

# ABUNDANT BORDERS



Creating a network of local food production in the Scottish Borders

**visit** [www.abundantborders.org.uk](http://www.abundantborders.org.uk) **contact** [robin@abundantborders.org.uk](mailto:robin@abundantborders.org.uk)

# GETTING STARTED - SEEDS

If we are going to consider plants, then where better to start than with the seed.

Put simply, a seed is the reproductive part of a plant. It is what we plant in the ground and from which a plant grows.

In our globalised world we can buy nearly any kind of food at almost any time of year and we forget where that food comes from and that out there, somewhere it started with a seed.

Our ancestors were much closer to plant life cycle. They planted seeds, hoped for a good year, and saved all that they could to feed themselves throughout the winter.

They saved the best seeds to plant the following year.

**Seeds were the ultimate savings account.**



# SEED STRUCTURE

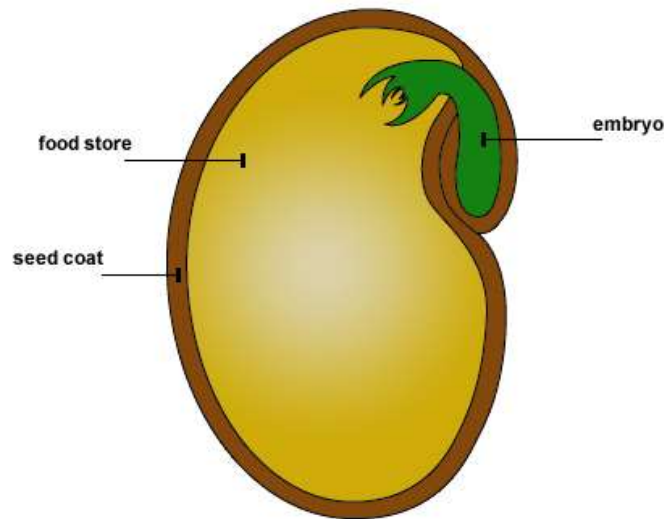
Inside each seed is all that is needed to create a new plant.

Seeds are, essentially, made up from three parts:

The embryonic plant – which will grow into the new plant

A food store, known as the endosperm – this takes up most of the seed and provides sustenance for the early stages of growth. Endosperm can be food for us too. When you eat foods like rice and wheat you are eating this endosperm. In fact, two-thirds of all human calories come from endosperms

A seed coat – this is a tough, outer coating which protects the embryo from damage





# SEED TYPES

If seeds have basically the same structure, why do they look so different? Good Question. Seeds have evolved different shapes and sizes to best suit the means of their dispersal.

## Wind

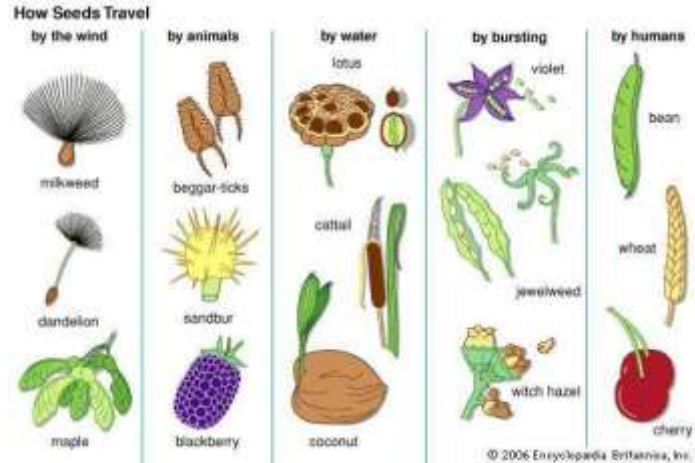
Seeds which are dispersed by the wind tend to be small and have wings or other hair-like or feather-like structures. Plants that produce wind blown seeds, like a dandelion, produce lots of seeds to ensure that some of the seeds are blown to areas where the seeds can germinate.

## Water

Many plants that live in or near water have seeds that can float and are carried downstream.

## Bursting

Some plants have seed pods which pop open explosively to eject their seeds far from the parent plan.



# SEED TYPES

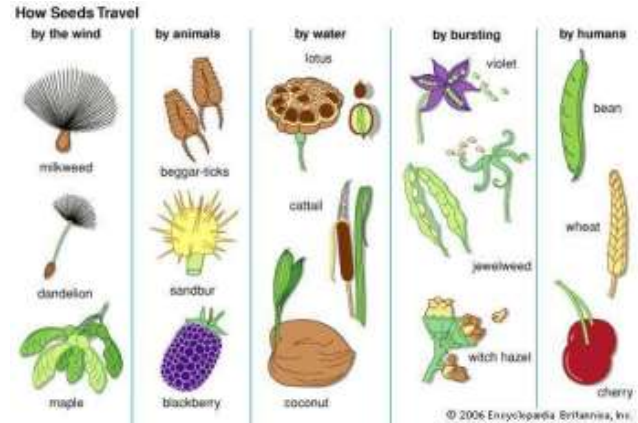
## Animals

Some plants have barbs that get tangled in animal fur. By the time the seed falls out it has been carried to a new location.

Some plants hide their seeds inside fruits which then get eaten by an animal. The seeds pass through the digestive tract and are excreted intact. Some animals bury seeds, like squirrels with acorns, to save for later, but they may not return to the seed later, so it can grow into a new plant.

## Humans

We purposefully collect and plant a whole range of different seeds.



# GERMINATION

- When conditions are right the seed starts to take in water and swells until the coat splits apart. Air can then get to the seed which helps the embryo plant burn the food store and make energy for growing
- A root starts to grow downwards, and a shoot begins to grow upwards
- Leaves sprout at the end of the shoot letting photosynthesis take place
- The primary root grows longer and thicker together with the secondary roots. The leaves grow larger
- More leaves grow, and the stem becomes thicker and stronger





A close-up photograph of several green leaves with prominent veins and numerous small water droplets on their surfaces. The leaves are arranged in a fan-like pattern, filling the entire frame. The lighting is bright, highlighting the texture of the leaves and the clarity of the water droplets.

# Any Questions?

We will have a Q&A each Wednesday morning 10am to 12 noon to answer questions in real time.  
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# WHAT DO PLANTS NEED TO GROW

- the right **temperature**
- **light**
- **water**
- **air**
- **nutrients**

and time and the room to grow





# WHAT DO PLANTS NEED TO GROW

## Water

- Water is the main component in plants cells.
- It is used in photosynthesis
- It transports nutrients throughout the plant
- Plants also use water to lower leaf temperature, increase mineral absorption and pull water from the roots to the top of the plants through a process known as transpiration



## Air

- Carbon dioxide is continually taken from the air by plants and used in photosynthesis
- The amount of carbon dioxide in the atmosphere is about 0.03 percent, meaning that there is roughly 2,000,000,000,000 tons in the atmosphere
- Carbon dioxide is continually being added to the air by respiration of plants and animals, decaying organic materials, combustion of fuels, and volcanic activity

## Nutrients

- Plants need 17 different nutrients to maintain growth. The elements needed in the largest amounts are nitrogen (N) for healthy foliage, phosphorus (P) for flower development, and potassium (K) for root growth

# WHAT DO PLANTS NEED TO GROW

## Temperature

- Temperature varies with latitude, altitude, and the immediate physical surroundings
- The temperature of an area determines what kinds of plants will grow
- The ability of a plant to withstand cold temperatures is known as cold hardiness while plants that can not tolerate cool weather are known as tender
- In the natural environment, temperature is continually changing

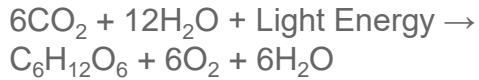
## Light

- Energy, in the form of sunlight is one of the driving forces in the chemical reaction known as photosynthesis
- Photosynthesis is the process by which green plants manufacture food from carbon dioxide in the air and water in the presence of chlorophyll in the leaves
- The quality, quantity, and duration of light influences plant growth
- Plants grown in direct sunlight are typically compact, while those in shade are taller and elongated
- Seeds may start to germinate without light, but then the new plant must have light if it is to continue to grow.



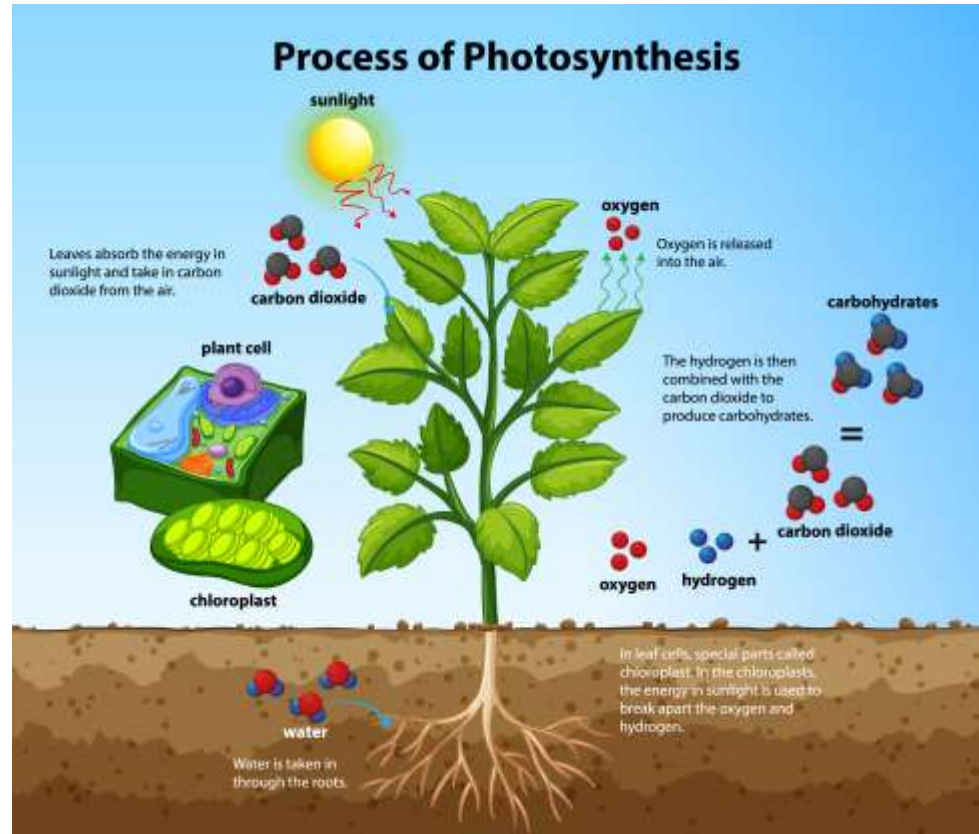
# PHOTOSYNTHESIS

Photosynthesis is a complex process which can be summarized as follows:



Six molecules of carbon dioxide ( $\text{CO}_2$ ) combine with 12 molecules of water ( $\text{H}_2\text{O}$ ) using light energy. The result is the formation of a single carbohydrate molecule ( $\text{C}_6\text{H}_{12}\text{O}_6$ , - glucose) along with six molecules each of oxygen ( $\text{O}_2$ ) and water ( $\text{H}_2\text{O}$ )

The  $\text{CO}_2$  enters the leaves through tiny holes on the undersides called stomata

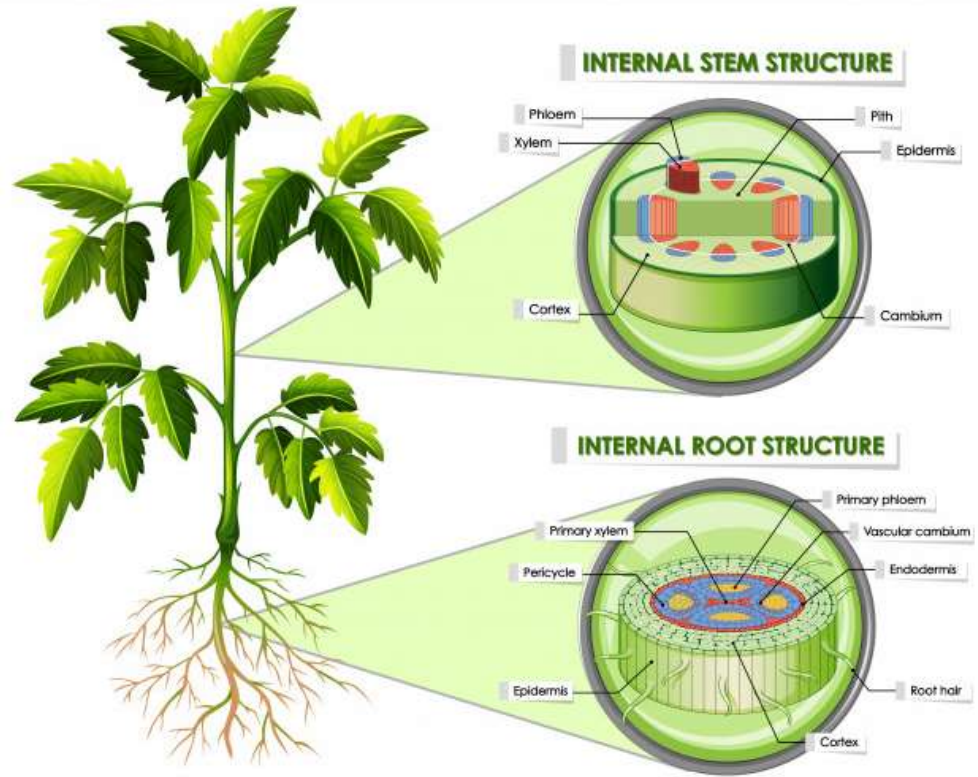


# NUTRIENT FLOW

Within the plant there are two transport systems.

**Xylem** – which brings water and nutrients into the plant from the soil. It works upwards in the plant.

**Phloem** – transports carbohydrates made in the leaves by photosynthesis around the plant. The phloem carries sap upward and downward, from where the carbohydrates are made, the leaves, to where it is used or stored, roots, tubers (underground stems), and bulbs (swollen leaves).



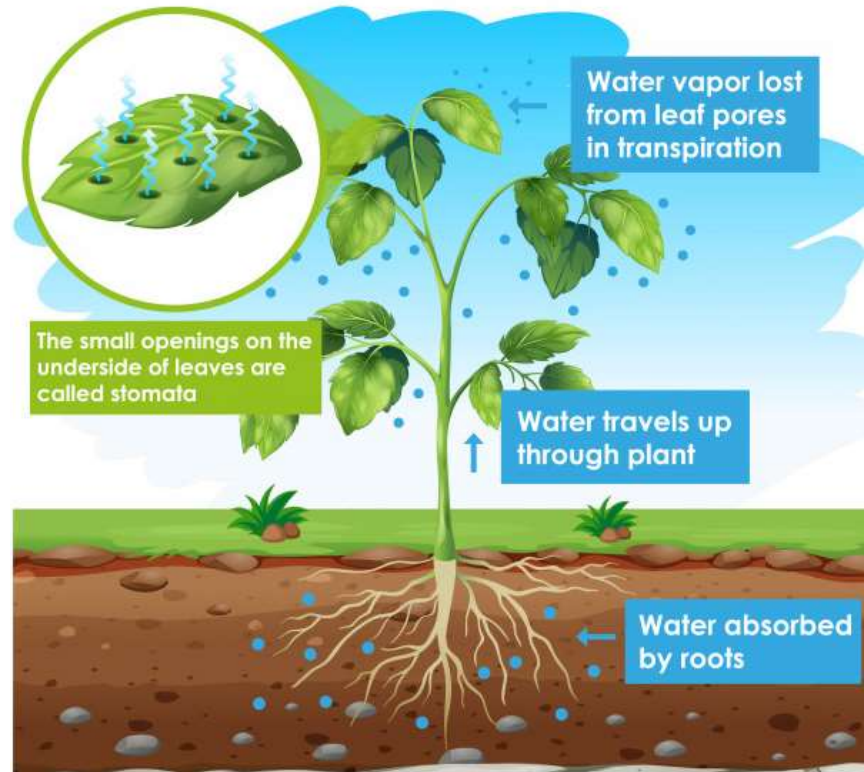


# TRANSPIRATION

Water is drawn up through the xylem in a process called transpiration.

As the water vapour is lost through the stomata it creates a drag through the plant which pulls more water up through the roots.

On a hot and/or windy day lots of water can be lost this way. If the water is lost quicker than it can be replaced, the plant will start to wilt.





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# PLANT PROPAGATION

There are 4 basic propagation techniques – ie ways of creating plants from other plants:

- From seed
- By layering
- By dividing plants
- From cuttings

There is a hugely informative section on the RHS website dedicated to propagation which you can refer to for more detail:

<https://www.rhs.org.uk/advice/profile?PID=999>



# PROPAGATION FROM SEED

Most plants, particularly annual plants, can be grown simply and cheaply from seed.

If the soil is warm and moist, seed can be sown directly into the ground, and it will germinate quickly. In Scotland, this usually means from June onwards.

To give plants an early start, sow in seed trays or individual pots and keep them on a windowsill or in a greenhouse. Plant out the seedlings when the soil is warm, again, typically from June onwards. Seedlings can go into the ground earlier if protected from late cold spells with fleece or in a cloche.

If you are sowing very fine seeds, like lettuce, mix with some sharp sand and sprinkle the mixture into soil/compost. This ensures an even distribution of seeds.





# PROPAGATION FROM LAYERS

Some plants can form roots from their stems when they come into contact with the ground:

- Choose a flexible branch, one near the ground
- Remove the leaves except for the ones at the very tip
- Bend the branch so that it is in contact with the soil and make a small nick in the stem where it touches
- Make a small hole in the soil immediately underneath the branch and bury the nicked part
- Peg/weigh the branch down so that it doesn't shoot up
- Cover with compost and wait
- Once the stem has rooted it can be cut from the parent plant and moved to a new site.

Rhododendrons, azaleas and honeysuckle can be propagated this way.



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# PROPAGATION FROM RUNNERS

Strawberry plants are easily propagated from their runners by layering.

Simply peg down the runner, leaving leaves at the growing tip.

The stem will root and the new plant can be removed from the parent plant.

In many cases, strawberries will do this for themselves without the need to peg down the runner so check your strawberry bed, you probably have more plants than you thought!





# PROPAGATION BY DIVISION

Splitting established plants is a great way of propagating herbaceous perennials as plants tend to be more tolerant of upset than younger plants:

- Dig up the root ball while the plant is dormant (no leaf growth)
- Wash off some of the soil so that you can see the roots clearly
- Split the ball into smaller clumps, making sure that each clump has a new growing shoot at the top
- Pot each clump into a new pot/space in the garden

By selecting clumps for vigorous growth, you're likely to get plants which are more robust than the parent.



# PROPAGATION BY CUTTINGS

Taking cuttings from established plants is often seen as something for the expert, but it is easy to do. And if it doesn't work, you still have the original plant, so nothing has been lost! There is a more detailed information sheet with this module but why not...

Get your confidence with herb cuttings:

- If you have some herbs growing in the garden, snip off 6-inch sections from growing tips and put them in the water-filled containers
- If you have herbs in pots from the supermarket, do the same
- The cuttings will soon root and can be transplanted to pots or into the garden

Or willow:

- Cut off small, fast-growing branches
- Remove the lower leaves
- Stand in a jar of water
- The cuttings will soon root and can be transplanted

**TOP TIP:** Do not throw the willow water away. It will contain rooting hormone making this water much better for rooting other plants than plain water!



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# CHOOSING PLANTS

This training course is usually based from one of the Community Food Gardens that we help to support across the Scottish Borders: Eyemouth, Ayton, Duns or Hawick.

At this point in the course we would be considering which plants we would be planting and choosing those that would flourish in local conditions.

In delivering the course on-line, it is not possible to do this so please take time now to consider your own garden.

**Take at least 15 minutes to look closely at your garden. Here are some hints as to what to look for.**





# CHOOSING PLANTS - LOOK AND LEARN!

Every garden is different. Choosing the right plant for the right place involves developing a good understanding of your own garden. When you understand the soil, light and shade, water and other factors and what they mean for the plants, you can work with nature to grow more and better plants. You are the expert in your own garden.

## What kind of soil do you have?

Last weeks module will help here. You can test the pH of the soil with a kit, but you can do a lot by observation. If Rhododendrons and camelias are growing well in your garden, (or in the neighbourhood) you are likely to have an acidic soil as these plants thrive in those conditions. In acid soil hydrangea flowers turn are blue. In alkaline soil the flowers are pink or even red.

Pick up a handful of soil. Loose soils that do not hold together in your hand are generally sandy, while those that clump together are generally clay.



# CHOOSING PLANTS - LOOK AND LEARN!

## Where is the sun?

Does your garden face north, south, east or west?

## Shade - Not all shade is the same!

Most gardens have some light and some shade, everything from light-dappled shade from taller plants to pitch-dark shade from the shadow of buildings.

Shade can go hand in hand with dryness – if the shade is coming from big trees which might be taking up water or with wetness if the shade is preventing the ground drying out properly.

Shade can create cold areas in the garden if the sunlight never gets chance to penetrate.

Take a good look around. Your garden is probably more complicated than you first thought and remember shade will change throughout the seasons.





# CHOOSING PLANTS - LOOK AND LEARN!

## **Where does the wind come from?**

In areas of high winds you can see the way that the trees bend.

Wind has a physical effect on plants and can also have a drying effect by speeding up water loss through transpiration.

Are some parts of the garden exposed or sheltered?

## **How wet is the soil?**

Clearly this changes over time but clay soil is better at holding water than sandy soil.

Are there wet areas? Are you collecting rain water?



# CHOOSING PLANTS - LOOK AND LEARN!

It is really important that you **always** take time to look at your garden.

- It is not one area with identical growing conditions. There will be different growing conditions in different places - microclimates
- It will change through the year as plants grow, flower, die back and are harvested
- It will change over the years as perennial plants become established and change their microclimate



Ayton Community Food Garden



# CHOOSING PLANTS

We have seen that all gardens are different.

To complicate matters even further, all gardeners are different!

What kind of plants you want to grow depends as much on **YOU** as the soil or the shade or the wind!

**Take time to think about what plants are FOR.  
Why you grow what you grow, or want to grow**



# WHAT ARE PLANTS FOR?

While we are talking in this course about growing food, it is clear that there are many reasons for what you grow in your garden and **YOU** are the most important.

The information sheet has some suggestions for plants that you might consider.





# WHAT ARE PLANTS FOR?

Permaculture encourages choosing “multi-purpose” plants. That is, planting plants for more than one reason and with more than one productive output. Here are a couple of examples from my garden



Comfrey

- Flowers to brighten salads
- Flowers attract early pollinators
- Leaves for mulch/compost
- Leaves for liquid fertiliser
- Shade tolerant so grow well filling an empty space under an old hedge



Willow

- As a windbreak
- Small stems for weaving
- Large stems for bean/pea poles
- Water from sprouting cuttings used to encourage rooting in other plants
- These are a yellow barked variety so add winter colour/interest

**Take time to think AGAIN about the plants in your own garden**

# CHOOSING PLANTS - FOREST GARDENING

## HOW TALL IS YOUR GARDEN?

Robert Hart is credited with having one of the first forest gardens in Britain and inspired Bill Mollison, one of the founders of Permaculture, to integrate it into the permaculture way.

This approach apes natural woodland while producing many more edible species. So we would see many more trees than in the conventional suburban garden. We are trying to attract as much wildlife as possible and would expect to see different species of plants happily co-existing in close proximity, ensuring that there is little or no bare soil. In this model the ground is fertile because of what and how we are growing and needs little help in maintaining a healthy eco-system.



The UK's oldest intentional food forest garden is in Coldstream. Established and still managed by Graham Bell and Nancy Woodhead



# FOREST GARDENING

## GARDENING IN MULTIPLE DIMENSIONS

- **Root Layer** - turnips, carrots, potatoes
- **Ground Cover** - alpine strawberries, mint, camomile, wild garlic
- **Herbaceous Layer** – chives, mint, angelica, lovage, sweet cicely
- **Shrubs** – bay, fruit bushes
- **Small trees** – fruit trees
- **Climax Trees** – walnut
- **Vines/Climbers** – brambles, climbing beans

These are some examples and the information sheet has more detail.



# FOREST GARDENING

We encourage forest gardening for many reasons. Graham Bell, leading permaculture teacher and Borders resident puts it like this:

“I live here on the Scottish Border, the same latitude as Alaska and Moscow.

The garden is 800 sq meters. Or .08 of a hectare. A fifth of an acre in old money.

Peak yield in this garden is 1.25 metric tonnes of food.

37 species of birds' nest in this garden, 20 come for their lunch and 20 more on their holidays.

We have willing workers. Two tonnes of them. They're called earthworms. That's the weight of thirty fit strong young men. But these guys dig seven days a week and fifty-two weeks of the year. They digest botanical waste and turn it into TOPSOIL!!!

Right now (May) there are sixty species of plant you can eat in a salad.

We have one hundred varieties of apple... and so much more.

What's the secret? **Stop. Think. Learn.** Let nature do the work.”





# LOOK AND LEARN!

One suggestion is that you create a **SIT SPOT** in your garden. Somewhere you can sit and observe and enjoy your garden. You can see the sun, see how the plants create shade, feel the wind, listen to the birds. It is where you can observe and simply be.

This is my Sit Spot.

Please share your own Sit Spot places on the Facebook page.

(<https://www.facebook.com/groups/virtualcommunitygarden>)





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# FURTHER INFORMATION

## Books

- The Permaculture Way, Graham Bell
- The Permaculture Garden, Graham Bell
- Creating a Forest Garden, Martin Crawford
- Permaculture 1, Bill Mollison and David Holmgren
- Permaculture, A Design Manual, Bill Mollison
- People and Permaculture, Looby Macnamara

## On-line

- The Permaculture Association  
([www.permacultureassociation.org.uk](http://www.permacultureassociation.org.uk))
- Permaculture Scotland  
(<https://Scotland.permaculture.org.uk>)
- Abundant Borders  
(<http://abundantborders.org.uk/training-programme/virtual-community-garden-learners/>)
- Royal Horticultural Society  
(<https://www.rhs.org.uk>)

## Facebook groups

<https://www.facebook.com/groups/virtualcommunitygarden/>  
<https://www.facebook.com/groups/foodcommunities/>  
<https://www.facebook.com/groups/permaculturescotland/>

# THANK YOU

We are a small, growing charity (SCO49008) supported by several organisations.

We are grateful for their support - without which we wouldn't be able to do what we do.

Thank you

