USDA

United States Department of Agriculture

Soil and Plant Science Division

Natural Resources Conservation Service

Building Capacity and Maintaining Technique: Soil Interpretations Focus Team

May 21, 2020 Robert R. Dobos

Natural Resources Conservation Service

nrcs.usda.gov/

What are "Interpretations"?

*** Interpretations are models which use soil and site properties to predict how a soil will respond to land use**

*** "Land use" can take on a variety of meanings, for example:**

- Production agriculture
- High tunnel
- Habitat for a tortoise
- Habitat for a soil-borne pathogen
- Sink for atmospheric carbon dioxide
- Sink for radioactive material
- Homesite development
- **A species or entity-non specific interaction with soil and or landscapes**

What is the Problem?

* The National Cooperative Soil Survey (NCSS) faces the dilemma of increased value and usage of soil survey data in a time where fewer soil scientists are available to interpret the data scientifically
* Subjects addressed in interpretive models range from crop productivity to vertebrate habitat to physical processes to fungal habitats
* The usefulness of the interpreted data is well known
* There is further need for model development and refinement for topics such as conservation practice standards, soil mass movement, liquefaction, methylmercury production, and productivity indices for tropical crops, to name a few.

NCSS
National Cooperative Soil Survey

What is the Problem?

* Current trend is a shift from a more centralized (think National Soil Survey Center) to a more distributed methodology for accomplishing national work
* Contraction of staff is just reality, but we will adapt
* Many of you have, of course, noticed a variety of teams performing or impinging on functions that 5 years ago would have naturally been performed at the NSSC
* With the notable exception of **Interpretations**

What is the Problem?

* States and regions do interpretation work for their use
* The NSSC does not have enough staff to be able to get enough national work done on a reasonable time scale
* This does not seem likely to change

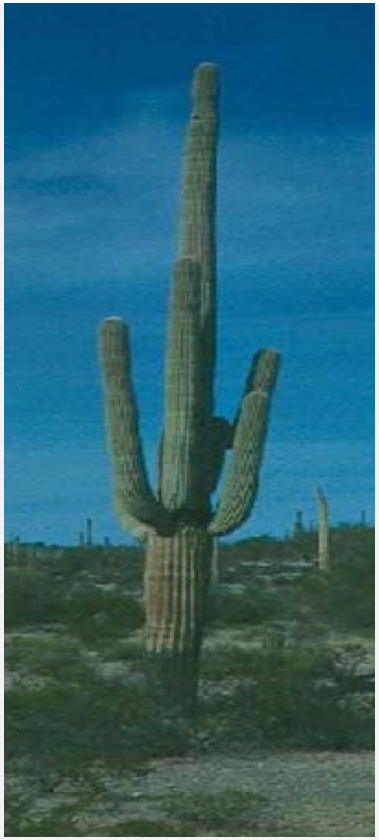
Proposal

- Establish a **Focus Team** that is provided with a mandate for using certain state and regional staff to accomplish national, regional, and state interpretive work
- This will be an interdisciplinary working group charged with:

    * Enhancing and developing the body of knowledge and techniques used in the process of creating soil survey interpretations

    * Developing new interpretations and maintaining the existing ones

    * Enhancing the documentation of current interpretations



Proposal

* The Focus Team is coordinated from the National Soil Survey Center

* The team draws talent from various offices across the country

* The team is divided into a work group for each of the four steps listed below

Proposal

- A **science group** handles the literature review and any other research required to develop the criteria needed to create the model
- This is basically what is done in the class known as the "Science of Interpretations", but would have time to be much more thorough
- While any grade level and discipline is welcome, some experienced people are needed from diverse professional backgrounds to best explore what soil and site properties need to be accounted for in a particular interpretation
- This is a good forum for engaging scientists from cooperating agencies and land grant universities directly in the process of developing criteria

Soil and Site Suitability – Growing Hops Commercially

USDA
United States Department of Agriculture

Property	Suited	Somewhat Suited	Not suited	Reason
Depth to Water Table	≥ 1 m	0.5 m – 1 m	< .5 m	Disease Control
Ponding	Rare	Occasional	Frequent	Disease control
Flooding	Rare	Occasional	Frequent	Disease Control
Frost Free Days	>120	≥120	<120	A minimum of 120 Frost Free Days is needed for full development of hop flower.
Depth to Restrictive Feature	≥ 1 m	0.5 m – 1 m	< 0.5 m	Hops have a very deep rooting system. Additionally, the poles used in the trellis system should be buried at least 3' below soil surface.
pH	6.0 - 7.0	5.7 - 6.0; 7.0 – 8.2	> 8.2, < 5.7	Prefers slightly acidic soil conditions. Alkaline and saline non-preferable. Soil amendments may be necessary.
Photo Period (hrs/day)	≥ 12 hrs.	10-12 hrs.	< 10 hrs.	During growing season. April – October (at a latitude 35-55)
Precipitation (non-irrigated)	>762 mm	508-762 mm	<508 mm	Dry climate discourages many diseases.
Slope	<5	5-10%	> 10%	Slopes greater than 10% may limit trellis installation and harvest methods.
% Sand	> 50% <50%	40-50% 40-50%	< 50% >50%	Fine sandy loam is the optimal soil texture in higher precipitation areas. Silt loam is optimal in lower precipitation areas.
% Clay	< 20% > 60%	< 30% 50-60%	> 30% < 50%	Fine sandy loam is the optimal soil texture in higher precipitation areas. Silt loam is optimal in lower precipitation areas.
% Rock Fragments	< 15%	15-35%	> 35%	Affects AWC, tillage, post holes for trellis system

Natural Resources Conservation Service

nrcs.usda.gov/

Proposal

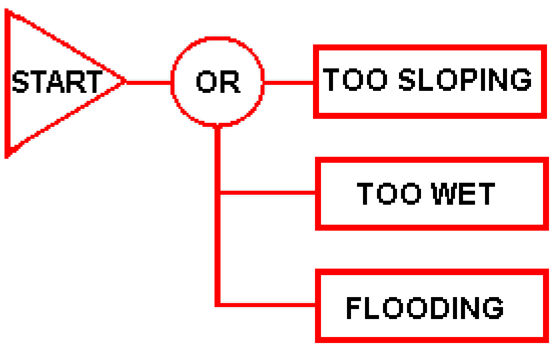
- A **model design, development and maintenance group** works in the NASIS environment to assemble the properties, evaluations, and rules needed to make the model work
- This group will receive specialized training as needed to attain a high level of proficiency with the rule-based fuzzy logic system as well as the Calculations-Validations-Interpretations-Reporting (CVIR) scripting language
- This group will keep up with NASIS data model changes and scientific advances in order to keep the syntax and logic of the interpretations up to date
- This group will also do the scripting needed to extract data and report interpretive information

NASIS Interpretation Approach

PRIMARY RULE

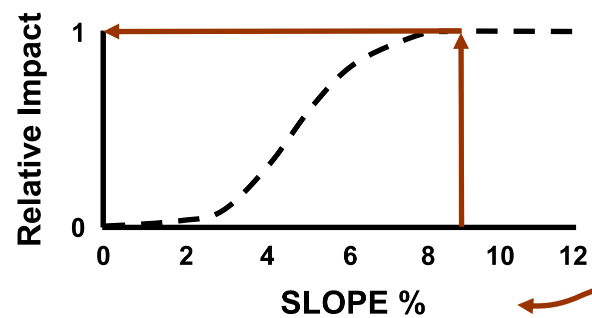
"soil has limitations
for playing fields if…"

BASE RULES



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 subrules that make up the parent 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 degree of membership in a set.

An evaluation produces a numerical result from 0 to 1.

A Property is an SQL-like statement that retrieves specific soil data from the database, or calculates a soil property (such as AWC) from one or more NASIS data elements

Proposal

A **testing group** examines the outputs generated from the interpretations that are being developed to assess the accuracy of the results and suggest ways to improve the predictions.

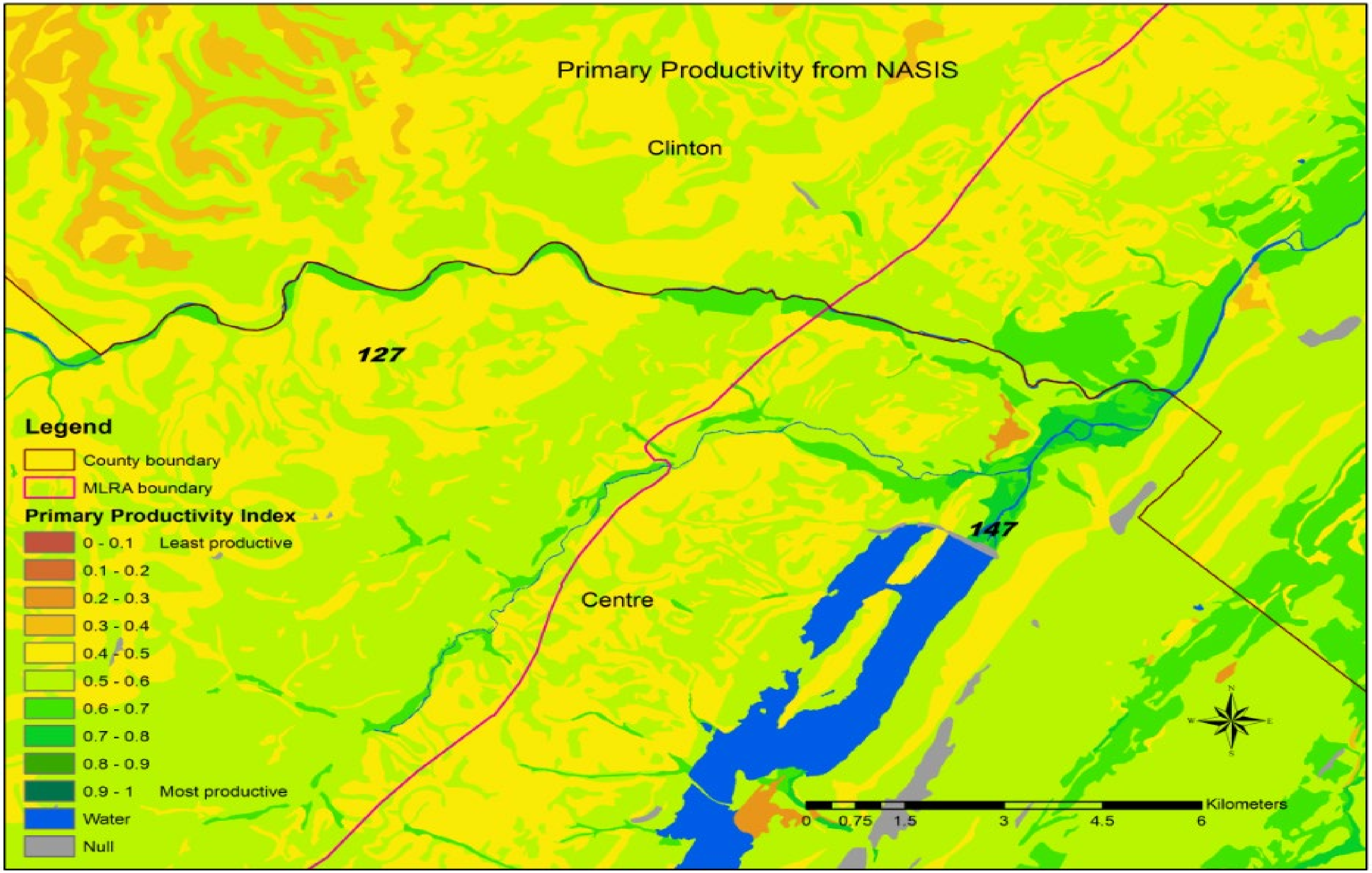
*This group should also include partners from other agencies, universities, and the private sector

* Proficiency in Arc-GIS and statistics would be very helpful in examining large quantities of information efficiently.

* Having a good idea of how soils should be rated for a particular land use or soil function in an area is essential.

* This group will also be able to detect data voids, peculiarities, and inconsistencies

Proposal


Primary Productivity from NASIS
Clinton
127
147
Centre
Legend
County boundary
MLRA boundary
Primary Productivity Index
0 - 0.1 Least productive
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1 Most productive
Water
Null
0 0.75 1.5 3 4.5 6 Kilometers

Proposal

* A **documentation group** is tasked with assembling and publishing the metadata for each interpretation

* This includes rule descriptions for the Web Soil Survey Rule and Report Manager as well as a more in-depth rule description with diagrams that could be linked to an as yet undeveloped documentation site associated with Web Soil Survey

* This also includes publication of model descriptions and results in scientific journals

Moorings: An Interpretation from the Coastal Zone Soil Survey of Little Narragansett Bay, Connecticut and Rhode Island

Deborah A. Surabian

In the last decade, the boating population has exploded, and moorings are increasing in number. The demand for mooring locations in Connecticut has grown, while the number of vessels most harbors can accommodate is fairly fixed. A mooring refers to a structure or anchor used to hold secure a boat in a certain area, with a float or buoy attached. Years ago, only *inner* harbors were used for mooring areas. Now, *outer* harbors and even bays and ocean-front properties have moorings that are very exposed (INAMAR, 2000). Safety of a boat on a mooring depends on a number of elements—one of them is the type of bottom or soil surface layer materials.

The Subaqueous Soil Survey

Traditional soil mapping is conducted by a field soil scientist trained to understand the interaction of soil forming processes and soil–landscape relations. Mapping soil typically involves field work with the soil scientist traversing the landscape and digging many holes to observe the soil condition and classify the soil. Subaqueous soil mapping is performed in much the same way, except the soil is under water. Instead of topographic maps to provide landscape position, subaqueous soil mapping uses bathymetric maps to identify landscapes and landforms. Shovels are replaced by augers and special tools such as peat corers and vibracores to obtain the soil samples.

Soil samples are described to depths up to 200 cm. If the soils are very soft and fluid (high *n* value soils) or high in organic material, the peat sampler or push tubes are used. The *n* value is a measure of the amount of water a soil can hold relative to the clay and organic matter content. It was originally applied to very young alluvial marine or fluvial soils in the Netherlands and derived as a measure of soil "rip-

Proposal

* The concept of parsing the stages of work to different groups will help to keep any one person from being overwhelmed, especially since we are already fully engaged in our present workloads.

* Distributing the various kinds of tasks will also allow us to play to the talents, strengths, and passions of the staff involved to make the process as inclusive as possible.

* This proposal will require buy-in and permission from managers and supervisors because the time commitment will be significant.

*Training will be provided to maintain a continuity of practitioners that have the background to accomplish the tasks that are needed.

* The techniques used and the capacity needed to scientifically interpret soils will be maintained and enhanced

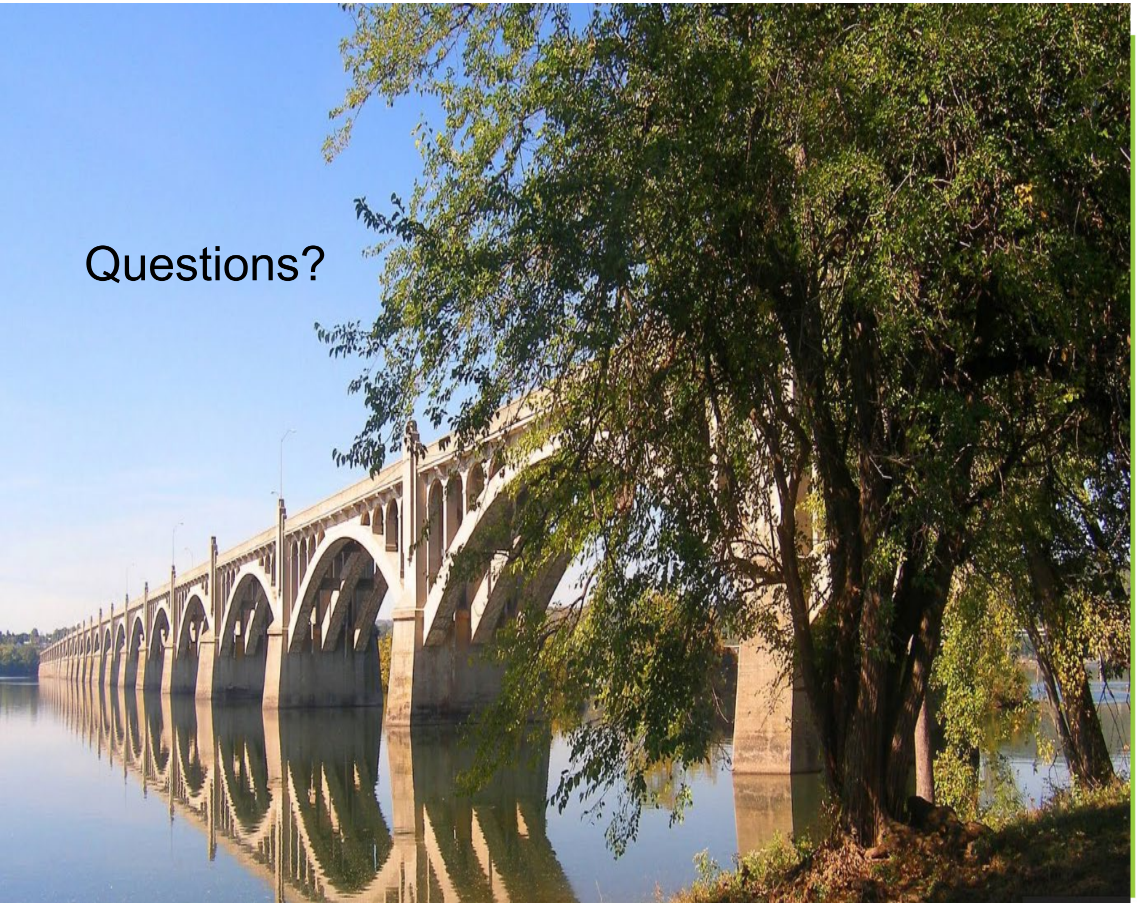
NCSS
National Cooperative
Soil Survey

Mechanics

The devil is in the details

- In the next two or three weeks, we will find a point person to be the leader for each of the four sub-teams
- After you have had a chance to think about how you would like to contribute to this effort, talk to your supervisor.
- Announcements distributed by soils.usda.gov will be used to solicit help on each aspect of a proposed interpretive model
- Teleconferencing will be used to work on criteria
- Three classes are available on AgLearn and are presented regularly to help individuals further develop their skills
- Any team activity is reportable as Technical Soil Service:
  "Develop or validate interpretations"

United States Department of Agriculture



Questions?

Natural
Resources
Conservation
Service

nrcs.usda.gov/