Based on the papers and lectures from last week (river ecology concepts, and vegetation dynamics) address the following:

Develop a unmodified, high order, river in a temperate system. Discuss hydroperiod pattern, nutrient cycling in the aquatic and terrestrial floodplain, and wildlife habitat and vegetation gradients. (half-page).

Now do the same analysis for the same type of river, except that this time a dam has been installed to create a reservoir for drinking water and power supply. Contrast the changes in hydroperiod, nutrient cycling, and wildlife habitat/vegetation gradients. (half-page)

Keep the assignment to single spaced, one-page, no less than 10 font (12 is preferable).

It will be a challenge to condense so much information in such a small space. This is good experience for abstract writing, and being concise with your ideas.

Use technical language to describe concepts.

Ecol 190 Article Review #2
Dahl Winters
9/15/05

An unmodified high order river in a temperate system would look much like the Roanoke River in terms of hydroperiod pattern, aquatic and terrestrial nutrient cycling, and vegetation gradients. The *hydroperiod pattern* would feature high spatial and temporal variability, with intermediate magnitudes and frequencies of inundation. Being in the temperate zone, there would be more flood pulses during the winter-spring months than at other times due to snow melt. Other seasons have frequent but not prolonged periods of inundation. Most of the time the frequency, duration, and magnitude of inundation are of moderate and fairly predictable values, which have allowed the floodplain biota to evolve lifestyles adapted to these intermediate flood regimes.

Nutrient cycling is fast. Though there is a high influx of nutrients from upstream, little of it is stored. High biomass and photorespiration levels indicate that more carbon is consumed by the floodplain biota than is stored by the floodplain biota. The river has greater turbidity from increased fine sediment load, but the wider channel means greater transmission of photosynthetically active radiation (PAR) to the water than at lower stream orders, increasing aquatic plant productivity. Autochthonous carbon inputs (sources within the river, such as benthic organic matter and living biomass) dominate allochthonous inputs (terrestrial carbon sources such as woody debris and leaf litter). There is less coarse wood debris in the river, so few nutrients are produced here because of the slow rates of wood decay and nitrogen immobilization. There is also lower retention of organic matter and nutrients due to the high water flow.

The highest levels of productivity can be found in the floodplain due to its diverse *wildlife habitats*. Its wide *vegetation gradient* extends from semi-aquatic plants near the river that can tolerate frequent flooding, to swampy backwaters, and then to higher bottomland forests whose trees can survive frequent but short periods of inundation. The river's slowly moving large volume of water, combined with frequent floods that deposit nutrient-rich sediment, creates meanders, banks, and other geomorphological features that increase habitat diversity, and thus overall biodiversity. While there are slightly fewer macroinvertebrates, there are many more fish and insects compared to further upstream.

If the river were dammed, the hydroperiod regime would generally decrease in spatial and temporal variability, aquatic and terrestrial nutrient cycling would slow, and there would be declines in wildlife habitat and biodiversity. Most large rivers in the US have been dammed, and would fit this description. Since *hydroperiod pattern* is being controlled by the dam, the normally variable downstream flood pulses never occur. Instead, the floodplain tends to be saturated with water for prolonged periods at only one or two heights, clearly visible on the bark of inundated trees. There is never a natural range of flood magnitudes or frequency of flood occurrence. Water is released whenever dam controllers and regulatory agencies decide to do so.

The infrequency of flood pulses affects *nutrient cycling* by starving the floodplain of upstream nutrient-rich sediment. As nutrients leach from floodplain soils or are used by plants or agriculture, floodplain productivity declines. Meanwhile, prolonged inundation causes floodplain vegetation in standing water to decompose, which releases stored nutrients back into the river. This, combined with animal deaths due to the low DO concentrations resulting from bacterial decomposition, may create such an influx of nutrients that the river eutrophicates.

The normally wide floodplain *vegetation gradient* (from aquatic plants to bottomland forest) becomes much narrower because the river floods with lesser magnitudes and frequencies. Sediment is deposited only along the banks, entrenching the river in place. At the edges of the floodplain, bottomland trees that die due to prolonged inundation cannot be replaced because their seedlings cannot grow underwater. This shrinking floodplain presents less of a buffer to agricultural and other pollution that can further harm the riverine ecosystem, and also reduces available *wildlife habitats*. Plant and animal diversity is also impacted. The dam reduces downstream turbidity because it slows the water flow, so one might think the increased transmission of PAR should increase aquatic plant productivity and diversity. However, slow water flow and lack of high floods erases a wide range of flood-created geomorphology that provide diverse species with many forms of habitat. Migratory fish species also decline because they are no longer able to reach spawning grounds above the dam.