Student Activities
Year 7-8

Design and Technologies
Geography

Sustainable Food and Fibre Production

Supporting students to learn about Australian agriculture's role in sustainability

Lesson 5
Winning with Water

This resource has been developed by:

Primary Industries Education Foundation Australia | primezone Food and fibre classroom educational resources.

Nutrien Ag Solutions™

Irrigation Techniques

Read the information below to learn about common irrigation techniques used in agriculture.

Irrigation Technique	Description	Advantages	Disadvantages
Flood Irrigation 	Flood irrigation involves flooding the entire field with water and allowing it to soak into the soil.	• Simple and inexpensive. • Suitable for a wide range of crops and soil types. • Can help to distribute nutrients in the soil.	• Water usage may be inefficient as water can evaporate or run off fields. • Uneven distribution of water, leading to waterlogging in some areas and dry spots in others. • Increased risk of soil erosion and nutrient runoff into waterways.
Drip Irrigation 	Drip irrigation sends water directly to the base of plants through a network of hoses or tubes with small holes/ emitters for the water to "drip" out of.	• Highly efficient water usage, minimises water loss through evaporation and runoff. • Precise water delivery to plant roots promotes healthier growth and higher yields. • Can be automated and controlled to deliver water at optimal times, reducing labour requirements.	• Initial installation costs can be high due to the infrastructure/equipment required. • Requires regular maintenance to prevent clogging of holes/ emitters to ensure even water distribution. • Vulnerable to damage from pests, rodents, and physical disturbances.
Pivot Irrigation 	Pivot irrigation involves large wheeled structures with sprinklers that rotate around a central pivot point, watering crops in a circular pattern.	• Efficient water usage with minimal evaporation. • Suitable for large-scale agriculture, covering large areas with less equipment and labour requirements. • Can adapt to irregularly shaped fields and hilly terrain.	• High initial investment for equipment and infrastructure. • Limited flexibility in crop selection and field layout due to the circular pattern of irrigation. • Energy-intensive operation, especially if powered by fossil fuels.
Central Irrigation 	Central irrigation systems distribute water from a central source through channels or pipes to multiple fields.	• Efficient water distribution, providing even coverage to all fields. • Can be customised to suit different crop types and field sizes. • Allows for the use of automation technology for precise water management.	• Requires significant infrastructure investment for construction and maintenance. • Vulnerable to leaks and pipe failures, leading to water loss and potential damage to crops. • Dependent on a single water source, which may be subject to availability and government constraints.

After modelling the irrigation techniques in the table above, record your responses to the reflection questions in the spaces below.

1. What are the differences between flood irrigation and drip irrigation?

2. How does the design of a pivot irrigation system allow water to be spread over a large area?

3. In what type of climate would drip irrigation work well?
   How does it address the challenges posed by water scarcity?

4. What are the advantages of central irrigation compared to other methods such as flood or drip irrigation?

5. Consider the economic factors (cost) involved in selecting an irrigation method for a farming operation. How might the initial investment and long-term maintenance costs differ between flood, drip, and pivot irrigation systems?

6. How do modern technologies enhance the efficiency and precision of irrigation practices?

7. Which method do you think is more sustainable? Explain your answer.

Fieldwork Experiment on Infiltration

When considering irrigation for farming in Australia, the type and depth of soil must be taken into account. The composition of the soil affects water drainage and retention capabilities. For example, sandy soils drain quickly but retain less moisture, requiring more frequent irrigation, whereas clay soils retain water for longer periods but may have poor drainage, increasing the risk of waterlogging. The depth of the soil is also crucial. Shallow soils have less capacity to hold moisture, limiting root growth and affecting crop yields. Understanding the soil type helps select the appropriate irrigation method to optimise water use efficiency and reduce costs.

Crop type is another vital consideration, as different crops have varying water needs to achieve optimal yields. For example, crops like rice require flooded irrigation, while others like wheat and barley need moderate irrigation. The season also impacts irrigation requirements, with summer often demanding more water due to higher evaporation rates. The availability of water sources, such as rivers, aquifers, or dams is critical, especially in regions where water is scarce. Cost factors, including installation, maintenance, and water pricing, must also be weighed against the expected yield benefits. Farmers must comply with legal requirements regarding water usage rights and environmental regulations which can affect the amount and timing of irrigation.

Infiltration is the movement of water into a soil profile. The rate at which infiltration occurs is controlled by the properties of the soil, the level of soil saturation when rainfall or irrigation starts, and by the ways in which humans have modified the landscape. Infiltration rates control runoff rates and soil erosion, which are important as these processes influence the quality and quantity of our water resources. An infiltration ring or ring infiltrometer is used to measure infiltration.

Infiltration Fieldwork Experiment

Method:

1. Prepare an infiltration ring using a tin can with the two ends and label removed. On the outside, mark a line around the can 2 cm from the 'bottom'. On the inside, mark a line 5 cm from the 'top'.
2. Place the can on the soil surface of a sample site 1.
3. Use a piece of wood and a mallet to gently tap the can into the ground up to the marked 2 cm line.
4. Pour water into the can up to the top.
5. Start the stopwatch immediately and time how long it takes for the water level to drop from the top to the 5 cm mark inside the can.
6. Record the time taken in seconds for the water level to drop to the 5 cm mark in the results table under trial 1.
7. Repeat steps 2-7 at the same sample site but at least 50 cm away from the first trial and record the time taken in the table under trial 2.
8. Calculate an average for the two trials at this site.
9. Repeat steps 2-8 for sites 2 and 3.

Infiltration Fieldwork Experiment

Results:

	Time taken for water to reach 5 cm mark inside infiltration ring (seconds)		
	Trial 1	Trial 2	Average
Site 1			
Site 2			
Site 3			

Discussion:

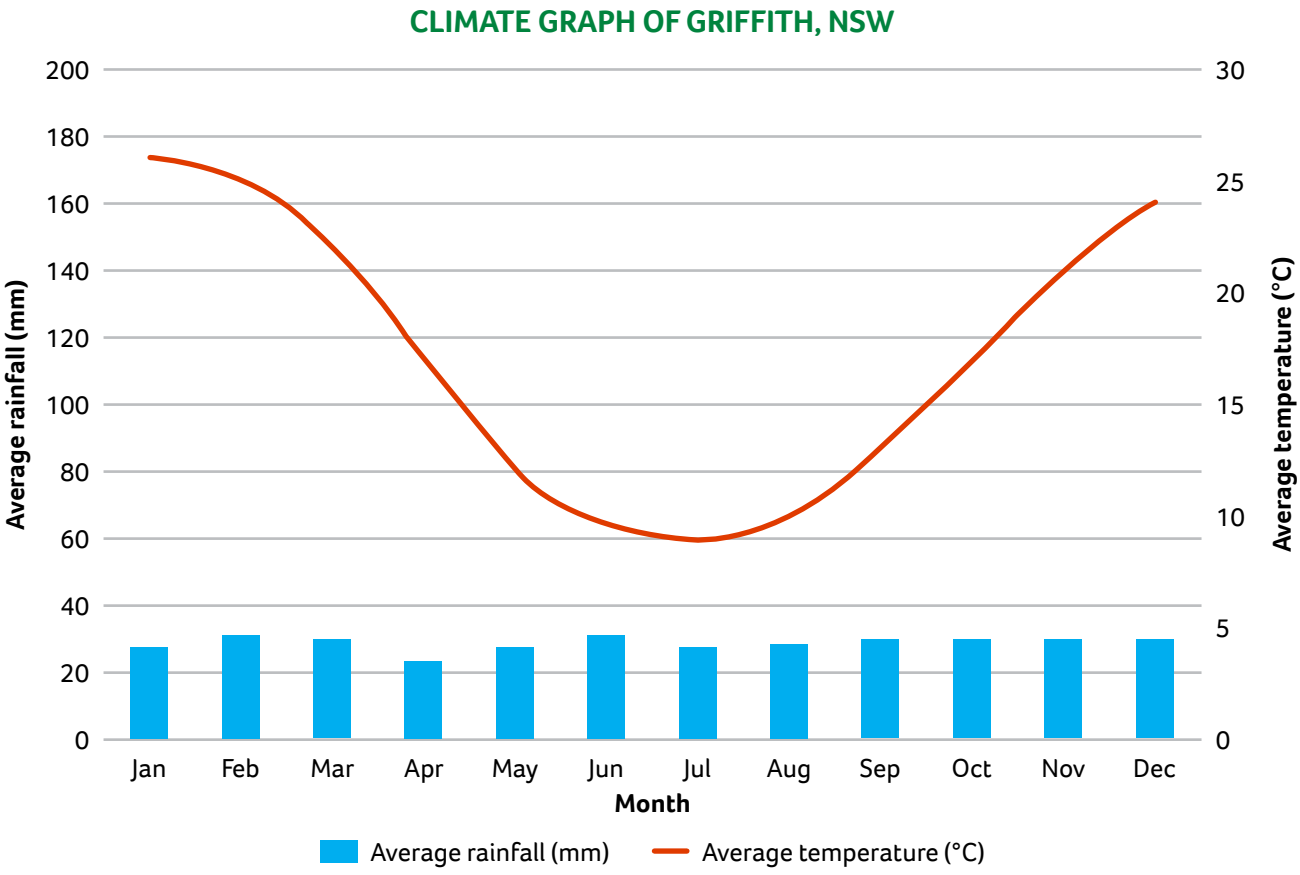
1. Outline your results from Trial 1 and Trial 2. How does the speed of water infiltration differ across each site? What might this tell us about the type of soil at each site?

2. Which irrigation technique would you suggest using for your school environment if it were an operational farm? Explain your choice.

Climate Graph of Griffith, NSW

Refer to the climate graph of Griffith below to answer the following questions.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average rainfall (mm)	28	31	30	24	28	31	28	29	30	30	30	30
Average temperature (°C)	26	25	22	17	12	10	9	10	13	17	21	24



1. How is temperature shown on a climate graph?

2. What unit of measurement is used for measuring temperature on the climate graph?

3. How is precipitation shown on a climate graph?

4. What unit of measurement is used to show precipitation?

5. Is there an even distribution of precipitation throughout the year?

6. Which month had the hottest temperature?

7. Which months had the highest rainfall?

8. Calculate the total annual precipitation.