Soil profile descriptions have largely relied on morphometrics by which soil profile properties are mechanically measured and visually observed. These observations are then combined with chemical, physical, and mineralogical data or thin sections from soil horizons. Official guidelines and handbook for describing soils include the *Soil Survey Manual* (Soil Survey Division Staff, 1993) and the *Field Book for Describing and Sampling Soils* (Schoeneberger et al., 2012). Detailed soil observations are made for a whole range of purposes (e.g., mapping, classification, land evaluation, and pedological investigation). Commonly, a soil pit is dug, but observations are also made using augers, samplers, push probes, slice shovels, trenches, road cuts, or in quarries. The overall purpose of describing a soil profile is to preserve the image of the soil, and a full soil profile description consists of reference and geographic location, profile environment (climate and geology), site and area description, and a description of the soil horizons and its attributes and properties. The traditional field toolbox for soil profile descriptions includes augers, pickaxe, spade, knife, spatula, rock hammer, Munsell charts, maps, notebook, water bottle, HCl, sample bags, tape measure, clinometer, compass, altimeter or GPS, and camera (Fig. 1). These are used to measure and observe soil properties and horizons.

The designation of horizons consists of interpretative symbols (e.g., Ah, Bt, etc.) that are based on morphology and soil genesis, and they are generally distinguished based on properties relative to those of an estimated parent material. Assessment in the field is based on differences in soil texture, color, coarse fragments, clay bridges, structural change, organic matter, mineralogy, concretions and accumulations, HCl effervescence, or the effect of frosts. The range of properties and features to distinguish horizons and horizon topographies (smooth or broken), distinctness (abrupt or gradual), and spatial variation requires pedological experience. Many soil profiles have complex horizons that can be turned into pixels or polygons. Figure 2 shows an example of a sandy overblown Spodosol—the polygon version of the soil profile (third from left) shows similarity to a polygon soil map (see example of soil map of parts of Oregon State). In a sense, soil profiles and horizons can be seen as polygon soil map. Just like we have put our soil maps in a geographic information system, we need to put our soil profile descriptions in a system.

Currently a range of sensors is being used in agricultural and environmental soil studies. These sensors and tools have been valuable for measuring and predicting soil properties, processes, and behavior in a horizontal sense, that is, across the landscape. They have been less applied for studying soils in the vertical sense, and observations of soil profiles rely on a toolbox that has not changed in the past decades. There are new tools available that can be used to investigate a soil profile—which I term here as digital morphometrics, or the application of tools and techniques for measuring and mapping soil profile properties and deriving continuous depth functions (Hartemink and Minasny, 2014). Digital morphometric techniques have been used for all soil properties both in a soil pit and on monoliths in the laboratory (Fig. 3).
Jenny (1941) emphasized that every soil property has its own vertical distribution pattern and depth function. Several depth functions are available that approximate the anisotropic character of soil properties, and these functions use a limited number of data points (usually from soil horizon data) and interpolate soil property values. Values for every possible soil depth increment are given, creating a continuous function of which the uncertainty can be quantified (Malone et al., 2011). In some cases, measurements can be made in a soil pit at very small depth intervals, and in other cases, the measurement is conducted in the lab and gives intervals in the micron or centimeter range and the increment is much smaller than the depth of soil horizons. It has the potential to create continuous depth functions of soil properties based on measurements rather than interpolations. It also has the potential to more precisely investigate horizon boundaries.

Pedology advances when increased data availability is combined with sound theoretical soil models and thinking that is tested across a wide range of conditions. Digital morphometrics follow the advances in proximal soil sensing devices. Attempts have been made to measure soil properties and attributes of soil profiles, and here I call for the use and integration of the proximal soil sensing technology and digital morphometrics in the analysis and mapping of soil profiles. Sampling protocols need to be developed to deal with the two- and three-dimensional variability in the soil pit. Core sampling (few centimeters in diameter) ignores much of the horizontal variation in soil horizons, just like the soil profile (relative narrow vertical cross-sections) ignores the three-dimensional body of the soil.

Considerable progress has been made in digital soil mapping and the timely collection of new soil data and information. There is an increased demand for soil information by a range of users that drives many of the new soil projects. That drive is related to issues around food, water, climate change, energy, ecosystems, or biodiversity. The wide array and use of proximal soil sensors contributes to increased data availability and soil information, and there is potential for using digital morphometrics for in situ soil characterization and the production of continuous soil depth functions. The combination of digital soil morphometrics and continuous soil depth functions has the potential to frame our understanding of soils and be valuable in the resurrection of pedology programs across the world.

References