



# Soil-Erosion Economic Decision Support Tool for Evaluating Cost Effectiveness of BMPs at the Field Level

By Daniel Ginting  
USGS Nebraska Water Science Center  
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# Outline

- Introduction
- Approach
  - Erosion Prediction
  - Crop Budget
- Demonstration

# Introduction

## □ Problem Statement

- Among many other factors, profitability is the main factor for adoption of BMPs.

“The research confirmed that while profitability was a motivation to farmers who practiced conservation tillage, a \$1,000 increase in income only increased the odds of conservation tillage by less than 1 percent.”

“Some find the practice profitable but others do not.”

“Farmers who recognize the water quality problem in the watershed caused by erosion and subsequently empathize with downstream water users are more likely to practice conservation tillage”

Lynne and Sheeder ,  
Cornhusker Economics,  
January 2009)

# Introduction (continued)

- **Big-picture questions:**
  - How do these factors interrelate?
  - What practices do meet the desired water-quality target and also provide adequate profit incentive

# Objective

## S

- To provide a tool that:
  - combines environmental and economical analysis of a wide range of alternative farming practices
  - can assist farmers, managers, and regulatory agencies in the planning process
  - is suitable for educational purposes in formal settings

## Purpose of this presentation

- Describe the concept of development of soil erosion economic decision support tool (SEE\_DST)
- Demonstration of SEE\_DST

## Scope of this presentation

- Major crop rotations in Nebraska

# General Approach

## Level of

## Design

- Process
- Model
- Fully Coupled Models
- Loosely Coupled Models
- ✓ Resource Management DST
- Analysis and Support Tools

Single Purpose

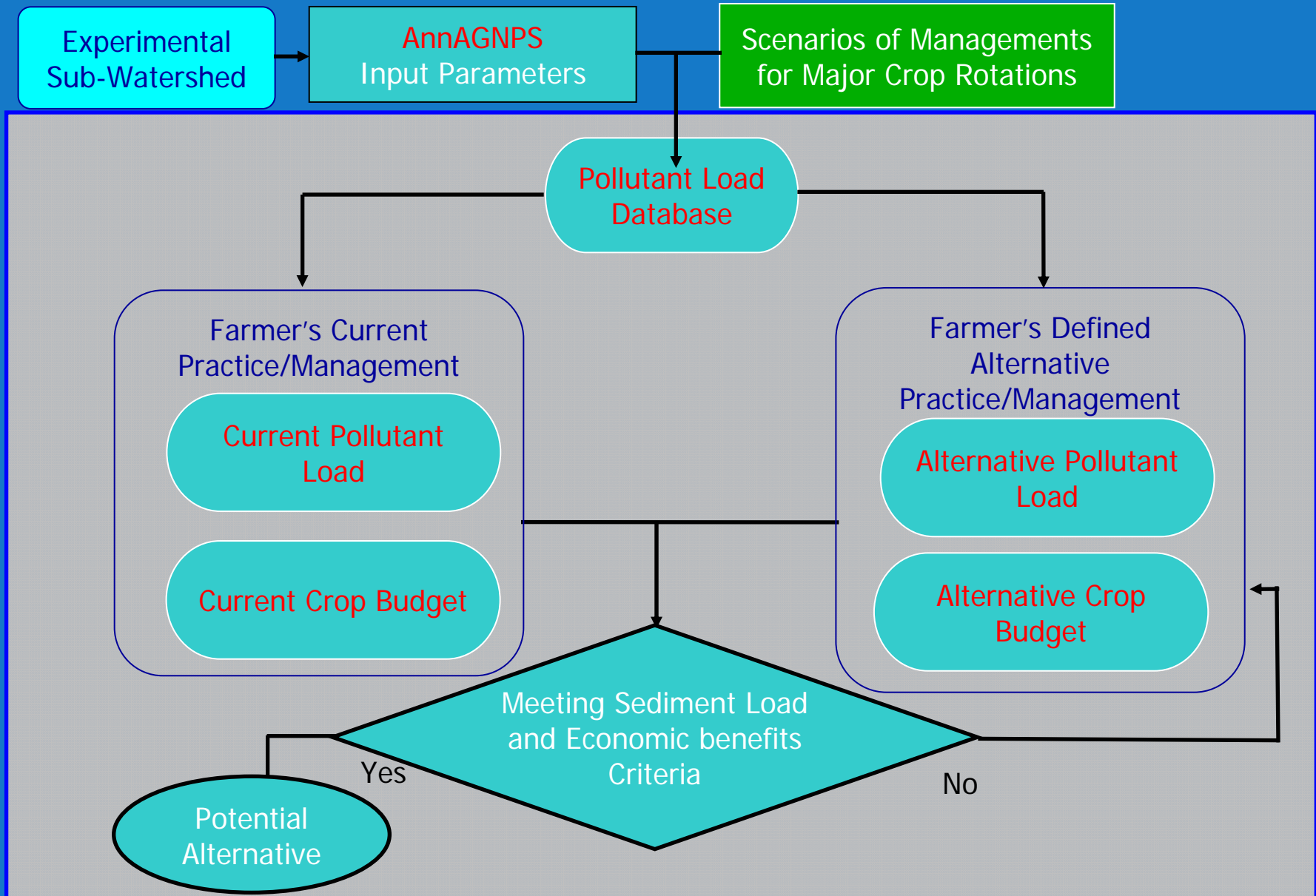


Multi-objective

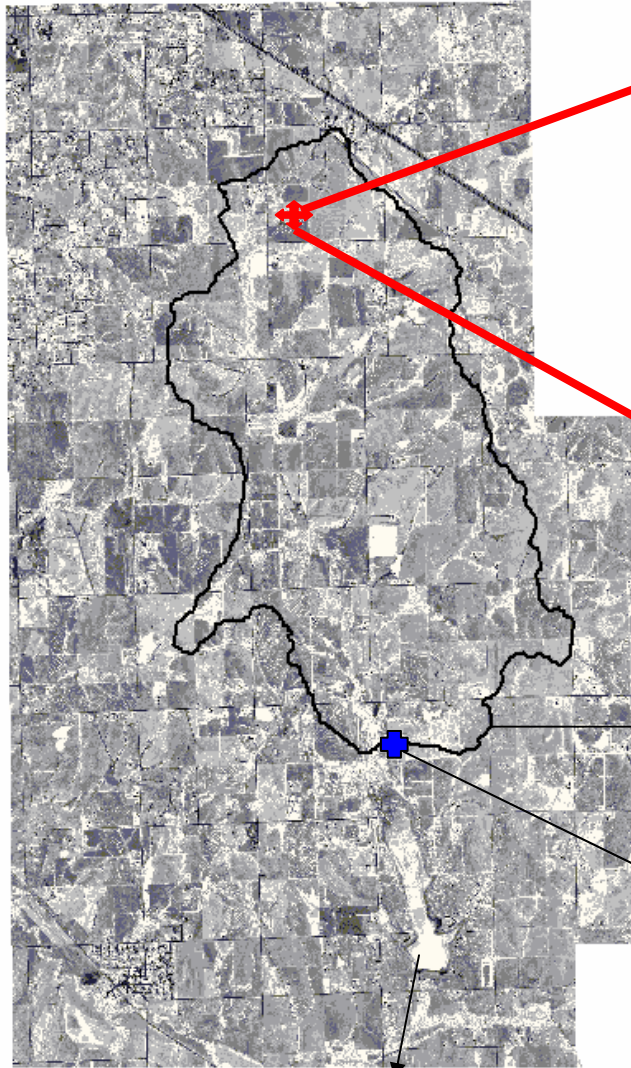
## Design Objective:

Emphasis is on the difference among agricultural practices, not the accuracy of prediction.

# General Approach (continued)



# Experimental Field



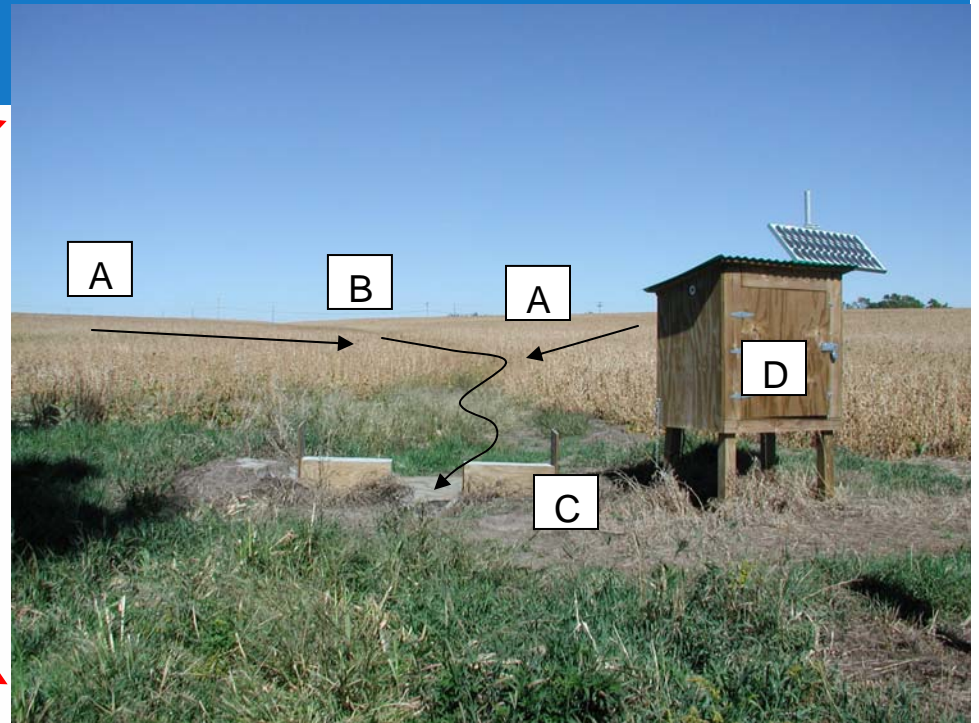
7000-acre watershed

Monitoring station



1 0 1 Kilometers

Wagon Train Lake



- A) Overland flow
- B) Ephemeral channel
- C) Weir, sensor, and sampling tube
- D) Housing, water sampler

Field Sub-Watershed  
(AnnAGNPS Cell, terraced or non-terraced)

Implement  
Operation

Irrigation

Pesticide  
Application

Fertilizer  
Application

**Management  
Schedule**

Pesticide  
Characteristic

Fertilizer  
Characteristic

Contour  
Characteristics

Crop

Curve  
Number

$$A_i = \frac{R_i}{R_o} * \frac{K_i}{K_o} * \frac{L_i}{L_o} * \frac{S_i}{S_o} * \frac{C_i}{C_o} * \frac{P_i}{P_o} * A_o$$

“i” identifies the field of interest

“o” identifies the experimental sub-watershed  
where  $R_o$ ,  $K_o$ ,  $L_o$ ,  $S_o$ ,  $P_o=1$ ,  $A_o$ , and detailed management are known

Erosion is adjusted for yield level (simulations)

Ephemeral channel erosion based on drainage area (MS. Student thesis)

## Crop Budget

- Farm revenue is solely derived from crop yield. Program payment and incentives are not included.
- Relies on the management-schedule scenarios (Univ. of Nebraska extension bulletin) .
- Only directly related to BMPs such as one-time structure installation (irrigation system, terrace), field operation, and material inputs.
- Costs of item that are minimally dependent on agricultural practice are not included.

- **Farm power units and implements are owned by the farmer.**
- **Cost of land ownership or renting is assumed to be independent of farming practices.**
- **Overhead costs (accounting, liability insurance, office expense, vehicle cost) are assumed to be independent of farming practices.**
- **Taxes, housing, insurance, and interest are assumed to be independent of farming practices.**

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(AnnAGNPS Cell, terraced or non-terraced)

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Crop

Curve  
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# Expenses Considered

- Implement and power-unit costs
- Materials (seeds, common fertilizer, herbicide, and insecticide)
- Conservation practice costs (include annualized installation of structures)
- Loss of yield due to taking land out of production (set aside for grass water ways)
- Increase of operational time for contour farming
- Irrigation cost

## Hypothetical-Case Demonstration

1. Default cost/price values are used for this example.
2. The Jane field is linear (uniform) in shape and located in east Lincoln, Lancaster County. Nearest weather station is IANR, UNL Campus.
3. The calculated topographic factor (length-slope, LS) factor is 4.35.
4. The field is NOT terraced. Ephemeral channel is tilled and planted. The field is not contoured.
5. The current management system is corn-soybean rotation with conventional tillage operation.
6. Find: alternative practices given maximum *erosion target* of 5 tons/acre and a \$3/acre income loss tolerance. The cropping system will remain a corn-soybean rotation and with the non-terrace conservation practice option.

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