

# Regional Estimation of Soil Carbon and other Environmental Indicators Using EPIC and i\_EPIC

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# Introduction

- Models are key policy analysis tools
- EPIC model (Envr. Policy Impact Climate)
  - very flexible: can simulate wide range of cropping systems & management alternatives
  - multiple indicators: water & wind erosion, nutrient & pesticide losses, carbon sequestration
  - can be applied for regional analyses

# Regional Applications of EPIC

- Typically require thousands or tens of thousands of simulations
- Results in a massive data management task
- CARD solution: interactive EPIC (i\_EPIC)

# i\_EPIC

- Windows interface; user friendly (mostly)
- Input & output data stored in single ACCESS Database
- Can execute thousands of EPIC simulations in a single application

# Objectives

- 1) Brief EPIC overview (version 1015)
- 2) Overview of i\_EPIC
- 3) Example EPIC/i\_EPIC applications

# EPIC Overview

- Continuous, daily time step, field-scale model  
-long-term simulations (hundreds of years)
- Generic crop growth routine
  - ~100 crops; crop rotations; simultaneous simulation of up to 12 crops/plants
- Six water erosion equation options (USLE, MUSLE, RUSLE, etc.)

# EPIC Overview

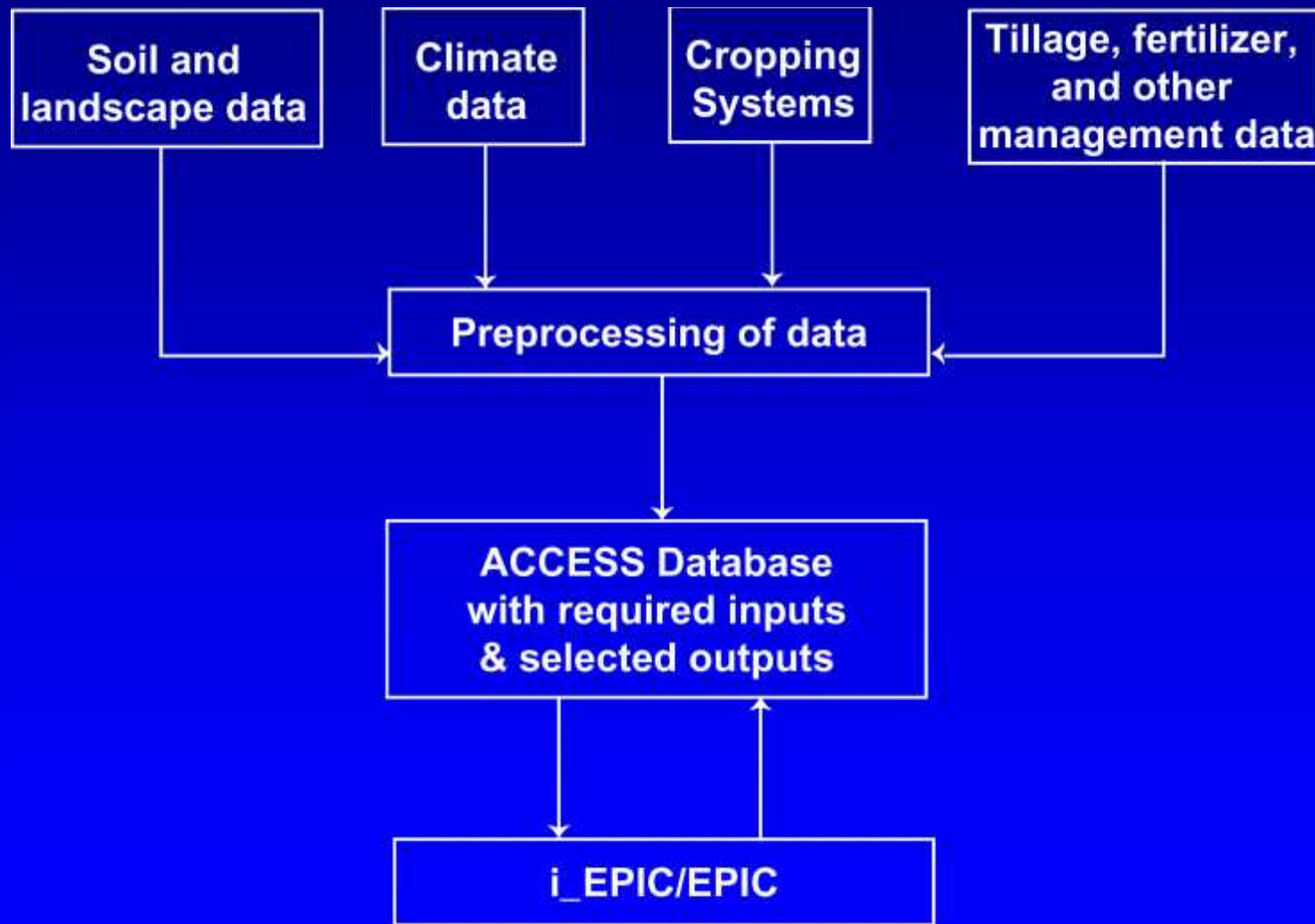
- Two water infiltration options and four evapotranspiration options
- Can input measured and/or generated climate data
- EPIC1015: enhanced soil carbon routine based on the Century model

# EPIC1015 Carbon Submodel

- Three soil carbon pools
  - biomass, slow, and passive
- Only two surface litter pools: biomass & slow
- Existing EPIC routines used for some functions
- Outputs: soil carbon levels; leaching & gaseous losses



# Schematic of i\_EPIC System



# i\_EPIC On-line

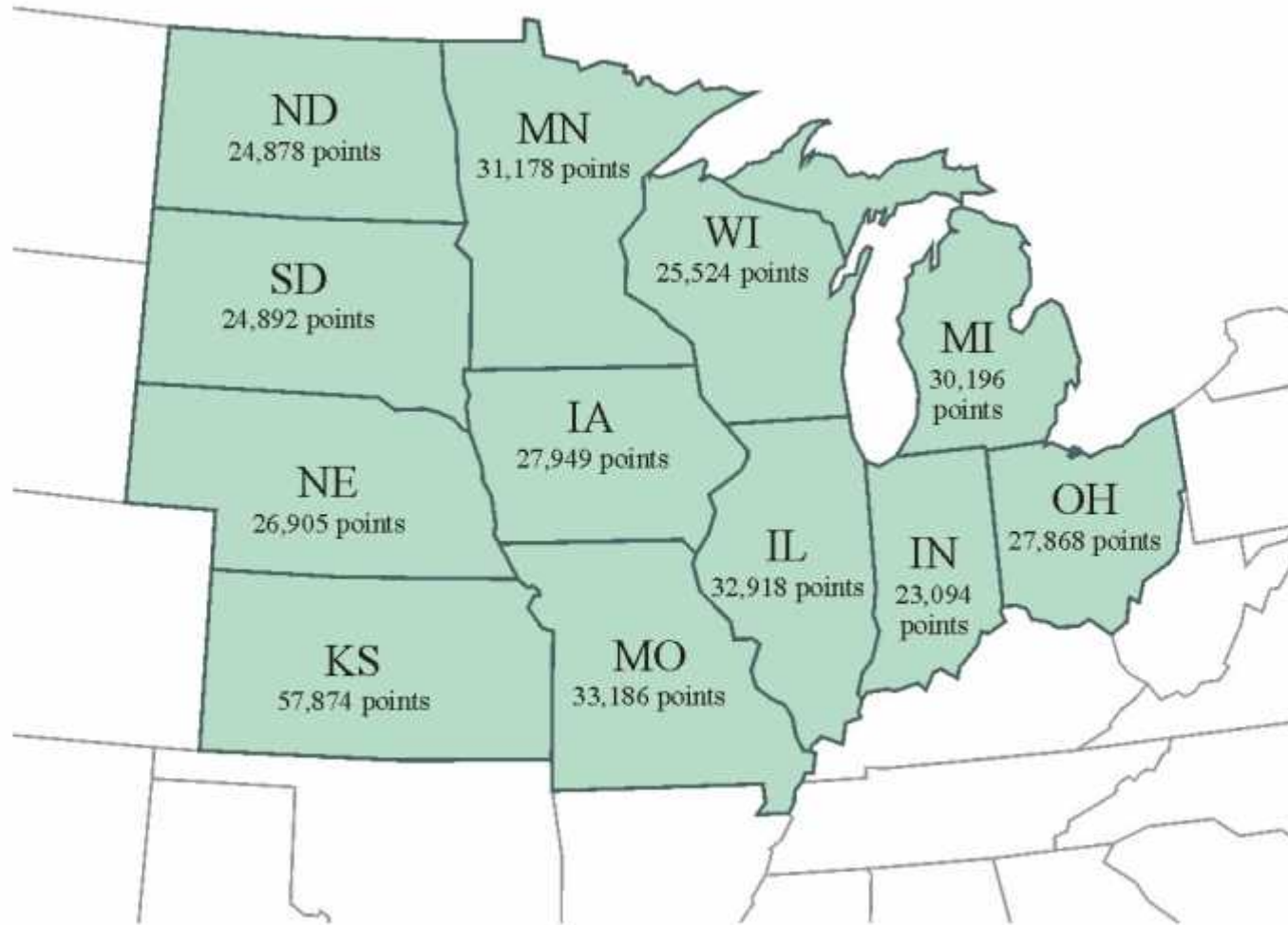
<http://www.iastate.public.edu/~elvis/>

- Download i\_EPIC & EPIC executables
- Documentation of database tables
- Other documentation (limited)

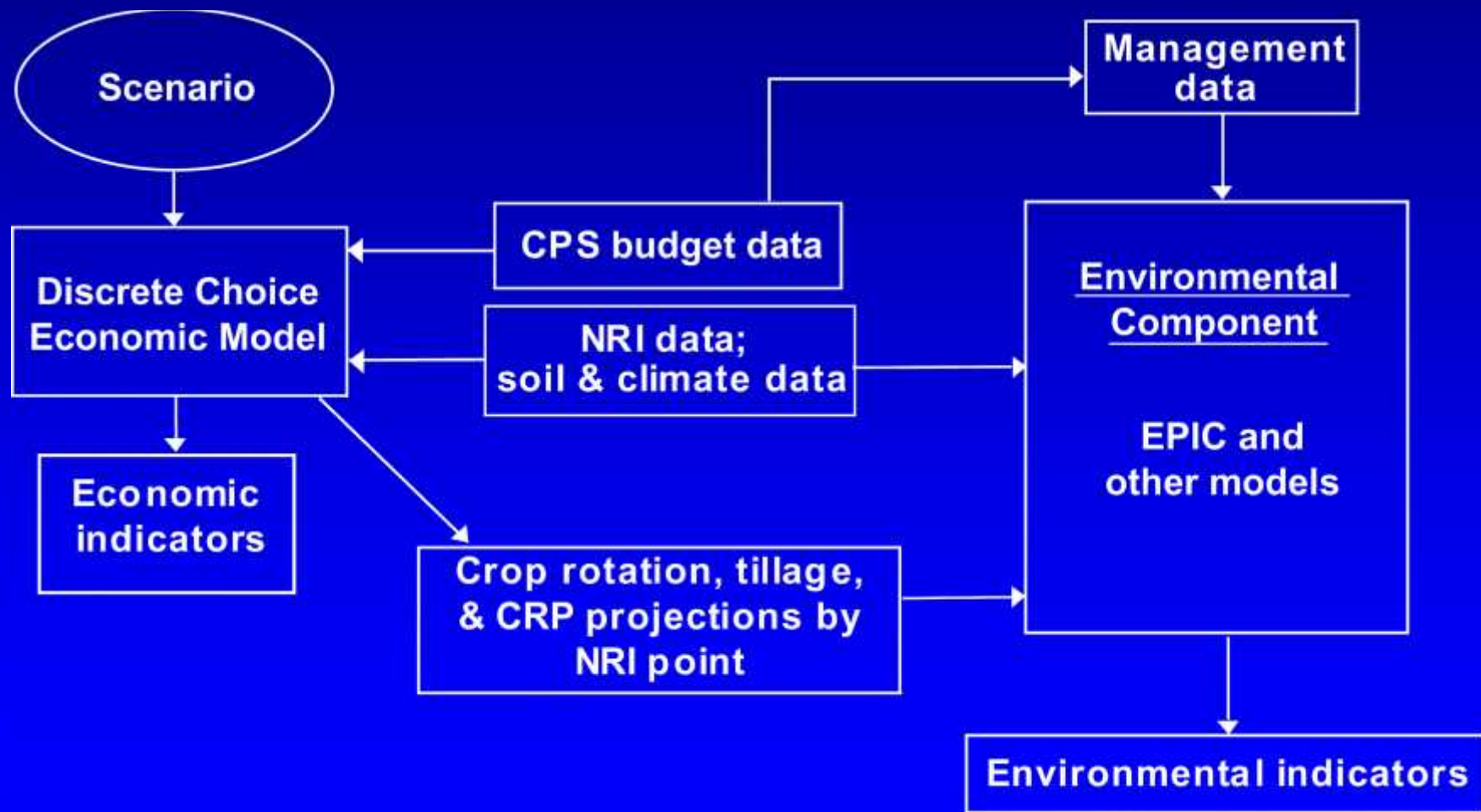
# CARD i\_EPIC Application

- Usually applied within the Resource & Agric. Policy System (RAPS)
- 12-state North Central region
- Key USDA Databases
  - 1992 & 97 National Resources Inventory (NRI)
  - 1990-95 Cropping Practices Survey (CPS)

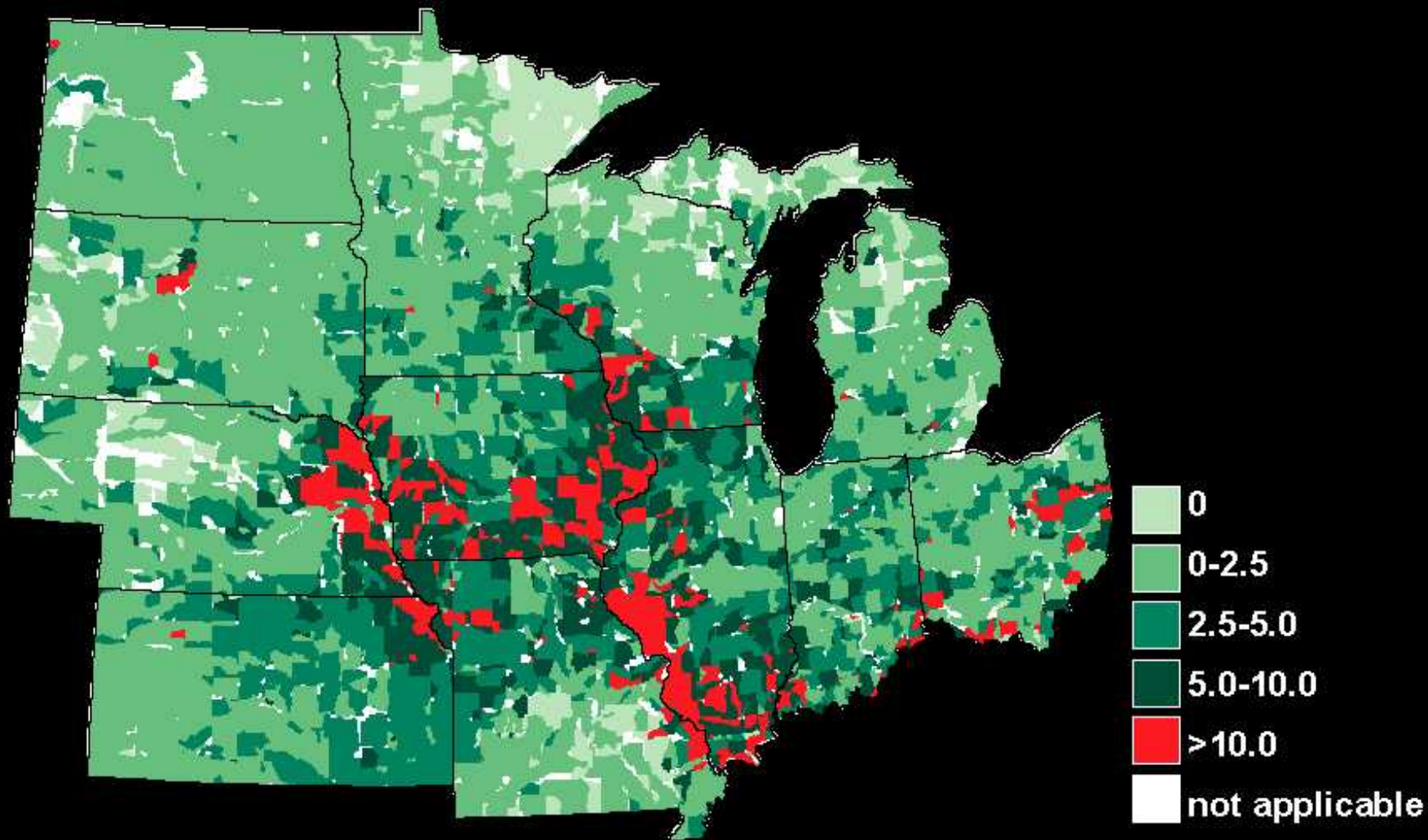
# NRI Points in North Central Region



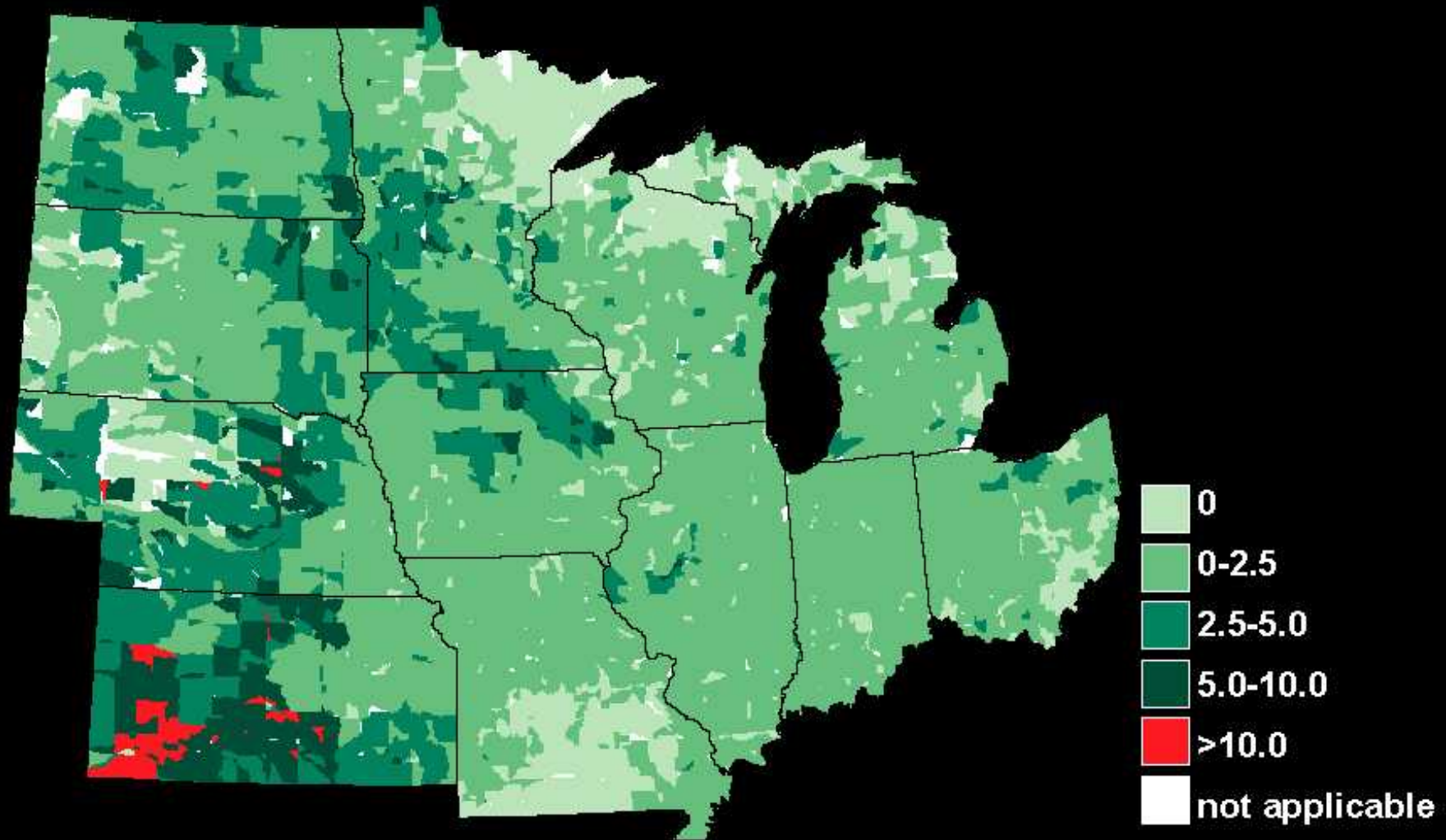
# Schematic of the RAPS System



# Soil Loss Due to Water Erosion, tons/ac: 1997 projection



# Soil Loss Due to Wind Erosion, tons/ac: 1997 projection

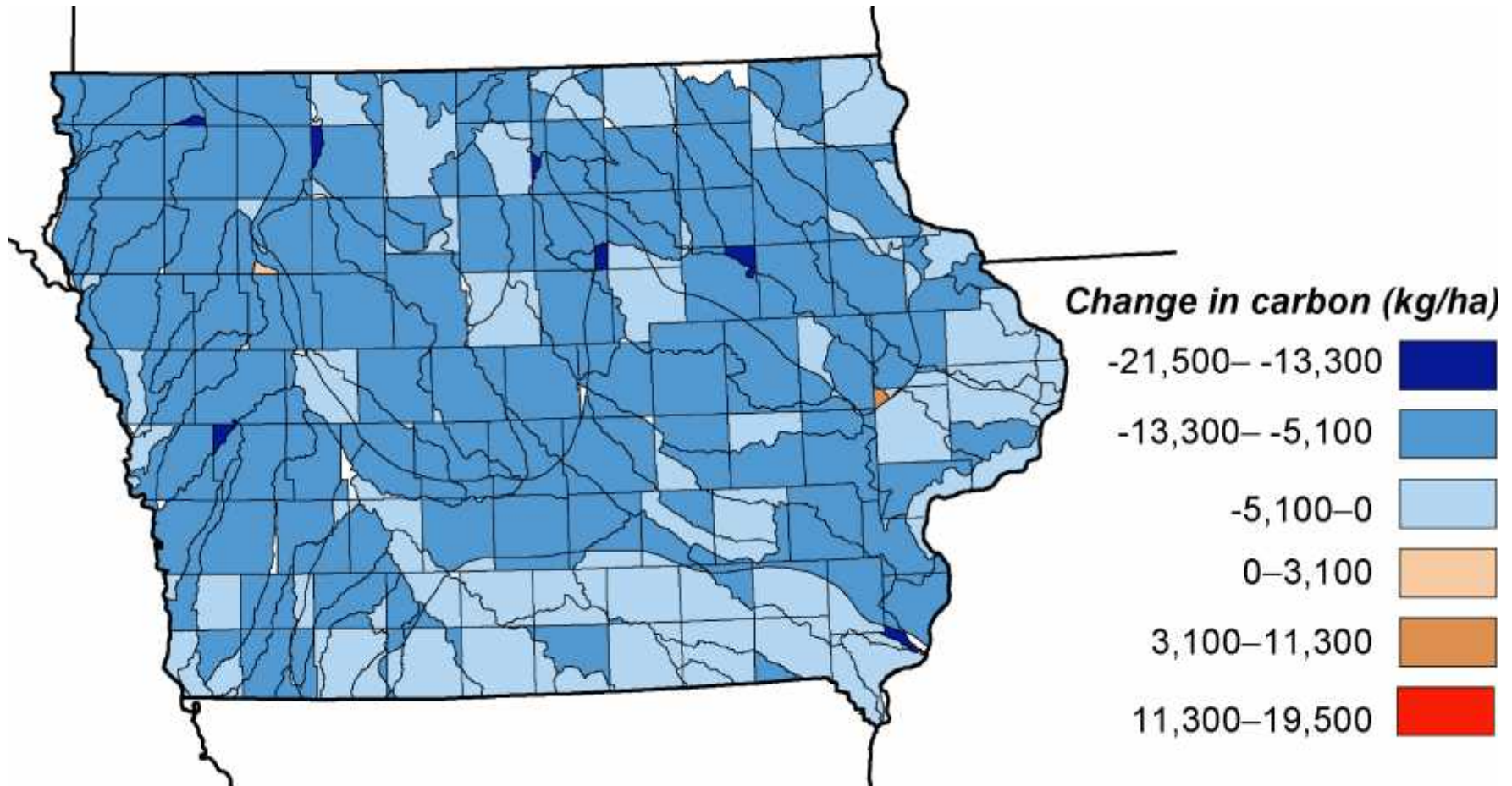


# Iowa EPIC1015 Carbon Application

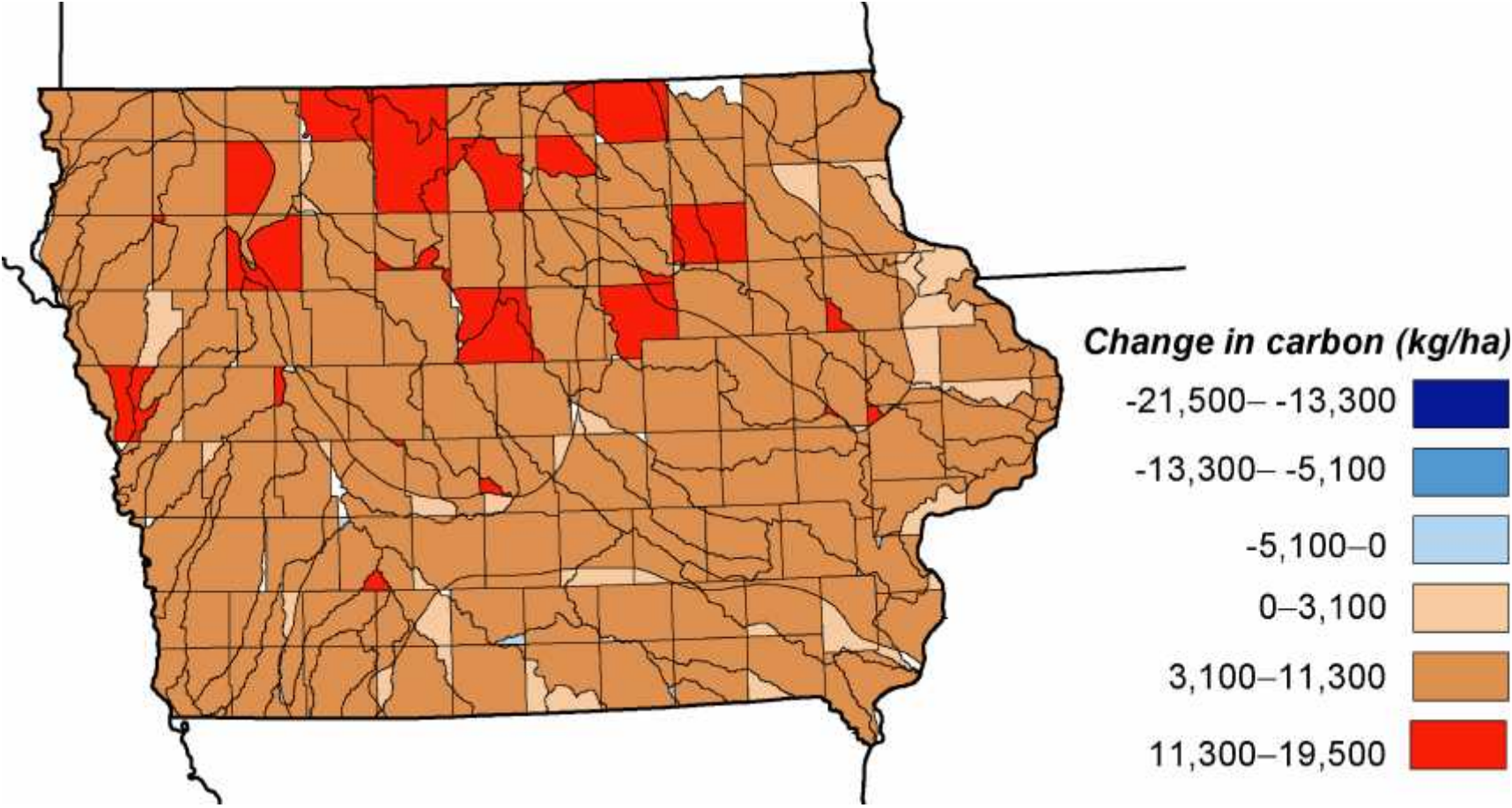
- EPIC1015 & i\_EPIC executed without economic model
- 3 sets of 30-year simulations
  - baseline (mix of tillages)
  - conventional till & notill scenarios
  - 15,000+ simulations each (at NRI points)
- Tillage scenarios compared against baseline



# Soil Carbon Difference: Conv. vs. Baseline (Based on 30-Year EPIC1015 Simulations)



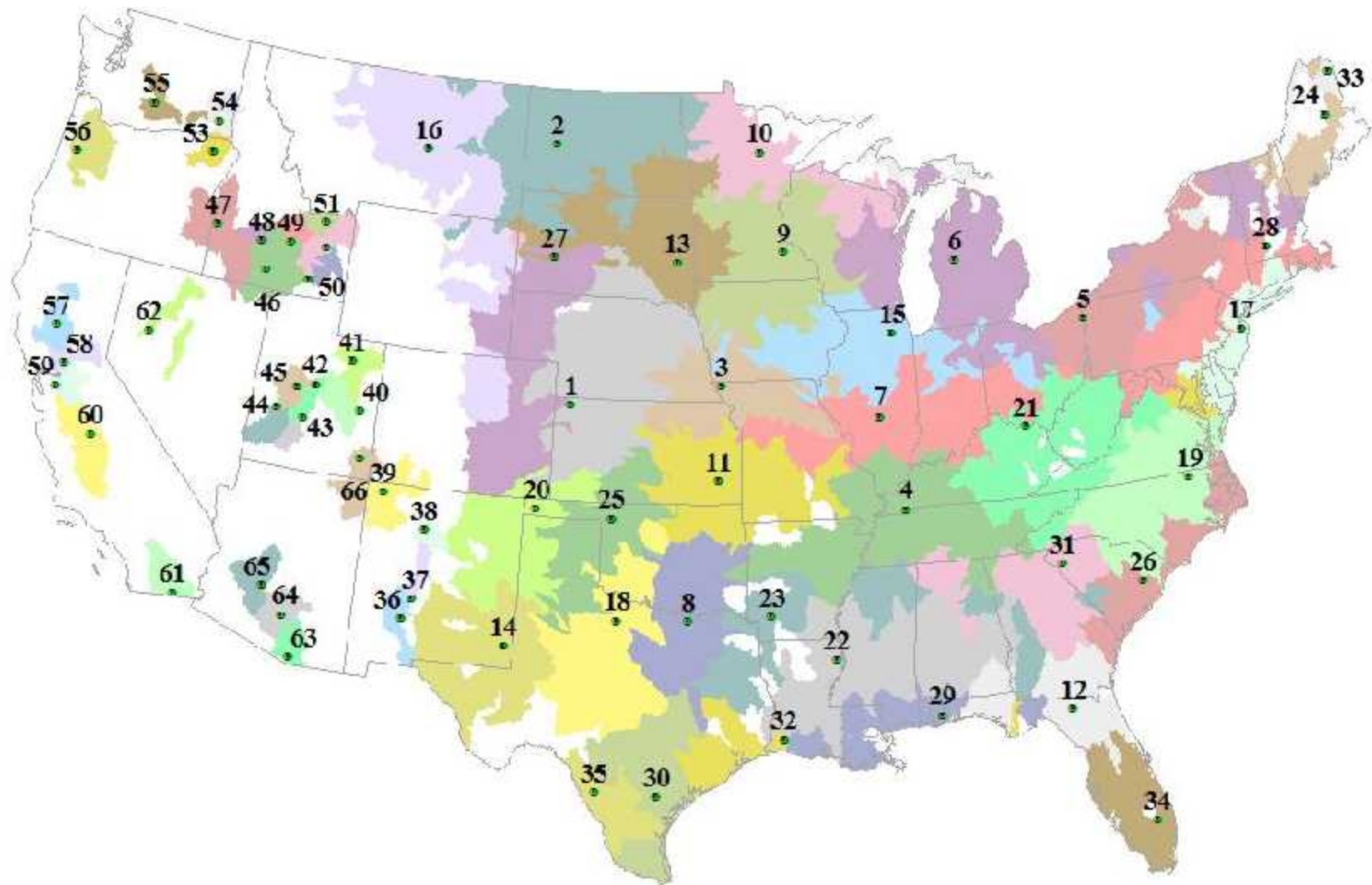
# Soil Carbon Difference: Notill vs. Baseline (Based on 30-Year EPIC1015 Simulations)



# NRCS i\_EPIC Application

- National resource assessments for 48 states
  - NRI: key source of crop. system & other data
- Multiple indicators: nutrient (N & P) losses, water & wind erosion, soil carbon, pest. losses
- Developed preprocessing software plus “climate and soil clusters” for modeling system

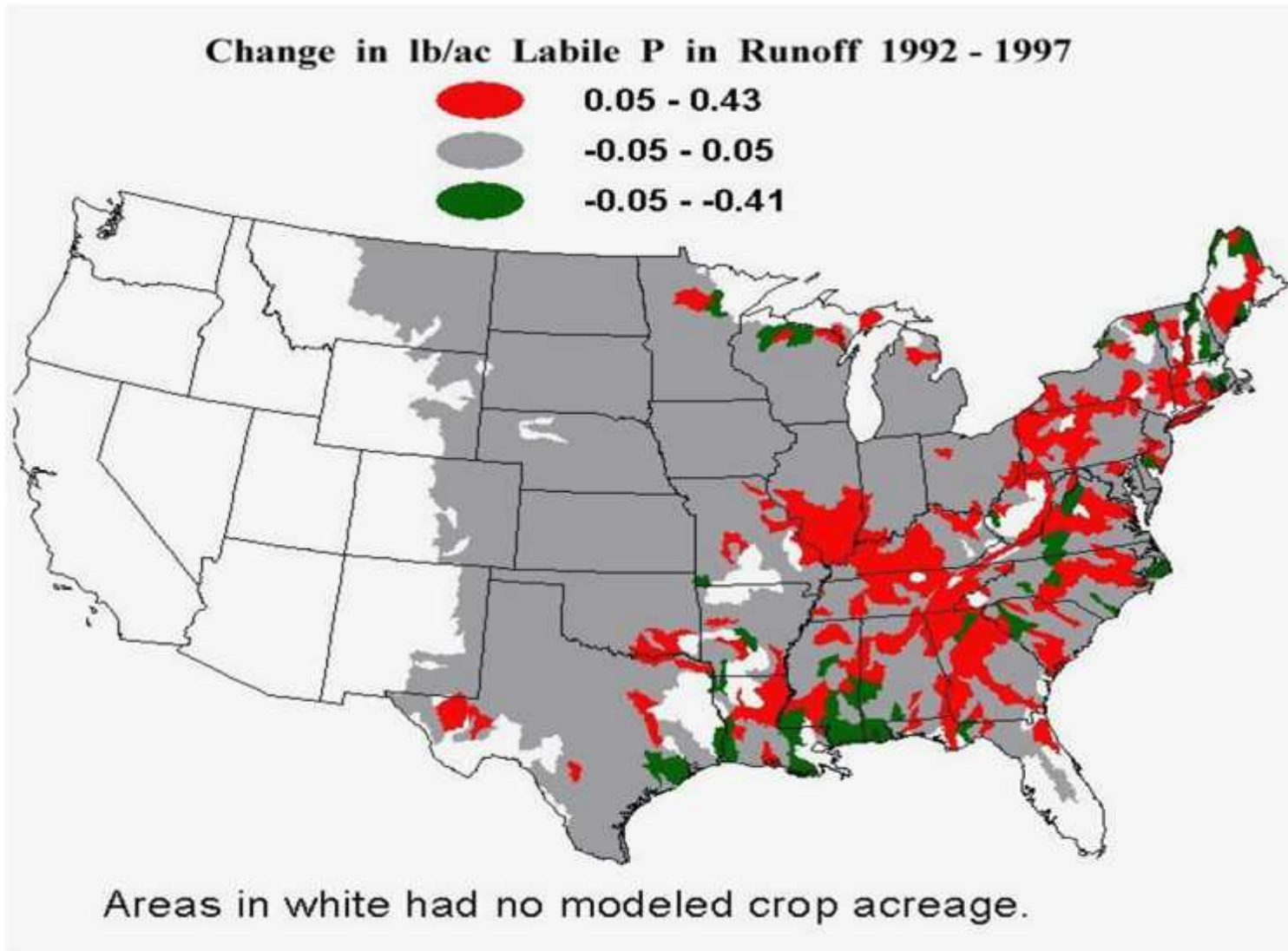
# Climate Clusters Developed for NRCS EPIC Modeling Scenarios



# NRCS System Statistics

- ~7,300 soil-climate cluster combinations
- ~35,000 homogeneous resource areas  
-f(cropping systems & other factors)
- ~1 million EPIC runs required for an analysis  
-array of fertilizer, tillage, & irrig. practices

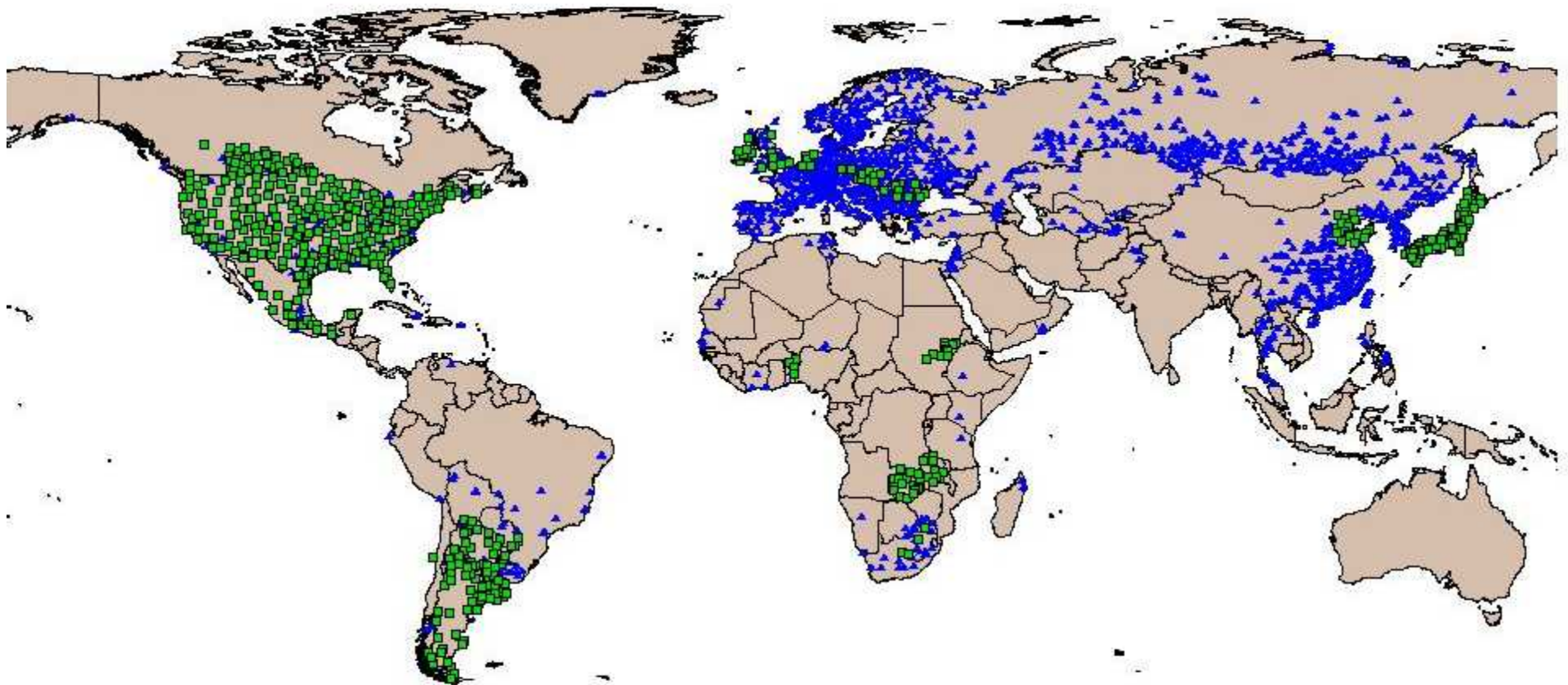
# Effects of NRI Land Use Changes on Predicted Labile P Runoff from the NRCS EPIC Modeling System



# JGCRI i\_EPIC Application

- EPIC1015 representative farms
  - key production regions across the globe
  - assess variations in management, cropping systems & climate
- 400+ farms constructed so far
  - includes input from researchers in 20 countries
- Soil & climate data identified for ~1,500 more potential farms

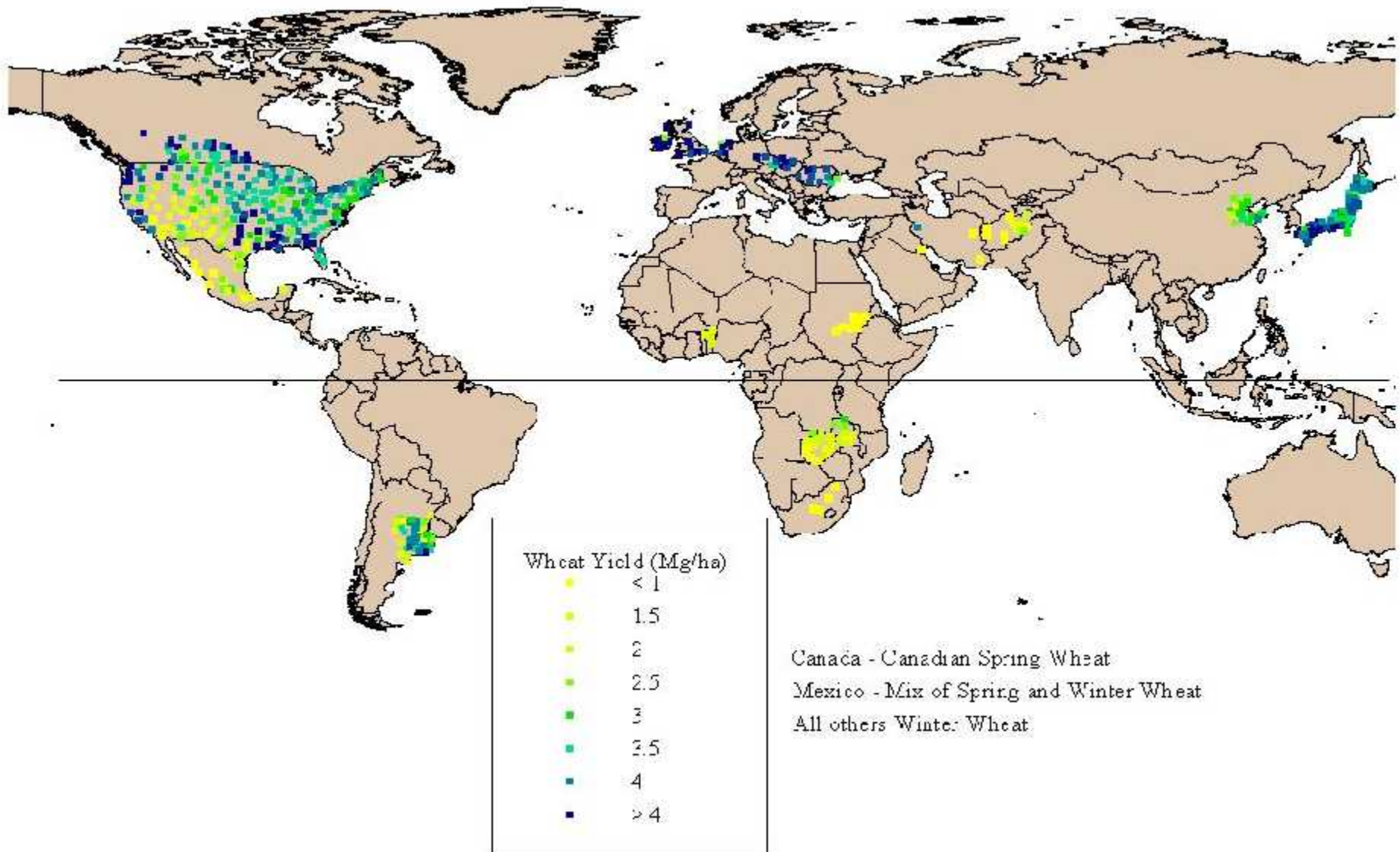
# JGCRI Working & Potential EPIC Farm Models



- Current Working Farms
- ▲ Farms with Daily Climate



# Wheat Yields Estimated for JGCRI EPIC Farms



# Conclusions

- EPIC1015: improved carbon assessments  
-released in near future?
- i\_EPIC is a robust tool for managing large sets of EPIC simulations  
-will continue to evolve and improve