

tinyforest



earthwatch
EUROPE

CITIZEN SCIENCE IN
YOUR TINY FOREST

SECONDARY SCHOOL GUIDE





MONITORING YOUR TINY FORESTS

Citizen science describes the long-term contribution members of the public make to scientific experiments. It has the power to provide the data we need to better understand and look after the natural environment, but can also inspire people to change their behaviour and use their voice to advocate for change.

Getting involved in projects can broaden the understanding and awareness of communities and encourage them to act for a sustainable future. Citizen science provides an opportunity for people from a range of ages and backgrounds to connect to science and learn more about local and global issues. It brings groups together and enables them to make a difference by contributing to valuable research and action.

Tiny forests are a powerful tool to tackle the climate and biodiversity challenges. This provides enormous potential to engage people, providing actions they can take whilst learning about the important benefits of trees and forest processes in helping the environment.



By monitoring Tiny Forests, we can build a database of knowledge focusing on four key environmental benefits thought to be provided by a Tiny Forest.

Additionally, by collecting data through citizen science, we can engage citizen scientists in their local community and the current urban environmental challenges which exist there and allow them to better understand the role of a Tiny Forest in tackling some of these challenges. By empowering young people to take individual and collective responsibility for nature in their local area, we support them in facilitating and creating a genuine connection with their local environment, improving social and environmental resilience

We monitor Tiny Forests by collecting data on key environmental focus areas. This helps us to improve our understanding of the possible benefits provided by a Tiny Forest associated with four ecosystem services: Carbon capture, thermal regulation, flood mitigation and biodiversity. Monitoring includes training participants to be the citizen scientists collecting the data, which educates them on the key environmental challenges we are studying and on the methods of data collection.



By conducting this regular monitoring, we can contribute to a growing conversation on urban Nature-based Solutions, as well as adapt our methodologies of Tiny Forest implementation to try and maximise their benefits and success.

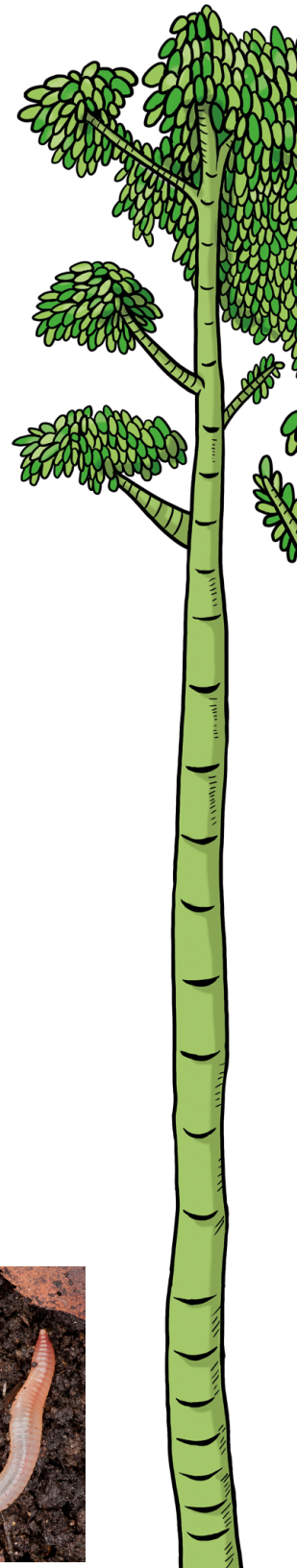
Before you begin with the monitoring, it may be useful to dedicate some time to discuss Tiny Forests with your pupils. You could ask pupils to conduct research around key issues such as climate change or biodiversity loss or take a visit to the Tiny Forest and discuss the benefits of Tiny forests. This can help to contextualise the students learning and assist them in understanding the aims and purpose behind the Tiny Forests initiative.



CITIZEN SCIENCE

Tiny Forests will be regularly monitored through citizen science. These methods have been designed by our team of researchers, so that they can be followed both with our team when we visit, and independently with your students. During a monitoring day, there will be four key areas researched, which are:

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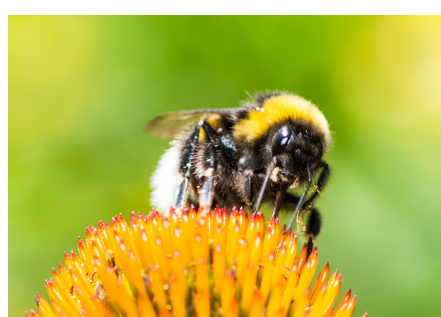


BIODIVERSITY

Biodiversity refers to the variety in type and number of different species of plants and animals that you may find in an area. Native plants and trees found in the Tiny Forest can support biodiversity by providing habitats and resources for a broad range of species. In providing an area of greenspace in urban areas, which commonly do not have much wildlife, Tiny Forests aim to increase the biodiversity of urban areas. We monitor the biodiversity of Tiny Forests to track the changes in the amount and type of wildlife found in the area. This is done by carrying out species surveys for targeted groups, including pollinators, ground-dwelling invertebrates and butterflies.

To monitor biodiversity, you will measure:

- Pollinators
- Butterflies
- Ground-dwellers



THERMAL COMFORT

Thermal comfort is the term used for how warm or cool we feel. In cities, making sure we feel cool enough is more difficult because there are many things that heat cities up; unnatural materials like concrete and tarmac can make you feel warmer, as can lots of people and lots of electricity being used in one space. This is called the Urban Heat Island (UHI) effect, whereby built-up areas experience warmer temperatures than their rural counterparts. Trees can play a role in cooling urban areas through shading, reflection and evapotranspiration. We monitor this effect to determine the magnitude of the cooling effect of the Tiny Forest. This is done by measuring the temperature at different points in and around the Tiny Forest.

To monitor thermal comfort, you will measure:

- Temperature
- Humidity
- Windspeed
- Personal thermal comfort

FLOOD MANAGEMENT

Trees play an important role in the water cycle, through intercepting rain and snow fall, which reduces or delays the amount of water that hits the ground. This means trees can play an important role in reducing soil erosion, improving water uptake in soil and preventing flooding. Tiny Forests are monitored to assess their potential in reducing flood risks to urban areas in the short and long term. This is achieved by measuring a variety of soil qualities to provide information about how the Tiny Forests absorbs and stores water.

To monitor flood management, you will measure:

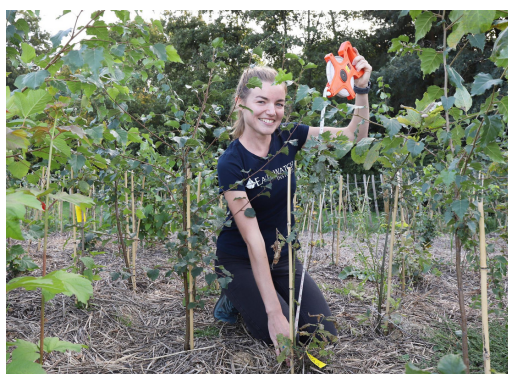
- Soil infiltration
- Soil compaction
- Soil classification

CARBON CAPTURE

Human activity is causing a rapid rise in the levels of carbon dioxide (CO₂) in the atmosphere, which is contributing to climate change. Trees take in carbon dioxide through photosynthesis, therefore playing a vital role in our battle against climate change. Tiny Forests are monitored to assess the amount of carbon stored over time, as well as how this changes based on factors such as location, soil type and tree species mix. This is monitored by measuring the height and diameter of the tree at various points.

To monitor carbon capture, you will measure:

- Tree species
- Tree diameter and height
- Tree growth, including stem count and mortality



The four focus areas summarise some of the key challenges faced on our planet, particularly to those living in urban areas. Tiny Forests are a Nature Based Solution to these challenges.

NATURE BASED SOLUTIONS

Nature-based solutions are methods that use nature (or mimic natural processes) for the benefit of people and the environment. They have huge potential to help cities become more resilient to climate change, and benefit people's health and the economy.

EQUIPMENT, RESOURCES & TIME

We aim to monitor Tiny Forest a minimum of two times a year for the first two years. The monitoring activities are designed to compare the benefits of Tiny Forests over time and in different locations.

Each activity should take around 15 minutes. For example, to monitor biodiversity, there are 3 activities: pollinators, butterflies and ground-dwellers. So, in theory, it should take 45 minutes to monitor biodiversity.

The Tiny forests will be formally monitored on monitoring event days, but we also encourage schools and communities to get involved and conduct their own monitoring throughout the year. The Tiny Forest is a great resource to teach young people about science and nature, and to promote scientific skills around monitoring, accuracy and data management.

The following table will give you a list of basic equipment you will need for collecting the data. We have also included alternative kit that you can use.



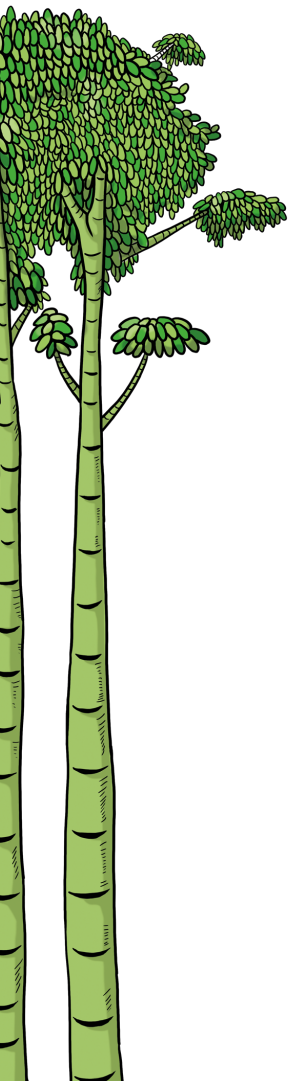
| Monitoring Module | Equipment | Purpose |
|-------------------|--|--|
| Carbon Capture | Diameter tape measure/digital calipers/tape measure and conversion chart | Tree stem diameter |
| | Tape measure/clinometer | Tree height |
| Flood Management | 15cm length of 15cm diameter PVC piping Mallet Timer/Stopwatch Water bottle/Measuring jug (500ml) | Infiltration/Soil water absorption |
| | Pocket penetrometer | Soil compaction |
| Thermal Comfort | Weather station & tripod | Temperature/Humidity/ Wind Speed |
| Biodiversity | Paving slabs (permanently in Tiny Forest) Timer/stopwatch | Ground dwelling organisms/biodiversity surveys |
| All | Laminated guides | Protocols & ID guides |

HOW TO RUN THE CITIZEN SCIENCE

There are lots of ways you can champion the monitoring of your Tiny Forest in school. For example, you could assign a specific focus area of the monitoring to a class or year group. Or, you could link each aspect of the monitoring to a term topic or subject area. For example, if you are learning about the life cycle, you could look at the biodiversity you might find in your forest, or think about the role that carbon capture plays in the life cycle of a tree.

We have provided guidance on the time of day, time of year and weather conditions during which each monitoring protocol should be conducted.

| Monitoring Module | Time of day | Weather | Season |
|-------------------|--------------------------------------|-------------------------------|----------------------------|
| Carbon Capture | All day | Any weather | Any season |
| Flood Management | All day | Any weather, avoid heavy rain | Any season |
| Thermal Comfort | All day, repeat at different times | Not when raining or snowing | Spring and summer are best |
| Biodiversity | Warm weather, when TF is undisturbed | Not when raining or snowing | Spring and summer are best |



On a monitoring day we will cover all of these elements, and depending on the equipment you have available, you can collect this data as frequently as you wish. There are two elements, thermal comfort using a weather station and the penetrometer reading within flood management that require specific kit. Due to equipment restrictions, some of our monitoring protocols can only be conducted with Earthwatch staff.

These include:

THERMAL COMFORT

Measurements must be taken using the weather station to ensure consistency of data. However, you could teach your pupils about thermal comfort by conducting the personal experience activity, in which pupils record how hot or cold they feel. You could also encourage pupils to create a weather or temperature journal, in which they monitor the temperature and weather conditions over a period of time.

FLOOD MANAGEMENT

Soil Compaction – this aspect of the flood management monitoring requires a soil penetrometer. However, you can teach your pupils about compaction by running a short activity, in which you find different areas of soil and ask pupils to insert wooden skewers in to the ground. They can then assess which areas were easier or harder to insert the stick in to, which you can then link back to soil compaction.

The remaining protocols use simple ID guides or basic equipment such as measuring tapes and so should be accessible to all. This means that you can conduct these monitoring activities at any point following the monitoring day. This includes -

- Carbon Capture
- Flood Management (soil infiltration and classification)
- Biodiversity

Below is a sample timetable from one of our school monitoring days. This can be used as a guide to plan your own monitoring events, and allow for time to introduce groups to the rationale behind Tiny Forests and the monitoring day, as well as transport to and from the Tiny Forest (if applicable).

| | |
|---------------|--|
| 09:00 - 09:30 | - Assembly about Tiny Forests |
| 09:30 - 11:40 | - Class 1 - Thermal comfort & Carbon capture |
| 12:00 - 13:00 | - Lunch |
| 13:00 - 14:40 | - Class 2 - Biodiversity & Flood management |
| 15:15 - 18:00 | - After school clubs using the Tiny Forest |

You can find out more about how to conduct all of our monitoring protocols in the individual monitoring guides, with supporting information in the data sheets and fact files.

TOP TIPS FOR MONITORING

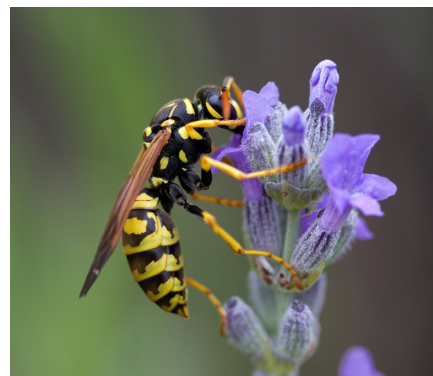
It is important plan your data collection if conducting your own monitoring. Make sure all of the members of your group know:

- What your focus area is (e.g. biodiversity)
- What data they will be collecting
- Where they will be collecting it from
- How the data should be collected
- How the data should be recorded

Ensure individuals understand and follow the instructions carefully during monitoring, ensure groups respect living things, do not touch them and return any items such as slabs, stones or leaves back where they found them.

Ensure individuals work:

- **Consistently** - When performing more than one sample, individuals should ensure they use the same method each time, so as not to influence the results. It is also important that different individuals performing the same activity use the same method.
- **Accurately** - Individuals should ensure all of their equipment is used correctly, instructions are followed and the correct units of measurement are taken, to ensure that data is accurate. You can repeat the measurements multiple times and take an average of the recordings, which will help to ensure accuracy in results.
- **Carefully** - Working outdoors comes with hazards, that all participants should be conscious of when monitoring.



If extra support is needed, you could run a training day or a practice session, so participants can familiarise themselves with the strategies used.

Make sure data is inputted in to the online platform as soon as possible, to ensure results won't be lost. Double check any inputs for accuracy.



DATA, FURTHER LEARNING & SHARING

The data collection can be done both through paper forms, or through the online platform, which can be accessed through a smart phone or tablet. This data will then come to our Earthwatch scientists who will analyse the impacts of the individual forests, and compare impacts from the network of Tiny Forests across the UK, and Miyawaki forests across the world. We hope that the findings from Tiny Forests will both inform and influence policy, and drive positive action for the environment in creating a climate proof and sustainable future.

Monitoring your Tiny Forest is a great, hands on way to teach your pupils about some of the key environmental challenges our planet is facing. Learning could be extended in many different ways and linked to topics such as science, geography, art, design & technology, maths and English. Some ideas to continue your learning are:

- Ask your pupils to plan and implement a research project. Present them with a focus questions, such as 'what are nature-based solutions and why do we need them?' or 'how are nature-based solutions helping in the fight against climate change?'. This will help your pupils to understand more about the purpose of their learning.
- Host a debate. Split your pupils in to groups and provide each group with a stance or argument that they have to defend. For example, you could assign each of the 4 focus areas to a different group and ask them to state why theirs is the biggest environmental threat. Or, you could ask groups to argue for and against key issues such as deforestation. Your pupils should be given the opportunity to research facts and information to support their stance. This will broaden the conversation and allow pupils to consider different perspectives on an issue.
- Encourage pupils to take action in their homes and personal lives. Pupils could encourage friends and family to visit the Tiny Forest, design awareness raising posters or artwork surrounding environmental challenges, create homes for wildlife or investigate ways to encourage climate consciousness within their communities. You can support your pupils in doing this with the help of our 'Community Change Makers' learning module.

Tiny forests are also a great tool to learn about climate, wildlife and community. We've curated curriculum linked, key stage specific resources for you to use inside and outside of the classroom, that will help you to maximise the benefits of your local Tiny Forest. You can find them all on our education platform.

We'd love to see all the work you're doing with Tiny Forests, so keep in touch with us on our social media channels!



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