Printable Resources for the Simulation Game on the next few slides.

Presentation follows, repetition of what is available on the sheet.

Recommend that at the end students brainstorm how to minimise occurrence of pugging. Use Landcare resource for answers.

To learn more…
- Landcare Research, Soil Health Factsheet. https://www.landcareresearch.co.nz/assets/Discover-Our-Research/Land/Soil-health-resilence/factsheet-compaction-pugging.pdf - State Government of Victoria (Australia), Pasture Recovery from pugging damage. https://vgls.sdp.sirsidynix.net.au/client/search/asset/1017146 - DairyNZ, Managing pugging damage. https://www.dairynz.co.nz/feed/feed-management/managing-pugging-damage/ UK resource, but has some great pictures: https://www.rothamsted.ac.uk/sites/default/files/LEAF-Simply_Sustainable_Soils.pdf

Simulation number: 1 **Stock 1** **Stock 2** **Stock 3** **Stock 4** **Stock 5**

Sequence: gate(start) – feed –water – feed – water – feed – water – feed – gate (finish)

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
16.	17.	18.	19.	20.

Simulation number: 2 **Stock 1** **Stock 2** **Stock 3** **Stock 4** **Stock 5**

Sequence: gate(start) – feed –water – feed – water – remove break fence - feed – water – feed – gate (finish)

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
16.	17.	18.	19.	20.

Simulation number: 3 **Stock 1** **Stock 2** **Stock 3** **Stock 4** **Stock 5**

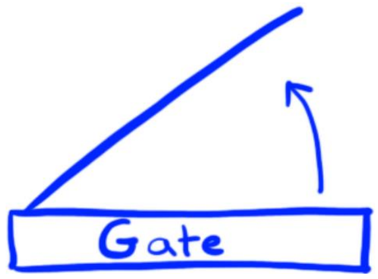
Sequence: gate(start) -

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
16.	17.	18.	19.	20.

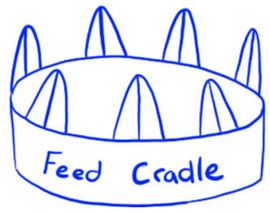
Cut out the following…

(You can choose between cows or sheep)

Water Trough

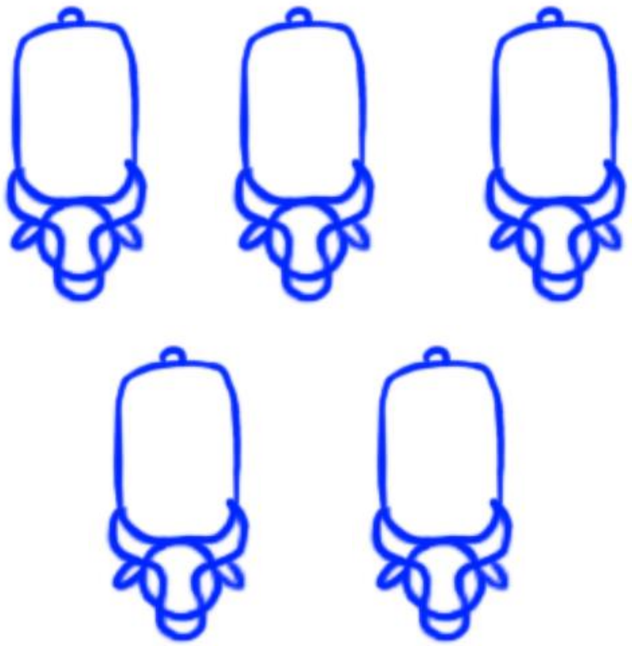


Gate



Feed Trough/ Cradle

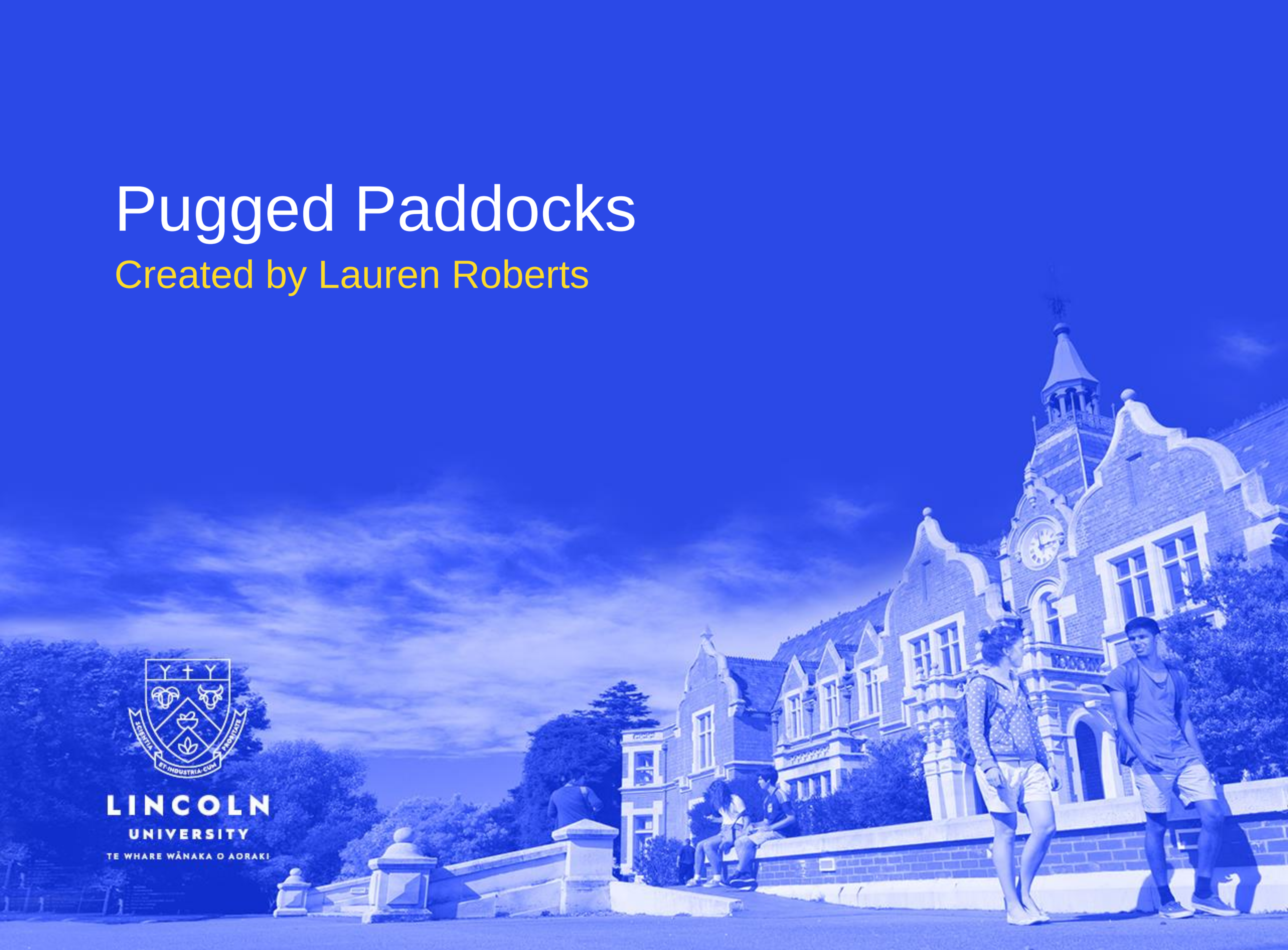
Cows



Sheep

Pugged Paddocks

Created by Lauren Roberts



Compaction of the ground commonly occurs through stock grazing or heavy machinery on moist pastures. It is difficult to observe as it occurs in in the subsurface soil (5–10 cm). So, an awareness of how pasture growth and paddock conditions (drainage) change over time is a good indicator if the paddock is becoming compacted.

*A **compacted** soil (left) and a **non-compacted** soil (right). (Photos John Drewry)*

When paddocks are saturated **pugging** is more likely to occur which results in the destruction of the soil structure and pasture plants. It also creates areas where weeds take advantage of the bare ground to grow and invade your paddocks.

Pasture showing the effects of pugging on the right *(Photo Nadia Laubscher).*

How bad is the pugging?

Figure 1. Light pugging

Figure 2. Light pugging

Figure 3. Medium pugging

Figure 4. Medium pugging

Figure 5. Heavy/severe pugging

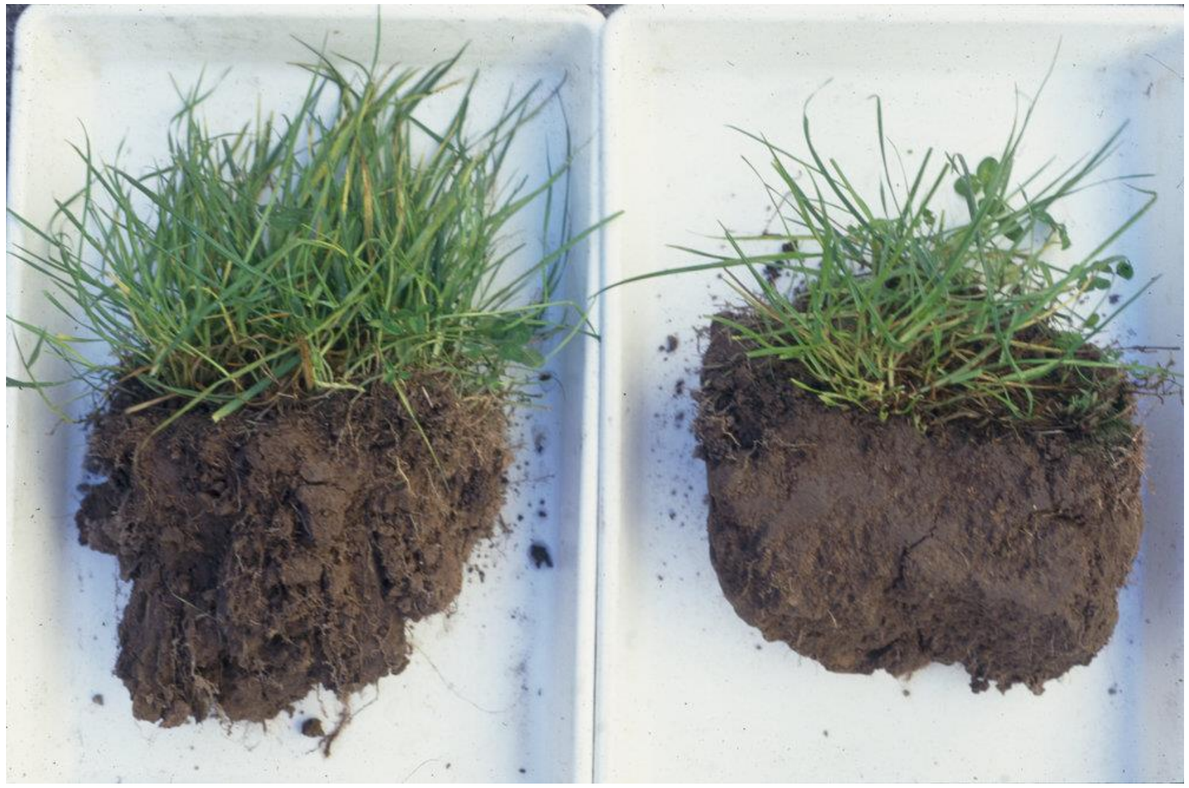
Figure 6. Heavy/severe pugging

https://vgls.sdp.sirsidynix.net.au/client/search/asset/1017146

	Looks like…	Treatment
Category 1: Severe pugging	Mud with little or no pasture growing. 	Sub-soiling or ripping followed by cultivation. Soil needs to be dry.
Category 2: Medium Pugging	Soil surface rough but not churned up. Plant density is low, gaps between plants. 	May need to roll the ground before direct drilling seed to improve the accuracy of seed depth placement.
Category 3: Light Pugging	Reduced plant growth but a good quantity/ number of plants are in the paddock. 	Roll and use urea (nitrogen fertiliser) to encourage pasture growth.

Farm Management Considerations

- Although compaction and pugging are undesirable, the risk of it occurring must be weighed up against maintaining pasture quality through grazing.
- There are areas of the paddock where compaction and pugging are more likely to occur, and management practices like break fencing and feeding out can also change what areas are affected by changing stock behaviour.
- A lactating (milking) cow will visit the water trough 6 times to drink, but most other stock would visit the trough 2-3 times a day if temperatures are not too hot. This is partly due to grass being 75-85% water, so as they eat, they also consume water.



Simulation Models

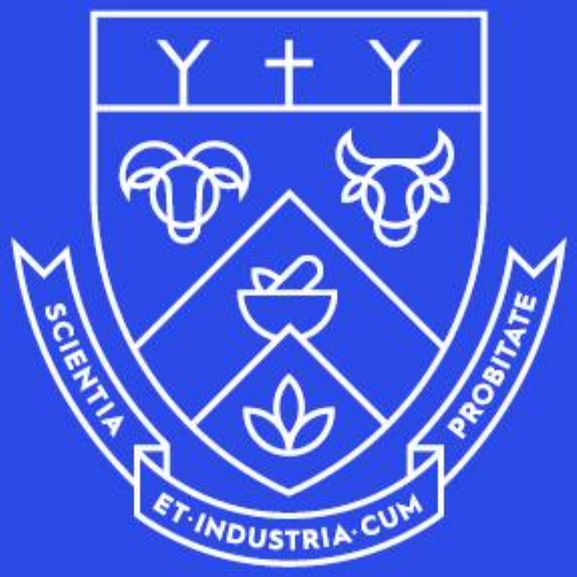
In science, simulation models allow us to change the variables to explore how they influence the outcomes. This can lead to interesting insights and patterns that allow us to plan and manage the land better.

Aim: In this activity you will be investigating where pugging is concentrated.

The variables are…

- location of the water trough
- location of the gate
- The location of break fences
- location of the feed troughs

Read through the instructions to complete the simulation model and answer the questions as you go.



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