



Terminology & Soil Science

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Presentation

- Soil Profile
- Soil Structure
- Soil Texture
- Compaction
- Cation Exchange Capacity
- Soil pH
- Nutrients / Organic Matter / EC / PTE's

What is Soil: A blend of sand, silt, clay & organic matter

Topsoil is composed of mineral particles, organic matter, water and air

Loam is composed of mineral particles, organic matter, water and air

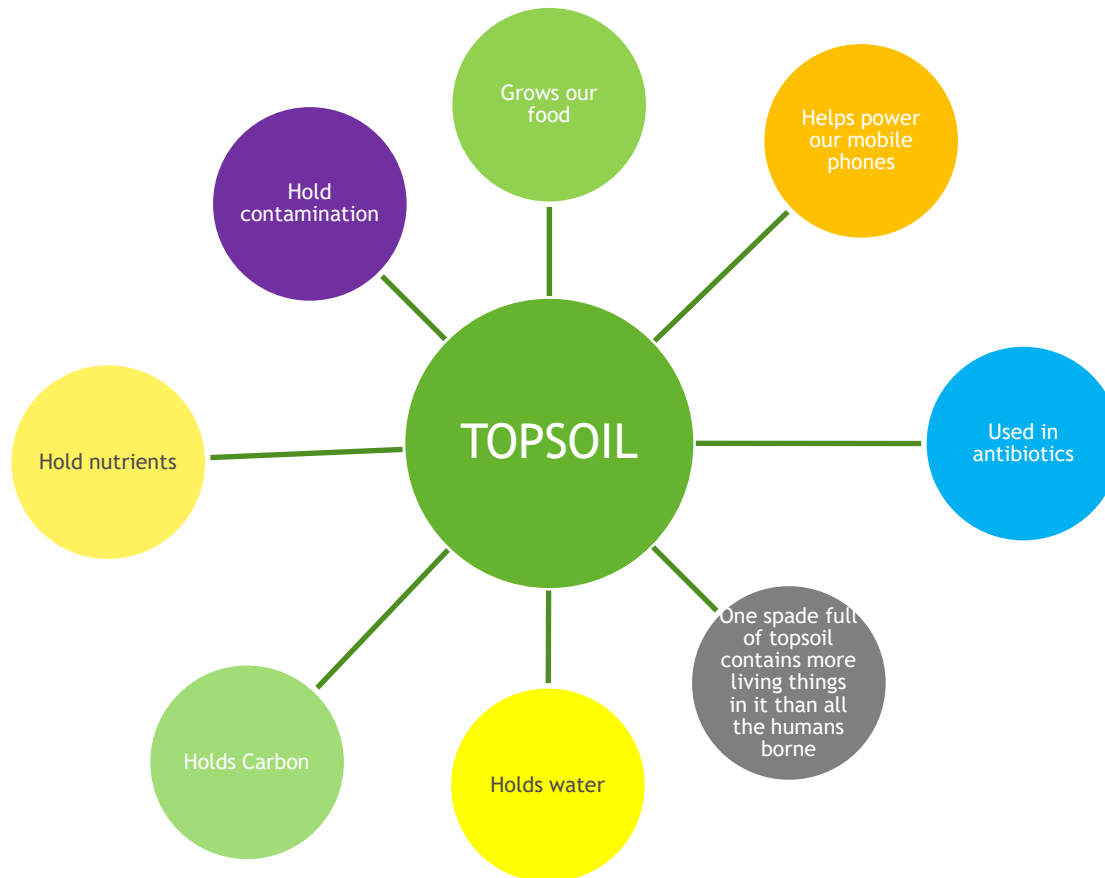
Muck away is not always topsoil

TOPSOIL The foundation to life

topsoil noun **[U]**

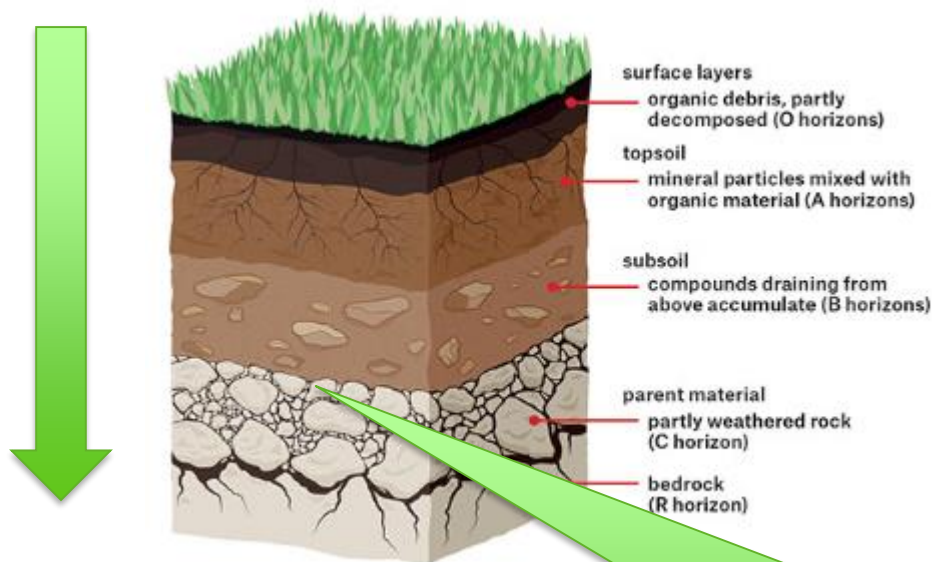
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> (the soil which forms) the top layer of ground in which plants grow



A Soil Profile

A Soil Profile should allow free movement of water, air and roots



Topsoil: Typically the top 30cm, darker and fertile

Subsoil: Directly under topsoil, lighter in colour, less fertility

Parent material / Bedrock: can be solid rock which breaks down with weathering

Dig a pit to understand your soil profile

Topsoil will only function if it is in sync with its subsoil

Soil Structure

What is soil structure?

- Soil structure is the arrangement of soil particles (sand, silt, clay and organic matter) into granules, crumbs or blocks. It is the shape that the soil takes based on its physical, chemical and biological properties. Soil structure is often confused with soil texture, both of which affect the soil's drainage and aeration capabilities.

Well-structured soils are crumbly and friable and have plenty of pore space to allow water and air movement and healthy root development.

Poorly structured are cloddy soil, which will be difficult to work.

Why is structure important?

- To perform effectively as a growing medium soils need an open structure through the soil profile.
- A good soil structure is important to allow air and water into the soil which are vital for healthy plant growth. It will improve drainage and reduce soil erosion caused by excess surface run-off.

Without structure, soils will suffer from anaerobism, waterlogging and nutrient lock-up and, ultimately, plants will die!



Don't forget the subsoil BS8601:2013

Subsoil shouldn't mean cheap!

- Only applies to IMPORTED Subsoil
 - Multipurpose Grade
 - Specific Purpose Grade (acid / alkaline / low fertility)
- It is not the 'be all end all'
- A good starting point
- Build 'project specific' soil specifications for each scheme
 - Consider the drainage?
 - Consider the topsoil?
 - Consider the planting scheme?
- Don't always think that compliance to BS8601:2013 means you will get a suitable subsoil delivered!

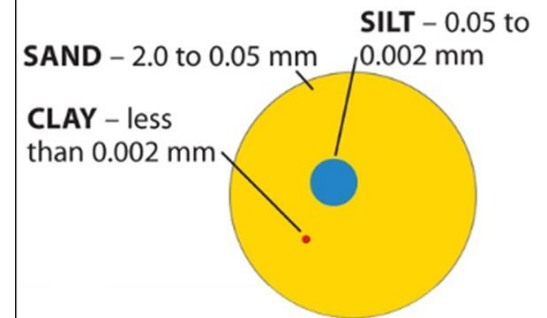
Soil Texture

Soil Texture indicates the relative content of particles of various sizes, such as sand, silt, clay and organic matter in the soil.

Texture influences the ease with which soil can be worked, the amount of water and air it holds, and the rate at which water can enter and move through soil



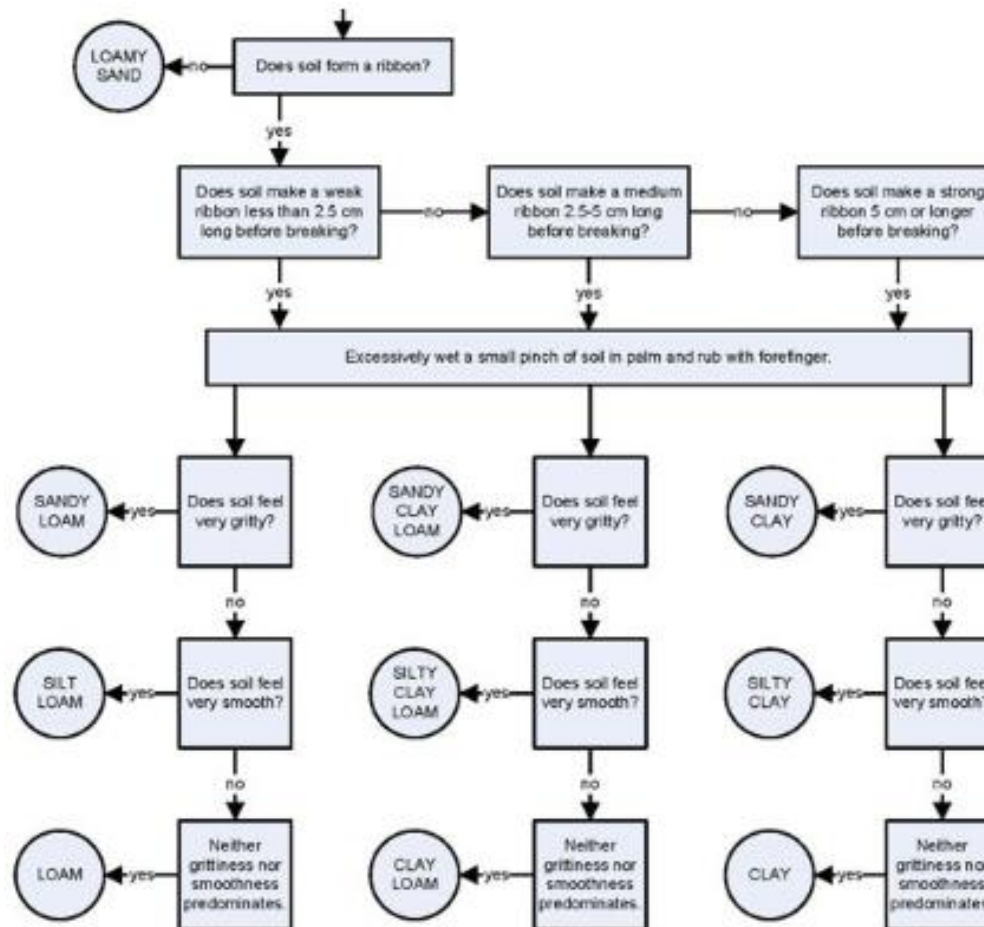
Need soil particle size analysis



Soil Texture: Spit & Rub

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Soil Compaction

Soil Compaction is the most common cause for a loss of soil structure on construction sites, and it can occur in the topsoil and subsoil layers.

The result is a soil profile that is impregnable to plant roots, water and air.

Typical causes of soil compaction include:

- Excessive foot trampling and vehicle trafficking over soils;
- Storage of building materials on exposed topsoil or subsoil;
- Handling soils when they are wet and plastic;
- Stockpiling soils inappropriately.

Signs of soil compaction include:

- Surface water 'ponding' and/or waterlogging;
- Soil resistance when pushed with a spade or probe;
- Black/grey, anaerobic topsoil with a sour odour ;

Soil Decompaction

Soil decompaction is therefore necessary on most construction sites to restore the landscape soils back to a suitable condition.

Topsoil is easier to restore than subsoil but the latter must not be ignored.

One method that is effective in smaller areas, such as back gardens, is the use of an excavator fitted with a 'ripper tine' attachment.

This involves ripping the soil profile to depths of between 30cm and 60cm to loosen and break up the compacted layer(s) before doing the final soil cultivations.



Top ten tips for soil sourcing and on-site management

To give your landscape project the best chance of success:

- Assess the quality and suitability of the site soils (preferably before stripping the topsoil) by conducting a Soil Resource Survey (separate from a normal Ground Investigation);
- If imported soils are required, use only BS 3882:2015 compliant topsoil and BS 8601:2013 compliant subsoil from reputable suppliers who must provide a valid load-specific Declaration of Analysis (including contamination analysis);
- Refer to both the above Standards for advice on correct soil sampling, handling, storage, soil preparation and depths;
- Avoid handling topsoil in wet conditions;
- Create a dry, clean, segregated holding area for storing topsoil, and seal in or cover the heap;
- Minimize the amount of human and mechanical traffic from the area to be landscaped to avoid compaction;
- Set levels for topsoil application - minimum depth 150mm, maximum depth 300mm;
- Avoid compacting newly laid topsoil;
- Slightly consolidate the new topsoil by lightly pressing with the back of a excavator bucket;
- Work off a board when planting or turfing.

Useful guidance documents

Defra *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*, 2009

- BS 3882:2015 Specification for topsoil
- BS 8601:2013 Specification for subsoil and requirements for use

The Essential Guide to Topsoil

Soil Science

- Cation Exchange Capacity
- Soil pH
- Nutrients
- PTE's

Cation exchange capacity (CEC) is a soil chemical property. It is the ability of the soil to hold or store cations.

Cation exchange capacity.

Soil nutrients exist as positively charged (SAND) or negatively (CLAY) charged ions when dissolved. The positively charged ions are known as cations and the negatively charged ions are known as anions

The nutrients which exist as cations include calcium (Ca^{2+}), Magnesium Mg^{2+} , ammonium (NH_4^+), potassium, manganese (Mn^{2+}), zinc (Zn^{2+}) and copper (Cu^{2+}).

Some of the nutrients exist as anions are chloride (Cl^-), nitrate (NO_3^-), sulphate (SO_4^{2-}) phosphate (H_2PO_4^- and HPO_4^-), borate (BO_3^-), and molybdate (MoO_4^-).

Cation exchange capacity (CEC) is a soil chemical property. It is the ability of the soil to hold or store cations.

Soils with high sand content have low holding capacity for cations compared to clayey and silty soils because they are +VE charged.

Clay and silt particles have negatively charged sites which enable them adsorb and hold on to cations.

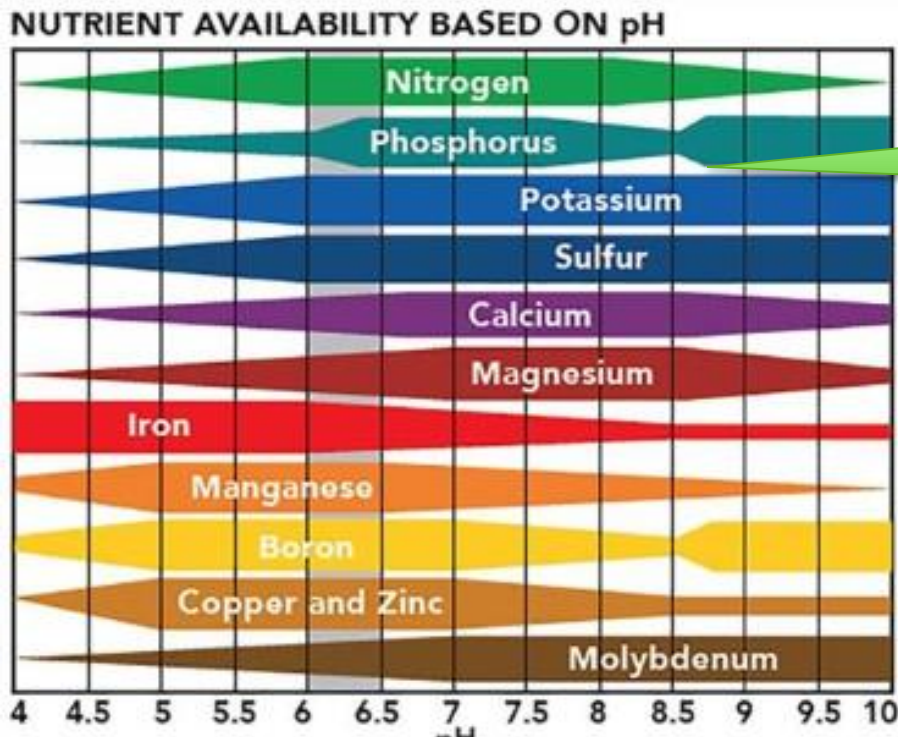
When soil particles are negatively charged they attract and hold on to cations (positively charged ions) stopping them from being leached down the soil profile.

The cations held by the soil particles are called exchangeable cations

Negatively charged soil particles repel anions (negatively charged ions). The implication of this is that negatively charged nutrients such as nitrates, sulphate and chlorides are vulnerable to leaching down the soil profile.

Soil pH

- **Soil pH** is an indication of the **acidity** or alkalinity of **soil**
- It is measured in **pH** units
- The **pH** scale goes from 0 to 14 with **pH 7** as the neutral point.



Remember Clay is -Ve charged and many major nutrients (cations) are +ve charged

Soil pH TEST

Nutrients

Nitrogen

Required for the growth of leaves and stems

Deficiency causes weak, stunted growth and yellowing of older leaves.

Excess nitrogen can also be detrimental causing such effects as disproportionate leaf growth at the expense of other parts of the plant (e.g. flowers)

Phosphorous

Principle nutrient for root growth and development

Deficiencies may cause stunted root systems whilst the leaves on some plants may also exhibit a dull green or purple coloration

Potassium

Essential for growth and water and nutrient transportation

Deficiency in plants include brown **scorching** and curling of **leaf tips** as well as **chlorosis (yellowing)** between **leaf veins**. **Purple spots** may also appear on the **leaf undersides**. Plant growth, root development, and seed and fruit development are usually reduced in potassium-deficient plants.

Magnesium

A constituent of chlorophyll, the green pigment which enables plants to photosynthesise

Deficiency may be noted by the interveinal yellowing of the plant's older leaves.

