


Soil Health Measurement & Management to Improve Wine Quality



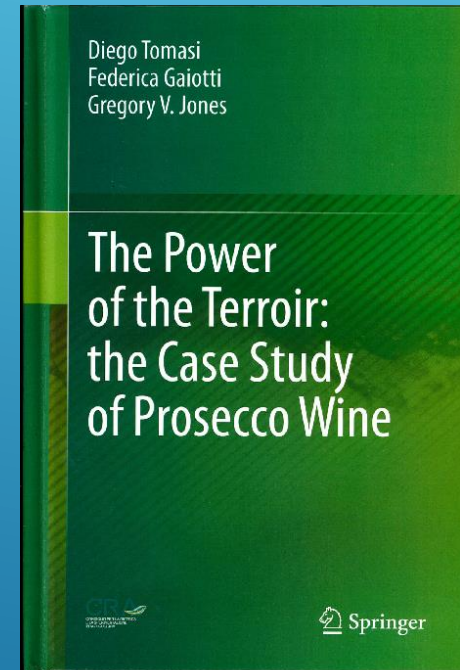
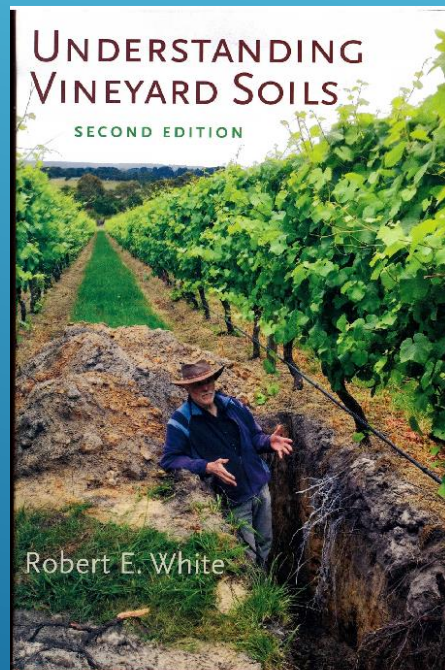
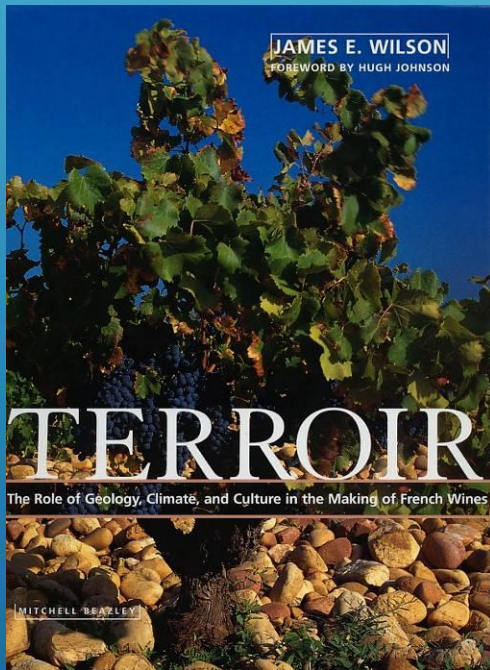
Dr David McKenzie
Soil Management Designs
Orange NSW 2800



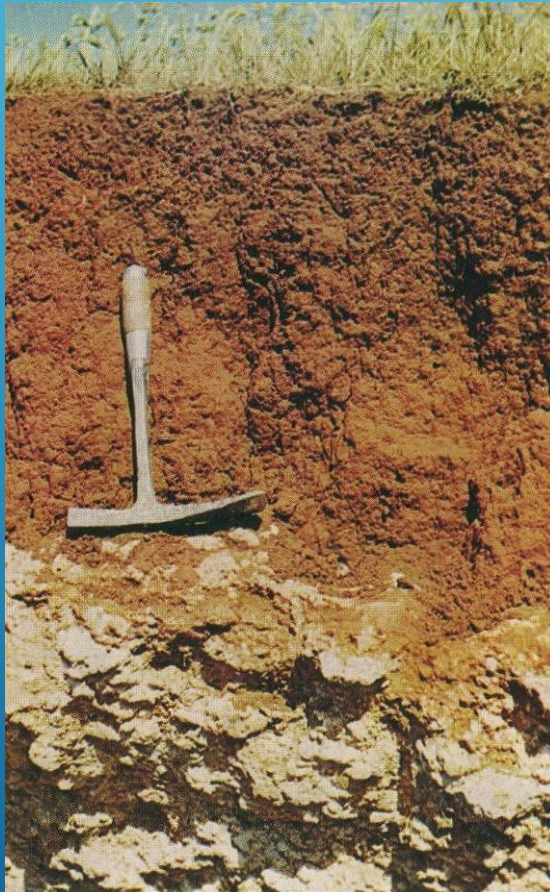
MAIN POINTS

1. Famous vineyard soil types & their characteristics:
Opinions of the experts.
 2. Recognition and treatment of soil constraints.
 3. Understanding the patterns of variation of key soil factors in vineyards.
 4. Vineyard soil audits.
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FAMOUS SOIL TYPES FOR WINE PRODUCTION: THOUGHTS FROM THE EXPERTS



“TERRA ROSSA”, S.A.



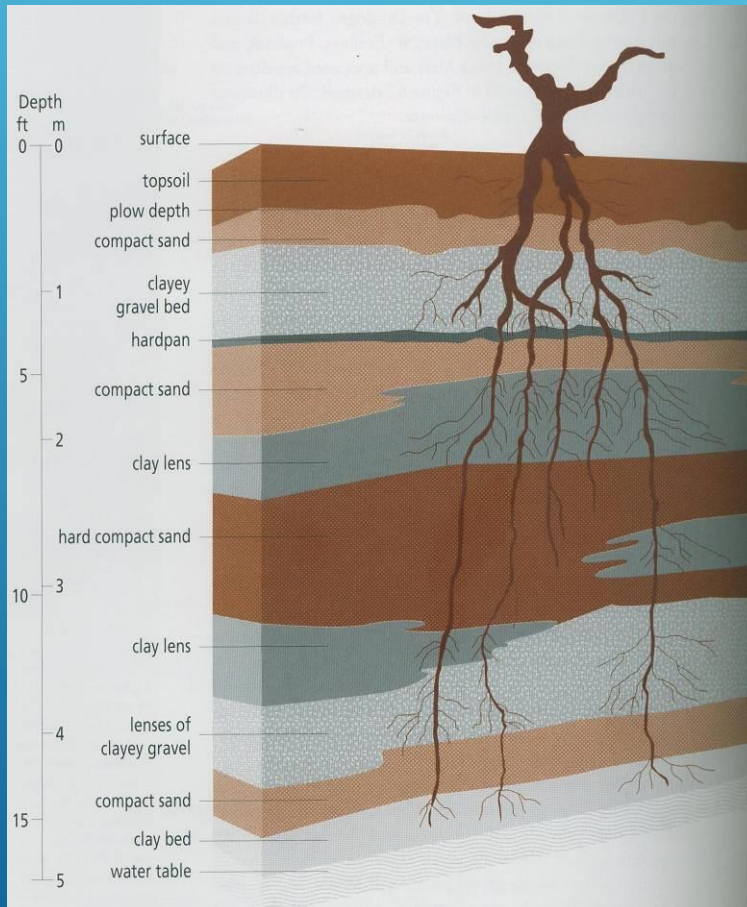
Coonawarra, South
Australia.

Water-stable clay loam soil
overlying well-drained
fissured limestone.

The limestone contains
important impurities,
eg. volcanic ash.

Photo: Stace et al. (1968) ‘A Handbook of Australian Soils’, CSIRO.

MÉDOC GRAVEL MOUND, BORDEAUX



Cos d'Estournel

Overlies limestone.

Very deep grapevine roots.


*(Research carried out by
Professor Seguin)*

Illustration: Wilson (1998) 'Terroir', Mitchell Beazley.

OPINIONS ABOUT THE LINKS BETWEEN SOIL HEALTH & WINE QUALITY

Seguin (1986):


“In the Bordeaux area the chemical properties of soils ... do not have a definite influence on the quality of harvests and wines. The quality of terroirs is perhaps better explained by considering the physical properties ... and their consequences for root development and on the regulation of water supply to the vine”

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OPINIONS ABOUT THE LINKS BETWEEN SOIL HEALTH & WINE QUALITY

Wilson (1998):


“The best wines (Cru Beaujolais) are produced ... on shallow coarse-textured soils over granite and schist. Here, the Gamay grape, a potentially vigorous variety, is restrained in its growth and produces a wine of subtle flavors. Variation in the metal content of the granite and schist is said to account for the individuality of the wines in this area”

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OPINIONS ABOUT THE LINKS BETWEEN SOIL HEALTH & WINE QUALITY

Lanyon, Cass & Hansen (2004):

“There is no one ideal soil for wine grape production *per se* but rather an ideal set of soil properties for a given climate, with possible further refinement based on consideration of target wine style and variety”

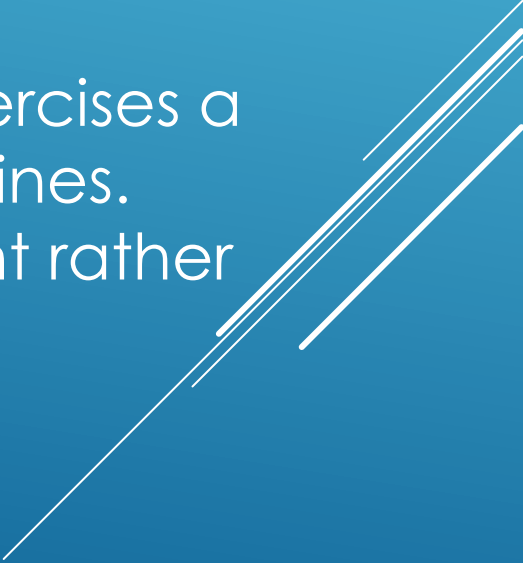
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OPINIONS ABOUT THE LINKS BETWEEN SOIL HEALTH & WINE QUALITY

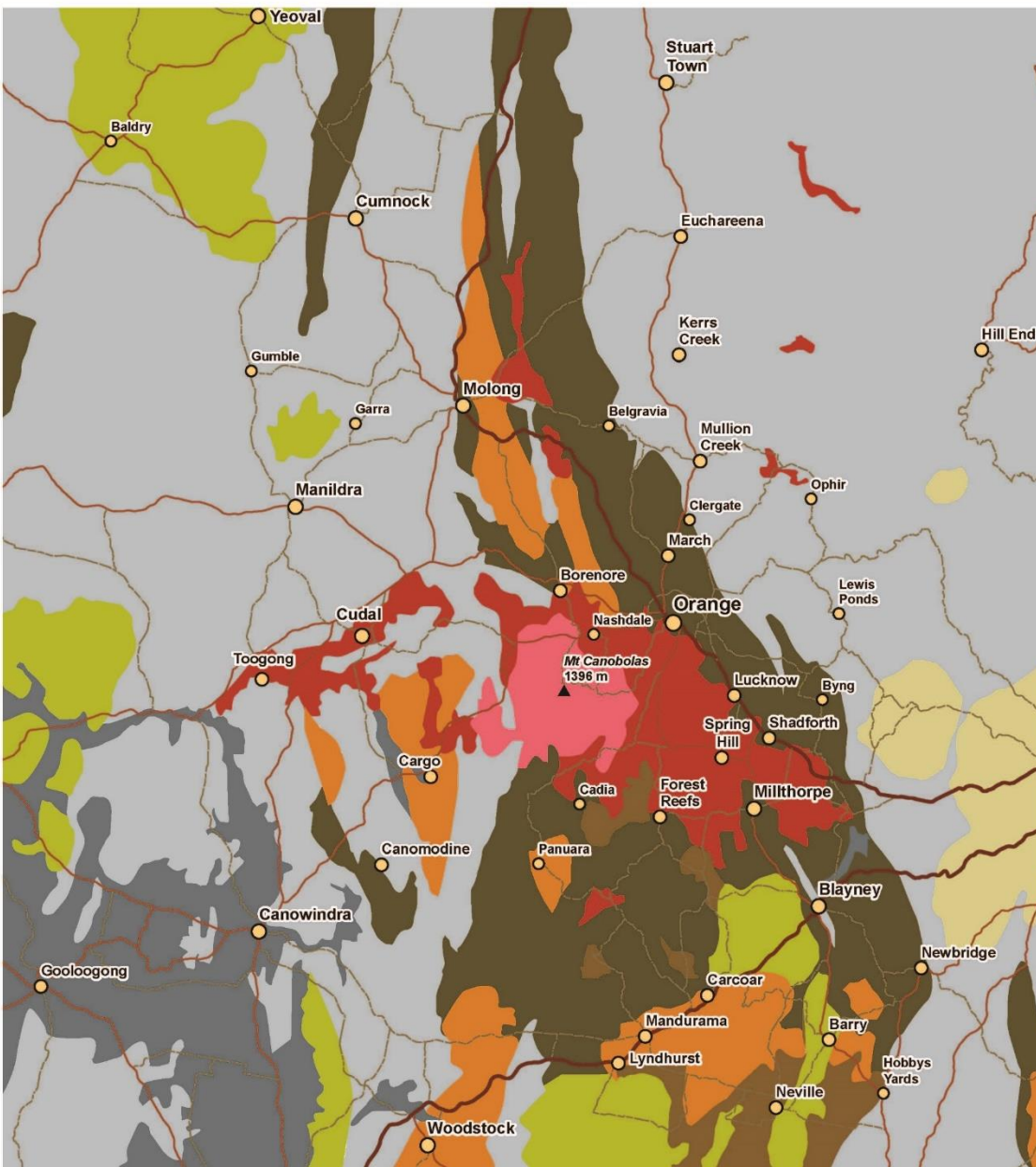
Tomasi, Gaiotti & Jones (2013):

“The fundamental properties of soil that exercise an effect on wine are depth, texture, permeability/drainage, pH and limestone content.

It is the water holding capacity that exercises a decisive role on the distinctiveness of wines. The vine prefers to suffer a bit of drought rather than have an excess of water.”

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Parent Rocks and Associated Soils of the Region



Legend

Main parent materials for soil formation and associated soil types

PARENT ROCK	ASSOCIATED SOILS
Alluvium	Dermosols, Vertosols, Chromosols
Lava from Mt Canobolas	
a) basalt	Ferrosols
b) trachyte	Kurosols, Tenosols,
Granite	Sodosols, Kandosols
Sedimentary rocks like shales dominate	Kurosols, Kandosols, Tenosols, Chromosols
Old granite	Sodosols
Ancient volcanics and limestone	
a) Cabonne group	Dermosols, Vertosols
b) Kenilworth group	Chromosols, Ferrosols
c) Other	Kandosols



Main sources of information about geological units and boundaries:

Raymond O.L., Pogson D.J. et al. 1998. Bathurst Geology Second Edition (1:250 000 geological map S155-08), Australian Geological Survey Organisation, Canberra / Geological Survey of New South Wales, Sydney.

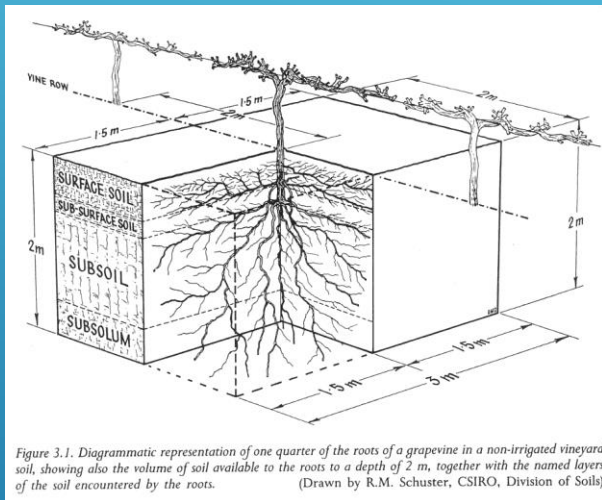
Pogson D.J., Watkins, J.J., Editors 1998. Bathurst 1:250 000

Geological Sheet S155-08, Explanatory Notes: Geological Survey of New South Wales, Sydney.



Information courtesy of Dr David McKenzie,
Soil Management Designs.

RECOGNITION OF SOIL PROBLEMS



Grapevine root penetration up to 8 metres deep; much deeper than mid-row pasture roots.

The 3 aspects of soil fertility:

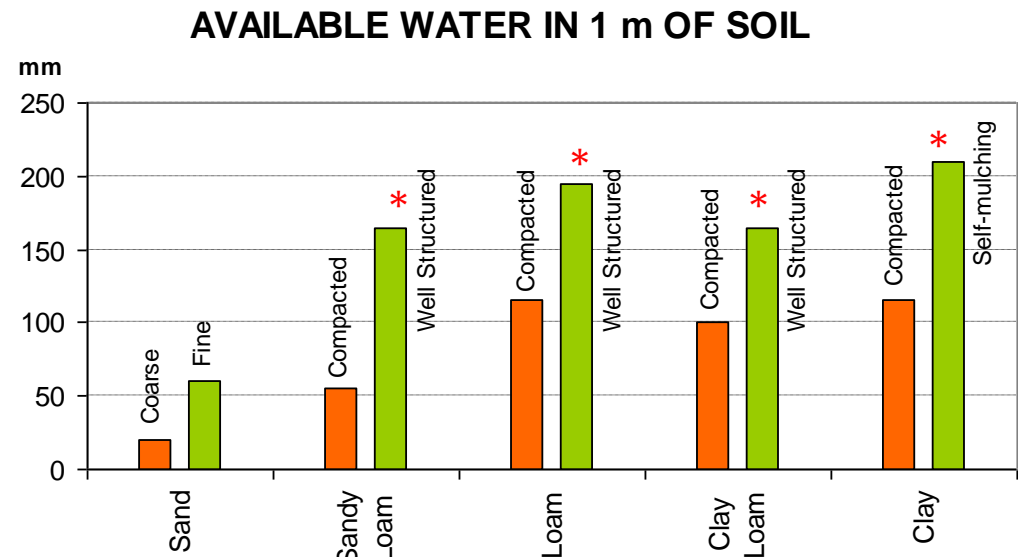
- **Physical** (*water holding capacity, compaction, waterlogging*);
- **Chemical** (*pH, salinity, sodicity, nutrients*);
- **Biological** (*OM, soil flora/fauna*).

Each of these interacting issues is critically important for all vineyard managers.

WATER-HOLDING CAPACITY – IMPACT OF COMPACTION

➤ Favourable soil structure encourages water to be stored in the root zone;

➤ Well structured soil has **twice** the water-holding capacity of compacted soil.



Source: WA SOILGUIDE




Gaiotti and Tomasi (2015):

Subsoil waterlogging is incompatible with the production of high quality winegrapes.

Photo: John Rasic

DANGERS ASSOCIATED WITH WATERLOGGING


- ▶ Some compounds (eg. Mn) and gases (eg. ethylene) can build up to toxic levels.
 - ▶ Root disease problems may be aggravated.
 - ▶ Impeded roots usually have restricted access to nutrient reserves.
 - ▶ N fertilizer is lost as the 'greenhouse gas' nitrous oxide.
 - ▶ Beneficial soil fauna (eg. earthworms) are unlikely to thrive.
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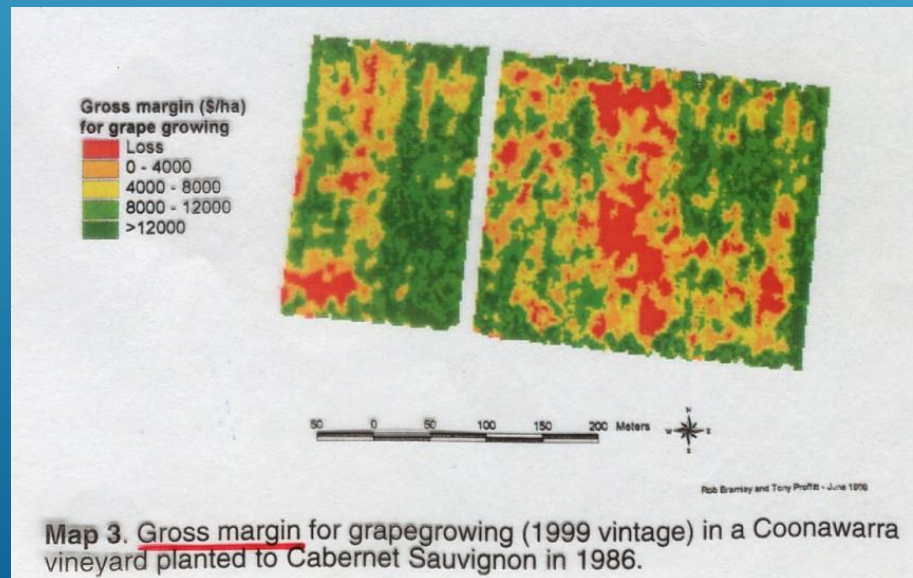
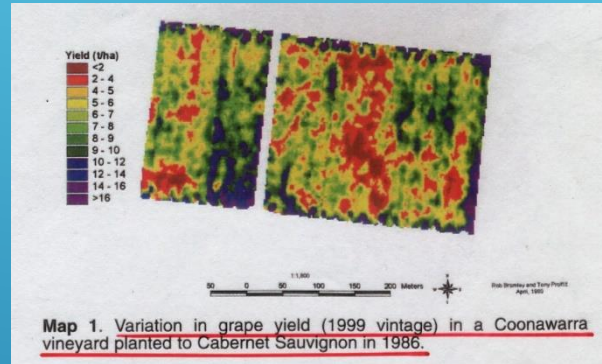
Successful intervention
using organics

RECOGNITION OF SOIL PROBLEMS

Financial issues

- ▶ Poor matching of soil condition with grapevine requirements can lead to major financial losses (disappointing yields &/or mediocre quality) and environmental impacts.
 - ▶ Sometimes the so-called “good” sections of a vineyard have sub-optimal performance.
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YIELD & PROFITABILITY MAPS ARE VERY USEFUL – THEY CAN SHOW THE FINANCIAL IMPACT OF UNSUCCESSFUL MANAGEMENT OF SOIL VARIABILITY IN VINEYARDS



TREATMENT OF SOIL PROBLEMS IN VINEYARDS

Related to geology, previous land use, topographic position

- ▶ Waterlogging caused by sodicity; excessive Mg - **gypsum**.
- ▶ Waterlogging associated with springs - **drains**.
- ▶ Topsoil & subsoil pH imbalance (mainly acidity) – **lime, dolomite**.
- ▶ Excessive stoniness (poor water holding capacity) - **IMUs**.
- ▶ Nutrient deficiencies - **fertilizers**.
- ▶ Subsoil salinity - **avoid**.

TREATMENT OF SOIL PROBLEMS IN VINEYARDS

Created during vineyard development

- ▶ Compaction by heavy machinery - **decompact.**
- ▶ Wet ripping - **avoid.**

TREATMENT OF SOIL PROBLEMS IN VINEYARDS

Induced by vineyard management (post-development)

- ▶ Sodicity, alkalinity, waterlogging caused by poor quality irrigation water – **treat water &/or soil.**
- ▶ Salinity following imprecise irrigation (either too much or too little) – **improve scheduling.**
- ▶ Compaction created by routine vineyard operations (worst when the pillars of compaction link up with the underlying bedrock) – **avoid if possible; maybe rip.**

THE ASSOCIATED PATTERNS OF VARIATION

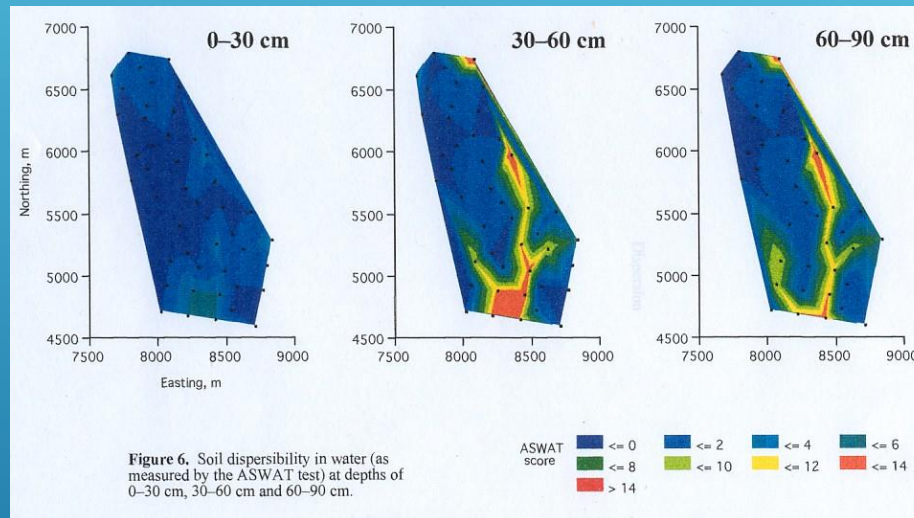
- ▶ Major short-range (sub-metre) changes that recur in a very predictable and repetitive manner across a vineyard, eg. wheel compaction, pH under & between the drippers. Therefore, only a few sampling points are needed.



THE ASSOCIATED PATTERNS OF VARIATION

- ▶ Major broad-range changes, eg. subsoil dispersion, acidity in landscapes with **highly variable geology**.

- ▶ Beware of EM!



**VARIABLE
RATE
GYPSUM
APPLICATION
MAP**

'Soil improvement
map'


'Key soil factor map'

Dots represent 30% of pits assessed on a 100 metre flexible grid

VINEYARD SOIL AUDITS



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Further information



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