

## SEDIMENTS IN THE MOHAWK: THE BIG PICTURE

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Sediment transport is a natural function of streams. Fresh sediments are necessary for maintaining habitat and as sea level rises, to raise the bed of the Hudson Estuary. Sediments arise from overland runoff and from side and bottom scour in streams, particularly during hydrological events. A very small number of events accounts for most of the sediment transport in the Mohawk. Between 2004 and 2009 half of the total sediment load of 2.6 million tons came out in 19 days, or in three events. One day, 6/29/2006, saw 39% of the average yearly sediment total (202,000 tons) exiting at Cohoes. During the same period the larger (4,606 sq miles versus 3,450 sq miles in the Mohawk) and more heavily forested Upper Hudson watershed put out 1.2 million tons of sediment. The Upper Hudson lost 53 tons of soil per square mile per year while the Mohawk lost 149 tons. The Upper Hudson is also less flashy; it required 54 high-sediment load days to pump out half the five year total load.

Natural soil and terrain factors favor agriculture in the Mohawk; 52% of the Mohawk basin is “prime farmland” whereas only 21% of the Upper Hudson is so classified. Anthropogenic factors influencing sediment loading include land use and stream modification.<sup>1-6</sup> Forest and pasture landscapes allow precipitation to soak into the ground. Leafy cover increases transpiration, evaporation, and decreases mechanical disruption of soils. Hard, impervious surfaces such as roads, roofs, and parking lots, speed water into stream channels. Streams become over-charged with water and severe bank and bottom scour results.<sup>4</sup> Trees topple, public structures are damaged, and private property is lost. Soil from plowed lands is also more easily mobilized by precipitation events.

Historically, the Mohawk Valley experienced deforestation where wood was used as fuel, as building materials, tan bark, and as sources of potash needed by industry. Careless use of fire by farmers, loggers, hunters, and industry resulted in enormous forest fires.<sup>7-10</sup> By 1880 only 25% of New York remained forested, and that was mostly in the Adirondacks and Catskills.<sup>11</sup> The 1900 sediment load in the

Hudson was 20 times background.<sup>12</sup> Alternative fuels such as coal and petroleum, alternative structural materials such as steel and concrete, measures to reduce forest fires, and chemical preservative such as coal-tar creosote, pentachlorophenol, and copper-chrome-arsenate maintain structurally competent wood for longer times. These measures have greatly reduced pressures on forests.<sup>8</sup> On the other hand, pulp wood for paper making became significant after the technology was developed in the 1870s.

Cleared land in the Mohawk became a prime wheat growing district of great strategic importance during the American Revolution.<sup>13,14</sup> Poor land management, introduction of an invasive pest from Europe, and fresh wheat lands to the west made accessible by the Erie Canal pushed Mohawk Valley lands to pasture.<sup>15</sup> This pasture supported sheep that became the basis of a significant textile industry.<sup>16,17</sup> By the mid-19<sup>th</sup> Century Mohawk Valley dairy cattle became part of the New York City “butter and cheese-shed.”<sup>18</sup> In 1915, 22% of US farm area went to feeding draft animals. Tractorization in the early 20<sup>th</sup> Century released much of this land, mostly back to forest.<sup>19</sup> New York is now 62% forest. Changes in agricultural technology have dramatically increased yields. Dairy, the dominant agriculture in the Mohawk Valley, now uses less pasture and more corn. Due to improved nutrition, antibiotics, breeding, and bovine growth hormone milk yield has quadrupled.<sup>20,21</sup> Corn crops increase sediment yield over pasture. Alternative agricultural practices, notably “no-till”, reduces erosion, soil oxidation, and fuel use at the expense of more pesticides and costly and specialized seed drills.<sup>22,23</sup>

Loss of the textile and other industries, military base realignment, the rise of automobiles, and urban disinvestment have severely damaged Mohawk Valley cities.<sup>17</sup> Sprawl can be seen in population growth occurring outside of existing high-density areas while densely inhabited areas are losing people. Sprawl harms wildlife through habitat fragmentation, barriers to animal migration, elimination of wetlands, application of lawn chemicals, and presence of pets.<sup>24,25</sup>

Sprawl increases energy use through operation of motor vehicles and through less efficient buildings. It increases public costs of school buses and greater per capita costs for providing emergency and environmental services. Existing public infrastructure becomes underutilized. Suburban development requires hundreds of times more asphalt per person than urban development.

The Mohawk Valley contains about 550 dams with a median age of 66 years. Many of these dams have outlived their purpose and many are poorly maintained. Dams disrupt stream function by changing flow patterns, temperature regimes, and migration routes. They trap sediment and normal dam water releases causes downstream scour. Dam failures release very large amounts of sediment.<sup>6</sup>

Excessive sediment harms aquatic life by reducing primary productivity, reducing visual acuity of predators and prey, by reducing habitat suitability, and by damaging filtration and respiratory structures.<sup>26</sup> Sediment fills navigational channels and berths requiring dredging.<sup>27</sup> Dredging costs are affected by the presence of regulated toxic chemicals, quantity, and by regulatory operational constraints. These include temporal windows to protect migrations and sensitive life stages, disturbance mitigation (dredge type, speed of operation, barge overfill), and disposal practices (beneficial use, disposed at sea, hazardous waste?). While there are locally contaminated sediments in the Mohawk, analyses of suspended sediment at Cohoes do not indicate high concentrations of actionable substances.<sup>28</sup> The cost of navigational dredging impact private businesses, the Canal Corp, the Port of Albany, and the Port Authority of New York/New Jersey. The Port Authority is

responsible for 270,000 regional jobs, \$11.2 billion in personal income, \$36.1 billion in business income, and over \$5 billion in federal, state, and local taxes.<sup>29</sup> It is in stiff competition with other east coast ports and measures taken in the watershed to reduce sediment loads and to improve sediment quality affects the region's economy.

Some of the on-going research into sediment transport is supported by the NYS Department of Environmental Conservation in cooperation with the US Geological Survey and other partners. A network of permanent high-frequency water quality and meteorological observing stations ([www.HRECO.org](http://www.HRECO.org)) has been established in the Hudson Estuary and there is a possibility of extending it into the Mohawk, particularly in the Schenectady area. Sediment observing stations have been operating at Cohoes, Waterford, and Poughkeepsie since 2002 and five Estuary turbidity stations have recently gone on-line, including on the Mohawk at Cohoes. We hope to see more installed on major Mohawk River tributaries. This monitoring would develop better understanding of how much and where sediments originate and, if the system is maintained, will show how changes in climate and land use affect sediment delivery. This information will be useful in targeting limited resources.

Solutions to the problem of excessive sediments require attention to a wide variety of factors requiring cooperation across many disciplines including conservation, agriculture, industrial development, forestry, urban planning, and transportation. Environmental problems are often the results of failures to address urban and rural social and economic problems.

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