Landscape & Soil

Healthy Soils Symposium

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QLD Department of Resources

25 – 26 November 2021 - Mackay

Overview

1. Value of knowing your soil
2. Soils of the Mackay district – the big picture
3. Accessing soil data
4. Things you can do to build/develop your soils knowledge
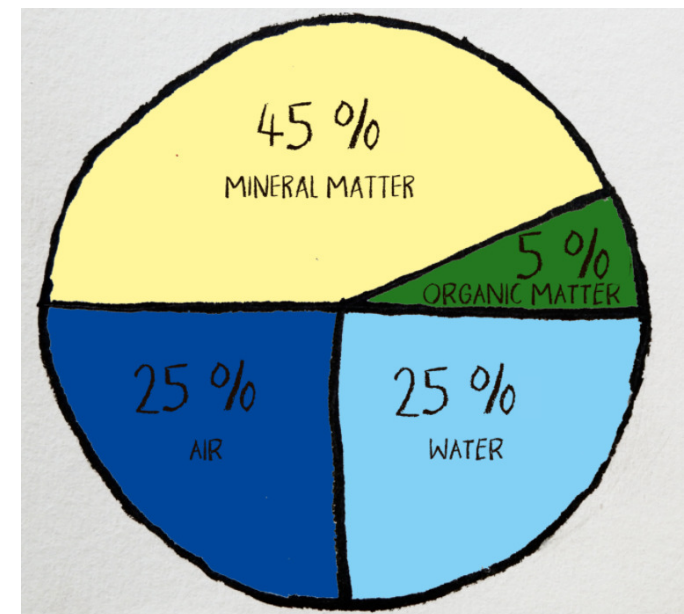5. Soil attributes important for understanding soils

Know your soil

"Without knowledge action is useless and knowledge without action is futile"
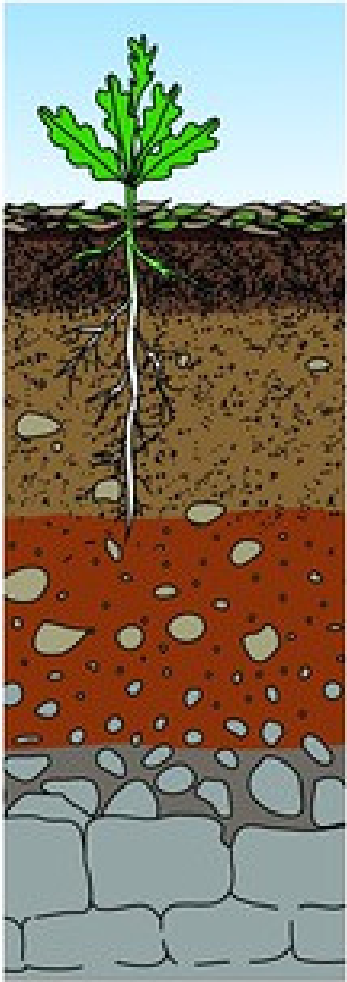
(A. Bakr 632 AD)

What does know your soil mean?

- Its parts

HEALTHY SOIL

Soil physical properties
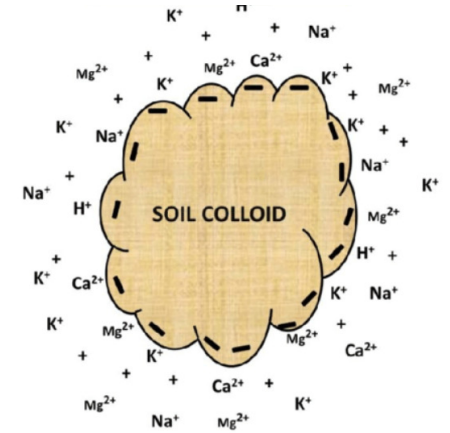
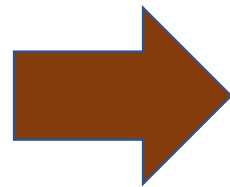Soil chemical properties

Soil biology properties
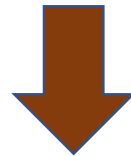
SOIL COLLOID

Know your soil

"Without knowledge action is useless and knowledge without action is futile"
Abu Bakr

What does know your soil mean?
- Its parts
- How it behaves
- Its strengths
- Its weaknesses

SOIL RESILEINCE

RESPOND

Best use / management

VALUE

↑ Productivity

↑ Economic return

↑ Ecosystem services

1. Value of knowing your soil
2. **Soils of the Mackay district – the big picture**
3. Accessing soil data
4. Things you can do to build/develop your soils knowledge
5. Important soil attributes important for understanding soils

Overview of the district

- Complex geology
- Complex landscapes and soils
- There is info and data available

Land resource surveys
- Elliot River-Bowen (BER)
- Mackay-Bakers Creek to Shoal Point (BPA)
- Mackay sugar cane lands (MCL)
- Plane Creek sugar cane lands (PCS)
- Sarina (SAR)
- Whitsunday Coast (WCS)

Sources: Esri, USGS, NOAA

- Mackay district soil mapping
- 1:50 000 scale
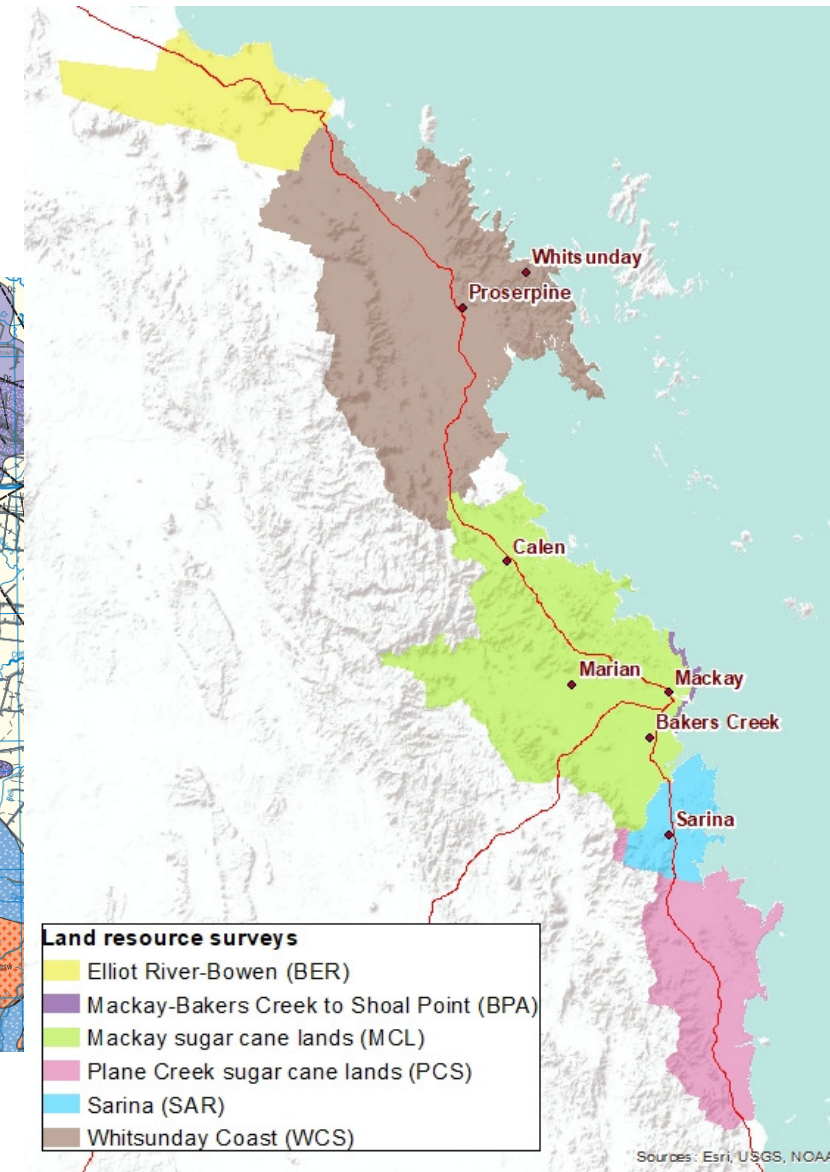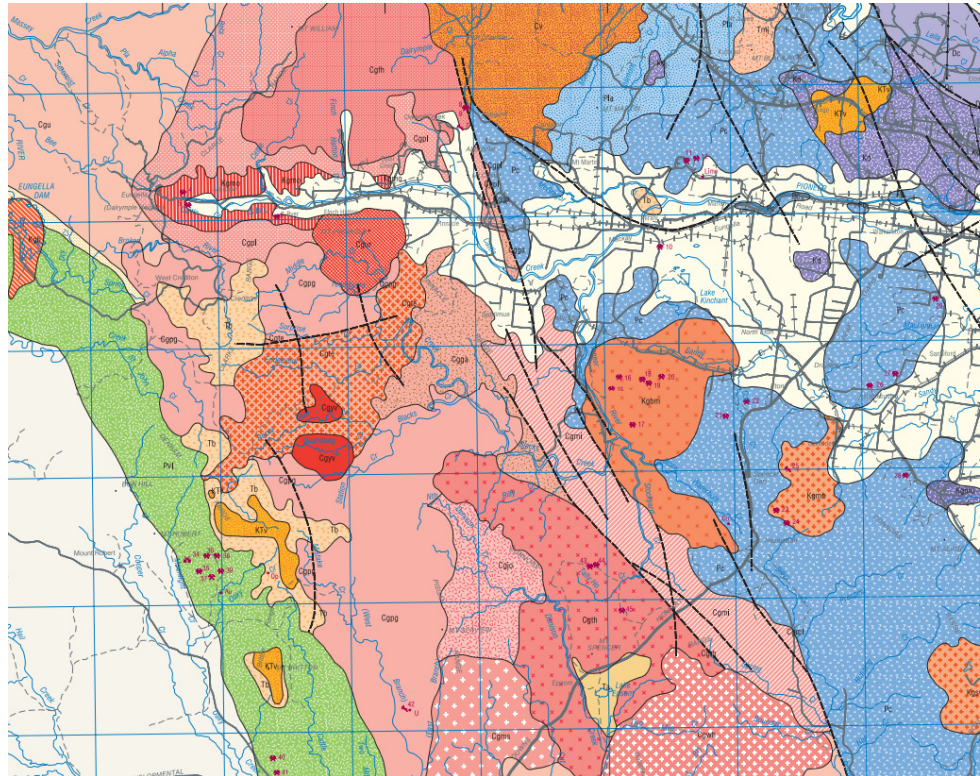
1. Value of knowing your soil
2. Soils of the Mackay district – the big picture
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5. Soil attributes important for understanding soils

Where to start?

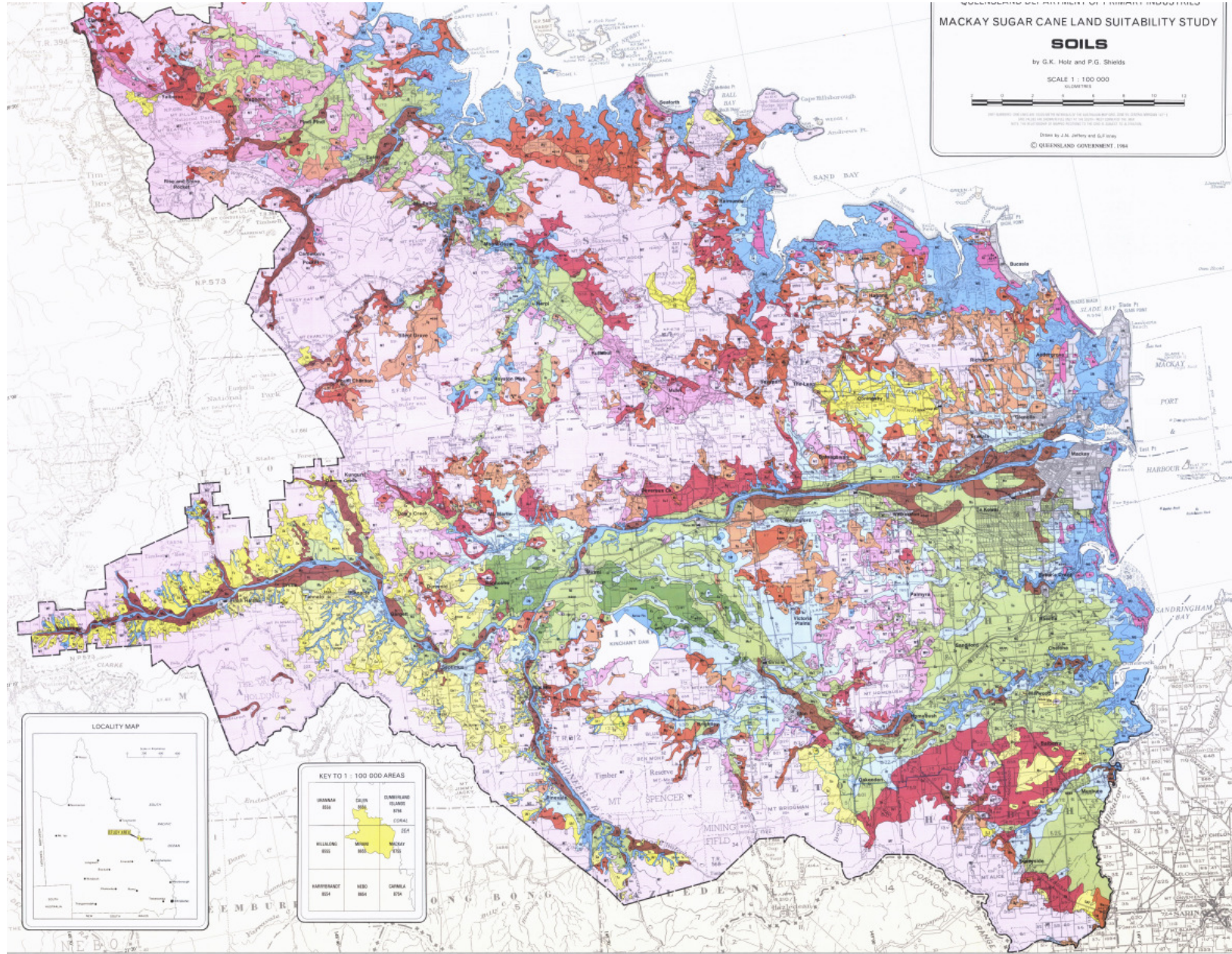- Queensland Globe (https://qldglobe.information.qld.gov.au)

- Interactive spatial tool

- Imagery from different years

- Soil mapping and site data

- Property boundaries

- Grazing land types

- A whole lot more (lot's of tutorials online)

NB: Google Earth also useful
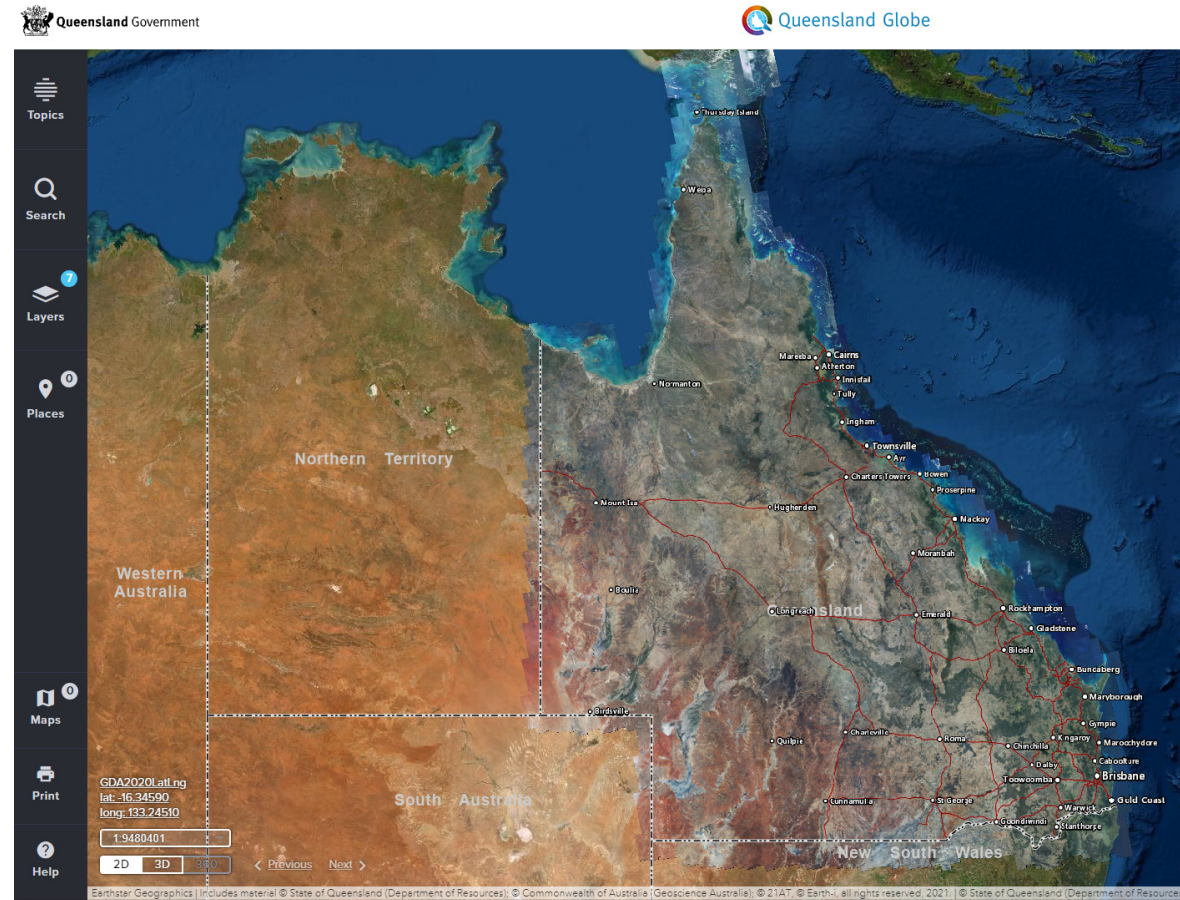
Healthy Soils
Symposium
Queensland Government

Queensland Globe

All Layers

Filter layers by name

- Geoscientific information ⓘ
  - Soils
    - ☑ Soil mapping sites
    - Soil mapping
      - ☐ Soils - 1:10 000 scale
      - ☐ Soils - 1:25 000 scale
      - ☐ Soils - 1:50 000 scale
      - ☑ Soils - 1:100 000 scale
      - ☐ Soils - 1:250 000 scale
      - ☐ Soils - 1:1 000 000 scale
      - ☐ Atlas of Australian soils Queensland - 1:2 000 000
  - ☐ Land management manual mapping
  - ☐ Other land resource mapping
  - ☐ Land degradation
  - ☐ Geology

ADD MY DATA

Topics | Search | Layers 9 | Places 0 | Maps 0 | Print | Help

GDA2020LatLng
lat: -21.14069
long: 148.95094

1:5959

2D | 3D | 360

‹ Previous   Next ›

Attributes

‹ Soil sites 1 of 1 ›

📍 MISCQ

PROJECT CODE — MISCQ

SITE ID — 305

NUMBER OF OBSERVATIONS — 1

FIRST OBSERVED — 08/09/2020

LATITUDE — -21.13581

LONGITUDE — 148.95798

LOCATION MEASUREMENT METHOD — Single GPS

LANDFORM — Plain on Alluvial Plain

SOIL NAME — Pioneer(1)

AUSTRALIAN SOILS CLASSFICATION — Chromosol Brown Eutrophic Melanic-Mottled

LABORATORY DATA AVAILABLE — Yes

SITE REPORT URL — Link

LAB DATA URL — Link

Attributes

‹ Project polygons Soils - 1:100 000 scale 1 of 1 ›

📍 MCL

DOMINANT ENTITY TYPE — SPC

DOMINANT ENTITY CODE — Ma

DOMINANT ENTITY MEANING — Marian

DOMINANT ENTITY PERCENTAGE — 34

SUBDOMINANT ENTITIES — Cl (33%),Ku (33%)

SPC GENERIC GROUP — Sand or loam over friable or earthy clay - Chromosols, Kurosols

CONCEPT — A neutral, bleached, mottled, brown duplex soil developed on Quaternary alluvium.

LAST UPDATED — 1/JAN/2013

SUITABILITY DATA AVAILABLE — Yes

SUIT REPORT URL — Link

Project description

Project name:	Miscellaneous Central Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Central Queensland

Site characteristics

Date described:	8/09/2020 1:03:20 PM	Observation type:	Relatively undisturbed soil core
Site Type:	Free survey site	Observation class:	Class IIa (deep boring >2m, no chemistry)
Slope (%):	1	Morphological type:	Flat
Slope type	Abney level or clinometer and tape	Landform element:	Plain
Geology:	Quaternary alluvium: Clay, silt, sand, gravel; floodplain alluvium	Landform pattern:	Alluvial plain
Soil Name:	Pioneer(1) (Pn)	Substrate lithology:	Unconsolidated material (unidentified)
Runoff:	Very slow	Depth to free water:	Not recorded
Permeability:	Moderately permeable (50-500 mm/day)	Erosion:	No erosion types present
Drainage:	Imperfectly drained	Microrelief type:	Zero or none
Disturbance:	Cultivation - irrigated, past or present	Proportion gilgai:	N/A
Rock outcrop:	No bedrock exposed	Vertical interval (m):	N/A
Surface condition:	Firm	Horizontal interval (m):	N/A
Surface coarse fragments:	No coarse fragments	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-21.13581	148.95798	55	703335	7661569	3	Single GPS
GDA 2020	-21.13580	148.95799	55	703336	7661570		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Melanic-Mottled, Eutrophic, Brown Chromosol; thick, non-gravelly, clay loamy, clayey, very deep.	No analytical data are available but confidence is fair.	Isbell and NCST (2016) The Australian Soil Classification Second Edition	N/A		

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	Ap	0	0.3	Very dark brown (10YR 2/2) moist	no mottles or other colour patterns mottles;	Fine sandy clay loam	Weak 5-10 mm Subangular blocky structure;	no coarse fragments;	No segregations;	Moist, Weak strength;	abrupt
2	B21	0.3	0.6	Dark yellowish brown (10YR 4/4) moist	very few (<2%) fine (<5 mm) distinct yellow mottles; very few (<2%) faint pale mottles;	Light medium clay	Moderate 10-20 mm Subangular blocky structure;	no coarse fragments;	No segregations;	Moist, Firm strength;	gradual
3	B22	0.6	1	Dark yellowish brown (10YR 4/6) moist	few (2-10%) medium (5-15 mm) distinct orange mottles; few (2-10%) medium (5-15 mm) distinct grey mottles;	Medium clay	Moderate 20-50 mm Prismatic structure;	no coarse fragments;	Very few (<2%) Fine (<2mm) Manganiferous Soft segregations;	Moderately moist, Very firm strength;	diffuse
4	B23	1	1.7	Strong brown (7.5YR 4/6) moist	many (20-50%) coarse (15-30 mm) distinct grey mottles; few (2-10%) medium (5-15 mm) distinct orange	Fine sandy medium clay	Moderate 20-50 mm Prismatic structure;	no coarse fragments;	Few (2-10%) Medium (2-6 mm) Manganiferous Laminae;	Dry, Very firm strength;	diffuse

Field test

Field dispersion test as per LRO guideline (2012)

Depth (m)	Value
0.35	0
0.65	1
0.9	1
1.2	1
1.5	2
1.8	3
2.1	2

Field test

Field slaking test as per LRO guideline (2012)

Depth (m)	Value
0.35	2
0.65	2
0.9	2
1.5	1
1.8	1
2.1	0

Field test

pH by Raupach and Tucker method

Depth (m)	Value
0.05	6.0
0.35	7.0
0.65	7.0
0.9	7.0
1.2	7.5
1.5	7.5
1.8	8.0
2.1	8.0
2.4	8.5
2.7	8.5

Working your way down

District ⟶ Paddock
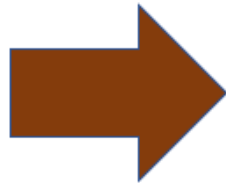
What does know your soil mean?

- Its parts
- How it behaves
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- Its weaknesses

SOIL RESILEINCE

RESPOND

Best use / management

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↑ Productivity

↑ Economic return

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The next level down →
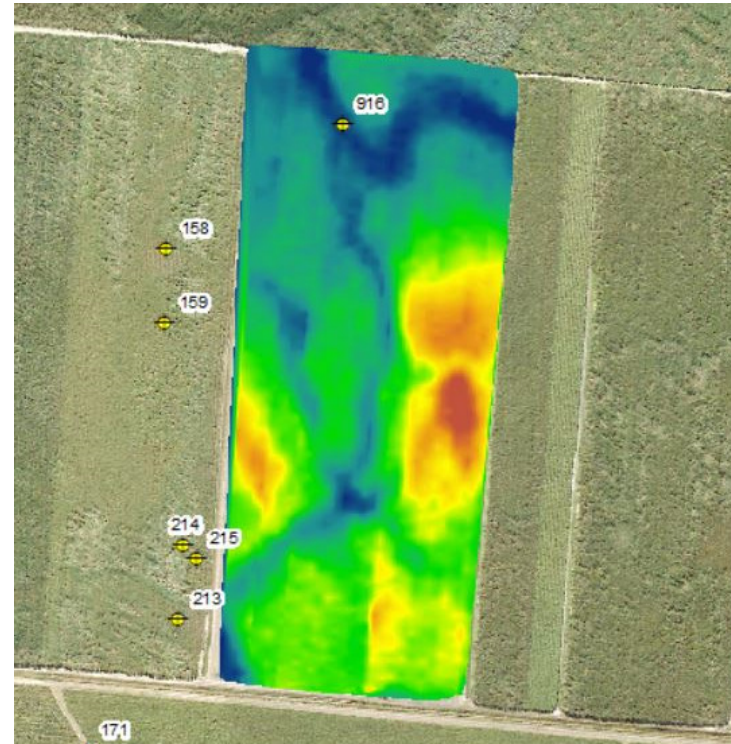*Access to local expertise – organisations, agencies, industry groups, agribusiness*

Healthy Soils Symposium

REEF CATCHMENTS

CANEGROWERS MACKAY

Mills

maps
mackay area productivity services

Agribusiness

FutureBeef

sra Sugar Research Australia

Queensland Government
Department of Agriculture and Fisheries

Field days

Mackay REGIONAL COUNCIL

Australian Government | National Landcare Program | Regional Agriculture Landcare Facilitator | REEF CATCHMENTS

The next level down → *Drones*

Next level down→ *Sensing underground (EMI)*
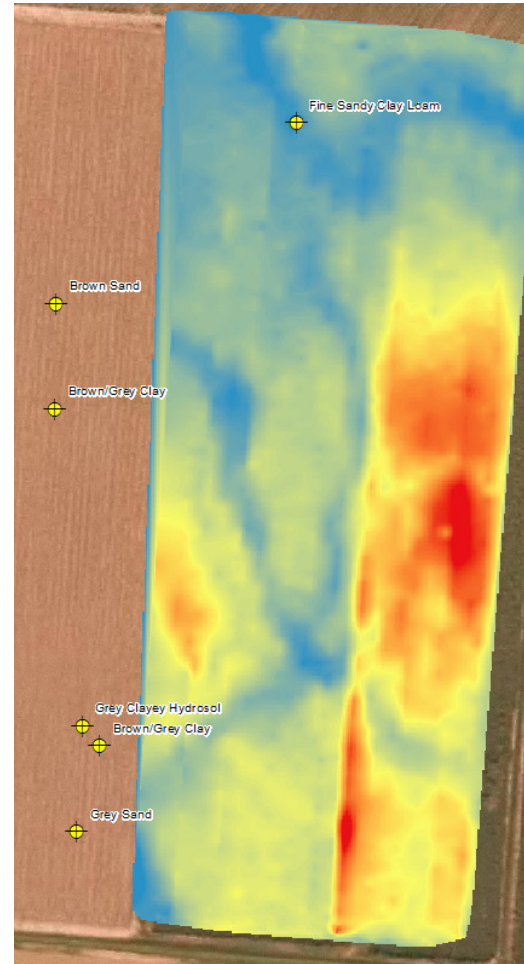
The Next level down → Sensing underground (EMI)
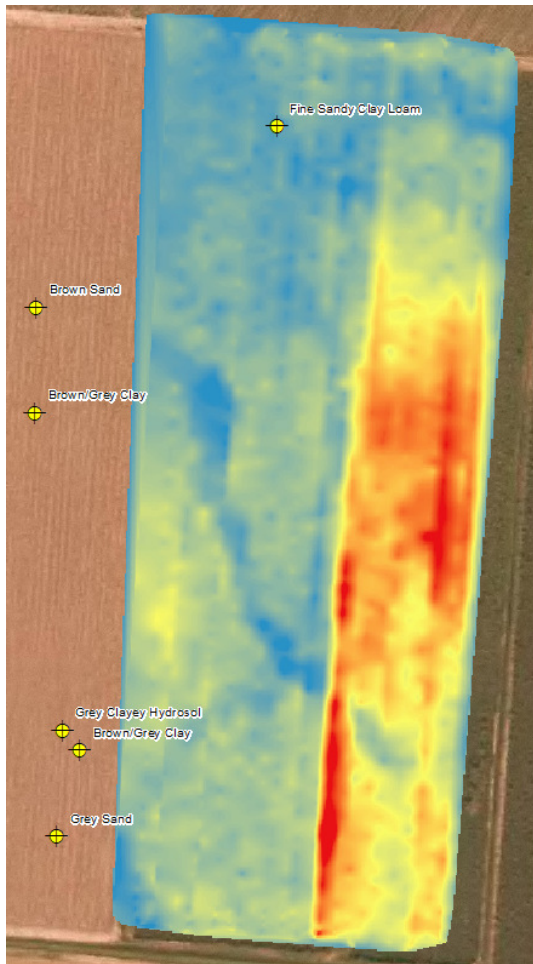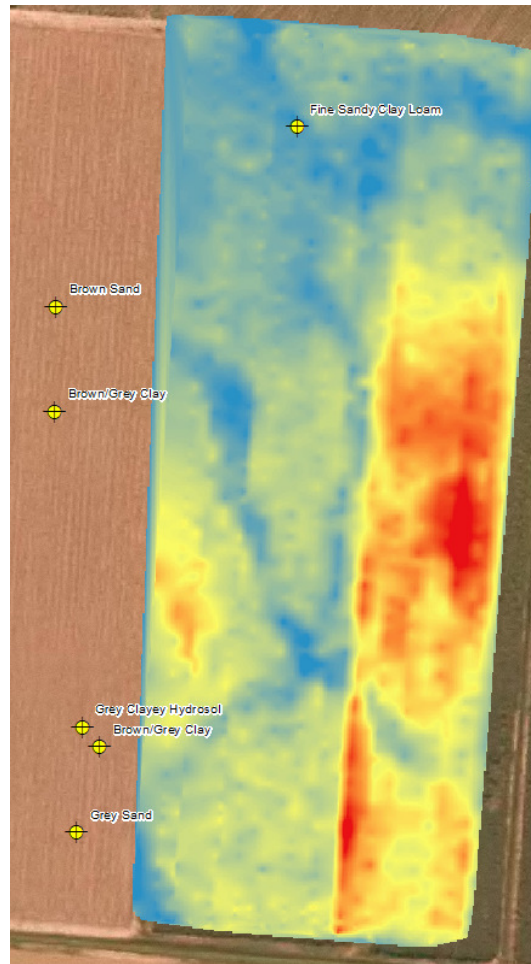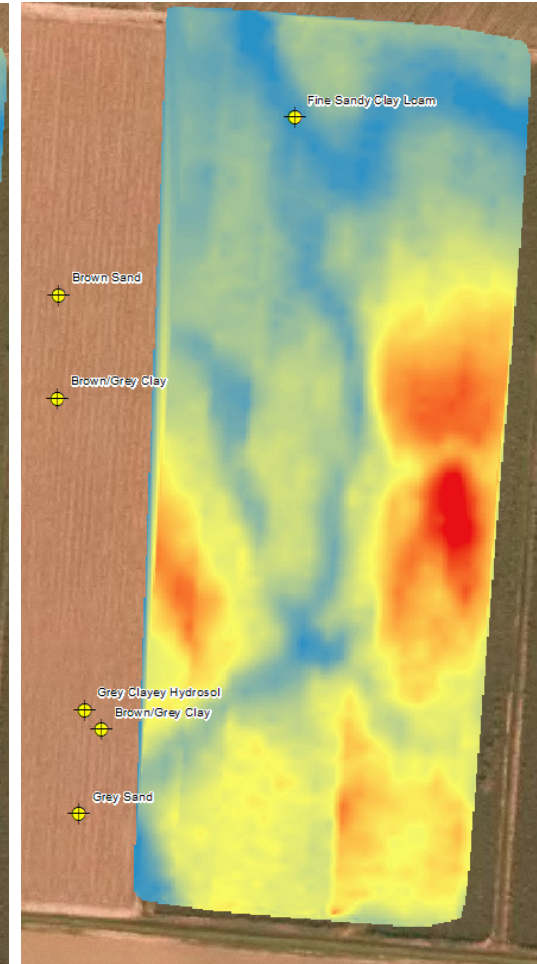
Surface   0.5 m   1.1 m   2.7 m

The Next level down→ **The output**

The next level down - *Landholder knowledge*

- Landscape response

- Soil behaviour

- Working the ground

- Yields and productivity

- Externalities

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5. **Soil attributes important for understanding soils**

What do the patterns mean?

- What have you observed – e.g. high / low plant vigour?

- Is it related to the soil or not? e.g. Could be pest/disease related

- How do the soils vary – soil physical /chemical /biological

- Major reasons for differences include
    1. Drainage
    2. Water holding capacity
    3. Nutrients – def or tox
    4. Soil health

    TOO MUCH / NOT ENOUGH

- What can you do to investigate – I.D. indicators of difference
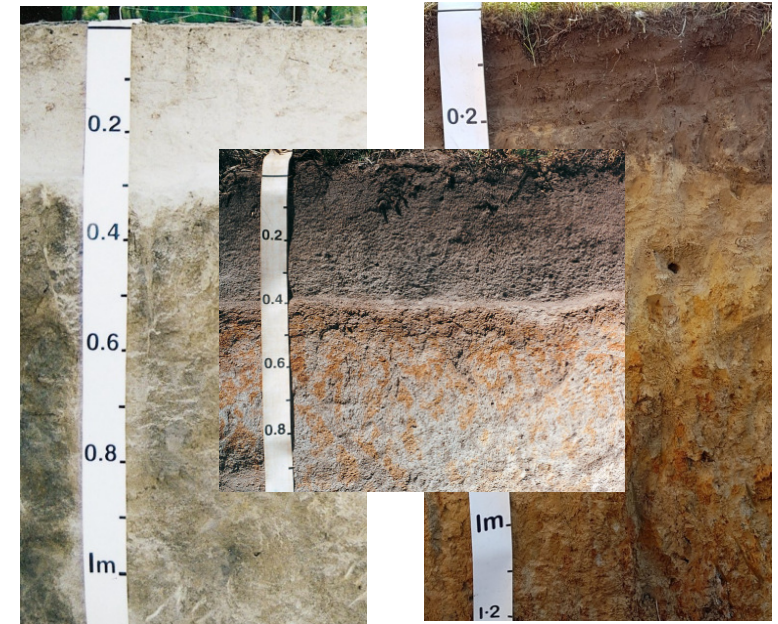
    DIG / AUGER / EXCAVATE
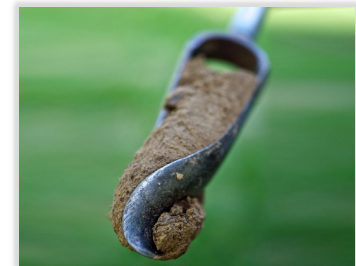
1. Poorly drained soils

- Low points in the landscape
- Soils that seasonally wet
- Soil that are grey and mottled
- Indicator vegetation species
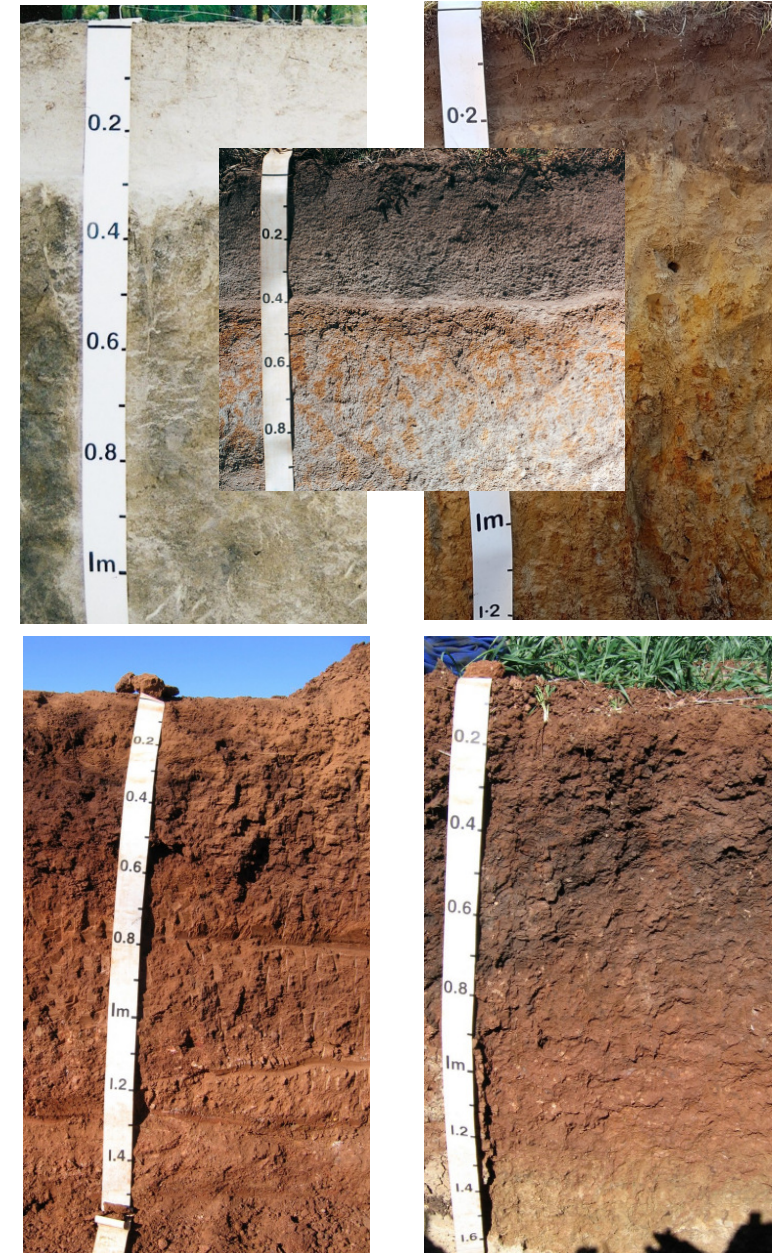- Poor access after rain

Poorly drained soils

- Low points in the landscape
- Soils that seasonally wet
- Soil that are grey and mottled
- Indicator vegetation species
- Poor access after rain

Well drained soils

- Brown or Red soils – whole coloured
- Not seasonally wet
- Less runoff more infiltration
- Quick access after rain

NB: Checkout factsheet: Understanding soil colour

2. Available water

- How much water is available to the plant?
- Driven by:
  - Clay content
  - Soil structure
  - Soil depth
  - Soil **physical** or **chemical** barriers
    - Compaction layers
    - Pans
    - Rock
    - Salinity
    - Sodicity
    - Soil nutrition

- How do you make a determination?
- Dig a hole and look/feel / soil testing

NB: Checkout factsheet: Understanding soil texture and sodic soils

| Field texture	Estimated SWS per 100 mm depth of soil
sand; clayey sand; loamy sand	4 mm
sandy loam	5 mm
loam; silty loam; sandy clay loam	6 mm
clay loam; clay loam, sandy; silty clay loam	8 mm
light clay; light medium clay	10 mm
medium clay; medium heavy clay; heavy clay	12 mm

3. Nutrients

- Soil Deficiency or Toxicity

- Driven by:
  - Clay content and mineralogy
  - Soil permeability and drainage
  - Climate
  - Soil pH
  - Extent of use (nutrient mining – crop removal – erosion)

- How do you make a determination?

  SOIL/LEAF TESTING, PLANT INDICATORS

- Can you change it?

NB: Checkout factsheet: Understanding soil pH
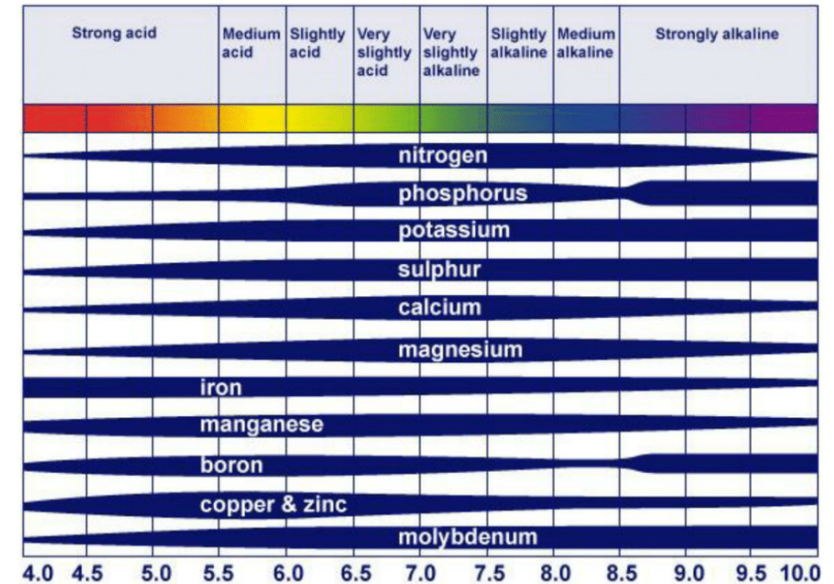
4. Soil health - biology

- Loss of soil health = loss of soil biology plus.......

- Organic matter is gold
    - Food for soil biology
    - Protection
    - Provides soil nutrition

- How do you make a determination?
    - Dig a hole and look/ soil testing / signs of life

HEALTHY SOIL

Soil physical properties

Soil chemical properties

Soil biology properties

Where to from here?

"Without knowledge action is useless and knowledge without action is futile"

- How well do you know your soils?
- What can you do to know them better?
- What is available already?
- What tools (info, people) can you access?