

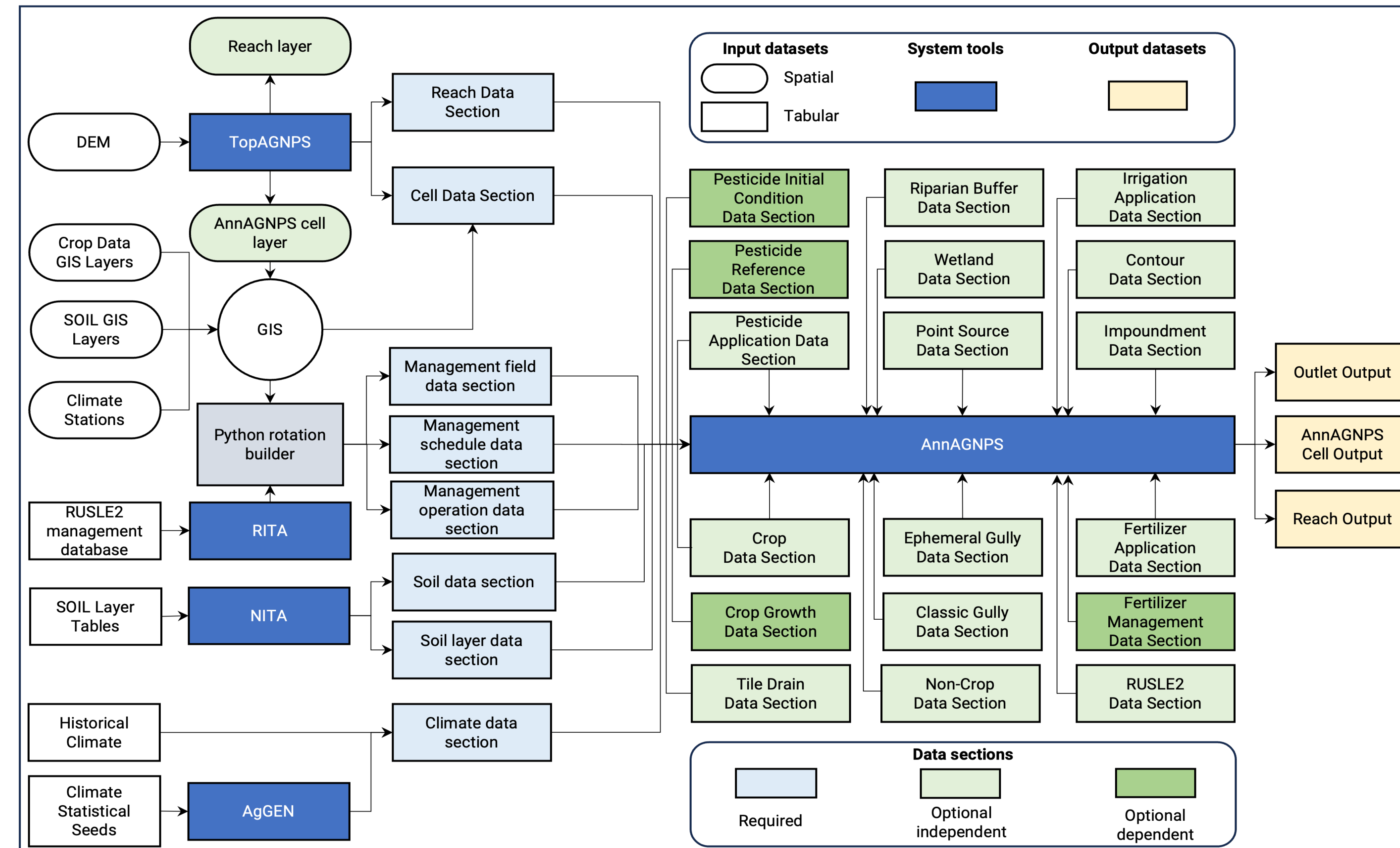
Abstract

The AnnAGNPS watershed management and pollution model, was developed to estimate the integrated effect of all farming and conservation practices on non-point source pollutants in predominantly agricultural watersheds. The AnnAGNPS model is the result of a partnership between the USDA-research branch (Agricultural Research Service-ARS) and the USDA-action branch (Natural Resources Conservation Service-NRCS), therefore benefiting from user-developer collaboration. In the AnnAGNPS modeling formulation, the watershed is represented using two basic modeling units: sub-catchments representing field-dominated processes and reaches representing channel-dominated processes. The model operates on continuous simulation at daily time scale tracking soil, nutrient, and pesticide loss yield, and loadings from field and channel sources throughout the watershed.

In the model's 30 years of existence, AnnAGNPS has been continuously enhanced with new science, links to other models, and novel characterization of sources and sinks. In this presentation, an overview of the model's recent enhancements and key capabilities is provided. Some of the enhancements discussed include: (a) integration with models like PEST, REMM, BATHTUB, CCHE-1D, RUSLE2, and MODFLOW. (b) characterization of sources and sinks at raster grid scales by integrated external GIS tools, (c) available input preparation tools like Agricultural Integrated Management System (AIMS) and the QAnnAGNPS (QGIS plugin), and (d) procedures parallelization in personal computers.

Similarly, the selected capabilities described include (a) the model's capability of estimating the impact of in field deposition, sediment retention ponds, wetlands, edge-of-field vegetative filter strips, ephemeral gullies, and grassed waterways and (b) the simulation of field-specific actual crop rotation. The AnnAGNPS model has been used in the US and in over 20 countries in Europe, Asia, Australia, and South America, to quantify the long-term effect of farming operations on non-point source pollution and the development of conservation management plans.

Input and Output Datasets, Key Data Sections, and Tools



Milestones

In the model's 30 years of existence, AnnAGNPS has been continuously enhanced with new science, links to other models, and novel characterization of sources and sinks. The model has been published in 23 countries with over 230 publications (complete list of publications at: https://annagnps.mtsu.edu/wp-content/uploads/sites/53/2025/10/AnnAGNPS_references.pdf)

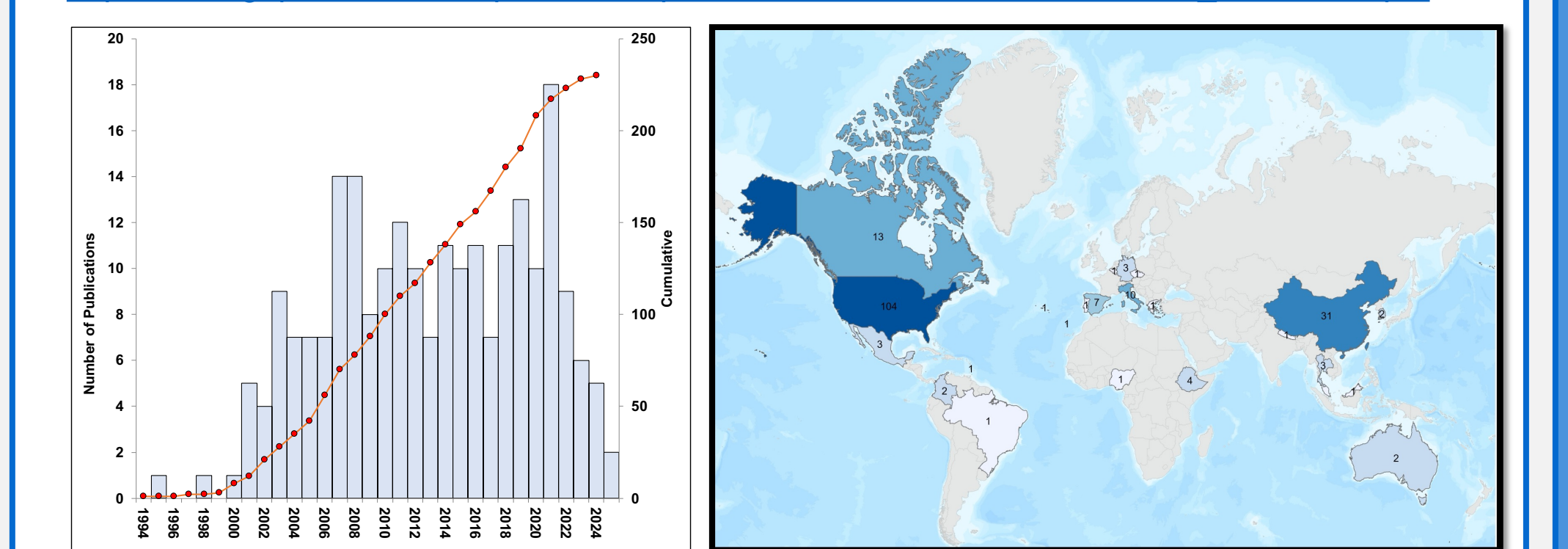


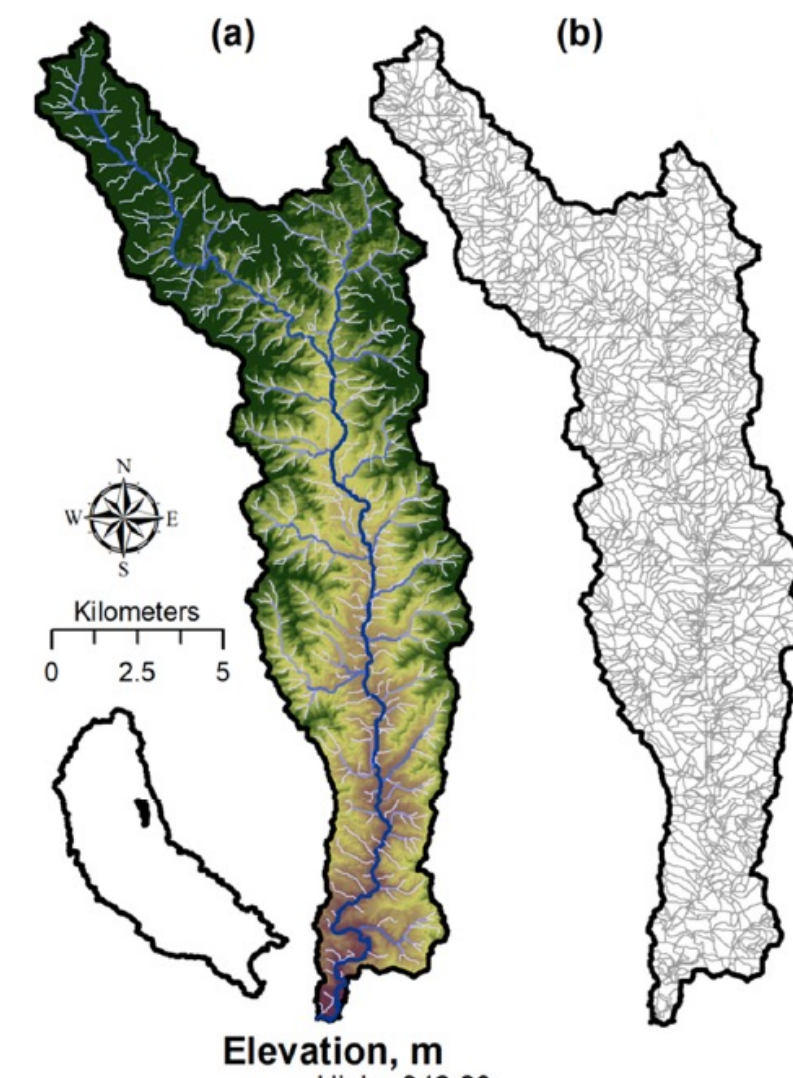
Figure 9: Number of publications over time.

Figure 10: Map of all the counties with published studies using the AnnAGNPS watershed pollution model.

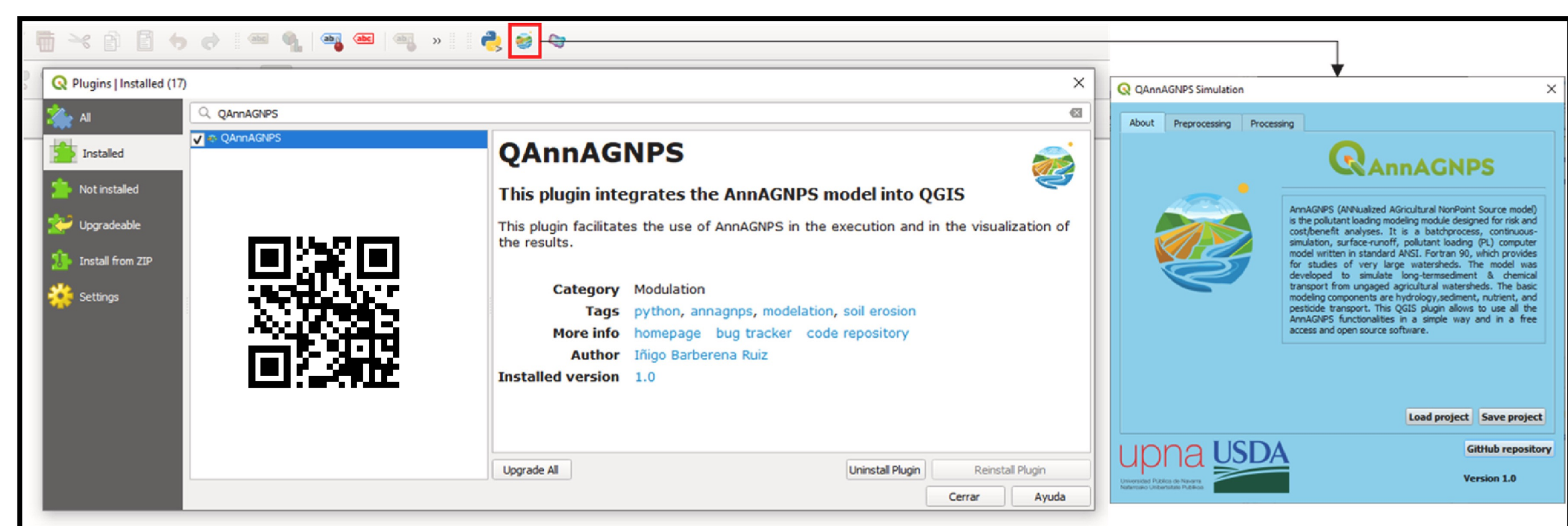
GIS Integration and Interfaces

TOPAGNPS

The TopAGNPS, is tool streamlines the processing of several GIS-based geoprocessing steps, the generation of the necessary AnnAGNPS input files, and integration with other AGNPS system components. It is designed to work with digital elevation model (DEM)s and contains tools to perform the following: DEM preprocessing, hydrologic division (sub-catchments and reaches), topographic characterization, and integration with other modules.



QANNAGNPS

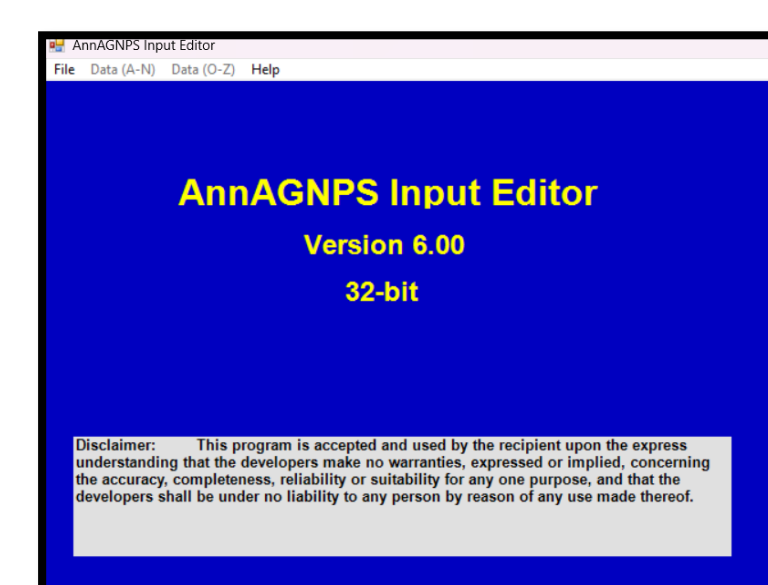


Agricultural Integrated Management System (AIMS)



The goal of AIMS is to provide a user-friendly way to produce all the necessary input files for AnnAGNPS.

Input Editor



The input editor is a GUI to support the development of the input databases.

Integrated Modules

Potential Ephemeral Gully Component (PEG)

Uses GIS tools to describe topographic conditions of ephemeral gully (EG) point of initiation, referred to as "potential ephemeral gullies". It records the upstream drainage area at the EG point, the slope, the distance to divide, the distance to other topographic barriers, the location at the watershed (sub-catchment or reach), and other auxiliary information. Analyses are performed at raster grid scale. The output is the AnnAGNPS ephemeral gully data section.

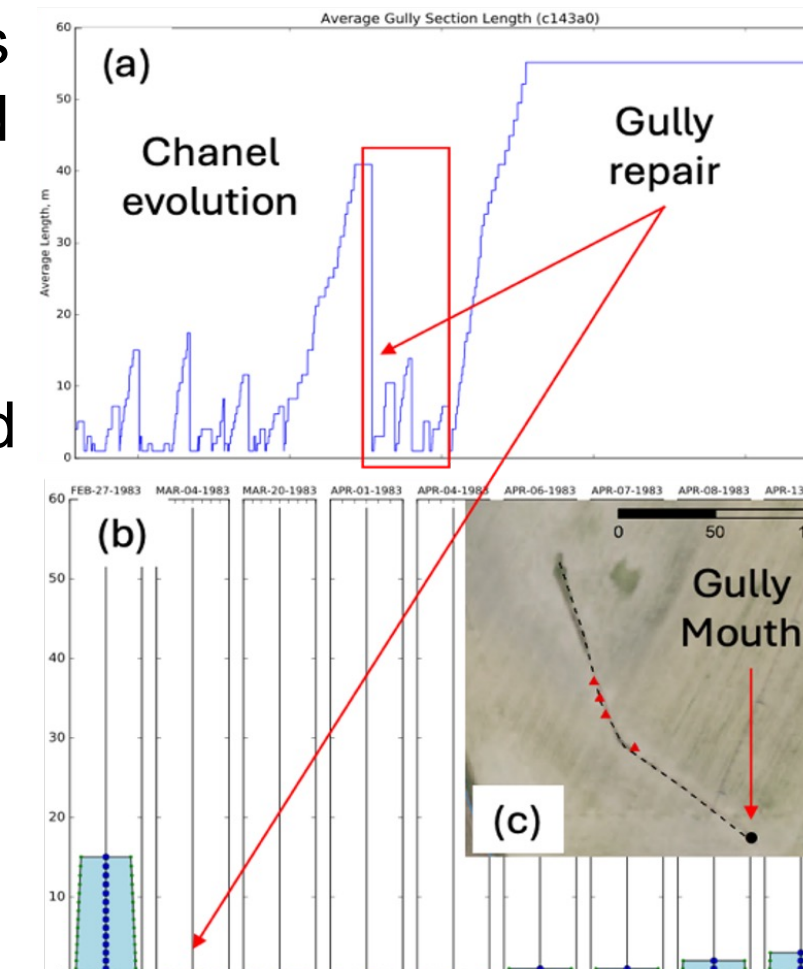


Figure 2. Illustration of EG formation, evolution and repair (a). Visualization of the changes in channel length and length (b) and the location of the EG "mouth".



Figure 1. EG being removed by natural farming operations (a), its point of initiation (b) and the use of topographic indices to locate EG mouth (c).

AnnAGNPS Riparian Buffer Component (AGBUF)

Uses GIS tools to process individual flow paths through edge of field vegetative riparian strips. AGBUF estimates local sediment trapping efficiency at each flow path and the potential sediment trapping efficiency for each sub-catchment and reach. AGBUF generates the AnnAGNPS riparian buffer data section. Layers used: DEM, riparian buffer, and vegetation cover.

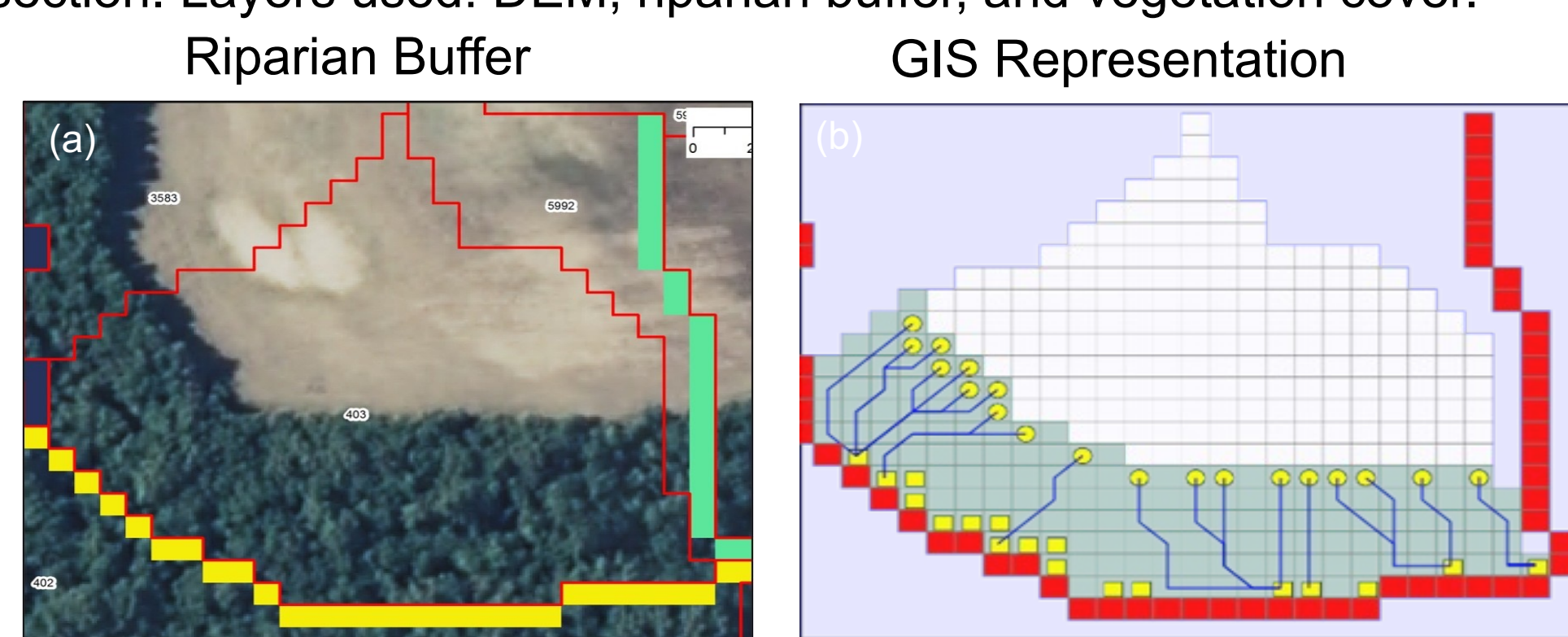


Figure 3: Actual vegetation at the edge of an agriculture field (a) and GIS characterization of riparian zones (b).

AnnAGNPS Wetland Characterization Component (AGWET)

GIS tool to characterize existing wetlands (sediment retention ponds) and to estimate potential locations for placement of new wetlands in agricultural watersheds. Generates the AnnAGNPS wetland data section.

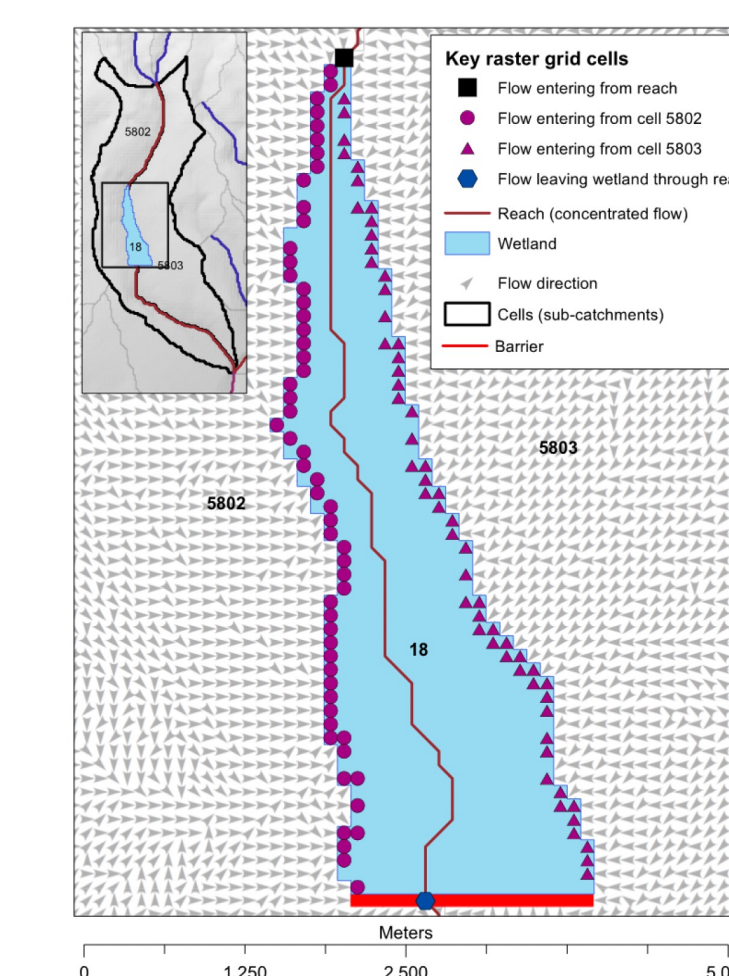


Figure 4. Raster grid analysis of flow entering and leaving the sediment retention pond.

Integrated Technology for Evaluation and Assessment of Multi-scale-hydrological Systems (ITEAMS)

Component to divide large functioning watersheds into smaller simulations allowing for concurrently execution. This component is designed to simulating larger catchments (basin-scale) but conditions represented at the field scale.

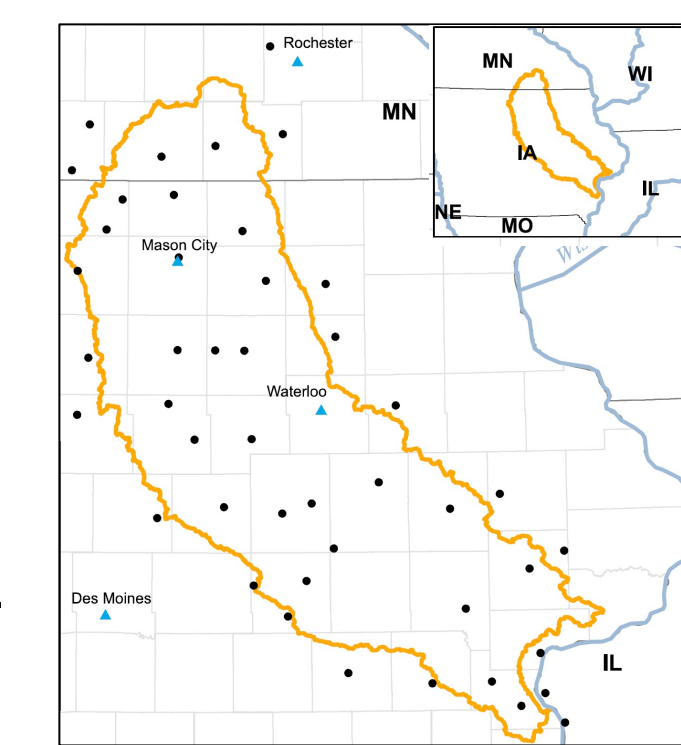


Figure 5. USGS HUC06 basin.

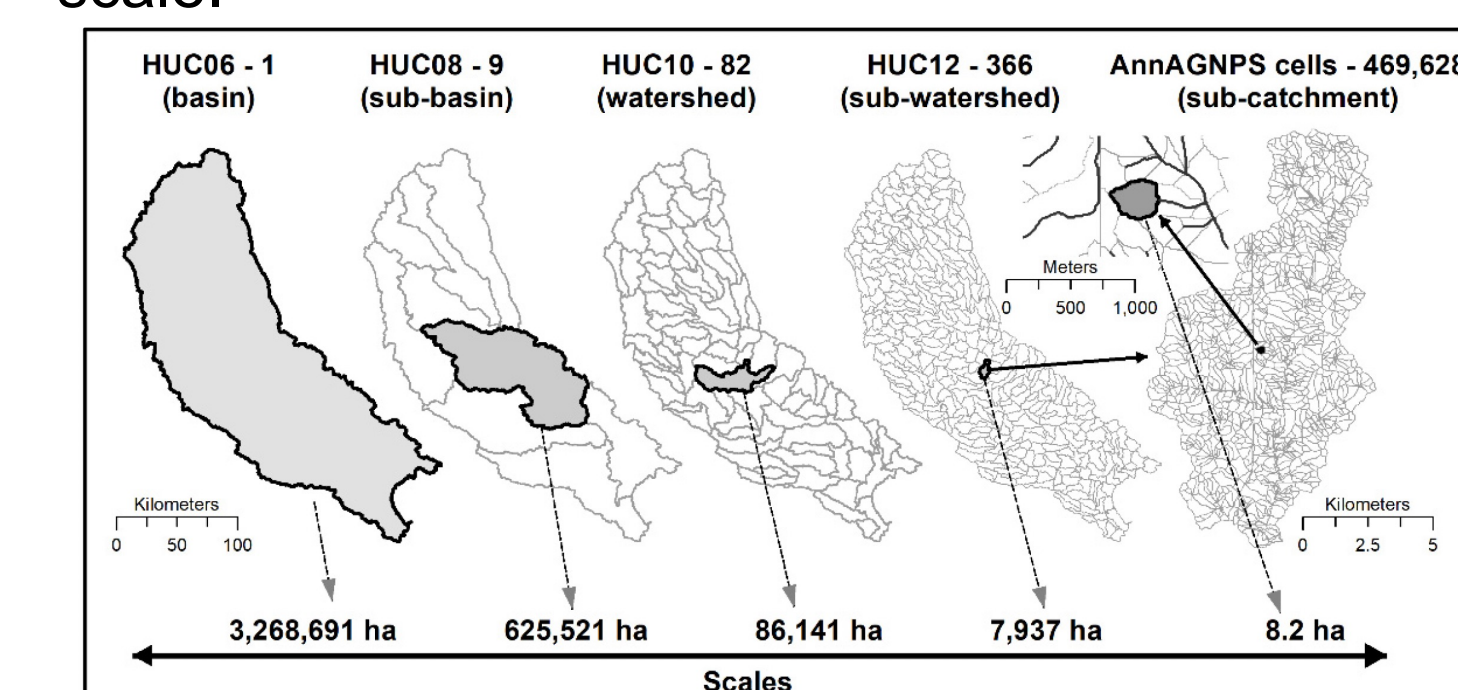


Figure 6. Multiscale analysis from sub-catchments to sub-basin scales.

Outputs and Products

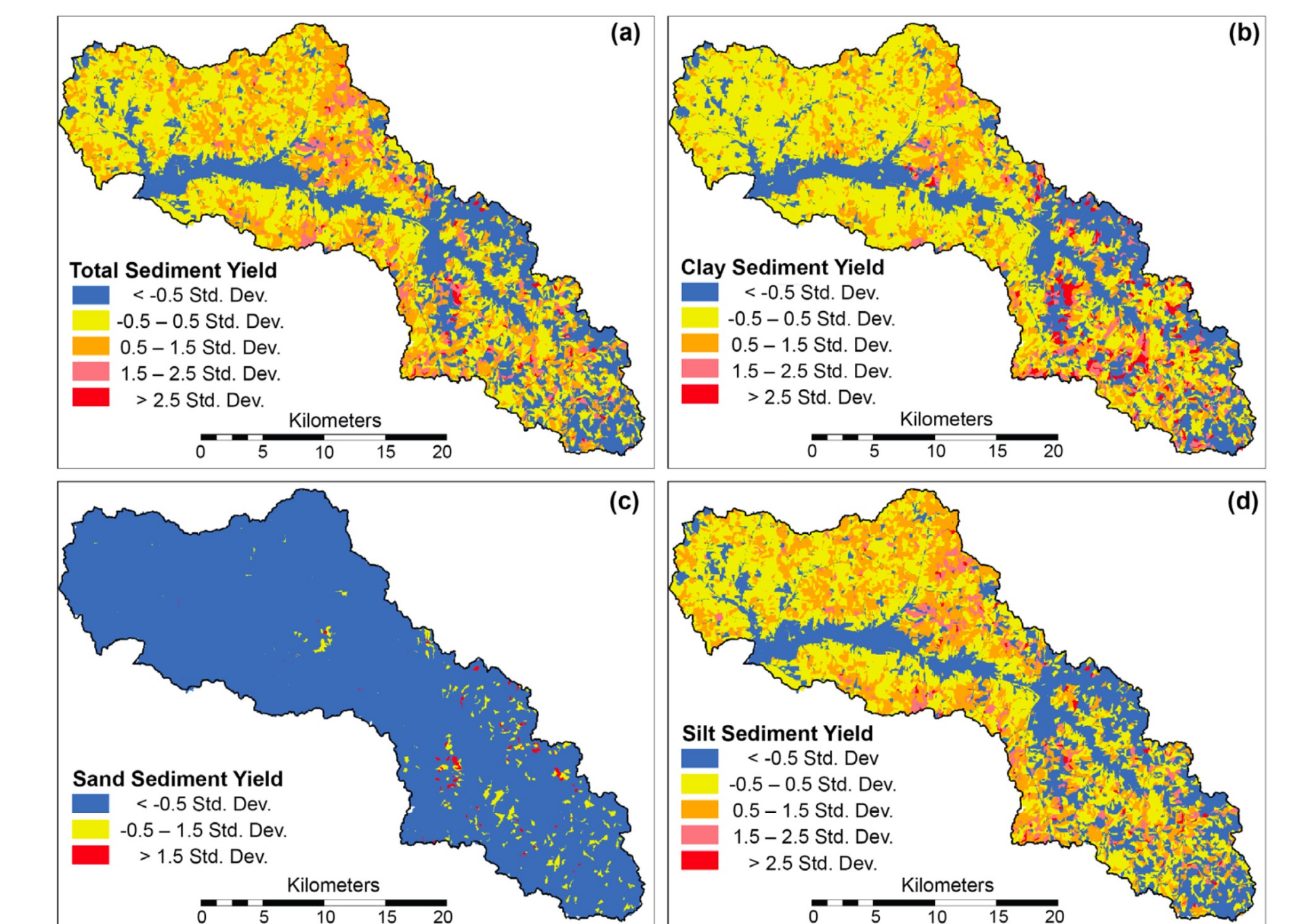


Figure 11: Sediment yield (suspended sediment leaving the sub-catchment into the stream) by particle size.

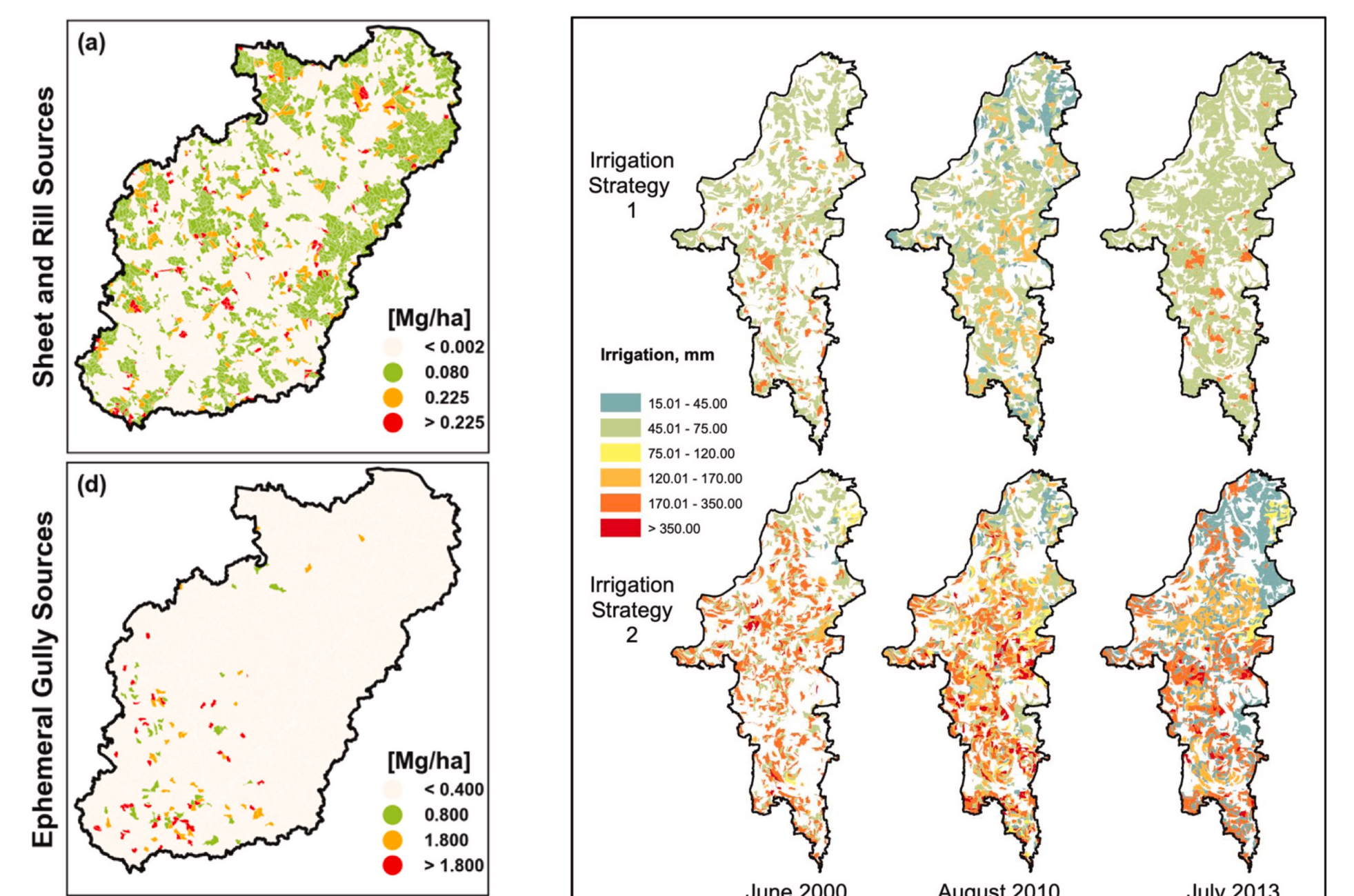


Figure 12: Sediment by erosional source.

Figure 13: Example of irrigation strategies varying in time and space.

What to download the latest version of AnnAGNPS? Scan the code or visit <https://annagnps.mtsu.edu>

