# SoilWeb:
A Mobile Phone-Friendly Soils App for Logging
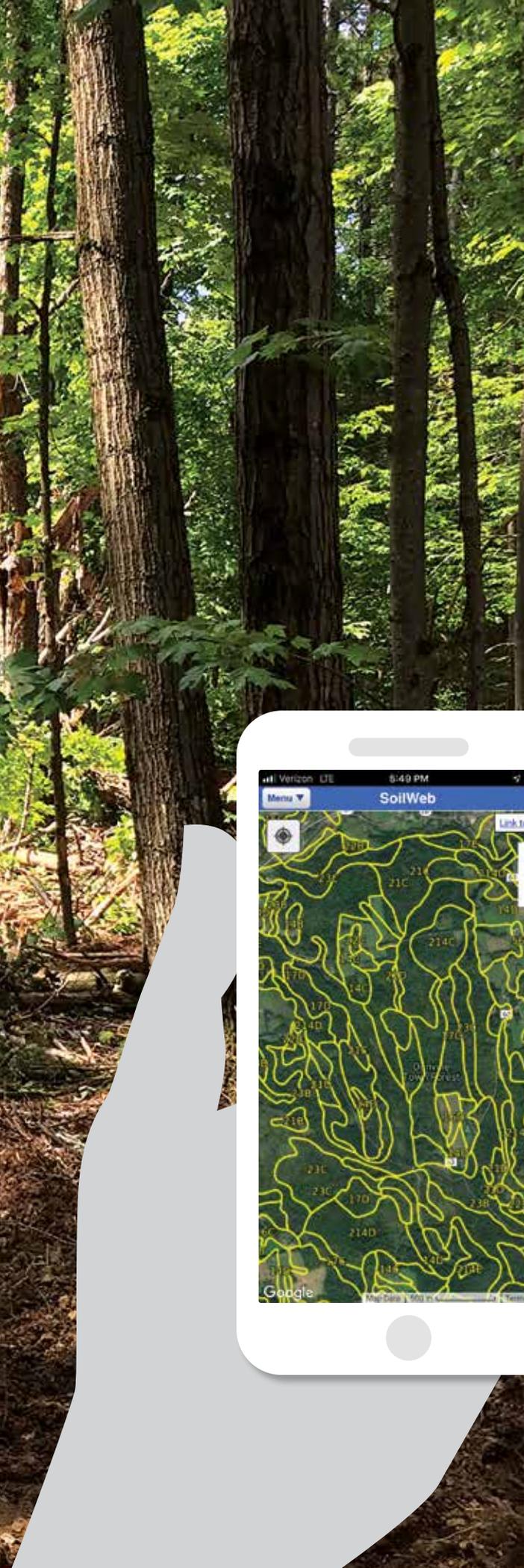
BY STEVEN BICK

SoilWeb uses modern technology to deliver soils information in a format that is just right for mobile users. This online soil survey browser makes investigating logging site soil characteristics from the USDA Natural Resource Conservation Service (NRCS) soil survey database easy and convenient. Soil survey information can help foresters and loggers determine the acceptable timing and conditions for harvesting a site and anticipate some of the challenges present there. While the National Cooperative Soil Survey data is no substitute for an on-site inspection, the information it provides can save time and help prioritize plans for a field visit.

NRCS Soil Survey

The NRCS National Cooperative Soil Survey dates back to 1896 as a federal effort to map and describe soil types, textures, and suitable uses nationwide. Agriculture was the primary purpose of this effort, but more information has been added as the field of soil science has grown. The NRCS became the successor to the old Soil Conservation Service in 1994 and continues this important work today.

Soil survey data has long been available for public use, mostly in the form of county-level printed reports. The NRCS now makes almost all of this soil survey data available on the interactive Web Soil Survey site (https://websoilsurvey.sc.egov. usda.gov/App/WebSoilSurvey.aspx). Users can map specific areas and produce and download custom reports.

While NRCS Web Soil Survey is an excellent resource, it is all but unusable on a smartphone and lacks any GPS functions for on-site positioning. SoilWeb overcomes these limitations, providing soil survey data for the entire nation in a mobile-friendly format.

SoilWeb

SoilWeb is a product of the California Soil Resource Lab at the University of California, Davis. This lab conducts useful research on many aspects of soil science and assists the working landscape by repackaging the soil survey data into free and publicly available interactive decision support tools.

SoilWeb works in a web browser and can be accessed with a computer, tablet, or smartphone. The mobile-friendly design of SoilWeb makes it particularly well suited for use as a phone app. Links and instructions for setting up the app on both iPhones and Android phones are included in a sidebar to this article.

Users can browse locations on a Google Map, with base map choices of satellite, roads, terrain or a hybrid (satellite and roads). A soil map overlay is provided when the user zooms in to a particular location, with soil unit boundaries defined by distinct yellow lines. Note that SoilWeb can only be used when an internet connection is present. Since SoilWeb is best used for investigating sites in advance, the internet connection requirement isn't a major drawback.

Tapping on an individual map unit brings up an abundance of soil survey information. A thorough explanation of all it contains takes up an entire manual – 639 pages of fascinating technical information. The rest of this article will focus on the much narrower subset of information that is most useful for forest operations, including some general properties of mapped soil units, soil type properties (including forest productivity), and forestry suitability ratings.

Map Unit Composition

The map unit composition includes the distribution of the map unit in various soil types, by percentage. One or two soil types typically dominate each unit.

Underneath the soil type description links is a list of map unit data. Two of these items are of particular importance for logging.

Frequency of Flooding (Dominant Condition) is a good indicator of how often a site is temporarily covered with water. A range of *none-very rare-rare-occasional-frequently-very frequent* is used.

Drainage Class (Dominant Condition) refers to the frequency and duration of wet periods. A range of *somewhat excessively drained-well drained-moderately well drained-poorly drained-very poorly drained* is used. Users can develop a good comparative sense of these designations over time.

Soil Type Properties

Map unit composition reports provide a list each of the soil types present. One or two soil types usually dominate a map unit. Tap on the link shown in the app and a soil profile is revealed, along with several categories of soil properties, including forest productivity and soil suitability ratings.

Among the dozen variables linked in the soil profile are two soil textures that are of particular interest in logging – sand and clay. Tapping on either of these reveHals percent composition of these soil textures at various depths. The amount of sand or clay in the first 50 centimeters (20 inches) is particularly important. Soils with a high sand content are more operable for most of the year than those with high clay content. High clay content soils are far

Figure 1. Sand and clay content data shown in SoilWeb.

more difficult to work on during wet periods. Images of the sand and clay content graphs are shown in **Figure 1**.

Below the Soil Profile area are several other sections linked to various data. One of these is Forest Productivity. Tapping on this produces a list of tree species, along with a site index curve number for each and an estimate of annual productivity in cubic feet per acre. This information is generally more useful to foresters than loggers, but it does provide some insight into logging conditions. Higher levels of productivity can often be linked to higher tree and fiber quality. Site index curves indicate the expected height of each tree species at a specified age. Higher site indexes are indicative of higher site quality.

Further explanations of the information available on map units and soil properties can be found in the *USDA Soil Survey Manual* (http://bit.ly/USDASSM).

Figure 2. Forest productivity and forestry ratings shown in SoilWeb.

Forestry Suitability Ratings

Within the soil type properties data there is a section called Soil Suitability Ratings. Tapping on this section reveals several ratings choices. Tap on **Forestry** to view the ratings related to forest operations. Fifteen separate variables are rated, with several of these being of particular interest in logging.

Soil Rutting Hazard indicates the level of risk of rutting by equipment in the uppermost soil surface layers. Ratings are based on 3 to 10 equipment passes, with rutting depths of 2 to 24 inches, when the soil moisture is near field capacity. A range of slight-moderate-severe is used for these ratings. Loggers already know that almost any site can be rutted under the right conditions. Comparative use of these rankings over time can be used in developing a reasonable sense of eventual remediation efforts and costs for different soil types.

Potential Erosion Hazard (Off-Road/Off-Trail) indicate the risk of soil loss after disturbance activities that expose the soil surface. This rate is based on the slope percentage (slight, moderate, severe, very severe). A range of *slight-moderate-severe* is used for these ratings.

Log Landing Suitability rates the fitness of the soil on the site for effective use of equipment for the temporary storage and handling of logs. Landing sizes of one-half acre or less with clearing of vegetation and debris is assumed. It is
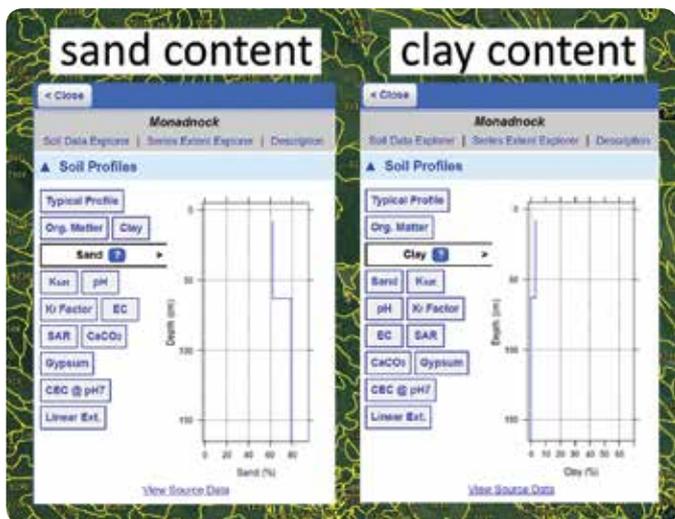
important to note that frozen or snow-covered soils are not included in these ratings. A range of *well suited-moderately suited-poorly suited* is used for these ratings. These ratings do not a apply to improved landing sites that are already in place from prior logging operations.

Construction Limitations for Haul Roads/Log Landings ratings are based on slope percentage, soil slippage potential, flooding frequency, soil texture and other variables. This rating is meant to assess excavation and related activities necessary for construction. A range of *slight-moderate-severe* is used for these ratings.

Harvest Equipment Operability rates the suitability of the soil for operating logging equipment, including both rubber tired and tracked machines and assumes that logging takes places during customary time periods for the local area. Ratings do not assess non-soil obstacles such as slash and do not include frozen or snow-covered soils. A range of *well suited-moderately suited-poorly suited* is used for these ratings. Observation and comparative use of these ratings over time can help loggers develop a good sense of their usefulness.

Soil maps in some states have additional forest suitability ratings categories relevant to logging, including *General Harvest Season* (Vermont) and *Soil Suitability for Forest Biomass Harvesting* (Connecticut).

Example SoilWeb screen shots showing forest productivity data and forestry ratings are shown in **Figure 2**. A complete description of all the forest productivity and soil suitability ratings for forestry can be found in the *NRCS National Forestry Manual* (http://bit.ly/NRCSNFM).

Accuracy and Applicability

How accurate is the NRCS soil survey data for a given location? How practical are the forestry suitability ratings? These questions can only be answered by using these references in multiple locations over time. Minor errors at the local level can be expected. The forestry suitability ratings are applied in a consistent and objective manner, but the wide range of logging equipment and on-going innovations in methods mean that these ratings will often suggest different possibilities to different loggers. Actual experience on areas with particular ratings can provide loggers with sharpened intuition of how the ratings scale applies to individual crews. Over time, this allows a good comparative sense of the meaning of each rating and ultimately worthwhile use of soil survey information in harvest planning and decision making.

SoilWeb provides a convenient summary of a thorough soil data set in a user-friendly format. The UC Davis Soil Laboratory lives up to its goal of "repackaging the soil survey into interactive decision support tools". Loggers and foresters alike can reap the benefits of this effort by integrating SoilWeb into their work.

Follow Steve Bick's forest operations posts on Instagram at: **www.instagram.com/northeastforests**

Descriptions of map unit compositions and soil type properties used in this article are referenced from the **USDA Soil Survey Manual**. A copy of this manual can be accessed via this QR code:

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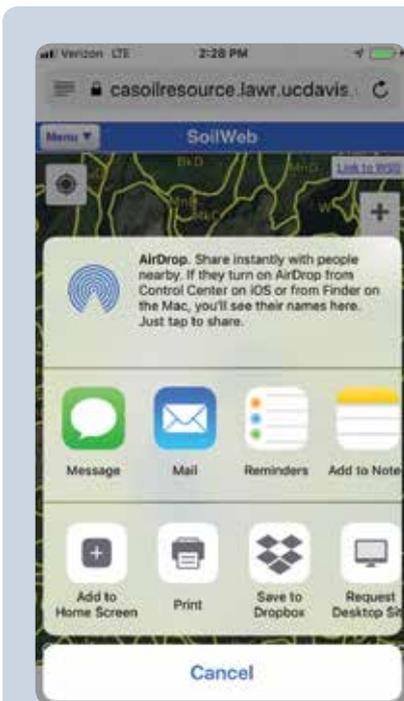
To setup SoilWeb on an iPhone:

1 Using the Safari browser, open this link: https://casoilresource.lawr.ucdavis.edu/gmap

2 Click on the share button at the bottom center of the browser ⬆; and

3 Choose "Add to Home Screen" from the share options ➕.

To setup SoilWeb on an Android:

1 Using the Chrome browser, open this link: https://casoilresource.lawr.ucdavis.edu/gmap

2 Tap the menu button and then tap "Add to Home Screen"; and

3 Give the SoilWeb icon a name (use SoilWeb!).

A SoilWeb icon will show on the home screen and it can be accessed and used like any other App. Enable location services to use the GPS function to investigate the current location.