Spatially Referenced Regressions on Watershed Attributes

SPARROW is a hybrid statistical-mechanistic modeling technique that relates stream nutrient loads to upstream sources and land-surface characteristics and which can then predict loads at locations with no data (Alexander et al., 2008; Moore et al., 2004), using a variant of a log-linear equation for riverine N flux:

$$\text{Flux} = \sum_j a_j N_j - b_j$$

Here, \(n\) is the source index (N sources), \(j\) is the set of all unmonitored upstream reaches of length \(L_j\), the coefficient for source \(n\), \(S_n\), is the nutrient mass from source \(n\) to reach \(j\), \(a_j\) is the vector of land/water delivery coefficients, and \(b_j\) is an error term.

The approach (Smith et al., 1997), has several important characteristics:

- Data for in-stream nutrient loads at monitoring sites, nutrient sources, and land-surface characteristics are assigned to each stream reach in a digital stream-reach network that provides continuity between upstream and downstream reaches.
- The stream-reach network consists of individual, hydrologically linked stream reaches and associated catchments.
- Catchments are the drainage areas that contribute directly to each stream reach, not including flow from upstream reaches.

The SPARROW model and its components in US watersheds

Nutrient sources in SPARROW include atmospheric deposition of nitrogen, urban sources, and nutrients in the runoff and subsurface flow from agricultural and other watersheds. Observed TN fluxes (estimated with Fluxmaster) and corresponding SPARROW estimates were obtained for the 425 US watersheds (Alexander et al., 2008). The mean annual load for each station is standardized to the 1992 base year (nutrient sources inputs to the model are for 1992). For visualization of N loads from different sources (accumulated to the outlet point without N removal in streams), the 425 watersheds (4000 km²) were dissolved.

For visualization of N loads from different sources (accumulated to the outlet point without N removal in streams), the 425 watersheds (4000 km²) were dissolved. Currently available SPARROW outputs are based on the E2RF1 data, an earlier version of MR8-E2RF1.