HIGH-PERFORMANCE MICROFORESTS:
Powerful Agents in Stormwater Abatement and Climate Stewardship

High-performance microforests are powerful agents to improve the quality of our coastal waters and combat climate change. Microforests have been planted, and many more are planned, here in the Southwest Florida Suncoast by SURF. SURF (Suncoast Urban Reforesters) is a coalition of nonprofits that includes our founding members (Florida Veterans for Common Sense Fund, Inc.; Solutions to Avoid Red Tide (START); and Sarasota Bay Rotary Club) as well as an expanding network of nonprofits and allies such as Elemental Impact, Tree Foundation, Suncoast Science Center and the Stoneybrook Natural Assets Committee. This consortium aims to establish microforests throughout the Suncoast and to establish a financing mechanism through which people can contribute toward the planting of future microforests with an understanding of how much stormwater they are diverting and carbon they are sequestering.

This document explains in FAQs what microforests are, why they are exceptionally valuable toward urban resilience and ecological health, and where they belong as part of our community's regeneration of a protective urban forest.

What is a microforest? A microforest is a very dense planting of native species on an area as small as 2/10 of an acre to as large as an acre or more. SURF's strategy follows the inspiration and guidance of Akira Miyawaki http://urban-forests.com/miyawaki-method/, a distinguished Japanese botanist who developed a strategy to convert otherwise unproductive, largely urban land into forests that grow exceptionally fast and provide many environmental benefits. Miyawaki forests such as appear at right are said to grow 100 years old in just 10 years. The trees in a microforest are small at first but grow quickly to create a dense thicket that is inviting to wildlife; if a trail is introduced – it affords passers-through with deep shade and privacy. The Japanese invented the term *shinrin-yoku*, which translates roughly to *forest bathing,* to describe the restorative benefits of surrounding oneself and meditating in dense forest.

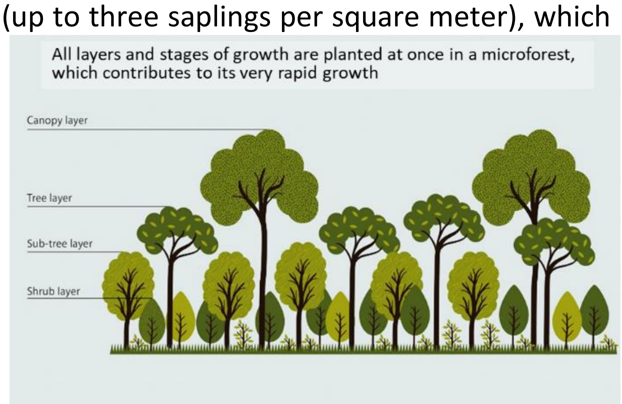
Microforests such as inspired by Miyawaki have been installed around the world although they are not yet common (if present at all, except here in Sarasota) in the US.

Benefits of Microforests. Because of the rapid growth rate, high-performance microforests intercept and transpire an enormous quantity of stormwater that would otherwise transport nutrients to the Bay. They also sequester prodigious volumes of atmospheric carbon (a greenhouse gas) over their lifecycles against climate change. Both stormwater diversion and carbon sequestration are quantified and planned for *commodification*[1] SURF collaborates with Dr. Brad Oberle at New College to forecast and quantify these ecological services and—as each microforest grows–to quantify its performance in diverting stormwater (nutrients) to protect coastal water quality and sequestering carbon to mitigate climate change. These rates will be used to help prospective donors to our project understand with unusual precision how their donation specifically benefits the environment both locally (stormwater) and globally (climate).[2]

Another quite remarkable benefit of Miyawaki forests is their ability to cool the air around them https://www.economist.com/science-and-technology/2021/07/01/could-miniature-forests-help-air-condition-cities, an important attribute in Florida where temperatures are predicted to rise markedly in response to global warming. As with all shade trees, they calm violent winds and intercept potentially damaging wind-borne missiles.[3] Microforests make it unnecessary to mow or otherwise tend unused land and restore the wildlife habitat that has been lost to recent and rapid development. In fact, the ticket-like nature of a microforest provides a habitat that is increasingly rare in Sarasota and that isn't necessarily achieved as part of horticultural urban forestry (e.g., graves and colonnades) or even traditional rewilding.

Why do microforests grow so fast? The trees in microforests almost seem to leap for the sky because of at least four design strategies:

1. We use an exceptional diversity of native species, sometimes including plants from hardiness zones north or south of our location to ensure that plenty of species are perfectly suited to whatever conditions might befall the forest and to ensure that attrition (die-off) will not unduly thin our forest.
2. We plant the trees extremely close together (up to three saplings per square meter), which creates shade stress that spurs them toward rapid growth.
3. We install not just canopy trees but also sub-canopy, understory, and ground-hugging species; the idea being to simulate all of the "seres" or stages in the normally time-consuming growth of a native forest. In scientific parlance, we are accelerating or even bypassing ecological succession.



[1]Conversion into a quantified and informally transactable commodity.
[2] While we encourage citizens to donate to informally offset the environmental impact of, say, their electricity usage or driving, we remind them that technology and lifestyle changes such as installing solar energy, driving electric cars, and walking instead of driving is even more valuable to climate stewardship.
[3] In these respects, microforests help *adapt* to climate change and improve *urban resilience.*

4. Before we install a single plant in the ground, we create a vigorous forest floor using a combination of (1) sheet-mulch cardboard to suppress any incumbent vegetation – especially turf[4] – and (2) many inches of recycled woodchips to hold the cardboard in place and create cool, dark, and moist conditions under the cardboard. The simple carbon of the cardboard attracts fungi and other soil microbes which in term attract earthworms, springtails, and other creatures that quickly build a biologically active soil. Our carefully crafted forest floor, which we incubate for several weeks before planting day, supports the super-fast growth that the dense spacing and resultant shade stress prompts the trees to undertake.

Where is the best place to plant a microforest? Microforests should be tucked onto small sites that are protected from future development by virtue of their location, shape, or undesirability for any competing use. This might be a lawn that really doesn't have a value as such next to a commercial or residential property – including schools and churches -- or it might be a small peninsula, corner, or insular area that isn't suitable for development or is too small for traditional rewilding. Vacant, degraded, or abandoned city or industrial lots are also perfect and are, in fact, what the conceiver of microforests (Akira Miyawaki) most had in mind. The bottom line is that microforests take small scraps of land that are not providing much ecological benefit and "supercharges" them into an extremely productive contributor of *ecological services* -- benefits such as stormwater diversion, carbon sequestration, and wildlife habitat, as well as shading and cooling to our suburban and urban environment.

The ideal size ranges from 2/10 of an acre up to several acres.[5] The rawer or more degraded the soil, the better because microforests build their own soil, in part by relocating so much carbon from the atmosphere into the host medium. The site needs to be accessible by a small to midsize truck such as arborists use to haul recycled woodchips. These woodchips are obtained for free from firms that would rather provide them to us than pay a tipping fee and drive farther to a landfill. Access to water is helpful, especially if we are not planting right before the rainy season. The microforest does not require very much water, just a small amount that we supply with a temporary drip irrigation system to help the early trees get established.

Who plans and plants the microforest? The process is overseen by SURF, our expanding coalition of nonprofits and allies. Volunteer scientists, horticulturists, and engineers from these organizations select and delineate the site, plus we pay paid native-plant specialists for technical or particularly arduous work. For every forest, we engage stakeholders and volunteers from the local area for a potential financial contribution but, more importantly, participation in the project. Every partner and volunteer learns about the power of trees–and improved planting strategies in general–as agents to mitigate climate change and protect Sarasota Bay.

---

[4] *Chemical-free* turf removal or invasives control

[5] Any protected property larger than a few acres might be best suited to traditional rewilding, the establishment of native habitats such as are being rapidly destroyed by development. Microforests are native habitats but they differ from (and grow faster than) traditionally rewilded forests by virtue of their highly engineered design.

What are the steps in planting a microforest?

A microforest could theoretically be planted in about six weeks of having the idea. The steps are illustrated at right. A footprint is de-lineated; cardboard is collected and spread over that footprint; recycled woodchip mulch is dumped and spread over the cardboard; and the underlying soil is left to incubate for a few weeks, during which our staff member negotiates the best deal on plant stock.







The steps in making a microforest are, from left to right, to de-lineate the footprint, accumulate cardboard and mulch, spread the mulch into an even bed, measure where the plants are going to go, drill the pockets for the plants, and then install the plants on a big volunteer day.

We also receive a lot of donated stock, as well as plants that are not sellable for cosmetic reasons. By using very small plants (one- and three-gallon plants) and salvaging unmarketable stock, we are reducing the time, water, and energy spent at the nursery and avoiding waste, all of which is excellent from a resource efficiency perspective. Shortly before planting day, we map out where the plants are going to go, drill holes, and arrange for the deliveries not just of plants but of soil supplements such as compost, vermicompost, and biochar, all of which improve the soil to make it especially hospitable. Right before planting, our staff drills holes so that the pockets are properly sited, flagged for the designated type of plant (canopy, subcanopy, mid-story, understory, and ground-dwelling), and otherwise made ready for the volunteers to easily install the plants. Planting day itself is nothing less than a celebration, with dozens of volunteers spending a morning in the sun, receiving a safety briefing, and experiencing the joy of installing trees that will live a hundred years or more. The event invariably attracts media and stimulates excited conversations about climate, reforestation, and our capacity to shape a better future.

Do microforests require much maintenance? Microforests are comprised of native species that require very little water except to get started and no fertilization, pest control, or pruning. Basically, the system is a maintenance-free natural forest, albeit an unusually dense one. Because of the cardboard and blanket of woodchips, the forest will not be invaded by hordes of weeds. Those *pioneer species* that do break through should be allowed to grow because they are building soil, attracting pollinators, and otherwise benefiting the environment. These understory species will quickly top out, succumb to the shade of a closing canopy, and decompose in a way that enriches the forest floor.

What does a microforest look like? Microforests are diminutive at first. We install one- and three-gallon stock so our trees have spent very little of their life cycle in the maintenance (and water- and carbon-) intensive regimen of a nursery. Their small stature also sets the stage for remarkable growth. This rapid growth is ecologically advantageous and wonderful at winning over the delighted acceptance of the community; stakeholders love their new forest and celebrate every animal that comes to investigate or reside there. Photos of our two recently planted microforests appear at right.

Stoneybrook I and Stoneybrook II Microforests at the Stoneybrook Golf and Country Club. SI was planted in October of 2021 and S2 in January of 2022. The Celery Fields forest is sometimes called a microforest but was not planted into properly incubated and contiguous forest floor, plus the trees are larger and more widely spaced than with a true microforest. Unlike the Celery Fields forest, which is regularly mowed, these forests will need no maintenance other than the eventual removal of the drip irrigation system that is visible along and across the walking trail.

(Additional Reading on commodifying stormwater diversion and carbon sequestration.)

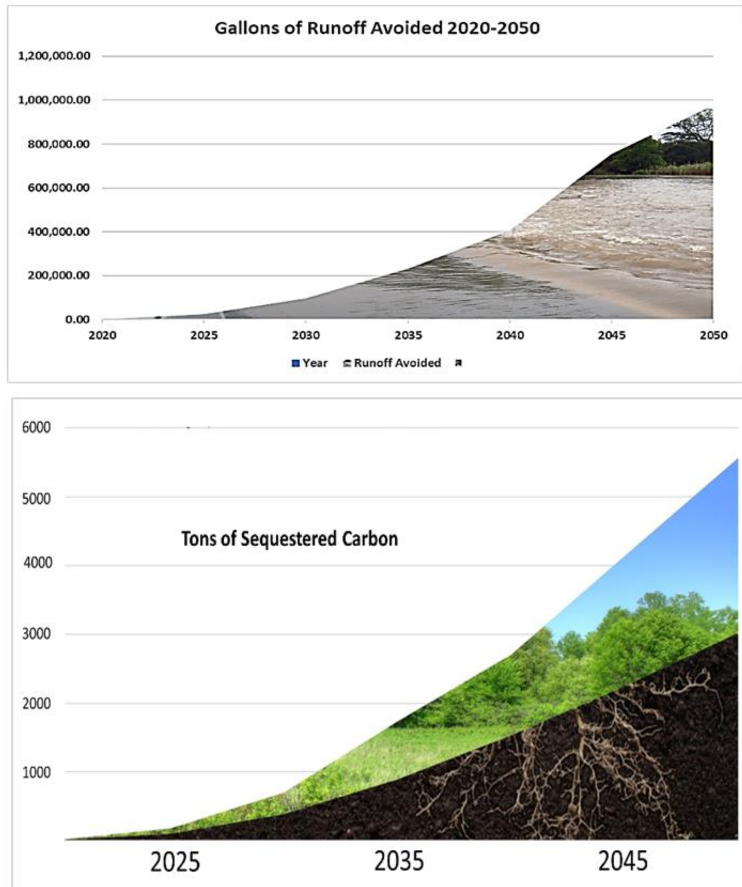
How do we quantify a microforest's ecological benefits to allow donors to potentially contribute toward a specific quantity of stormwater diversion or carbon sequestration? Quantifying environmental benefits or ecological services is called *ecological commodification* and it is always challenging. However, microforestry simplifies this challenge because we start from before planting day and operate over a relatively small and uniform ecological entity.

Our present tool of choice is i-tree, a software that predicts or models the long-term benefits of our forest in capturing carbon and transpiring stormwater that would otherwise transport nutrients to the Bay. I-tree wasn't designed for microforests (it was created before they were invented) but we can use it for rough estimates such as shown on the next page of runoff (stormwater) diversion and carbon uptake.

We start by sampling the soil under the microforest's footprint or immediately nearby in identical (turf) habitat to determine the starting or baseline amount of carbon in the soil. Each year, we will look at the increased amount of carbon in the soil, which we use to estimate the forest's overall growth rate as well as its annual transpiration or movement of water from the soil to atmosphere. This provides a reasonable estimate and update to our projections for the first few years. However as the forest matures, we will begin to rely increasingly on the trees themselves – their girth when measured in a systematic way – as indicators of the forest's performance.

These estimated rates of diversion and sequestration will be measured or calculated with greater confidence each year that the microforest exists.

The precision with which ecological services can be quantified depends in good measure on the amount of monitoring effort applied. As an all-volunteer organization that largely invests its own money in the microforest initiative, SURF can only dedicate so much resource to this modeling and validation. However, we are generously assisted by New College, plus some of our stakeholders who have donated toward this end. Our objective is to establish sufficient precision and confidence that donors can contribute toward or sponsor a new microforest with a sense of how much benefit they will be underwriting in their community *locally* relative to coastal water quality and *globally* relative to carbon and climate.



Rates of stormwater diversion and carbon uptake projected using i-tree for our pilot microforest installed at the Celery Fields.

As we obtain more confident predictions of our forest per-formance, we will rely on national or international pricing schemes to assign values to our realized and projected rates of water diversion and carbon uptake. Washington DC has a commodified (priced) stormwater program associated with its efforts to protect the Anacostia and Potomac Rivers, as well as Chesapeake Bay, from nonpoint source pollution. A "price" for carbon can be inferred from the California Climate Action Reserve, International Carbon Finance, and a host of informal and formal carbon markets. Combining these commodified ecological services into a single "price" or value toward which one can donate to underwrite our Suncoast's microforests will be special challenge and unique effort that will be undertaken with transparency and good faith.

What can you do to support microforests in Sarasota County? SURF is a new venture that benefits from all interest and support. If you would like to know more or if you have a prospective microforest site, please reach out to Charles Reith at 703 342 685 or charles.c.reith@gmail.com.