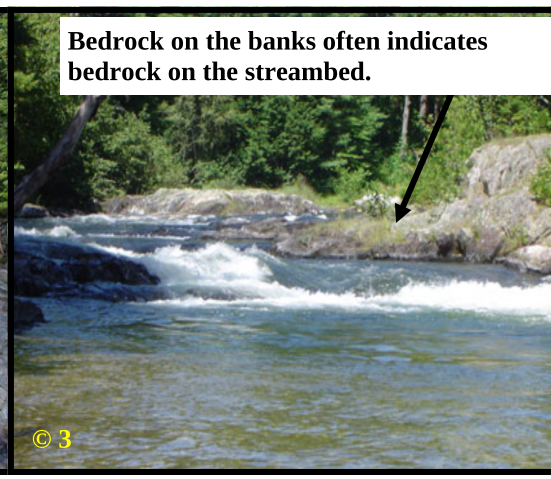
EVIDENCE OF DEGRADATION

The river cuts deeper into the land. One result is that bridge footings are undermined and exposed. Degradation can sometimes be caused by straightening and shortening a channel, which increases the slope of the river. The water flows faster down this steeper slope and has extra energy to move sediment, causing the river channel to cut deeper or degrade. Other causes of degradation include increases in peak flows and frequency due to activities such as poorly-planned urbanization, agriculture, and forest practices.

1. Channel incision into undisturbed overburden/bedrock—The exposure of an erosion-resistant layer of relatively large materials or bedrock on the surface of the streambed.

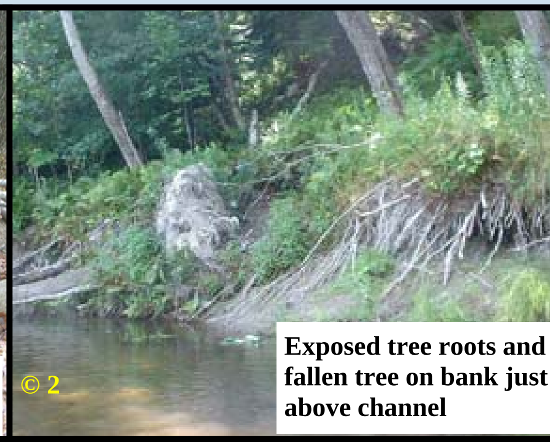
Incision: *n. The process in which a river cuts downward, lowering its base elevation.*



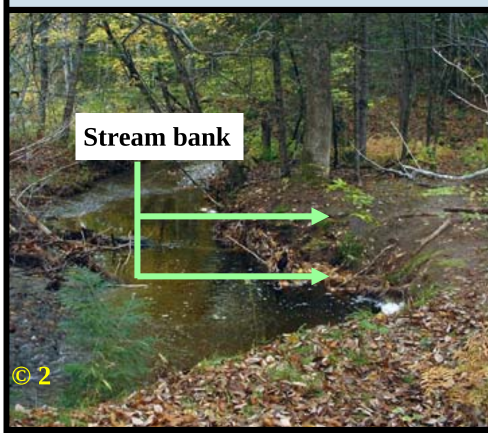


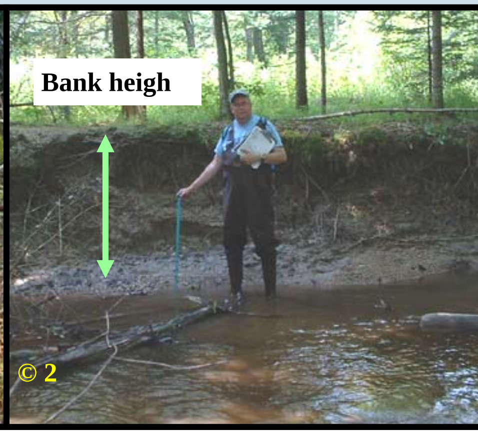
EVIDENCE OF DEGRADATION

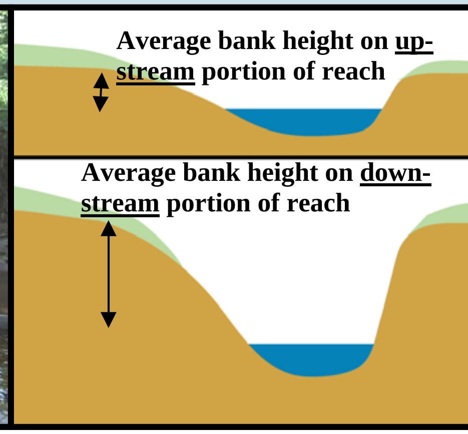
2. Elevated tree roots/root fan above channel bed—Are the trees within the channel or just above on the adjacent bank being scoured around their root network?



3. Bank height increases—Typically, bank heights are relatively uniform through a reach. If, on average, the banks of downstream areas are noticeably higher than upstream areas, then bank heights are increasing.

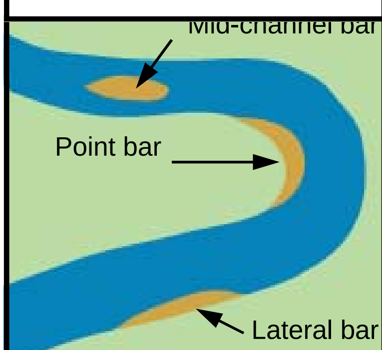


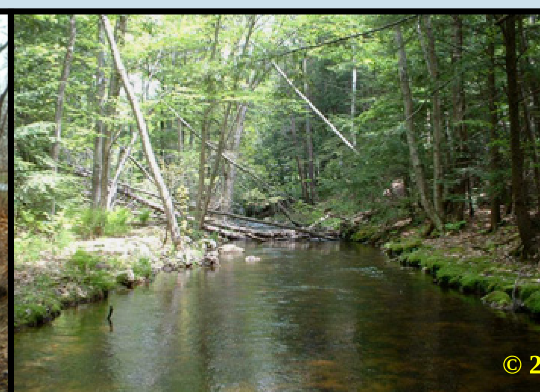




4. Absence of depositional features—No bars or other depositional features are present (particularly where you would expect to see depositional features). Should be a reach-wide condition.

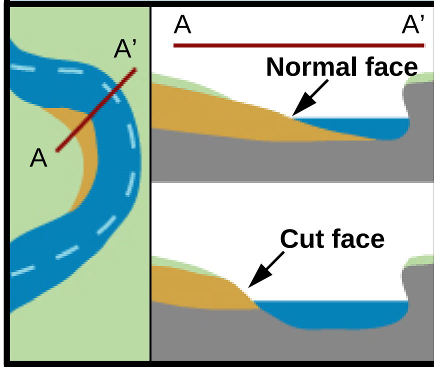
Common depositional features:





EVIDENCE OF DEGRADATION

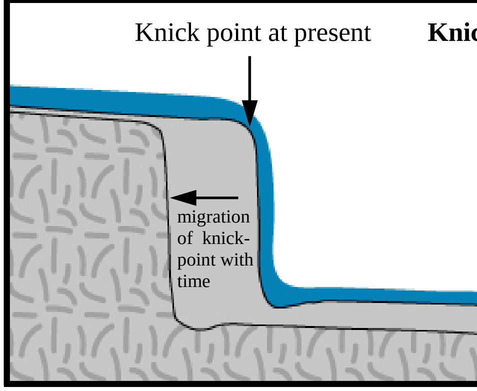
5. Cut face on bar forms—Are the toes (lowest portions) of bars being actively scoured away?



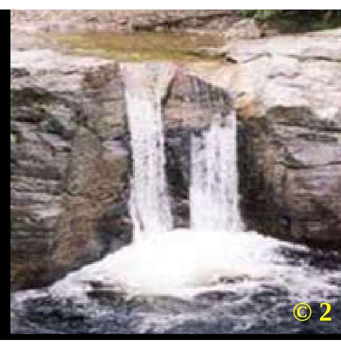
Cut face on bar

Scour: *v. to remove with high flows of sediment-bearing water*

6. Head cutting due to knick point migration—Upstream migration of an abrupt change in slope (cascade or waterfall) of the stream channel resulting in increased current velocities



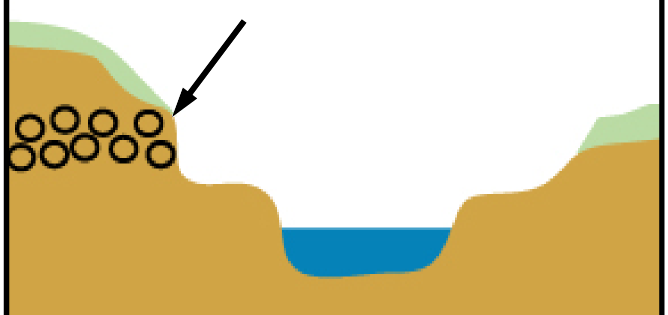
Knick point migration in bedrock



Knick point migration in unconsolidated sediments.

7. Suspended armor layer visible in bank—The exposure of an erosion-resistant layer of relatively large materials higher up in the stream bank.

Erosion-resistant layer of cobbles indicates old stream channel bottom elevation.

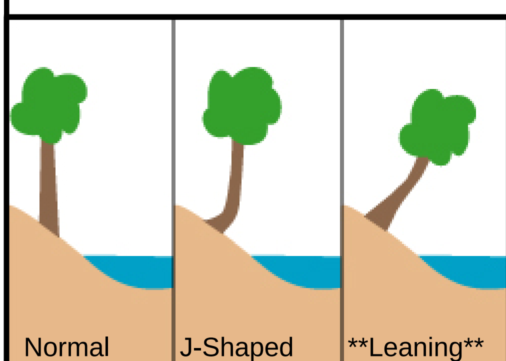


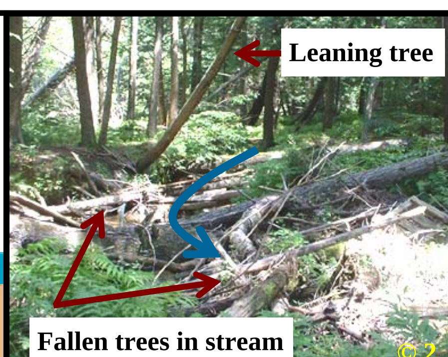
EVIDENCE OF WIDENING

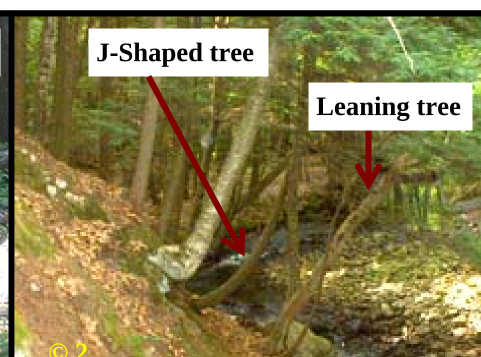
Banks collapse, and the river becomes wider and shallower. A wider, shallower river does not have the same capacity to transport sediment, so sediment can build up in the channel. ~ ~ ~ Widening is a process that typically follows aggradation or degradation geomorphic phases. Widening occurs because the stream bottom materials eventually become more resistant to erosion (harder to move) by the flowing waters than the materials in the streambanks.

1. Fallen or leaning trees, fence posts, etc.—Are nearby stream bank structures falling into the channel?

QUICK TIP: Take a careful look at the shape of tree trunks on the stream banks. Trees growing on a stable slope will have a straight, vertical trunk. Trees growing on a slowly slumping (but mostly stable) slope will have a J-shaped curve in their trunk, but the top of the tree will be oriented close to vertically. Trees growing on an unstable slope may have a curve to their trunk, but will not be oriented vertically; they **lean** towards the channel. See the drawing below.





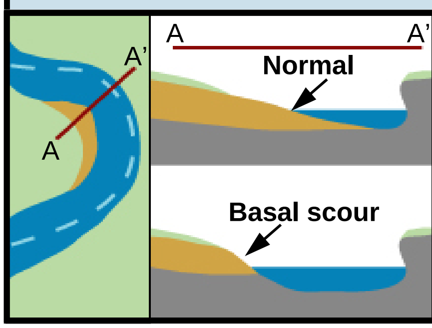


EVIDENCE OF WIDENING

2. Occurrence of large organic debris—Are trees or collections of woody debris present in the channel/on bars?

3. Exposed tree roots—Are trees on the banks being scoured out with roots exposed?

4. Basal scour on inside meander bends—Are point bars being actively eroded away, or is the thalweg migrating toward the inside of the meander?



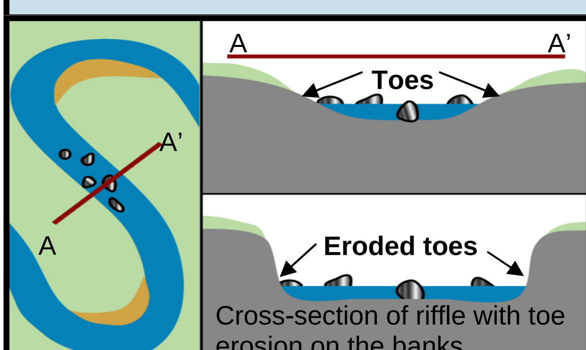
Meander bend: n. Broad, semi-circular curve in a stream that develops as a stream erodes the outer bank and deposits sediment on the inner bank.

Thalweg: n. The deepest part (often fastest moving) portion of the channel. For a stable stream, the thalweg is on the outside edge of a meander bend (see pale-blue dashed line on the figure).

IMPORTANT NOTE:

The point bar may be partially-scoured or may be missing altogether.

5. Toe erosion on both sides of channel through riffle—Are sediments being actively eroded from both sides through higher velocity areas?

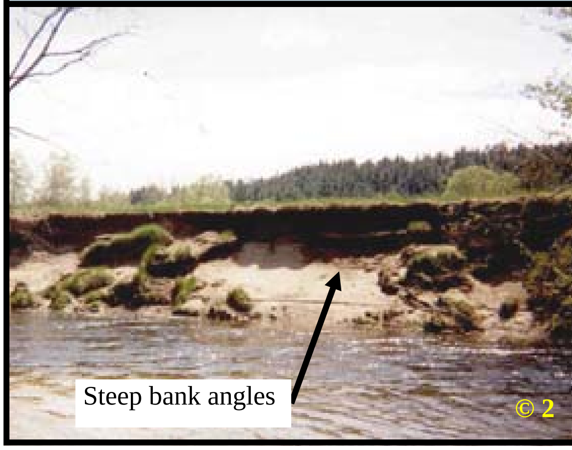


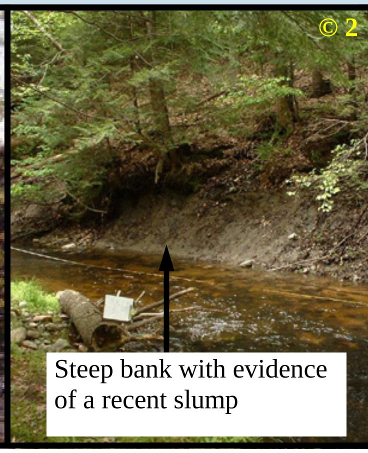
Toe: n. Base of a bank or bar

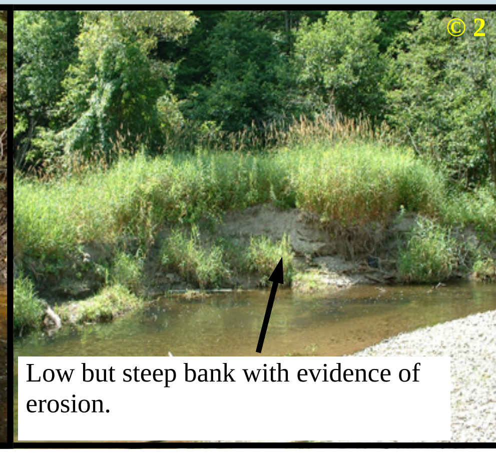
Riffle: n. Shallow, turbulent area in stream where water flows swiftly over rocks.

EVIDENCE OF WIDENING

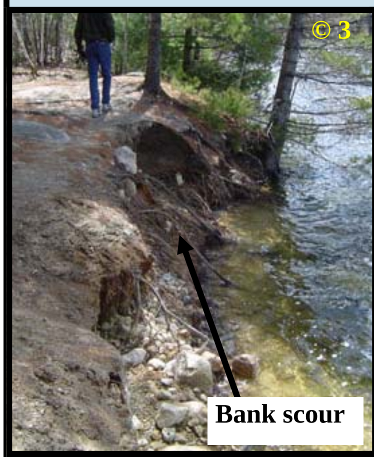
6. Steep bank angles through most of reach—Are the stream banks on both sides steep with evidence of recent slumps or erosion? Focus more on straight segments of the stream, where slumping would be less expected. (Banks may be steep due to natural processes, but for this question you're looking for banks steepened by slumping and erosion from river processes.)

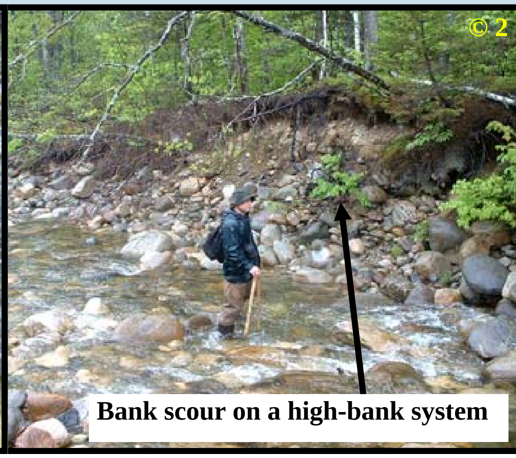


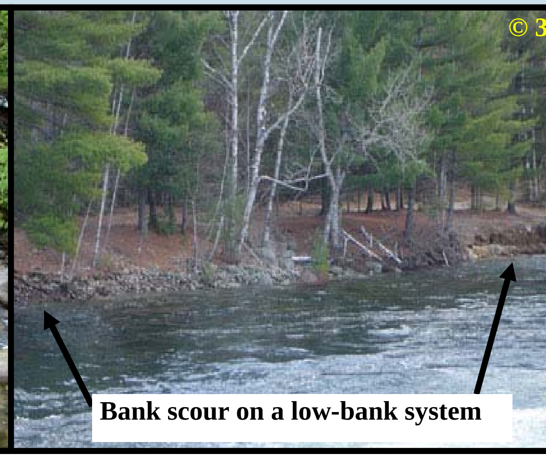




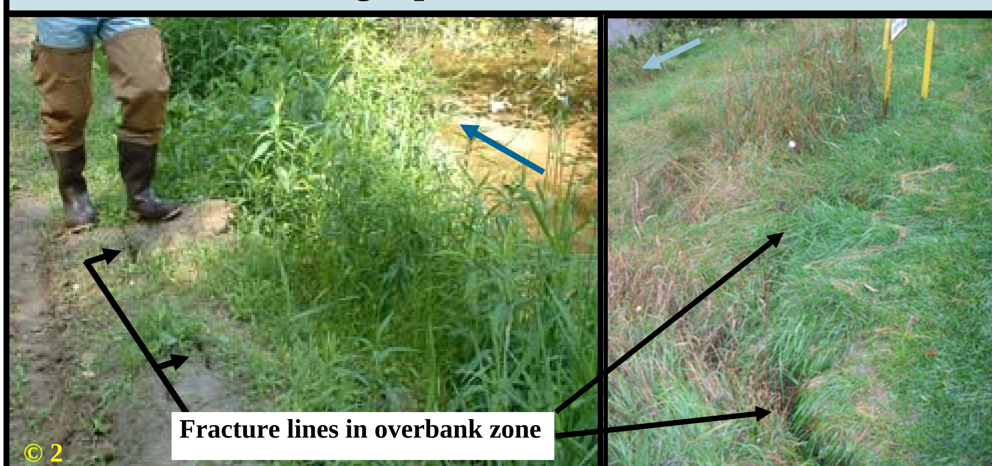
7. Length of bank scour >50% through subject reach—Is there evidence of active erosion or bank slumping along more than half of the reach?







8. Fracture lines along top of bank—Are there cracks or visible lines parallel to the channel in the overbank zone?



Overbank zone—
n. The floodplain (relatively flat slope) adjacent to the river bank (steeper slope).