

NASIS  
SOIL SURVEY  
INTERPRETATIONS

A NEW PERSPECTIVE

NATIONAL SOIL SURVEY CENTER,  
LINCOLN, NE

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# Objectives of NASIS INTERPRETATIONS

Develop a soil survey interpretive  
system that is:

Constant

Natural

Defensible

# Objective of NASIS INTERPRETATIONS

- Constant - Large shifts in interpretative results do not occur among soils which are similar and have insignificant physical, chemical, or climate soil properties differences.
- Natural
- Defensible

# Objective of NASIS INTERPRETATIONS

- Constant
- Natural - Represents the natural gradation of a soil's physical, chemical, and climate characteristics across landscapes and broad geographical areas.
- Defensible

# Objective of NASIS INTERPRETATIONS

- *Constant*
- *Natural*
- **Defensible** - Requires few or no exceptions to the basic interpretive evaluations and rules to correctly array soil interpretive rating values across large geographical areas.

# ACRONYMS & DEFINITIONS

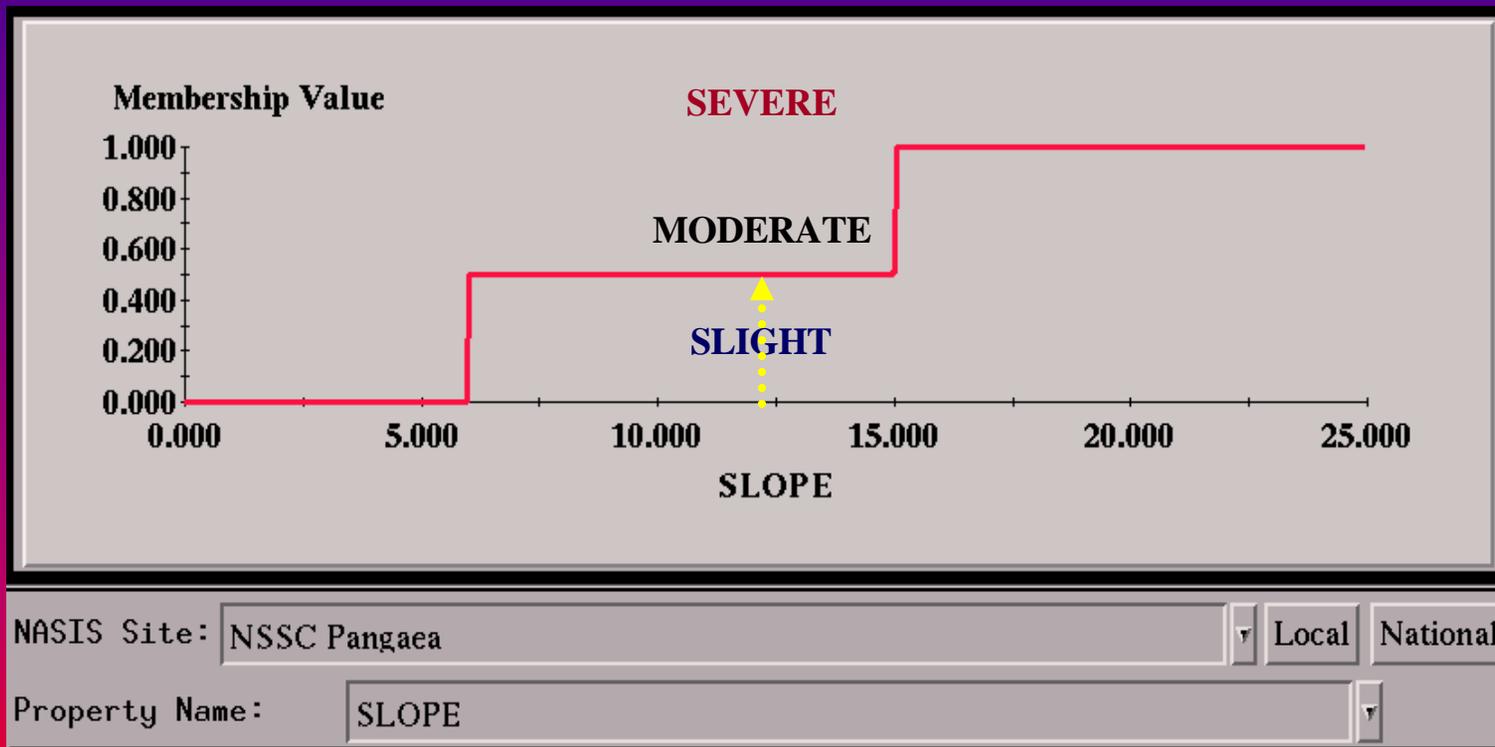
- ? **ARBITRARY LINEAR** - Threshold Response Evaluations -- Soil either is or is not a member of the set of soils that have limiting or suitable features for the application.
- ? **FUZZY** - Approximate Reasoning (Continual Response Surface Evaluations ) -- Soil is a full member, partial member, or not a member of the set of soils that have limiting or suitable features for the application.

# ARBITRARY LINEAR CONCEPTS

- For the installation of ag. waste holding facilities the site is a member of the set of sites that have severe slope limitations when slopes are  $> 15\%$ .
- When slopes are between 6 and 15% then the site is a member of the set of sites that have moderate slope limitations.
- When slopes are  $< 6\%$  then the site is a member of the set of sites that have slight slope limitations.

# ARBITRARY LINEAR SLOPE EVALUATION

## Ag. Waste Holding Facilities



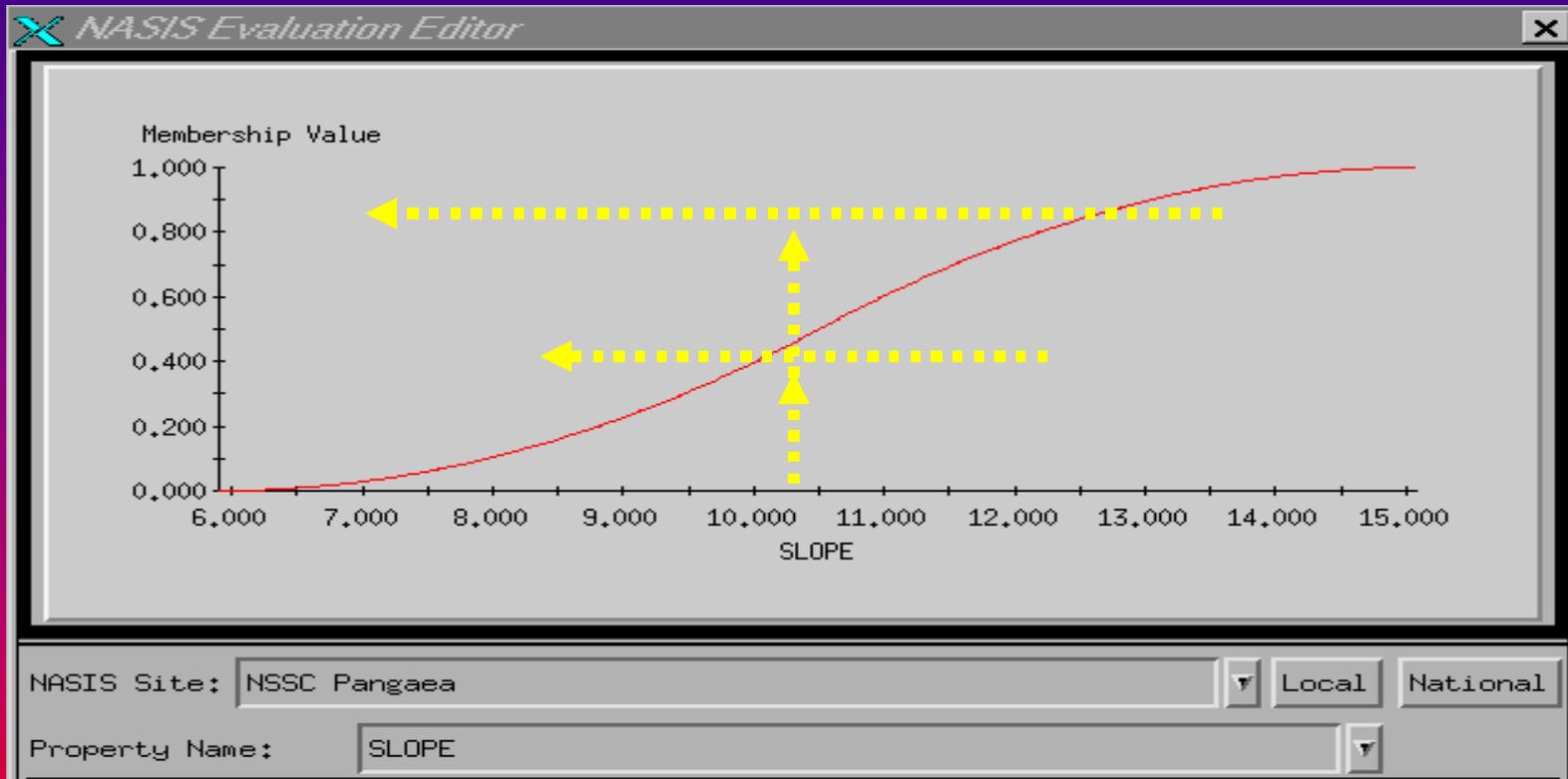
Using the Arbitrary Linear approach; slopes of 6% and 14% are rated as moderate while  $> 15\%$  slope are rated severe.

# FUZZY/BOUNDARY CONCEPTS

- For the installation of ag. waste holding facilities the site is a member of the set of sites that are too steep when slopes exceed 15% and have a fuzzy number of 1.
- A site has partial membership in the set of sites that are too steep when slopes are between 6 and 15% and the degree of membership is represented as a continuum by fuzzy numbers between 0 and 1.
- Sites with a fuzzy membership of 0 in the set of sites that are too steep are not a member of the set of sites that are too steep.

# NASIS FUZZY SLOPE EVALUATION

## Ag. Waste Holding Facilities



### Example:

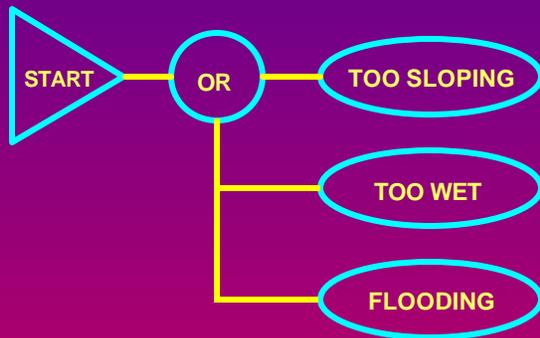
10% slope - rating{.42 MODERATELY SLOPING}

12% slope - rating{.81 STRONGLY SLOPING}

# NASIS Interpretation Approach

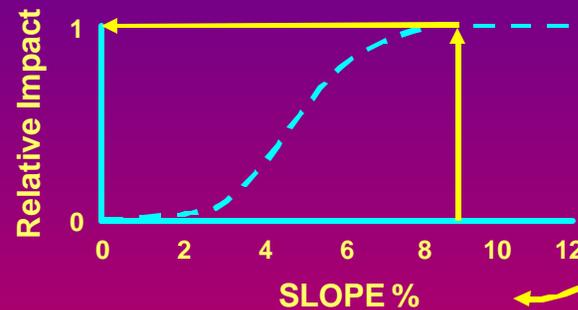
## RULE

“soil has limitations for playing fields”



## EVALUATION

“soil is too sloping”



## PROPERTY

“slope”

```
EXEC SQL  
SELECT component  
slope_gradient_r  
FROM component  
WHERE ...
```

A Rule is a logic diagram that describes the relationship between the evaluations and other rules that make up the rule.

A Rule produces a numerical value based on fuzzy mathematics operating on the numerical values from evaluations and other rules.

A Rule processes the evaluation results into rating classes (interpretive values).

An Evaluation takes the property value retrieved or calculated from the database, ranks it using approximate reasoning, and graphs its membership in a class.

An evaluation produces a numerical result from 0 to 1.

A Property is an SQL-like statement that retrieves a specific soil value from the database, or calculates a soil property (AWC, permeability).

# NASIS INTERPRETIVE REPORT

Custer and Pennington Counties, Praire Parts, South Dakota

Print date: 06/13/2001

Table AWM-1.--Agricultural Waste Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
AaB: Altvan-----	90	Very limited Filtering capacity	1.00	Very limited Filtering capacity	1.00	Very limited Filtering capacity Too steep for surface application	1.00  0.08

# NASIS INTERPRETATIONS

## Advantages

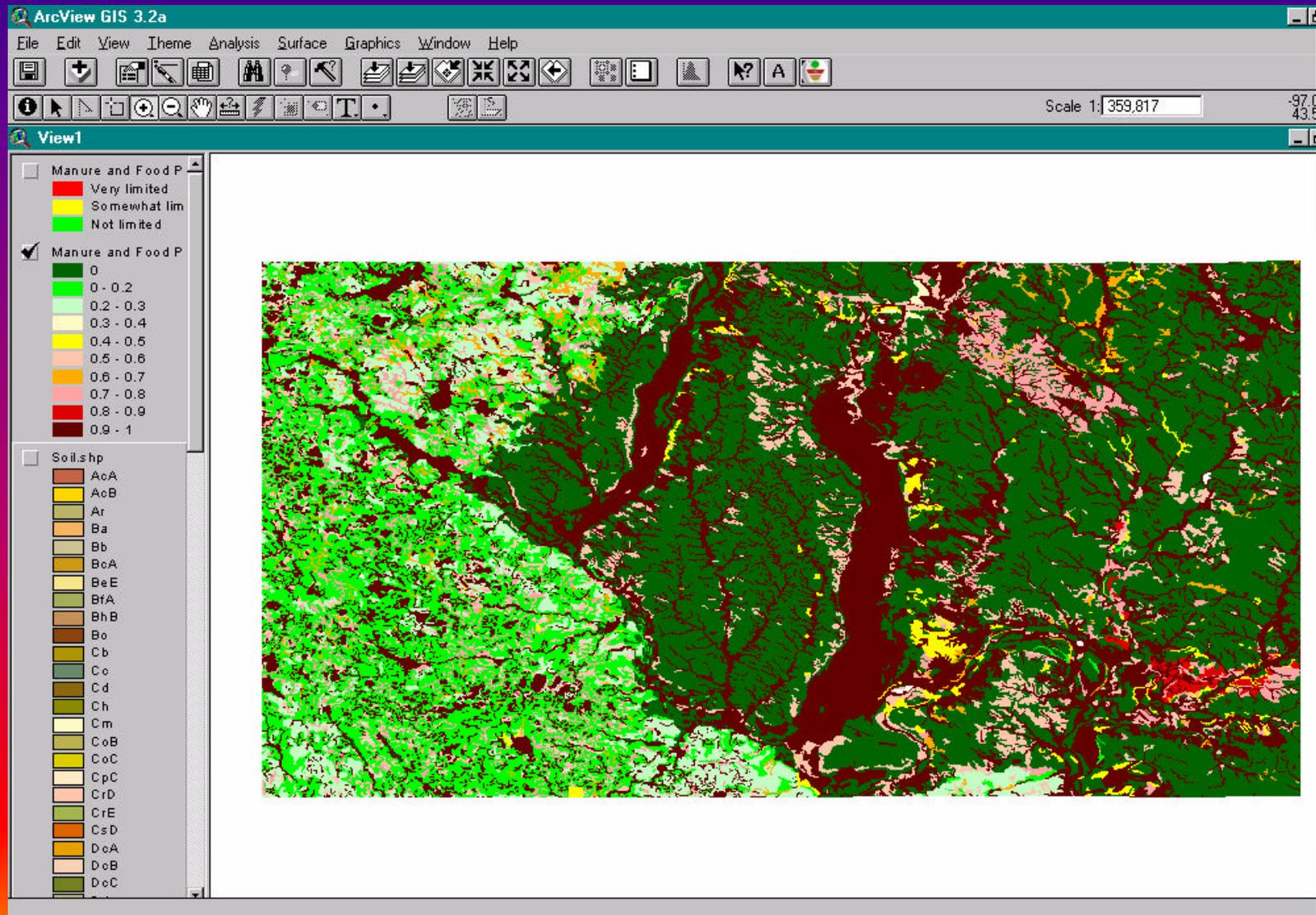
- 1 - FUZZY (Approximate Reasoning) Techniques.
- 2 - Integrates with GIS and GIS products.
- 3 - Potential, Interactions and Aspects concepts can be easily implemented.
- 4 - Locally generated and easily maintained; can be adjust to fit local conditions.

# NASIS INTERPRETATIONS

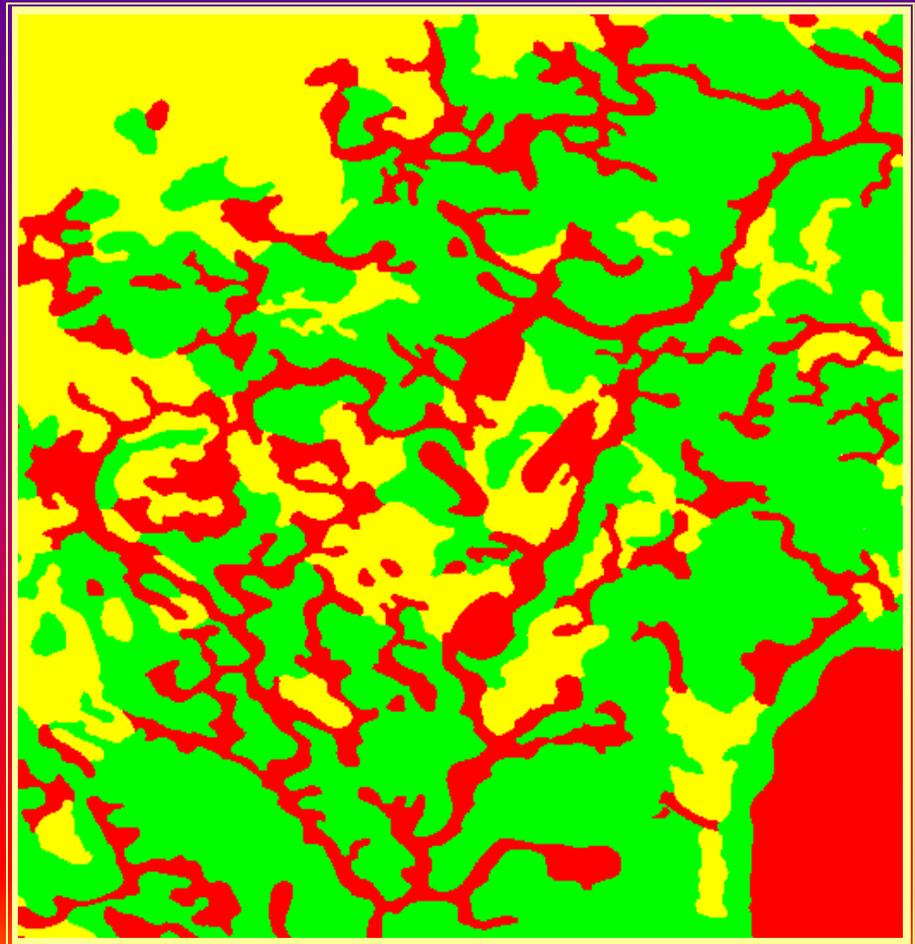
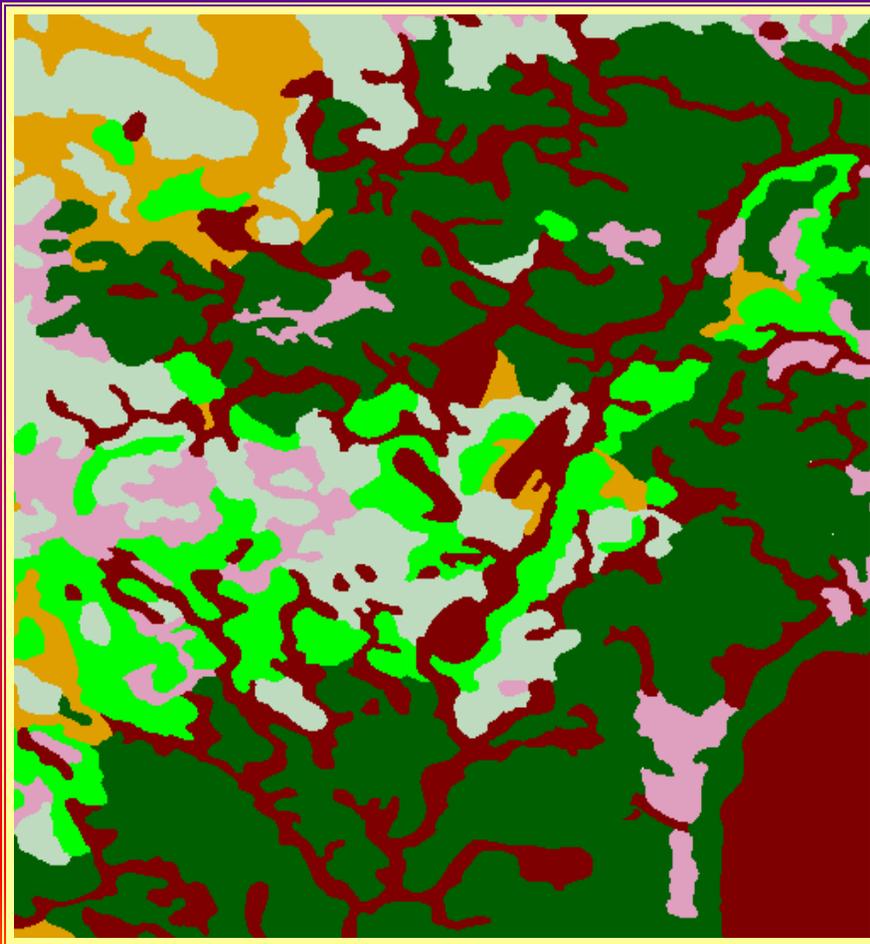
## Local Applications.

- Military Interpretations
- Forest Service; Forestry Interpretations for Region 1
- Montana; Crop Yield Model for predicting small grain yields.
- Kansas, Missouri, and Oklahoma; General Crop Production Index for their respective Departments of Revenue.
- Irrigation -- California

# Example of GIS Interpretive Map Base on the Membership of a Soil in the Set of Soils That Are Limited for a Specific Application.



# Comparison of Index to Class Interpretations



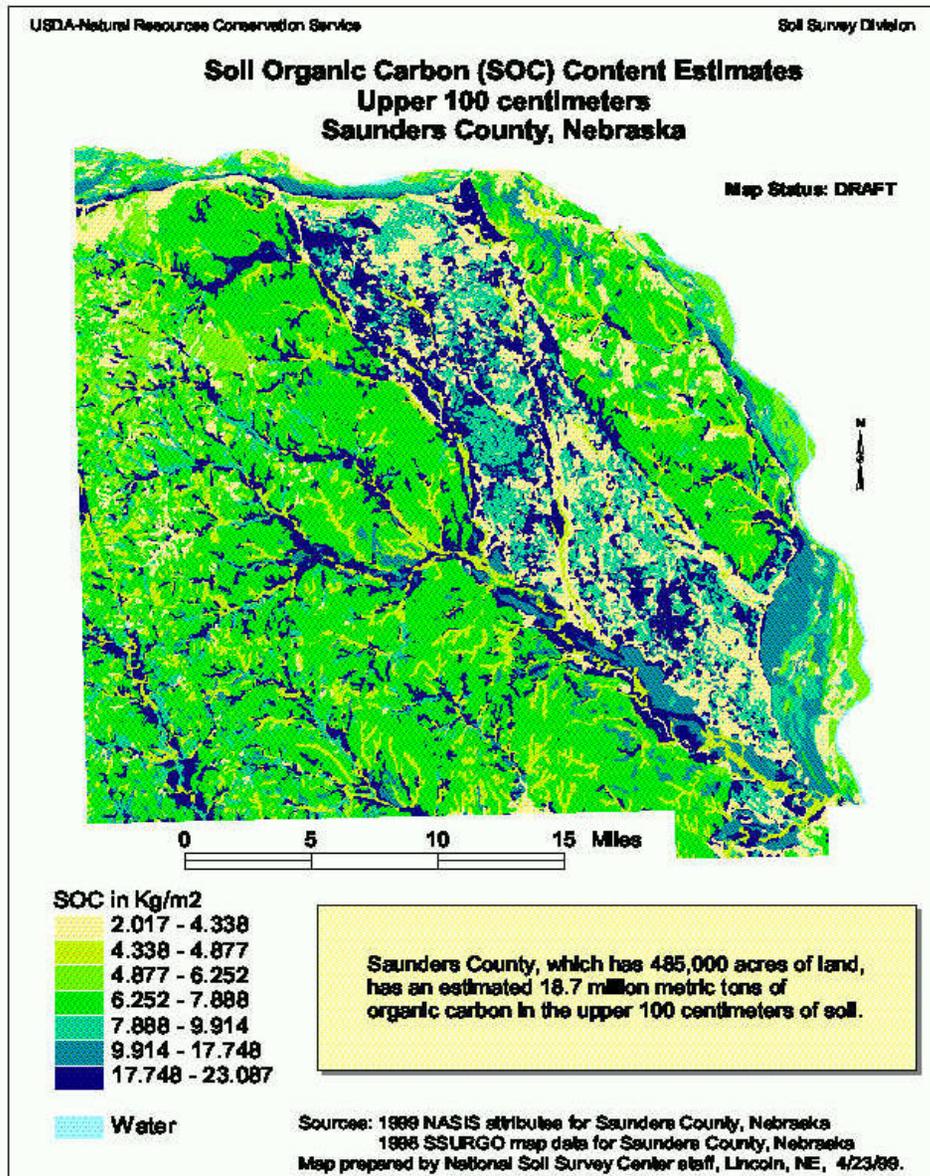
# GIS Products using the NASIS Concepts

Organic Carbon Content

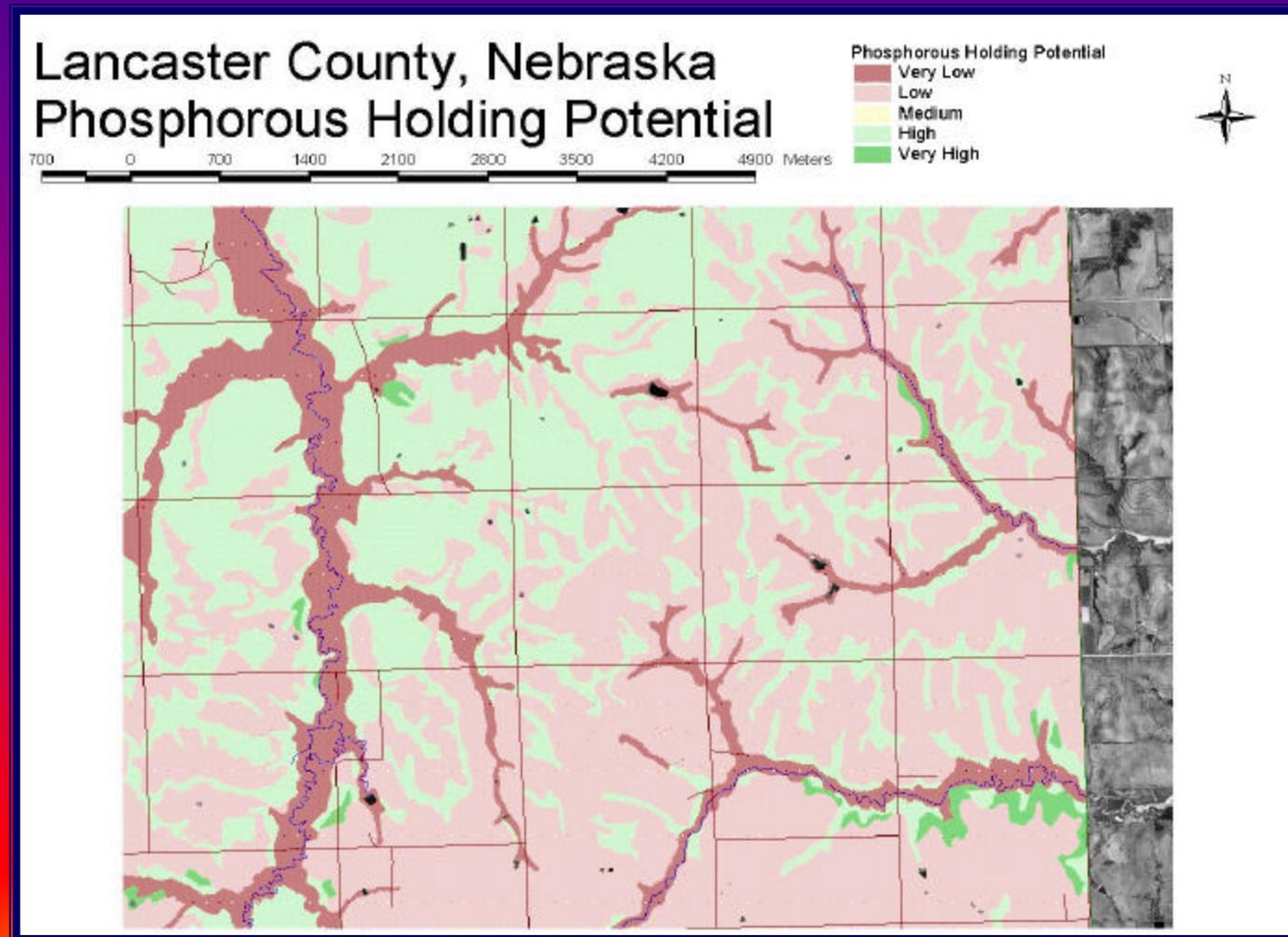
Agricultural Waste Management

Soil Rating for Plant Growth (SRPG)

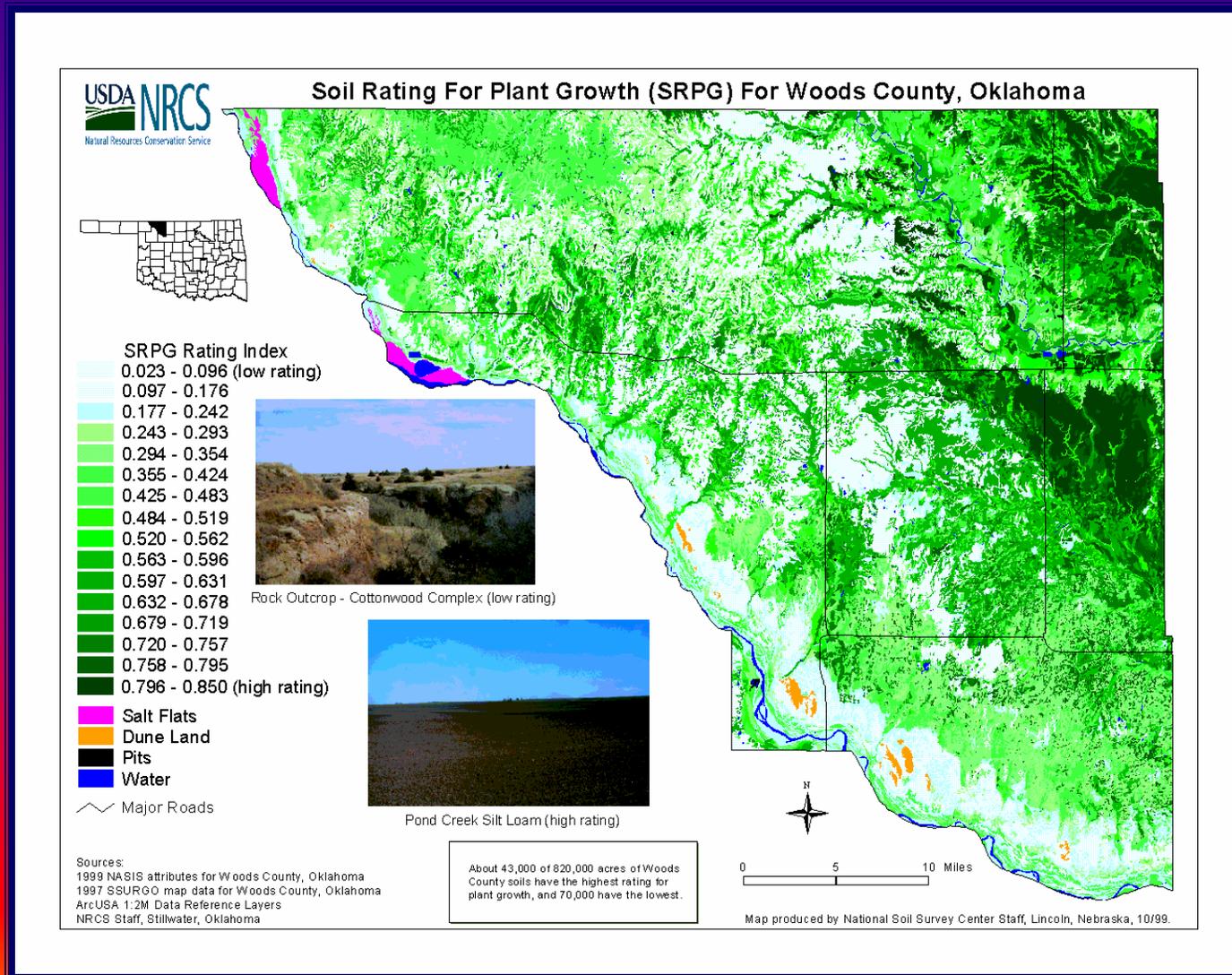
# Organic Carbon



# Agricultural Waste Management



# SRPG Rating for Woods Co Oklahoma



# Assumption for Sighting an Area Landfill.

Dominate component used (maximum mapunit component %).

- Show area where Area Landfills have some type of limitation.
- Show areas where seepage is a limitation.
- Show areas where seepage and high water table are limitations.

# Sighting Area Landfill

