The Soil Survey in the Rural-Urban Complex

Kenneth E. Grant, U.S.D.A., Soil Conservation Service
Indianapolis, Indiana

Introduction

The high standard of living which is almost taken for granted by the American public stems in large measure from the plentiful supply of land resources with which we have been so richly endowed. Still, these resources are limited in contrast to human wants which appear limitless.

It was inevitable that our land use problems would multiply as population increased with its concomitant expanding public and private demands. Man, with his varying social, economic and personal tenants exerts his influence in the form of needs and wants. It is, however, a sad testimony that we have developed an environmental standard characterized by rural-urban sprawl, strip cities, clogged highways, and contaminated air and water. We may conquer "outer space" as we lose the battle for "open space." Secretary of Interior Stewart L. Udall (4) in his book **The Quiet Crisis** wrote "Each generation has its own rendezvous with the land, for despite our fee titles and claims of ownership, we are all brief tenants on this planet. By choice, or by default, we will carve out a land legacy for our heirs. We can misuse the land and diminish the usefulness of resources, or we can create a world in which physical affluence and affluence of the spirit go hand in hand."

It is in the urban and rural-urban fringe that the greatest land use conflicts confront us. There can be no quibbling with the need for housing, supermarkets, highways, and recreation areas. But we need to ask ourselves if we can afford the extravagant price we are paying in wastage of soil resources, to say nothing of the increased urban-associated costs, resulting from poorly planned or unplanned development. The problem is not one of an absolute shortage of land. Even with the projected population increases, and accepting our present helter-skelter pattern of development, it would be a long time in the future before an actual physical shortage of land forced adjustments in land use.

The total acreage in urban use[1] in 1959 was only 147 million acres and the 1980 projected use is 196 million acres (3). Clawson (1) estimates that the acreage in urban areas will total only 41 million acres by the year 2000, but that 80 percent or more of the total population will live in urban communities (255 million out of 310 million). The fact that urban land takes up such an insignificant amount of our total area (perhaps 2 percent by 2000) however, in no sense states the spatial significance of urban land resources. It is the land affected by the city that assumes importance. Water needs, for example, embrace entire river basins and exert a pronounced influence on land use over the entire area. Parks and recreation areas assume importance both within

1. Includes urban and built-up areas and recreation and wildlife land.

and around the city, and transportation systems require additional land. These problems do not stop at city boundaries or even at county lines. They frequently become regional if not national in character. Luther Gulick (2) sums it up as follows: "We need to create in the United States some broader basis of comprehensive thinking. While it is a wonderful thing to break bottlenecks by having one group build water systems, another group build highway systems, another one build bridges, and so on, it is also desirable to have these activities interrelated and that condition can be achieved only by using governmental units that cover a bigger regional area."

The problem lies in the pattern of growth, or, perhaps it would be better to state, the lack of a pattern. One has only to look with open eyes to see our patchwork attempts. This paper, however, will not explore this aspect any further, but rather will attempt to discuss the importance of the soil survey and its interpretations in the rural-urban complex.

Status of the Soil Survey and Interpretations

The Soil Conservation Service, United States Department of Agriculture, has the principal Federal responsibility for making soil surveys. Its work is carried out cooperatively with the State Agricultural Experiment Stations and other Federal, State and local agencies. The work includes field and laboratory investigations, classification of the soils according to a national system, and publication in a standard series by the Department of Agriculture.

Soil surveys have been published for over 2000 counties and areas. Although many of these are now old, they still have limited use, especially for general planning. The more recently published soil surveys contain detailed soil maps and specific interpretations for many different uses. In addition, there are millions of acres of completed soil surveys on unpublished maps in soil and water conservation district offices which can be interpreted and used for planning purposes.

In Indiana, soil scientists and other specialists have developed tables giving brief descriptions of the major soils, their classification, and their measured and estimated physical and chemical properties. Engineering properties have also been tabulated. These tables provide extremely valuable information for users who need to know such things as permeability, available water capacity, frost potential, shrink swell potential, seasonable water table levels, location of flood plains, and depth to bedrock.

Recently, tables of "Interpretations of the Soils in Indiana for Rural and Urban Development" have been completed. These tables appraise the individual kinds of soil according to their relative suitability for residential development, light industry and commercial buildings, and roads and highways. These evaluations are expressed in terms of degree of soil limitations (slight, moderate, severe and very severe) and are predictions of the behavior of specific soils under stated conditions. Tables have been developed for "Interpretations of Engineering Properties of Soils—Nonagricultural (Urban) Uses," "Interpretations of Engineering Properties of Soil for Agricultural Uses," "Interpretations for Recrea-

tional Development" and several others of value in rural-urban fringe areas. The planner of today has tools available to help prevent many mistakes of the past and to aid in the planning and development of a rural-urban complex that more nearly meets society's expectations.

The literature contains many references to individual case histories documenting facts about housing developments that have been flooded, failure of septic tanks, foundation failures, and excessive costs associated with poorly located roads and facilities. When these conditions exist there is significant loss to the individual and the entire community.

An often overlooked fact is the amount of erosion occurring in the rural-urban fringe. Many believe that soil erosion and the resultant sedimentation problem around the metropolitan Washington, D. C. area must be numbered among the most serious problems. Recent studies by the Interstate Commission on the Potomac River Basin (5) point out that this area generated approximately a million tons of sediment in a single year, or almost one third of the total sediment discharge of the Potomac River. Studies by the commission also point out that sediment discharge in this basin varies from 21 to 2300 tons per square mile of drainage area per year depending on land use. Intensively cropped agricultural land experienced losses as high as 500 tons per square mile, but it was the areas undergoing urban development that reached the 2300-ton loss. Losses many times higher than this have occurred where entire areas have been bull-dozed and left exposed for long periods before construction was completed and vegetation established.

Rather than dwell on past mistakes, let us examine some of the specific types of interpretations that can be developed and how they can aid in shaping a better community. What can be done on a community-wide basis can of course be applied to a larger geographic area, and can also be pinpointed to the individual landowner. At the outset it should also be understood that consideration of the potentials and limitations of the soils is only one of the many interrelated considerations that must be evaluated, but it can be one of the most important and useful. This can be said for the rural-urban complex that is still only emerging on the drafting board, or the one that is experiencing current and often acute growing pains.

Transparent overlays of the detailed soil map, developed with soil interpretations for urban uses, are relatively easy to prepare and can be easily understood. A single rural-urban complex might find five or ten specific interpretations of special value, but the number that could be developed for specific problem solving would certainly number several times this figure.

The following interpretations on overlay maps are illustrative of how the basic facts and alternatives can be brought together for eventual decision by local interests.

Slope—An overlay indicating the degree of slope is frequently very valuable in developing an overall perspective of the area being studied. Slope breakdown into general groupings can be decided on the basis of available land, other limiting soil qualities, local decisions on maximum public road slopes to be permitted, etc. In Lake County, Indiana, for

example, a tentative slope range of 0-2%, 2-6%, 6-12%, 12-18%, 18+% has been developed for urban purposes. In areas of steep topography an entirely different grouping might be appropriate.

Slope is particularly significant in areas that include soils that have a tendency to slip. Urban development frequently has been directed to the more picturesque hillside but the soil slope relationship has frequently been ignored. Shallow soils also present particular construction problems on the steeper slopes.

The slope map overlay quite frequently will indicate potential for natural beauty areas on sloping lands, areas where town or city forests may be developed or maintained, or perhaps a grassland agriculture located within the rural-urban complex. Even if the decision is to permit housing developments on the steeper slopes it will flag probable higher costs for construction and for maintenance.

The potential uses could be expanded at great length, but where topography does vary significantly it is an important consideration.

Drainage—Soil drainage is important in almost every use of soil. Overlays can be prepared which describe drainage in general terms such as droughty, well drained, poorly drained or very poorly drained. These may be adequate at the earliest stages of planning to indicate possible general patterns of use and growth. However, as more detail becomes needed it will be important to develop interpretations of more specific nature such as depth and frequency to seasonal water table, frost potential, percolation rate, shrink-swell potential and flooding hazard.

Suitability for Septic Tank Filter Fields—The development of an overlay indicating suitability for septic tank filter fields will necessarily consider several characteristics of soils that affect their suitability for absorbing waste from domestic sewage disposal systems. The major characteristics considered are soil permeability, percolation rate, ground water level, depth to bedrock, flooding hazard and slope. All soils in Indiana have been appraised for their relative suitability using the previously expressed degree of soil limitations (slight, moderate, severe, and very severe). These overlay maps will certainly figure very importantly in decisions involving housing, public buildings and size of lots.

Light Industry and Commercial Buildings—Overlays indicating suitability for light industry and commercial buildings can be developed based on considerations of several engineering characteristics. These would include soil texture, bearing capacity, shear strength, shrink-swell potential, compressibility, depth to bedrock, depth to water table and susceptibility to liquefaction and piping. All soils in Indiana have been appraised for this purpose.

These and many other overlays for specific purposes can be developed. It is a rewarding experience to see a pattern for future development emerge in the eyes of local planners as these overlays provide a sound basis for action.

Soil maps are made at a field scale of 4″ = 1 mile. The boundaries on maps between kinds of soil are not precise to the width of an ordinary house. The soils are examined consistently to depths of 4 to 6 feet. Thus, for heavy construction (roads, large buildings) and for specific

on-site evaluation of a particular structure, the soil survey should be supplemented by more detailed and deeper examination at the site of the proposed structure.

Summary

The rural-urban complex includes the farmer, the suburbanite, the businessman and the industrialist. They all need land. The task of today's planner is to harmonize their demands in such a manner that an orderly and comprehensive plan results. The soil survey with its interpretations is one of the most important tools with which he has to work Properly utilized it can aid in arriving at a desirable spacial distribution of industrial, agricultural, residential and recreational development. It can help to identify areas well adapted to the requirements for open space. It can appraise suitability of soils for individual sewage disposal facilities, for building sites and development of transportation systems. It can be used by tax assessors as a basis for valuing land. It can, in fact, be important and useful in shaping and guiding the development of the entire rural-urban complex. We have the responsibility to see that all possible steps are taken to insure that the soil survey is used.

Literature Cited

1. CLAWSON, MARION. 1960. Suburban Development Districts. Reprint No. 20. Resources For The Future.
2. GULICK, LUTHER. 1958. The City's Challenge in Resource Use. In: Perspectives on Conservation. Ed. by Henry Jarrett. Resources For The Future. Johns Hopkins Press.
3. Land and Water Resources, A Policy Guide. 1962. U. S. Department of Agriculture. Washington, D. C.
4. UDALL, STEWART L. 1963. The Quiet Crisis. Holt, Rinehart, and Winston.
5. WORK, J. W., et al. 1963. Preliminary Study of Sediment Sources and Transport in the Potomac River Basin. U. S. Department of the Interior, Geological Survey; and Interstate Commission on the Potomac River Basin. Washington, D. C.