

Green River of the Upper Colorado – Case Study

Riparian Ecosystems

Cottonwood and willow forests are a prominent feature of the riparian ecosystems found along the Green River. These mixed-age forests occupy a broad range of habitats across the floodplain which are, in turn, influenced by the river's flow patterns (particularly the frequency and duration of floods and high flow pulses), sediment regime, and channel dynamics.

Viewed from the air, the Green River looks like a sinuous snake. The river migrates back and forth across its floodplain over time. River migration is particularly active during big, long-duration floods. As the river channel migrates laterally, sand and gravel bars are formed on the inside of meander bends. Young cottonwoods and willows become established on these low-lying floodplain areas. Over time, sediment accumulates in the cottonwood and willow stands, such that by the time the cottonwoods and willows reach the end of their lifespan, their lower trunks will be buried in meters of sediment.

Riparian ecosystems such as those found along the Green River comprise a small percentage of the overall landscape area, but they provide habitat for many different animal species. For instance, the riparian ecosystem on the Green River supports beaver, kangaroo rat, montane voles; a variety of avian predators (e.g., owls, hawks, falcons) and mammalian predators (e.g., mountain lions and coyotes); and a litany of insects including the cottonwood beetle. Each of these animal species, in turn, exerts their own influence on vegetation patterns and the riparian ecosystem as a whole.

The following paragraphs explain the variety of conditions shaping the riparian ecosystem along the Green River, highlighting the role of the hydrologic regime:

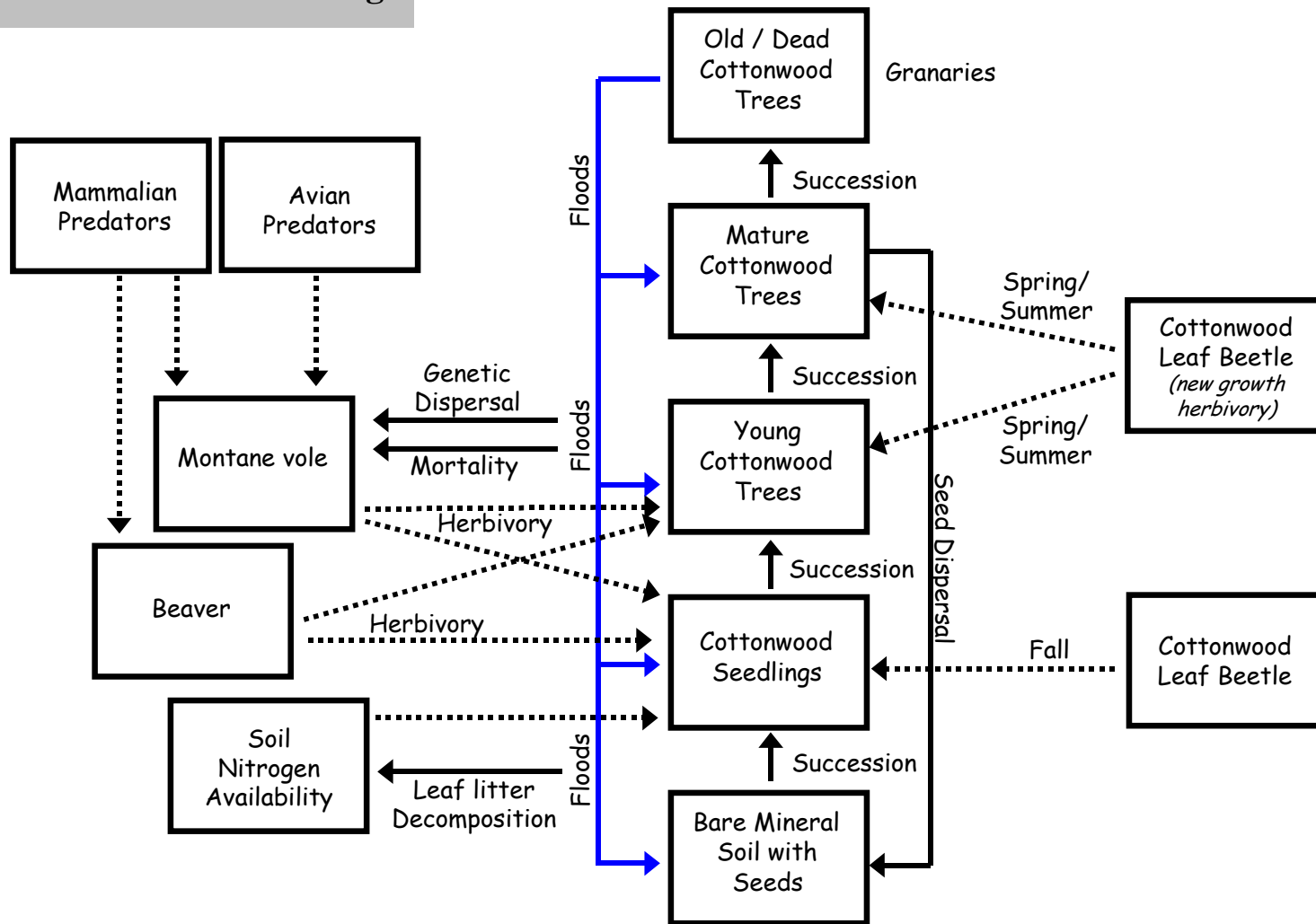
- **Formation of sand and gravel bars:** Cottonwood and willow seeds will germinate only on low-lying, moist sand and gravel bars. These sand and gravel bars are formed as the river migrates laterally, scouring the outside banks of meander bends during the peak of a flood and then depositing sands and gravels on the inside of the meander curve as the flood recedes. Channel migration and sediment deposition on the Green River typically occurs during flows greater than 8,800 cfs. Optimal conditions for cottonwood and willow recruitment are created when the sediments contain high levels of soil nitrogen that support seedling growth. These optimal conditions are created by floods large enough to inundate the floodplain (which occurs when floods exceed 11,700 cfs). During these occasional larger floods, leaves and detritus are flushed from the higher areas of the floodplain and subsequently deposited in the sediment bars that form as the flood recedes.
- **Establishment of seedlings:** Cottonwoods and willows disperse their fluffy white seeds in the late spring (May-June). If seed dispersal occurs as the annual flood is receding, the seeds will land on freshly-formed sediment bars that provide the

moisture and nutrients necessary for seedling establishment and growth. Optimal conditions for seedling establishment occur when the annual flood recedes very slowly, thereby sustaining adequate soil moisture for the seedlings. Floods and high flow pulses during the period of seedling release (spring time) are also critical for transporting and distributing willow and cottonwood seeds to sediment bars along the river's course.

- **Early growth years:** For two or three years after seedlings become established on low-lying sediment bars, they are quite vulnerable to being killed by floods. Consequently, the best sequence of years for cottonwood and willow recruitment consists of a fairly large flood in one year, followed by one or two years of lower-than-average floods.
- **Drought mortality:** If summer low flows drop too low, the water table beneath the floodplain can drop to levels that stress or kill riparian trees. Conversely, years with high summer low flows promote accelerated growth of the trees.
- **Role of beaver and other small mammals:** Beaver as well as other small mammals native to the upper Colorado River system (e.g., deer mouse, montane vole, and kangaroo rat) affect vegetative patterns within the riparian system through their herbivory. For example, large populations of montane vole have been shown to reduce cottonwood seedling and sapling survival through herbivory. The population of beaver and other small mammals on the Green River have increased since flow regulation. Large floods can be catastrophic events for many of these small animal species when they are swept away by floodwaters or drown in their burrows. Flow regulation by Flaming Gorge Dam has decreased the frequency and duration of large floods on the Green, thereby improving conditions for small animals but increasing the potential for increased herbivory on riparian vegetation.

Please find an ecological model diagram on the next page that illustrates some of the relationships described above.

Riparian System Model with a Focus on Flooding



Green River, UT

(Greendale Gauge)

