

Corporation Act, a corporation has been created that will be responsible for planning, management, and supervision of development for the new community (Bill 181).

As development proceeds, local citizens and municipal officials hopefully will offer ideas for environmental management. One approach to participation being considered is the establishment of a citizen's environmental advisory committee to review and guide the work of the management program for land resources at the North Pickering site.

Assuring Watershed Integrity

An integrated consideration of land and water resources has resulted in the reservation of both broad and narrow corridors of the North Pickering site for public open space uses. These considerations have been scientific in nature. They reflect public desires to some degree and are cognizant of ecosystem relationships. Similarly, consideration of cultural elements of existing settlements and significant landforms has suggested the reservation of additional open space corridors and areas for preservation. The resulting framework of open space is interconnected and offers the opportunity to meet the general requirements for watershed integrity and outdoor recreational activities. In anticipation of a dynamic new urban system tending to expand into an open space area of "unused freedom," advanced management strategies have been proposed and activities already are underway to exercise existing freedom through outdoor education and reforestation projects.

REFERENCES CITED

1. Dorney, R. S., et al. 1969. *Ecoplanning—the contribution of ecology to the process of urban planning*. School Urban and Regional Planning Univ. of Waterloo, Waterloo, Ont. p. 76.
2. Horton, K. W. 1976. *Of trees, ecosystems, and community design*. Plan Canada, Ottawa, Ont.
3. Ontario Parliament. 1975. *The North Pickering Development Corporation Act*. Bill 181. Toronto.
4. Plantown Consultants Ltd. 1974. *Environmental planning: An approach to environmental analysis*. Interim Rpt. Ont. Ministry Housing, Toronto.
5. Shully I. Solomon and Associates Ltd. 1974. *A hydrologic model for environmental impact assessment in the Rouge, Little Rouge, Petticoat, and Duffin watersheds*. Ont. Ministry Housing, Toronto.
6. U. S. Army Corps of Engineers. 1974. *Urban storm water runoff (model) "STORM"*. Generalized computer program 723-58-1.2520. Hydrologic Eng. Center, Vicksburg, Miss. □

New generalized soil maps guide land use planning in Maryland

ROBERT L. SHIELDS

BOTH detailed soil maps and general soil maps have value in land use planning. If combined, they provide a valuable built-in option and mechanical convenience for the user. He can plan broadly, yet he has enough detail at his fingertips, if it's needed, to focus on a specific project area. This can be provided in the form of a small-scale map that has map units of excellent interpretive value.

This is what the Soil Conservation Service did in Maryland in cooperation with one of the agency's prime users of soils information, the Maryland Department of State Planning. The department's use of these multi-purpose maps is resulting in an adaptable and accurate application of soil survey information to achieve a state-wide land use plan with a strong natural resource base. The system is applicable anywhere in the country where detailed soil surveys are available.

How Maryland Got Started

Just before Christmas in 1972, three representatives of the Maryland Department of State Planning came to the SCS office with a problem. They had been assigned responsibility for preparing a state land use plan, and their time for doing so was limited.

Their consultant was convinced that they had a unique tool available to them—detailed soil surveys of the entire state, scheduled for completion within a matter of months. There existed no other single resource reference so relevant, current, and available. But how could they convert detailed soil maps of more than 6 million acres into one meaningful state-wide map with optimum detail for broad land use planning?

Existing general soil maps were not detailed enough; and soil associations,

Robert L. Shields is state soil scientist for Maryland, Delaware, and Washington, D. C., with the Soil Conservation Service, U. S. Department of Agriculture, College Park, Maryland 20740.

as map units, were difficult to interpret. The planners needed a good interpretive map with detail intermediate between existing general soil maps and detailed soil maps.

Whatever the answer, it had to satisfy these requirements:

1. Basic data must be convertible to a map scale of 1 inch = 1 mile (1:63,360) and remain readable.
2. The data must be compatible with computer systems.
3. The map must locate these primary needs: prime farmland, floodplains, steep slopes, areas of instability, permeability, depth to bedrock, and depth to seasonal high water table.
4. The data must be available for the entire state within weeks.

SCS already had converted soils data to so many forms for so many purposes that a project of this magnitude posed no problem. The key question concerned what alternatives existed for making the data available in a matter of weeks.

The Alternatives

The planners indicated that the detail on color-line soil maps in old published soil surveys at a scale of 1:62,500 would be optimum for their purpose. SCS acknowledged the possibility of adapting these maps for their purpose. The maps were available for every county in the state. But SCS was just completing a modern detailed soil survey of the state. Why move backward? Besides, slope and erosion phases were poorly differentiated on the early surveys, but these phases were important in providing the answers the State Planning Department needed.

SCS began thinking about the work done in Connecticut with natural soil groups.¹ As possibilities were consid-

¹"Know Your Land, Natural Soil Groups for Connecticut," prepared by the Soil Conservation Service and published by the Connecticut Cooperative Extension Service for the Connecticut USDA Rural Development Committee.

ered, the advantages quickly became apparent.

1. The groups would be based on modern detailed soil surveys.

2. All but two of 23 counties had detailed soil maps either published or available in a prepublication form.

3. If the generalized natural² soil group map were drawn on the actual detailed soil maps, the detailed soil survey could possibly be retained in the background. This would provide a generalized interpretive soil map supported by the "ground truth" of a detailed soil map (Figure 1).

4. Not only would this provide a computer-compatible soil resource reference for the new state land use plan, but it would satisfy the demands of consultants and county and regional planners for a generalized soil map of intermediate detail that could easily be interpreted for broad land use planning.

5. The system would be ideal for providing base maps for acetate overlay kits to be prepared for each soil conservation district office.

6. The general soil map would show all the commonly flooded areas in the county.

As SCS people convinced themselves, the representatives from the State Planning Department became equally convinced. The decision was made. The mass of detail on SCS soil maps would be channeled into the computer via soil groups.

Constructing the Map Units

As SCS officials prepared the soil groups, they realized the groups were somewhat different than those used in Connecticut. Soil parent materials, landscape positions, and geomorphic character were de-emphasized in favor of a few important soil characteristics and features that strongly influence many important farm and nonfarm land uses. In fact, these groups of soils were similar to some that were developed years ago in certain states as first attempts to present soil interpretations for nonfarm uses in published soil surveys. Only now these

²SCS recognizes the fact that the soil groups to be defined were not natural soil groups in the strictest sense of the term, with all natural qualities of the soils considered in their definition. However, as those properties of critical importance to the key land uses were chosen and since there were properties of the natural soils, the term "natural soil groups" was chosen.

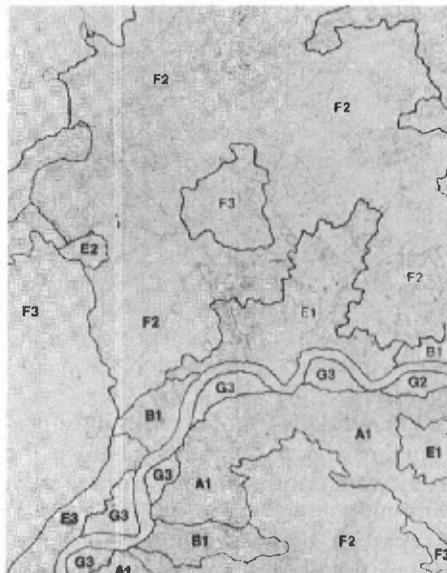


Figure 1. Soil group map at 4 inches = 1 mile. The heavy lines and symbols delineate map units.



Figure 2. Soil group boundaries being joined at the edges of detailed soil map atlas sheets on partial mosaics of a county.

groups were going to be expressed as units on maps and be plugged into computers.

Soil groups were formed around the following major characteristics and features: (a) drainage class, (b) texture, (c) depth to and character of bedrock, (d) permeability, (e) flooding and ponding, (f) stoniness or rockiness, (g) slope (0 to 8 or 10 percent, 8 to 15 percent, and 15 percent or more). After going through a series of approximations, more than

2,100 mapping units from detailed soil maps (statewide) were finally fit into 19 major groups. Eight of the groups consisted of soils with a wide range of slopes. Such groups were broken into slope subgroups and designated by lower-case slope subscripts (a, b, or c). However, the slope subgroups required their own specific sets of interpretations, so they were treated as individual groups in the system.

Ultimately there were 34 groups for the entire state. Each group was assigned both a capital letter and a numeral, such as B1. Where there were slope phases within a group, the lower case suffix was added. For example, B1c represents the deep, well-drained, permeable soils in Maryland with slopes of more than 15 percent.

The system begins with excessively drained sandy soils (A1a, A1b, and A1c) followed by the deep, well-drained permeable soils (B1a, B1b, and B1c) and then the shallow to bedrock soils. The latter groups include those soils with wetness limitations and stony and rocky soils. Tidal marsh, freshwater marsh, and swamp are grouped together. All well or moderately well drained alluvial soils are distinct from the poorly drained alluvial soils.

These groupings naturally would vary from one state to another, as would the emphasis on specific soil characteristics and features.

Constructing the Maps

To construct the maps, the Department of State Planning obtained a federal grant from the President's Disaster Relief Fund following Hurricane Agnes. Other funds were obtained through the 701 planning assistance program. We justified the project primarily by creation of a floodplain map, a primary product of the project.

SCS realized that the State Planning Department's deadline could not be met if the SCS soils staff were to construct the maps, but SCS did insist on exercising quality control. The planning department then agreed to contract with a firm in the Washington metropolitan area for the actual map construction.

As map construction began, materials moved back and forth between SCS, the planning department, and the map construction firm. SCS supplied the soil groupings, base maps, and quality control in the form of

ESTIMATED SOIL LIMITATIONS FOR

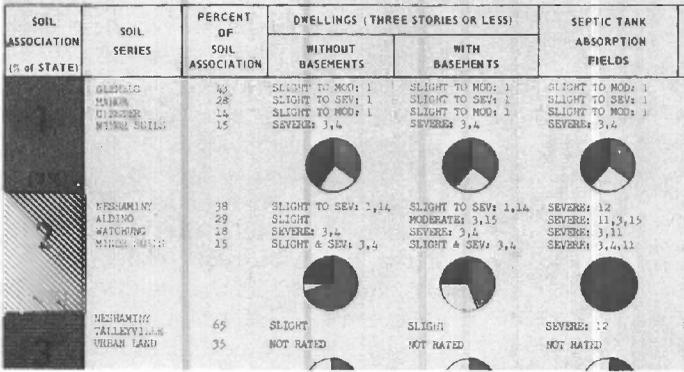


Figure 4. A section of a soil interpretations chart that accompanies a soil association map. Limitations of the specific soil series are shown as "slight," "moderate," or "severe." Limitations for the entire soil association are summarized in a green, yellow, red color pie for each use.

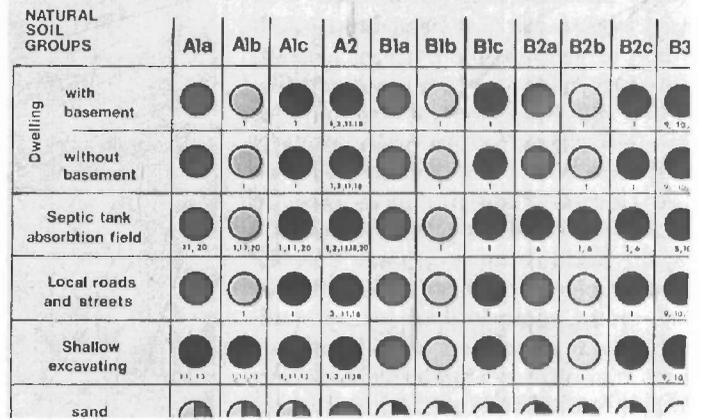


Figure 5. Same interpretive principle applied as in figure 4, but for natural soil group map. The high degree of interpretive purity in the natural soil group map permits the single-color spot rather than pie.

county. Because some features of the conversion legend were misinterpreted by the map workers, it was necessary to add and remove delineations in some places. This was done by applying typist's opaque white eradicator over the black lines. The press-on symbols were easily removed with a razor blade.

Once SCS completed its review and revision of the five or six full-scale partial mosaics comprising a county, they were sent to the Cartographic Division for reduction and reproduction. Each of the partial mosaics of full-scale (1:15,840 or 1:20,000) atlas soil map sheets were photographically converted to 1 inch = 1 mile (1:63,360 scale) negatives and trimmed. Then the five or six pieces of negative comprising a county were spliced together to complete a 1 inch = 1 mile negative of the entire county. From this, a Chronaflex³ positive was made and appropriate north arrow, credit block, and scale added. This completed the map construction.

Text and Interpretations

The text for the natural soil groups maps of Maryland, like the maps, is adaptable to statewide, regional, or county use. Each soil group description consists of an opening paragraph that establishes the physiographic set-

³Trade names are used solely to provide specific information. Mention of a trade name does not constitute a guarantee of the product by the U. S. Department of Agriculture, nor does it imply an endorsement by the department over comparable products that are not named.

ting, locations, and nature of landform of the soils in each group. A second paragraph emphasizes the soil characteristics, properties, and features that would have some effect on most land uses. Specific paragraphs are then devoted to interpretive statements concerning use of soils in the group for cropland, urban, recreation, wildlife, and woodland uses. An additional paragraph specifies the unique value of the group of soils in statewide planning.

One appendix catalogs all the soil legends for every county in the state. The map symbol, mapping unit name, capability unit symbol, number of acres, and soil group symbol are also shown. The acreage of any soil group or interpretive category expressed on a county natural soil group map can thus be determined. Of course, the other reason for having this kind of appendix is to identify the map symbols on the detailed soil map underlying the natural soil group map.

The publication includes two tables. One provides a range of estimated physical and chemical properties for a group of soils. The other provides interpretations for 15 farm and non-farm uses (Figures 3 and 5). Each interpretation consists of a circle—green, slight limitations; yellow, moderate limitations; or red, severe limitations—for each soil group showing the intensity of the soil limitations. The specific limitations are indicated by a series of numbers printed below the circle and described in a "Key to Principal Soil Limitations" below the table.

This color interpretive chart is also effective for visually and accurately demonstrating the percentages of a soil association that have slight, moderate, or severe limitations for various uses, such as in the color interpretive chart that accompanies the Tri-County General Soil Map for Southern Maryland (Figure 4). However, the units on a natural soil group are not composed of soil associations, but similar kinds of soils that dominate the unit and are interpreted the same. For this reason, solid-colored circles can be used to represent a uniform interpretation for the map unit, although the user must realize there are some inclusions of other limitation classes.

Maps showing limitations by county are also available (Figure 6).

The Payoff

Thus far the natural soil group maps at a scale of 1:63,360 have been useful in designating prime and productive farmland, wetlands, alluvial soil floodplains, land suitable for truck crops, areas with best potential for urbanization, and least costly pipeline routes.

Basically, the same soil interpretations can be made as from detailed soil maps. However, users must remember that the information is more generalized than that on a detailed map. Once a user gets beyond broad land use planning into specific land use or investment decisions, the extra ground truth of a detailed map is needed, and possibly on-site testing as well.

There have been several unexpected

fringe benefits from the project. One surprising result has been better definition of geomorphic patterns of soils. Formerly, these were not so well disclosed on either general soil maps or detailed soil maps. An example is the Fall Line, where the Piedmont Plateau and Coastal Plain provinces meet in Maryland, which is precisely outlined on the natural soil group maps by the contact of two groups. Likewise, the soil group comprised of loamy sands and sands disclosed details of old stream and torrent patterns heretofore lost in published general soil maps and camouflaged in a mass of detail on detailed soil maps.

SCS already is realizing tremendous savings by soil scientists and conservationists in time expended on attempted synthesis of a general soil map for special interpretations as requested by planning groups or individuals. In fact, these types of requests have decreased markedly because the natural soil group project has been so highly publicized in connection with the upcoming state land use plan. Any individual can purchase the statewide interpretive publication and a county map directly from the Department of State Planning for about \$4.

The natural soil group maps are but one of many resource inputs into the state plan. The Maryland Automated Geographic Information System also stores data on geology, unique natural

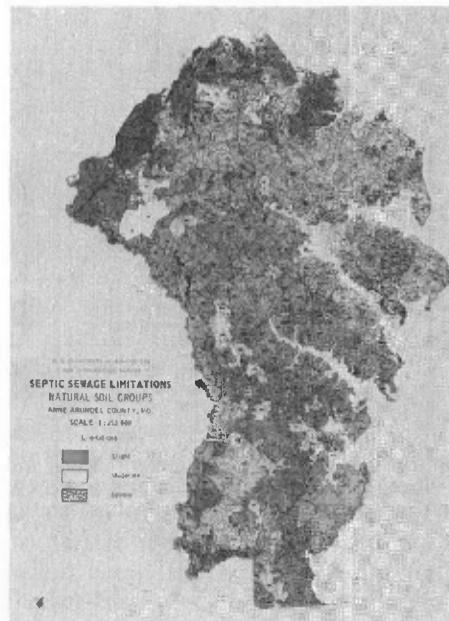


Figure 6. Paper copies of natural soil group maps are available showing limitations for specific uses.

features, transportation facilities, sewer and water service areas, and current land use (Figure 7). The latter is to be periodically updated by ERTS high altitude photography. Based on an analyses of these data, the system can be used to generate computer maps displaying the relative capability and suitability of land throughout the state to sustain various uses. All the data are subject to recall on a 91.8-acre

cell base (Figure 8).

The 91.8-acre cell can be subdivided into smaller cells. This approach is currently being used in several highway corridor alignments under study. The most significant barrier to widespread application is the availability of data at an appropriate scale.

In addition, a technique has been developed that fully uses the capacity of the automated data system to display the detail found in the original data maps. The technique was developed using the land use data element, but is applicable to the soils data element as well.

This process enables the cell to be divided into smaller units based upon stratified statistical samples. Using this technique, the scale of the data is comparable to the 1:63,360 level of generalization found on the data maps. Put another way, it is equal to the level of generalization produced by the creation of the natural soil groupings.

Should you need to know where there are 100-acre units of a deep, well-drained, loamy soil that is non-wooded, nonurbanized, has no bedrock within 5 feet of the surface, and is located beyond the area included in the 10-year sewer and water plan but within 100 miles of Washington, D. C., just ask. This information and more can be obtained from the Maryland Automated Geographic Information System. □

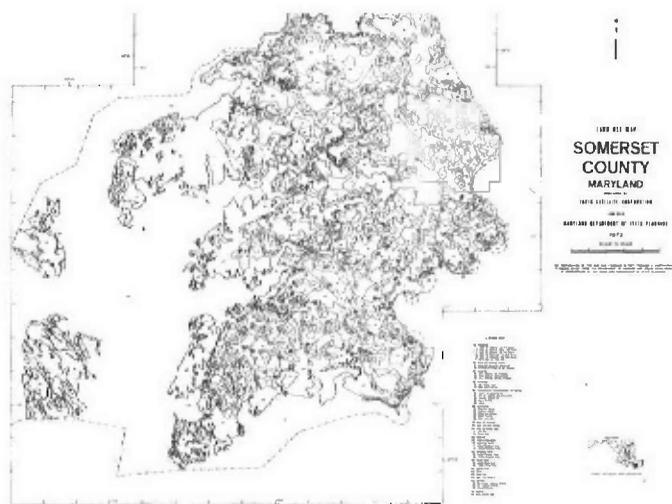


Figure 7. Every county in Maryland has existing land use map prepared from earth satellite photography. Almost 50 classifications of land use are shown. Scale is 1 inch = 1 mile, which allows the map to be superimposed on the same natural soil group map. Land use conversions by kinds of soils can be determined visually or by computer.

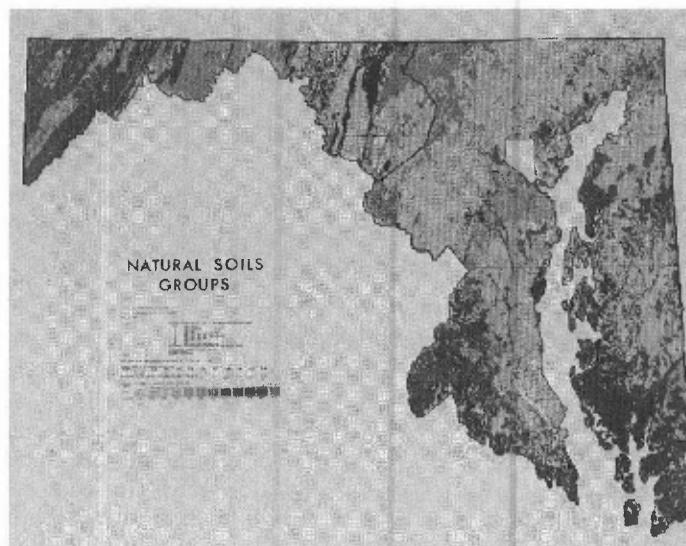


Figure 8. Statewide computerized natural soil group map. Individual cells are 91.8 acres in size. Lightest colored areas on the printout have the greatest adaptability or are the most problem-free for all uses.