



Soil Scout Hydra User Manual

Hydra100



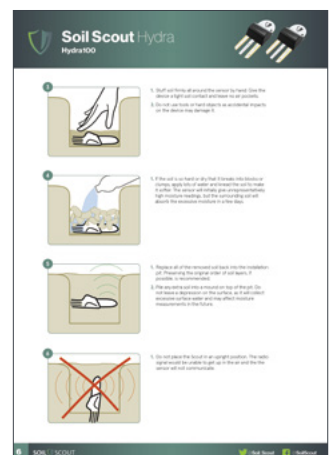
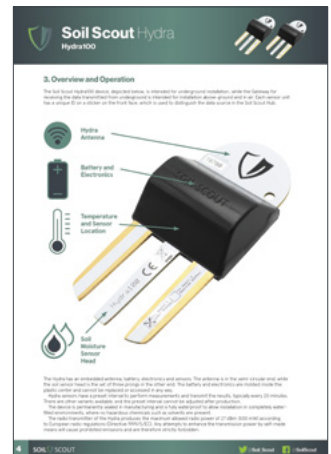
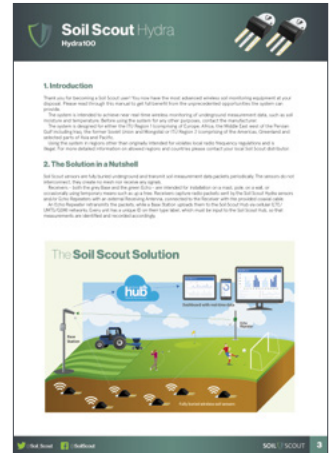
Soil Scout Hydra

Hydra100



Contents

- 1. Introduction page 3
- 2. The Solution in a Nutshell page 3
- 3. Overview and Operation page 4
- 4. Before Installing Devices page 5
- 5. Field Installation of Hydra Sensors page 5
- 6. Troubleshooting page 8
- 7. Technical Specifications page 8
- 8. Compliance Statements page 9
- 9. Disclaimer page 9



Soil Scout Oy
 Lapinlahdenkatu 16
 00180 Helsinki
 Finland

sales@soilscout.com
www.soilscout.com



Soil Scout Hydra

Hydra100



1. Introduction

Thank you for becoming a Soil Scout user! You now have the most advanced wireless soil monitoring equipment at your disposal. Please read through this manual to get full benefit from the unprecedented opportunities the system can provide.

The system is intended to achieve near real-time wireless monitoring of underground measurement data, such as soil moisture and temperature. Before using the system for any other purposes, contact the manufacturer.

The system is designed for either the ITU Region 1 (comprising of Europe, Africa, the Middle East west of the Persian Gulf including Iraq, the former Soviet Union and Mongolia) or ITU Region 2 (comprising of the Americas, Greenland and selected parts of Asia and Pacific).

Using the system in regions other than originally intended for violates local radio frequency regulations and is illegal. For more detailed information on allowed regions and countries please contact your local Soil Scout distributor.

2. The Solution in a Nutshell

Soil Scout sensors are fully buried underground and transmit soil measurement data packets periodically. The sensors do not interconnect, they create no mesh nor receive any signals.

Receivers - both the grey Base and the green Echo - are intended for installation on a mast, pole, on a wall, or occasionally using temporary means such as up a tree. Receivers capture radio packets sent by the Soil Scout Hydra sensors and/or Echo Repeaters with an external Receiving Antenna, connected to the Receiver with the provided coaxial cable.

An Echo Repeater retransmits the packets, while a Base Station uploads them to the Soil Scout Hub via cellular (LTE/UMTS/GSM) networks. Every unit has a unique ID on their type label, which must be input to the Soil Scout Hub, so that measurements are identified and recorded accordingly.





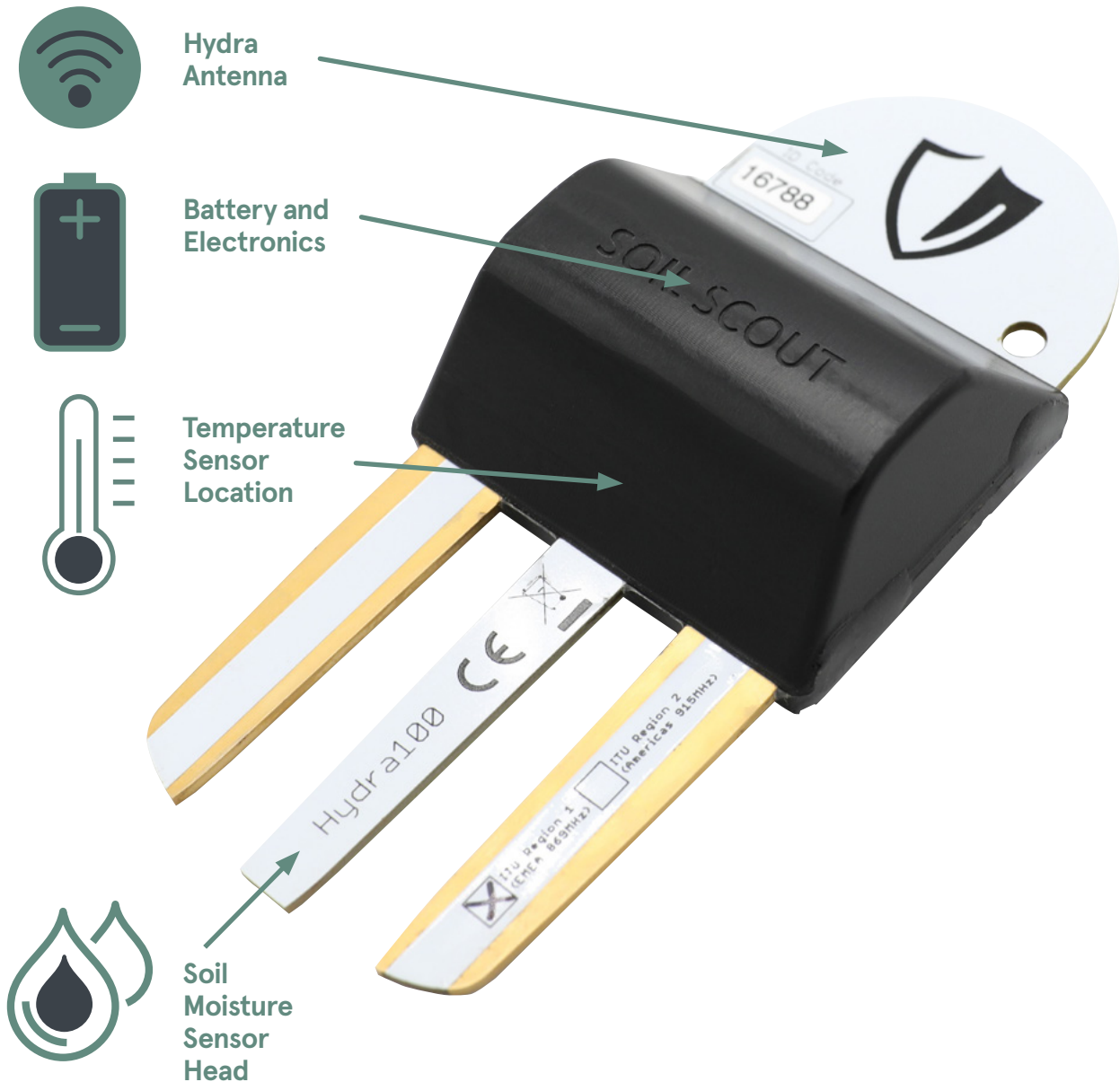
Soil Scout Hydra

Hydra100



3. Overview and Operation

The Soil Scout Hydra100 device, depicted below, is intended for underground installation, while the Gateway for receiving the data transmitted from underground is intended for installation above-ground and in air. Each sensor unit has a unique ID on a sticker on the front face, which is used to distinguish the data source in the Soil Scout Hub.



The Hydra has an embedded antenna, battery, electronics and sensors. The antenna is in the semi-circular end, while the soil sensor head is the set of three prongs in the other end. The battery and electronics are molded inside the plastic center and cannot be replaced or accessed in any way.

Hydra sensors have a preset interval to perform measurements and transmit the results, typically every 20 minutes. There are other variants available, and the preset interval cannot be adjusted after production.

The device is permanently sealed in manufacturing and is fully waterproof to allow installation in completely water-filled environments, where no hazardous chemicals such as solvents are present.

The radio transmitter of the Hydra produces the maximum allowed radio power of 27 dBm (500 mW) according to European radio regulations (Directive 1999/5/EC). Any attempts to enhance the transmission power by self-made means will cause prohibited emissions and are therefore strictly forbidden.



4. Before Installing Devices

All Soil Scout devices are ready for use when delivered. The Hydra transmitters have been tested and put into operation in manufacturing and there is no way to adjust their operation.

However, it is good practice to perform certain procedures before mounting receiving equipment or burying Hydra transmitters. This way device setup can be verified with the least effort before going out in the field. Set up your site in the Soil Scout Hub as outlined in the Hub Manual. Power up your Base Station and check that it reports to the online Hub properly – detailed instructions for this can be found in the Receivers Manual.

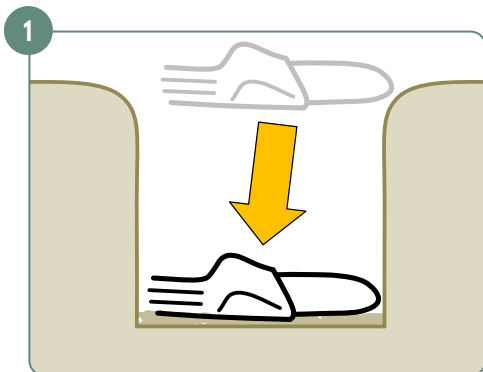
Keep the Hydra sensors in near vicinity to the Base Station for an hour and check all scouts report data to the Cloud. Once they do, you can be sure everything will work out in the field as well.

Make a plan of your sensor deployment before going out. It is easier and more reliable to execute a good plan and write down eventual changes to it, than simultaneously carry out the field work and document it. A good plan covers following:

- Map of intended locations where each Hydra goes
- Hydra ID numbers on the map
- Intended depths of each Hydra
- Means to write down soil observations during installation
- Positioning device or other means to exactly record the realized locations

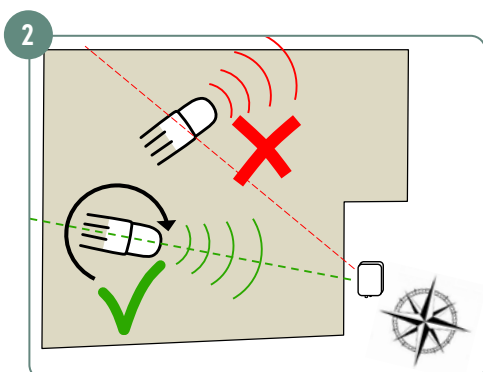
Keep a copy of your plan in office and make a backup of a modified plan after the field work. Remember, that after deployment there are no means to resolve an individual Scout Hydra's location. The transmissions are very short, occur seldom and often have powers below noise floor, so feasible technical methods to triangulate devices do not exist to date.

5. Field Installation of Hydra Sensors



- Dig an installation hole to the desired installation depth only. Digging too deep will disturb the bottom soil.
- Leave approx. 1 cm (0.4") of loose soil on the bottom of the pit to allow for firm soil contact with the device.
- Place the device on the pit bottom. Place only one Scout in one pit.

Note: Before installation, write down the 5-digit Hydra ID code for each unit you are burying. During installation, record exact depth and precise

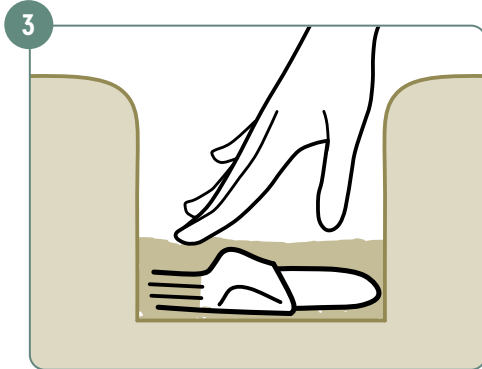


- Ensure that the round end (the antenna) of the Hydra sensor is pointing towards your desired receiving antenna (Base Station or Echo Repeater).
- Installing the Hydra sideways will ruin communication range distance.
- Choose the locations for your devices so that the line of sight from Scout to the Receiver is open and free of obstacles.

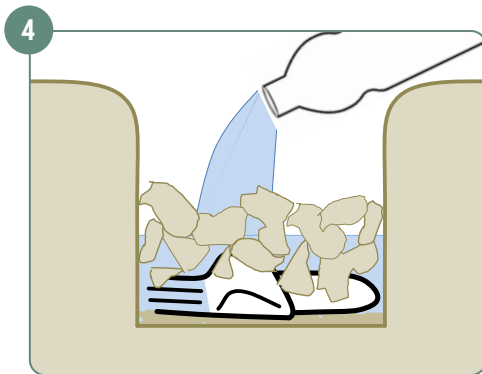


Soil Scout Hydra

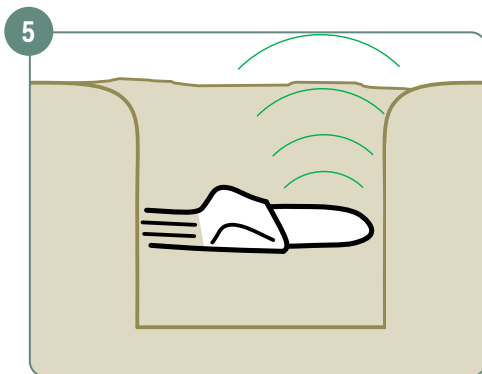
Hydra100



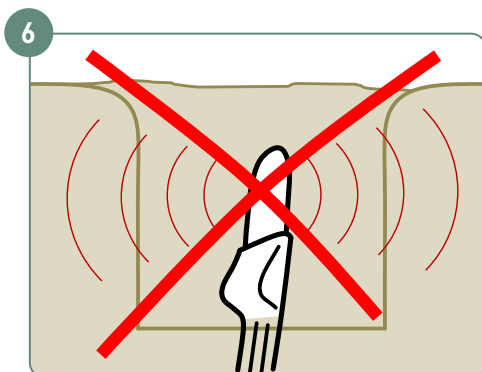
- Stuff soil firmly all around the sensor by hand. Give the device a tight soil contact and leave no air pockets.
- Do not use tools or hard objects as accidental impacts on the device may damage it.



- If the soil is so hard or dry that it breaks into blocks or clumps, apply lots of water and knead the soil to make it softer. The sensor will initially give unrepresentatively high moisture readings, but the surrounding soil will absorb the excessive moisture in a few days.



- Replace all of the removed soil back into the installation pit. Preserving the original order of soil layers, if possible, is recommended.
- Pile any extra soil into a mound on top of the pit. Do not leave a depression on the surface, as it will collect excessive surface water and may affect moisture measurements in the future.

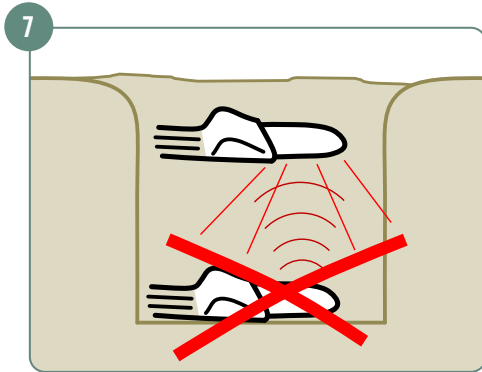


- Do not place the Scout in an upright position. The radio signal would be unable to get up in the air and the sensor will not communicate.

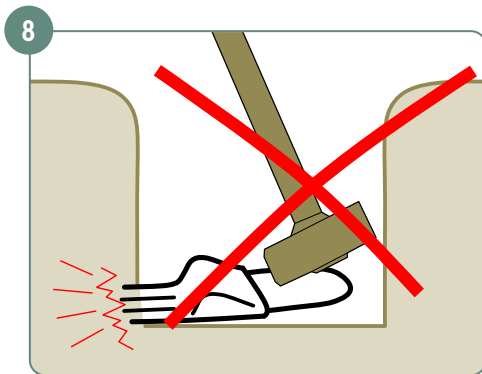


Soil Scout Hydra

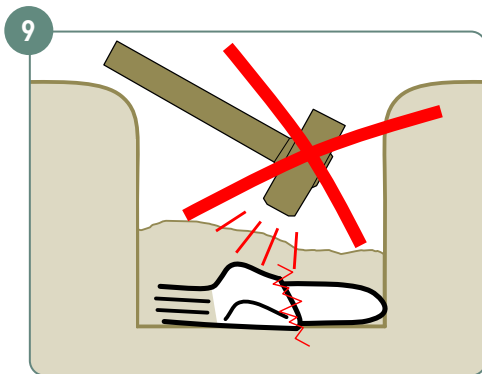
Hydra100



- Do not place multiple Scouts in one pit. The top one will block radio transmissions from deeper ones. Give each Scout its own pit and keep the pits at least 0.6m (2 feet) apart.



- Do not use tools to compact the soil. Once the sensor is well covered, it's OK to step on the soil to compact it to the original compaction level.



- If you choose to push the sensing head pins into the undisturbed soil wall, be absolutely sure to have the sensor flat and firm on the bottom of the pit. Any loose soil beneath the sensor will compact back over time, causing a high risk of breaking the sensing head pins.
- If the soil is too hard to penetrate gently pushing by fingers, use a pocket knife or similar tool to make the opening before pushing. Bear in mind, that the warranty will not cover for mechanically broken sensors.

A few good practices on how to set up a larger monitoring site instrumentation step by step:

- ✓ Begin by installing sensors close to a Receiver and make sure they communicate before working your way further out.
- ✓ In case you want to bury a sensor exceptionally deep, place the deepest ones nearby a Receiver to balance the depth and distance attenuations.
- ✓ Install Scouts in sessions, if possible, and observe the performance before you continue.
- ✓ If the most distant sensors don't connect when buried, resolve whether you can elevate the Receiving Antenna or obtain a directive one.
- ✓ When you have reached the limit of reception range, put up an Echo Repeater and continue the process.



6. Troubleshooting



No data coming in from a Hydra Scout, right after installation

The standard Hydra Scouts report once per twenty minutes. A single packet can be lost by chance, but if several packets regularly go missing, the Scout is either too deep or too far or both. Bring the unit closer or install an Echo Repeater to cover that location.



No data coming in from a Hydra Scout, after initially working

If the Scout has been at the very edge of reception, changing conditions can render the received signal strength too low to be picked up. Such changes are increased moisture levels, increased salinity in the soil, growing plants and other objects in the radio path. Bring the unit closer or install an Echo Repeater to cover that location.



Moisture reading is very low after installation

The sensor needs to be properly in contact with the soil. This can best be achieved by working a part of the soil around the Scout with water into a moist paste and stuffing the paste tightly around the sensor.



Moisture reading doesn't change during heavy watering event (rain or irrigation cycle)

Percolation speed through the soil is largely dependent on soil type, installation depth and the crop growing. If the readings don't change, chances are that it's because the conditions at sensor level don't change - meaning that the sensor is actually working correctly. If you want to make sure the sensor reacts to water, place it in a glass of water and see the reading go to typically above 60% (it won't go 100% even when fully immersed since the sensor value is calculated for soil with water, not water without soil).

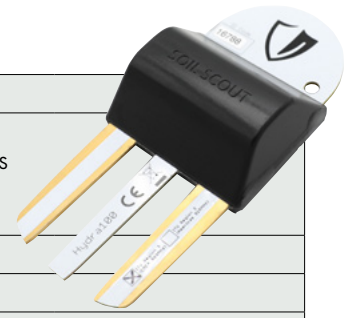
7. Technical Specifications

Specifications subject to change without notice

For additional information, please contact the Soil Scout team at: info@soilscout.com

Hydra100 Scout

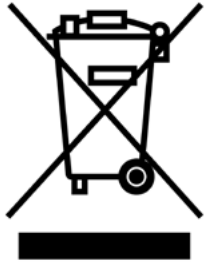
Radio power	27.0 dBm (500 mW) ERP, Bandwidth <250 kHz, duty cycle <0,001%.		
Frequency Variants	869.525 MHz (ITU-1) Europe & selected other markets 921.700 MHz (ITU-2) Americas, Australia, NZ & selected other markets 920-925 MHz (FHSS) Hong Kong, China Custom Information upon request		
Battery Capacity	3000 mAh, encapsulated primary lithium		
Life expectancy	Up to 20 years @ 1 cycle per 20 minutes		
Encapsulation	Black polyurethane molding		
Dimensions (LxWxH)	129 × 59 × 25 mm (5.1" × 2.3" × 1.0")		
Sensors	Temperature 3-prong integrated Capacitive (moisture content) & Resistive (EC / salinity)		
Moisture Accuracy	± 2 % mean error (1 % with correct soil type, 1 % installation repeatability)		
EC Accuracy	± 0.2 dS/m mean error, Typical resolution 0.1 dS/m, Range 0 to 20 dS/m		
Dielectric Accuracy	± 2 % mean error, Resolution 0.5 to 1.5 €, Range 1 to 135 €		
Temperature Accuracy	Range -40 to +80 °C / -40 to +176 °F		Accuracy: +/- 0.1 °C / 0.18 °F
Resolution	-40 to -11 °C	1.00 °C	-40 to +12 °F
	-10 to +10 °C	0.25 °C	-12 to +50 °F
	+10.5 to +80 °C	0.50 °C	+51 to +176 °F
			1.80 °F
			0.45 °F
			0.90 °F





8. Compliance Statements

Soil Scout Ltd. / Soil Scout Oy hereby declares that Soil Scout Hydra 100 is in compliance with the following requirements:



- **RoHS Directive** (2011/65/EU)
- **WEEE Directive** (2012/19/EU)
- **Battery Directive** (2006/66/EC)
- **RED Directive** (2014/53/EU)
- **EMC Directive** (2014/30/EU)
- **Low Voltage Directive** (2014/35/EU)
- **ErP Directive** (2009/125/EC)



Please dispose this product by taking it to your local collection point or recycling center.

This will help to protect the environment in which we all live.

FCC compliance: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by Soil Scout Ltd. could void the user's authority to operate the equipment.

9. Disclaimer

Soil Scout Ltd. / Soil Scout Oy disclaims any and all liabilities related to or arising from third parties' products or services, which use the data generated by a Soil Scout product. Soil Scout Ltd. / Soil Scout Oy disclaims any and all liabilities related to or arising from the functioning / malfunctioning of third party product or service, its interoperability with a Soil Scout product, safety of a third party product or service as well as any other liabilities related to or arising from a third party product or service. Soil Scout Ltd. / Soil Scout Oy shall not be liable for any data transfer fees or any other fees which might be due to or related to the use of Soil Scout products.

These products are protected by patent pending.

SOIL SCOUT



How to find out more

For more information on the Soil Scout solution and to request all relevant pricing options please contact the Soil Scout sales team via email or your nearest reseller.

sales@soilscout.com

Soil Scout Oy
Lapinlahdenkatu 16
00180 Helsinki
Finland

www.soilscout.com

 @Soil_Scout

 @SoilScout

#GAINADEEPPERVIEW