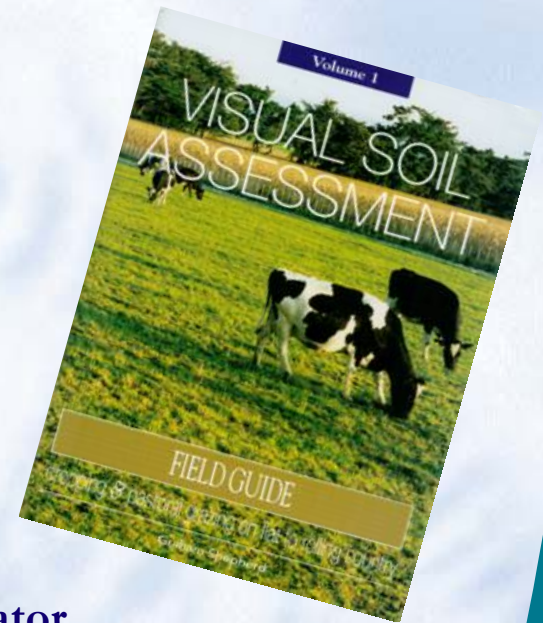


Nutrient and Soil Health Management

Visual Soil Assessment *A Tool for Soil Health Monitoring and Management*



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What I am going to talk about

- **Nutrient Budgeting and Management Plans**
- **Nutrient Budgeting of Dewar's property**
- **Soil Physical properties**
- **Visual Soil Assessment**
- **Questions / discussions**

What is Nutrient Budgeting?

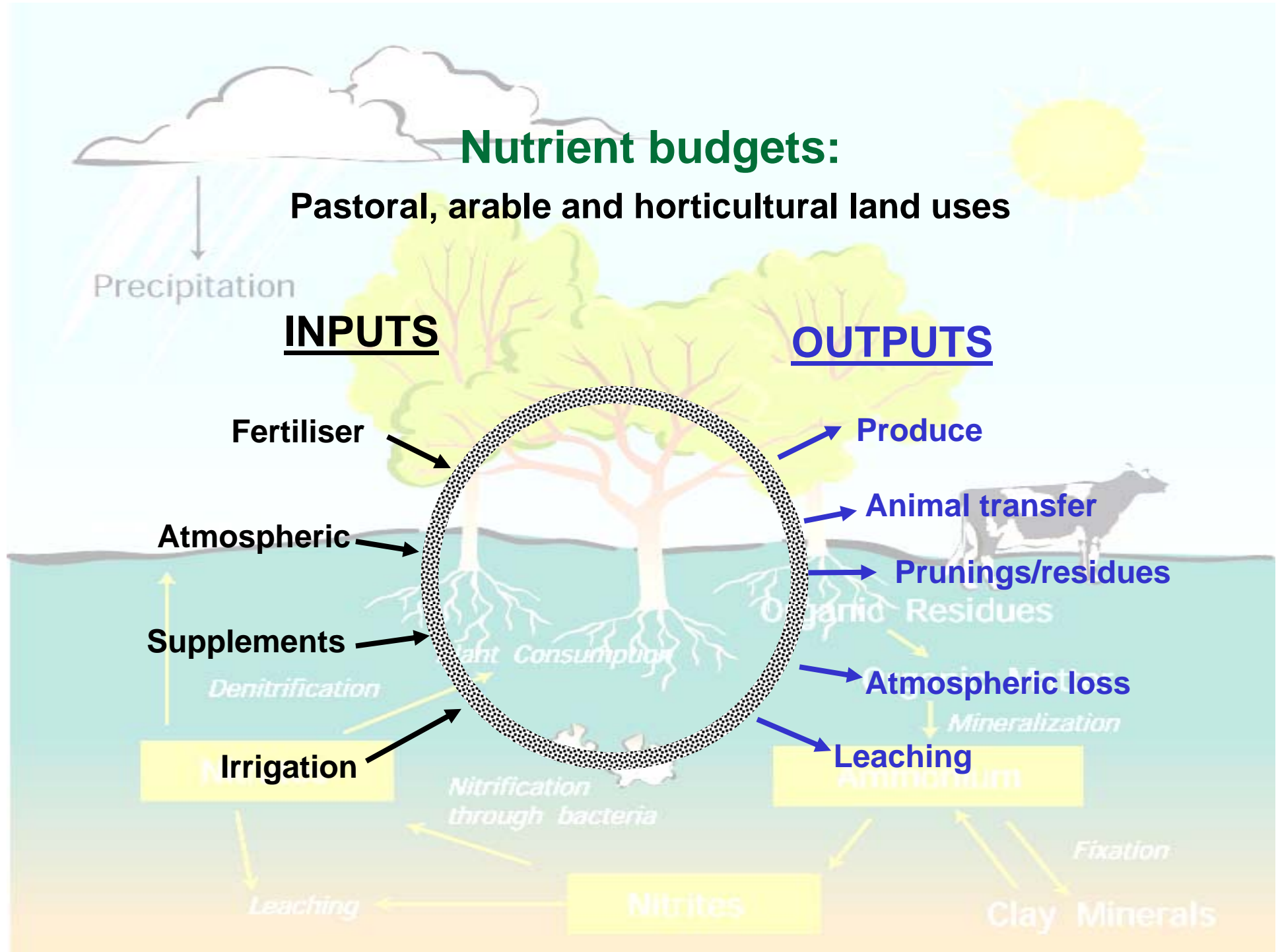
- Nutrient budgeting is a long-term measure of sustainability of a farming system
- It indicates the balance sheet of inputs and outputs
- Nutrient budgeting can quickly identify
 - situations of nutrient surplus or deficit
 - can be easily rectified with appropriate management changes

CAUSED BY • Soil organisms that rot the residues rapidly use up the free oxygen supply, and then denitrifying organisms begin to multiply).

and get their oxygen (O) by taking it from nitrate (NO₃)

Nutrient budgets:

Pastoral, arable and horticultural land uses



Nutrient Management Plan

- Describes all the practical steps that a farmer undertakes to reduce nutrient and sediment losses.
- Based on nutrient budgets.
- *PA rule – 3.9.4.11* – Farmers applying more than 60 kg of N/ha/yr and or applying fertiliser to land that has had farm animal effluent applied to it in the past 12 months must prepare a nutrient management plan.



Nutrient management strategies include:

- Nutrient Budgets
- Effluent Management
- Nitrification Inhibitors
- Fertiliser timing, rates and placement
- Feed & supplements
- Riparian management
- Wintering strategies
- Standing off
- Soil Health Management
- Grazing management
- Seepage areas and Wetlands
- Fenced and Grassed Drains
- Tracks and Raceways
- Bridges and Crossings
- Strategic Cut & Carry
- Pasture Improvement (HSG).

(kg /ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
Inputs								
Fertiliser and lime	26	31	5	23	34	1	0	0.0
House block imports	0	0	0	0	0	0	0	0.0
Atmospheric / clover N	38	0	1	3	2	3	8	0.0
Irrigation	0	0	0	0	0	0	0	0.0
Slow Release	0	3	20	10	1	0	5	0.0
Supplements imported	0	0	0	0	0	0	0	0.0
Outputs								
Product (milk, meat, fibre)	9	2	1	1	4	0	0	0.0
Effluent removed	0	0	0	0	0	0	0	0.0
Supplements sold	0	0	0	0	0	0	0	0.0
Atmospheric	12	0	0	0	0	0	0	0.0
Leaching/runoff	14	1	20	35	13	5	57	-0.8
Net immobilisation/absorption	29	28	0	0	0	0	0	-0.1
Change in inorganic soil pool	0	2	5	0	19	-1	-44	0.9

* acidity (affects lime requirements)

[whole farm]

Av. NZ farm

Nutrient loss indices

N leached	kg N/ha	14	5-20
Loss from effluent pond to waterways (farm equivalent)	kg N/ha	0	
	kg P/ha	0.0	
P runoff risk		Medium	
Farm surplus	kg N/ha	55	30-80
	kg P/ha	31	10-30
N conversion efficiency	%	14	15-25
Average nitrate conc. in drainage (+/- about 30%)	mg N/L	na	2-7

Production efficiency indices

\$ fertiliser per SU (approximate)		19.03	5-10
kg CO ₂ equivalent per SU		388	320-380

Greenhouse gas emissions (kg CO₂ equivalents/ha pastoral)

Inventory based emissions		3306	
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Graph greenhouse
gas impact



Comments

Interpretation

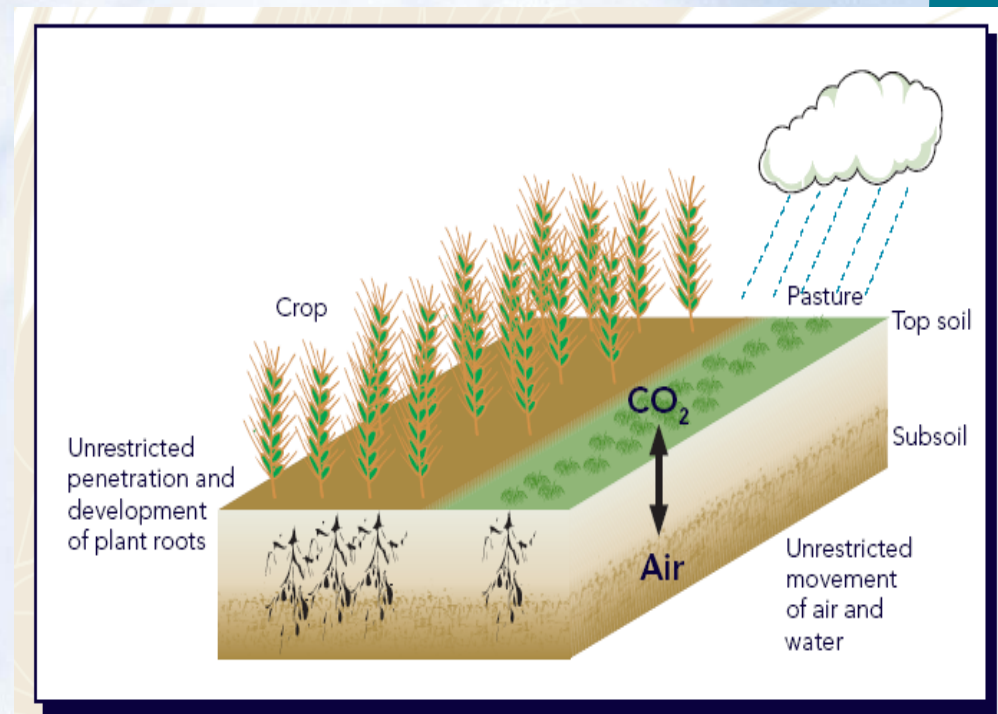
Fertiliser cost

Current farm

	N in drainage* (ppm)	N leached (kg N/ha/yr)	N surplus (kg N/ha/yr)	Added N** (kg N/ha/yr)	Wetland reduction (%)
Overall farm	na	14	55		
Block name					
Hills	na	8	58	26	0
Rolling	1.0	7	56	26	0
Hay Paddock	na	8	58	26	0
Winter Crop	na	48	82	36	0
Summer Crop	na	164	202	36	0

Soil Physical Properties

- Vital for environmental and economic sustainability of farming
- Control movement of water and air
- Damage to soil can change these properties
- Reduce plant growth, *regardless of nutrient status*
- Considerable expense and many years to correct
- Can increase the risk of soil erosion



How can we maintain the productive capacity of our soils?

- ▶ 50% of our soils show signs of severe compaction
- ▶ Our soils are loosing carbon = organic matter
- ▶ Only 34% of sites meet national soil quality targets fully
- ▶ Pukekohe: 7 – 30 to/ha/yr of topsoil lost through erosion

Figure 1

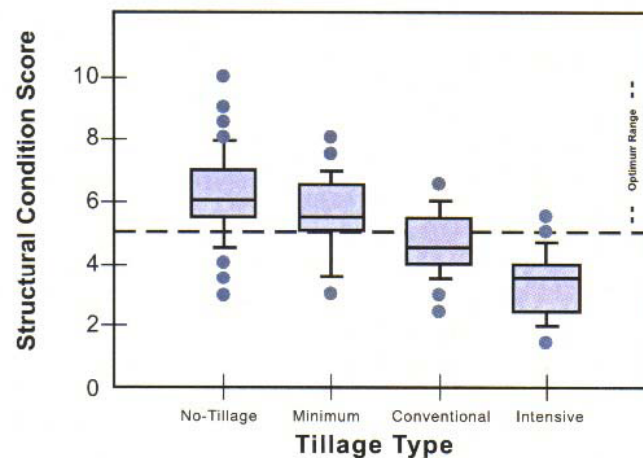
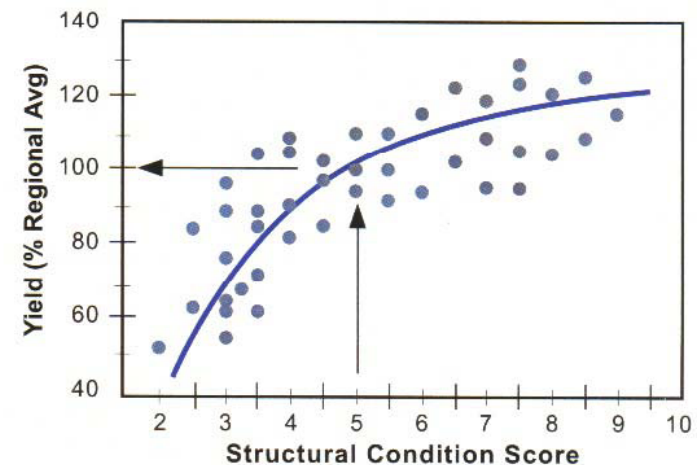


Figure 2



So, as a Land Manager, you need reliable tools



- Often, not enough attention is given to:
- Basic role of soil quality in efficient and sustained production
- Effect of soil quality on the farm's gross profit margin
- Effect of soil health on environmental sustainability

The answer is “**Visual Soil Assessment**”

Visual assessment provides an immediate effective diagnostic tool to assess soil quality, and the results are easy to interpret and understand.

What is Visual Soil Assessment (VSA)?

- Simple tool to effectively assess and monitor soil quality quickly and cheaply.
- Many physical, biological & chemical properties show up as visual characteristics.
- Compare a soil under well-managed pastoral grazing and poorly managed long-term continuous cropping.



How VSA works?

- Based on the observation of **key visual indicators** that are **diagnostic of soil quality**, and incorporated on an easy-to-use **scorecard**
- Soil indicators are supported by **plant indicators** that link soil condition to plant performance.



Drop Shatter Test

- Dig 20 cm cube
- Drop 3 times – Waist
- Transfer the soil onto the plastic bag
- Coarsest clods one end & finest aggregates other end
- Compare with field guide photographs & assign visual score





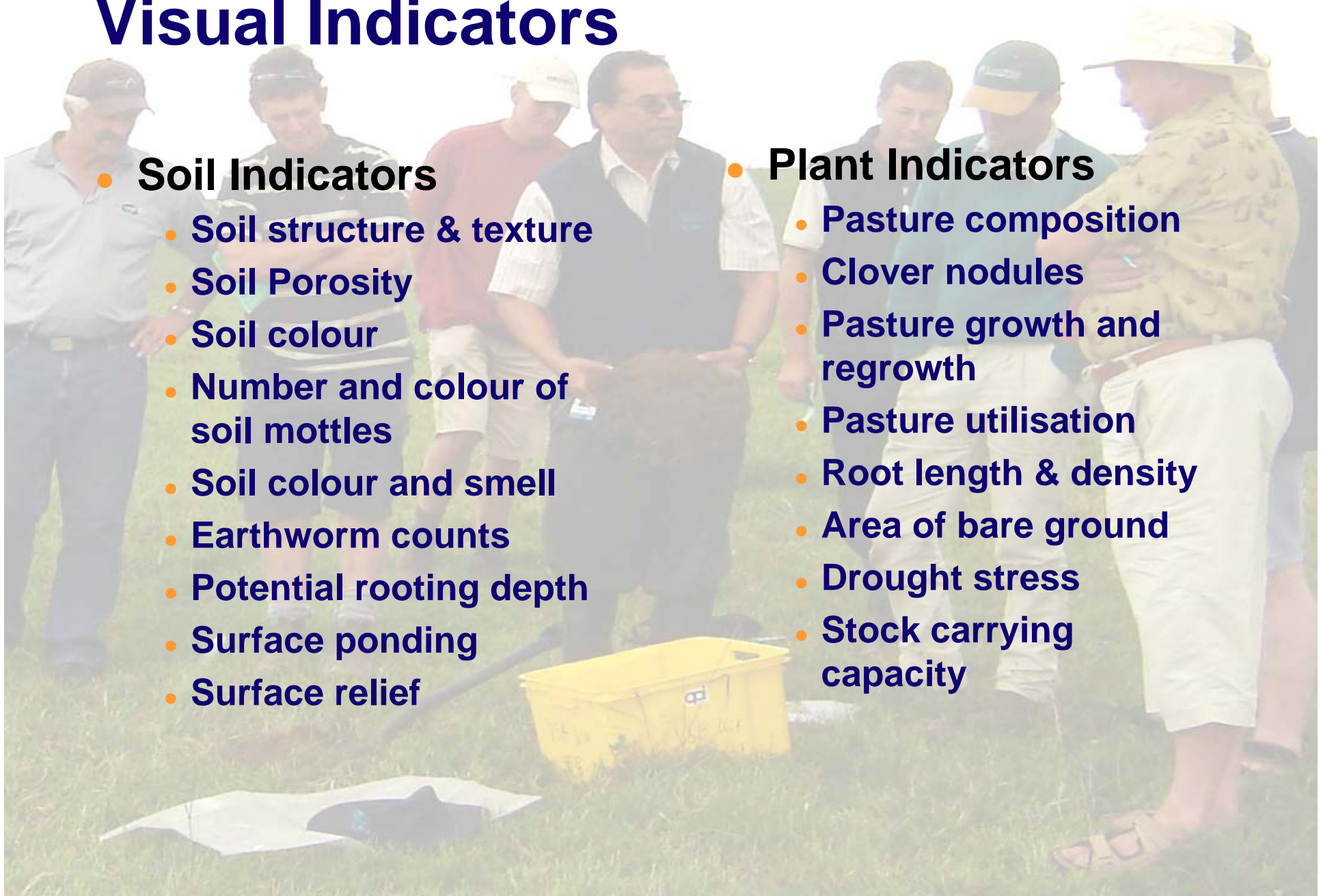
Visual Indicators

- **Soil Indicators**

- Soil structure & texture
- Soil Porosity
- Soil colour
- Number and colour of soil mottles
- Soil colour and smell
- Earthworm counts
- Potential rooting depth
- Surface ponding
- Surface relief

- **Plant Indicators**

- Pasture composition
- Clover nodules
- Pasture growth and regrowth
- Pasture utilisation
- Root length & density
- Area of bare ground
- Drought stress
- Stock carrying capacity

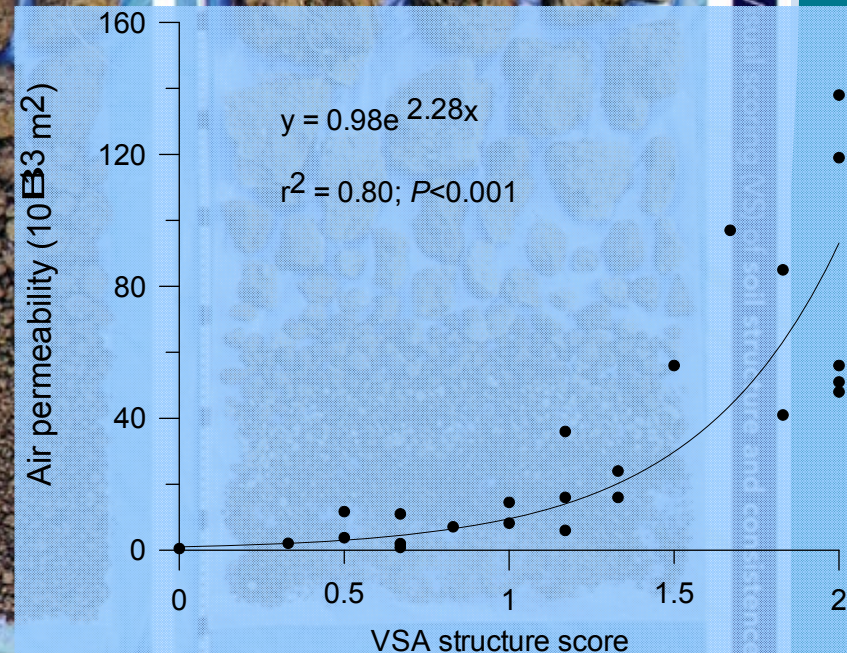
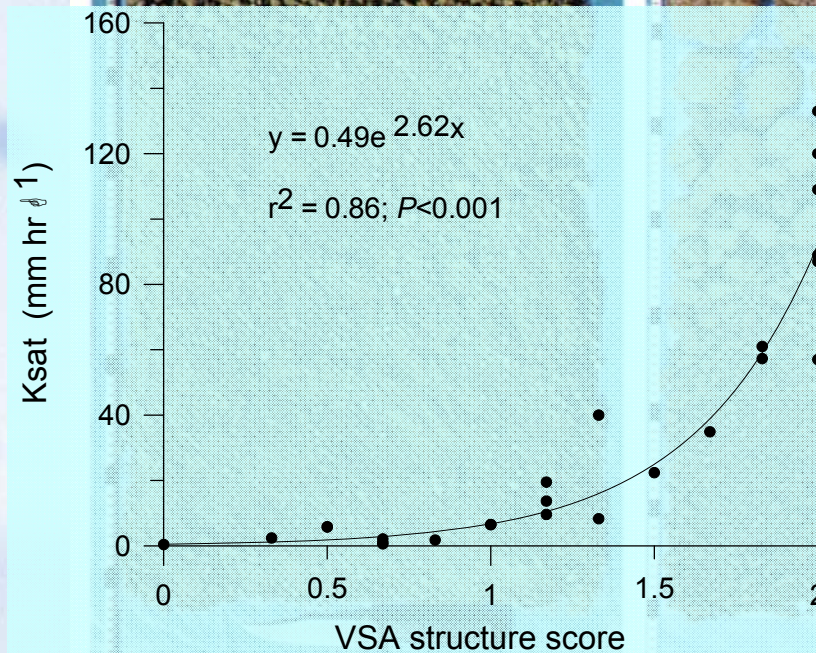


Firstly, assess the soil structure

Soil samples are dropped 3 times from a height of 1 metre and the clods and soil aggregates sorted with the coarsest at the top and the fines at the bottom



FIGURE 1: V



GOOD CONDITION VS = 2
Good distribution of friable finer aggregates with no significant clodding

MODERATE CONDITION VS = 1
Soil contains significant proportions of both coarse firm clods and friable, fine aggregates

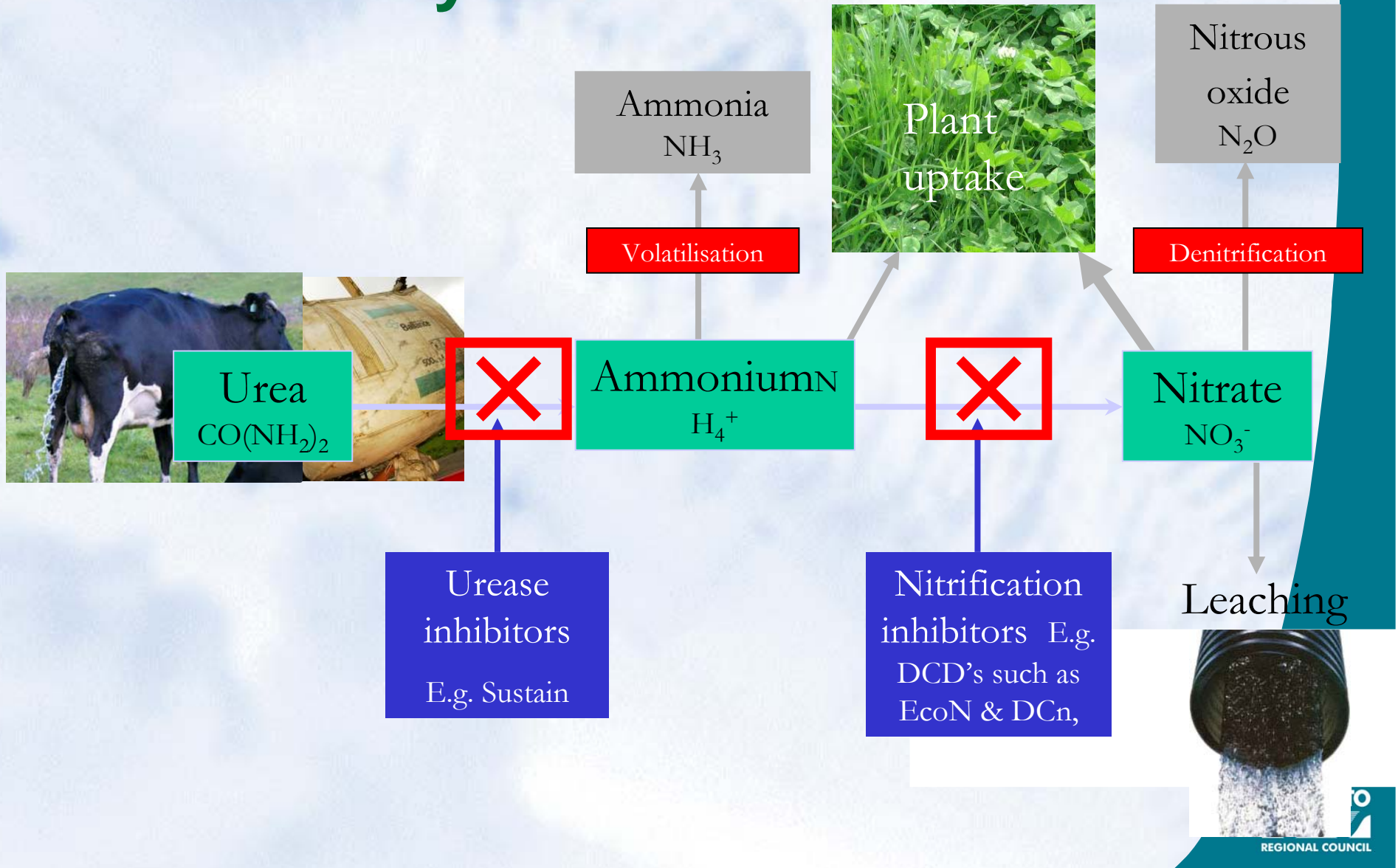
POOR CONDITION VS = 0
Soil dominated by extremely coarse, very firm clods with very few finer aggregates

These images are strongly related to the movement of both water and air through the soil

**The way you manage your farm
has profound effects
on your soil and water quality,
and your soil has profound effects
on your long-term profits**



N cycle



Visual Scoring (VS)

- Each indicator is given a visual score :
 - 0 (poor), 1 (moderate), or 2 (good)
- ❖ Some soil factors are relatively more important than others – VSA provides a weighting factor of 1,2 or 3 (E.g. Soil structure has 3 compared to surface relief with only 1)
- ❖ Indicator score is multiplied by the weighting factor to give VS ranking