Cumberland State Forest
Geography Year 11
Lesson Plan

Syllabus Links

Preliminary course - Biophysical Interactions
Focus: a geographical investigation of biophysical processes and how an understanding of these processes contributes to sustainable management.

Outcomes
The student:

- P2 describes the interactions between the four components which define the biophysical environment
- P3 explains how a specific environment functions in terms of biophysical factors
- P6 identifies the vocational relevance of a geographical perspective
- P7 formulates a plan for active geographical inquiry
- P8 selects, organises and analyses relevant geographical information from a variety of sources
- P9 uses maps, graphs and statistics, photographs and fieldwork to conduct geographical inquiries

Content

Students learn to:
Investigate and communicate geographically by:

- asking and addressing geographical questions such as
    - what are the biophysical interactions which occur between components of the biophysical environment?
    - what are the effects of human impacts on the functioning of the hydrosphere?

Use geographical skills and tools such as:

- identifying, collecting and recording data about erosion and deposition from primary sources

Students learn about:

The biophysical environment

- the nature and functioning of the four components: the atmosphere, hydrosphere, lithosphere and biosphere in a specific biophysical environment including:
    - atmospheric processes, climatic components, climatic variation
    - parent material, slope processes, weathering, mass movements, erosion, transport and deposition, and the fluvial, aeolian and/or coastal geomorphological processes
    - the variety and distribution of plants and animals and soil formation
- the interactions between, and the human impacts on, the functioning of the atmosphere, hydrosphere, lithosphere and biosphere.

Biophysical processes and issues

A case study investigating ONE issue in ONE of the biophysical components, to illustrate how an understanding of biophysical processes contributes to sustainable management in the environment. The investigation will include:

- identification and explanation of the key biophysical processes which relate to the issue
- scale of operation
- interactions with other components of the biophysical environment
- the sensitivity of the biophysical environment to change
- the importance of understanding key biophysical processes for effective management

Activity/Lesson

Introductory talk
Give context and history about Cumberland state forest – has been logged in the past and is, not totally natural. Explain that the old logged sections are reasonably close to a natural composition, but the recently logged areas, and arboretum are not.

Split students into groups of 4 or 5. At each stopping location you will need to rotate the groups between the equipment to get all of the tests done in time.

Activity 1
Talk about management issues in the forest e.g. fire, feral animals, weeds, erosion.
Explain how the biophysical environment of the forest is sensitive to change, and change can lead to issues such as tree dieback and myrtle rust.

> Myrtle rust (*Puccinia psidii s.l.*) is a newly described fungus that is closely related to the Eucalyptus/Guava rusts. These rusts are serious pathogens which affect plants belonging to the family Myrtaceae including Australian natives like bottle brush (*Callistemon* spp.), tea tree (*Melaleuca* spp.) and eucalypts (*Eucalyptus* spp.).
>
> Myrtle rust is distinctive in that it produces masses of powdery bright yellow or orange-yellow spores on infected plant parts. It infects leaves of susceptible plants producing spore-filled lesions on young actively growing leaves, shoots, flower buds and fruits. Leaves may become buckled or twisted and may die as a result of infection. Sometimes these infected spots are surrounded by a purple ring. Older lesions may contain dark brown spores. **Infection on highly susceptible plants may result in plant death.**

There are three main stopping points along the track. Site 1 is just after marker 3, in the area with log seating. Site 2 is at the 1993 regrowth area (marker 4) and Site 3 is at the Arboretum.

Activity 2
At site 1, students are to:

- Describe the creek
- Do a field sketch of the creek noting hydrologic features such as drainage, erosion, pools etc. OR
- Take photos of hydrologic features

Activity 3

At each of the sites students are to:

- Measure temperature and humidity
- Measure light (using a light meter or canopy cover)
- Describe the canopy and assess tree dieback
- Describe the undergrowth
- Describe and estimate the % of ground cover
- Name the main plant species
- Look and listen for animals, birds and insects, noting the differences between the sites. Students may look for tree scratchings, scat, nests etc.
- Note evidence of rocks and rock types e.g. sandstone, shale
- Test soil pH
- Texture a soil sample (see worksheet for description)
- Measure soil moisture
- Conduct the ASWAT test (testing for salts) (see worksheet for description)
- Do a soil colour rubbing
- Take photos of the three different areas and their key features

Activity 4

Back at the visitors centre, discuss with students the importance of understanding the forest environment (e.g. monitoring, evaluation, research) so it can managed effectively. Give examples

Timing

- Introductory talk – 10 minutes
- Site 1 – 20 minutes
- Site 2 – 20 minutes
- Site 3 – 20 minutes
- Plus 30 minutes walking time
- Closing discussion – 15 minutes

Resources and Equipment

- Worksheets
- Students need to bring clipboards and pencils.
- Lux light meter
- Shovel/hand trowel for soil
- Bucket of water to texture soil and wash hands
- pH test kits
- Containers for water sampling
- Soil moisture meter
- Petri dishes
- Deionised water or rainwater for the ASWAT test
- Camera or camera phones

How to texture a soil

1. Take a handful of soil. Don't take the soil directly from the surface because you'll get mostly plant roots. Dig a small hole and take the soil from about 10cm depth. Remove all pebbles and stones.
2. Add water slowly until you can make a wet ball with the soil – a 'bolus'. Be careful not to add too much water, as it's very difficult to texture a soil that is saturated.
3. If you can't make a ball, and the soil feels like sand, you've probably got a sand.
4. Keep working the soil around in your hand. Using your thumb and forefinger, try and make a 'ribbon' out of the soil
5. Use the flow chart and table to work out your soil texture.

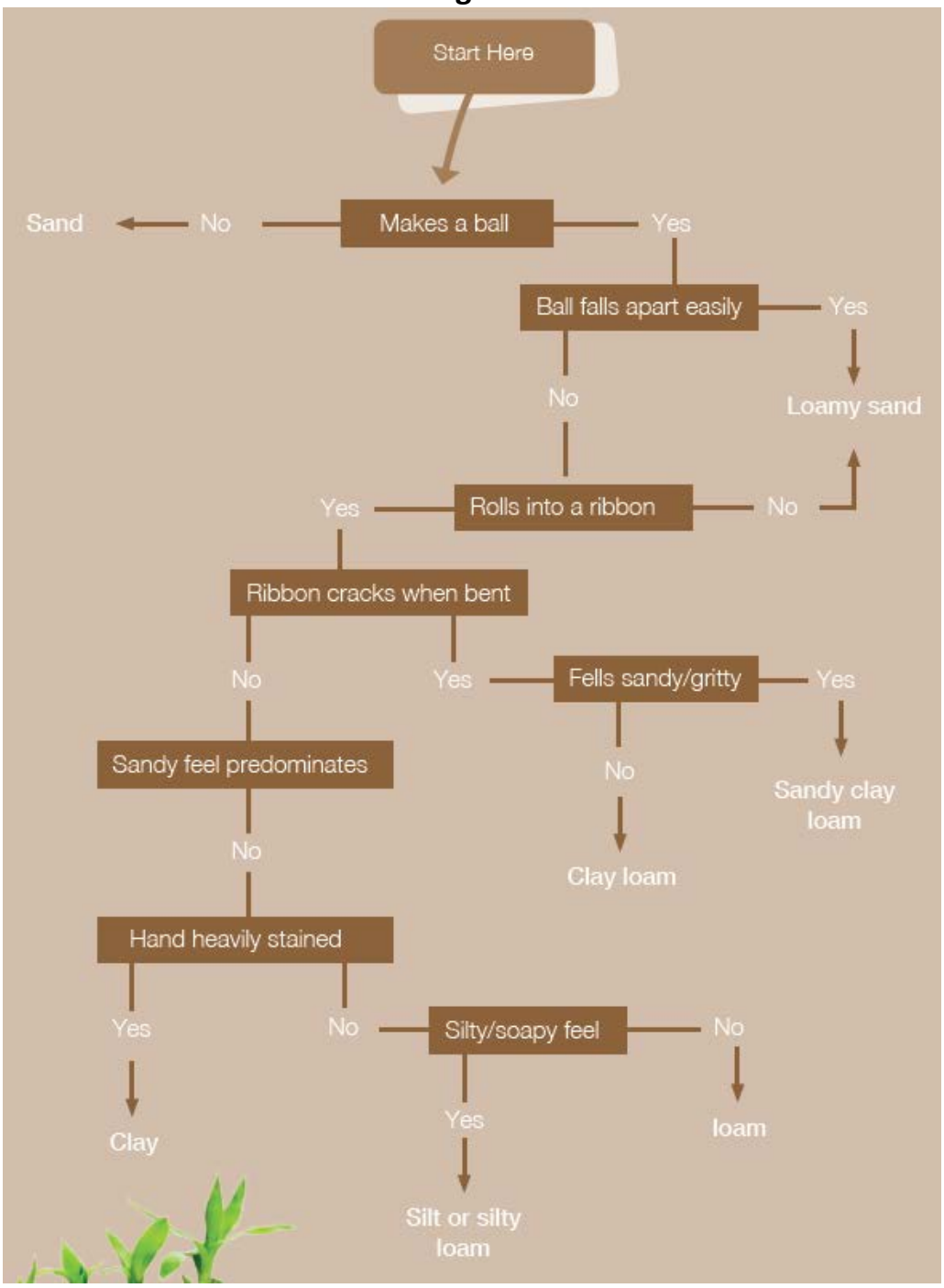
Slowly add water to soil

Work soil in hand to make a 'bolus'

Soil Texture	Description	Ribbon Length
Sand	Sand granules up to 2 mm in size. Sand	Sand granules up to 2 mm in size. Sand
Loam	Approximately 40 % sand, 40 % silt and 20% clay. When worked into a bolus, a loam is smooth and spongy in the hand, and very coherent.	Approximately 40 % sand, 40 % silt and 20
Clay	A clay will become more plastic (i.e. more difficult to squash) when worked in the hand. Clay soil often stains your hand	> 75 mm

Note: a soil with higher organic matter will feel a bit 'spongy', like a loam.

Flow chart to use when texturing a soil



The Aggregate Stability in Water (ASWAT) Test

You can get an idea of how salty a soil is by using the ASWAT (Aggregate Stability in WATer) test. You will need:

- Air dry aggregates of soil (called peds)
- Rainwater (or distilled water if you don't have any rainwater)
- A Petri dish, or shallow clear container

Method

1. Fill the container with 1 – 2 cm of rain water
2. Carefully place 3 or 4 soil aggregates into the dish, evenly spaced around the edges
3. Check them immediately and record if the soil has slaked or dispersed
4. After 10 minutes, check the aggregates again
5. Leave the aggregates undisturbed for 2 hours, then check (you won't have enough time for this step at the State Forest, but if doing the test again, you should include this step)

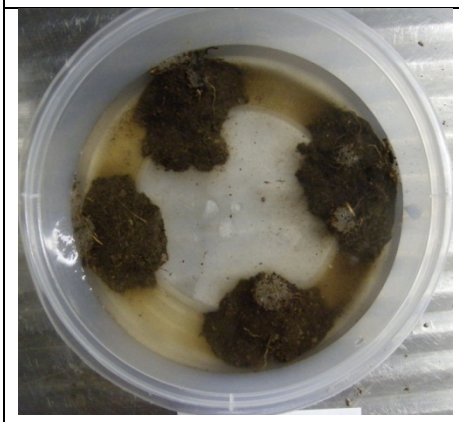
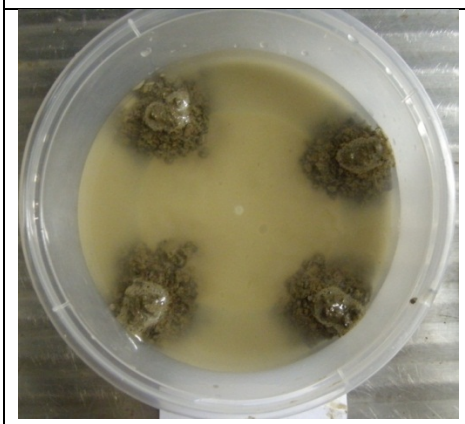
If the water around the aggregates becomes 'cloudy', then dispersion has occurred. If the aggregates have only 'crumbled', then only slaking has occurred. You can have both slaking and dispersion at the same time.

The more a soil disperses, the more salt (sodium) it contains.

A soil that slakes, has a weak structure. This means that if the soil was cleared, it would be more likely to erode. Soil slakes because the water enters pores in the ped and forces it apart. A slaked soil also indicates low organic matter content. The more organic matter a soil has, the stronger its structure.

If the aggregates remain intact you have a soil with a good structure, and enough organic matter to hold it together. This is good for plant growth, as the soil will retain its structure during rainfall or irrigation.

ASWAT Test Descriptor Photos

	No slaking or dispersion
	Slaking, minimal dispersion
	Slaking and dispersion. Note how the water around the soils is very cloudy – this is dispersion

Cumberland State Forest Worksheet
Year 11 Geography

Name: _____

1. Describe using examples how the forest environment is sensitive to change._____

_____

_____

_____

_____

_____

_____

2. At sites 1 and 2, complete a field sketch noting hydrologic features such as drainage, erosion, pools etc. Write a description of each site

Site 1 Creek – Field sketch	**Description**
Site 2 Creek – Field sketch	**Description**

3. Complete the following table of information for each site. You should also take photos of the key features of each site.

	Site 1	Site 2	Site 3
Canopy cover (%)			
Canopy cover Description Is dieback occurring?			
Ground cover (%)			
Ground cover description			
Undergrowth description			
Main plant species			
Look & listen for any plants, animals and birds. Write down what you see and hear (e.g. scat, tree scratchings, nests)			
Rock types in the area			
Soil pH			
Soil texture (sand, loam, clay, or something in between?)			
Soil Moisture (%)			
Soil structure: Slaking? Dispersion?			
Soil colour rubbing (a 'blacker' soil will contain more organic matter)			

4. What are the main differences between the sites? Explain these differences in terms of biophysical processes.

5. Why is it important to understand the biophysical processes in a forest? Explain how Forests NSW builds its knowledge of biophysical processes.

How to texture a soil

6. Take a handful of soil. Don't take the soil directly from the surface because you'll get mostly plant roots. Dig a small hole and take the soil from about 10cm depth. Remove all pebbles and stones.
7. Add water slowly until you can make a wet ball with the soil – a 'bolus'. Be careful not to add too much water, as it's very difficult to texture a soil that is saturated.
8. If you can't make a ball, and the soil feels like sand, you've probably got a sand.
9. Keep working the soil around in your hand. Using your thumb and forefinger, try and make a 'ribbon' out of the soil
10. Use the flow chart and table to work out your soil texture.

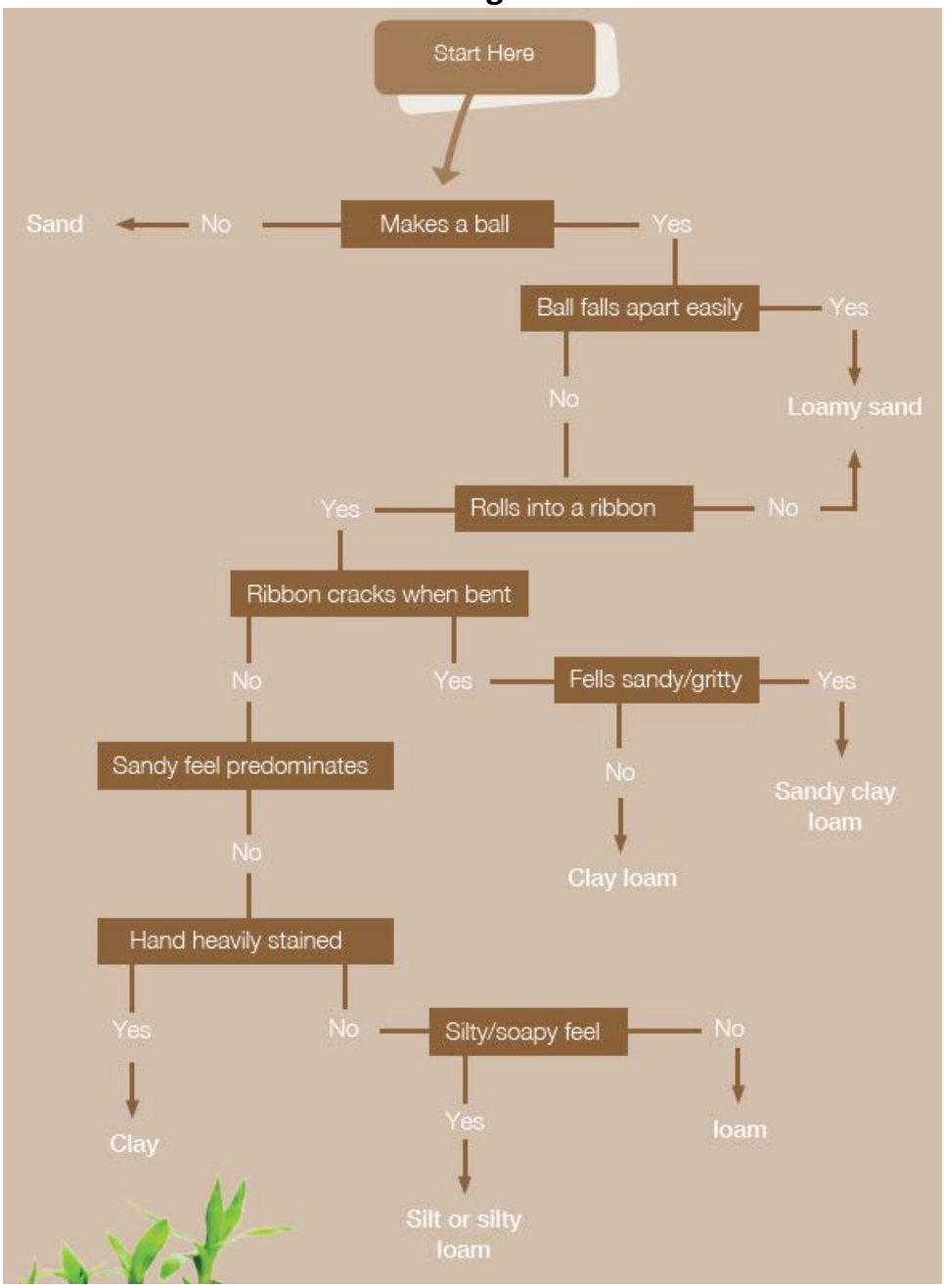
Slowly add water to soil

Work soil in hand to make a 'bolus'

Soil Texture	Description	Ribbon Length
Sand	Sand granules up to 2 mm in size. Sand	Sand granules up to 2 mm in size. Sand
Loam	Approximately 40 % sand, 40 % silt and 20% clay. When worked into a bolus, a loam is smooth and spongy in the hand, and very coherent.	Approximately 40 % sand, 40 % silt and 20
Clay	A clay will become more plastic (i.e. more difficult to squash) when worked in the hand. Clay soil often stains your hand	> 75 mm

Note: a soil with higher organic matter will feel a bit 'spongy', like a loam.

Flow chart to use when texturing a soil



The Aggregate Stability in Water (ASWAT) Test

You can get an idea of how salty a soil is by using the ASWAT (Aggregate Stability in WATer) test. You will need:

- Air dry aggregates of soil (called peds)
- Rainwater (or distilled water if you don't have any rainwater)
- A Petri dish, or shallow clear container

Method

6. Fill the container with 1 – 2 cm of rain water
7. Carefully place 3 or 4 soil aggregates into the dish, evenly spaced around the edges
8. Check them immediately and record if the soil has slaked or dispersed
9. After 10 minutes, check the aggregates again
10. Leave the aggregates undisturbed for 2 hours, then check (you won't have enough time for this step at the State Forest, but if doing the test again, you should include this step)

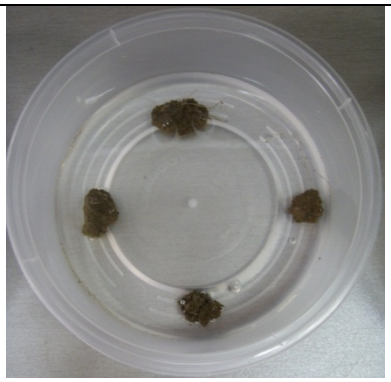
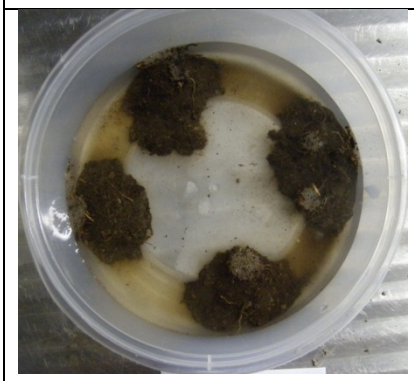
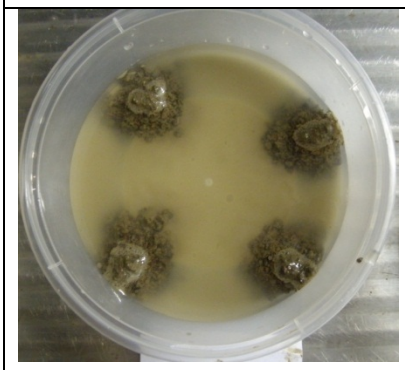
If the water around the aggregates becomes 'cloudy', then dispersion has occurred. If the aggregates have only 'crumbled', then only slaking has occurred. You can have both slaking and dispersion at the same time.

The more a soil disperses, the more salt (sodium) it contains.

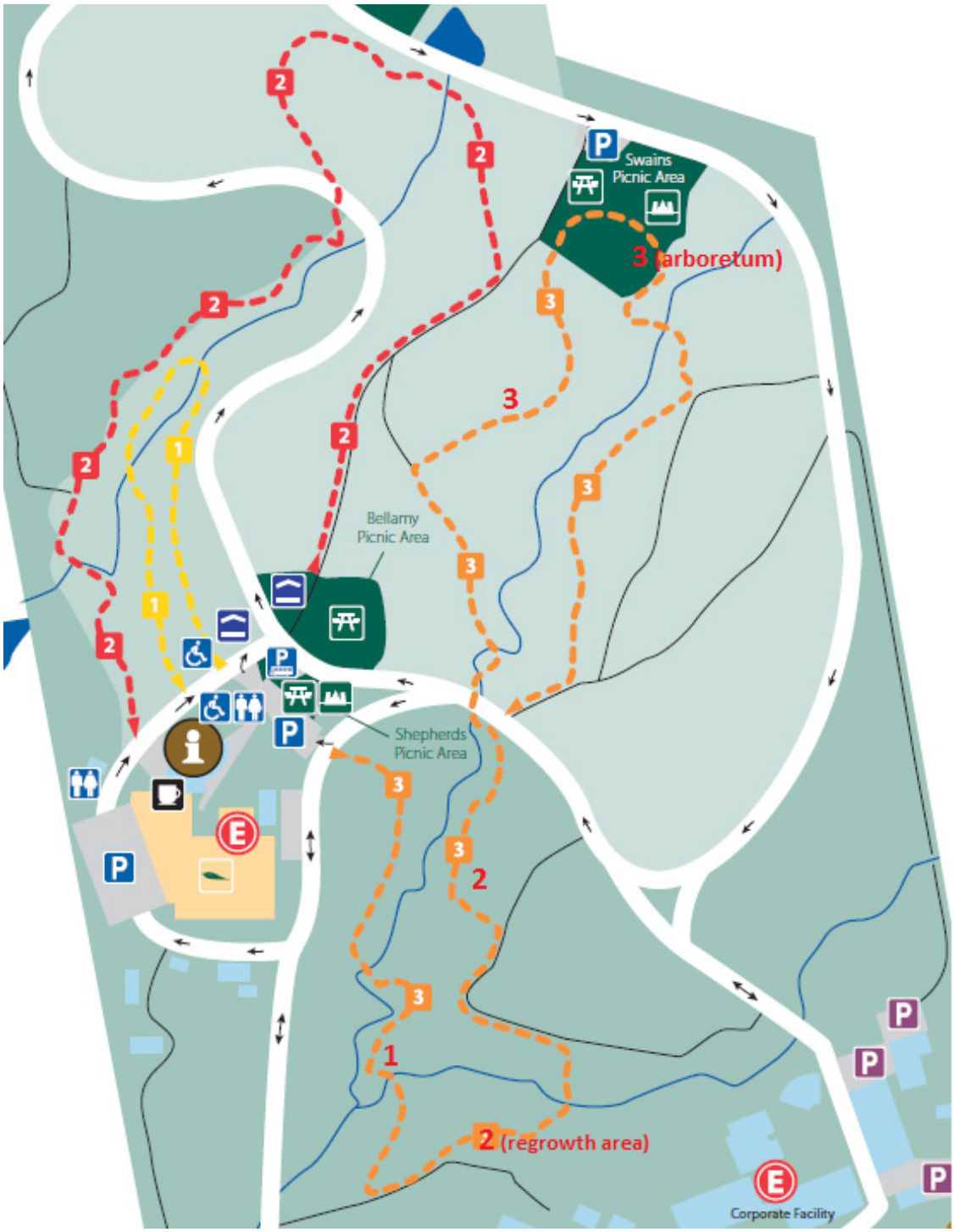
A soil that slakes, has a weak structure. This means that if the soil was cleared, it would be more likely to erode. Soil slakes because the water enters pores in the ped and forces it apart. A slaked soil also indicates low organic matter content. The more organic matter a soil has, the stronger its structure.

If the aggregates remain intact you have a soil with a good structure, and enough organic matter to hold it together. This is good for plant growth, as the soil will retain its structure during rainfall or irrigation.

ASWAT Test Descriptor Photos

	No slaking or dispersion
	Slaking, minimal dispersion
	Slaking and dispersion. Note how the water around the soils is very cloudy – this is dispersion

Cumberland State Forest Map



Forest and Wood Products Australia
Level 4 10-16 Queens St, Melbourne, VIC 3000 • Phone 03 9927 3200 • Email info@forestlearning.edu.au