**Supplemental file 4 (SF 4):**

**Table S2** Key parameters used in the current study

|  |  |  |
| --- | --- | --- |
| Parameters | Description | Computation |
|  | A non-physical parameter that characterizes the natural climatic-soil properties | , is an seasonality constant that captures the local precipitation pattern and hydrogeological characteristics, ranging from 1 to 30; (mm) is the volumetric plant available water content; the 1.25 term is the minimum value of ; (mm/yr) is the annual precipitation for pixel |
|  | An empirical constant that captures the local precipitation pattern and hydrogeological characteristics | Estimated as , where is the average number of rain days (>1mm) per year over the study period (Donohue et al., 2012) |
|  | The volumetric plant available water content | , (mm) is the plant available water capacity; root restricting layer depth is the soil depth at which root penetration is inhibited because of physical or chemical characteristics; vegetation rooting depth is given as the depth at which 95% of a vegetation type’s root biomass occurs |
|  | Evapotranspiration coefficient for each pixel | Defined according to literatures (Wang et al. 2016) and the InVEST user’s guide (Sharp et al. 2016) |
|  | The runoff potential index for each pixel | , is the nutrient runoff proxy for runoff on pixel , and is the average over the raster |
|  | The maximum retention efficiency of nitrogen and phosphorus for each LULC, varying between 0 and 1. | Defined according to the literature data and the InVEST user’s guide (Sharp et al. 2016) |
| for NDR model | The index of connectivity | ,, (m/m) is the average slope gradient of the upslope contributing area and (m2) is the upslope contributing area, (m) is the length of the flow path along the pixel |
|  | The amount of annual soil loss on each pixel | ,where,(MJ·mm·(ha·hr)-1) is the rainfall erosivity, (ton·ha·hr·(MJ·ha·mm)-1) is the soil erodibility, is the slope length-gradient factor, is the crop-management factor, and is the support practice factor |
| for SDR model | The index of connectivity | , is the upslope component defined as: ,where, is the average factor of the upslope contributing area, (m/m) is the average slope gradient of the upslope contributing area and (m2) is the upslope contributing area  and, is the downslope component defined as: , where and are the factor and the slope gradient on pixel , (m) is the length of the flow path along the pixel |
|  | The maximum theoretical *SDR* | Defined as 0.8 according to the InVEST user’s guide |