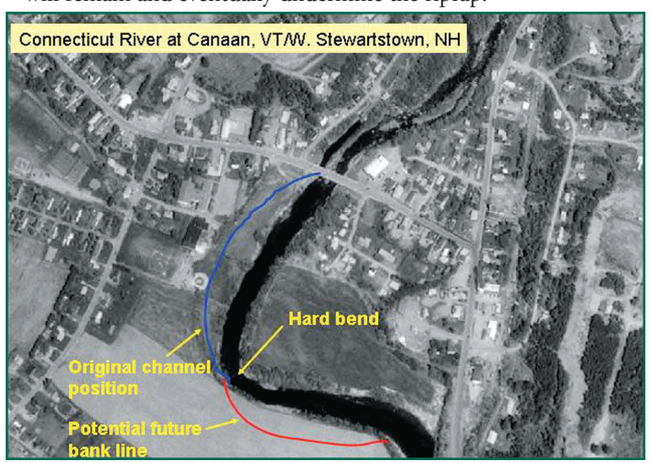
# Channelization

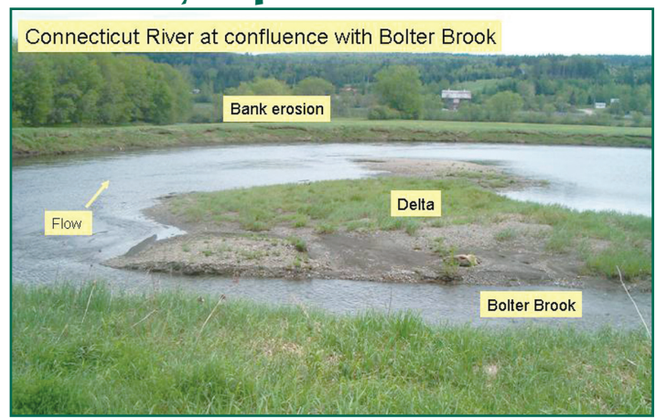
Over 30 percent of the northern Connecticut River was straightened by humans in the 19th century. Reasons for this straightening likely include log drives, railroad construction, and agriculture. While bank erosion previously occurred in the straightened areas as the channel widened, erosion continues today primarily where the straightened channels re-enter naturally meandering sections at artificially sharp bends. The erosion will likely continue for decades but will diminish over time as the river spends its energy more evenly throughout the bend rather than focusing it at a single point.

### MANAGEMENT OPTIONS

- **Recreate the Natural Meander Pattern.** Returning the river to its original meandering channel would eliminate hard bends in the river, reduce erosive pressures, and diminish downstream sedimentation impacts. Current land use makes this option impossible in most situations but opportunities should be sought where this option can be used when land use changes.
- **Riparian Buffer Plantings.** Planting trees where erosion is occurring will reduce the rate of erosion as the trees mature. A reduced rate of erosion will minimize downstream impacts while enabling the channel to reach a stable configuration with more gentle bends. Federal programs are available to establish conservation easements and compensate landowners for lost agricultural productivity in planted areas.
- **Rock Riprap.** Placement of large rocks on the river bank will stop erosion at the site temporarily. However, this option should be employed only when roads or other human infrastructure are under immediate threat because stopping erosion at hard bends will lock the river in an unstable condition and transfer erosion downstream. Long-term success of this option is low, as erosive pressures will remain and eventually undermine the riprap.




# Tributary Inputs



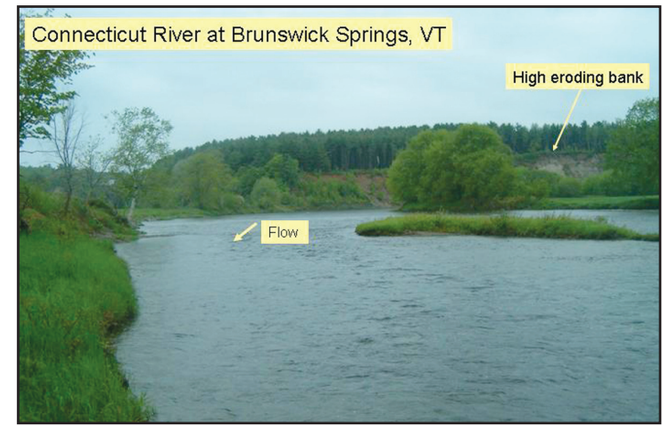

Small deltas form at the mouths of tributaries as they enter the Connecticut River and deposit their sediment. Flow diverted around these deposits causes erosion as it is deflected into the opposite bank. Point bars and mid-channel bars often form downstream of larger confluences and erosion results from flow diverted around them. While some erosion probably occurred naturally at tributary confluences, human activities within the tributary watersheds, such as extensive land clearance or channel straightening, speed up the delivery of sediment to the mainstem and make the erosion problems worse.

### MANAGEMENT OPTIONS

- **Reduce Sediment Inputs.** If the amount of sediment entering the mainstem is reduced, the sand and gravel bars will diminish in size, cutting down the rate of erosion. Sediment inputs could be reduced by either stabilizing sediment sources or storing sediment in the tributary watershed. This option may require watershed-scale restoration and could take years before improvements are seen. May work best in smaller tributary watersheds.
- **Bioengineering.** The use of logs to deflect water away from the eroding bank will reduce erosion while improving fish habitat. The deflected flow could scour the bar at the tributary confluence and reduce flow impacting the eroding bank. If sediment inputs remain high, however, sediment may be transferred further downstream, creating new erosion problems. Buffer plantings are also advised.
- **Rock Riprap.** Placement of large rocks on the river bank will stop erosion at the site temporarily. However, as sediment continues to build out into the channel, the lack of erosion on the opposite bank will result in a narrowing of the channel and scour at the base of the riprap. If riprap is not built below the channel bed, the rock could be undermined.

# High Eroding Banks

Sediment eroding from high banks of glacial outwash deposits may create a greater load of sediment in the river than it can carry. Therefore, sand and gravel bars form downstream of the high banks. Flow diverted around the bars leads to erosion of the adjacent banks much like at tributary confluences. Erosion of high banks may supply sediment several miles downstream, accelerating bar growth and aggravating erosion problems. The location of erosion can shift over time as bars migrate downstream.




### MANAGEMENT OPTIONS

- **Realignment of River Channel.** Moving the river channel away from the high bank and placing it elsewhere on the floodplain would eliminate the sediment inputs from the high bank. This option would work best where channel straightening is responsible for instability of the high bank and the channel can be returned to its original location. Current land use may make this option impossible but opportunities should be sought to use this option as the use of the land changes.
- **Riparian Buffer Plantings.** Planting trees where erosion is occurring will reduce erosion rates as the trees mature. Although flow deflection around bars will undermine the bank, the trees that fall in will provide further bank protection. Plantings should extend beyond the immediate area of erosion since the bars migrate downstream over time.
- **Rock Riprap.** Placement of large rocks on the river bank will stop erosion at the site. However, as bars migrate downstream, the focus of erosion will shift to unprotected areas along the river bank. This option should be employed only when roads or other human infrastructure are under immediate threat, because erosive pressures are unlikely to persist in a single area for long periods of time while the rock will remain indefinitely and affect channel stability downstream.

## Bank Erosion on the Upper Connecticut River

A 2004 fluvial geomorphic assessment of 85 miles of the Upper Connecticut River between Pittsburg, New Hampshire, and Gilman, Vermont, identified the major factors causing bank erosion: 1) human channelization and straightening; 2) sediment inputs from tributary watersheds; and 3) sediment inputs from high eroding banks of glacial outwash deposits. While floating ice and debris can also do considerable damage, these three causes largely control the location, extent, and severity of bank erosion along the upper Connecticut River. They are described in this brochure with suggestions for managing the erosion. Fluvial geomorphology is a branch of geology that studies how rivers respond to changes in natural conditions and human land use within the watershed.

Over 25 percent of the river banks in this region are eroding, and another 15 percent are protected with rock riprap. More than 30 percent of the river's length here was straightened by humans before 1925. Most banks along straightened channels are now stable after an earlier period of erosion that left these segments wider and deeper than their natural meandering counterparts. Erosion still occurs, however, at the downstream and upstream ends of straightened segments as the river meets artificially sharp bends.

Sand and gravel bars at tributary confluences divert the flow into the opposite river bank, causing erosion. Examples are the mouths of the Mohawk River, Israel's River, and several smaller tributaries where extensive land clearance has recently occurred in the watershed. Sediment from high eroding banks also creates bars downstream that divert flow into adjacent banks where erosion results. Migration of the bars means that the channel instabilities shift through time and that attempts to armor the banks will prove ineffective as the location of erosion changes.

A riparian buffer is absent along 20 percent of the 85 miles of river studied. While the absence of a buffer does not in itself cause erosion, banks are more susceptible to erosion where a buffer is absent. Study results indicate that establishing a riparian buffer at least 25 feet wide can improve bank stability even where erosive pressures are high.

Long term resolution of erosion problems depends on addressing their root cause, but such an approach often requires realigning the river channel or providing the river room to more freely migrate. If the river's erosive power is allowed to dissipate within an area that will remain free of development, rather than remain focused at a single point, the rate and severity of erosion potentially can be reduced where homes, roads, or other infrastructure might be at risk. Towns and landowners wishing to reduce the need to manage erosion problems over the long term should actively seek opportunities to establish conservation easements to protect the river's floodplain and avoid future conflicts with homes and other structures.

This brochure is intended to accompany maps of bank erosion and composition prepared for each town along the Upper Connecticut River. Please contact your town office for a copy of the erosion map of your town, or visit www.crjc.org. (Colebrook is shown below.)


**For more information contact:**
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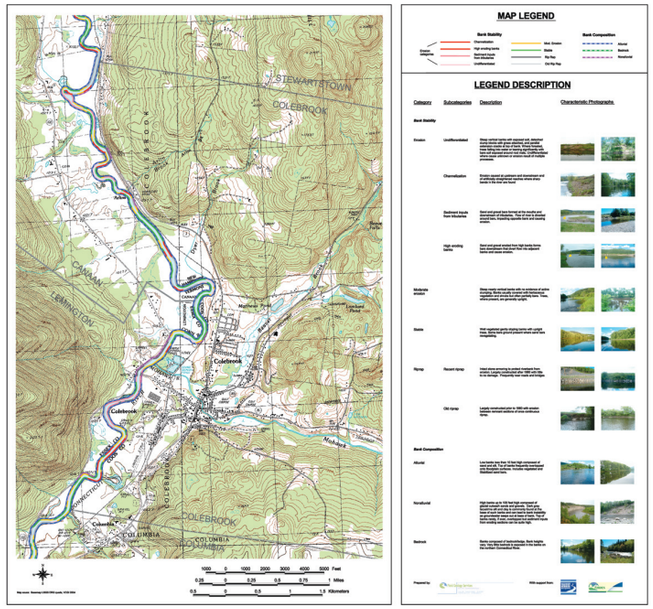
Bank Stability and Composition on the Connecticut River in Colebrook, NH

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NEW HAMPSHIRE CHARITABLE FOUNDATION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

THE Vermont Community Foundation


Dec. 2005


# Causes & Management of Bank Erosion on the Upper Connecticut River

*Connecticut River at Brunswick Springs, Vermont.*

***Understanding the causes of erosion can lead to long-term solutions to persistent problems***