Tiny Forests for Giant Lessons

A guide to integrate urban biodiversity into education

To teachers,

who create the soil of the future

Summary

Introduction

One tiny forest - twelve benefits

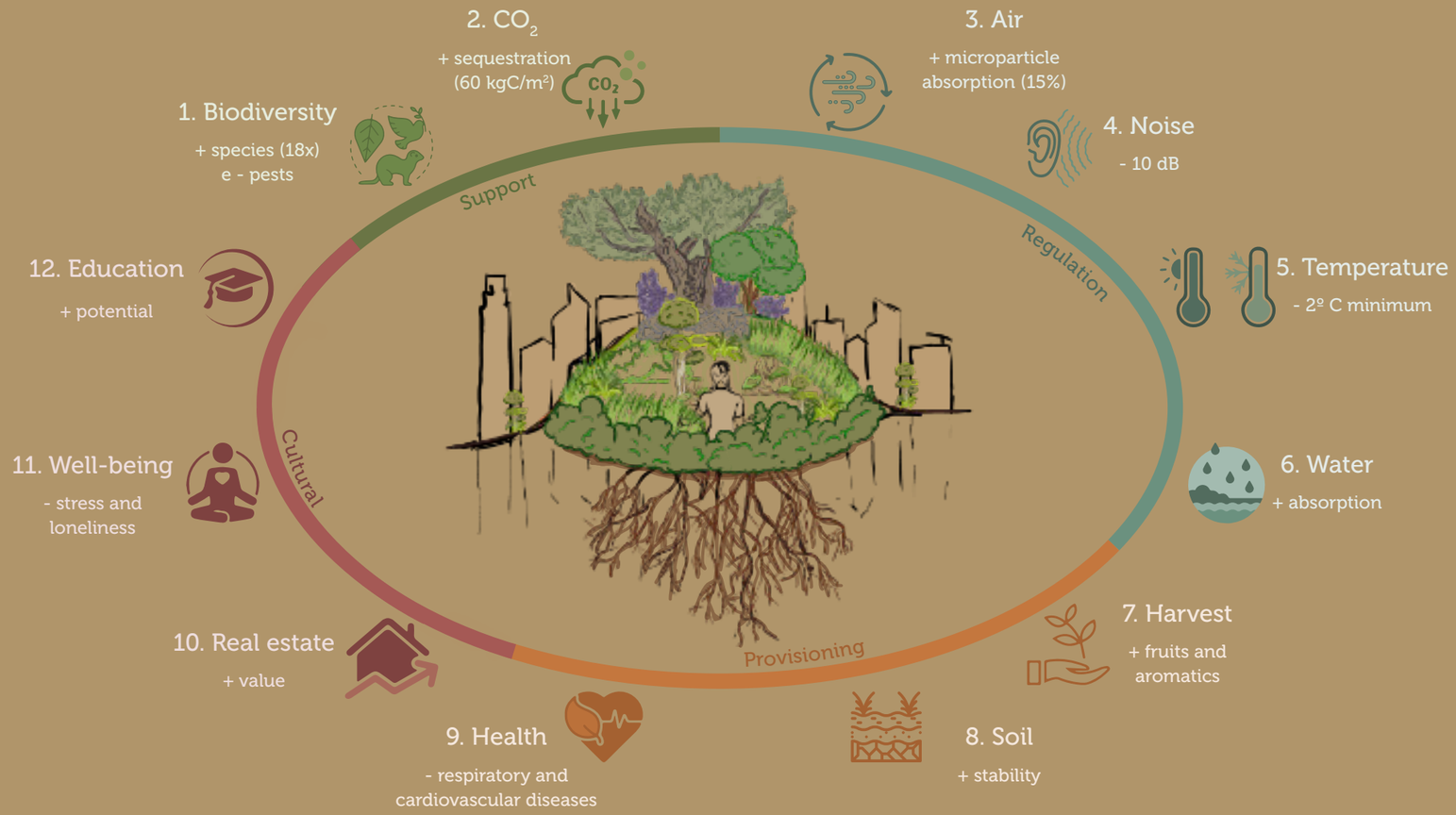
Tiny forests promote different benefits, their **ecosystem services**, at the local scale. These are typically structured in four different areas:

Support, (1) attracting biodiversity towards the urban environment and (2) sequestering atmospheric CO_2;

Regulation, reducing (3) chemical and (4) noise pollution and providing (5) thermal and (6) water balance to the territory;

Provisioning, generating (7) crops and (8) soil and benefiting (9) human health;

Cultural, such as the valuation of (10) real estate, improving (11) well-being and (12) education.



Network of tiny forests - a growing movement

Urban tiny forests are small spaces of native biodiversity in an urban context that are spreading all over the world, from Japan, India, Netherlands, United Kingdom, Chile and, more recently, in Portugal, through FCULresta, the tiny forest of the Faculty of Sciences of the University of Lisbon. Since then, more people and entities are inspired and have the will to plant tiny forests in their community. Doubts emerge about **what to plant, how and when.**

Tiny forests in the
Metropolitan Area of Lisbon

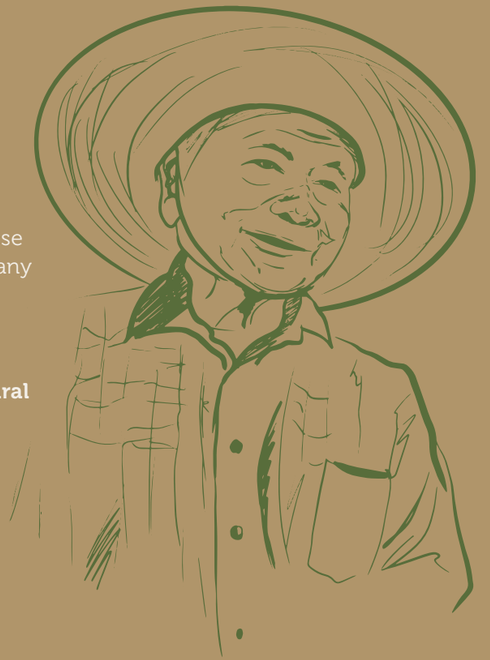
Tiny forests as teaching and learning spaces have large potential if planted in **schools**, allowing to combine the biodiversity component and community involvement with environmental education and awareness. As such, it is essential to empower the school community to **create, manage and educate in these spaces**. The aim of this guide is to make a small contribution in this direction.

Akira Miyawaki – the inspiration

Urban tiny forests are based on the **Miyawaki method**, created by the Japanese professor and botanist Akira Miyawaki, with the aim to create areas of native biodiverse forest that develop faster than traditional reforestation techniques.

Miyawaki was inspired by the thousand-year-old Japanese forests, spaces that have remained virtually untouched for many hundreds of years thanks to the Japanese people's connection with the gods and their presence in all elements of nature.

With his academic training in phytosociology and the **natural potential of vegetation**, he managed to develop a methodology that has proved successful in various parts of the world. It stands out for the unusually **high survival and growth rates** due to the **soil abundance in nutrients and water**, the **density and diversity of planting** and the **community involvement**.



Tiny forests - Contributions to the SDG

Urban tiny forests are a direct contribution to all the Sustainable Development Goals (SDG) proposed by the UN 2030 Agenda, most notably:

SDG 11. Sustainable cities and communities, as they reduce the adverse effects of natural disasters (Target 11.5) by regulating temperature (mitigates heat waves) and water (promotes infiltration); mitigate the negative environmental impact of cities (11.6), such as reducing noise, visual and chemical pollution, and provide direct access to safe and inclusive green and public spaces (11.7).

SDG 15. Life on land, as they are a way to integrate the value of ecosystems and biodiversity in planning (15.9), as mostly native species are planted, which in turn attract animal species, creating important biodiverse hotspots.

SDG 4. Quality education, as these are places that allow students to acquire the necessary knowledge and skills to promote sustainable development (4.7) by living sustainability and (re)connecting with nature and its cycles.

SDG 13. Climate action, given that it is an action that strengthens resilience and adaptive capacity to climate-related disasters such as losses due to floods or mortality derived from heat waves (13.1) and a mitigation action that allows sequestering atmospheric CO_2 (13.2).

SDG 17. Partnerships for sustainable development, has they catalyse and promote effective partnerships (17.7), engaging people in the process of creating spaces for unlikely and healthy encounters.

Framework

Case studies

This guide is born from the will to **inspire and stimulate new tiny forests**, based on the experience of co-creating tiny forests in 3 different contexts:

Academy - Faculty of Sciences of the University of Lisbon

School - Alfredo dos Reis Silveira Secondary School and the Army Pupils' Institute

Community - Neighborhoods of Bela Vista and Areeiro, in Lisbon

The first one, FCULresta, inspired the germination of the other four tiny forests at school and community contexts, the four case studies of this guide. The tiny forests in the first two contexts were developed within the scope of the european project "1Planet4All" implemented by the NGDO VIDA, while those in the third context were promoted by the NGO URBEM in partnership with the Lisbon City Council and the CONEXUS and LIFE-LUNGS projects.


FCUL


IPE


Bela Vista

Methodology

This guide structures the various tasks into **four sequential phases**: Dream & Observe, Plan & Collect, Implement & Connect and Celebrate & Empower

It was also inspired by the **DragonDreaming** methodology, which structures successful projects that promote personal growth, form mutually supportive communities and aim to protect the Planet Earth. It is intended that these interact in a circular mode, just as a seed creates a tree that will create more seeds. The initial dream, which will lead to the celebration of the tiny forest, will allow new dreams to be raised and strengthened in people or communities, leading to the repetition and amplification of the process with more tiny forests being created. Each of these four phases is divided into three tasks in which the **why** and the **how** will be explained, through written content, images and videos.

Resources

To support the reading of this guide, explanatory and demonstrative videos were produced on the different case studies. With testimonies from various people and entities involved in the process of co-creation of the tiny forests mentioned above, they try to bring a greater diversity of perspectives ("expert", "teacher" and "student"). These videos are a complementary resource to the guide.

At the end, more **resources** are also provided to support each step: Map of Portugal and the respective species for each region, timetable for the different tasks, monitoring sheet and designs of tiny forests in Portugal.

0

Dream and Observe

Task 1

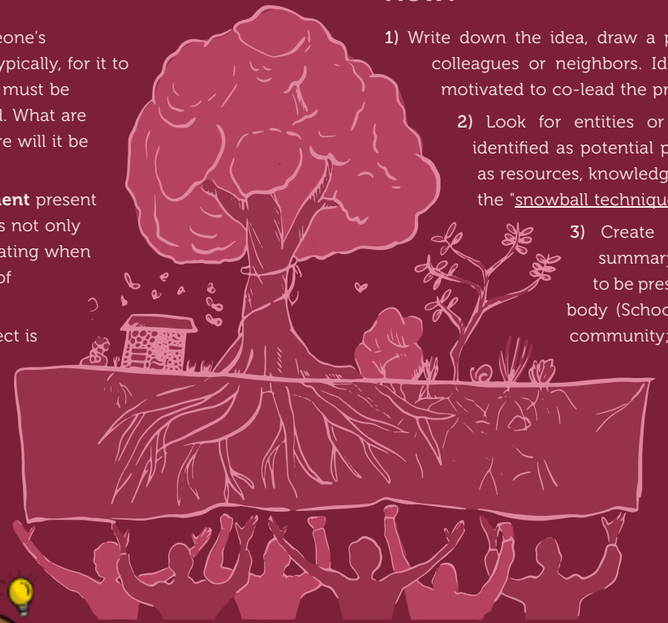
Involve the community

Why?

A tiny forest starts in someone's imagination and **dream**. Typically, for it to come true and succeed, it must be shared and complemented. What are the long-term goals? Where will it be planted? Who to involve?

The **community involvement** present in the **Miyawaki method** is not only fundamental but differentiating when compared to other forms of reforestation.

The **resilience** of the project is proportional to the network of people and partners involved, creating a greater sense of collective belonging and therefore greater success. Share ideas, seek close partners, create community, enforce and reward the role of each one.



How?

1) Write down the idea, draw a picture and share it with friends, colleagues or neighbors. Identify at least one more person motivated to co-lead the project;

2) Look for entities or groups of people around you identified as potential partners who can add value, such as resources, knowledge or communication. You can use the "snowball technique";

3) Create an objective proposal, with a summary description, timeline and budget to be presented and approved by the higher body (School Board or City Council) and the community;

4) Ensure there are frequent meetings - moments for discussion, integration of ideas and involvement of important people throughout the next tasks.

This task is one of the most important - the more energy you put into it, the more successful the tiny forest will be! Allow unlimited creative processes to emerge at this stage!

1

Resources

- Idea
- People
- Proposal

Task 2

Identify the area

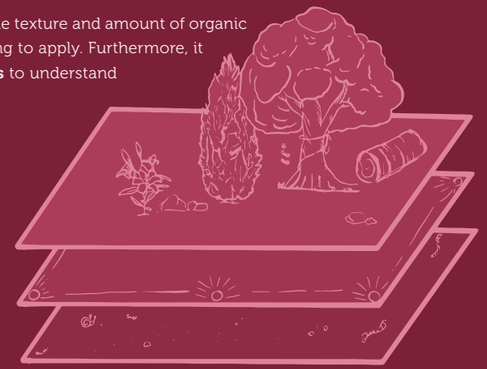
Why?

Now that you are not alone, it is time to **choose the space** for the tiny forest. Any space with a minimum of 100m2 (to minimize the edge effect) can be transformed into a tiny forest. It is important to take into account **five different aspects**: i) water source (see Task 5) ii) vegetation, iii) orography, iv) soil and v) sun and wind sectors.

The **presence of vegetation** may condition some of the works. It is advised to remove (and compost) plants with **invasive behaviour** (e.g. grass, reeds, acacias). In the case of native trees and shrubs, we should conserve and care for them.

The **orography** or nuances of the terrain are relevant to the design of the tiny forest - look at the **slope** and the presence of elevations along it. These influence the design for **water retention**, leading to the creation of ponds or infiltration ditches, for example.

It is important to analyse the **soil characteristics**, such as the texture and amount of organic matter, so we can understand which corrective we are going to apply. Furthermore, it is necessary to take into account the **sun and wind sectors** to understand which areas are hotter or colder and dry or humid throughout the year.



How?

1) Look for underused sites with high potential for social cohesion around the tiny forest;

2) Search for a satellite image of the space (e.g. Google Maps), print it out and take it with you;

3) Calculate the area of the space;

4) Mark on the map any depressions or elevations that exist in the space and the presence of grass, trees or shrubs;

5) Identify the water point;

6) Analyse the soil using the "jar test";

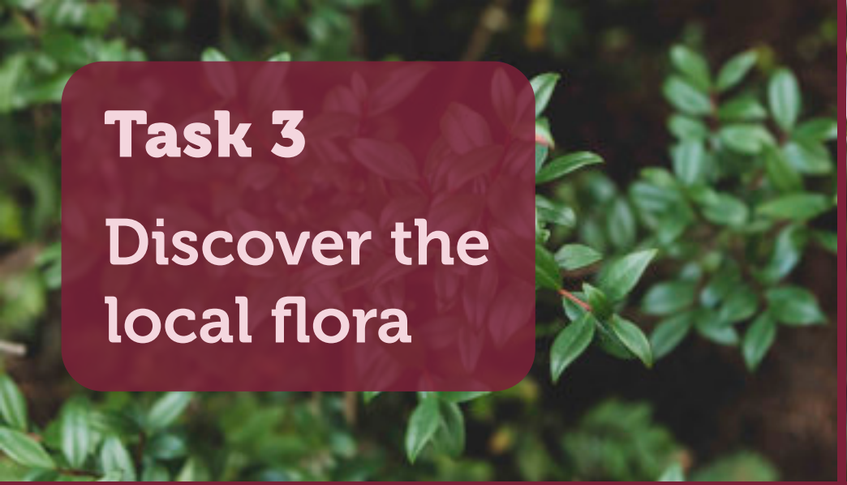
7) Identify the south/north and analyse the sun sector (take into account the angle of summer and winter) and the prevailing wind. You can use online tools.

Each space is unique and getting to know it is fundamental, both in terms of its history and its characteristics that can be enhanced. Try to get to know "who" this land is.

Resources

- Measuring tape
- Camera
- Pencil
- Eraser
- Mobile phone
- Map
- Glass jar
- Shovel
- Perm. marker
- Sieve
- Tbs. of detergent

2



Task 3

Discover the local flora

Why?

Native flora is the basis of any urban tiny forest that applies the Miyawaki method as it promotes **local biodiversity,** thus creating more **resilient systems** that are able to thrive with minimal human intervention in the long term. Native species are better adapted to local conditions. They find it easier to cooperate with other species, creating a quasi-natural system, soliciting the different relationships and services provided by the different species as a plant community, and attracting animal communities.. In other words, the aim is to recreate a forest that would exist if there were no human intervention.

For this, it is important to promote functional diversity (**forest structure**), noting that the tiny forest is composed of species of different heights, occupying different strata. Typically, we can identify **five strata**: Herbaceous (0-1,5 m), Shrubs (1-2 m), Understorey (up to 10 m), Canopy (more than 10 m) and Climbers.

There are ways of finding the plants we need to create a tiny forest!

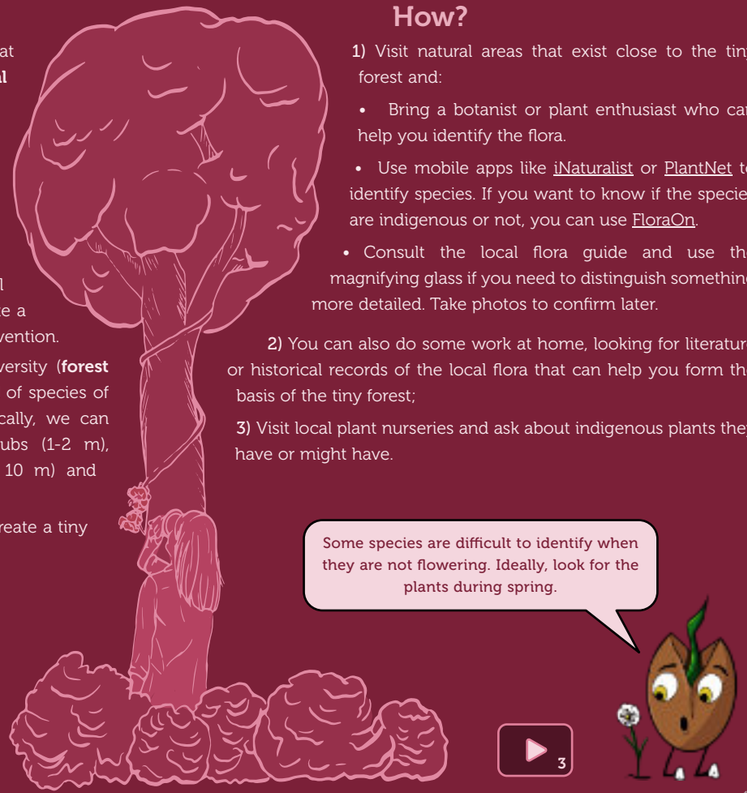
Resources

Magnifying glass

Flora guide

Mobile phone

Camera



How?

1) Visit natural areas that exist close to the tiny forest and:

- Bring a botanist or plant enthusiast who can help you identify the flora.
- Use mobile apps like iNaturalist or PlantNet to identify species. If you want to know if the species are indigenous or not, you can use FloraOn.
- Consult the local flora guide and use the magnifying glass if you need to distinguish something more detailed. Take photos to confirm later.

2) You can also do some work at home, looking for literature or historical records of the local flora that can help you form the basis of the tiny forest;

3) Visit local plant nurseries and ask about indigenous plants they have or might have.

Plan and Collect

Task 4

Draw the forest

Why?

A good plan and design elevates the **vision and needs** of the community (Task 1) and integrates the **specific characteristics of the site** (Task 2). In addition to hosting the diversity of appropriate flora to the site, making the most of temperature and moisture gradients, the tiny forest will provide several ecosystem services that your design can enhance!

How?

Maximise the retention of water and organic matter

1) Based on orography, design contour ditches with extreme winter precipitation events in mind.

2) Draw ponds (temporary or permanent) in existing depressions (Annexes) - and convey water from the system to these ponds.

Maximise the capture of solar energy:

Knowing the flora (Task 2 and documents in Annexes) and taking into account the sun and wind sectors:

1) Plan the floristic basis of your tiny forest. Based on the total planting area and the planting density (2-7 plants/m2), obtain the total number of plants. Use the following percentages as a reference for each stratum: canopy (15%), understorey (40%), shrub (30%), herbaceous (10%) and climbers (5%);

2) Plan the location of canopy stratum plants taking into account the size of their crowns and roots in 30 years. Evaluate leaf decay in winter shade (deciduous trees allow more light to reach the ground at that time);

3) Enhance the edges of the tiny forest, especially those on the south side which will have greater solar incidence.

Maximize interaction with (and between) the community

1) Create as many paths as possible with at least 1.2 m wide, inviting people to enter and avoiding trampling in inappropriate places;

2) Consider creating a glade in the tiny forest where people can gather. This could be around the pond that will serve as a water retention basin in winter and a classroom in spring;

3) Design informational posters that explain the project to be placed in the tiny forest after implementation.

This task has a great co-creation potential, use it to integrate people!

Resources

- Notebook
- PC/Tablet
- Pencil
- Eraser

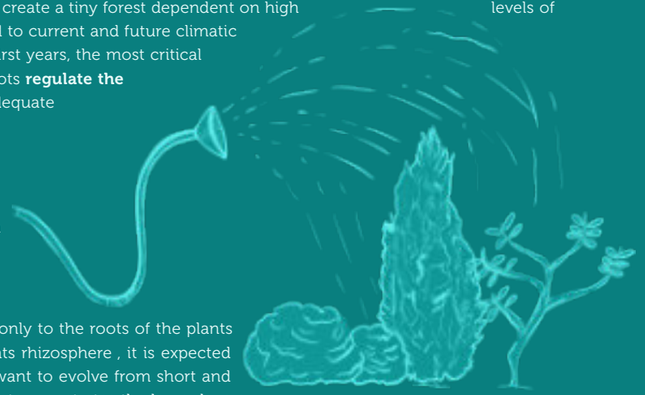
4

Task 5

Plan irrigation

Why?

In the first warm and dry months - until plants are two, three years old - watering is essential to **increase the survival rate and growth of plants**, especially in mediterranean climates. With irrigation, we promote soil humidity and thus greater root growth of plants, and an increase in the number of bacteria, fungi and their connectivities in the soil. The aim is not to create a tiny forest dependent on high levels of humidity in the dry months. We want to evolve into a system adapted to current and future climatic conditions. We intend to accelerate the ecological succession in the first years, the most critical After planting, to reach a state where the network of canopies and roots **regulate the hydrological cycle autonomously**. Thus, it is important to plan an adequate irrigation in frequency and water abundance, putting its end in perspective.



How?

We want to guarantee uniform irrigation. When installing an irrigation system, it is important to take into account the water range of the sprinklers and the plants' own growth, which may create barriers to water dispersion.

We want to maximize irrigation efficiency by making water available only to the roots of the plants we choose. Depending on the soil and the average depth of the plants rhizosphere , it is expected that the growth in depth will be proportional to their height. So, we want to evolve from short and very frequent waterings to long and sporadic waterings so that the water penetrates the lower layers of soil. If the planting takes place in the first months of the year, the watering scheme could be:

1) Water for 30 minutes every other day for the first month;

2) Water 40 minutes every three days between the second and sixth month;

3) Water 60 minutes every five days from the seventh month onwards;

4) Stop watering after two years.

This proposal is highly dependent on the weather conditions (temperature, rainfall and wind). The best indicators are the soil humidity at various depths and the health (greenness) of the plants. It is vital that the soil is not always too wet and even less waterlogged - the plants can die from lack of air in the soil or the appearance of harmful fungi.

Consider acquiring a controller to install in the irrigation system to ensure automatic watering during summer and school breaks.

5

Resources

- Irrigation system
- Controller
- Notebook
- Pen

Task 6

Collect resources

Why?

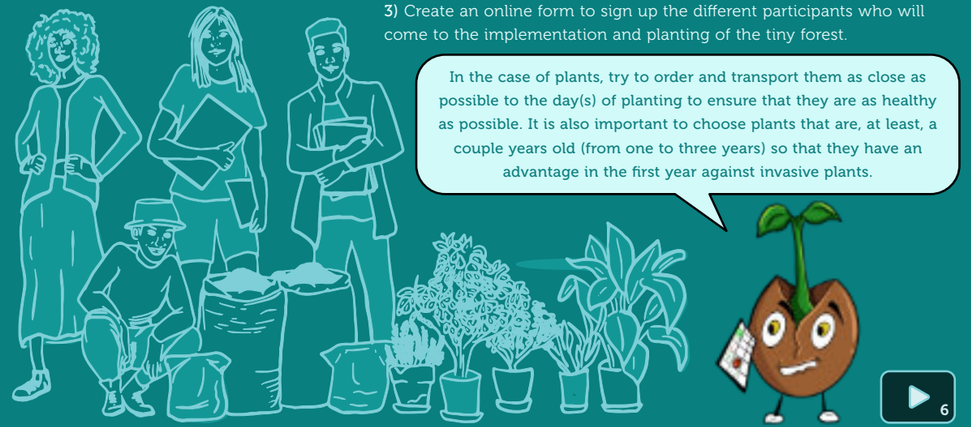
Implementing a fast-growing tiny forest requires some very special ingredients such as people, plants, seeds and compost. The aim is to create such an abundant environment where the only scarce resource is sunlight. In this way, you will be able to generate a positive competition (that promotes collaboration and synergies) for the growth and appropriation of space by plants, guaranteeing a high initial survival rate.

On the other hand, for community involvement on planting day to be efficient and effective, all resources and tools need to be gathered in time. That day, or period, will be one of the most important moments of celebration and community gathering - many people will only show up on that day and we want to make sure that they are not only integrated in tasks but that they have all the conditions to carry them out.

How?

1) Interact, at least weekly, with the partners or suppliers of the resources, in order to guarantee not only the order but also its transport. Some suppliers will have transport, others will not. Find out local enterprises that can do this service, if necessary. It is always a good opportunity to create new partnerships!

2) Find a sheltered place close to the tiny forest where you can store your resources;



3) Create an online form to sign up the different participants who will come to the implementation and planting of the tiny forest.

Resources

- Plants
- Seeds
- Mulch
- Compost
- Tools
- Irrigation syst.
- Clay
- Computer

Implement and Connect

Task 7

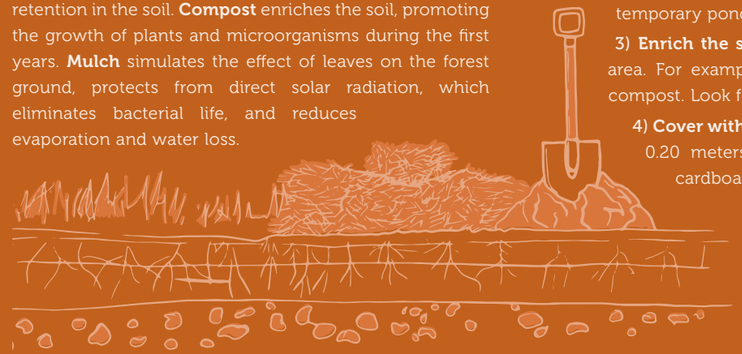
Prepare the ground

Why?

From **dream to action!** It is in this task that we will start to germinate the tiny forest.

The aim is to prepare the soil to receive the plants and thus guarantee their maximum **survival and growth**. This is divided into four steps: **weeding**, **mobilizing**, **enriching** and **covering**.

Weeding aims to reduce or eliminate invasive species, reducing competition on the new plants, most of which are very young. **Tillage** promotes maximum water retention in the soil. **Compost** enriches the soil, promoting the growth of plants and microorganisms during the first years. **Mulch** simulates the effect of leaves on the forest ground, protects from direct solar radiation, which eliminates bacterial life, and reduces evaporation and water loss.



How?

1) **Weed out unwanted plants:**

- If it is a lawn it is advised to remove (and compost!) the first 15 cm of soil. If there is time, you can cover the lawn for a few months. That will "smother" the weeds and leave the ground clean (thermal or solar weeding).
- If it is a meadow with different species, but with some invasive species, try your best to remove them manually.

2) **Mobilise the soil:** according to the design of the space, dig swales in a contour line (minimum 30 cm deep). You can also use logs as a base for the swales and to implement other permanent elements, such as temporary ponds, or to outline the paths.

3) **Enrich the soil:** put 10 cm of compost over the whole planting area. For example, for an area of 300 m, you will need 30 m^3 of compost. Look for compost at your local waste disposal service.

4) **Cover with mulch:** over each square meter of planting area with 0.20 meters of mulch (at least 20 cm high). You can place cardboard on top of the swales, before the dead blanket, to delay the growth of existing species that will compete with the new plants.

▶ 7

Resources

Wheelbarrow		Hoes		Shovels	
Soil and compost		Mulch		Logs	

Given the effort and time involved in the radical transformation of the space, this task is very important for creating social connection to the space!

Task 8

Plant densely

Why?

The big moment has arrived: the **planting**! We come to one of the most differentiating points of the Miyawaki method. Typically 1000 plants are planted per hectare, resulting in a **density** of 0.1 plant/m². However, the Miyawaki method suggests planting between 20 000 to 30 000 plants per hectare, resulting in a density of between 2 and 7 plants/m². The aim of this "ultra-density" is to create **positive competition** for sunlight, as the soil, the matrix that will support the tiny forest, is abundant in nutrients, water, air and life. This competition will thus promote rapid vertical growth of plants in search of sunlight, also promoting leaf development.

A natural forest has a chaordic spatial constellation of plants that we want to emulate, i.e. a balance between some organisation and harmonisation of plants by area and by strata, as well as a certain randomness in their location.

How?

1) Divide the planting area into sections;
2) Know the area of each section and calculate the number of plants of each stratum for each section;
3) Plant randomly within the space, with two caveats:
   - Emergent species at least 1.5 m away from paths or boundaries and at least 50 cm away from each other.
   - Climber species near emergent or tree species.
4) Place a signpost next to smaller plants.

8

The success of the tiny forest depends on good planting. It is normal for planting to be imperfect when carried out by inexperienced volunteers. Here are some tips.

Resources

Plants

Seeds

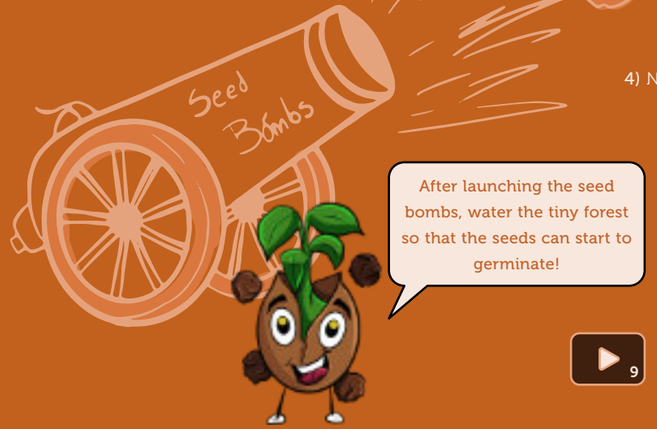
Tools

Task 9

Seed bombing

Why?

In Task 7 we covered the soil with mulch to, among other benefits, prevent the appearance of unwanted plant species. However, this may affect the herbaceous layer brought by annual plants in the first years of ecological succession. This is essential to create a vigorous lower stratum in its first years and give the permanent plants of higher strata time to grow. This can be done by producing **seed bombs**, small balls of **clay**, **compost** and **native seeds** that can be thrown after planting, further promoting community links! Clay absorbs and accumulates moisture and compost provides food, so that seeds contained in these bombs dropped on top of the mulch have some competitive advantage in germination and development. The plants will grow and flower next spring and their smells and colours will attract insects and the sounds of their symphonies.



How?

1) Put clay and compost in the bowl (approximately 40 and 60%, respectively), add water and mix;

2) Handle and try to make a small ball (5-10 cm in diameter). If you succeed, the mixture is ready. If the ball still falls apart, add some clay and a little water;

3) After the mixture is at the desired consistency, break the ball up again and add seeds. Mix again;

4) Now, with the mixed seeds, make balls of the above size and let them dry for a few hours in the sun on top of the tarpaulin;

5) Once dry, drop the bombs and celebrate!

The task of producing the seed bombs can be done in advance, storing them in a dry place.

Resources

Bucket, Clay, Compost, Water, Seeds, Tarpaulin

9

Celebrate and Empower

Task 10

Take care of the forest

Why?

Congratulations on planting your tiny forest! Now that the tiny forest is growing, you need to **take good care of the plants**, especially during the first t**wo to three years**, to ensure that you will have a **diverse, self-sufficient and resilient tiny forest**. To get this, there are some tasks to take into account: **watering**, **weeding**, **pruning**, **litter picking**, **creating shelters** and **interacting with the community.** The first three tasks aim to promote soil and plant health in the early growth phase. Cleaning will prevent vandalizing and disrespect for the project, giving the community time to take ownership and autonomous care of their tiny forest. The creation of shelters will allow animals to live in the tiny forest, fundamental to its success. The last task will strengthen the social bonds between people and the project. This period, after the planting, is another opportunity to integrate new interesting and interested people!

How?

Watering: Follow the indications of Task 5. ensuring constant moisture in the soil during the first months.

Weeding: Invest a lot of energy in the first three to four months to control the grass or other weeds that start to take over the space. Organise weekly events during this period with the community to control these competing plants early on.

Pruning: During the winter months, prune plants that are growing into the path or boundaries of the space to control and direct their growth.

Picking up rubbish: Pick up rubbish found in the space on a weekly basis. Incorporate a litter bin in the space to raise community awareness.

Create shelters: Creating shelters for amphibians or reptiles, or even hotels for insects, will enhance biodiversity in the tiny forest and promote plant health through the interaction between the different elements.

Interact with the community: Print and place a poster in the tiny forest explaining the project and talk to the different people who come to get to know it.

Resources

Poster and structure | Bin | Gloves | Pruning scissors

10

Task 11

Keep track of the evolution

Why?

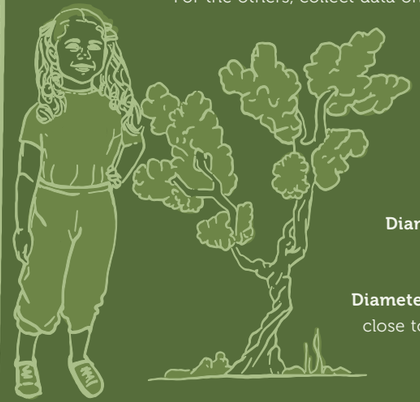
We can understand how the tiny forest is evolving by **monitoring** the health of the plants. In this way we can **involve the community** in the search for knowledge and answers about the real effectiveness of these sites and methods. Monitoring may cover several areas, such as the capacity of the tiny forest to retain rainwater, the effect on temperature, the number of people visiting and the number of projects created. In plant monitoring in particular, it tries to answer questions such as: which species have the highest survival rate? Which new plant species have appeared (and animals?) Which zone (North/South) has the highest growth rate? Which species have the highest growth rate at the beginning of the tiny forest? And after two years? There is data that you can collect over time, thus obtaining a detailed view of the evolution of the space as well as its needs and virtues.

How?

Monitoring, to be carried out **every six months** (with an initial monitoring after planting), depends on your knowledge of the area and the plants present at the site. Collect the data as follows:

1) **Georeference** each plant in the space with the help of the tape measure. Record an **horizontal (x)** and **vertical (y) coordinate** for each plant;

2) For canopy and climbers, collect data on survival, height and diameter at the base. For the others, collect data on survival, height and crown diameter. Use the monitoring form in the appendices to record the values.



Survival – Record whether the plant is alive or dead.

Height– Measure from the base to the tallest structure of the plant, in a straight line, and record.

Diameter of crown – Measure and record the distance between the two furthest points of the crown.

Diameter of the base – Measure with the calliper, close to the ground, the width of the base of the plant and record.

11

Resources

This can be a way of bringing people and students into contact with plants. This task may be integrated into the curriculum of one or more subjects.

Map | Measuring tape | Calliper

Computer | Monitoring sheet | Pencil

Task 12

Live the forest

Why?

Everything culminates into this ultimate task: **live the forest**. The tiny forest will become part of the **life of the community**, just as the community is part of the tiny forest. To live the forest means to organise events inside it such as classes and workshops, to bring in art by creating decorative elements, to use it as a source of inspiration or as an object of study and learning.

A Tiny Forest for Huge Learnings is an open-air classroom. The result of a regenerative process of transforming an underused school space into a biodiverse place. Some children and young adults spend too little time in contact with nature and begin to show symptoms resulting from this deficit. The tiny forest provides an outdoor learning resource to complement classroom education in various subjects. This experience benefits both teachers and students who gain knowledge and skills to understand the natural world, develop a healthier relationship with nature and address their environmental concerns in a concrete way.

How?

Education

University: take advantage of the tiny forest to complete a master's or doctoral thesis or publish scientific papers based on the data collected.

School: integrate the tiny forest in different subjects, for example:

Biology and Geology: monitor animal and plant biodiversity;

Mathematics: learn statistics from Task 11 data;

Environmental Studies: walk around, record and identify new species of plants or animals and learn more about ecosystems;

Visual Arts: create artistic exhibitions in the tiny forest;

Music: promote music lessons in the tiny forest;

Any subject: remember that whatever the subject, the tiny forest will always be an opportunity for an outdoor lesson.

Community

Walk around the area, observe its growth, invite family and friends, get inspired by the tiny forest, learn more about plants and animals and involve more people in this support network for the creation of more tiny forests.

12

Resources

Materials for class | Notebook | Pencil

Conclusions

Urban tiny forests adopting the **Miyawaki method** have the principles of biodiversity and natural forest ecology as a basis to create dense, diverse and sustainable forests in urban and other human-modified landscapes.

This method enables the creation of **self-sustaining tiny forests** that can thrive with minimal maintenance. It involves the dense planting of a wide variety of native tree and plant species on abundant soil, creating a natural forest ecosystem. It is based on the idea that natural forests are more resilient and able to adapt to change than monoculture plantations.

The Miyawaki method has been used all over the world, demonstrating its effectiveness in creating **biodiverse forests**. It has also been applied to restore degraded or damaged ecosystems and to create green spaces in urban areas, helping to **mitigate concrete problems of cities such as thermal comfort, air quality and rainwater absorption**. Urban tiny forests have enormous potential to improve the living experience of urban communities, while promoting biodiversity and a harmonious communion with nature.

This guide seeks to present tiny forests as an object of **study, learning and inspiration in a school environment**. Nature is an inexhaustible source of knowledge. Among the many lessons that we can learn, one of them relates to our relationship with time and natural cycles, with the importance of small, slow and gradual changes, as opposed to the frenetic urban rhythms.

Tiny forests also call on us to **understand and respect the different learning rhythms and times that coexist in the universe of the classroom**. **Diversifying the place of education by using the tiny forest will respect the biodiversity inherent to each class, moving towards a more inclusive education**. With this, **children and young people** who live in an urban environment, often confined to artificial spaces, **are the ones who will most enjoy the creation and use of tiny forests**.

Teachers have a key role to play in inspiring and facilitating these processes. As we recognise their importance, this guide is dedicated to them, hoping that it becomes a useful tool in the incredible mission that is education.

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Resources

Infographics "Map of autochthonous plants of the forests of mainland Portugal"

Annexes

Time-table

Monitoring sheet

Designs

- Tiny Forest URBEM e CML — Areeiro, Lisboa
- Escola Sec. Camilo Castelo Branco — Carnaxide, Oeiras
- Escola Básica e Secundária Dr. Rui Grácio — Montalavar, Sintra
- FCULresta — Campo Grande, Lisboa

Map of autochthonous plants of the forests of mainland Portugal

Adenocarpus telonensis • Codesso-de-flores-grandes
Corema album • Camarinha
Erica ciliaris • Lameirinha
Fragaria vesca subsp. vesca • Morango-silvestre
Hyacinthoides hispanica • Jacinto-dos-campos
Hypericum androsaemum • Hipericão-do-Gerês
Paeonia broteri • Rosa-albardeira
Pervinca adiformis • Pervinca
Prunella vulgaris • Prunela
Ruta angustifolia • Arrudão
Scilla monophyllos • Cila-de-uma-folha
Stachys arvensis • Rabo-de-raposa
Stachys germanica • Betónica-da-Alemanha

Adenocarpus lainzii • Codesso
Cistus albidus • Roselha-grande
Cistus crispus • Roselha
Cistus ladanifer • Esteva
Cistus libanotis • Esteva-das-areias
Cistus monspeliensis • Sargaço
Cistus populifolius • Estevão
Coronilla glauca • Pascoinhas
Cytisus scoparius • Giesta-amarela
Daphne gnidium • Trovisco
Lavandula stoechas • Alfazema
Lavandula viridis • Alfazema-verde
Nerium oleander • Loendro
Rosmarinus officinalis • Rosmaninho
Ruscus aculeatus • Gilbardeira
Thymus spp. • Tomilho
Ulex densus • Tojo-da-charneca
Ulex minor. • Tojo-molar

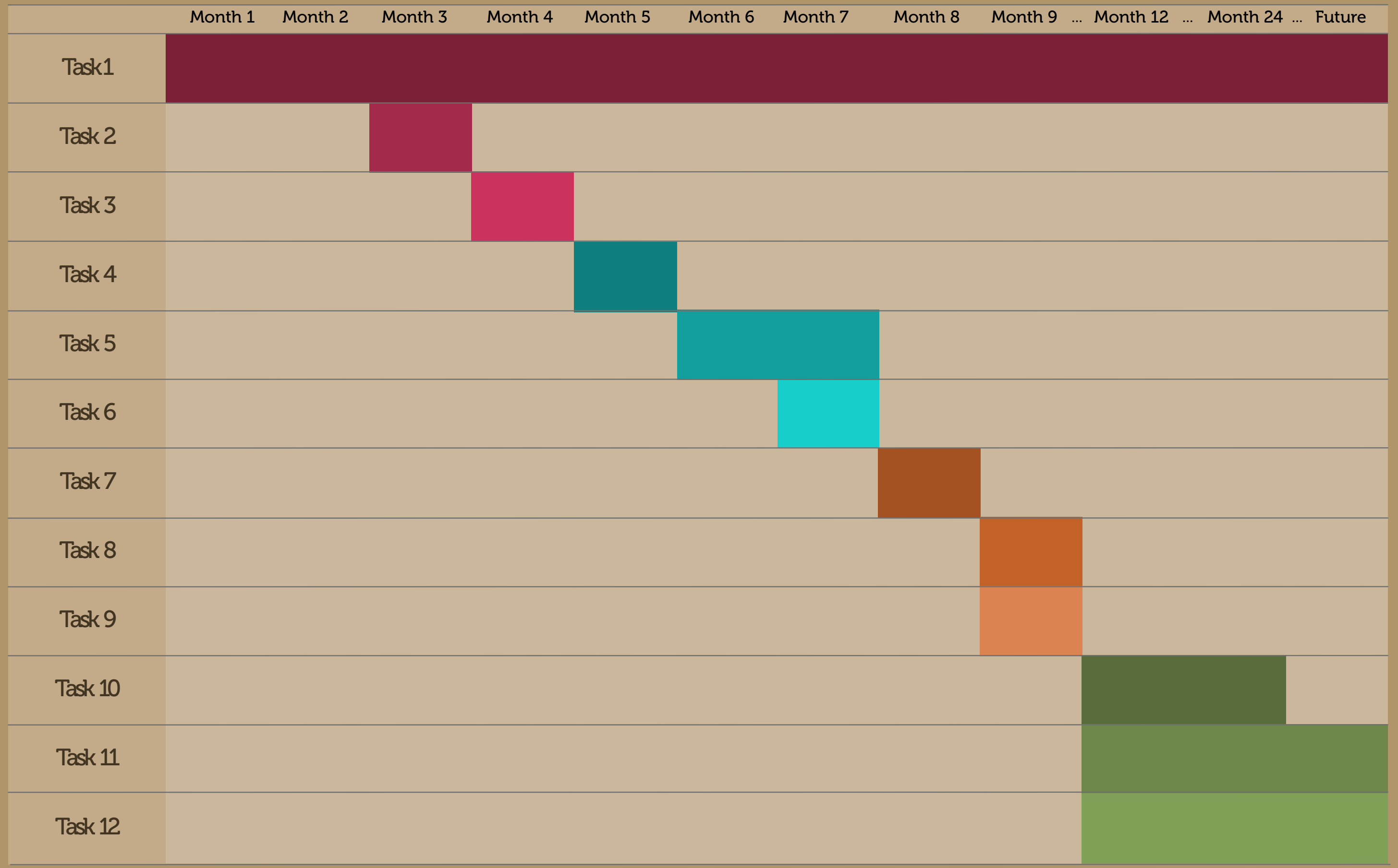
Arbutus unedo • Medronheiro
Chamaerops humilis • Palmeira-das-vassouras
Corylus avellana • Aveleira
Crataegus monogyna • Pilriteiro
Cytisus multiflorus • Giesta-branca
Erica arborea • Urze-arbórea
Erica australis • Urgueira
Erica ciliaris • Lameirinha
Erica lusitanica • Urze-lusitânica
Erica umbellata • Torga
Frangula alnus • Sanguinho-de-água
Ilex aquifolium • Azevinho
Laurus nobilis • Loureiro
Malus sylvestris • Macieira
Myrica faya • Faia-da-terra
Myrtus communis • Murta
Phillyrea angustifolia • Ademo-de-folhas-estreitas
Phillyrea latifolia • Ademo-de-folhas-largas
Pistacia lentiscus • Aroeira
Prunus avium • Cerejeira
Prunus lusitanica • Azereiro
Prunus mahaleb • Cerejeira-de-Santa-Luzia
Prunus spinosa • Abrunheiro-bravo
Pyrus bourgeana • Pereira-brava
Pyrus cordata • Escalheiro
Rhamnus alaternus • Sanguinho-das-sebes
Sambucus nigra • Sabugueiro
Tamarix africana • Tamargueira
Viburnum tinus • Folhado

Strata

Acer monspessulanum • Zelha
Betula celtiberica • Bétula
Castanea sativa • Castanheiro
Celtis australis • Lodão-bastardo
Fraxinus angustifolia • Freixo
Olea europaea sylvestris • Oliveira-brava
Quercus canariensis • Carvalho-de-Monchique
Quercus coccifera • Carrasco
Quercus faginea • Carvalho-português
Quercus pyrenaica • Carvalho-cerquinho
Quercus robur • Carvalho-alvarinho
Quercus rotundifolia • Azinheira
Sorbus aria • Mostajeiro-branco
Sorbus latifolia • Mostajeiro
Sorbus torminalis • Mostajeiro-das-cólicas
Taxus baccata • Teixo
Ulmus minor • Ulmo

Lonicera etrusca • Madressilva-caprina
Lonicera implexa • Madressilva
Lonicera periclymenum • Madressilva-das-boticas
Rosa canina • Rosa-canina
Rosa sempervirens • Rosa-brava
Smilax aspera • Salsaparrilha

Time-table



Monitoring Sheet

Date	Common name	Species name	Strata	Position		Living/ Dead	Height (m)			Base diameter (m)			Crown diameter (m)			Notes
				X	Y		Initial	6months	12months	Initial	6 months	12 months	Initial	6 months	12 months	

“If the end of the world comes tomorrow,
I will plant a tree”

Akira Miyawaki

Tiny Forests for Giant Lessons

A guide to integrate urban biodiversity into education

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