THE GEOGRAPHIC DISTRIBUTION OF HISTORICAL CHANGES IN EXCESS AGRICULTURAL NITROGEN AND STREAM BASEFLOW IN AN INTENSIVELY CROPPED REGION OF THE UNITED STATES.

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Nitrogen (N) loads have increased during the 20th century in large rivers draining the Midwest U.S. However, N stream-load data in tributary streams are limited, making it difficult to identify watersheds where major contributions to these loads are generated. Consequently, we are developing methods to estimate potential loads by mapping the temporal and geographic extent of two critical variables, stream baseflow and excess nitrogen. Nine watersheds draining 1300 to 36,000 km^2 that represent the physiography and hydrology in Iowa were selected to map the temporal changes in baseflow and excess nitrogen through much of the 20th century. Baseflow and excess nitrogen can be calculated from publicly available data and are among the most critical variables needed to define general trends in nitrogen loads in unmonitored streams. Baseflow represents groundwater discharge to streams, the principal hydrologic path by which nitrate is delivered to streams. Nitrate is the principal form of N in streams draining dominantly agricultural watersheds. The ratio of baseflow to total discharge in a stream was calculated using daily-discharge values collected during 1903 to 2000. The baseflow fraction of total discharge has significantly increased relative to precipitation during the period of record in essentially all regions of the State. The potential source of nitrogen to groundwater, and ultimately streams, can be represented by the excess mass of nitrogen generated by agricultural systems in a watershed. Excess N has also significantly increased during the period based on a mass-balance model that incorporates N inputs from fertilizer and manure, mineralized N from soil and crop residues available for leaching, losses resulting from harvest and a variety of losses to the atmospheric. Causes and timing of the increases in baseflow and excess N varies with changes in rowcrop agriculture. The temporal trends of area in rowcrops vary throughout the State, but these trends are significantly related to changes in both baseflow and excess N.

Keywords: Nitrogen, Agriculture, Baseflow, Groundwater, Stream loads