

NASIS
SOIL SURVEY
INTERPRETATIONS

A NEW PERSPECTIVE

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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

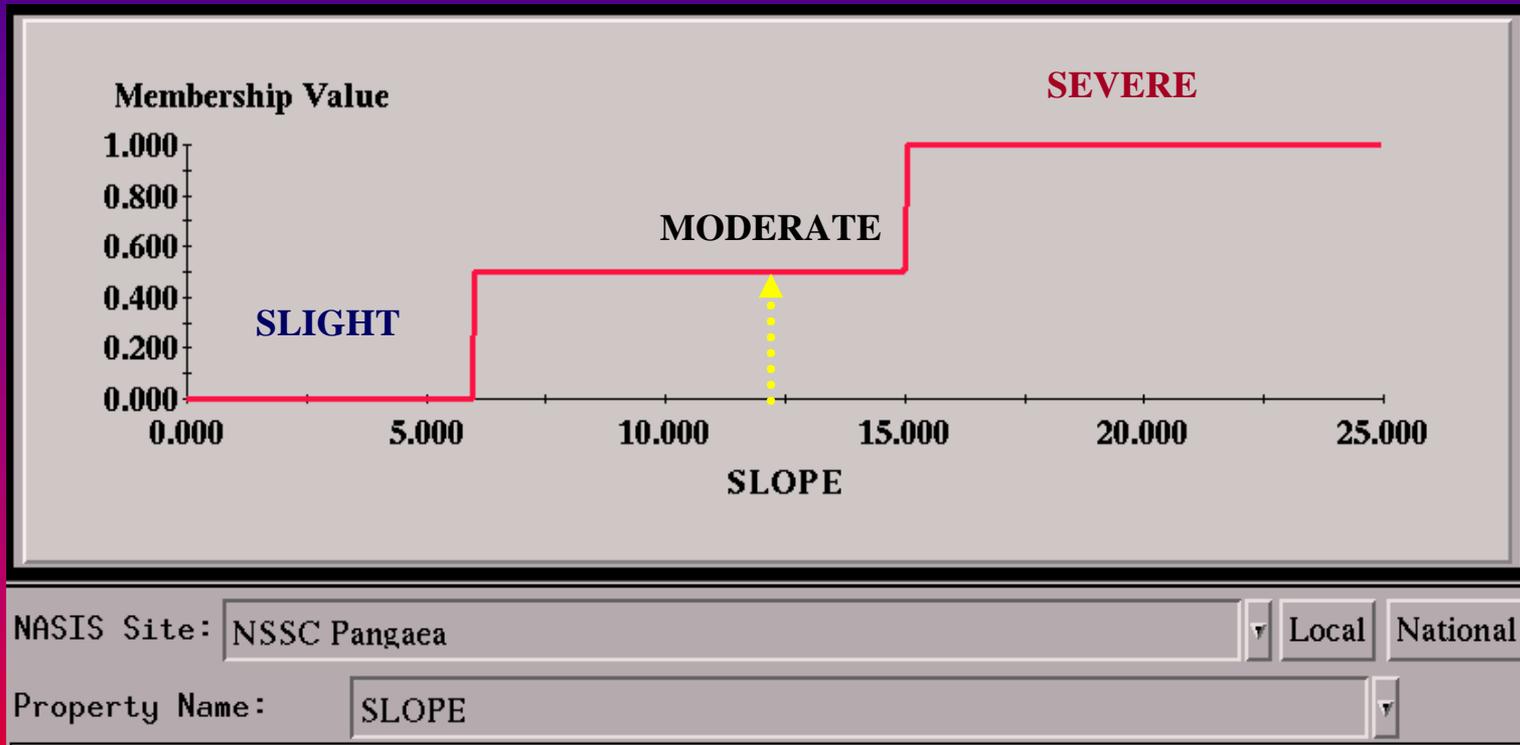
- **ARBITRARY LINEAR** - Threshold Response Evaluations -- Soil either is or is not a member of the set of soils that have limiting or suitable features for the application.
- **FUZZY** - Approximate Reasoning (Continual Response Surface Evaluations) -- Soil is a full member, partial member, or not a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



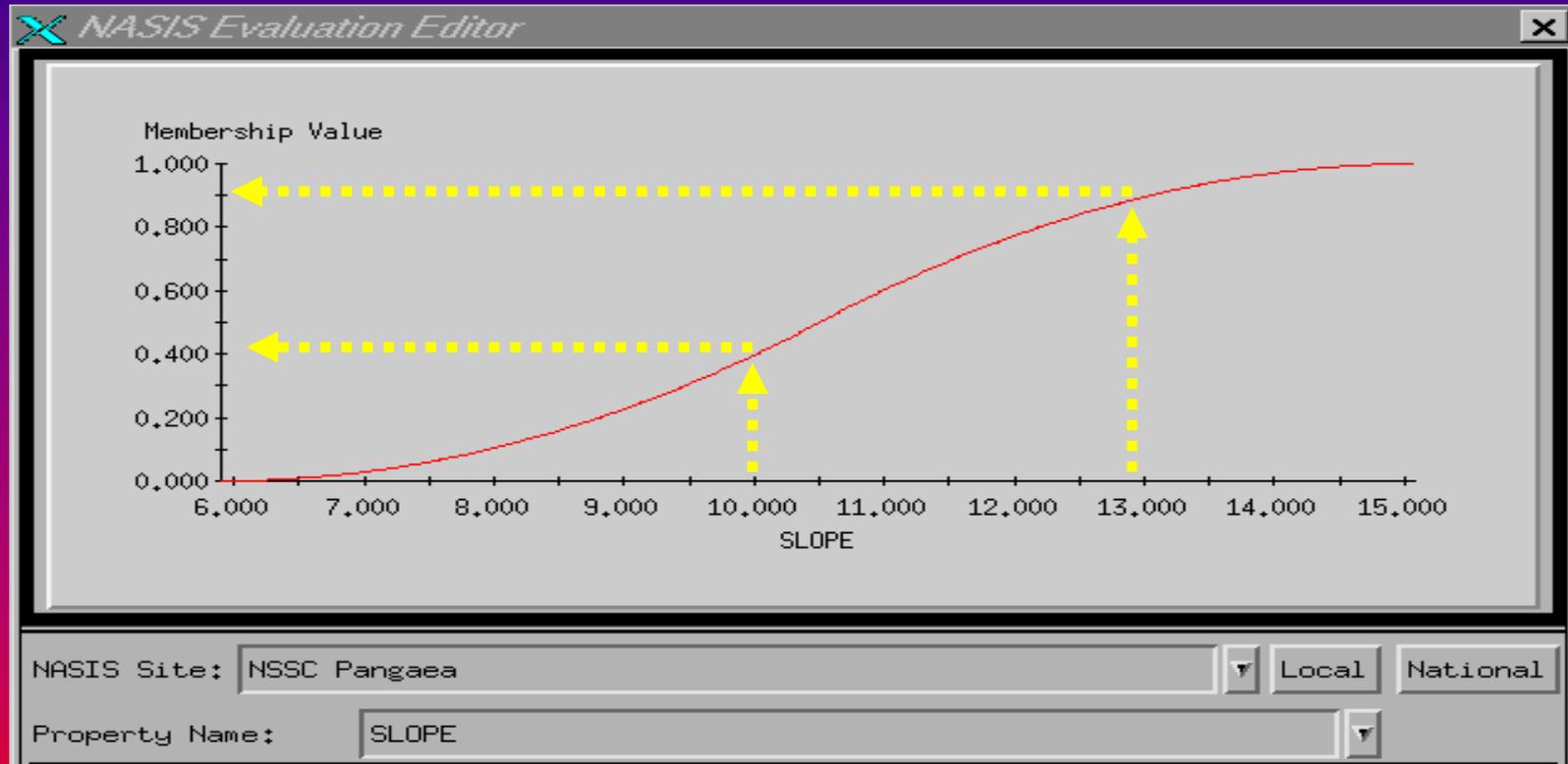
Using the Arbitrary Linear approach; slopes of 6% and 14% are rated as moderate while $> 15\%$ slope are rated severe.

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:

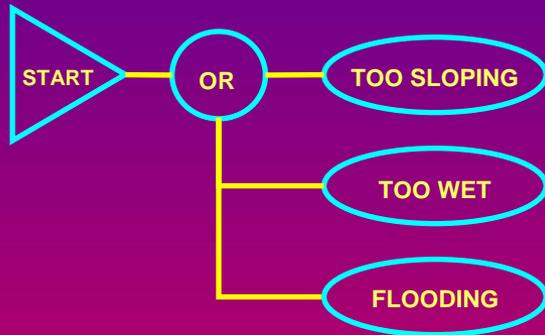
10% slope - rating{.42 MODERATELY SLOPING}

13% slope - rating{.90 STRONGLY SLOPING}

NASIS Interpretation Approach

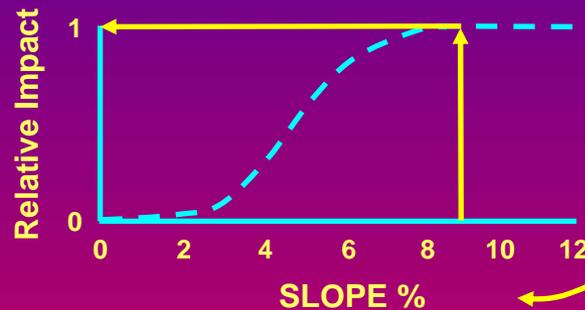
RULE

“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, Weights, and Aspects concepts can be easily implemented.
- 4 - Locally generated and easily maintained; can be adjust to fit local conditions.
- 5 - Soil property data and interpretations are aligned.

NASIS INTERPRETATIONS

Current NASIS Interpretive Constraints

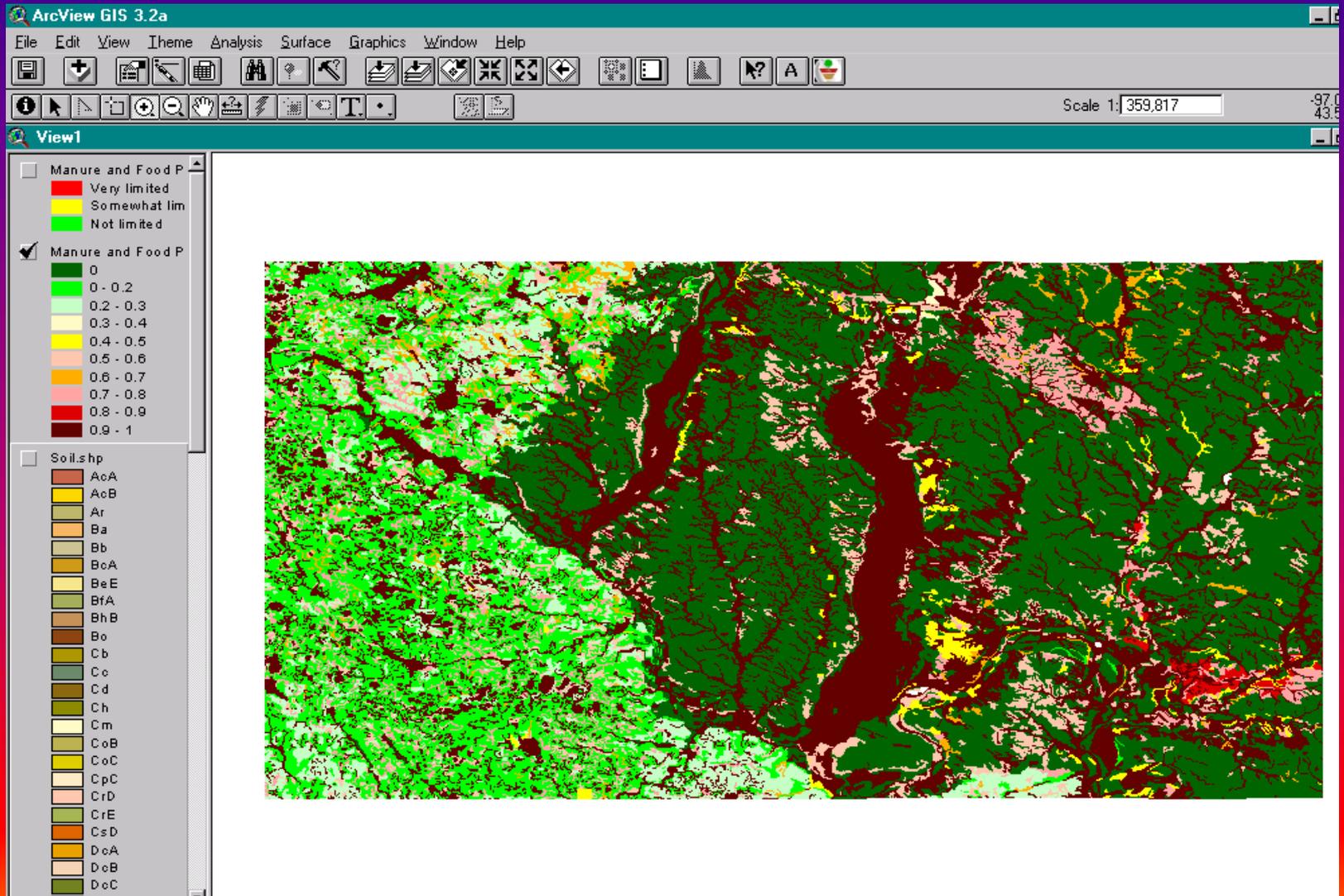
- 1 - Reflects the accuracy and precision of the data use by the interpretative model.
- 2 - Is dependent on how well the interpretive model and interpretive criteria represent the natural processes described.

NASIS INTERPRETATIONS

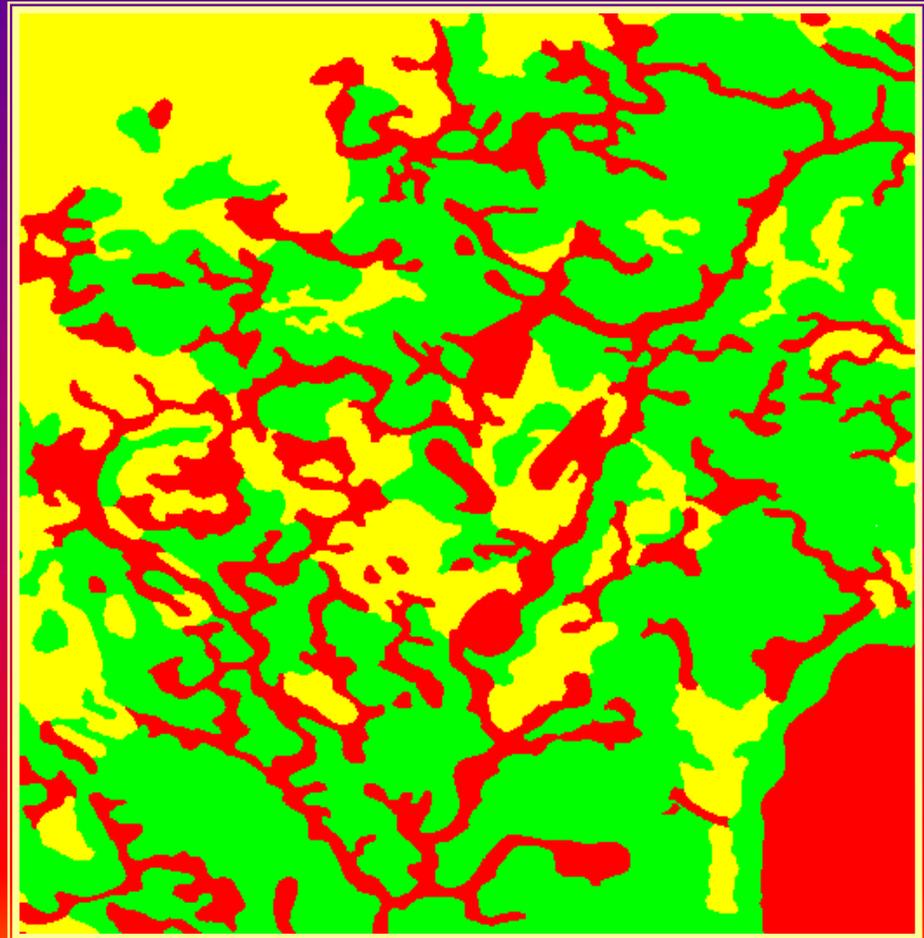
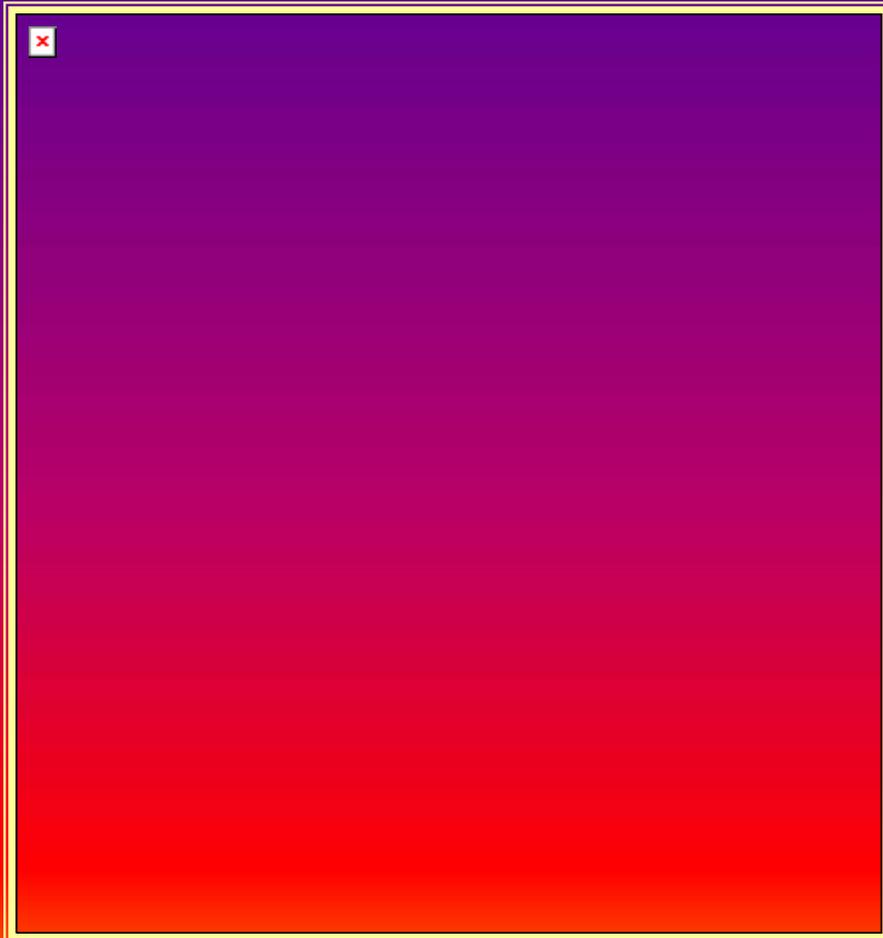
Local Applications.

- 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)

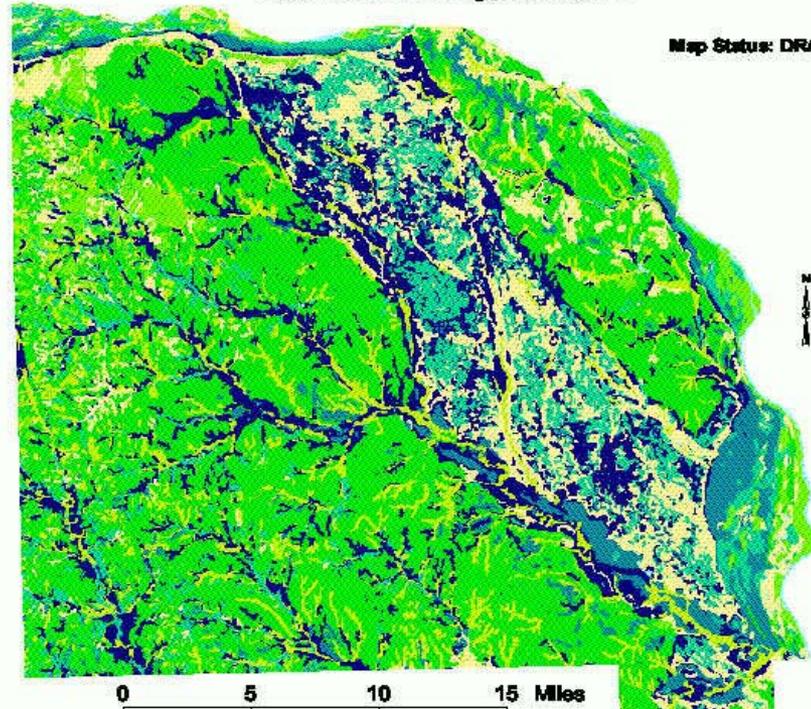
Organic Carbon

USDA-Natural Resource Conservation Service

Soil Survey Division

Soil Organic Carbon (SOC) Content Estimates Upper 100 centimeters Saunders County, Nebraska

Map Status: DRAFT

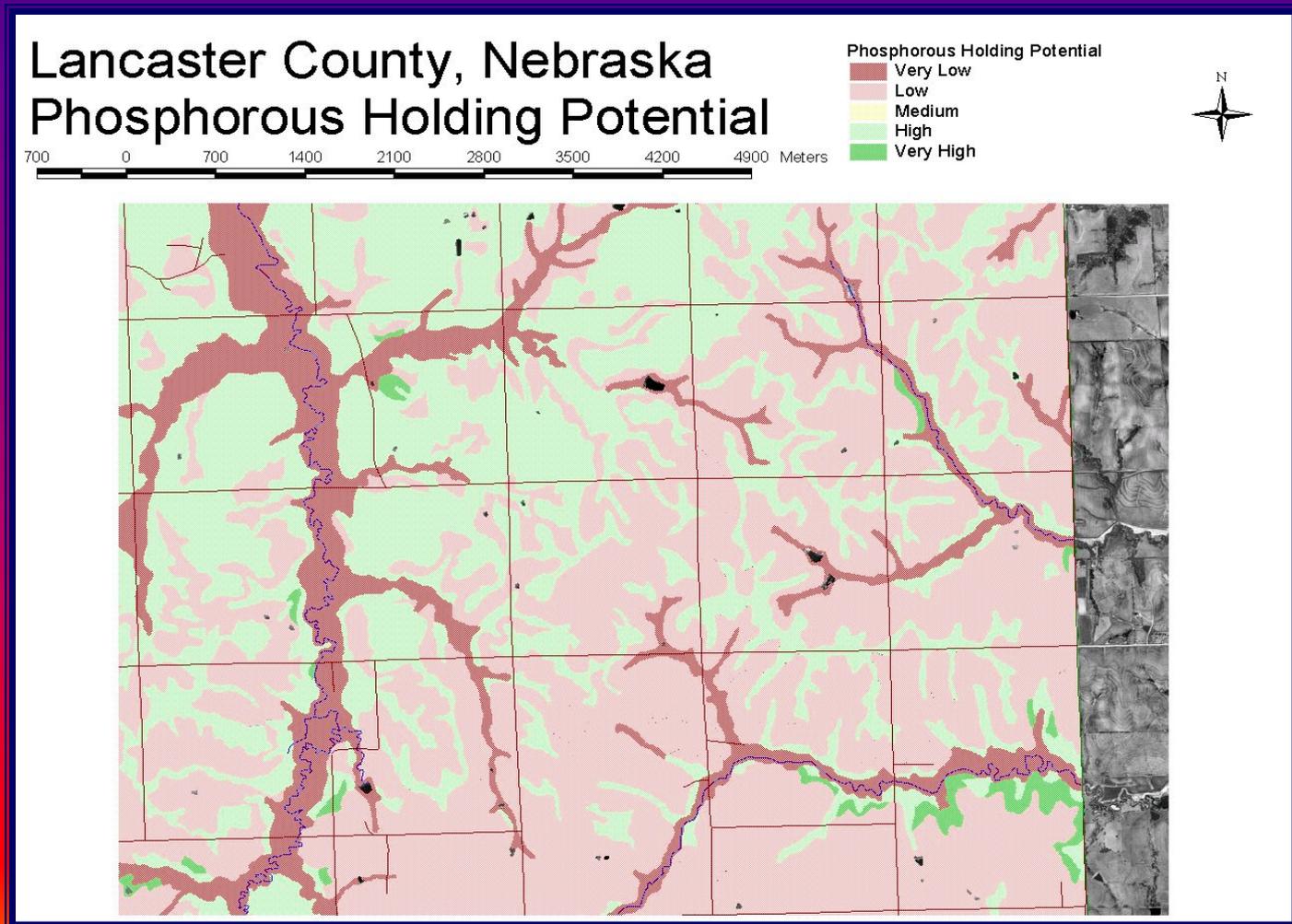


Water

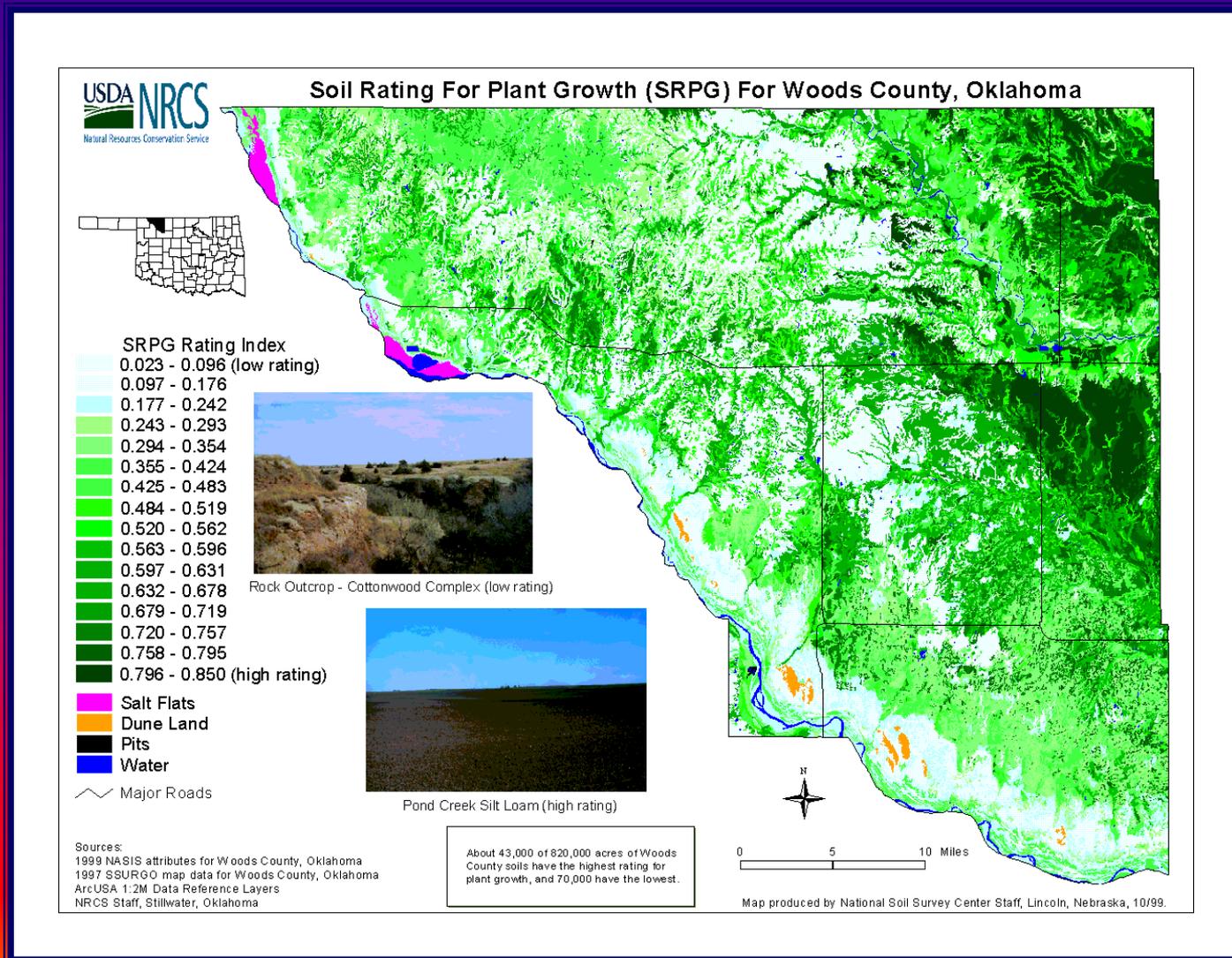
Saunders County, which has 485,000 acres of land, has an estimated 18.7 million metric tons of organic carbon in the upper 100 centimeters of soil.

Sources: 1999 NASS attributes for Saunders County, Nebraska
1998 SSURGO map data for Saunders County, Nebraska
Map prepared by National Soil Survey Center staff, Lincoln, NE, 4/23/99.

Agricultural Waste Management



SRPG Rating for Woods Co Oklahoma

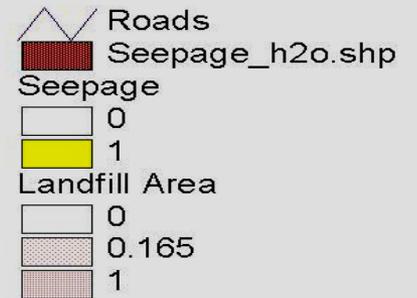
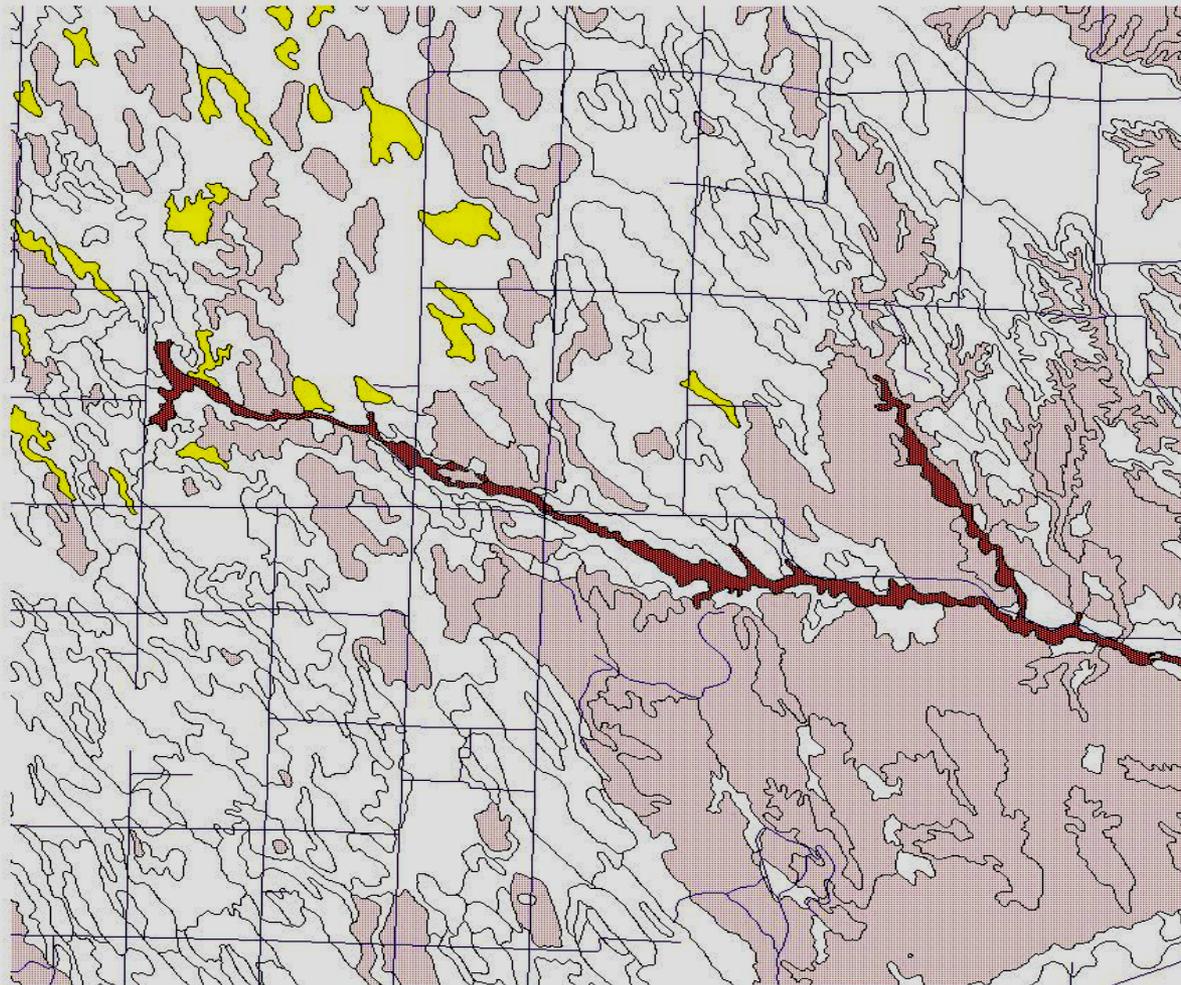


Assumption for Sighting an Area Landfill.

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



NASIS INTERPRETATIONS

Conclusions

NASIS fuzzy system interpretation:

- 1 - provide the user with more information by describing a soil's relative interpretive rating for a given application.
- 2 - are a natural extension of the soil/landscape model concepts and reflect changes in soil properties and characteristics as those properties change spatially.

