Understanding Cranberry Soil Maps

by James Turenne

Introduction

A soil survey is an inventory of the nation's soil resources. Soil surveys record the location of soil types occurring in an area and predict soil performance under defined use and management. The survey also highlights limitations and hazards inherent in the soil and improvements needed to overcome the limitations. Soils are classified using a taxonomic system of classification, similar to the system in which plants and animals are classified. Soil series are named for the location where the soil was first classified.

Soil surveys are made by soil scientists and are the result of extensive field work. Soil scientists delineate soil types by walking the landscape and digging holes to study the soil profile, and classifing the soil. The boundary of that particular soil is delineated on an aerial photograph. The published soil survey consists of soil maps and descriptions of the soil map units along with interpretive tables for each soil type. Soil survey reports are published for each county within Massachusetts and for most areas of the U.S.

Plymouth County Soil Survey

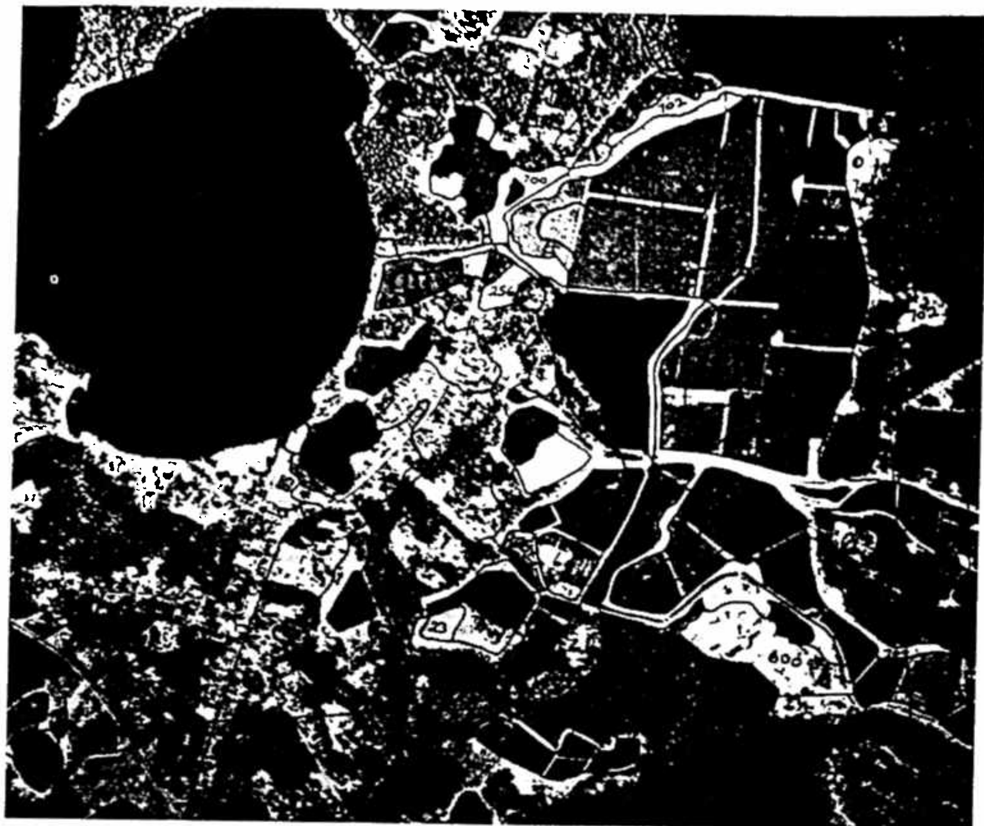
The USDA Natural Resources Conservation Service is in the process of updating the soil survey for Plymouth County. The updated soil survey report of Plymouth County will use state-of-the-art technology to produce a detailed, modern soil survey. The updated mapping makes use of high resolution color-infrared aerial photography. The survey also uses remote sensing equipment such as global positioning systems (GPS), geographic information systems (GIS), and ground penetrating radar (GPR) to increase the accuracy of the soil maps and provide more information to the users of the survey.

ABOUT THE AUTHOR: *Soil scientist James Turenne is group leader for Plymouth County Soil Survey, USDA-Natural Resources Conservation Service, West Wareham, MA 02576*

Soil Survey on Cranberry Beds

Soil survey maps in the past often delineated cranberry beds as an undifferentiated map unit, meaning that all cranberry beds were delineated as one soil type. This provided the person using the soil survey with very little information or interpretations about the soil conditions of the bed and the underlying geologic deposits. The 1969 Plymouth County Soil Survey Report mapped all cranberry beds Sanded muck (map unit Sb).

The number one priority for updating a soil survey is understanding users needs, and then designing the soil survey to address them. To do this soil scientists talked with the growers and other people involved with cranberries to get a comprehensive understanding of cranberry cultivation. The soil scientists then conducted extensive soil investigations across representative areas to determine the variability of soil conditions within cranberry beds. Test pits were dug to classify the soil, samples were collected for laboratory analysis to determine the chemical and physical properties, and deep borings were made to classify the geologic material. Soil scientists also used remote sensing technology to study cranberry beds. A ground-penetrating radar (GPR) unit was used to investigate the subsurface soil and geologic features on cranberry beds. The GPR is a geophysical tool which provides a graphic profile of subsurface features. The GPR shows the distribution of organic deposits (referred to as peat), thickness of peat, and the depth and contour of the underlying mineral material. Results of the soil investigations showed that there was considerable variability within the soils of cranberry beds.



An aerial photo shows an updated soil survey map of an area of cranberry beds in South Carver, Massachusetts. Map unit 23 shows a recently constructed bed in sandy material, map unit 55 shows areas of deep organic (peat) deposits. Upland soils are to the right of the bog.

Based on the extensive field investigations, soil map units were developed to delineate areas used for the production of cranberries (see Table 1). Each unit has a range of chemical and physical properties that differentiates it from other map units.

Mapping Cranberry Beds

Field soil mapping on cranberry beds is conducted using a tile probe (thin rod of spring steel) and an auger (device used to retrieve a thin core of soil). A soil scientist mapping a bed traverses across the bed and takes borings in select areas to determine the soil type. A boring consists either of pushing the steel rod through the soil surface and feeling for resistance, or augering a small hole to observe the underlying material. Most of the cranberry bed map units are differentiated based on the thickness of the organic layers, and the underlying geologic sediments that the bed is constructed on. The different soils identified during the mapping are delineated on a color-infrared aerial photograph.

Cranberry Bed Soils

All cranberry bed soils consist of a surface layer of sandy material that was added to the surface for a rooting medium for the cranberry vines. The thickness of the sandy fill material is variable and typically ranges between 4 to 20 inches thick. A bed that has been in production for several decades has a surface layer consisting of alternating layers of sand and organic material (see photo on cover page). Below the fill material is the buried soil on which the bed was constructed. The varied soil conditions underlying this upper sandy surface is the basis for separating and delineating the different cranberry bed soil types.

Most cranberry beds are constructed on deposits of peat formed within depressional areas, commonly referred to as kettle bogs. These bogs were formed by large blocks of ice which detached from the main ice sheet as a continental glacier began retreating from the area during the last ice age, about 15,000 to 20,000 years ago. The detached ice blocks were covered by sediment and remained frozen for many years. Eventually the ice melted out and the overlying sediments collapsed forming a depression on the landscape, refereed to as a kettle hole. If the ice block was large enough to intercept the watertable a pond formed within the depression (kettle pond). Throughout time vegetation growing within the pond gradually filled the pond with organic sediments, forming a bog. Many of the older cranberry beds in Plymouth County are constructed on these kettle bogs. The thickness of the peat deposits are variable ranging from less than a few inches to more than 50 feet.

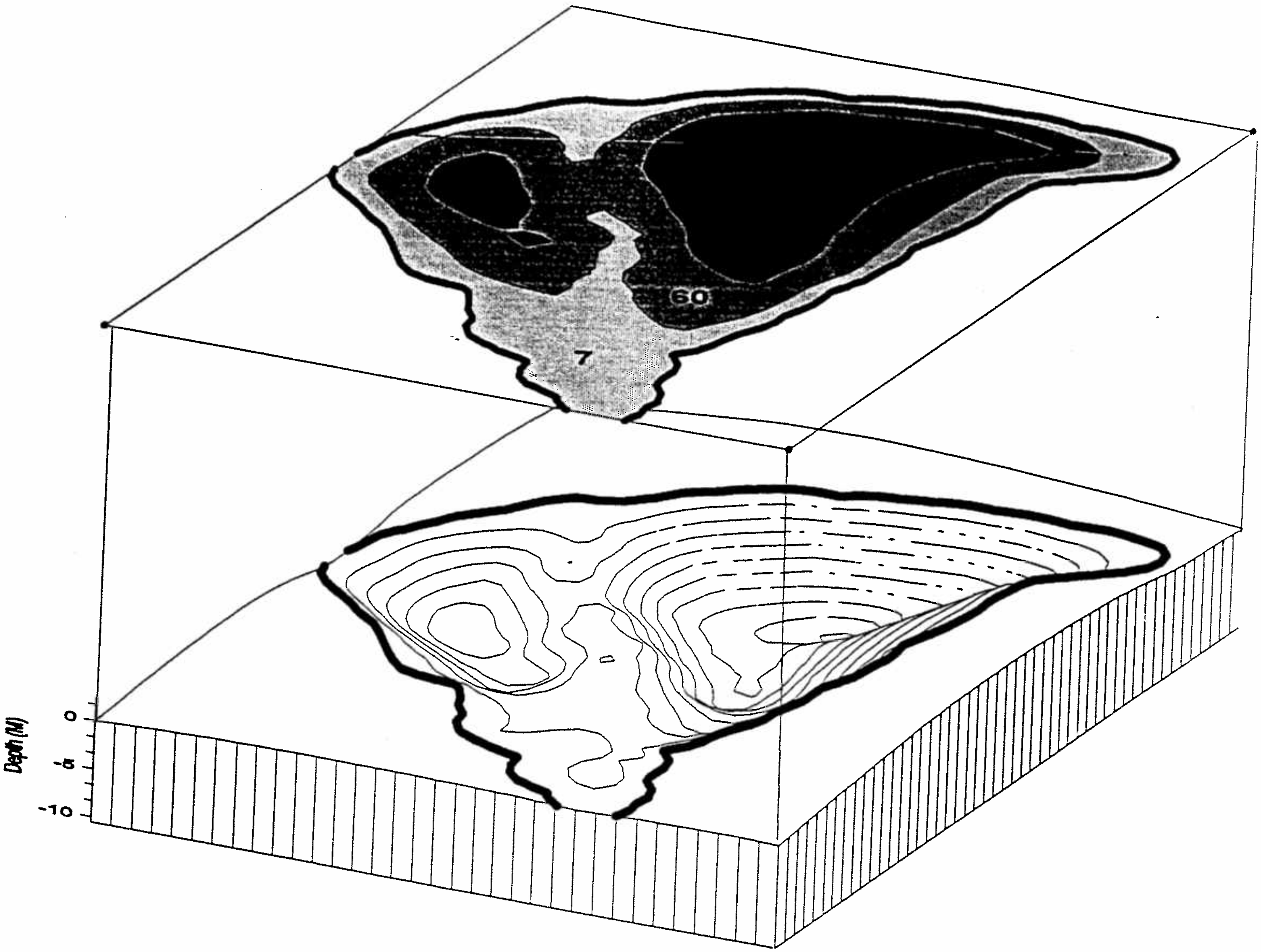
New cranberry beds that were constructed in upland areas do not have a naturally occurring peat layer in them. Some new bogs use a restrictive layer (natural or artificial) to perch the water above the underlying true watertable (see map unit 658). Others are constructed by excavating the upland soils (typically sandy soils) down to the watertable and establishing the bed at that elevation (see map unit 23).

Cranberry Bed Soil Map Units

A soil survey is designed to meet the needs of many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum production. Planners, engineers, builders, and home buyers can use the survey to plan land use, select the best sites for construction, and identify practices needed to ensure optimal performance.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are unstable and cannot be used as a foundation for buildings or roads. All of these, and many other soil properties are included in a soil survey report. Soil properties and limitations are described in the soil map unit description and listed on interpretive tables in the survey.

There are nine soil map units which delineate areas used for the production of cranberries in Plymouth County, Massachusetts. Brief descriptions and some of their interpretations are listed in Table I.



1: Graphic representation of a cranberry bed, showing the relation between soil types and bog morphology. Top diagram shows the soil map units (see legent below). Bottom diagram is a three dimensional contour plot of a cranberry bed which was surveyed using a ground penetrating radar unit.

Table 1. Cranberry Bed Soil Legend for Soil Mapping.
(Note: these are tentative map units, subject to change.)

Unit Symbol	Unit Name
7	Berryland coarse sand
23	Psammaquents, cultivated
26	Sippican coarse sand
27	Birdsall coarse sand
55	Freetown coarse sand
60	Swansea coarse sand
701	Cranberry bed, abandoned, mineral
704	Cranberry bed, abandoned, organic
658	Epiaquents, cultivated

Figure 2: Profile of the upper part of Freetown coarse sand. The dark and light layers near the surface are the result of sanding for cranberries.

Map units 55 and 60 are organic soils, (soils formed in deposits of organic material which is greater than 16 inches thick). Swansea soils have an organic layer, ranging from 16 to 51 inches. Freetown soils formed in thicker organic deposits that are greater than 51 inches thick and in many areas greater than 20 feet thick. Map unit 704 is used for abandoned cranberry beds consisting of Freetown and Swansea soils.

Map units 7, 26, and 27 are areas of mineral soils which have less than 16 inches of organic material. The soils are differentiated based on the type of underlying mineral material the soil formed on. Berryland soils formed in sandy material, Sippican soils formed in dense loamy material, and Birdsall soils formed in silty and clayey deposits. Map unit 701 is used for abandoned mineral beds.

Map units 23 and 658 are map units used for recently constructed beds which are or were in upland areas. The names of these map units come from the taxonomic placement of the soil in the classification system used to name soils. Since these are recently made soils, they do not have a soil series name as the other units. Map unit 23 (pronounced sam-aquents), is used for recently constructed beds made by excavating the upland soils (typically in sandy deposits) down to the apparent water table and establishing the bed. These soils are generally at the same elevation as the mineral and organic map units. Map unit 658 are upland cranberry beds which was constructed by perching the water either on a naturally occurring material or on fill material. These beds are typically at higher elevations than the surrounding beds.

Map Unit Interpretations

The purpose for producing a soil survey is to provide users with soils information which will enable them to better manage their land, optimize their returns, and protect the environment. For each of the map units, soil scientists have compiled detailed information about their physical and chemical properties. Examples of soils information which may be of particular interest to cranberry growers include: the permeability of the soil, presence of restrictive layers, water-holding capacity, depth to watertable, acidity, drainage, and organic matter content. This information is not included in this report but can be obtained from the soil survey office.

Having knowledge of the physical and chemical properties of the soil, a grower working with an agronomist, conservation planner, soil scientist, or engineer can predict or interpret how this soil may respond to different practices. Cranberry bed soil map units can be interpreted for the following uses:

- Susceptibility to subsidence.
- Placement of dikes to avoid settling.
- Locating the best areas for bed expansion and pond construction.
- Locating sources of sand and clay for upland bed construction.
- Ability of the underlying soil to bind and retain chemicals and fertilizers.
- Determining if a bed can support heavy equipment for bed renovation and maintenance.

Subsidence

An example of how the cranberry bed map units could be used to assist a grower can be illustrated by using a common problem associated with cranberry beds; subsidence. Cranberry management practices such as dike and ditch construction, and bed sanding require a load to be added to the bed. The type of soil occurring in the area of such practices can have an impact on the success of these structures. A dike built on a deep organic soil (Freetown soil) may begin to subside shortly after construction. Using the diagram above as an example, a dike constructed in the area mapped 7 and 60 (along the ridge running length wise) would be less likely to subside than if it were constructed in the area mapped 55. Sanding may also be a problem on this bed. Sanding adds a tremendous amount of weight to the bed and the low strength of organic soils may cause uneven subsidence in the area of the Freetown soils. Subsidence will be minimal in the areas of Swansea and Berryland soils.