

Bringing it all together – monitoring and evaluation

Declan McDonald
Principal Soil Scientist






1

Agriprove modules


1. How soil works and how plants grow; the drivers of the case for change (acidification, SOC loss, erosion)
2. Organic matter – the cornerstone of soil health and sustainable production
3. Soil biology – millions of years in the making
4. Mineral management – the role of macro and micro elements
5. Managing fertility to build soil carbon.
6. Management practices to grow soil carbon – grazing, cropping and perennial horticulture
7. Bringing it all together – monitoring and evaluation. Soil and tissue testing – chemistry, physics and biology (and the role of soil health cards)



2

How do I know I'm making a difference?

- Leaving land in better condition
- What is better? Fencing, trees, weeds, productivity, appearance ???
- Soil must be better
- Improving soil with organic matter
- Measuring and monitoring improvement




3

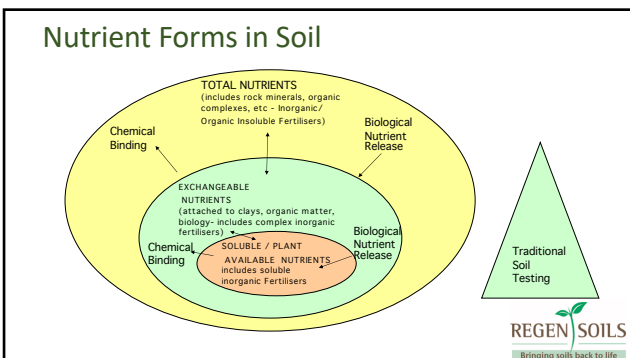
What to measure?

- Soil chemistry
 - pH, EC
 - Cations
 - Nutrients
 - Organic matter
 - NATA and ASPAC accreditations

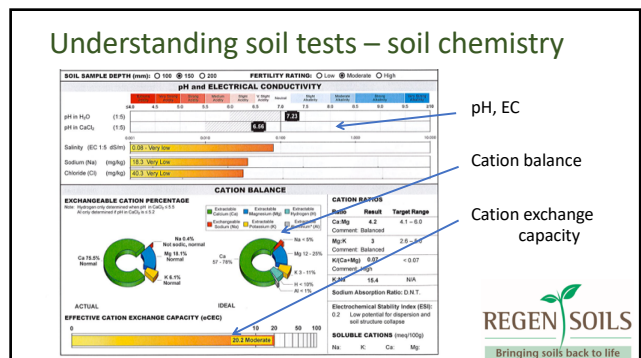
- Soil physics
 - Bulk density
 - Aggregate stability
- Soil biology
 - Microscopy
 - PLFA
 - Microbiometer



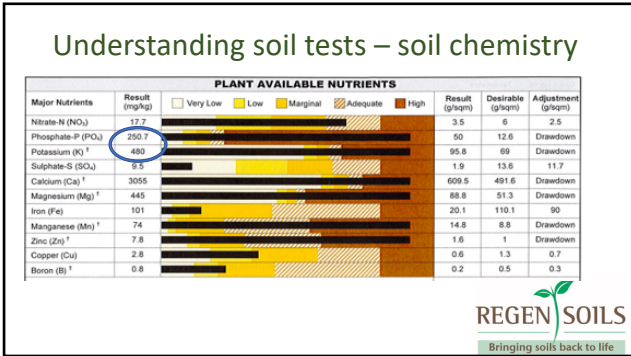
4



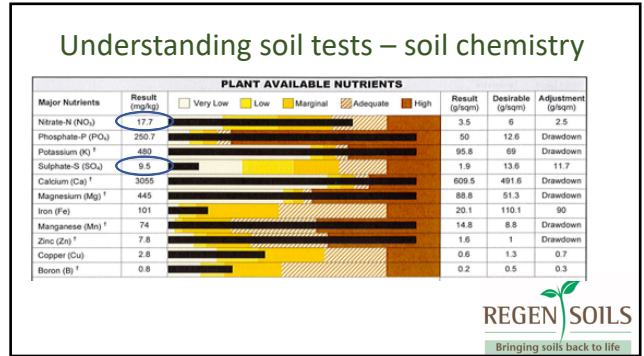
5



6



7



8

Balliang - Yellow Sodosol

Horizon	Horizon Depth	pH (water)	pH CaCl ₂	EC (dSm)	NaCl %	Exchangeable Cations meq/100g				ESP %
						Ca	Mg	K	Na	
A1	0-10	6.7	6.0	0.11	0.04	7	2.5	0.29	0.54	5
A2	10-25	6.5	5.6	0.06	0.02	1.7	1.1	0.11	0.29	9
B21	25-45	8.1	6.9	0.16	0.05	4.6	11	0.34	3.0	16
B22	45-95	8.8	6.0	0.46	0.16	3.8	13	0.41	5.6	25
B23	95-105	9	8.0	0.28	0.10	1.8	5.9	0.18	3.0	28
B24	105+	8.9	7.7	0.19	0.06	1.6	5.8	0.14	2.6	27

REGEN SOILS
Bringing soils back to life

9

Understanding soil tests – soil physics

- Soil structure
 - Bulk density
 - Aggregate stability
- Need to look to 'hands-on' tests
- Visual Soil Assessment (VSA)
 - <http://www.fao.org/3/i0007e/i0007e00.htm>

REGEN SOILS
Bringing soils back to life

10

Understanding soil tests – soil physics

Northern Rivers

Soil Health Card

A soil management tool developed by farmers for farmers

- Soil structure
 - Bulk density
 - Aggregate stability
- Need to look to 'hands-on' tests
- Visual Soil Assessment (VSA)
- Soil Health Cards
 - Northern Rivers

https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0007/168703/northern-rivers-soil-health-card.pdf

REGEN SOILS
Bringing soils back to life

11

Understanding soil tests – soil physics

- Soil structure
 - Bulk density
 - Aggregate stability
- Need to look to 'hands-on' tests
- Visual Soil Assessment (VSA)
- Soil Health Cards
 - Northern Rivers
 - Cornell University



[https://mydairvadmin.cce.cornell.edu/uploads/d_11.pdf](https://mydairvadmin.cce.cornell.edu/uploads/documents/11.pdf)

REGEN SOILS
Bringing soils back to life

12

Understanding soil tests – soil biology

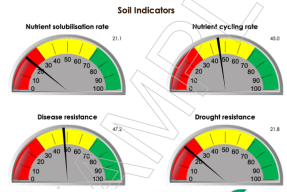

- Direct microscopy
 - Train yourself / get trained
 - Instant results
 - Instant feedback
- Professional microscopy
 - More accurate
 - More informative (?)
 - More costly
 - Slow feedback

13

Understanding soil tests – soil biology


- Phospholipid fatty acid (PLFA)
 - Tests for a range of target organisms
 - Can be confused by plant tissue (e.g. root hairs)
 - Extrapolate additional information but some can be flawed
 - Can be costly
 - Best used as repeat evaluations

14

Understanding soil tests – soil biology


- Microbiometer
 - Could be useful??
 - May have a place on farm
 - Not cheap – not expensive




15

Natural capital


- Accounting for Nature
 - Origins in Wentworth Group of Concerned Scientists
 - Measures condition of environmental assets (e.g., native veg, soils, waterways, fauna) on a property
 - Independent assurance and certification for regen ag, natural capital conservation etc
 - Considerable interest from the banks
 - Needs a Soil Protocol
 - Levels 1-3
 - Landcare method – level 3



16

Natural capital

- Landcare method – level 3
- Five key indicators
 - pH
 - EC
 - Soil organic carbon
 - Phosphorus
 - Groundcover




17

Natural capital

- Landcare method – level 3

Soil property	Soil orders	Land use categories	Depth	Annual rainfall (mm)	Reference value for Econd™	Reference value for Pcond
Soil pH (1:5 in water)	All	Pastures, cropping & horticulture	10cm	All	TBD*	5.5 – 7.5
		Native veg / Forestry	10cm			4.5 – 7.5



18

Natural capital, Landcare method – level 3

SOIL ENVIRONMENTAL ACCOUNT - J CITIZEN

Sub-asset	Assessment unit	Indicator	Reference Benchmark	Target Benchmark	APPENDIX A - WORKED EXAMPLE		Tributary Carbon Type	Tributary Carbon Value	Assessment Unit	Assessment Unit	Tributary Carbon Type	Tributary Carbon Value	Tributary Carbon Type	Tributary Carbon Value
					Average Soil Carbon Value	Carbon Type Reference								
Native vegetation	Soils	Soil Organic Carbon (%)	6.077	1.41	1.53	0.0	0.0	8.0	300.0					
		Soil pH	4.813	4.712	5.00	0.0	0.0	8.0	300.0					
		Soil Electrical Conductivity (dS/m)	1.013	0.21	1.80	0.0	0.0	8.0	300.0					
		Soil Available Phosphorus (mg/kg)	30.24	20.21	10.00	0.0	0.0	8.0	300.0					
Grass pastures	Soils	Soil Organic Carbon (%)	6.077	1.41	6.00	0.0	0.0	18.0	8.0					
		Soil pH	4.813	4.712	5.00	0.0	0.0	18.0	8.0					
		Soil Electrical Conductivity (dS/m)	1.013	0.21	1.80	0.0	0.0	18.0	8.0					
		Soil Available Phosphorus (mg/kg)	30.24	20.21	10.00	0.0	0.0	18.0	8.0					
Cropping and stock	Soils	Soil Organic Carbon (%)	6.077	1.41	1.20	1.0	1.0	8.0	300.0					
		Soil pH	4.813	4.712	5.00	0.0	0.0	8.0	300.0					
		Soil Electrical Conductivity (dS/m)	1.013	0.21	1.80	0.0	0.0	8.0	300.0					
		Soil Available Phosphorus (mg/kg)	30.24	20.21	10.00	0.0	0.0	8.0	300.0					
Olivegrove	Soils	Soil Organic Carbon (%)	6.077	1.41	1.20	1.0	1.0	8.0	300.0					
		Soil pH	4.813	4.712	5.00	0.0	0.0	8.0	300.0					
		Soil Electrical Conductivity (dS/m)	1.013	0.21	1.80	0.0	0.0	8.0	300.0					
		Soil Available Phosphorus (mg/kg)	30.24	20.21	10.00	0.0	0.0	8.0	300.0					

REGEN SOILS
Bringing soils back to life

19

Natural capital, Landcare method – level 3

SOIL ENVIRONMENTAL ACCOUNT - J CITIZEN

APPENDIX A - WORKED EXAMPLE			
Sub-asset	Assessment unit	Asset Econd™	Asset Poond
FERROSOL	Soils	64.5	86.8

REGEN SOILS
Bringing soils back to life

20

Natural capital – soil organic carbon

- Most important component of healthy soil
- Key to combatting climate change
- Key to profitable and sustainable agriculture
- Key to ecosystem function
- Key to soil chemical, physical and biological health

REGEN SOILS
Bringing soils back to life

21

Natural capital – soil organic carbon

- Federal government's Emissions Reduction Fund
- Aims to reverse decades of mis-directed effort by taking atmospheric carbon and putting it back in the soil
- Soil carbon projects pay farmers to do this.
- Process is slightly involved and quite exacting so specialist assistance is usually required.
- Win – win. Farmers who sign up to an ERF project are working to be paid twice – once by government, and many times over in improved production

REGEN SOILS
Bringing soils back to life

22



23

THANK YOU

Declan McDonald
Principal Soil Scientist
B.Sc (Urban Hort), M.SustAg (Soils)

REGEN SOILS
Bringing soils back to life

24