What's wrong with this soil?

Lab record and investigation planner

Name: _____ Class: _____ Date: _____

Keep this record as you work through the lesson. Each part has the number of its screen and its level of inquiry: at each level you are given less and plan more for yourself. The tables work with real lab tests as well as with the models.

SCREEN 1 Five samples

CONFIRMATION

Read each sample's note. Write a first guess about what is wrong, then come back on screen 10 and write what you think now.

SAMPLE	THE NOTE IN THE BAG	MY FIRST GUESS (SCREEN 1)	WHAT I THINK NOW (SCREEN 10)
A Liverpool Plains, near Gunnedah	*Our paddock on the rise above the creek was bare after harvest when the February storms came. Now there are little channels all the way down the slope and mud in the dam.*		
B Pasture near Wagga Wagga	*The lucerne we sowed last autumn came up patchy and thin, and the clover looks yellow. The neighbours reckon it might be the soil.*		
C Mallee country near Balranald	*After two dry years the paddock blew for days. The fence line is buried in sand and nothing we sow will take.*		
D A backyard in Broken Hill	*Our son's blood lead test came back high. He plays in the dirt out the back, near where we grow our vegetables.*		
E Irrigation farm near Deniliquin	*Patches in the bottom paddock have gone white and the wheat dies off there first. Our bore shows the water table less than two metres down.*		

SCREEN 1 How a soil develops

CONFIRMATION

Change one factor at a time in the model. Write what the model showed, and tick the box if it matched the known effect.

FACTOR	WHAT THE MODEL SHOWED WHEN I CHANGED IT	MATCHED?
Time		☐
Climate		☐
Topography		☐
Parent material		☐
Living things		☐

SCREEN 2 The oven and the furnace

CONFIRMATION

Water content (%) = (moist mass − oven-dry mass) ÷ oven-dry mass × 100. Organic matter (%) = (oven-dry mass − mass after the furnace) ÷ oven-dry mass × 100. Organic carbon (%) = organic matter ÷ 1.72.

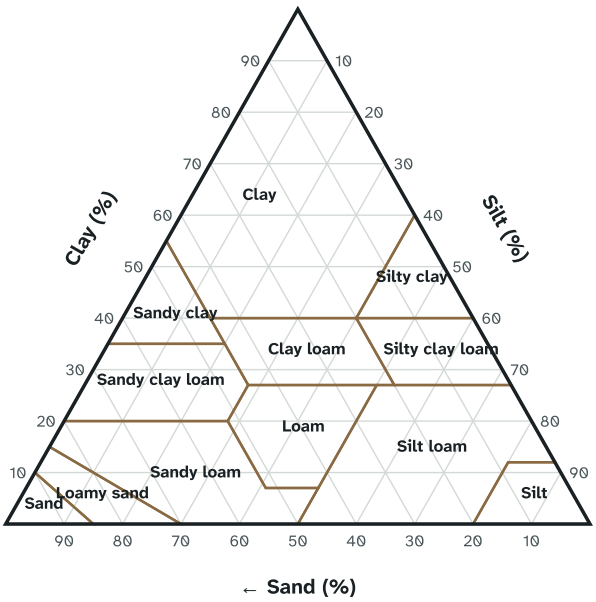
SAMPLE	MOIST (G)	OVEN-DRY (G)	AFTER THE FURNACE (G)	WATER (%)	ORGANIC MATTER (%)	ORGANIC CARBON (%)
A						
B						
C						
D						
E						

SCREEN 3 Sand, silt or clay?

STRUCTURED

Sand = the 40 s reading. Silt = the 6 h reading minus the 40 s reading. Clay = the 2 day reading minus the 6 h reading. Divide each layer by the 2 day reading and multiply by 100, then plot the sample on the triangle.

SAMPLE	40 S (MM)	6 H (MM)	2 DAYS (MM)	SAND (%)	SILT (%)	CLAY (%)	TEXTURE
A							
B							
C							
D							
E							



← Sand (%)

The USDA soil texture triangle. Mark each sample with its letter.

What did the jar and the triangle show about each sample? Which samples were hardest to tell apart, and why?

SCREEN 4 Testing soil quality

STRUCTURED

Record each result, and circle any result outside the comparison level in the top row.

SAMPLE	PH ($CACL_2$)	EC (DS/M)	ORGANIC CARBON (%)	BULK DENSITY (G/CM^3)	CRUMB TEST	LEAD (MG/KG)
Compare with	5.5 to 8.0	below 0.15	above 2	1.6 or less	stays whole	300 or less
A						
B						
C						
D						
E						

Choose a sample that failed a test and a treatment that could fix it, then test again.

Sample: _____ Treatment: _____

Result before: _____ Result after: _____

Which tests did each sample fail, and what does each failure tell you? What changed when you tried a treatment?

SCREEN 5 Lead in the backyard

STRUCTURED

Sample the backyard on screen 5, then fill in the summary.

Points sampled: _____ Points above 300 mg/kg: _____

Mean: _____ mg/kg Highest: _____ mg/kg

Where to grow vegetables: _____ Where the children should play: _____

Who is most at risk from lead in Broken Hill's soil, and how does it reach them? What did the two other cases show about plants and animals?

SCREEN 6 Salt on the rise

GUIDED

Plan your runs in the catchment model. What will you change in each run, what will you keep the same, how long will you run it, and what will you measure?

One row for each run. Change one thing at a time, and keep the rest the same.

RUN	WHAT I CHANGED	WHAT I KEPT THE SAME	YEARS	WATER TABLE AT THE BORE (M DOWN)	SALTY GROUND (%)	SALT TO THE RIVER
1						
2						
3						
4						
5						
6						

Explain how clearing and irrigation each raised the water table and brought salt to the surface, using your runs as evidence. What happened to the river?

SCREEN 7 Salt and seedlings: my plan

GUIDED

Use at least three salt levels, including 0 dS/m as a control, and more than one tray at each level.

Plant: _____ Trays at each level: _____

Independent variable: _____ Dependent variable: _____

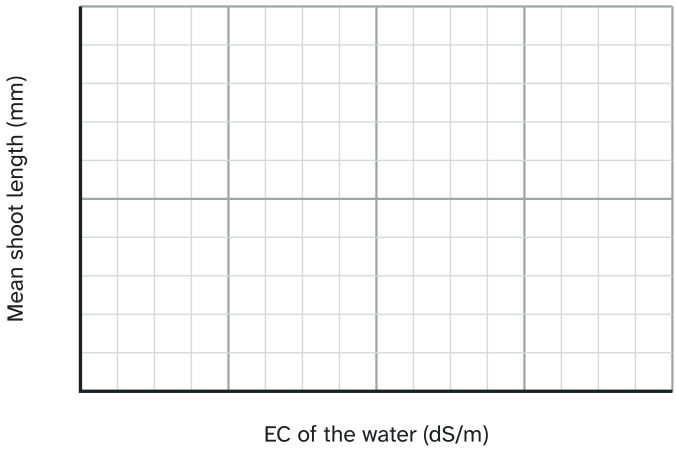
Controlled variables: _____

Why did you choose that plant, those salt levels and that number of trays?

SCREEN 7 Salt and seedlings: my results

GUIDED

EC (DS/M)	TRAY 1	TRAY 2	TRAY 3	MEAN



What did your results show? Describe the pattern in your graph, explain it, and say how reliable your results are.

SCREEN 8 Fixing salty land

GUIDED

The strategy I am evaluating: _____

Give each criterion a weight from 0 (doesn't matter) to 3 (matters most), and the strategy a score from 1 to 5. Write the evidence behind each score.

CRITERION	WEIGHT (0 TO 3)	SCORE (1 TO 5)	THE EVIDENCE FOR MY SCORE
Lowers the water table			
Brings salty ground back into use			
Works quickly			
Costs little			
Has few side effects			

SCREEN 9 Holding the soil down

OPEN

Write your own question about how well a way of preventing erosion works. For example: how much does a certain level of groundcover reduce soil loss on a certain slope?

Record the soil lost from each tray in each storm. Run more than one storm.

STORM	TRAY 1	TRAY 2	TRAY 3	TRAY 4
Set-up				
1				
2				
3				

SCREEN 10 The soil reports

OPEN

For each sample write the main problem, the best evidence for it, and the two strategies that fit best.

SAMPLE	MAIN PROBLEM	BEST EVIDENCE	TWO STRATEGIES
A			
B			
C			
D			
E			

Look back at the first guesses you wrote in the case files on screen 1. Which guess changed most, and which piece of evidence changed it?