Subsoil structural quality (Ssq) assessment of a soil layer

SubVESS Flowchart

a) Mottling	b) Strength	c) Porosity	d) Roots	e) Aggregates	Ssq Subsoil quality
Photo by Anne Weill, Quebec	**1a-3a** No mottling or many diffuse (faint) mottles	**1c** Many small pores (< 2mm) throughout, includes loose sand	**1d-2d** Roots growing through-out	**1e** Rounded friable aggregates	**Ssq1 Friable** with high porosity and fissures. Good drainage and aeration.
	1b-2b Easily fragmented with fingers	**2c** As for 1c, but occasional less porous zones		**2e** Uniform, small scale roughness due to sub-angular aggregates	**Ssq2 Firm** with slightly less porosity and fissures than Ssq1, but with only a small effect on rooting. If present, mottling due to anaerobism is minor.
	3b Difficult to penetrate with knife and slices keep their shapes after breakage	**3c** Visible porosity mostly outside aggregates as cracks, isolated pores and earthworm holes, acting as bypass pores	**3d** Roots mainly in cracks and worm channels	**3e** Large-scale angular roughness with angular aggregates	**Ssq3 Some compaction** as either natural or man-made pans among angular or weak-grained structures. If present, mottling due to anaerobism is faint.
4a-5a Well-defined rust-coloured zones around pores or blocked channels	**4b-5b** Fragments are difficult to extract and are angular wedges	**4c** Very few small pores and cracks visible on broken surfaces (< 5/100 cm^2)	**4d** Roots can be distorted	**4e** Dense with a mixture of angular aggregates and poorly visible structure. Knife marks visible. Includes single grain structures	**Ssq4 Compact or large scale structures**. Large aggregates, possibly prismatic, laminated or single grained. If poor drainage, grey colours, mottles few and well-defined.
		5c No pores or few, blocked channels	**5d** No roots	**5e** Smooth unbroken face very dense. No visible structure. Fragments tough (clay). Knife marks visible	**Ssq5 Massive or structureless.** Dense structural units with smooth, unbroken faces, possibly laminated. If poor drainage, colour mostly grey, with very few well-defined mottles.

Subsoil Visual Evaluation of Structure, SubVESS

Produced by: Bruce Ball; Rachel M. L. Guimarães; Tom Batey and Lars Munkholm

Subsoil structure quality, Ssq, is a rating of the agronomic quality of soil. Use of this rating allows identification of problem soil layers caused by compaction or waterlogging that may need improvement. Work through steps 1) to 10), using the flowchart overleaf.

1) Dig profiles to 1-1.4m depth located across the direction of travel of cultivators and tractors. Consider locating profiles on 'high yielding areas'.

2) Remove soil from any surfaces compacted or smeared during digging the pit using a spade or a knife.

3) Observe the soil below the topsoil , the transition layer, and to the expected rooting depth (~ 30 cm to 1.4 m depth).

4) Aim to record information on the score sheet.

5) Identify layers of contrasting colour and hardness. Look for hard layers e.g. the transition layer that may be compacted or platy, by prodding with the point of a knife or a pen. Usually there are only one or two layers.

6) Mark the layers with a knife or by inserting plastic tags and measure their depths.

7) Using the flowchart overleaf, give a score for each heading. starting with mottling, then strength (already assessed with the knife), then roots, porosity (large worm holes and cracks) and aggregates. When observing strength and small pores, use a knife to extract fragments about 10 cm long, 10 cm wide and 2-3 cm thick. To assess the strength of a fragment, hold the ends in either hand and snap like a twig. Look for small pores on the broken surfaces.

8) Use the individual assessments to reach the final score e.g. Porosity 3b, Roots 3c, Strength 3d, Structure 3e = Ssq3

9) After scoring each layer give the overall score as the sequence of layers and depths e.g. Ssq4 25-45 cm, Ssq3 45-90 cm.

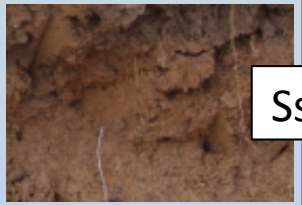
10) Repeat in another location if the pit is wide enough.

11) For a complete assessment of soil quality, that includes the topsoil, measure VESS in undisturbed soil nearby.

Typical profile

Fragment extraction

Typical surface



Typical fragment

For further information, contact: bruce.ball@sruc.ac.uk; rachelguimaraes@utfpr.edu.br; tombeth33@gmail.com; lars.munkholm@agro.au.dk