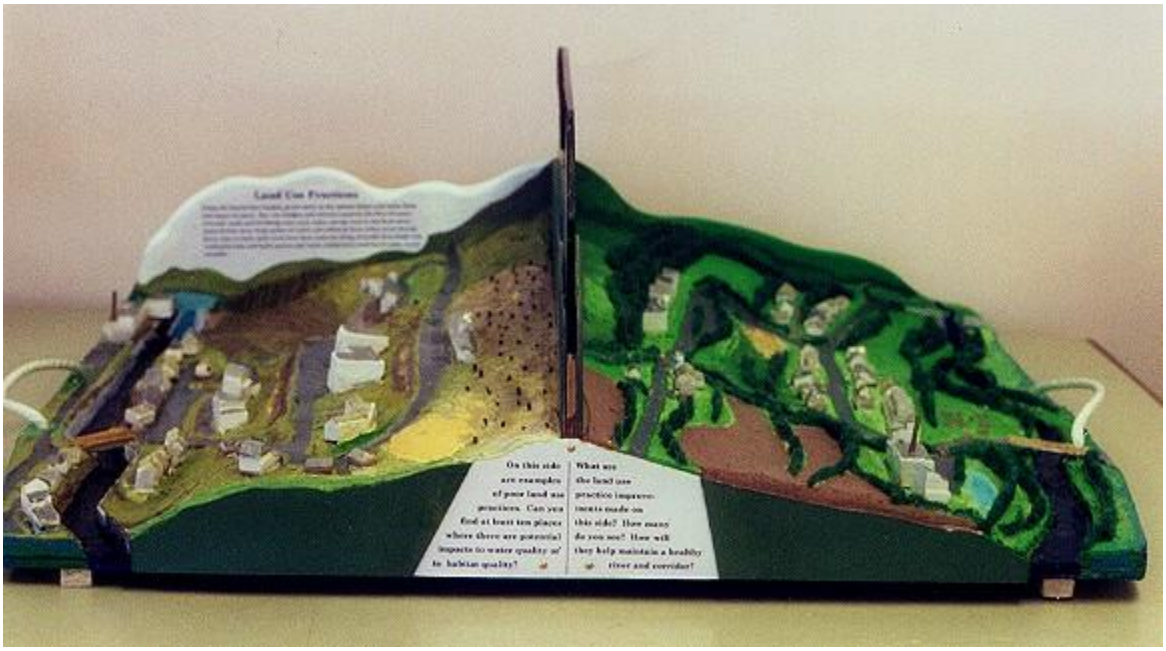
# THE WORK & BEHAVIOR OF RIVERS: PART 4




*Students love this exhibit. The model challenges the viewer to see how many differences they can find and why they are important. (Houses, businesses, a factory and a gas station, are moved up out of the floodplain, which is used instead for community gardens. The factory parking lot has a swale for run-off. The dam is removed, as well as a concrete lining of the river channel and a road too close to the river. Vegetation is planted along the river and its tributaries, and a forested area protects the upland slopes. New housing development sites have run-off protection features. Barn wastes are contained and all farm fields have vegetated buffer strips. Some roads are of gravel to increase drainage, and road bends are protected from gully washes. Even the main bridge over the river leading into town has been specially designed so it won't constrict the floodplain.)*

Today the forests have largely grown back on the upland slopes and many dams and mines are gone. But, our bridges and culverts constrict the flow of water; riverside roads and buildings take away water storage area in the flood plain; storm drains carry large pulses of water and sediment from urban areas during heavy rain or snow melt; trees have been removed along riverside farm fields and residential lots; and hydro-power and water withdrawal continue to make rivers unstable.

## *SOME DIFFERENCES BETWEEN GOOD & POOR LAND USES*

**Poor:**

- *Placement on streambanks of "hard armor," like concrete walls or steel sheetpiling.*
- *Erosion along streambanks.*
- *River is dammed.*
- *Industry and stormwater waste pipes go into the river.*
- *Road adjacent to the river.*
- *Lots of buildings in the floodplain, including what appears to be a gas station.*
- *Lots of pavement shedding water fast, with no soil to take up moisture, nutrients and pollutants.*
- *Narrow bridge constricting the river.*
- *Plowed farmland adjacent to the river.*
- *Barnyard next to tributary with wastes going into the water.*
- *No vegetation on upland terraces which exhibit erosion and runoff into tributary.*
- *No culvert or ditching into vegetated area where roads converge, creating an eroding gully.*
- *No vegetation along tributary.*
- *A large dirt or sand pile without runoff protection.*
- *Large clear cut forested area on uplands.*

**Good:**

- *Streambanks are well vegetated.*
- *Roads well away from river.*
- *Bridge stretches across floodplain, and has culverts in the floodplain to pass floodwaters through.*
- *No buildings on the floodplain.*
- *The dam has been removed and the river is free-flowing.*
- *Pavement is limited; some roads are dirt.*
- *Farmland sits back, with plenty of vegetation between fields and the river.*
- *Cropland is contour plowed; barnyard is set back from river.*
- *Upland terraces are well vegetated.*
- *Gas station is away from the river.*
- *Industry's runoff receives pre-treatment in a ponded area.*
- *The tributary has vegetated buffer zones.*

---

Knowing the principles of a healthy "stable" river system gives us hints at how we can help restore unstable rivers. There is not much we can do in urban areas, and moving people and infrastructure out of floodplains is enormously complex and expensive. However, one of the most important actions we can take elsewhere is to

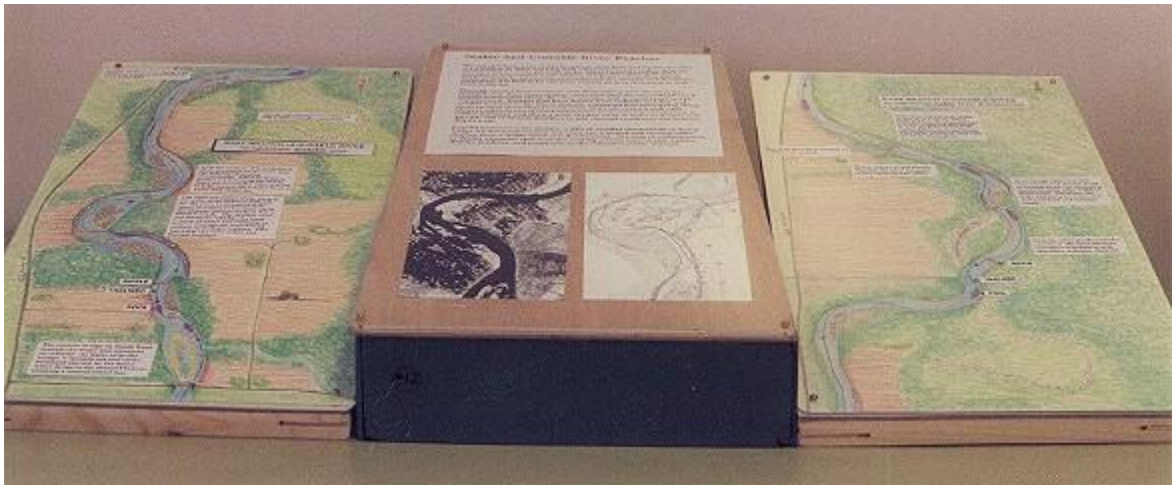
accurately map flood prone areas to restrict further development, restore wetlands, plant vegetation along river channels, and create permanent vegetated buffer zones between human activities and water courses.

The riparian zone is the area adjacent to a river, a transition between the river and upland terrain. It might be wetlands, sloping hillsides, a floodplain or level terraces. Vegetation in this zone is crucial for organic detritus, edge habitat (providing food or shelter/nesting/ hiding/resting environments where the terrestrial and aquatic worlds meet), erosion control, and temperature control. The plant communities provide animal habitat, moderate temperature on land and in water, inhibit erosion and bind soil, provide organic material to the soil and river, and the woody debris that creates micro-habitats important to fish and invertebrate species.

*A river and riparian area with and without vegetation. Two beautifully painted plexiglas panels depict animals, trees, shrubs, and grasses that provide wildlife habitat, and tree roots that help bind the bank soil. The panels can be levered and when in an upright position the riparian area without vegetation appears with rills, gullies, erosion, and one sees a very muddy river.*


---

*This model compares a stable river reach in Keene Valley, NY, with an unstable river segment just upstream. A complete description of the model would require too much space. Principles of stream morphology, and a portion of an engineered survey map, are shown on the center box. Two other side boxes depict the differences (width, depth, meander pattern, slope, substrate, channel roughness, and vegetation) between an unstable reach and a downstream stable section.*



We can help some rivers restore their beds and banks, but this must always be done working with natural processes rather than imposing what we want the river to be. Since rivers should be active partners to accomplish work, and what they are capable of doing can be predicted by measurements and observation of the channel and floodplain, sometimes it is best to let the river correct a problem area of erosion or sediment build-up.

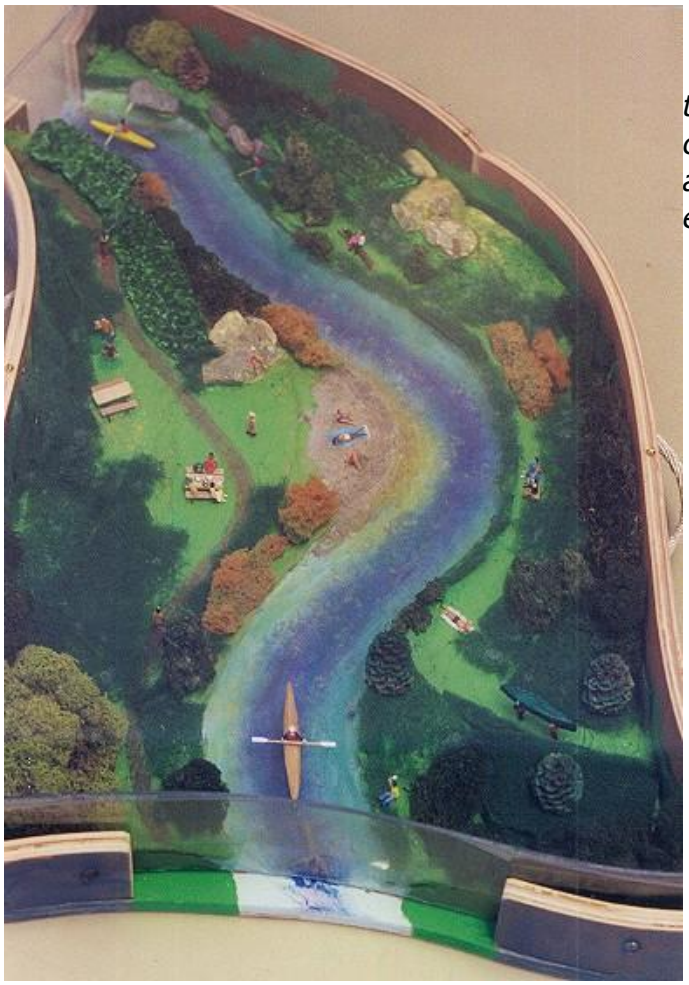
Through careful measurements, and determining how the river has changed over time, some streambank and habitat restoration designs can be implemented. Designs that have helped river stability and fish and wildlife habitats in the Basin include: anchoring tree revetments along short eroding streambanks; root wads and rock vanes;

brush rolls along eroding banks of small tributaries; in-stream logs revetments to collect sediment and allow a wide shallow river to begin to deepen and narrow; and in-stream boulders to add channel roughness and improve fish habitat.

Careful measurements along a ½ mile of eroding streambank in Keene Valley NY demonstrate how the river has widened and become more shallow than a stable reach just downstream. The task of restoration will be to design measures that turn the eroding section into similar widths, depths, gradient, and roughness as the reference stable channel.

---

The benefits of promoting the processes and ecology of river systems as they occur most frequently in nature are multiple. Narrow and deep channels will best transport sediments which means there will be less streambank erosion and channel scouring by the river. Vegetated riparian corridors and buffers will provide animals with nesting, food, and movement corridors. Water quality and channel substrate will be suitable for aquatic insects and fish spawning. In addition, we will have the best rivers for recreational uses such as swimming, boating, and fishing.



*Tiny figures in this model hike, sit on the point bar and on a log, fish, carry a canoe and kayak. The vegetation is lush and varied, and the stable river section is enjoyed by people and animals.*