ONLINE TRAINING FOR SOIL AND SITE EVALUATION

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ABSTRACT

Ohio regulations require the soil evaluation work be done by either a certified soil scientist or a registered sanitarian. However, sanitarians receive no soils training. With a shortage in the number of qualified soil scientists, the state regulations have caused unprepared sanitarians to conduct site and soil evaluations. Sanitarians are asking for training opportunities. The goal of this course of study was not to try to replace the certified soil scientist, but rather it is to instruct sanitarians and other onsite wastewater professionals to act as a soil practitioner to assess sites for onsite wastewater treatment and assist soil scientists in site evaluations. Eighteen (18) hours of on-line instruction was developed in three segments: soil depth and vertical separation distance, soils in the landscape, and water and soils. After a pilot offering to three sanitarians and one contractor in 2019 the course was offered the summer of 2021. Eleven sanitarians are enrolled and completing the first segment. Students watch videos, read text material and journal articles and complete assignments and quizzes. The online soil course is filling an important training gap for sanitarians.

INTRODUCTION

In Ohio, as in other states, all homes beyond the reach of city sewer must have an onsite wastewater treatment system. Since the soil treats the wastewater in these systems, the soil must be carefully described and evaluated before a system is designed and permitted.

State regulations require the soil evaluation work be done by either a certified soil scientist or a registered sanitarian. However, sanitarians receive no soils training. With a shortage in the number of qualified soil scientists, the state regulations have caused unprepared sanitarians to be asked (or sometimes told) to conduct site and soil evaluations. Sanitarians have been asking for training opportunities.

In Ohio, all registered sanitarians must obtain 18 hours of approved continuing education over a range of public health topics each year to maintain their registration. Onsite wastewater treatment professional who work as installers, service providers and pumpers, must obtain 6 hours per year. Professional engineers also must obtain continuing education to maintain their license, though not necessarily related to septic systems. Starting in 2020, The Ohio State University established the Soil Environment Technology Learning Lab and constructed a training site on a university farm in London, Ohio. In person, training for regulators, contractors, and service providers was offered for years at the site (Mancl and Slater, 2004).

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Interest has increased in online instruction for continuing education to provide flexibility and reduce costs. Offering a class in skill development online offers special challenges, but some universities have developed introductory online soils courses. In Australia, an online soils course called "Soil Characteristics and Survey Techniques" is offered for horticulture students (McAlpine and Dudly, 2001). Oregon State University offers an online introductory soils course where the labs were simplified to use household equipment (Reuter, 2007). In comparing the results to the on-campus version of the same course, the online students did as well as their on-campus peers. The COVID-19 pandemic also pushed even traditional soils courses online. Sadly, an introductory soil course at the University of British Columbia, redesigned their labs for online delivery to focus on concepts and moved away from procedures (Brown and Krzic, 2021).

Inspired by success and recognized shortfalls with online introductory soil instruction, the goal of this course of study was not to try to replace the certified soil scientist, but rather it is to instruct sanitarians and other onsite wastewater professionals to:

- learn to act as soil practitioners to assess sites for onsite wastewater treatment
- assist soil scientists in site evaluations
- gather background soils information and do preliminary site work
- identify clearly observable limiting conditions and site limitations
- identify complex soil and site conditions for referral to a soil scientist for evaluation

MATERIALS AND METHODS

A continuing education course was developed and is offered through Ohio State University Extension. Eighteen (18) hours of on-line instruction was developed as a part of a comprehensive educational program in soils for rural wastewater treatment. The online instruction will be supplemented (post COVID) with 18 hours of field instruction. To match their continuing education requirements, sanitarians and onsite wastewater professionals can enroll in the training in 6-hour segments.

Online instruction

The online instruction is delivered through the Canvas instructional learning management system (Instructure Community, 2021). The learning system organizes lessons and accepts assignment. Quizzes can be created to measure competency and time logged into the system is monitored.

The course was divided into 3, 6-hour segments:

Segment 1: Soil depth and vertical separation distance
Segment 2: Soils in the landscape
Segment 3: Water and soils

Each segment is further divided into 7, 9 and 6 modules, respectively (Table 1). Each module contains lectures, demonstrations, readings, and assignments.

The lectures were recorded in actual classroom settings with students, so the participant feels like they are a part of the class. Likewise, the demonstrations were recorded during field days, as the content was being presented to students in the field. Videos are no longer than 10 minutes to

avoid fatigue with longer lectures split into multiple parts. The videos were uploaded to a private YouTube channel where closed caption of all dialogue was inserted. All teaching materials meet ADA requirements for images and documents (Rabidoux and Rottmann, 2017)

Table 1. Online course modules.

Segment 1: Soil Depth	**Segment 2: Soils in Landscape**	**Segment 3: Water and Soils**
Soil depth and onsite wastewater treatment	Suitability of Ohio soils to treat wastewater	Site water balance
Soil horizons	Soil topography	Water tables and wastewater treatment
Soil color	Soil survey	Water movement through soil
Soil texture	Electronic soil survey	Soil chemistry
Soil structure and consistence	Site and soil assessment	Morphology of wet soils
Soil morphology influencing soil permeability	Researching soils	Landscape hydrology
Preparing a soil description	Visual assessment	
	Estimate of soil extent	
	Finding and mapping suitable soil	

Readings

One book and 2 Extension bulletins serve as the textbooks for the course and can be purchased as eBooks. Each module assigns only 2 to 8 pages of reading to focus on the most relevant content. The books also have extensive and detailed pictures and tables for future reference.

- Wetland Soils: Genesis, Hydrology, Landscapes and Classifications. Vepraskas, M. and C. Craft. 2016.
- Suitability of Ohio Soils for Treating Wastewater. Mancl, K. and B. Slater. OSU Extension Bulletin 896.
- Site and Soil Evaluation for Onsite Wastewater Treatment. Mancl, K. and B. Slater. OSU Extension Bulletin 905.

In addition, all students must use a Munsell Color Book to complete their assignments.

To illustrate the scientific basis for site and soil evaluation, students read and summarize 10 journal articles (Table 2). Students learn in the first module how to quickly review and summarize a journal article to encourage them to access the published literature. Using this summary method, a journal article is reviewed in about 30 minutes.

Table 2. List of journal articles assigned in online course. Students must review and summarize each article

Segment	Journal Article
1	Velachalam, S., F.J. Hitzhusen and K.M. Mancl. 2013. Economic analysis of poorly sited septic systems: a hedonic pricing approach. Journal of Environmental Planning and Management. 56(3): 329-344.
1	Gerba, CP, C Wallis and JL Melnick. 1975. Fate of wastewater bacteria and viruses in soil. Journal of the Irrigation and Drainage Division ASCE. 101(IR3): 157-173.
1	Guertal, WR, GF Hall. 1990. Relating soil color to soil water table levels. Ohio Journal of Science. 90(4):118-124.
1	Hart, KS, BD Lee, PJ Schoeneberger, DP Franzmeier, PR Owens, DR Smith. 2008. Comparison of field measure soil absorption field loading rates and loading rates estimated from soil morphologic properties. Journal of Hydrologic Engineering ASCE. 13(8): 665-670.
2	Mancl, M. and B. Slater. 2001. Suitability assessment of Ohio soils for soil-based wastewater treatment. Ohio Journal of Science. 101(3-4): 48-56.
2	He, X, MJ Vepraskas, DL Lindbo and RW Skaggs. 2003. A method to predict soil saturation frequency and duration from soil color. Soil Science Society of America Journal. 67(2003):961-969.
2	Beal, CD, EA Gardner, and NW Menzies. 2005. Processes, performance and pollution potential: A review of septic tank – soil absorption systems. Australian Journal of Soil Research. 43(2005):781-802.
3	Borchardt, MA, KR Bradbury, C Alexander, RJ Kolberg, SC Alexander, JR Archer, LA Braatz, BM Forest, JA Green and SK Spencer. 2011. Norovirus outbreak caused by a new septic system in a dolomite aquifer. Ground Water. 49(1):85-97.
3	Amoozegar, A, C Niewoehner, D Lindbo. 2008. Water flow from trenches through different soils. Journal of Hydrologic Engineering ASCE. 13(8): 655-664.
3	White, KD, LT West. 2003. In-ground dispersal of wastewater effluent: The science of getting water into the ground. Small Flows Quarterly. 4(2):28-35.

Assignments

Assignments were created to help practice the new concepts. All assignments can be completed with household items or in the back yard. For example, common food items – coffee, chili, cocoa, and curry powder – are assigned to practice using the Munsell Color Book (Table 3). A yard or garden soil is used to practice determining soil texture or structure (Figure 1).

Table 3. Example soil color assignment

Soil Color Assignment Preview: Using the Munsell Color Book

	Hue	Value	Chroma
Coffee			
Chili powder			
Curry powder			
Coco powder			

Figure 1. Example of soil structure and consistence assignment.

Obtain a soil sample from your yard or garden. Take a photo of the soil sample. Use the NRCS Field book as a reference guide pages 2-52 to 2-68.https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf1.

1. Where did you obtain the soil? Back yard – dug hole
2. What is the dominant structure type and size that you observe?
   Structure type(shape)-Blocky Structure size – Fine
3. Attach a photo showing the soil structure. Place a quarter in the photo for scale.

Assessment

At the end of each segment, students must pass an online quiz. A large question set was developed for each segment and questions are randomly selected to reduce cheating. Participants have 3 chances to pass the quiz before moving onto the next segment. If they are unable to pass the quiz, they must repeat the online lesson to receive their 6-hours of continuing education credit.

RESULTS

A pilot offering was conducted in the summer of 2019, 3 sanitarians and 1 contractor participated in the pilot. The 3 sanitarians completed Segment 1 in the 6 hours allocated. The contractor did not complete the segment. When asked, she indicated that she watched the videos, but did not have the time for the readings and the assignments.

The online course was launched in June 2021. Ten sanitarians and 3 contractors are enrolled and 4 sanitarians have already completed Segment 1. Once all of the assignments are posted, the quiz opens up. To date, no one has gotten a perfect score on the quiz.

DISCUSSION

Reading and summarizing journal articles was a new experience for the sanitarians. By recording the research objectives, important findings and conclusions, they learned where the science fits into the septic system codes. For example, one of the articles (Gurtal and Hall, 1990) showed where the use of chroma of 2 or less helps to predict water table depths in Ohio soils. Another article (Hart et al. 2008) illustrated that the method used by a neighboring state health department to determine loading rates overestimated the soil hydraulic conductivity.

Students also had the opportunity to practice filling in the Ohio Site and Soil Evaluation form. Through the lesson exercises they learned how all of the information requested was observed and how they can make decisions on system permits based on reports generated by others.

In the future, each online segment will follow up with corresponding in-person field instruction. The pilot offering revealed that the online instruction was effective at teaching new knowledge and skills. However, the sanitarians still lacked experience and confidence in site and soil evaluation. Working in the field with a soil scientist will reinforce what they learned in the online instruction.

With all of the lectures and exercises completed online, the field instruction time can focus on actual practice of new skills, giving the participants a chance to evaluate multiple sites that are simply suited or obviously not suited for onsite treatment to exercise their legal authority. The field instruction can also include complicated sites that suggest referral to a certified soil scientist, to ensure that Ohio property owners and the environment are protected.

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