

Terrace Permaculture Gardening

Gardening offers many benefits. Compared with buying fresh produce at a market, properly managed gardens can provide fresh, healthy produce in a fraction of the time and at much lower cost than purchasing food. A single trip to the market can easily take 20 minutes to several hours out of your day and cost over \$100 per visit. Gardening by contrast requires an initial investment to set it up and a few minutes a week to maintain and use.

For apartment and condominium dwellers, however, the lack of space stops most from pursuing their own garden. But with careful design and planning, even a small terrace can yield a surprising amount of food.

While conventional gardening can be a lot of work, our approach will be to mimic a natural ecosystem to make your garden as self-sustaining as possible.

Site Assessment

To design a good garden space, you will first need to assess the space you have available. The single biggest limiting factor is climate. If you are in a temperate area, you will need to know your local growing season. How long is your frost-free season? This will determine how much time you will have for outdoor growing. If you are in a sub-tropical area, you would probably benefit from growing tropical foods during the hot season and temperate plants during the cool season.

Not every apartment or condo unit faces the sun, so you will need to determine if you have full sun, partial sun or shade at your particular site. If you have partial sun, would you be able to increase the exposure to sunlight with the aid of reflectors strategically placed on the balcony? If you have full shade, you will have to avoid growing plants that require full sun as they will grow poorly in such conditions.

For high rise buildings, wind is a limiting factor. Strong wind stresses plants, stunting growth, and it reduces soil moisture. The difference on a windy terrace growing avocado, for example, versus a sheltered site can be a 100% greater yield for the sheltered site. If there is too much wind, you will need to block it with some sort of barrier such as a trellis. In any event, make a note of the direction of the prevailing winds.

You may be lucky enough to have a fair amount of rainfall on the terrace or, if permitted, be able to tap into a downspout from the roof. If not, you will need to take on more of the watering yourself.

How much floor space do you have on the terrace or by windows? We will see shortly how to maximise the space you do have, but for now, you will need to know the area you have to work with.

Finally, you will have to know what sort of artificial restrictions there are such as local ordinances and/or restrictions from the landlord or the condominium's management.

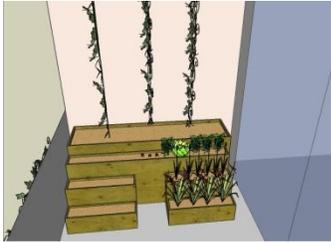


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Planning and Layout



First, create a map of the site. It needn't be anything too fancy, just something you can use for planning purposes. Freehand maps will do fine.

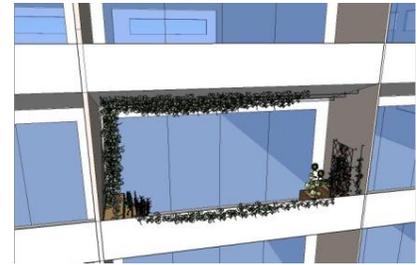


Plan your access routes. Without easy access to everything in your garden, you are more likely to neglect hard to reach areas. You may stuff your site with growing space, but be sure to give yourself 40-cm-wide (16-inch) paths to walk on.

After laying out the paths, you will know what floor space is available to you. Now you need to consider sun exposure and wind direction. You'll generally be placing taller plants so that they do not obstruct the sunlight of other plants. You may need to break this guideline if you need either the taller plants such as bamboo) or a trellis to act as a windbreak to prevent wind damage to other plants.

Hanging plants are a great way to make use of window space for growing, so you need not be limited by floor space.

To make maximum usage of the outdoor growing space available to you, you are going to have to design in 3 dimensions. It will be much easier to access the space if you set up the planters in a terraced fashion with the highest ones in the back and the lowest ones in the front.



The installation of trellises will also help us to grow plants up walls and across ceilings. A trellis with a mesh pattern is good for plants that climb using tendrils such as grapes and bitter melon (*Momordica charantia*). Poles or lengths of string can be used for plants like beans or hops (*Humulus lupulus*) that twist around objects as they grow. In addition to natural climbers, plants such as squash and kiwis (which have a variety of species suited to climates from sub-tropical to cold temperate) can be tied to trellises to grow where you want them to. An added benefit of climbing plants is that they shade buildings in the summer, helping them to stay cooler.



PVC tubing can be used to create planters that maximise growing space with the minimal usage of floor space. These tubes can even be hung if necessary, though they may need to be anchored at the bottom if winds are strong on your site.

Planters can be ready-made units, or constructed out of bricks, wood, or other available materials. They can be fancy or simple depending on your taste. Just make sure that your planter gives you at least a 30 cm (one foot) of depth for the

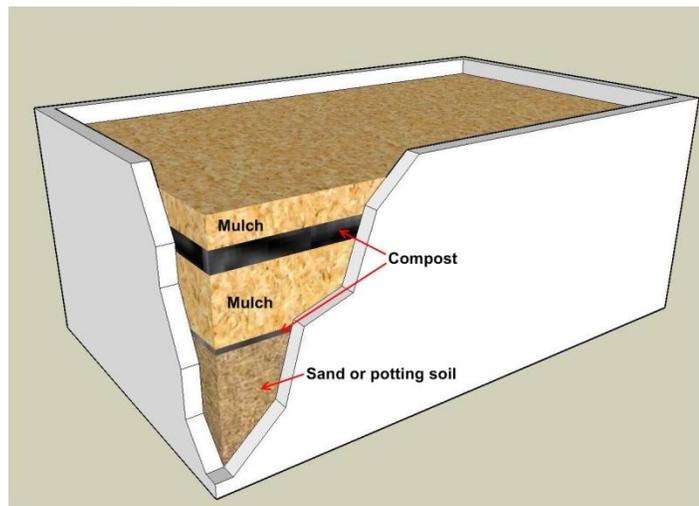
soil. If you plan on having root crops, you will need a planter that is deep enough for at least 60 cm (2 feet) of soil for plants like daikon, carrots, potatoes, etc.

Preparing the Soil

Proper soil preparation is what distinguishes easy, low-maintenance gardens from gardens requiring lots of effort spend on weeding, watering and tending. If you look at a natural system, you will see that it is able to survive without the constant input that most gardens need to survive. If you mimic this natural system, you will save yourself a lot of work.

In your planter, you can use potting soil if you wish, but starting with sand is cheaper and does the trick. But you are also going to need compost and mulch, preferably woodchips as they are less likely to blow around in the wind. It will also be helpful if you can go to a natural place such as a healthy woodlot with minimal foot traffic and grab a few handfuls of soil to put in your planters. This will serve to “seed” the soil in your planters with beneficial microorganisms.

First, put in a base layer of soil – either sand or potting soil – about 15 cm (6 inches) thick or more, depending on how deep the planter is. Place some of the natural soil you collected outside in the planter. Water the soil. The deeper the planter, the more you can put in. Next, add a dusting of compost on top of the soil followed by 10 cm (4 inches) of mulch and water it. Next add about 5 cm (2 inches) of compost and water it. Finally, add on about 5 cm of mulch and water it.



The mulch serves several purposes: it suppresses the growth of weeds, it helps retain moisture in the soil, it breaks down over time to feed the soil, and it creates a niche for spiders, which will help control any unwanted pests that show up. This mulch is a key element, and without it your garden will be less likely to be successful and will surely take more effort from you to maintain.



It will be helpful if you sow white clover seeds (*Trifolium repens*) in the mulch. Just sprinkling it on top will do. As the clover grows, it will create a weed-suppressing groundcover and it will fix atmospheric nitrogen into the soil, helping to fertilise your garden naturally. Groundcover also reduces soil moisture loss due to evaporation.

Planting and Harvesting

Now you are ready to plant seedlings into the planter. To do this, dig aside the mulch in a small area of mulch until you reach the soil layer. Throw in a handful of compost then place the seedling into the hole. The mulch will settle over time, so place the plant so that the seedling sits down in the mulch about 5 cm (2 inches). Make sure that the mulch is not touching the stem of the plant. Water the seedling.

If you sowed white clover into the surface layer of mulch, you will be on your way to maintaining the soil fertility that your plants need. You can also plant nitrogen-fixing vegetables to help your garden. You can plant beans with other plants and the nitrogen they provide will help the other plants grow. You will, however, need to purchase inoculants for the beans at a garden supply store. This inoculant is simply a type of bacteria that joins with the roots of the beans to fix nitrogen from the air into the soil. The exception to plants that are benefitted by beans and peas is members of the onion family. Beans and peas do not grow well together with onions, garlic or chives. If you grow these together in the same planter, make sure that you have at least one other kind of plant between the beans and the onions.

When using your garden, you may need to just harvest just parts of the plant but any time you harvest the entire top of a plant, leave the roots in the soil where they can decompose and feed the soil. If, on the other hand, you harvest a root crop, bury the top of the plant just under the mulch where it can breakdown. Additionally, vegetable and fruit waste from your kitchen can help to feed the soil when buried under the mulch.

Avoiding Artificial Inputs

You may be tempted to add synthetic fertiliser, just in the beginning to get things started. Although this may seem like a good idea at first thought, it will lead to less soil life and less fertile soil over time. In a natural, healthy soil, most of the biomass is in the ground. In fact, there is twice the biomass below the ground compared to above the ground. Plant roots account for only a fraction of this biomass. The majority is in the form of soil micro and macro-organisms. These are so important to plant health that plants release up to 20% of the photosynthates they produce through their roots to feed them.

Adding synthetic fertiliser will reduce the amount of soil carbon, which reduces the productivity of your plants. Synthetic fertiliser is sometimes bound in a cadmium salt, which kills off soil fungi. And the addition of artificial fertiliser increases the plants' uptake of water, bloating them. This causes the root hairs to shut down, starving the soil life. The bloated plants are now more attractive to insect pests and more likely to suffer a parasitic fungal attack. In this way, the end result of adding artificial fertiliser is going to be to kill off most of the beneficial soil life, which would otherwise have done most of the work of fertilising the soil for you. In other words, adding synthetic fertiliser means you are setting yourself up to do more work and spend more money than you would have to do otherwise.



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Life in the soil is the key to healthy plants, which are, in turn the key to human health. The bacteria in your soil will be regulating soil gases that plants need for growth and reproduction. They are also mobile storages of nitrogen and other nutrients essential for plants; and at up to 80 kg (176 pounds) per square metre of soil (compared with 500 to 600 grams per m² in ploughed soils), they are significant stores of these nutrients.

The mycorrhizal fungi in soil physically enters the roots of most plants and provides them with nutrients from the surrounding soil and even allows plants to swap nutrients and send chemical signals among themselves. Saprophytic fungi break down dead plant material making the nutrients from the detritus available for plants to absorb. The samples of wild soil that you "seeded" your planters with will hopefully contain both types of fungi, but you can purchase these fungi, if you wish. (See resources.)

Compost worms (*Eisenia fetida* or *Lumbricus rubellus*) will produce 1 kg of worm castings (the best fertiliser available) per m² per year. If you can get some of these in your planters, they will self-regulate their numbers and provide you with much healthier soil.

Dealing with Pests and Disease

If you plant a variety of plants and mix them in together, you are unlikely to suffer from a huge loss of plants as you might with just or two species of plants planted together. However, when establishing a new ecosystem (i.e. your garden) the first year is going to be the most turbulent as the system establishes a relative equilibrium. Pests may show up and, with the lack of predators, their numbers are free to expand. If you are having too much problem with pests, the simplest, safest and cheapest means of control for you is to spray milk on the bugs. It does not matter what sort of insect pest this is, spraying them with milk will get rid of them. Another common problem is powdery mildew (it looks like a white dusting on the leaves of roses, cucurbits and other plants). This can be dealt with naturally using a 0.5% solution of baking soda. Mix one teaspoon of baking soda with one litre of warm water. Add one teaspoon of liquid dish soap and spray this on the leaves of the affected plants, making sure to spray the underside of the leaves as well.

Planting different flowers that flower at different times of the year will create a habitat for predatory insects that will help control the numbers of pests. If you have the space, this can be very beneficial. If you plant flowers that you yourself can use (like chamomile and marigolds, for example), you will not be sacrificing space for predator habitat.

Some plants are good at repelling certain pests. Aphids are a common menace, but you can help chase them away with nasturtiums, garlic, onions, spearmint, basil and oranges.

When you "seeded" your planters with wild, healthy soil, you probably imported some saprophytic fungi with you. These fungi now have a head start and can out-compete any potentially harmful parasitic fungi that might show up.



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Plant Propagation

Many of the foods that you pick up at your local supermarket can be propagated and grown in your garden:

- Onions or garlic cloves placed in a 10-cm-deep bowl of potting soil with the top third of the bulb emerging should grow if left in a bright window.
- Chickpeas (*Cicer arietinum*) and other dry beans can be started in a 10-cm-deep pot. Cover the seeds with 5 mm of soil, water and put in a sunny place.
- Potatoes with eyes growing out of them can be placed on soil in a 15-cm-deep pot and covered with 3 cm of soil and left in a sunny place.
- Avocado pits can be placed in a one-litre plastic bag with sphagnum moss that is just a little bit moist. Seal the top of the bag and place it in a warm, dark place for a few weeks. After two weeks, punch some holes in the bag to allow air circulation. When the avocado has roots that are 8 or 10 cm long, you can transplant it to a pot, leaving the top half of the pit above the soil.
- Lemon grass (*Cymbopogon citratus*) that has some grass blades left on it can be placed in a glass with enough water to cover the wide portion of the base of the stalk. Add about a tablespoon of activated charcoal to the water. When the roots are about 6 or 7 cm long, cut the top half of the stalk off and carefully transplant it (the roots will be delicate) to a pot and keep the soil moist.
- Fresh ginger root can be placed on top of moist soil and kept in a warm place that is bright but not in direct sunlight. It should sprout and grow very rapidly.
- Jujube pits (*Ziziphus jujuba*) can be placed in a pot with moist peat moss, covered with plastic wrap and placed in the refrigerator for 2 to 3 months to stratify the seeds. Once removed from the refrigerator, the pits should germinate within 3 weeks. When the roots are about 10 cm long, the seedlings can be transplanted.
- Chinese Yams (*Dioscorea batatas*) can be placed in a plastic bag with slightly moist sphagnum moss. The closed bag is then placed in a warm, dark place until it has roots that are 5 to 10 cm. Watch out for soft spots on the yam and cut out any that appear. Place the yam in a pot and just cover it with soil.

Keep the soil for these plants moist and make sure they are in a sunny place or they will grow weak and spindly. Once these plants start growing, they can be transplanted into your garden as described above.

For seeds, they generally germinate best in soil that is twice as deep as the seed is high as it rests on the ground; so, a 5 mm high seed would be covered with 1 cm of soil. They can be set in seed trays or any small containers that you may have. Once sown and watered with a mister, cover the tray with plastic wrap. Once the seeds germinate, make sure they get enough light to avoid weak and spindly plants.



Resources

Beneficial Fungi:

Fungi Perfecti LLC

Box 7634

Olympia, WA 98507

www.fungi.com

The Arunyik Mushroom Center

Box 1

Bankok, Thailand 10162

Mycelia

Jean Bethunestraat 9

9040 Gent, Belgium

www.mycelia.be



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Appendix

Worm Farms

Another simple and useful way to deal with kitchen waste is with a worm farm. A worm farm is just a watertight container with compost worms (*Eisenia fetida* or *Lumbricus rubellus*) in it. Every square foot (30 cm X 30 cm) of worm farm surface area is able process about 200 grams of kitchen vegetable scraps per week. Once established, you can use the worm farm to dispose of not only vegetable waste, but also tea bags, coffee grindings and used filters, the occasional crushed eggshell and shredded newspaper (but not glossy colour paper). A properly run worm farm produces no smell and can be kept indoors without any problems.

The tailings from worm farms are the best plant fertiliser available. When the worms are ready, you can take the compost from the worm farm and sprinkle it onto the soil in your planters to feed the soil. Capturing some worms to put directly into the planters will help with the plant life as well – a dozen per planter would be fine. They regulate their own numbers and will be fine left to help out in the garden. If you have very cold winters, however, the worms might not survive over the winter. If this is the case, their eggs are very likely to survive over the winter and repopulate the planters in springtime.

To construct a worm farm, take any watertight container that is 30 cm X 30 cm or bigger and add 10 cm of compost and shredded paper. Water it just enough that the mixture is moist. If it is too wet, you will drown your worms. Add vegetable scraps just under the surface where the worms can get at them. Finely chopping the scraps will help the worms to break them down faster. If you wish, you can put a lid on the container; just make sure to cut air holes in the lid. Covering the holes with screen or cloth will prevent any fruit flies from entering the container.

Actively Aerated Compost Tea

A great natural fertiliser and pest-repellent for plants is compost tea. To make it, put a handful of compost into a ten litre bucket of rain water (or any water that is free of chlorine). Add a tablespoon of sugar, put in an aerator, and leave the mixture to bubble for 24 hours. When finished, the tea can be put in a watering can and used to water the garden. The mixture will be rich in beneficial bacteria, which, when poured over the leaves of the plant, helps to prevent parasitic attack.

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