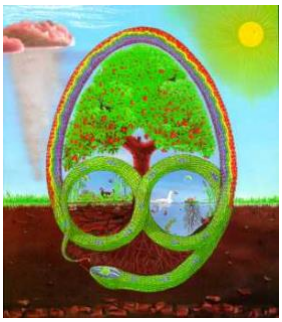
Sustainable Biomes: A Geographical Inquiry

Case study: Permaculture @ Brewongle EEC



You will investigate the permaculture elements and soil health at Brewongle EEC to discover effectiveness for growing food, sustainability and use of Permaculture in food security.

- **Use a map, compass and iBook to find and investigate the permaculture elements @ Brewongle EEC**
- **Use field equipment to collect data on soil health and differences between native soil at Brewongle and enhanced soil in our Food Forest**

Key Inquiry Questions

How do people use and alter biomes to produce food?

What are some of the factors affecting food production?

Outcomes

GE5-1 explains the diverse features and characteristics of a range of places and environments
GE5-2 explains processes and influences that form and transform places and environments
GE5-3 analyses the effect of interactions and connections between people, places and environments
GE5-5 assesses management strategies for places and environments for their sustainability
GE5-7 acquires and processes geographical information by selecting and using appropriate and relevant geographical tools for inquiry
GE5-8 communicates geographical information to a range of audiences using a variety of strategies

Student Name: _____

Pre-Visit Activity One

You will need to use the internet, and the Brewongle Excursion Webpage to answer the following. https://brewongle.wordpress.com/student-learning/secondary/stage-5/stage-5-geography-sustainable-biomes-excursion-page/

Describe each of the following:

Biosphere: _____

Atmosphere: _____

Lithosphere: _____

Hydrosphere: _____

What is a Biome? _____

_____

Utilising the Google Map provided on the Brewongle excursion webpage, explain the Biome/s that surround Brewongle EEC?

_____

_____

_____

_____

_____

Download or view the Brewongle Permaculture Plan to answer the following:

What is Permaculture (Pg 1)?

_____

_____

_____

Identify the problems and elements to be placed in the following zones (Pg 3)

Zone 0:

Problems:_____

Elements: _____

Zone 2:

Problems:_____

Elements: _____

Use the Site and Sector analysis map (pg 5) to answer the following:

What is the orientation and maximum slope angle at Brewongle EEC?

_____

Why are we interested in knowing this?

_____

_____

What is the benefit of understanding the Sun Arc (pg 6) to locating our food gardens?

_____

_____

Use the Climate figures for Brewongle EEC (Pg 7 & 8) to answer the following:

Wettest month: _____ Driest Month: _____

Hottest month: _____ Coldest Month: _____

What is our expected average temp rise by 2030? _____

Use the CSIRO Climate Analogues Explorer at
https://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-analogues/analogues-explorer/

What is the expected temperature increase for your suburb by 2030? _____

Which towns will your local climate be more like in 2030 (These are the analogous towns)

_____

_____

Pre-Visit Activity Two: Geographical Questions

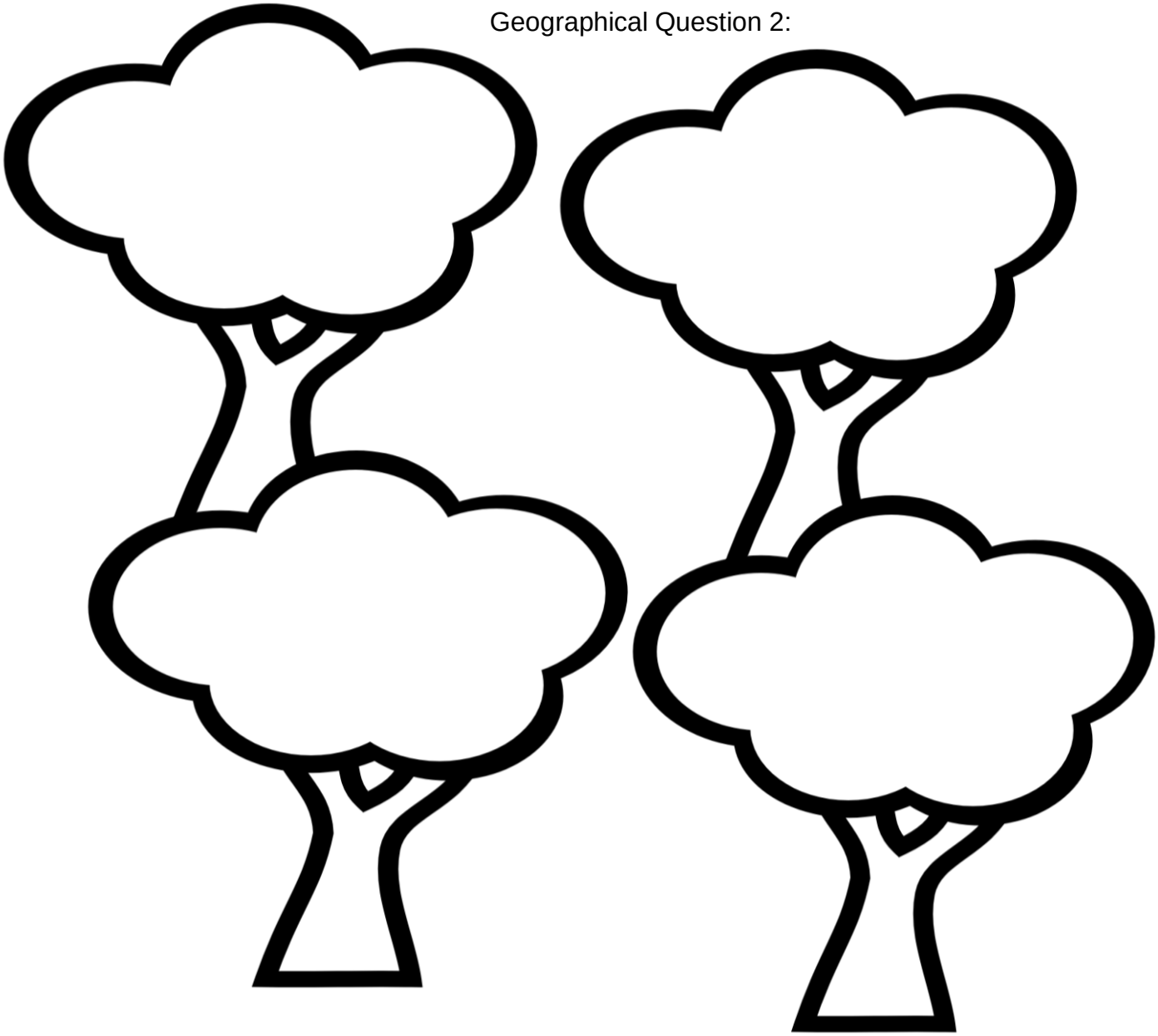
Geographical questions are questions which help you identify the information you need to answer the inquiry questions. Your inquiry questions are written on Page 1.

Brainstorm: What are some geographical questions you might ask for this Inquiry?

Example: What is the current type of native vegetation growing at Brewongle EEC?

Geographical Question 1:

Geographical Question 2:



Geographical Question 3:

Geographical Question 4:

Pre-Visit Activity Three: Planning Your Inquiry

Answer the following questions for each of the Geographical Questions you came up with last lesson:

1. What information is needed to answer this geographical question and where can you find that information?

2. What are the geographical tools you need to access the information?

3. The following worksheet will help you record information. Think of some other ways you could record information on your field trip.

Excursion Activity One: iPad/Mapping Inquiry into Permaculture Elements

Use your iPad and compass to navigate to each element listed below. Create a map of the location of each element and answer the inquiry questions using the iBook provided on the iPad.

Element Name	What is where? Describe location	Why is it there?	Why do we care? (what is the importance)
Rainwater management. (Water tanks attached to buildings)			
Stormwater Management. (Swales and drainage lines).			
Waste Water Treatment			
Food Forest			
Vegetable/ herb garden beds.			
Bush Tucker Garden			
Solar Cells			

Sketch a map of permaculture elements @ Brewongle EEC. Use BOLTS (border, orientation, legend, title and scale). Include element name and other major features (eg buildings etc).

Title: _____

Legend:

How do permaculture elements impact the natural environment?

_____

_____

Excursion Activity Two: Soil Assessment

SOIL HEALTH CARD RESULTS SHEET

Date _____

Soil Type – "Sandy Loam" Days since 20mm rain _____ Soil Moisture: Dry / Moist / Water Logged

	RESULT TEST	POOR 1 --- 2 --- 3	FAIR 4 --- 5 --- 6	GOOD 7 --- 8 --- 9	TEST SCORES Forest	 Garden
1	**GROUND COVER (ground plants or mulch)**	Less than 50% ground cover	50% to 75% ground cover	More than 75% ground cover		
2	**LEAF COLOUR**	Stunted plants, leaf discolouration	Some variation in growth and colour	Appropriate leaf colour and uniform plant growth		
3	**ROOT DEVELOPMENT**	Few fine roots only found near the surface	Some fine roots mostly near the surface	Many fine roots throughout		
4	**DIVERSITY OF MACROLIFE**	Fewer than 2 types of soil animals	2 to 5 types of soil animals	More than 5 types of soil animals		
5	**EARTHWORMS**	0 - 3	4 - 6	More than 6		
6	**SOIL TEMPERATURE**					
7	**SOIL STRUCTURE**	Mostly in clods or with a surface crust, few crumbs	Some clods but also many 10mm crumbs	Friable, readily breaks into 10mm crumbs		
8	**SOIL pH 5cm depth**	pH 5 or lower or pH 9 or higher	pH 5.5	pH 6 - 8		
9	**SOIL WATER STATUS (Demo)**	A higher rate of infiltration will mean faster absorption, less run off and erosion				
10	**AGGREGATE STABILITY (Demo) 10cm depth**	Aggregate broke apart in less than a minute	Aggregate remained intact after one minute	Aggregate remained intact after swirling		

In what areas did the two sites differ?

_____

_____

The Soil Tests

1. Ground Cover
Throw your coat hanger quadrant onto the ground at random and estimate the proportion of plant or mulch cover within the frame. Both ground plants and mulch contribute organic matter to the soil that will feed soil animals and microbes. Roots of ground plants also help maintain good soil structure.

2. Leaf Colour
Examining your crop, trees or pasture at the soil test site may reveal plant health problems not identified by the completed soil tests. In crops or orchards examine fully formed leaves about four leaves back from the growth tip. (Young leaves at the tip are often naturally pale and red leaves, while old leaves nearer the stem may show mottling that is normal)

3. Root Development
Observe (but don't disturb) the 20x20cm sample of soil provided. Examine the distribution of plant roots and complete your results card. The distribution of fine roots will show whether soil structure is restricting the plants' access to nutrients.

4 & 5. Diversity of macrolife (soil life) and worms
Using the soil sample provided in your tray, examine the surface for soil animals and then carefully sift through the litter. Note how many different varieties of soil animals you see such as ants, beetles, spiders, millipedes, mites etc. It is the variety that is important, not the numbers – a column of ants counts as one variety.

6. Soil Temperature
Place the soil thermometer carefully into soil as far is will go and read the temperature after minute.

7. Soil Structure
Examine the size and arrangement of the soil aggregates or 'crumbs' (discrete clumps of soil particles). Under firm finger pressure soil should be friable which means breaking into crumbs varying in size up to about 10mm. There should also be evidence of root penetration throughout. Poor structure may be seen either as overly solid soil (hard crumbs, soil layers or clods) or as very loose soil (absence of even small crumbs, eg. in beach sand). Good structure results in easy passage of air and water, an ability to hold water and superior resistance to erosion.

8. Soil pH (Acidity)
Take two small samples of soil from your sample. Test each sample for pH, following the instructions included in the kit. Acidity has a strong effect on the ability of plants to take up soil nutrients as well as upon the wellbeing of soil organisms.

9. Aggregate Stability (Demonstration)
Select three or four pea sized soil aggregates (crumbs) from about 10cm depth, avoiding small stones. Drop the aggregates into 125ml water in the small wide mouthed jar and allow to stand for one minute. Observe if the aggregates break apart or stay intact. If they are intact after one minute, gently swirl the bottle several times and observe again. If they are still intact, swirl the bottle vigorously and check again. The aggregates of a healthy soil are normally more stable than those of a less healthy one. Poor aggregate stability is associated with greater susceptibility to erosion.

10. Soil Water Status (Demonstration)
Push the infiltrometer ring 2cm into the soil, avoiding cracks and other holes in the ground. The ring should be nearly level for accurate testing. Use your finger to gently firm the soil around the inside edge of the ring to prevent leakage of water here. Carefully pour 500ml of water into the ring and note the time. Stop timing when the surface is just glistening. A higher rate of infiltration will mean your soil will absorb rainfall more quickly, resulting in less run off and erosion.

Explain the reasons for the differences you found:

Provide some recommendations on how to maintain soil health at Brewongle EEC in the food forest.

Compare contrast and explain the differences in productivity of the soil between the forest and the permaculture garden at Brewongle.

Use the data you have collected in the field to answer at least 2 of your geographical questions.

Excursion Activity Three: An original Australian biome

Find 4 Aboriginal Bush Tucker plants and fill out the following table for each of them

Drawing of plant *(using the actual plant or accompanying information sheet).*	Region of Australian found in	Food Uses	Other Uses	Toxicity

Why do we not see more Australian native plants in use for food in Australia?

_____

_____

Why would native food plants be a sustainable option for agriculture in Australia?

_____

_____

What were some Aboriginal methods of farming the Australian landscape?

_____

_____

Draw some firesticks.

Why was Aboriginal agriculture not acknowledged by British settlers?

_____

_____

Post-Visit Activity One: Processing the Data

Below is a list of Geographical Tools used to collate, review and evaluate data and information. Choose at least 5 of these tools to analyse and present your data in a Word Document.

The information you create here will be used in your documentary assessment task.

- Using ICT software, use a **topographic map** or **satellite image** as a base map, locate Brewongle and identify surrounding biomes as well as natural and man-made features.
- Collate data from your field study into a **table** to summarise your findings.
- Create **flowcharts** to demonstrate your understanding of the ways humans have altered the natural environment at Brewongle EEC to produce food.
- Assemble and annotate **photographs** to provide a visual representation of the site. Analyse and label interconnections.
- Develop **consequences charts** to explain human impacts (positive and negative). Show the impacts on Google Tour Builder. Use photos taken on the day to match parts of the tracks we walked.
- Use a **T-chart** to represent data on advantages and disadvantages of permaculture in terms of worldwide food production.
- Create a **mind map** to assess management strategies for local biomes that account for input from various stakeholders such as Traditional Owners, National Parks Rangers, local residents and local farmers etc
- Construct a **flow chart** or **concept map** to explain the role of government, and other major stakeholders in sustainably managing biomes.

Assessment Task: Communicating Geographical Information

Work in small groups to develop a 5-6 minute documentary on the results of your field study. Include answers to the inquiry questions on page 1. Your documentary should include:

- A definition of a biome and the type/s of biome evident at Brewongle.
- A clear description of the permaculture design plan of Brewongle EEC and the elements implemented
- An evaluation on how the natural biome has been altered by Brewongle EEC to produce food and introduce permaculture elements to the landscape. Is it sustainable? Effective?
- Tools to support your information, such as maps, satellite images, graphs, statistics, flowcharts, labelled photographs, diagrams, illustrations/sketches and other labelled visual representations;
- A description of the role of soil health in producing food.
- A description and justification of a course of action to decrease the impact of changes to the natural environment around Brewongle EEC.