

A temporal rise in anthropogenic nutrient input to freshwater bodies and tributaries in the form of phosphorous (P) and nitrogen (N) has deteriorated the quality of water resources and the health of aquatic ecosystems throughout the United States. Intensified nutrient inputs promote eutrophic conditions characterized by excessive algal blooms, potential release of toxins, and fish kills, with 50% of lakes in the US categorized as eutrophic or hypereutrophic. Agricultural land use and nonpoint source nutrient pollution associated with stormwater runoff processes are among the leading physical and chemical stressors to the biological quality of lakes throughout the nation. To reduce nonpoint P loading into Lake Champlain, Vermont regulation has banned the application of manure fertilizers while soils are frozen (Dec 15<sup>th</sup> – April 1<sup>st</sup>). Changing climate may also lead to differences in timing of thaw events and intensities of precipitation which may have significant consequences for nutrient transport and loading into Lake Champlain. Multiple inputs contribute to excessive P loading into the lake and involve complex relationships between degree of soil saturation, seasonal rain intensity, topography and occurrence of CSAs. Critical Source Areas (CSAs) have been defined as nonpoint P sources that contribute disproportionately higher amounts of P to the watershed. In order to identify potential CSAs a Water Erosion Prediction Project (WEPP) model will be used to combine complex site specific variability of topography, hydrology, soil and management practices in a distributed, process-based continuous simulation program. WEPP distributed parameter models represent sub-plot variability, potentially smoothed over by lumped-parameter modeling. Using WEPP, calibrated to three agricultural fields in St. Albans, spatial and temporal distributions of sediment yield and deposition, and explicit estimates of watershed and hill slope erosion will be identified. WEPP Validation will be performed in April during spring flush conditions to indicate sediment P yields and identification of CSAs.