

How to: understand and maintain healthy soils



Wildlife gardening is about encouraging biodiversity in your garden, but there is no *single* fix, since gardens differ in altitude, climate, and especially soils. Knowing your soil type is essential if the species you plant in your garden are to thrive. Trying to grow plants that don't like your soil is going against nature, and these plants are less likely to help wildlife species adapted to your local soils. If you want only native species in your garden it's *vital* to work with your soils.



Photo: Ustill via Wikimedia Commons



Photo: Philip Halling via Wikimedia Commons

Chalk grassland and heather moorland – two communities largely determined by their soils

Target species:

The below-ground ecosystem, the zone of plant roots (rhizosphere). Surface life, the plants and all that depend on them.

Soils – The Basics See our web page www.wlgf.org/soils for more details

Soils are very variable in character, depending on what they contain and how they are managed.

Mineral particles

Soils are mainly a blend of mineral particles. The larger particles, sand and pebbles, are chemically inert but create the pores and channels by which roots grow into the depths and water and air can enter the soil. The smallest mineral particles, clays and silts, have complex microstructures and they are chemically active; binding to each other and holding water and minerals. They also shelter bacteria, plant root hairs and fungal hyphae. Working alongside organic matter, the clays are the places where most important soil processes take place. The most productive soils have a good balance of mineral grains of different sizes and are called loams. They are most fertile when they contain plenty of organic material.

Organic material

Humus (decayed organic matter) is a vital ingredient of fertile soils. It is micro-porous, holds water and nutrients and helps shelter microorganisms. Soils without enough organic matter are often “tired” and infertile.

Acidity

Soil acidity is measured on the pH scale, where a value of 7 is neutral. Above 7.1 is alkaline, and below 6.5 is slightly acid, and below 5 significantly so. Soils with pH between about 6.5 and 7.1 are

classed as neutral and support most plants. The more your soil deviates from neutral towards extremes the more limiting it can become.

- Acid soils (low pH) are either very sandy with some useful elements washed out by rain, or peaty or woodland soils with lots of humus. Only specialist plants can cope with really acidic soils
- Alkaline soils (high pH) are those with high content of chalk or limestone. Ericaceous plants like most heathers can't grow in them, but mildly alkaline soils are generally good for vegetables.

The question of pH is so often raised by garden programmes that it can seem a bigger issue than it really is. Few trees, for example, have particular pH preferences, and most plants tolerate a wide pH range. Extremes could be welcomed as they will favour a flora of great distinctiveness.

Water and air

Water is essential for plant growth, but too much water is just as bad for most plants as too little at time of drought. Clay soils are notorious for holding water in the winter and drying to a hard crust in summer. Sandy and chalky soils on the other hand drain very quickly, which can become a problem in long dry spells. Adding lots of organic matter as compost can help both soil types. All soils can be made less porous to water and air when compacted by people or machinery working or even walking on them.

Fertility

Vegetable and fruit gardeners need highly fertile soils for best results. For a wildlife garden with plant species mixed together as in a meadow, low productivity is often helpful as it limits growth of aggressive competitive or invasive plants such as grasses, nettles or brambles. This in turn allows a wider range of wildflowers and associated invertebrates to thrive. Grown alone without competition, most [wild plants like fertile soil](#) as much as any vegetable.

How to do it:

Research has shown that the key to maintaining a healthy soil is mostly about what you *do not* do: Avoid chemicals, minimise digging, avoid compacting the surface and maintain continuous plant cover as much as is possible. By standing back we are putting trust in the natural processes that made the soil to begin with. Furthermore, you should let a wildlife garden adapt to the soil on which it grows, rather than trying to change the soil to grow a different range of plants. This means understanding your soil and choosing plants to suit. However, if you want parts of your garden to support conventional flower beds or especially vegetables and fruit bushes, you may need to “improve” the soil in these parts.

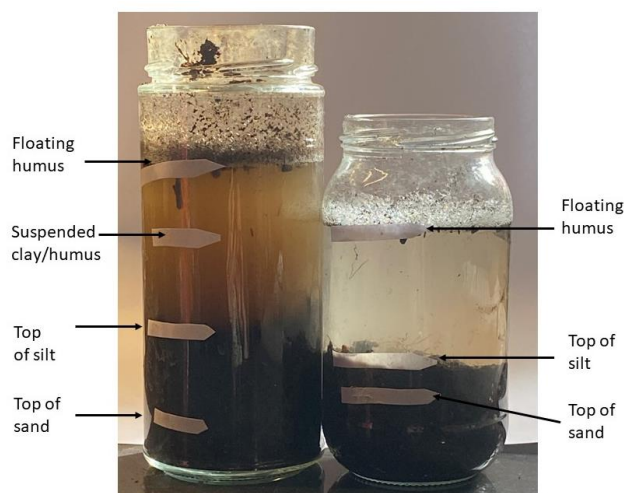
Check your soil character.

Many soils are different from the “ideal loam”, suiting some plants but less good for others. Changing your soil character is a major long-term undertaking, so find out what soil you have and plant accordingly.

Assess soil texture

- Soils with high proportions of sands and gravels are drought prone and infertile. They are coarse and gritty between your fingers.
- Silty soils look muddy but you can feel the fine particles with your tongue against your teeth!
- You can roll soils with high clay levels into a sausage shape in your hand.
- You can try the [jar test](#) in which you shake a sample of soil in water in a straight-sided jar. As it falls out of suspension, the coarse gravel and sands settle first, followed by silt and eventually

clays. Some of the humus sinks, some will float. This lets you assess the relative amounts of sand, silt, clay and humus it contains.

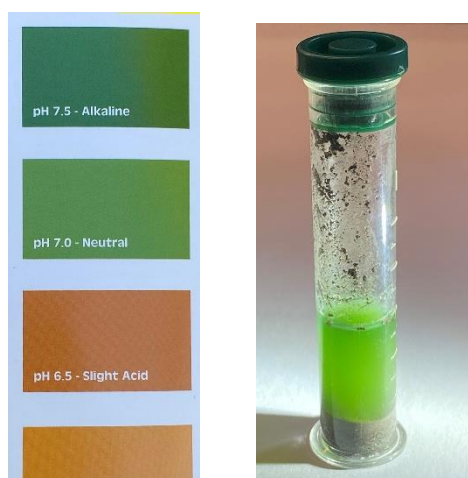


Two soil samples from one garden. On the left a silty sample from a bog garden, on the right, a sample of tired soil from a sandy/chalky flower bed clearly in need of some compost.

Photo: Steve Head

Assess soil pH

- Really chalky soils fizz when you add vinegar, but this doesn't tell you much!
- Test your soil with a pH test kit available cheaply on line or from garden centres. This involves shaking a small soil sample with a special indicator reagent and comparing the colour of the liquid with a standard chart.



This garden soil is pretty chalky, but the colour shows the pH is about neutral because it has been mulched with plenty of compost.

Photo: Steve Head

Coping with your soil type

Before you try to interfere, have a good look at what your soil is supporting. Do you really need to change it?

Loam soils

These generally support most plants, although pH will be another factor to consider. Loams grade into more sandy, silty and clay types. Loams can easily get depleted of humus if you clear dead material from your beds, so benefit from addition of home-made compost.

Sandy/gravel soils and dry soils

These can support well adapted grasses and flowering plants such as species of *Achillea*, *Agapanthus*, *Allium*, *Argyranthemum*, *Armeria*, *Artemisia*, *Asphodeline*, *Buddleja*, *Cistus*, *Cynara*, *Dianthus*, *Eryngium*, *Euphorbia*, *Foeniculum*, *Helianthemum*, *Helichrysum*, *Hylotelephium (Sedum)*, *Hypericum*, *Hyssopus*, *Bearded Iris*, *Lavender*, *Lychnis*, *Malva*, *Nepeta*, *Nerine*, *Oenothera*, *Origanum*, *Phlomis*,

Salvia, Santolina, Stachys, Ulex, Verbascum, Verbena. Native wildflowers for dry soil include lady's bedstraw, ox-eye daisy, bird's-foot trefoil, viper's bugloss and wild carrot.

To increase the range of plants (and for vegetables), add lots of home-made compost to dry soils as a surface mulch. This helps them retain water, especially as the humus becomes incorporated into the upper soil layers.

Clay soils

Lack of drainage is a big problem, and clay soils would need impractical amounts of sand and gravel to become more permeable. Adding lots of compost onto the surface helps. Clay soils are too wet to dig in winter, and too dry and solid in summer.



Clay soil is best avoided when it is wet!

Photo: Ildar Sagdejev via Wikimedia Commons

It may be best to put in some raised beds with added loamy soils on top of the native clay soil if you want to grow vegetables.

Some plants do well on clay soils, including species of maple, *Aster*, birch, *Cotoneaster*, *Ilex*, *Laburnum*, *Mahonia*, apple, *Sorbus*, *Miscanthus*, *Heuchera*, *Hosta* and *Hydrangea*.

Alkaline/chalky soils

Many plants thrive on mildly alkaline soils, including *Ceanothus*, *Clematis*, true *Geranium*, lavender and many vegetables. Alkaline soils are good for native knapweeds, geraniums, scabious, vetches and bedstraws. See the [RHS guide](#) for a very full list, and look on the web for suppliers of wildflower seed for chalky soils. It is difficult to lower the pH chemically (although sulphur and sulphates have been used), but regularly adding lots of compost makes the upper levels effectively neutral. Alkaline soils can make the important minor nutrient iron hard for plants to take up, causing chlorosis or yellowing of leaves, especially in plants that don't do well on chalky soils. Lots of compost will help, and you can apply sequestered iron in liquid form for a short-term fix. Best not to try to grow acid-loving plants on chalky soils at all, grow them in a pot with acid compost if you want.

Acid soils

Most garden plants will cope with pH levels approaching 5, but acid soils are poor for vegetables. Plants that require acid soil include *Camellia*, heathers, *Azalea*, *Rhododendron*, *Skimmia*, blueberry, many *Magnolia* and maples. Acidic soils support native sorrel, buttercup and bugloss. Conventionally veg gardeners regularly dig in or top-dress with lime or chalk.

Soggy soils

Many plants can't cope with wet soils that exclude oxygen from their roots. There are however plenty of specialist [bog-garden plants](#). They can be drained, but this is a very serious job and probably not practical at small garden scale. The solution might be to treat some of your area as a bog garden and create raised beds for other plants.

Generally, let your soil attract the community that suits it best. The decision to alter the soil in your garden depends on your plans and ambitions for the space. Making acidic soils more neutral using lime is standard, acidifying alkaline soil rarely works. If you must have camellias keep them in pots!

Management practices to avoid in a wildlife garden.

Avoid using herbicides, pesticides and fungicides, all of which disturb or destroy parts of the soil community. Avoid walking over the soil which causes compaction, one of the reasons that raised vegetable beds are helpful, by avoiding compaction there is no need to dig as a healthy soil fauna will do that for you. Don't assiduously remove dead vegetation or non-problem "weeds" leaving bare earth, as continuous plant cover will help keep things cool, ensure that water infiltrates and cycles well, carbon storage is optimised, and help to feed the mycorrhizal fungi that assist roots in obtaining water and nutrients. Standing dead vegetation supports much wildlife including moths and small rodents too.

How easy is it to do?

Maintaining healthy soil is moderately easy as it largely relies on stopping doing damaging things. It is certainly worth putting some effort into [home composting](#). The hardest bit is arguing with tidy people who hate to see fallen leaves and standing dead grass!

How much will it cost?

Almost nothing unless you believe the claims of manufacturers and spend money on proprietary "soil improvers"!

How effective is it for the target species?

Very effective as a healthy soil is the foundation for a healthy ecosystem.

Golden rules – what the science tells us

- Soils are resilient and self-maintaining, so our main role is and avoiding actions that disrupt their ability to do so and interfering as little as possible
- Leave fallen leaves and dead plants to naturally rot and maintain humus levels
- Avoid soil humus levels reducing on cultivated ground by regularly adding compost
- All garden chemicals have a big effect on soil communities and ecology, so try to avoid them
- Soils need to be permeable to water and air, so avoid compaction by minimising walking on them, and then routing digging, which disturbs soil ecology won't be needed.
- Above all, adjust your planting to suit the soil, not the other way around

What to look for?

Indicators of healthy soil include little water pooling on the surface even in heavy rain, your plants have healthy green foliage and are resistant to short periods of drought, and you have good earthworm populations and bird diversity.

Things to be aware of

Your soil isn't inert, it's an amazing ecosystem and should be treated with respect!

All plant cover is good, and many weeds such as plantains, docks and dandelions are great soil improvers and good for wildlife too.

Further information

Our website:

Our page on [soil science](http://www.wlgf.org/soils.html) www.wlgf.org/soils.html

Our page on [soil fertility](http://www.wlgf.org/compost_fertility.html) www.wlgf.org/compost_fertility.html

The myth that wildflowers only grow in [low fertility](http://www.wlgf.org/myth_fertility.html) soil www.wlgf.org/myth_fertility.html

Our summary of [garden statistics](http://www.wlgf.org/The%20garden%20Resource.pdf) www.wlgf.org/The%20garden%20Resource.pdf

Plants for ponds and other [damp areas](http://www.wlgf.org/water_flowers.html) www.wlgf.org/water_flowers.html

How to: Make your own [compost](http://www.wlgf.org/ht_compost.pdf) www.wlgf.org/ht_compost.pdf

RHS information

[Woody waste](http://www.rhs.org.uk/soil-composts-mulches/woody-waste-using-as-mulch) as mulch www.rhs.org.uk/soil-composts-mulches/woody-waste-using-as-mulch

Using [leafmould](http://www.rhs.org.uk/soil-composts-mulches/leaf-mould) www.rhs.org.uk/soil-composts-mulches/leaf-mould

Plants for [chalky soil](https://www.rhs.org.uk/plants/for-places/chalky-soils) <https://www.rhs.org.uk/plants/for-places/chalky-soils>

Managing [chalky soils](http://www.rhs.org.uk/soil-composts-mulches/chalky-soils) www.rhs.org.uk/soil-composts-mulches/chalky-soils

Managing [clay soils](http://www.rhs.org.uk/soil-composts-mulches/clay-soils) www.rhs.org.uk/soil-composts-mulches/clay-soils

Managing [wet soils](http://www.rhs.org.uk/soil-composts-mulches/gardening-on-wet-soils) www.rhs.org.uk/soil-composts-mulches/gardening-on-wet-soils

pH [testing](http://www.rhs.org.uk/soil-composts-mulches/ph-and-testing-soil) www.rhs.org.uk/soil-composts-mulches/ph-and-testing-soil

Other sources

The [jar test](https://hgic.clemson.edu/factsheet/soil-texture-analysis-the-jar-test/) for soil texture <https://hgic.clemson.edu/factsheet/soil-texture-analysis-the-jar-test/>

[No-dig](http://www.gardenorganic.org.uk/expert-advice/garden-management/soil/the-nodig-method) gardening www.gardenorganic.org.uk/expert-advice/garden-management/soil/the-nodig-method

This guide was drafted by Tony Kendle, extended and compiled by Steve Head and reviewed by Ken Thompson