

Your Questions Answered!

Answers from Cindy Forde author of *Bright New World* – Monday's lesson on imagining a sustainable future

Would we still be alive when these changes happen?

The changes are already happening. It is already cheaper to produce green energy than energy from fossil fuels; we are already designing energy efficient vehicles and sustainable cities, transport and agricultural systems; responsible manufacturers are developing materials that create far less pollution and waste and we are learning that we can enjoy our lives more when we don't buy so much stuff; organisations all around the world are working to conserve our rainforests, oceans and biodiversity.

To make the changes happen faster and more completely we have to phase out the old ways of doing things that have caused all the problems and makes sure our governments and big companies know we will not vote for them or buy their products if they continue putting us in danger. Instead, we want them to help us move more quickly to a world where you can look forward to seeing these changes all around you by the time you are grown up.

How are we going to get everyone to help and listen?

What you are doing in school this week is a brilliant example. You are showing how we can solve the problems, and not just by patching things up, but by demonstration. With your ingenious designs for houses, how we can use the current danger we are in to learn how to build a much brighter world. We can all get overwhelmed by how big the problems seem, but when we tell, and show, people what the solutions are and how much better this can make our lives people are much more ready to listen and to help.

How can we make sure that everyone is doing what they need to be doing to make these changes?

The best place we can start is with ourselves, then our families, our classrooms, our schools and communities. There are almost 8 billion of us on planet Earth, if those of us who can do even a small thing every day, that can make a big difference. Try not to worry about the things you can't do, and choose the things you can. It is very important to make sure you and your family and schools know about what the problems are and how we can solve them so we can get on and do what we can, as well as using our voices to ask our governments and leaders to make these changes across our villages and towns, our cities and countries and across our world.

Why are greenhouse gases so dangerous? How do we know when they are at a 'safe level'?

We need greenhouse gasses to keep Earth at the right temperature to support life, they only become dangerous when there is too much of these types of gasses in the atmosphere.

You can measure greenhouse gasses by how many parts per million, or molecules (tiny particles) per million, there are in relation to other molecules in the atmosphere. Since the beginning of human civilisation there have been about 275 parts per million of carbon dioxide in the atmosphere, now there are well over 470 molecules per million of CO₂ and other greenhouses gasses which means they are trapping far too much heat.

If Earth gets more than 1.5 degrees hotter than it was before the industrial revolution, when we started to produced so much CO₂, Earth becomes much more unsafe for human life. To stop this happening we need to get greenhouse gas levels below 350 parts per million within about the next 6 years.

We can do this by rapidly cutting emissions from fossil fuels and methane released in farming cattle, as well as from landfill among other sources.

Will humans be in danger if robots are made?

Not necessarily. It all depends on how and why we design the robots and programme them to behave. If we design robots and AI to carry on doing things the way we do now, to extract as many resources as possible from the natural world, to make things as cheaply as possible, pay people as little as possible so a small

part of our human family can get very rich and others become poorer, almost disposable, we will have some very nasty robots and AI (not to mention the robots designed to go to war!). But if we think differently, if we think like a human family instead of warring tribes and design AI and robots to help us shape a world where our purpose is to live peacefully and thrive, where nature can regenerate, and people and other creatures on Earth are treated kindly and fairly, then I think we might have some very wonderful robots indeed!

Answers from Nicola Marshall from Jacobs – Tuesday’s lesson on engineering sustainable homes

Are we using sustainable forests as we are worried about chopping down trees and taking away habitats for animals?

It’s very important that we use forests sustainably if we start using them more to create wood for our homes. We need to ensure that our forests are able to grow back naturally. We can do this by carefully selecting & managing what trees & forests we use. As well, we need to make sure we replant new trees to make up for the ones we have cut down.

Is hydro power a sustainable source of power?

Yes, hydro power is a sustainable source of power. This is because the main source of power comes from moving water quickly. There are no greenhouse gases released during this process.

How many people own sustainable homes in Scotland?

This is a very tricky question to answer. We don’t really know. There are over 2.5 million homes in Scotland. Some will have more sustainable features than others. When we build our future homes we need to make sure we make sustainable choices! And we also need to make sure we do all that we can do to make our current home sustainable as possible.

Can wood insulation rot?

Wood rot occurs when wood becomes wet over a long period of time. Wood insulation is treated during its production so that it won’t become wet when its used as insulation. So it’s unlikely that wood insulation will rot!

Is creating a wooden home more dangerous (i.e. more flammable)?

Not necessarily! Some building materials, especially when they are manmade, are more flammable than wood. Examples of manmade building materials include plastic and vinyl. Fire safety is an important component of building homes & there are strict building codes & rules that engineering companies need to follow when selecting building materials. Additionally, we also need to make sure homes are built with smoke detectors, fire extinguishers and have a safe escape routes just in case.

What type of house do you currently live in?

I live in flat that was constructed in the 80s. It’s main building material are bricks. Although it has a gas boiler, it has plenty of insulation so that I don’t have to turn the heating on that often.

How many houses have you been on the engineering team for?

Whilst I have not worked on any houses, I have supported our projects in laboratories, engineering workshops, office buildings & waste treatment plants. I have also helped with a bridge we are building in Glasgow to connect Renfrew with Clydebank & Yoker. I loved being able to see a project come to life & see my local community benefit from it!

Answers from Eve Armstrong at Royal Botanic Garden Edinburgh – Thursday's lesson on climate ready gardens

Questions about what to plant where:

Are there particular plants that you put in a rain garden?

Generally, you want plants that intercept water with their leaves, absorb lots of water with their roots and which don't mind being in waterlogged soils. You also want to make sure that you have plants of different sizes. One of the things we are experimenting with as part of our Nature-Based Solutions project is which plants work best. Some good examples are hosta, primrose, hydrangea, iris and alder trees but there are many more!

What plants are good for bees in our beehive?

Bees need the nectar from flowers to eat and to make into honey so the best thing you can plant is pretty much any flower, particularly those with single flowers (not doubles) and not too many petals. Wildflowers especially those which are common in the UK like clover, knapweed and honeysuckle. Foxgloves, lavender, primulas, sage and bluebells are great for bees too!

What flowers would be good to grow in raised beds - we are currently creating our own sustainable garden at school?

Lots of flowers will grow in raised beds! Apart from the bulbs like daffodils and crocuses, we have geranium in our storm water planter which is growing very well! Heather can do well in raised beds as do ox-eye daisies and edible flowers like nasturtiums, calendula and borage! How about holly if you are looking for something a bit different? Raised beds are also great for growing some food crops like herbs, carrots, tomatoes, potatoes and even beetroot. Just make sure you don't mix daffodils with anything you plant to eat!

What plants are thirsty and would be good to include in flooded areas?

The plants like hosta, primrose, hydrangea, iris and alder tree do well in rain gardens and flooded areas. However if it is quite shady too, ferns are a great choice because they are very good and surviving in very damp soil. Other options would be to choose plants which traditionally grow on bogs and moorlands like marsh marigold, meadowsweet, lady's mantle, willow trees and many different sedges.

What plants would be good for a city centre school in Glasgow?

This will depend on how much sunlight and wind you get in the area where you hoping to put your plants. If you are planting in pots and looking for something easy to maintain, then now is the perfect time of year to plant bulbs like daffodils and crocuses. Another great option is planting food crops like herbs, carrots, tomatoes, potatoes and even beetroot. Just make sure you don't mix daffodils with anything you plant to eat! Fruit trees can thrive in large deep planters. If you have some ground to plant in, then spreading a great mix of wildflower seeds and starting a small wild patch in your playground is fantastic for biodiversity.

Questions for Duncan Young, Herbaceous Supervisor at the Royal Botanic Garden Edinburgh:

How much do you enjoy your job?

I enjoy my job very much. I love being outdoors and horticulture has so many different avenues: from looking after parks/gardens to caring for wilder natural places and from growing fruit and veg to arboriculture (caring for trees), the list is endless.

What's the most difficult part of your job?

The weather quite often dictates what we can and cannot do in the garden, especially if there are high wind speeds as it can become dangerous to work around large trees. Heavy rainfall and frosts quite often make working in the garden more difficult as well.

What is the best plant you have ever grown at the gardens?

When I worked in the nursery, where we grow all our plants from seed, I spent a lot of time growing conifers from Chile which are very important plants as they are part of our conifer conservation programme. A lot of these conifers are now planted in the Edinburgh Garden, and they grow to become very large trees.

What is your favourite season? / What season has the nicest plants?

I like spring because all the plants that have been dormant over winter begin to start poking out of the ground and showing signs of life. You also get a lot of spring bulbs like daffodils and tulips which add a lot of colour to the garden. Summer probably has the most plants out in flower though as that is when plants are at their peak flowering time after doing some growing in Spring.

Questions about seasons, soil and water:**Are there plants that grow in every season?**

Evergreen plants provide garden interest year-round. These plants put on a lot of growth during the summer but also (very slowly) grow in the winter.

What are the best plants to grow in spring?

Bulbs, daffodils and tulips are probably the best and easiest to grow for some colour in spring.

Are certain plants quicker to grow?

Annuals grow very quickly. These are plants that you grow from seed, and they will germinate, grow and flower all in the one year. They don't appear the following year however, so you would need to repeat the process or grow perennials which take longer to establish and grow.

What type of soil do you use to plant the plants?

We have a very rich soil here at the garden due to years of composting and adding the compost back into the beds where we plant our plants. It is slightly acidic which is great for growing plants like Rhododendrons and Meconopsis.

How do we keep badgers from ruining our grass but can still enjoy their habitat?

We don't do anything to stop the badgers from ruining our grass as they are a protected species in the UK. All we can do is go around after them are tidy up and repair the grass back to its original state.

Do plants need different amounts of water depending on where they grow?

Plants which grow near our ponds, streams and rain gardens tend not to need any water at all throughout the year. However, plants which live in some of our more sunny south facing spots in the garden tend to need a drink in the summer months when the temperature is at its hottest. Whenever we plant new things in the garden, we water them until they have established a strong root system which can find water for itself.

What is a plant that doesn't need lots of water?

Cactus which we grow in our glasshouses are the main plants that don't need a lot of water as they have good methods of storing water for long periods of time.

Do you have to water all the plants and flowers by hand when it's hot?

We do have some areas of the garden which are on automatic systems, these plants get watered during the night when nobody is in the garden. We also have some sprinklers and hoses which we can set up and they water large areas for us.

Questions about what grows in the Royal Botanic Garden Edinburgh:

How long has the garden been open for?

The Royal Botanic Garden Edinburgh was founded near Holyrood Abbey in 1670 as a garden growing plants for medicine. In 1675 it then moved to where Waverley Station now stands, and in 1763 it moved to near Leith Walk. The move to the Inverleith site – where the Garden still stands – began in 1820. The Garden has had four different homes and a 354 year history!

How many varieties of plants do you have?

We have around 13,500 different species of plants growing in the Edinburgh Garden.

What plant in the botanic gardens lives the longest?

One of the oldest living trees in the world is a bristlecone pine (*Pinus longaeva*). We grow this tree in the rock garden but ours is not especially old yet! One of the cycads in our Glasshouses may have come from the Glasshouse on Leith Walk, so it could be over 200 years old!

Do you sell any of your plants that are edible?

Our edible plants are used as ingredients in lots of tasty food and drink made in our cafes and restaurant.

Do you have poisonous plants or medicinal plants?

We do! We grow lots of medicinal plants like (lungwort, yarrow, rosemary and sage), which are used by our Herbiology students to learn about using plant remedies for wellbeing. Although we don't intentionally grow poisonous plants, hemlock self-seeds and pops up in our Garden from time to time.

Are there maple trees in the botanic gardens?

Maples are in the genus *Acer*. We grow 136 species over *Acer* this includes the field maple, sugar maple and many Japanese maples.

What is the most common plant you have?

Grass! Millions of blades of grass make up the lawns in the collection. Yew is our most common tree and is used in the hedge that surrounds the garden.

What is the rarest plant you have?

We have lots of rare plants. Some of them are even thought to be extinct in the wild! An example of this would be *Rhododendron adenosum*. This species was thought to be extinct in the wild but in 2020 one plant was rediscovered growing in the wild - it is critically endangered.

What is the smallest plant you have?

The smallest plant we have grows in some of our ponds – duck weed!

What unique plants are there at the Botanic Garden?

Some of our unique plants are closely guarded secrets – plant collectors may look to steal them because of their rarity!