Visual Soil Assessment (VSA)

Summary statement

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Environmental and economic performance and sustainability of our pastoral, cropping, horticultural and forestry land can be greatly influenced by soil quality. **Given the financial, technical and time constraints** on farmers and land managers, the Visual Soil Assessment (VSA) method was developed to provide land managers with **a simple tool** to effectively assess and monitor soil quality and plant performance quickly and cheaply.

VSA is based on the simple observation of **key visual indicators** that are **diagnostic of soil quality**, and incorporated on an easy-to-use **scorecard**. Indicators are **closely correlated** to measured indicators of soil quality including hydraulic conductivity, air permeability, oxygen diffusion rate, macroporosity, bulk density, aggregate-size distribution, organic carbon and mineralisable-N.

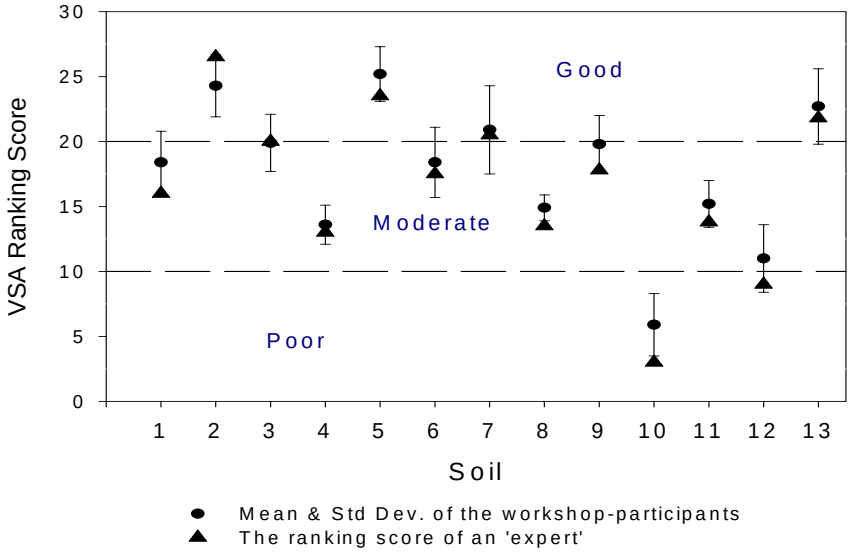
The soil indicators are supported by **plant indicators** that link soil condition to plant performance, farm production and management practices. VSA scores are closely related to **farm income**; aim to keep your VSA score's above 25.

VSA is able to provide relevant, credible and timely information on soil and plant performance that can be used to help establish best management practices and quality assurance programmes. As such, the VSA can be useful for **on-farm self-regulation and self-determination**, and can provide a useful educational tool.

The visual indicators are **underpinned** by sound pedological principles and extensive research, and are **linked** to economic and environmental performance and sustainability.

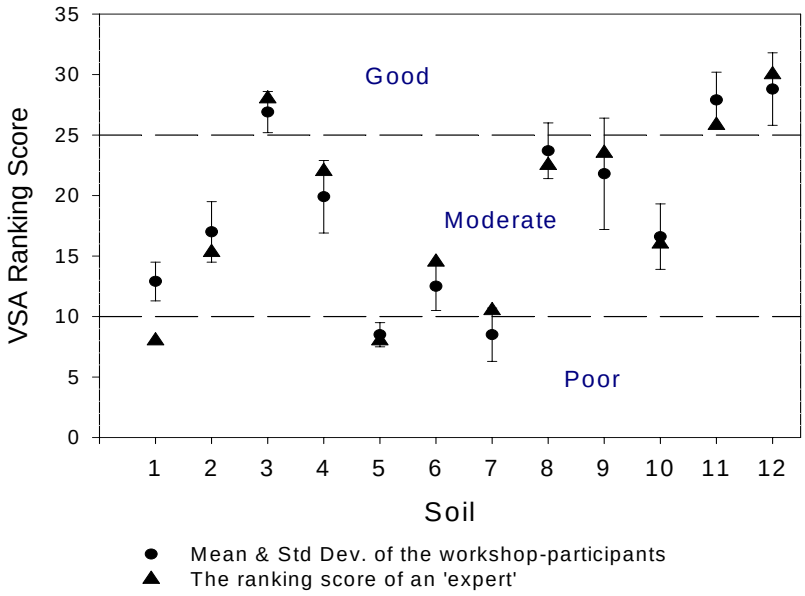
Soil indicators used in the VSA are **generic**, and their interpretation has the major advantage of being independent of soil type. This enables the VSA to be applied anywhere.

The VSA method provides a framework that **allows laypeople** with little or no understanding of soil science or agronomy to assess the condition of their **underground economy** as successfully as an expert (Figure 1 and 2).



Pasture

Figure 1. VSA of the condition of 13 soils under **pastoral grazing** on flat to rolling country from Northland to Southland – A comparison of soil ranking scores between an 'expert' and lay people



Cropping

Figure 2. VSA of the condition of 12 soils under **cropping** from Northland to Southland – A comparison of soil ranking scores between an 'expert' and lay people

The VSA Field Guide is **self explanatory**, and its use does not require special training or technical skills. While the VSA contains a wealth of information about soil quality and pasture/crop performance and their fundamental importance to sustainable resource and environmental management, the information is expressed in a simple and concise way.

Physical properties of the soil are emphasised in the VSA for a number of reasons. Firstly, they are easily seen. Secondly, physical properties have a profound influence on the biological and chemical properties of soil. Thirdly, they have a significant impact on the productivity and input costs of a farming enterprise. Fourthly, the loss of physical properties can take decades to recover, and fifthly, as a consequence, they are costly to remedy.

What do the VSA ranking scores mean in terms of farm production?
Pasture and crop performance is excellent, and production costs are low on soils in good condition (with VSA scores >35), provided climatic conditions, soil moisture, soil fertility, pest and plant diseases etc. are non-limiting. Soils in moderate condition (with a VSA score of 20–35) can maintain acceptable gross profit margins. If the score falls much below 25, pasture and crop production can begin to decrease significantly, particularly in marginal and poor seasons. A score of 25 under dairying can give rise to a loss of 200 kg DM/ha/month (or 13 kg MS/ha/month). Under cropping, a score of 25 can equate to a 10–15% decline in maize yields (1.3–2.0 t/ha). Pasture and crop performance is generally poor and production costs can be high on soils in poor condition, i.e. with VSA scores less than 20. Under dairying, this can equate to a loss of 400 kg DM/ha/month (or 26 kg MS/ha/month). Under cropping, a score of <20 can give rise to a 20–45% decline in maize yields (2.5–5.8 t/ha).

Aim to keep your soil ranking score above 25. Should your score fall below 25, alarm bells should start ringing as to the need to modify or tweak your soil/crop management practices.

Economic implications of soil quality are also outlined in the plant indicators section for pastoral grazing on flat to rolling country (Vol. 1, pp. 34–50) and for cropping (Vol. 1, p. 101–103) and for and hill country (Vol. 3, pp. 25–38).

Environmental Scorecards
In addition to assessing the condition of the soil and the performance of the plant, the VSA includes three environmental scorecards that address the potential for:
1. nutrient loss into the groundwater and waterways and whether a farm is likely to be a low, moderate or high emitter of nutrients into the groundwater and waterways.
2. carbon sequestration and whether a farm (or a field) is likely to be C positive, neutral or negative, and therefore in a position to claim C credits or pay C taxes
3. greenhouse gas emissions and whether a farm is likely to be a low, moderate or high emitter of GHGs.

The scorecards help to assess the environmental footprint of farming practices and a farms position with respect to the Emissions Trading Scheme.

Soil Management Guidelines
A farm's long-term economic viability hinges partly on the maintenance of soil quality. The Soil Management Guidelines provide management options for sustainable farming, and promote an awareness of key management issues. Issues covered include soil compaction, pugging, soil erosion, the loss of organic matter and close and space planting. The Guidelines are used in conjunction with the Visual Soil Assessment **Field Guides** which provide a simple, quick tool to assess soil quality and plant performance. If the Field Guide indicates your soil and pasture/crops are in moderate or poor condition, the Soil Management Guidelines provide management options and recommendations to repair the loss of soil and plant quality, and establish best management practices. If the Field Guide indicates that your soil and pasture/crops are in good condition, the Soil Management Guidelines provide suggestions to keep it that way by preventing or minimizing soil degradation.

VSA Distinctions

The Foundation for Research, Science and Technology Communicator Award was conferred by the New Zealand Association of Scientists for excellence in the conception, development and advocacy of the Visual Soil Assessment (VSA) method, and for an outstanding contribution to advancing science in New Zealand concerning scientific principles, achievements and education. The VSA was also identified in the Landcare Research 2001 Research Report as "one of the 10 most outstanding pieces of work produced by Landcare Research", and is described as "one of the most successful tech-transfer tools to have emerged from the soils research group". The VSA has been adopted in NZ and by agencies in many parts of the world (including FAO) as the method of choice for the semi-quantitative assessment of soil condition and pasture/crop performance.

VSA Publications

Shepherd, T.G. 2009. Visual Soil Assessment. Volume 1. Field guide for pastoral grazing and cropping on flat to rolling country. 2nd Edition. Horizons Regional Council, Palmerston North, New Zealand. 106 p. ISBN 978−1−877468−75−9

Shepherd, T. G.; Ross, C. W.; Basher, L. R.; Saggar, S. 2000: Visual soil assessment. Volume 2. Soil management guidelines for cropping and pastoral grazing on flat to rolling country. horizons.mw/Landcare Research, Palmerston North. 41 p. ISBN 1–877221–93–7

Shepherd, T.G. 2009. Visual Soil Assessment. Volume 3. Field guide for pastoral grazing on hill country. 2nd Edition. Horizons Regional Council, Palmerston North, New Zealand. 58 p. ISBN 978 -1-877468-76-6.

Shepherd, T. G.; Janssen, H. J.; Bird, L. J. 2000: Visual soil assessment. Volume 4. Soil management guidelines for hill country land uses. horizons.mw/Landcare Research, Palmerston North. 24 p. ISBN 1–877221–95–3.

Shepherd, T. G., Stagnari, F., Pisante, M. and Benites, J. 2008. Visual Soil Assessment – Field guide for wheat. FAO, Rome, Italy

Shepherd, T. G., Stagnari, F., Pisante, M. and Benites, J. 2008. Visual Soil Assessment – Field guide for vineyards. FAO, Rome, Italy

Shepherd, T. G., Stagnari, F., Pisante, M. and Benites, J. 2008. Visual Soil Assessment – Field guide for olive orchards. FAO, Rome, Italy

Shepherd, T. G. 2009. Visual Soil Assessment – Field guide for pastoral grazing. FAO, Rome, Italy

Shepherd, T. G. 2009. Visual Soil Assessment – Field guide for maize cropping. FAO, Rome, Italy

Additional references

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Shepherd, T.G.; Bird, L.J.; Jessen, M.R.; Bloomer, D.J.; Cameron, D.J.; Park, S.C. and Stephens, P.R., 2001. Visual Soil Assessment of Soil Quality By Trial By Workshops. In: Precision Tools for Improving Land Management. (Eds L.D. Currie and P. Loganathan). Occasional report No. 14. Fertilizer and Lime Research Centre, Massey University, Palmerston North. pp. 119−126.

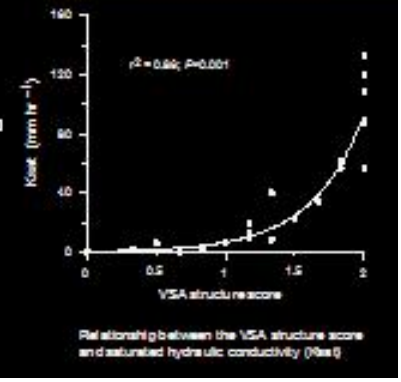
Shepherd, T.G., and S.C. Park. 2003. Visual Soil Assessment: A Management Tool For Dairy Farmers. p 111–123. *In*: Brookes, I.M. (*ed).* Proceedings of the 1st Dairy3 Conference. Continuing Massey University Dairyfarming Annual (Volume 55) Dexcel's Ruakura Dairyfarmers' Conference, April 7–9, 2003, Rotorua.

Shepherd, T.G.; Saggar, S.; Newman, R.H.; Ross, C.W. and Dando, J.L. 2001: Tillage induced changes to soil organic matter fractions and soil structure in New Zealand soils. *Australian J. Soil Res.* 39 (3), 465–489.

Shepherd, T.G.; Sparling, G. P.; Todd, M.D. 2002: Visual Soil Assessment: Can we see what we measure? *In* Stephens, P.R., Callaghan, J. *Compilers.* Proceedings Soil Quality and Sustainable Land Management Conference, April 3-5, 2002, Landcare Research, Palmerston North, New Zealand. pp. 117–122.

VSA indicators of soil quality are closely correlated to measured soil properties

i.e. we can see what we measure



Relationship between the VSA structure score and saturated hydraulic conductivity (Ksat)

VSA is about being able to peel back the veneer of the observable world to expose a more complicated reality underneath

VSA takes the laboratory to the field in the form of an easy to use 'self help' tool

Conclusions

VSA:

- is quick and simple
- is very inexpensive and cost effective
- can be used by anyone, anywhere
- is independent of soil type
- is closely related to measured soil properties
- gives the same answer as quantitative methods
- is an effective tool to assess and monitor soil quality semi-quantitatively
- links plant performance to soil condition and farm management practices
- is closely related to farm production and income. Aim to keep your score above 20
- provides an effective educational and farm management tool
- allows farmers to assess the condition of their own underground economy