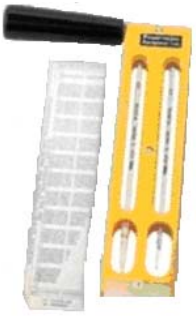
Rumbalara Environmental Education Centre

Guidelines for Geography Field Work

Abiotic Factors

Humidity

Hygrometer (Wet and Dry Thermometer), Whirling psychrometer



A hygrometer measures the relative humidity ie-the amount of moisture in the air compared with what the air *could* hold at that temperature. For example, deserts have characteristically low humidity and rainforests have high humidity. At a relative humidity of 100% the air is saturated.

A hygrometer is made up of two thermometers – a dry bulb and a web bulb thermometer. The wet bulb is encased in a damp cloth.

It works by combining two principles:

- Evaporation of water from the cloth causes cooling
- The evaporation rate depends on humidity.

The more depressed the wet bulb temperature the lower the humidity.

To use a hygrometer:

- Ensure that the dry bulb is dry and the wet bulb is wet.
- Expose both thermometers to air but keep out of direct sunlight.
- Whirling the hygrometer maximises the evaporation by minimising the boundary layer around the wet bulb.

The difference in temperature between the dry bulb and wet bulb is used to calculate the relative humidity of the air. The humidity reading is at the intersection of the dry temp and the temp difference on the table provided.

Light Intensity

Light Meter

Digitech QM1587

Light meters measure in the visible light spectrum. The unit is Lux.
Note that our eyes unconsciously regulate the amount of light entering through the pupil (eg. pupil dilation in low light), so that we perceive a much smaller range of light intensities than is actually available eg for photosynthesis.

- Select the Lux function not fc (foot candles)
- If there is too much light in the lowest range the meter will not read and a higher range should be selected. Always select the lowest range possible.
- Press the MAX button to record the highest reading in a given time period.
- In some situations eg where a canopy produces dappled light, it may be more meaningful to measure and compare light reflected from the ground.

pH (Soil)

The acidity or alkalinity of the soil influences the availability of nutrients to plants. Different plants have different pH range preferences. On the Central Coast most soils are slightly acidic ie pH < 7.

- Take a quarter teaspoon of dry crushed soil.
- Saturate the sample with universal indicator which will cause the soil to change colour depending on pH.
- Sprinkle barium sulphate powder over the surface. This white, neutral powder will absorb the indicator and show the colour change.
- Compare colour with the colour card to find the pH.

Slope (angle)

Clinometer

A clinometer is used to measure the gradient of a slope (steepness). It can also be used to determine the height of trees.

- Hold the clinometer steady at arms length and using the 'sights' aim at a distant point parallel with the slope.
- Pull the trigger to allow the pointer to move. Release the trigger to lock arrow in place.
- Read angle from the protractor.

Tree height is found by measuring the distance from tree trunk base to a point where the angle to the top of the tree is 45^0

Angle	Slope
0 º	Flat
1º - 10º	Gentle
11º - 20º	Moderate
21º - 30º	Quite steep
31º - 40º	Very steep
41º - 70º	Extremely steep
71 º - 100 º	Cliff

Soil Colour

(see attached Fact Sheet)

Colour is an initial guide to soil properties. It can indicate moisture, organic content, minerals such as phosphorous, iron and aluminium.

Colours are best <u>compared</u> by smearing the soil onto a white page eg a cell of your results recording table

Colour

Red	Well drained, medium organic matter, possible iron
Yellow	Moderate drainage, medium organic matter
Black	Slow drainage, high organic matter, fertile
Brown	Moderate drainage, medium organic matter
Grey	Poorly drained, low organic matter, waterlogged
Pale	Well drained, low organic matter, nutrients leached out, low fertility

Soil Salinity

Salt occurs naturally in oceans (3.5%), estuaries and in groundwater. Human activity such as irrigation, mining, gas extraction can bring it to the surface where it becomes a problem.

- Collect a sample (down to 10 cm) of soil from your fieldwork site.
- Thoroughly mix the soil and place 100 mL in a bottle with markings.
- Add rainwater (not tap water) up to 600 mL mark.
- Shake for 1 minute and allow to settle for 1 minute.
- Use an electrical conductivity meter. Hold the meter in the clearer water at the top until a steady reading appears on the screen.

Salty water conducts more electricity than fresh water.

Temperature – Soil

Soil temperature can influence chemical reactions and biological interactions eg seed germination.

Instructions: Using a soil thermometer

- Carefully insert the soil thermometer probe into the ground to a depth of about 5 cm. Allow to stabilise before reading.

Soil Texture

Texture affects the movement and availability of air, nutrients and water. It describes the relative amounts of sand, silt, and clay particles, along with organic matter.

Use the ribbon test to determine texture.

1. Take a small sample of soil in your hand and add enough water to make a ball. Sandy soils will not roll into a ball.
2. Feel the ball with your fingers to find out if the ball is: Gritty (sandy) Silky (silty) Sticky (clay)
3. Now press the ball between your thumb and forefinger to form a long rope/ ribbon. The longer the soil 'ribbon' the more clay is present.

Reference the sheet provided. In summary:

- If the ball will not roll into a rod and breaks easily – sandy
- If it rolls into a rod but cannot be made into a ring without cracking – loam
- If it rolls into a rod easily and can be made into a ring without undue cracking - clay

Temperature - Air

Using a thermometer

Instructions:

- Ensure that the bulb of the thermometer is clean and dry.
- Hold the thermometer near the top - **not** by the bulb.
- Hold the thermometer out of direct sunlight (use your own shadow).
- Allow the thermometer to stabilise before taking your reading.
- Thermometers are fragile and the liquid inside will cavitate (break up) if they are subjected to shocks.
- Avoid using mercury thermometers.

Wind Speed & Direction

Anemometer

Wind intensity and direction has many effects eg ocean waves, erosion, formation of sand dunes.

Tools for measuring wind include an anemometer, a Beaufort wind scale and a weather vane.

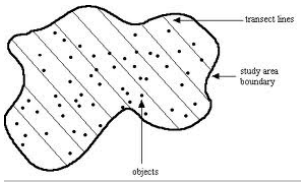
Digital Anemometer

1. Set the scale to m/s (metres per second)
2. Hold the anemometer at arms length and away from objects that could interfere with wind flow.
3. Record the highest reading in a 1 minute period.
4. Record the direction from which the wind comes.

Distribution and abundance

'Where?' and 'how many?' are fundamental ecological questions that can be answered through well designed procedures. Ultimately analysis of the results can lead to 'why?' ie an explanation of the distribution.
There are 2 main methods, transects and random sampling. When there is an observable change or zonation then sampling along a transect is appropriate..

Transect



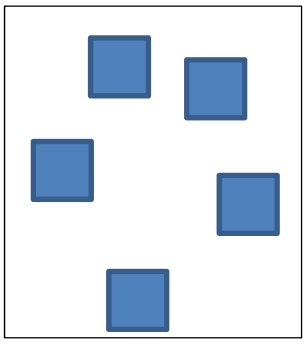
A transect is a cross section along which features are recorded, such as different types of plants, animals and abiotic conditions. It can be a useful way of showing and explaining changes in space eg vegetation.

It can be done by continuous sampling eg an observer moves along a fixed path recording occurrences within a predetermined distance from the transect line, or using quadrats to sample at intervals along a transect line

- Lay out a tape measure along the cross section
- set the rules (eg only record plants touching the transect, or within 0.5m)
- record occurrence along the line, including distance from the starting point
- replicate transects improve the reliability of the data

The results can be graphically described as a cross section showing the distribution and abundance of different species and also the abiotic factors that may influence the zonation.

Random sampling



If the area looks to be uniform then it should be randomly sampled.
The area is sampled using quadrats (often $1m^2$) placed at random within a larger known area.

Method.

1. identify the study area eg a 10m X 10m area
2. randomly place quadrats within the study area. Aim for at least 5% sampling eg for a 10m x 10m area sample 5 x $1m^2$ quadrats
3. eg estimate the percentage vegetation cover of each species in the quadrat

Quadrat results are usually combined to give an average for the area

Vegetation structure – Spechts classification

See Attached chart

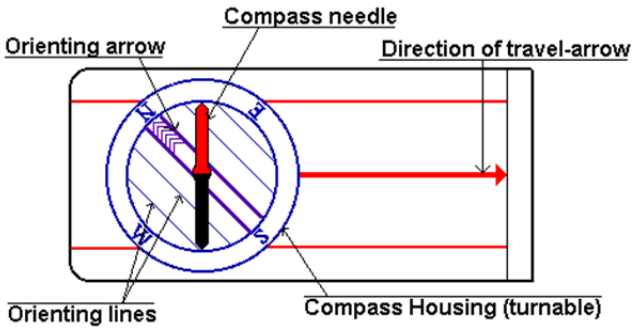
Instructions:

- Identify the tallest layer of vegetation (trees, shrubs, grasses / groundcover)
- Estimate the height or type of vegetation in the tallest layer
- Estimate the % foliage cover of the tallest layer
- Use the table to find the intersection of the vegetation type / height and the % foliage cover. This will provide a description of the plant community.

Spatial

Compass

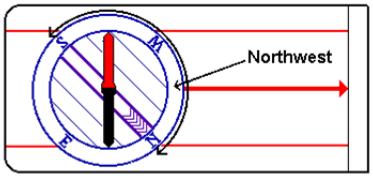
A compass is a delicately balanced magnetised needle that when held flat aligns itself with the earth's magnetic field. Note – you need to stand away from objects that contain steel or iron as this will affect your reading.



The red end of the compass needle points towards Earth's magnetic north pole.

The edge of the circular compass housing is marked in degrees 0^0 to 360^0. North is 0^0, south is 180^0, east is 90^0 and west is 270^0.

An example: You want to go northwest.



1. Find out where on the compass housing northwest is.
2. Turn the compass housing so that northwest on the housing comes exactly there where the large *direction of travel-arrow* meets the housing.
3. Hold the compass in your hand. Hold it quite flat, so that the compass needle can turn.
4. Turn yourself, your hand, the entire compass, until the red end of the compass needle is pointing to North on the housing.
5. The direction of travel arrow is now pointing northwest

Use of Compasses and maps

A topographic map used in conjunction with a compass to identify landmarks, find directions etc. must first be aligned with magnetic north:

1. Place the compass on the magnetic north arrow printed on the map. Move the map till this arrow is aligned with the red needle of the compass. Keep the map in this position.
2. To find a bearing move the compass so that the side of the base plate is along the route you wish to travel on your map
3. Rotate the compass housing so that North on aligns with the red needle
4. Read the bearing at the base of the directional arrow

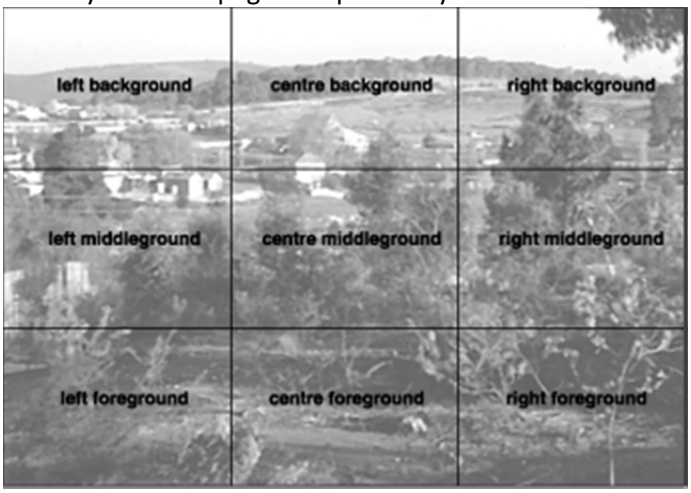
Field sketch

A field sketch is quick to draw and used to record the main geographical features of your fieldwork site. It provides a summary of the area you are studying. You don't have to be an artist but you do have to keep work neat and tidy so you can interpret it later.

To create a field sketch, follow these steps:

- Select the view relevant to your fieldwork and a good place to stand or sit. You will need a hard surface to draw on such as a book or clipboard.
- Write down details such as date, time, location, direction.

Divide your blank page into parts so your sketch is more manageable.:



- Start by simply sketching the skyline (horizon) in the background
- Draw simple lines showing foreground features.
- Fill in the middle ground only including features relevant to your fieldwork.
- Label your sketch, including details that might not be obvious
- Develop a key if required and indicate the north point.

Beach Measurements

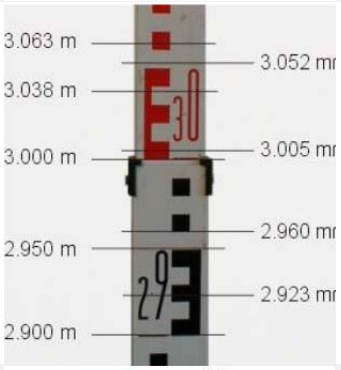
Long shore drift

Measures the potential for sand to be transported along a beach. It can be affected by local conditions such as rips – so we need to be cautious when interpreting results.

Oranges are chosen as they float low in the water and are less affected by wind. If we lose them, then they are biodegradable.

1. Throw your float into the surf as far out as possible.
2. Mark the position on the sand level with where the float hits the water.
3. Note the time that the float hits the water.
4. The distance moved divided by the time taken is the long shore drift. Eg 10 metres in 2 min is a velocity of 5m/min
5. The direction must also be included eg 5m/min north.

Dumpy level profile

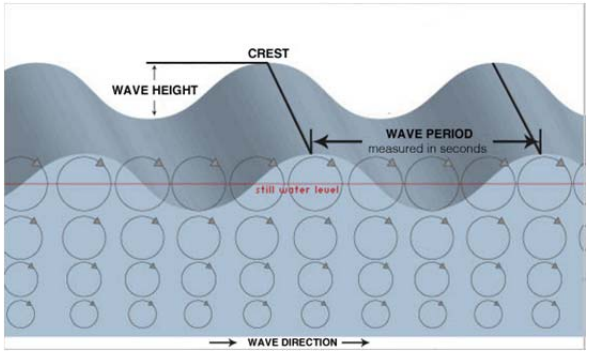


A **dumpy level** is used to establish relative heights. It is basically a telescope that can be aligned horizontally and used in conjunction with a staff to measure the rise and fall of the land.

It is important that the dumpy level is set and stays horizontal.

- First make sure that the tripod is set up so that the eyepiece is at eye-level and the legs are firm and stable.
- Adjust the 3 screws beneath the attached bubble level until the bubble is at the center of the marker. It should be regularly checked.
- Once the dumpy level is set, ask your assistant move along the profile line to a point where there is a visible change in slope and at this point hold the E meter staff vertically and still.
- Find the staff through the eyepiece and focus on the markings which are in 1 cm blocks. Each 'E' represents 5 centimetres.
- Read the staff at the centre cross hairs of the dumpy level and record.
- Measure the distance to the staff from the dumpy and record.
- Ask assistant to move along the profile to the next point where there is a change of slope and repeat procedure until end of the profile.

Wave Period & Height



Wave height is the distance between the trough and crest of the wave.

Wave length is the distance between two successive wave crests (or troughs).

Wave period is the time for two consecutive crests to pass a fixed point. To measure the Period:

- Record the time it takes for a number of wave crests to hit the shore or pass a point
- Divide this time by the number of 'periods' between waves

(eg. 11 wave crests in 2 minutes = 120secs/10 periods
Therefore 1 period = 12 secs.

Water Testing

Water Temperature

Instructions:

1. Lower the thermometer bulb into the water.
2. Allow 1 minute before taking the temperature reading.
3. Read the thermometer while it is still in the water.

Note: Only measure from a sample bottle immediately after collection.

What do the results mean?

There are no trigger values for temperature to apply a healthy or poor rating however higher temperatures result in lower oxygen levels.

Turbidity

Turbidity measures the cloudiness of the water. Suspended material such as clay, silt, sand or algae can increase the turbidity of water. The more suspended material in water, the higher the water's turbidity and the lower its clarity. Turbidity should not be confused with colour resulting from dissolved substances eg tannins give water a yellow-brown appearance like tea.

Procedure

1. Assemble the turbidity tube by sliding the two pieces together. Shake the water sample in the sample bottle and slowly pour it into the tube. Pour a little at a time and look down into the tube. For day to day comparisons always take the readings in the shade.
2. Stop pouring when the three distinct black lines at the bottom of the tube cannot be seen clearly (you may need to wait for the water to stop swirling to see whether the lines can be observed clearly).
3. Measure the turbidity by recording the last marked point below the level of the water. Do not estimate between the lines as the scale is non-linear. e.g. correct reading is 15 when the water level is between 10 and 15. **Note:** If you can still see the black lines when the water reaches the top of the tube, record the result as 7 NTU (Nephelometer units)

   Note: for school students calling them Turbidity Units is acceptable.

pH

pH is a measure of acidity or alkalinity measured on a scale of 0–14.

Equipment: pH papers, sample water specimen container.

Procedure

1. Fill the container with sample water or test directly.
2. Take a pH strip and dip all the coloured squares into the sample water and remove quickly before the indicators bleed out.
3. Match colours against the colour chart to work out pH. (estimate between two colours to 0.5 of a pH unit).
4. Dispose of the pH strip in the bin and record your result.

Salinity

Refractometer

A **refractometer** can be used for measuring high salt concentrations eg estuaries, ICOLLS.

Instructions:

1. Make a thin film of the water sample between the main prism and the transparent cover plate.
2. Holding the cover plate down firmly but without obscuring it look through the eyepiece in the direction of bright light. Focus the eyepiece until the scale can be seen clearly.
3. Read the right hand scale at the light / dark boundary. This is the salinity in parts per thousand (ppt)

Electrical conductivity meter

An **electrical conductivity** meter is used to measure low salt concentrations eg freshwater. These meters can provide electrical conductivity readings in micro Siemens or as parts per thousand or million (ppt or ppm) salinity. For school students ppt or ppm is more meaningful.

1. Turn on the meter and immerse only the probes in water
2. Keep immersed while taking digital readout

Oxygen

See attached Chemet instructions

Extreme care must be taken to avoid adding oxygen during sampling. Testing must be conducted as soon as possible after sampling.

Phosphorus

Filter the sample before commencing the test.

See attached Chemet instructions

References

About Fieldwork - http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/about_fieldwork/index.htm

CoastalWatch - http://www.coastalwatch.com/surfing/176/wave-period

Chemetrics - http://www.chemetrics.com/

Waterwatch - http://www.environment.nsw.gov.au/waterwatch/getPublications.htm

Public Works Ocean Data - http://new.mhl.nsw.gov.au/data/realtime/wave/

Appendices

Phosphate Test

Phosphate CHEMets® Kit

K-8510/R-8510: 0 - 1 & 1 - 10 ppm

Safety Information

Read MSDS (available at www.chemetrics.com) before performing this test procedure. Wear safety glasses and protective gloves.

Test Procedure

1. Fill the sample cup to the 25 mL mark with the sample to be tested (fig 1).
2. Add 2 drops of A-8500 Activator Solution (fig 2). Cap the sample cup and shake it to mix the contents well.
3. Place the CHEMet ampoule, tip first, into the sample cup. Snap the tip. The ampoule will fill leaving a bubble for mixing (fig 3).
4. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
5. Dry the ampoule and wait **2 minutes** for color development.
6. Obtain a test result using the appropriate comparator.
   a. **Low Range Comparator (fig. 4):** Place the ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found.

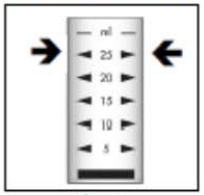


Figure 1


Figure 2

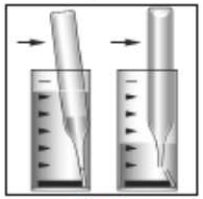


Figure 3


Figure 4

   b. **High Range Comparator (fig. 5):** Place the ampoule between the color standards until the best color match is found.

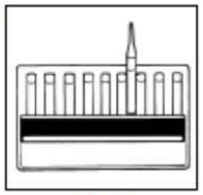


Figure 5

Test Method

The Phosphate CHEMets®[1] test kit employs the stannous chloride chemistry.[2] In an acidic solution, ortho-phosphate reacts with ammonium molybdate to form molybdophosphoric acid, which is then reduced by stannous chloride to the intensely colored molybdenum blue. The resulting blue color is directly proportional to the phosphate concentration.

Condensed phosphates (pyro-, meta- and other polyphosphates) and organically bound phosphates do not respond to this test. Sulfide, thiosulfate, and thiocyanate will cause low test results.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 21st ed., method 4500-P D (2005)

Visit www.chemetrics.com to view product demonstration videos.
Always follow the test procedure above to perform a test.

CHEMetrics
Water Analysis Systems

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Oct. 12, Rev. 8

Run

Dissolved Oxygen Test

Oxygen CHEMets® Kit

K-7512/R-7512: 1 - 12 ppm

Sampling

The most critical part of any dissolved oxygen test is sampling. It is difficult to obtain an aliquot which accurately reflects the oxygen content of a sample. Exposure to the high oxygen content of "air" will cause a sample to approach saturation. Biological activity may cause rapid oxygen depletion. Dipping and pouring operations should be performed with as little agitation as possible.

Test Procedure

1. Fill the sample cup to the 25 mL mark with the sample to be tested (fig 1).
2. Place the ampoule, tip first, into the sample cup. Snap the tip. The ampoule will fill, leaving a bubble for mixing (fig 2).
3. To mix the ampoule, invert it several times, allowing the bubble to travel from end to end.
4. Dry the ampoule and wait **2 minutes** for color development.
5. Obtain a test result by placing the ampoule between the color standards until the best color match is found (fig 3).

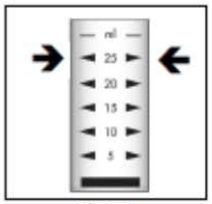

Figure 1

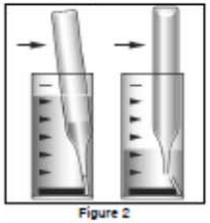
Figure 2

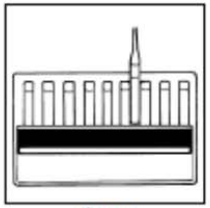
Figure 3

Test Method

The Oxygen CHEMets®[1] test kit employs the indigo carmine method[2,3]. In an acidic solution, oxygen oxidizes the yellow-green colored leuco form of indigo carmine to form a highly colored blue dye. The resulting blue color is proportional to the dissolved oxygen concentration in the sample.

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. ASTM D 888 - 87, Dissolved Oxygen in Water, Test Method A
3. Gilbert, T. W., Behymer, T. D., Castaneda, H. B., "Determination of Dissolved Oxygen in Natural and Wastewaters," American Laboratory, pp. 119-134, March 1982

Safety Information

Read SDS (available at www.chemetrics.com) before performing this test procedure. Wear safety glasses and protective gloves.

Visit www.chemetrics.com to view product demonstration videos. Always follow the test procedure above to perform a test.

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Sept. 13, Rev. 15

Soil Type

Soil type

Colour *Texture*

Texture

Soil texture refers to the size of the grains making up the soil. An accurate description of soil texture can be made by rubbing a small lump of soil between your fingers.

Describe the soil texture (some guidelines are listed below) or mark the texture triangle (Figure 6.7 below) according to your best estimation of the texture.

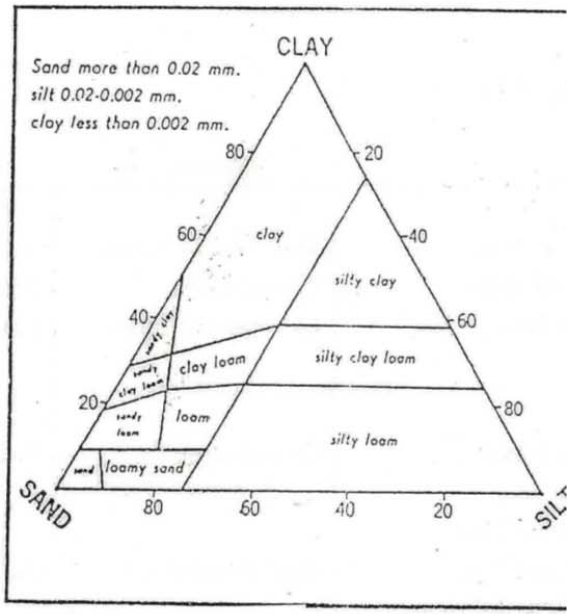
Note that these descriptions are assumed to refer to the surface layer of the soil. If other soil layers are exposed through erosion, please apply the same description to each layer. Do not estimate the colour from one layer and combine it with the texture of another layer.

For use with the texture triangle:

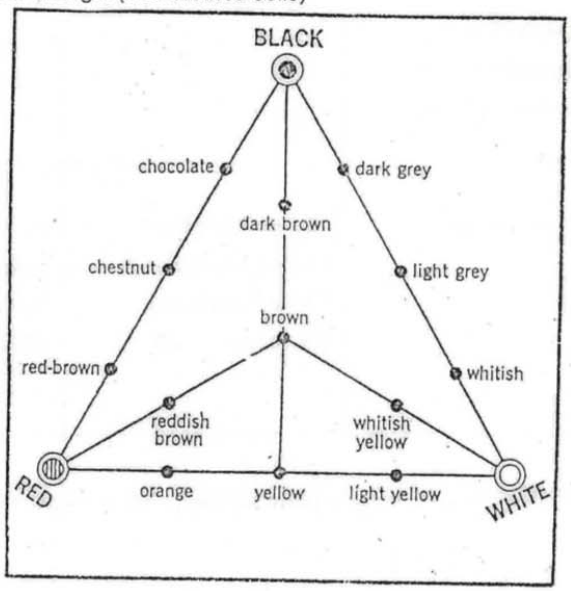
Clay: very smooth or greasy to feel
Silt: feels silky
Sand: feels gritty

For use for written descriptions:

Sand:	does not cohere, has a gritty feel	will not roll into a rod breaks easily
Loamy sand:	cohesion just perceptible, has a gritty feel	
Sandy loam:	coheres and is friable, has a gritty feel	
Silty loam:	friable and coherent, with a silky feel	
Loam:	friable and coherent, sand grains cannot be felt	
Sandy clay loam:	has a gritty feel	rolls into a rod but cannot be made into a ring without cracking
Silty clay loam:	has a silky smooth feel	
Clay loam:	sand grains cannot be felt	
Sandy clay:	has a gritty feel	
Silty clay:	has a silky smooth feel	
Light clay:	easy to mould, grains cannot be felt	rolls into a rod easily; can be made into a ring without undue cracking
Medium clay:	fairly stiff and plastic to mould, grains cannot be felt	
Heavy clay:	very stiff and plastic to mould, grains cannot be felt	



Soil colour triangle (well drained soils)



Specht Chart for Classifying Vegetation Structure

Height of Tallest Layer	Foliage Cover of Tallest Layer				
	100-70%	**70-50%**	**50-30%**	**30-10%**	**<10%**
Trees > 30m	Tall closed – forest	Tall forest	Tall open-forest	Tall woodland	
Trees 10 –30m	Closed-forest	Forest	Open forest	Woodland	Open-woodland
Trees< 10m	Low closed - forest	Low forest	Low open-forest	Low woodland	Low open-woodland
Shrubs > 2m	Closed-scrub	Scrub	Open-scrub	Tall Shrubland	Tall open-shrubland
Shrubs 0.25-2m					
Sclerophyllous	Closed-heathland	Heathland	Open-heathland	Scrubland	Open-shrubland
Non-sclerophyllous	-	-	Low shrubland	Low shrubland	Low open-shrubland
Shrubs < 0.25m					
Sclerophyllous	-	-	-	Dwarf open-heathland	Dwarf open-heathland
Non-sclerophyllous	-	-	-	Dwarf shrubland	Dwarf open-shrubland
Grasses (tussock)	Closed grassland	Grassland	Grassland	Open grassland	Very open grassland
Sedges	Closed -sedgeland	Sedgeland	Sedgeland	Open-sedgeland	Very open-sedgeland
Herbs	Closed-herbland	Herbland	Herbland	Open-herbland	Very open-herbland
Ferns	Closed-fernland	Fernland	Fernland	-	

* A tree is a woody plant usually with a single stem; a shrub is a woody plant usually with many stems arising at or near the base.