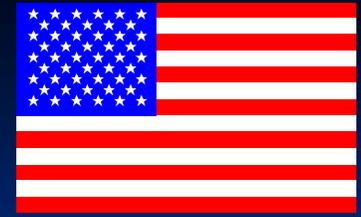




AGNPS



**A partnering effort between the USDA:
Agricultural Research Service
and
Natural Resource Conservation Service**

**National
Sedimentation
Laboratory**



United States Department of Agriculture



Erosion can occur anywhere in a watershed



Erosion in small field channels



Erosion in fields



Erosion in stream systems

BMP's can be studied from field scale to their impact on a watershed scale.



Field scale BMP



A watershed with diverse land use, including BMPs.

Evaluation of Watershed Conservation Programs for Sediment Control

Erosion Control

- Residue Management

Sediment Yield Control

Sediment Load Control



Evaluation of Watershed Conservation Programs for Sediment Control

Erosion Control



Sediment Yield Control

- Edge of Field Filters



Sediment Load Control



Evaluation of Watershed Conservation Programs for Sediment Control

Erosion Control



Sediment Yield Control



Sediment Load Control



Grassed Waterways



Evaluation of Watershed Conservation Programs for Sediment Control

Erosion Control



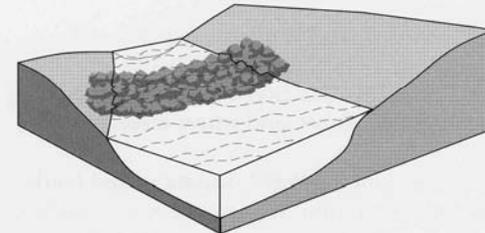
Sediment Yield Control



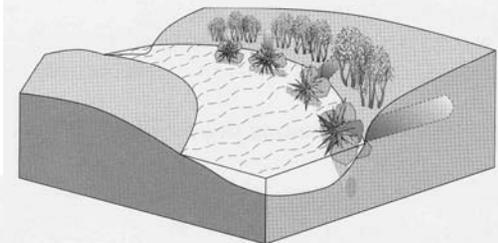
Sediment Load Control

- Instream Measures

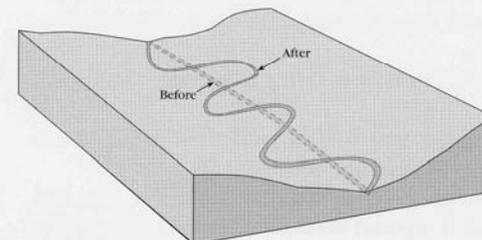
Grade Control Measures



Log, Rootwad, and Boulder Revetments



Stream Meander Restoration



AnnAGNPS: Uses NRCS Standards

Processes

- Weather Generation - GEM
- Runoff – SCS Curve Number
- Peak Runoff – TR-55
- Erosion - RUSLE

Databases

- Soils - NASIS
- Crops and Operations – Set by NRCS State Agronomists
- HUWQ Databases – Fertilizer, Pesticides, Animal Wastes, etc.

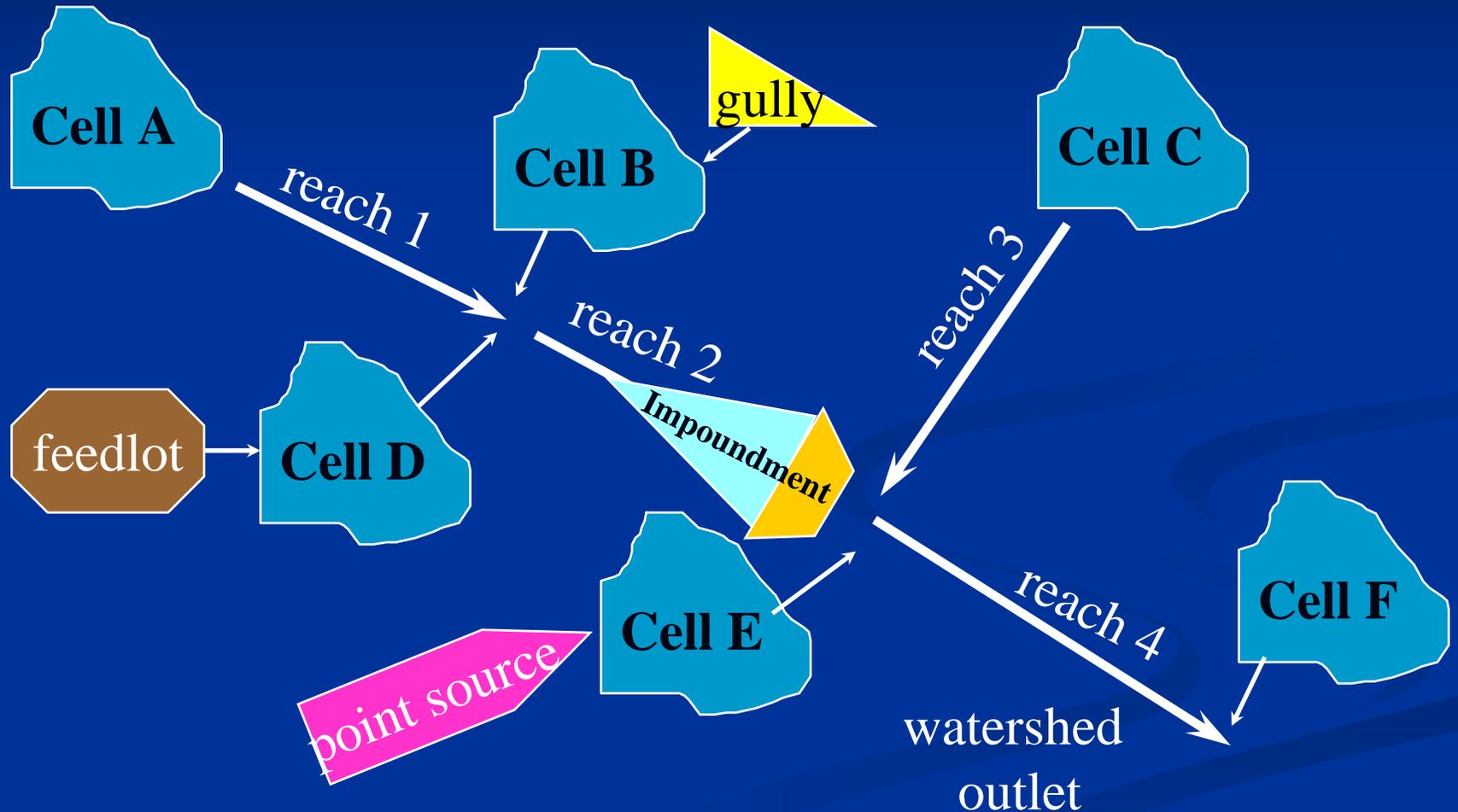
Model Process Components

Type of loadings:

- **Water**—rainfall, snowmelt, irrigation, & point sources.
- **Sediment by particle size-class:**
 - clay;
 - silt;
 - sand;
 - small aggregate; &
 - large aggregate.
- **Chemicals (attached & dissolved):**
 - nutrients—nitrogen, phosphorous, & organic carbon; and
 - pesticides—any number, any kind.

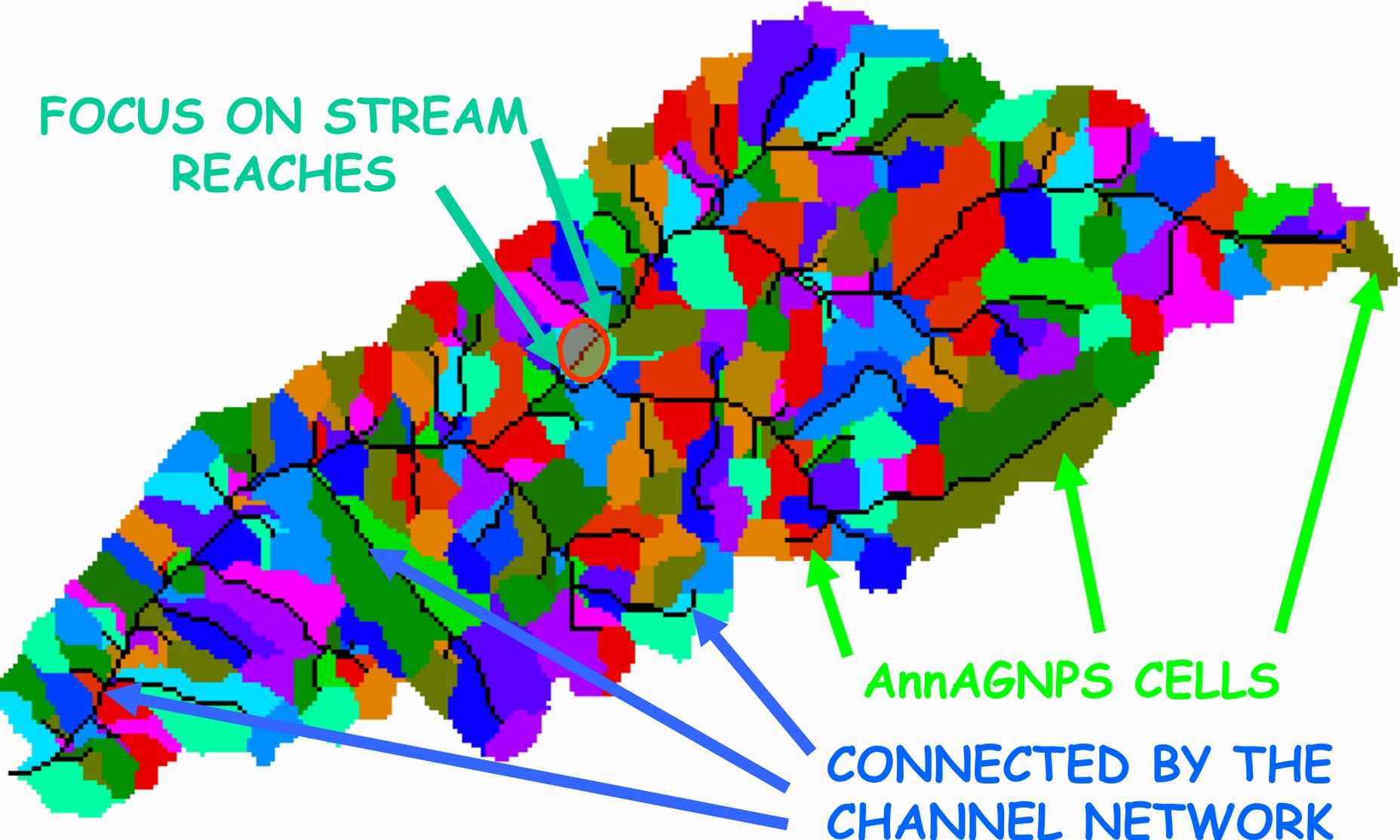
Water, Sediment, & Chemical Sources

Tracks loadings by source throughout the transport process



Automatically Determined Watershed Delineation

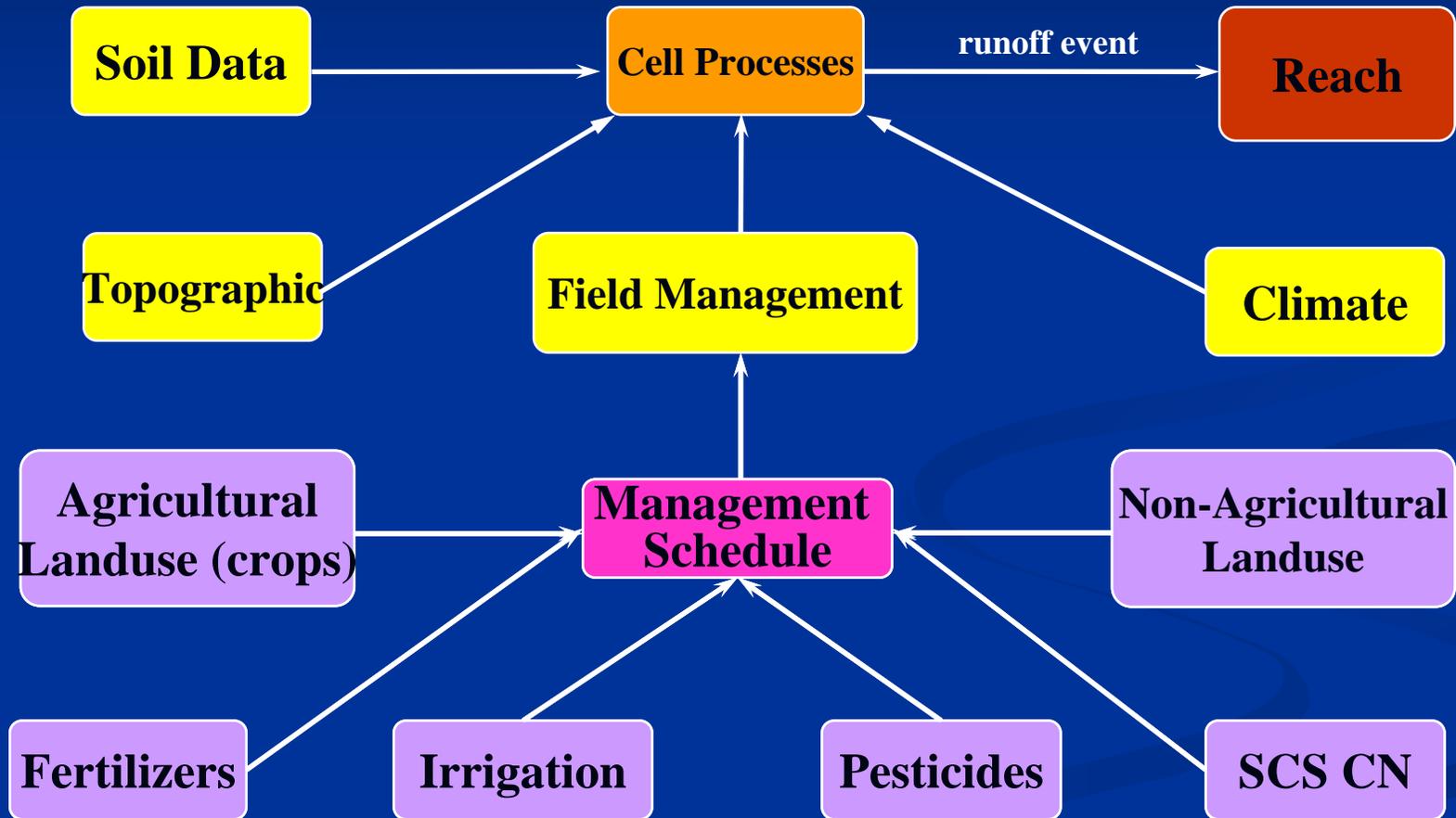
FOCUS ON STREAM REACHES



AnnAGNPS CELLS

CONNECTED BY THE CHANNEL NETWORK

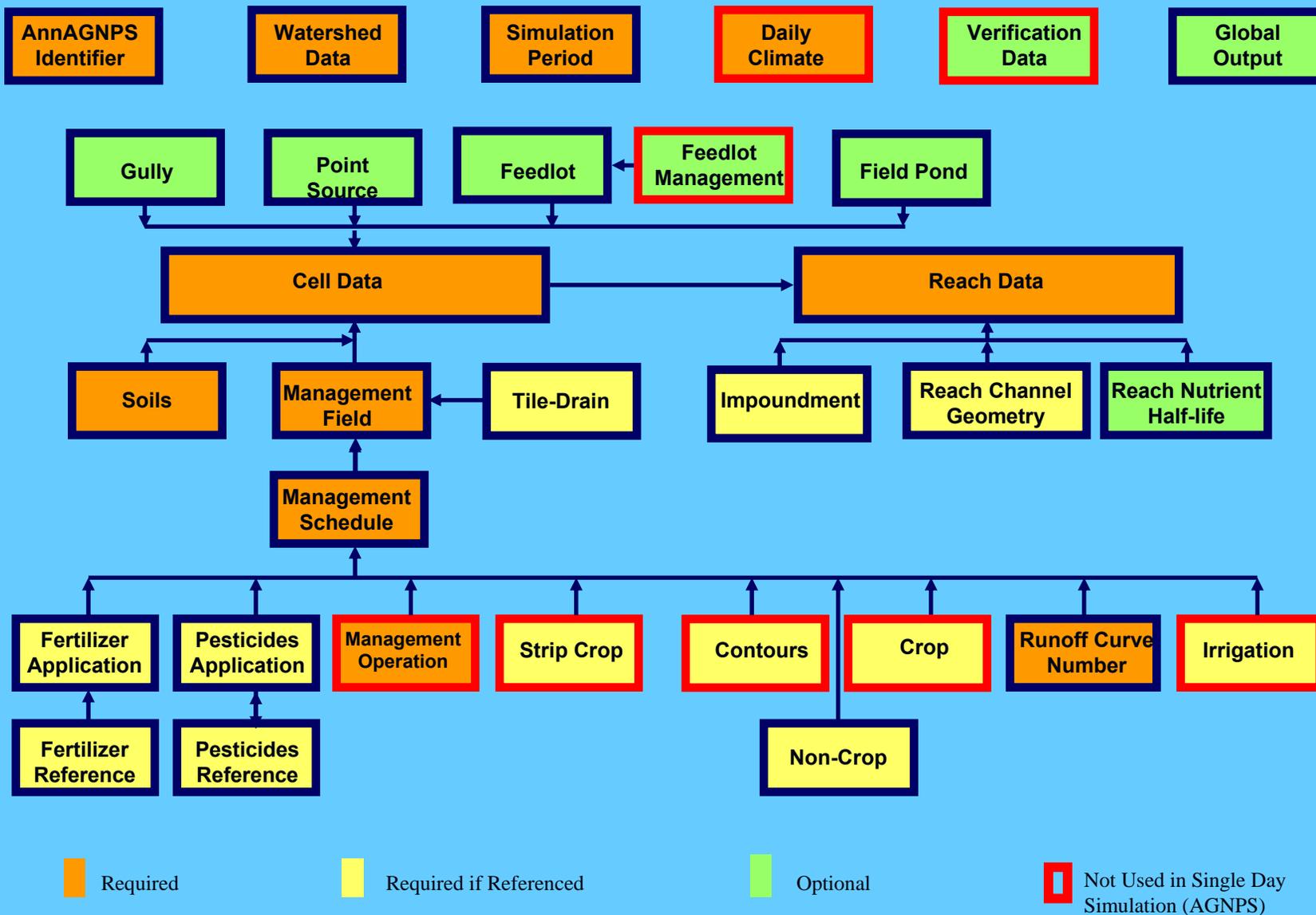
Data Requirements



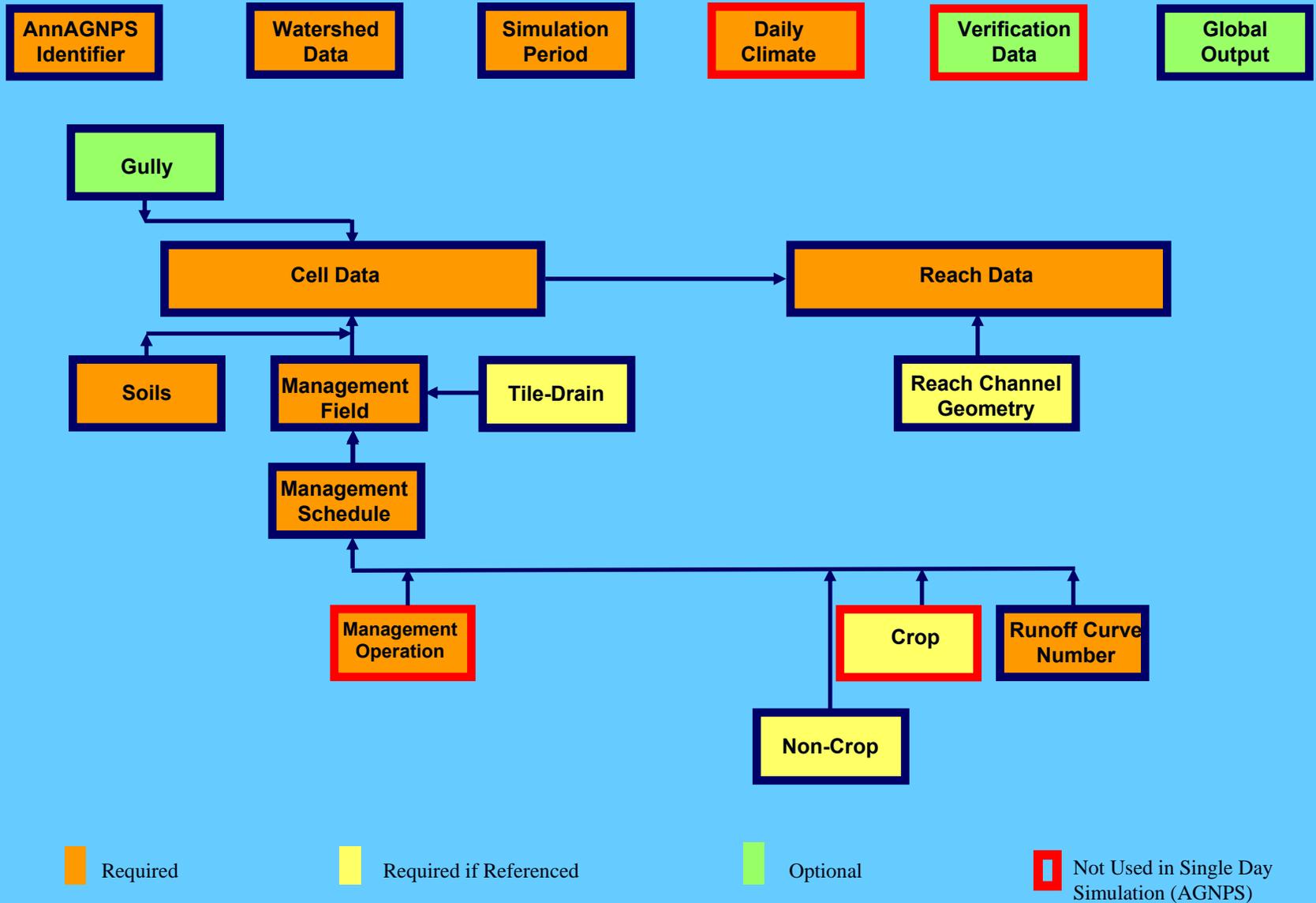
Data Availability

- Climate – From historical databases or weather generators
- Topographic – From DEMs used with TOPAGNPS
- Soil Data – Spatial representation from GIS layers & soil input database from NASIS.
- Field Management – Spatial representation from GIS layers & erosion management databases from RUSLE

All Available AnnAGNPS Input Data Sections



AnnAGNPS Input Data Sections Used for the Upper Auglaize Watershed, Ohio Project



AnnAGNPS: output

Average annual contribution of each cell's unit-area loads to the outlet as well as by individual event are available such as:

- sediment & chemical (nutrients and pesticides) pollutants;
- yield of all constituents (water, sediment, & chemicals) to its receiving stream;
- loading of all constituents at any location in the stream network; and
- virtual constituent daily mass datasets for risk analyses.

AGNPS OVERVIEW: WEB SITE

AGNPS can be accessed on the Internet at:

<http://www.ars.usda.gov/Research/docs.htm?docid=5199>

Watershed Erosion

- Sheet & Rill
- Ephemeral Gully
- Classical Gully



Watershed Erosion

- Sheet & Rill
- Ephemeral Gully
- Classical Gully
- Channel Erosion



Watershed Erosion

→ AGNPS Components

- Sheet & Rill
 - Ephemeral Gully
 - Classical Gully
 - Channel Erosion
- RUSLE
 - EGEM → REGEM → TIEGEM
 - Runoff/Sediment Relat.
 - CONCEPTS, CCHE1D
when significant changes
of channel morphology
are possible

Tillage-Induced Ephemeral Gully Erosion -“TIEGEM”

As a result of a non-erosive layer at the bottom of the tillage depth



Severe sheet and rill erosion on highly erodible soils in northwest Iowa after heavy rains. The spring rains fell on soils that had no protection against soil erosion.



Branching of Ephemeral Gullies

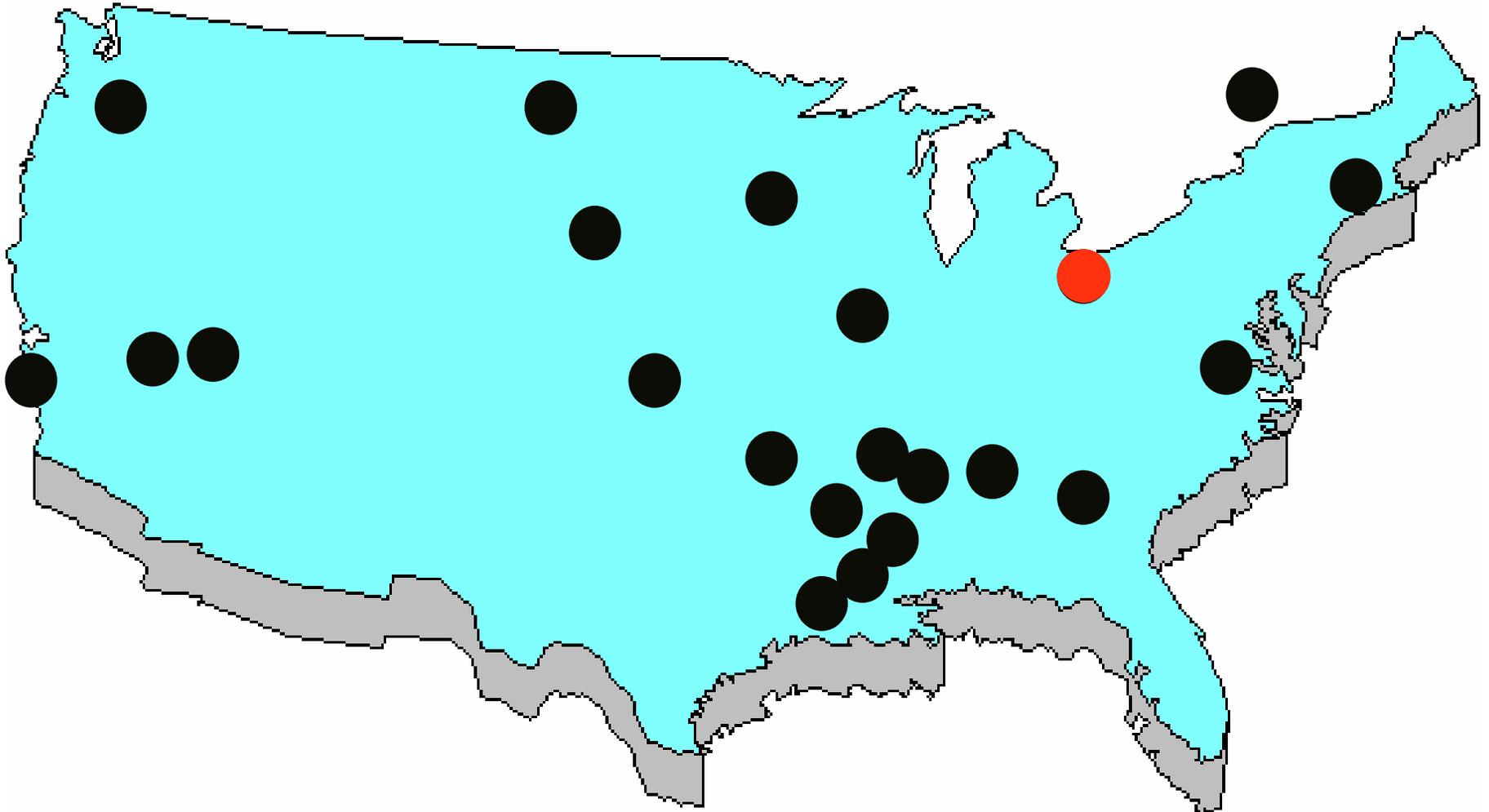


Studies have shown that only one-half of erosion in cropland occurs today as had occurred in the recent past.

Sheet & rill erosion has decreased as a result of conservation practices, which do not appreciably affect ephemeral gullies.

Thus, ephemeral gullies are becoming a dominate source of cropland erosion.

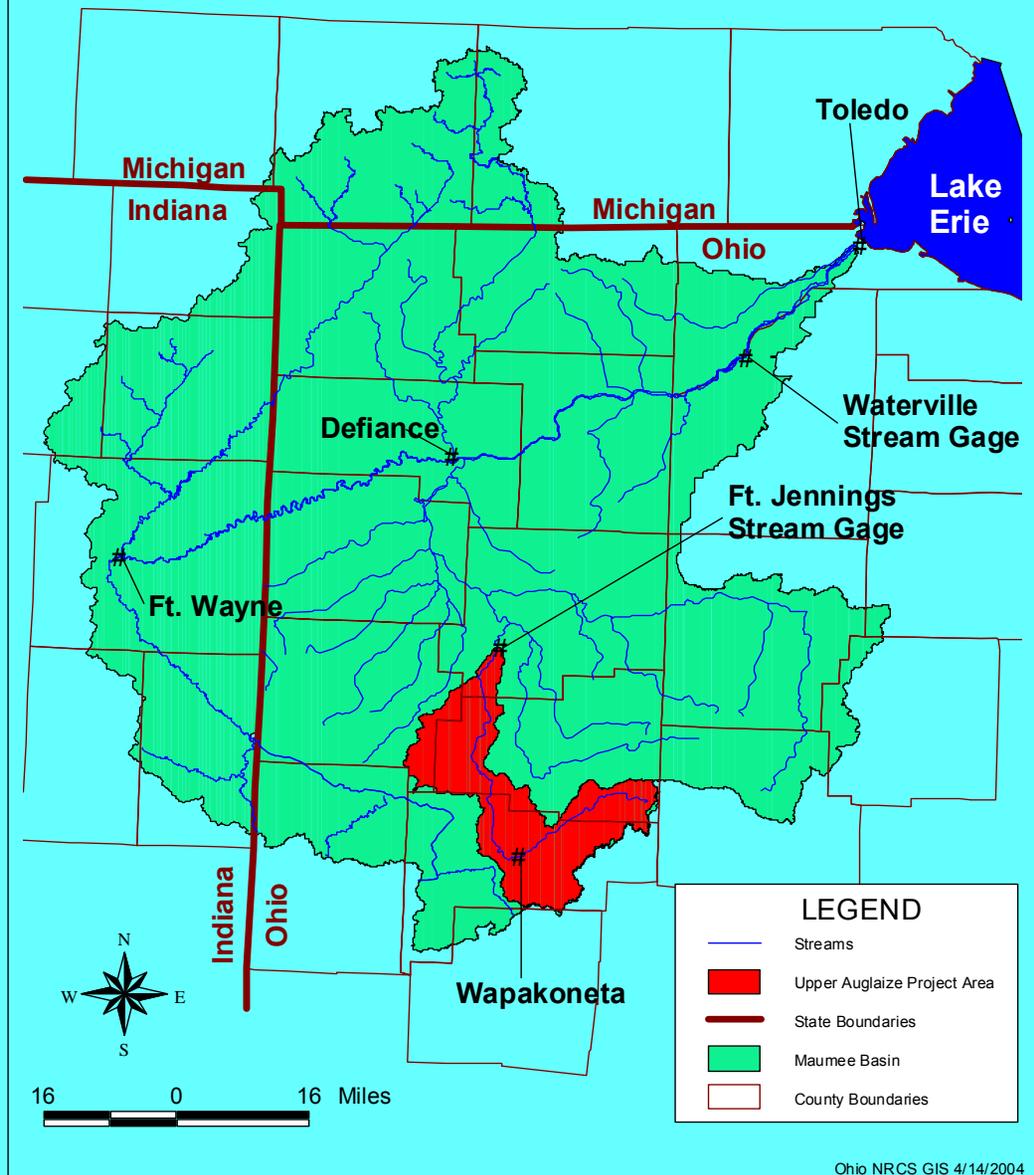
Watershed Locations with AnnAGNPS Datasets Developed or in Development



Upper Auglaize Watershed, Ohio

Upper Auglaize Project Area Maumee River Basin

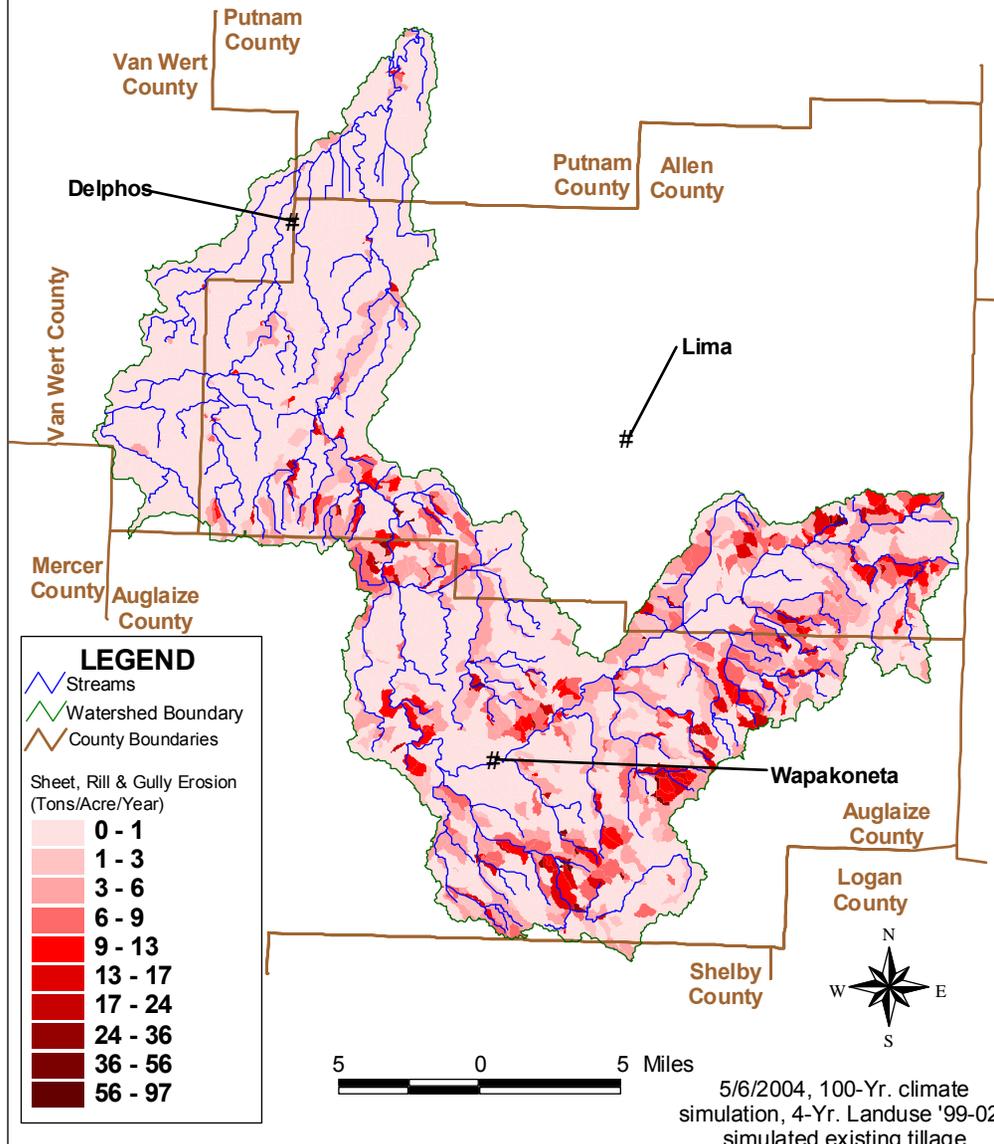
AnnAGNPS Application with EGEM



UPPER AUGLAIZE WATERSHED

AnnAGNPS modeling - Simulated existing condition erosion
(Tillage type randomly assigned per watershed tillage transects)

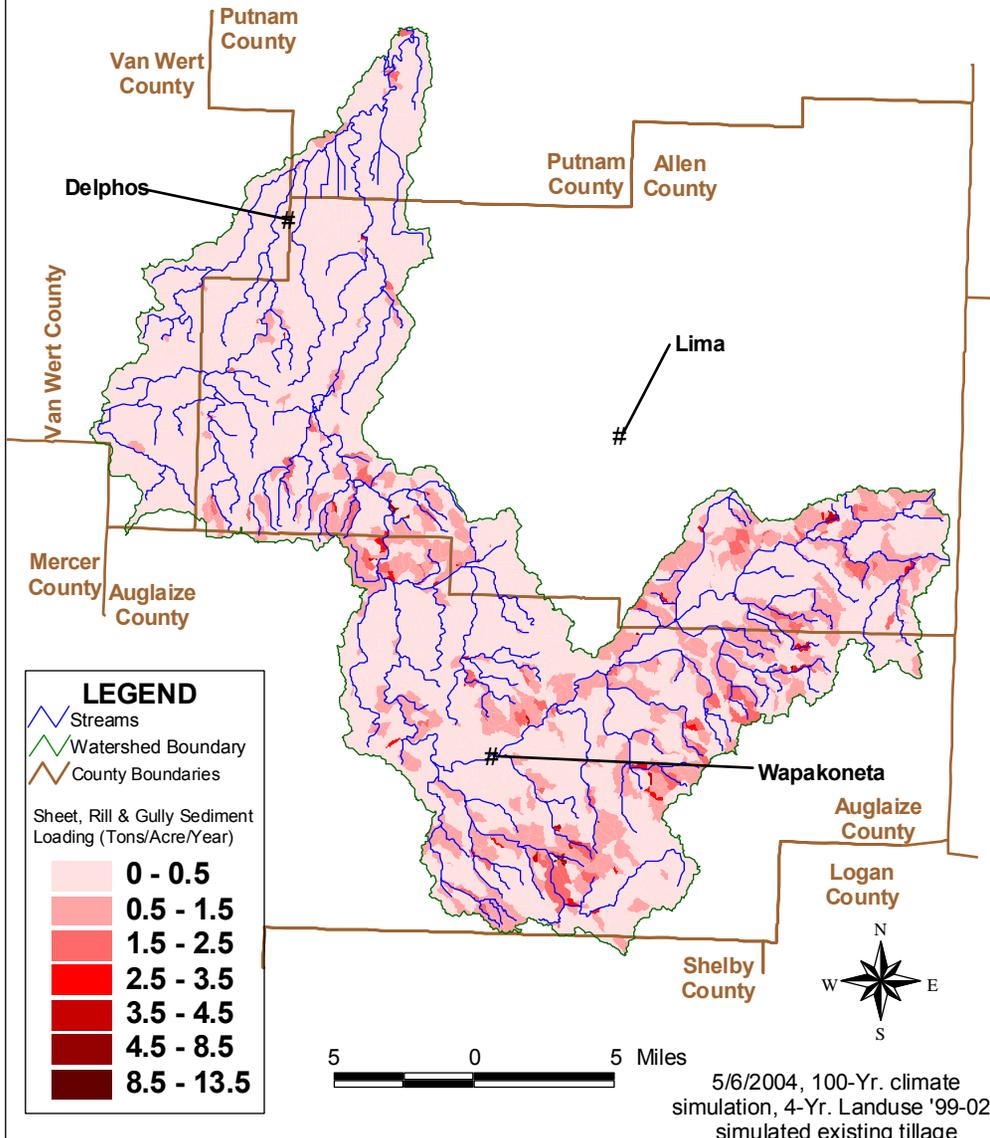
Existing Condition Erosion



UPPER AUGLAIZE WATERSHED

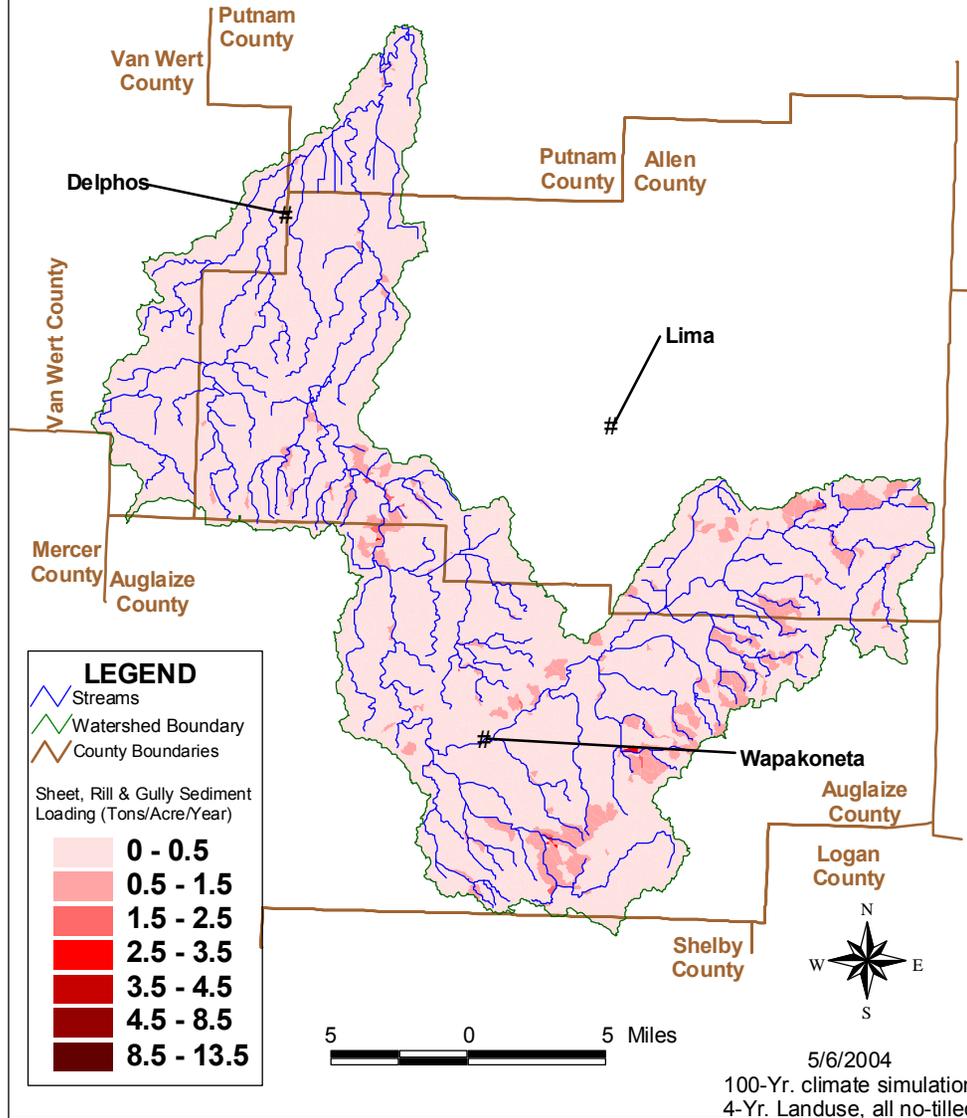
AnnAGNPS modeling - Simulated existing sediment load to outlet
(Tillage type randomly assigned per watershed tillage transects)

Existing Condition Sediment Load



UPPER AUGLAIZE WATERSHED

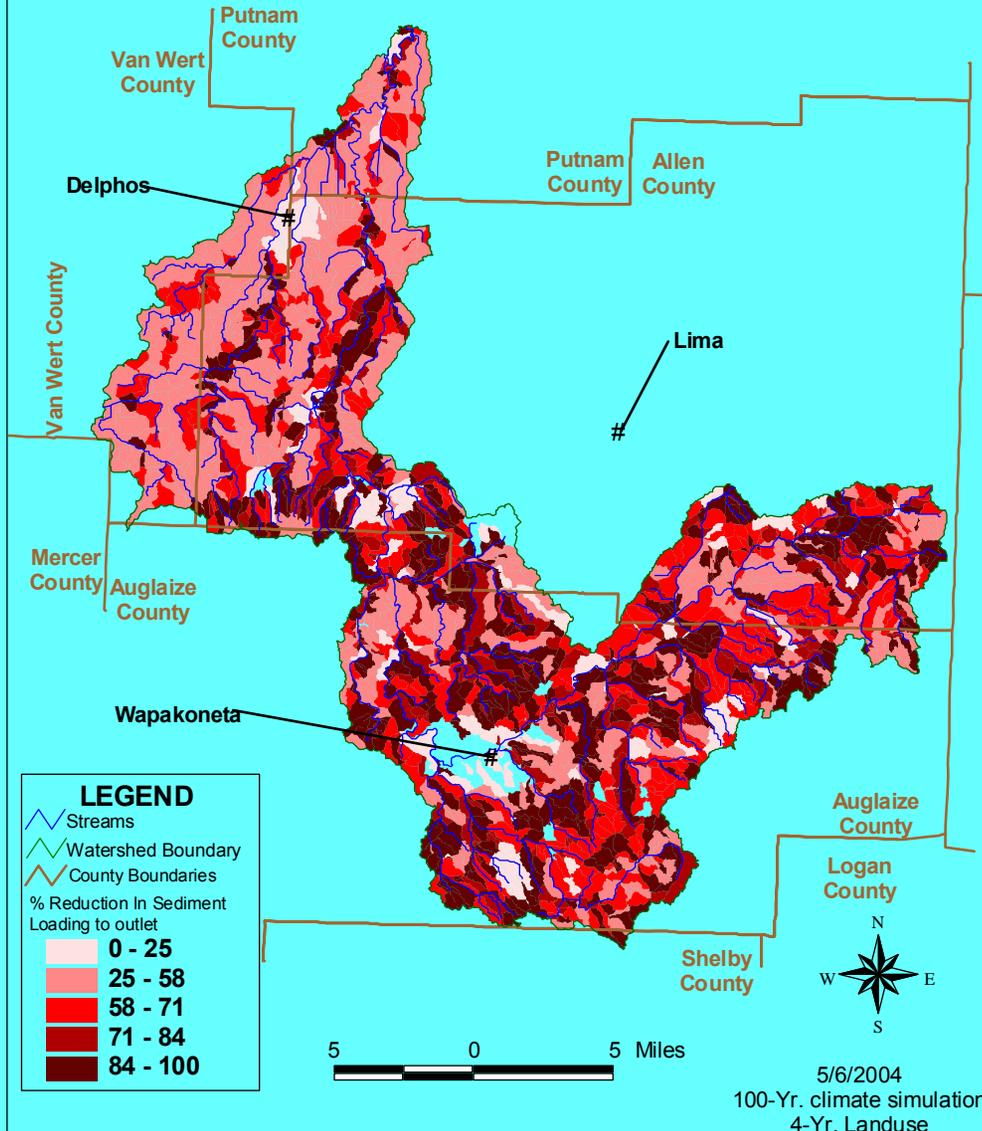
AnnAGNPS modeling - Sediment Loading to outlet
under conditions of all cropland no-tilled



No-Till Sediment Load

UPPER AUGLAIZE WATERSHED

AnnAGNPS modeling - Percent reduction in sediment loading to outlet by converting from all conventional tillage to all no-till



% Sediment Load Reduction from Conventional Till to No-Till Using AnnAGNPS and EGEM as standalone computer models

Sediment Load Reductions:
 70% - Ephemeral gullies
 35% - Sheet & Rill Erosion
 60% overall sediment loading

Required estimate of gully runoff-sediment discharge relationship from EGEM for each cell.

EGEM was not integrated with AnnAGNPS.

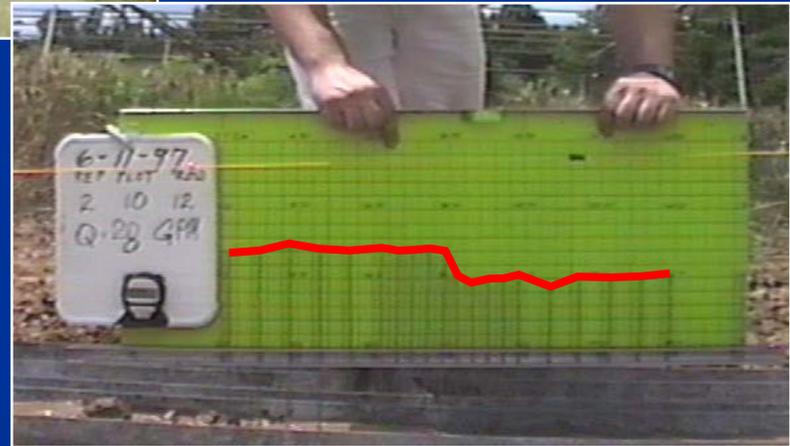
AnnAGNPS Recent Enhancements

- **Ephemeral Gully Erosion Integration**
- **Runoff Calibration**
- **Controlled Drainage (includes improved subsurface nutrient transport, surface inlets)**
- **Storm Type Distribution**

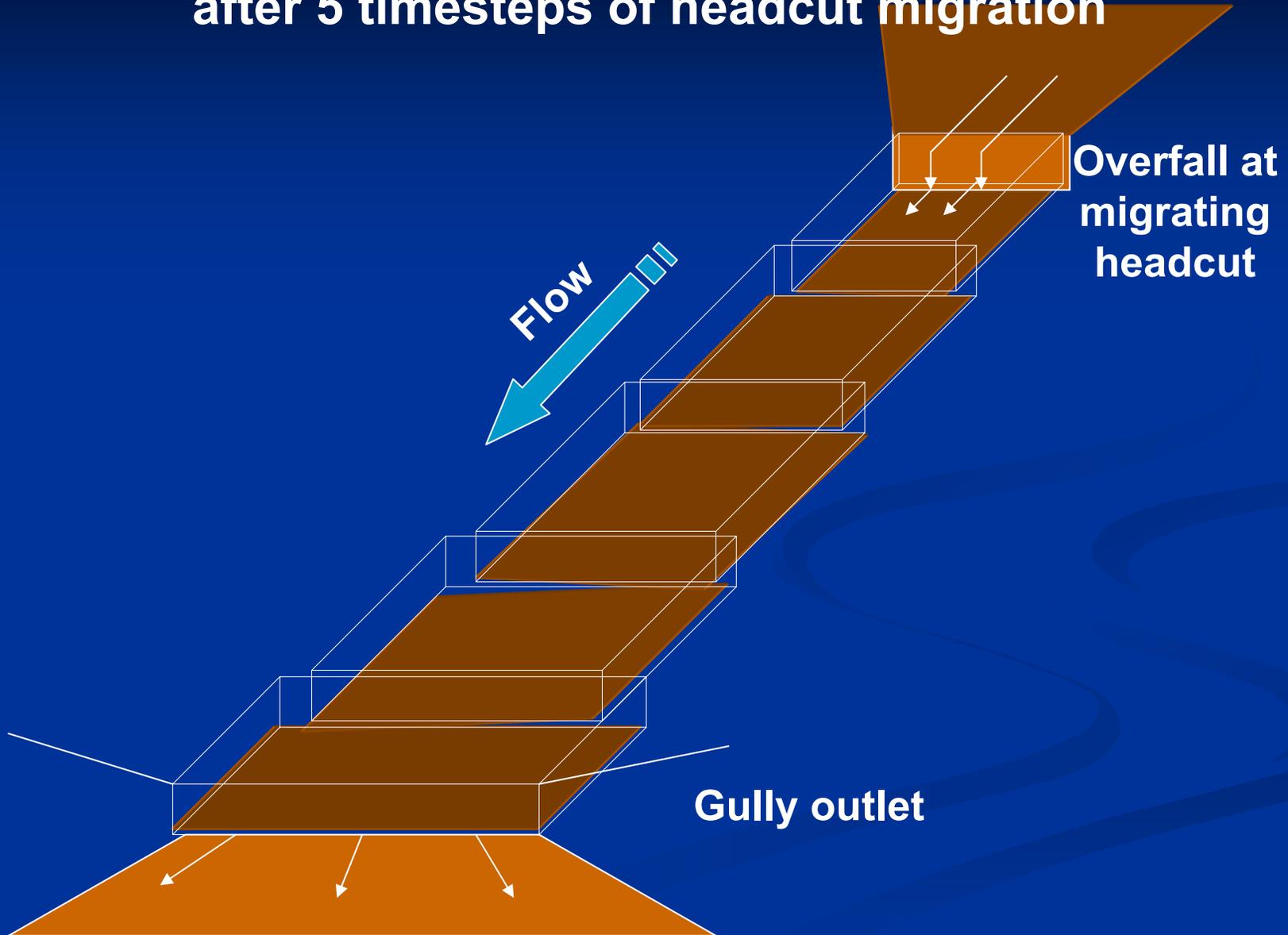
Controlled Drainage

- Users determine the depth of controlled drainage, and when and where it occurs. This ranges from a drain completely open or closed.

Typical Headcuts



3-D Representation of gully system after 5 timesteps of headcut migration



Research Needs

- **Headcut width relationships**
- **Resistance of soil to ephemeral gully erosion**
- **Effect of non-erosive layers**
- **Multiple ephemeral branches**



AnnAGNPS Future Enhancements

- **Base Flow Processes**
- **Improved ET components**
- **Riparian Buffers (filters)**
- **RUSLE2 incorporated**
- **Frozen water/soil processes**
- **Chemical Application Accounting (similar to erosion accounting)**



UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

Thank you

