The study I'm sharing is entitled "Segment-based assessment of riparian buffers on stream water quality improvement by applying an integrated model" and was authored by a collaboration by three institutions in Canada and one at the Inner Magnolia University in China.

I chose it because of my own interest in applying environmental engineering principles and practices to restoration planning and management, as well as its relevance to water quality modeling. This study specifically focuses on riparian buffers, which are the channels of vegetation and saturated soil that run parallel to rivers and streams. They are known for serving ecosystem services such as riverbank stabilization, which in turn decreases sediment loading, habitat maintenance, nutrient cycling, and flood protection.

This study aimed to achieve two main goals. One was to develop a multistep model that could quantify the effectiveness of riparian buffers in processing surface runoff, nutrients, and sediment.

Two was to assess the effectiveness of more variable riparian buffer management. That is, instead of applying a uniform riparian buffer to a river system, assess the impact of riparian buffers that vary in vegetation, soil characteristics, and size, thus encompassing variability that is mirrored in the dynamic environments they are within.

To develop this model, they used SWAT (Soil and Water Assessment Tool) and REMM (Riparian Ecosystem Management Model). The former is a hydrology model, which assesses the movement of water through defined cells (HRUs) of the basin. This model identifies where flows will move, and then those flows are fed into inputs of the REMM model. The REMM model then tracks the nutrient cycling of upland nonpoint source pollutants as they move through riparian buffers. The resulting outputs are concentrations of sediment and nutrients (phosphorus and nitrogen specifically) that can be analyzed for reduction from initial inputs. The researchers combined these models through ArcGIS, which was used to integrate all of the spatial data into the models, and helped define characteristics of the buffers.

The researchers tested their model on the Black Brook Watershed, in New Brunswick, CA. As you can see, most of the land cover is agriculture (potatoes), and resident development exists mostly along the riverbank. Most of the natural landscape is forest.

Using ArcGIS, the researchers divided the river into segments of riparian buffers, all of which vary in composition and width, to test the effectiveness of riparian buffers of varying compositions on resulting water quality.

Figure A shows the HRU cells that would be independently assessed for hydrologic processes.

The findings showed complex relationships among riparian buffer composition, the surrounding environment, and initial concentrations. Different buffer compositions have different effects on reduction of these elements, though some showed more impact than others (i.e. Subbasin 1 and phosphorus reduction). Overall, a tool such as this could be useful in strategic and adaptive management of riparian buffer conservation projects.

The researchers did cite some limits to their model. First, the SWAT model was calibrated at a watershed level, though analyzed within the sub basins. This may skew some of the findings. Models of this type are also subject to uncertainties in DEM accuracy. Finally the authors admitted that there was little data to validate this model, so future field studies (such as Daniel's) would be needed to do so.