



Councilmember Sophie Hahn
City of Berkeley, District 5

SUPPLEMENTAL AGENDA MATERIAL for Supplemental Packet 1

Meeting Date: September 12, 2023

Item Number: 31

Item Description: Budget Referral: Miyawaki “Pocket Forest” Pilot Program to Support Carbon Sequestration, Biodiversity, Cooling, Noise Reduction, Health, and Equity

Submitted by: Sophie Hahn

Submitting recent New York Times article detailing the benefits of pocket forests as an attachment to the item. Adjusting co-sponsorship.



Councilmember Sophie Hahn
City of Berkeley, District 5

To: Honorable Mayor and Members of the City Council
From: Councilmember Sophie Hahn (Author); ~~Councilmember Terry Taplin~~
(Co-Sponsor)
Subject: Budget Referral: Miyawaki “Pocket Forest” Pilot Program to Support Carbon Sequestration, Biodiversity, Cooling, Noise Reduction, Health, and Equity

RECOMMENDATION

Refer to the November 2023 Budget Process \$140,000 to fund staffing, materials, and consultants for a Miyawaki Pocket Forest Pilot Project, including the planting of two pocket forests on City of Berkeley sites, preferably in areas most impacted by poor air quality, and a report to Council on opportunities and funding for a broader Citywide Miyawaki Forest program. Should November 2023 funding not be available, refer to subsequent budget processes for consideration.



SUMMARY STATEMENT

Climate change is one of the greatest challenges of our time. Greenhouse gas emissions have led to catastrophic heatwaves, wildfires, loss of biodiversity, and instability. Large scale deforestation has further escalated the crisis. As carbon dioxide is one of the most commonly emitted greenhouse gasses, carbon sequestration - the removal of carbon dioxide from the Earth’s atmosphere - is an important tool to fight global warming.

Miyawaki Forests - small, fast growing “pocket forests” densely planted with native shrubs, bushes and trees. They are a quick and effective method of achieving carbon sequestration, and offer numerous additional environmental benefits, both local and global. Under the leadership of Berkeley Unified School District (BUSD) science teacher Neelam Patil and head of sustainability Steven Collins, with the partnership of BUSD, students and community members

have already successfully planted four Miyawaki forests in Berkeley at Cragmont Elementary, King Middle School, Malcolm X and most recently the Berkeley Technology Academy.¹

The City of Berkeley can also benefit from the establishment of Miyawaki Forests, especially in areas prone to excessive air pollution and heat. Funding a pilot Miyawaki Forest project with two sites on City property provides the opportunity for the City's Parks/Forestry Division to learn from BUSD's facilities staff and Miyawaki Forest specialists and to establish protocols for the potential establishment of pocket forests in appropriate locations citywide.

Grant funding, including from the State of California as well as via federal Inflation Reduction Act funding, is already available and may become more abundant soon. With the experience of a successful pilot, Berkeley will be better positioned to apply for outside funds, and may decide to allocate future one-time City funds for additional projects, which can likely be delivered at lower cost than the two initial pilot locations. As established Miyawaki forests require only minimal maintenance, ongoing costs for the City will be insignificant, while generating significant environmental, health, and other community benefits.

BACKGROUND

Miyawaki Pocket Forests (also called micro forests, mini forests, and tiny forests) are densely-planted, multilayered indigenous forests planted in urban spaces that act as self-sustaining ecosystems, reconnecting fragmented habitat and restoring biodiversity. Named after Akira Miyawaki, a Japanese botanist and plant ecologist who had a particular interest in phytosociology, i.e. how plant species interact with each other within communities, the Miyawaki method is an innovative approach to growing forests.

The density of a Miyawaki forest doesn't merely support the growth of biodiversity; it also increases carbon capture, enhances air pollution filtration, and produces an area more resilient to flooding, landslides, and wildfires. In addition, increased canopy cover reduces the amount of rainfall that hits the ground, increases shade, and promotes cooling - as well as providing a sound barrier to reduce ambient noise.

The 40 year old forest at Yokohama National University in Yokohama, Japan, pictured on the following page, was formerly a golf course. It is now a thriving ecosystem that mimics the positive impacts of old growth forests.

¹ Ally Markovich, "Berkeley Schools' 'pocket Forests' Are Taking Root," Berkeleyside, December 8, 2022, <https://www.berkeleyside.org/2022/12/08/miyawaki-pocket-forests-berkeley-unified-school-district>.



Yokohama National
University

Miyawaki Forest after
40 years



Miyawaki forests do not require significant space. They can be planted almost anywhere in sites as small as 60 square feet. Even at this size they quickly become habitat for species and offer multiple ecosystem services. Pocket Forests planted using the Miyawaki method are an excellent tool for rapid regeneration of urban areas, and have been used across the globe to transform school playgrounds, city parks and curtilage, and urban rivers. Even in the most crowded urban environment, a Miyawaki forest can have an important impact, providing greenery, shade, and cooling the environment.

The Miyawaki method is community-based and people-centered, using volunteers for planting and early maintenance, and providing social and health benefits for both people and the planet.

Dr. Miyawaki, who first developed the method, asserts that “[o]ne of our fundamental tasks is to restore ‘native forests of native trees’ that will be the main component of ecosystems that will also encompass human beings. That is something each of us can do immediately, wherever we are, no matter what our position; it is the most realistic way to secure the scenery for playing out our future.”

According to SUGi, an NGO devoted to restoring biodiversity that plants Miyawaki “Pocket Forests” across the globe, the Miyawaki method of afforestation draws inspiration from nature’s ecosystems to create 100% organic, dense and diverse pioneer forests in as little as 20-30 years.² They’re quick to establish and relatively maintenance-free after the first two-to-three years. As such, Miyawaki pocket forests are viable solutions for cities looking to rapidly build climate resilience.

² “The Miyawaki Method for Creating Forests,” SUGi, accessed August 1, 2023, <https://www.sugiproject.com/blog/the-miyawaki-method-for-creating-forests>.



Multi-faceted benefits of urban forests

The Miyawaki forest planting method mimics the way natural habitat would recolonize an area if humans - and their transplanted invasive plants - disappeared. Naturally-occurring native species that have spent thousands of years adapting to their environment would be re-established, increasing biodiversity and responsiveness to climate change.

The Miyawaki method's afforestation principles are based on the understanding of how local species interact in a natural forest. A diverse mixture of trees is planted close together to maximize density and create balance. As closely planted saplings have to compete for light, they shoot upwards very quickly, creating rapid growth not experienced when trees are planted individually or in more widely spaced configurations.

In addition to fostering extremely rapid growth, planting a wide variety of native trees and other plants close together results in increased biodiversity, providing forage for pollinators and refuge for birds. More dense canopy cover shades weeds, creating a cool home for insects and increased leaf litter enhances soil fertility.

Planting densely provides multiple additional benefits. Mature multi-strata pocket forests create their own precipitation on top of annual rainfall - reducing the need for watering and recycling water through a natural system. This is partly due to the cooling effects of shade and photosynthesis that produce humidity and precipitation - particularly at the upper canopy layer. The lower layers of the forest then cycle the cooler moist air as it naturally sinks down to the forest floor where it is absorbed. This effect doesn't happen within single strata mono plantations where cooler air and moisture are blown away by the wind and lost to evaporation. (see below, a 3-year old Miyawaki Forest)



According to James Godfrey-Faussett, lead SUGi Forest Maker, "Within a forest, biodiversity means balance, birds control pests, insects pollinate plants, and beneficial fungi keep the trees healthy. Every organism has a role to play, and all these roles interact. And if you build a healthy, biodiverse habitat that can look after itself, it becomes self-sustaining. You can step away and let nature get to work."

Miyawaki Pocket Forests support the creation of flourishing forest habitats with a range of social, environmental and ecological benefits, including air purification, water management, climate regulation, oxygen creation, biodiversity, soil health, species habitat, sound mitigation, and shelter. Green spaces have even been found to increase joy and reduce violence.

The Miyawaki Method:

Planting a Miyawaki Pocket Forest is a four-step process:

1. **Species Identification and procurement:** Identify local native vegetation best suited to the area being planted, and coordinate with local plant nurseries to grow saplings of the target species. Plants should be grown from locally-collected seeds; in some cases locally-collected cuttings may be used but seeds provide greater genetic diversity to support climate resilience. It is important to arrange for procurement of enough saplings to plant the forest all at once. Forests are multi-layered, and as the Miyawaki method mirrors nature, layers of vegetation build a resilient green assemblage of canopy trees, shrubs, subshrubs, and forbs. A variety of species are used in each forest, maximizing density.
2. **Soil preparation.** In urban areas soil is often degraded, compacted, waterlogged or otherwise impaired. However, freshly planted saplings and other plants need soft, porous, crumbly soil so their roots can establish faster and have better access to nutrients. Forest makers till the soil to add amendments to restore the missing biology, and put it on the path to becoming fertile and self-sustaining. Compost tea is also added as the soil is turned; this contains strains of beneficial fungi (known to interact with the specific tree species) and a stimulant, such as molasses or liquid seaweed, to give the fungi fuel to grow.
3. **Planting:** Plant multiple layers of forest, with the help of community volunteers: canopy tree, tree, sub-tree, and shrub. The Miyawaki method requires randomized planting of small saplings of various indigenous shrubs and trees (grown from local, regionally adapted seeds) in very close proximity together, where no two trees or shrubs of the same height are planted side by side. This complex layering ensures that the trees are able to grow to their ideal sizes without directly competing with a neighboring tree of the same height, while at the same time, maximizing every bit of space in the forest. Planting can often be achieved over just one weekend with the assistance of volunteers, creating an opportunity for community members to learn about and invest in climate resilience.
4. **Apply a layer of mulch.** Once planted, mulching protects the soil and retains moisture. Species such as earthworms, beetles, and other insects feed from the top-down, building soil fertility by pulling the mulch into the ground to be broken down by microbes. As mulching helps soil retain moisture and enhances the ability for soil biology to improve, Miyawaki Pocket Forests require limited watering and only need to be

maintained for the first two-to-three years. Once established, weeding, watering, and mulching are no longer required.

5. **Maintenance:** A temporary irrigation system is installed to ensure adequate water for young saplings. This will only be necessary for the first 18 months to 3 years. Other than watering during these early months and years, the Miyawaki Forest requires very low to no ongoing maintenance. Weeding can be beneficial in the first year as well, but is not required on an ongoing basis. Community “weeding parties” have brought together volunteers of all ages and offer a much-appreciated opportunity to take action to address climate change and to expose children and families to nature.

Benefits of Miyawaki Forests: Environmental, Human Health, and Community

1. **Climate Change and Carbon Sequestration:** According to the United Nations, climate change refers to long-term shifts in temperatures and weather patterns.³ Since the 1800s, human activity has been the main driver of climate change, primarily due to burning fossil fuels such as coal, oil and gas, and the release of methane. Energy, industry, transport, buildings, agriculture and land use are among the main emitters of greenhouse gasses (GHGs) including gasoline, coal, animal husbandry, clearing of land and forests, and landfills.

According to the City of Berkeley’s 2022 Climate Action Plan and Resilience update, Berkeley’s GHG emissions are down 31% since the year 2000, with transportation and buildings accounting for the largest share of emissions.⁴ While the city works to create a fossil fuel-free transportation system and benefits from transitioning to the East Bay Community Energy’s 100% renewable energy plan, if it is to meet its goal of reducing emissions by 80% below 2000s levels by 2050, more progress must be made.

One method for reducing the impacts of climate change is carbon sequestration. Carbon sequestration is the capturing, removal, and storage of atmospheric carbon. Biological carbon sequestration is when carbon is stored in trees, woodlands, grasslands, and other natural environments. Nature-based solutions such as pocket forests are considered one of the more efficient “carbon sinks,” and as such are specifically promoted by State policy and funding. Miyawaki forests are an efficient mechanism of carbon sequestration, helping to mitigate the effects of the climate crisis both locally and globally.

2. **Mitigating the effects of biodiversity loss:** California is a biodiversity hotspot and home to more than 6,500 species of native plant. Roughly 40% of these plant species are found nowhere else and more than 2,000 of California plant species are ranked as

³ “What Is Climate Change?,” United Nations, accessed August 1, 2023, <https://www.un.org/en/climatechange/what-is-climate-change#>.

⁴ Jesse Arreguin, “Progress on the Climate Action Plan,” Mayor Jesse Arreguín, December 7, 2022, <https://www.jessearreguin.com/newsletters-2/2022/12/6/progress-on-the-climate-action-plan>.

rare, threatened, or endangered.⁵⁶ While not specifically including rare or protected plant species, the diversity of native plants used makes Miyawaki forests far more biodiverse than other planting methods. They help bring wildlife to the area by introducing new habitat, reducing existing habitat fragmentation, increasing landscape-scale connectivity, and attracting a diversity of species.

3. **Reducing the urban heat island effect:** The urban heat island effect occurs when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. This effect increases energy costs (e.g. air conditioning), air pollution levels, and heat-related illness and mortality. Climate change will likely lead to more frequent, more severe, and longer heat waves. Miyawaki forests can help mitigate urban heat islands by shading building surfaces, deflecting radiation from the sun, and releasing moisture into the atmosphere.⁷
4. **Making our air cleaner:** Trees remove air pollution by the interception of particulate matter on plant surfaces and the absorption of gaseous pollutants through the leaf stomata.⁸ Poor air quality is a critical issue that damages ecosystems and negatively impacts human health and wellbeing. Poor air quality can lead to a myriad of health issues, including bronchitis symptoms, increased risk for glaucoma, heart attacks, changes in vascular function, autism, high blood pressure, cognitive development problems in children, heart failure, and increased mortality.⁹ Air quality in Berkeley is especially low in areas close to the freeway and downwind from the Chevron facility in Richmond. Berkeley's health report shows that asthma and other respiratory illnesses are more prevalent in African American and other communities of color. Due to historical redlining, these communities are clustered in areas with poor air quality. Improving air quality is thus a health *and* equity issue.
5. **Reduction in violent crime:** Researchers in South Africa found that, controlling for socio-demographic confounders (such as unemployment, education, income, etc.), for every 1% increase in green space, violent crime decreased by 1.3%.¹⁰ A 2021 study conducted at Michigan State University found that nature can help reduce violence by

⁵ Soumya Karlamangla, "What Makes California the Most Biodiverse State in the Nation," The New York Times, April 17, 2023, <https://www.nytimes.com/2023/04/17/us/california-biodiversity-conservation.html>

⁶ Irene Gutierrez, "California's Role Fighting the Global Biodiversity Crisis" (Natural Resource Defense Council, February 3, 2023), <https://www.nrdc.org/bio/irene-gutierrez/californias-role-fighting-global-biodiversity-crisis>.

⁷ "Reduce Urban Heat Island Effect," EPA, July 17, 2023, <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect>.

⁸ Nowak, David, Hirabayashi, Satoshi, Bodine, Allison, Greenfield, Eric, "Tree and forest effects on air quality and human health in the United States," Environmental Pollution, Volume 193 (October 2014), pgs 119-129, <https://www.fs.usda.gov/research/treesearch/46102#>.

⁹ Meaghan Weeden, "How Trees Clean the Air," One Tree Planted, June 22, 2023, <https://onetreeplanted.org/blogs/stories/how-trees-clean-air>.

¹⁰ Venter, Zander, Shackleton, Charlie, Faull, Andrew et al., "Is green space associated with reduced crime? A national-scale study from the Global South," Science of the Total Environment, Volume 825, June 2022, <https://www.sciencedirect.com/science/article/pii/S004896972201097X>.

lowering stress and bolstering mental and physical health.¹¹ Furthermore, a literature review published in the International Journal of Environmental Research and Public Health found, across the peer-reviewed scientific literature on the subject of the relationship between green spaces and crime, that an increase in green space leads to a statistically significant reduction in crime.¹²

Additional Benefits of Miyawaki Forests:

In addition to carbon sequestration, reduced temperatures, cleaner air, and biodiversity enhancement, reforestation is healing for the community and brings people together. Previous Miyawaki forest plantings in Berkeley were honored by involvement of local and out-of-state Native American participants, who spoke to the meaning of this restoration. It is a way we can honor Indigenous knowledge and bring in Indigenous communities. Caring for the forest uplifts people through service, increases neighborly connections, and helps address eco-anxiety and eco-grief.

Maintenance of Miyawaki forests requires work and attention in their first three years, typically mulching and weeding. During the first two-to-three years they require watering only every ten days, as the plants are native and once established are able to thrive in the local environment, saving water, time, and money. Once mature they become autonomous.



13

¹¹ Katherine Cullen, “Can Green Spaces Reduce Violence?,” Psychology Today, September 23, 2021, <https://www.psychologytoday.com/us/blog/the-truth-about-exercise-addiction/202109/can-green-spaces-reduce-violence>.

¹² Shepley, Mardelle, Sachs, Naomi, Sadatsafavi, Hessam et al, “The Impact of Green Space on Violent Crime in Urban Environments: An Evidence Synthesis,” Int J Environ Res Public Health (December 2019), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6950486/>.

¹³ Sullivan, Kelly. *Posing for a photo as part of the Miyawaki forest project are, top row from left: Vernon Medicine Cloud of the Assiniboine and Turtle Mountain Chippewa nations, Alisha Graves, Marlene Hunt of the Yakama Nation, Tamsin Smith of SUGi, Joelle Jones of the Yakama Nation, Jeff Smith, Mary Lee Jones of the Yakama Nation, Ethan Bryson of Natural Urban Forests, Monica Arellano of the Muwekma*

THE PILOT PROJECT PROPOSAL - TWO MIYAWAKI FORESTS

Refer to the November 2023 Budget Process \$140,000 to fund staffing, materials, and consultants for a Miyawaki Pocket Forest Pilot Project. These will allow City Staff, working with consultants, to plan, organize, and plant two approximately 10,000 square foot pilot Miyawaki forests on City of Berkeley property, preferably in an area in West Berkeley where the tree canopy is less dense and air pollution and its health impacts are more prevalent.

Carrying out a pilot project with two sites will allow the City to establish protocols appropriate for City locations (conditions at City sites are significantly different from BUSD sites) and to better understand how the City can more broadly disseminate this uniquely powerful carbon sequestration, biodiversity, shade, and air quality intervention to support our climate action, health, and equity goals. Once completed and evaluated, the City Council may consider seeking and allocating additional funds, including state and/or private funds, for a larger rollout of Miyawake forests throughout Berkeley.

Due to the accelerated carbon sequestration, cooling, habitat provisions, and other benefits of Miyawaki forests, this pilot program is likely to offer a valuable complement to the city's existing efforts. Staff should report back to the City Council on progress and outcomes of the Pilot Project and may use existing tree-planting funds, grant funds, or additional one-time City of Berkeley funds to roll out a broader program of Miyawaki forests citywide.

REVIEW OF EXISTING PLANS, PROGRAMS, POLICIES AND LAWS

- The City of Berkeley has recognized the benefits of planting trees and has taken on tree planting initiatives over the past few years:
 - The city has planted over 200 trees in industrial areas in West Berkeley, courtesy of a \$725,000 grant awarded by the state in 2020.¹⁴
 - In March of 2022, the City was awarded a further \$500,000 grant from the California Transportation Commission to continue its work planting trees, especially in underserved neighborhoods in Berkeley.
 - Berkeley's Climate Action Plan calls for "a healthy urban forest" that will be able to reduce energy consumption, reduce temperatures, intercept stormwater, improve quality of life, and serve as a carbon sequestration mechanism.¹⁵
 - Berkeley has plans to plant significantly more trees. There have been pledges to plant over 1000 trees in residential neighborhoods, as well as a "wall of trees" along the I-580 to reduce freeway noise.

Ohlone Tribe, Elise Van Middeltem of SUGi, Kat Livingston, science teacher Neelam Patil, Sofia Peltz of BUSD, Travis Andy of National Urban Forests. Bottom row: Principal Candy Cannon, Grounds Supervisor Genaro Macchiavello, and Stephen Collins, December 8, 2022, Berkeleyside.

¹⁴Jesse Kathan, "Berkeley Residents Can Request Free Saplings to Combat Tree Inequity," Berkeleyside, August 4, 2022, <https://www.berkeleyside.org/2022/03/08/trees-make-life-better-berkeley>.

¹⁵ Climate Action Plan, City of Berkeley, 2009. <https://berkeleyca.gov/sites/default/files/2022-01/Berkeley-Climate-Action-Plan.pdf>

- Through the Trees Make Life Better program, residents can apply to have a tree planted in front of their residence.¹⁶
- BUSD has already planted several thriving Miyawaki forests. Miyawaki forests have been planted on the Cragmont Elementary, Martin Luther King Jr. Middle School, Berkeley Technology Academy, and Malcolm X campuses (see photos below). Through this process, Indigenous groups, BUSD students, and other members of the community have joined efforts to solve the climate crisis. Community members and BUSD Staff have expertise in planting, growing, and maintaining these forests and are committed to supporting the city in pursuing and expanding Miyawaki Forests.



17

- The State of California is encouraging tree-planting programs around the state:
 - California allocated \$74.8 million in 2022 for urban forestry, via the California Department of Forestry and Fire Protection Urban Forestry Program, and has recently allocated additional amounts.¹⁸

¹⁶ “Get a Tree in Front of Your Home or Business – or Help Plant One,” City of Berkeley, April 7, 2022, <https://berkeleyca.gov/community-recreation/news/get-tree-front-your-home-or-business-or-help-plant-one>.

¹⁷ Sullivan, Kelly. *Students plant saplings in the Miyawaki forest at Cragmont Elementary*, November 15, 2021, *Berkeleyside*. <https://www.berkeleyside.org/2022/12/08/miyawaki-pocket-forests-berkeley-unified-school-district>

¹⁸ “Urban and Community Forestry Program,” California Climate Investments, November 30, 2022, <https://www.caclimateinvestments.ca.gov/urban-forestry>.

- In the 2022 budget, the state appropriated a total of \$292 million for Resilient Forests and Landscapes, including \$20 million for urban forestry.
- In the 2023-2024 budget, the Governor proposed an additional \$290 million for Resilient Forests and Landscapes, with \$10 million earmarked to support urban forestry.¹⁹
- In 2022 the Governor signed into law AB 2251, requiring the creation of a plan to increase urban tree canopy cover by 10% by 2035.
- CA Assembly Bill No. 57, introduced by Assemblymember Ash Kalra and co-authored by Assemblymember Buffy Wicks, would establish a Pocket Forest program through CAL FIRE for “pocket forests” initiatives rooted in the Miyawaki method. It was originally introduced during the 2021-2022 legislative session, and reintroduced in 2023.²⁰ AB 57 has passed through the Assembly and is nearing passage in the Senate.
- The Inflation Reduction Act of 2022 made funding available for conservation and forestry through the Urban and Community Forestry Program.
 - This includes \$1 billion in grants available to increase equitable access to trees and green spaces in urban and community forests.

The Miyawaki Forest pilot program will be an extension of these existing efforts, bringing greenery to the City while also combating poor air quality, loss of biodiversity, and climate change. Even this small proposed investment would give the City a significant advantage in applying for these and other funds.

ACTIONS/ALTERNATIVES CONSIDERED

The City of Berkeley could forgo exploring Miyawaki forests and continue with only traditional tree planting methods that yield less environmental, health, community, and other benefits, and whose benefits accrue more slowly. California lost 2.65 million hectares of tree cover from 2001 to 2021, leading the nation in tree loss.²¹ Given these circumstances, and the acceleration of Global Warming, the City will be well-served by piloting this proven method of rapid urban reforestation, at very low initial and long-term cost, and considering the addition of a broader Miyawaki forest initiative to the City’s reforestation programs.

CONSULTATION/OUTREACH OVERVIEW AND RESULTS

Councilmember Hahn and her office have consulted with City Staff, BUSD, and Miyawaki Forest experts, as well as undertaking an extensive literature review. Throughout the planning, planting, and growth of King Middle School’s Miyawaki forest in District 5, Councilmember Hahn met and worked with BUSD Miyawaki Forest project sponsor Science Teacher Neelam Patil,

¹⁹ Legislative Analyst’s Office, *Wildfire and Forest Resilience Package*, January 22, 2022, <https://lao.ca.gov/Publications/Report/4495>

²⁰ California Pocket Forests Initiative, AB-57, California State Assembly (2023-2024), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB57

²¹ Sabrina Toppa, “Neelam Patil: Time Innovative Teachers 2022,” *Time*, June 8, 2022, <https://time.com/6181167/neelam-patil-innovative-teachers-2022>.

BUSD facilities staff, Foundations providing funds for BUSD's projects, community volunteers, and students. She also participated in planting events at other BUSD locations.

Councilmember Hahn invited City Parks and Forestry staff to visit the King Middle School forest site and meet with BUSD facilities staff to examine the forest and learn about the school's processes. City Staff has expressed support for a pilot for the City of Berkeley, as the reforestation method has been successful at BUSD, and can offer significant environmental benefits more quickly than traditional plantings. There are factors around siting of forests on City vs. BUSD property which are best addressed via a pilot program, prior to moving forward to incorporate Miyawaki Forests citywide.

IMPLEMENTATION, ADMINISTRATION AND ENFORCEMENT

The Parks Department has expressed interest in taking on this pilot, and BUSD has generously offered to provide technical support and guidance. Hiring of a consulting group with expertise in Miyawaki forests will further ensure that the pilot is successfully implemented, documented, and evaluated. Once established, Miyawaki Forests require little, if any, maintenance, which can be carried out by existing City of Berkeley Forestry staff. As more trees are planted citywide via a variety of programs, it is expected that additional staffing may be needed to maintain those trees; the Miyawaki Forests are likely to have less costs and staffing impacts than traditionally planted trees and greenery while providing more rapid and concentrated benefits.

ENVIRONMENTAL SUSTAINABILITY AND CLIMATE CHANGE

See above.

FISCAL IMPACTS

\$140,000 for the pilot project, including two sites. In the future, existing City tree planting funds, grant funding, federal funding, and funds from the State of California may be used to roll-out a citywide Miyawaki Forest program.

OUTCOMES AND EVALUATION

City Parks and Forestry staff, with the support of the Miyawaki Forest consultant, should evaluate outcomes on an ongoing basis and report back to the City Council on benefits, challenges, costs, and savings associated with a potential expansion of the Miyawaki Forest program. Suggested evaluation metrics could include: ease/difficulty of implementation, environmental benefits/costs, community benefits/challenges, and cost/savings/benefits to implement and maintain Miyawaki Forests, with comparisons to alternative reforestation programs and a "no program" alternative. Speed of deployment and regeneration and other measurable benefits (average tree height after 12 months and 24 months, air and surface temperatures within and next to the forest, amount of water used per square foot, amount of volunteers engaged, amount of hours people are exposed to nature in areas typically starved of nature, increase in tree equity scores, air quality, sound reduction, species return, level of volunteer involvement, etc.) can provide useful metrics to form the basis of the evaluation.

If the experience is deemed positive and public or private grant funding becomes available during the Pilot Project implementation period, staff should apply for funding, even if no report has yet been issued to the City Council.

CONTACT PERSON

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1 year of growth at MLK Middle School



Students at Cragmont Elementary School in approx. 1 year's growth

Tiny Forests With Big Benefits

Native plants crowded onto postage-stamp-size plots have been delivering environmental benefits around the world — and, increasingly, in the U.S.



By Cara Buckley

Published Aug. 24, 2023 Updated Aug. 26, 2023

Climate Forward There's an ongoing crisis — and tons of news. Our newsletter keeps you up to date. [Get it with a Times subscription.](#)

The tiny forest lives atop an old landfill in the city of Cambridge, Mass. Though it is still a baby, it's already acting quite a bit older than its actual age, which is just shy of 2.

Its aspens are growing at twice the speed normally expected, with fragrant sumac and tulip trees racing to catch up. It has absorbed storm water without washing out, suppressed many weeds and stayed lush throughout last year's drought. The little forest managed all this because of its enriched soil and density, and despite its diminutive size: 1,400 native shrubs and saplings, thriving in an area roughly the size of a basketball court.

It is part of a sweeping movement that is transforming dusty highway shoulders, parking lots, schoolyards and junkyards worldwide. Tiny forests have been planted across Europe, in Africa, throughout Asia and in South America, Russia and the Middle East. India has hundreds, and Japan, where it all began, has thousands.

Now tiny forests are slowly but steadily appearing in the United States. In recent years, they've been planted alongside a corrections facility on the Yakama reservation in Washington, in Los Angeles's Griffith Park and in Cambridge, where the forest is one of the first of its kind in the Northeast.

"It's just phenomenal," said Andrew Putnam, superintendent of urban forestry and landscapes for the city of Cambridge, on a recent visit to the forest, which was planted in the fall of 2021 in Danehy Park, a green space built atop the former city landfill. As dragonflies and white butterflies floated about, Mr. Putnam noted that within a few years, many of the now 14-foot saplings would be as tall as telephone poles and the forest would be self-sufficient.

Healthy woodlands absorb carbon dioxide, clean the air and provide for wildlife. But these tiny forests promise even more.

They can grow as quickly as ten times the speed of conventional tree plantations, enabling them to support more birds, animals and insects, and to sequester more carbon, while requiring no weeding or watering after the first three years, their creators said.





Andrew Putnam, superintendent of urban forestry for the city of Cambridge, Mass. Cassandra Klos for The New York Times



Flowers in the Miyawaki forest in Danehy Park, which includes 1,400 native shrubs and saplings, all thriving in an area roughly the size of a basketball court. Cassandra Klos for The New York Times

Perhaps more important for urban areas, tiny forests can help lower temperatures in places where pavement, buildings and concrete surfaces absorb and retain heat from the sun.

“This isn’t just a simple tree-planting method,” said Katherine Pakradouni, a native plant horticulturist who oversaw the forest planting in Los Angeles’s Griffith Park. “This is about a whole system of ecology that supports all manner of life, both above and below ground.”

The Griffith Park forest occupies 1,000 square feet, and has drawn all manner of insects, lizards, birds and ground squirrels, along with western toads that journeyed from the Los Angeles River, Ms. Pakradouni said. To get to the forest, the toads had to clamber up a concrete embankment, traverse a bike trail, venture down another dirt embankment and cross a horse trail.

“It has all the food they need to survive and reproduce, and the shelter they need as a refuge,” Ms. Pakradouni said. “We need habitat refuges, and even a tiny one can, in a year, be life or death for an entire species.”

Known variously as tiny forests, mini forests, pocket forests and, in the United Kingdom, “wee” forests, they trace their lineage to the Japanese botanist and plant ecologist Akira Miyawaki, who in 2006 won the Blue Planet Prize, considered the environmental equivalent of a Nobel award, for his method of creating fast-growing native forests.

Dr. Miyawaki, who died in 2021 at the age of 93, developed his technique in the 1970s, after observing that thickets of indigenous trees around Japan's temples and shrines were healthier and more resilient than those in single-crop plantations or forests grown in the aftermath of logging. He wanted to protect old-growth forests and encourage the planting of native species, arguing that they provided vital resilience amid climate change, while also reconnecting people with nature.

“The forest is the root of all life; it is the womb that revives our biological instincts, that deepens our intelligence and increases our sensitivity as human beings,” he wrote.

Dr. Miyawaki's prescription involves intense soil restoration and planting many native flora close together. Multiple layers are sown — from shrub to canopy — in a dense arrangement of about three to five plantings per square meter. The plants compete for resources as they race toward the sun, while underground bacteria and fungal communities thrive. Where a natural forest could take at least a century to mature, Miyawaki forests take just a few decades, proponents say.



A Miyawaki forest in New Delhi. Arvind Yadav/Hindustan Times, via Getty Images



Butterflies in the Miyawaki forest of Kalina Biodiversity Park at Mumbai University, which opened last year. Vijay Bate/Hindustan Times, via Getty Images

Crucially, the method requires that local residents do the planting, in order to forge connections with young woodlands. In Cambridge, where a second tiny forest, less than half the size of the first one, was planted in late 2022, Mr. Putnam said residents had embraced the small forest with fervor. A third forest is in the works, he said, and all three were planned and organized in conjunction with the non-profit Biodiversity for a Livable Climate.

“This has by far and away gotten the most positive feedback from the public and residents than we’ve had for any project, and we do a lot,” Mr. Putnam said.

Still, there are skeptics. Because a Miyawaki forest requires intense site and soil preparation, and exact sourcing of many native plants, it can be expensive. The Daneyh Park forest cost \$18,000 for the plants and soil amendments, Mr. Putnam said, while the pocket forest company, SUGi, covered the forest creators’ consulting fees of roughly \$9,500. By way of comparison, a Cambridge street tree costs \$1,800.

“A massive impact for a pretty small dollar amount in the grand scheme of the urban forestry program,” Mr. Putnam said.

Doug Tallamy, an American entomologist and author of “Nature’s Best Hope,” said that while he applauded efforts to restore degraded habitat, particularly in urban areas, many of the plants would eventually get crowded out and die. Better to plant fewer and save more, he said.

“I don’t want to throw a wet blanket on it, the concept is great, and we have to put the plants back in the ground,” Dr. Tallamy said. “But the ecological concept of a tiny forest packed with dozens of species doesn’t make any sense.”

Kazue Fujiwara, a longtime Miyawaki collaborator at Yokohama National University, said survival rates are between 85 and 90 percent in the first three years, and then, as the canopy grows, drop to 45 percent after 20 years, with dead trees falling and feeding the soil. The initial density is crucial to stimulating rapid growth, said Hannah Lewis, the author of “Mini-Forest Revolution.” It quickly creates a canopy that shades out weeds, and shelters the microclimate underneath from wind and direct sun, she said.

Throughout his life, Dr. Miyawaki planted forests at industrial sites globally, including at an automotive parts plant in southern Indiana. A turning point came when an engineer named Shubhendu Sharma took part in a Miyawaki planting in India. Enthralled, Mr. Sharma turned his own backyard into a mini-forest, started a planting company called Afforestt, and, in 2014, delivered a TED Talk that, along with a 2016 follow up, ended up drawing millions of views.



Critics point out that because a Miyawaki forest requires intense preparation and exact sourcing of many native plants, it can be expensive. The Daneyh Park forest cost \$18,000 for the plants and soil amendments, plus roughly \$9,500 for the forest creators' consulting fees. Cassandra Klos for The New York Times

Around the world, conservationists took notice.

In the Netherlands, Daan Bleichrodt, an environmental educator, plants tiny forests to bring nature closer to urban dwellers, especially city children. In 2015, he spearheaded the country's first Miyawaki forest, in a community north of Amsterdam, and has overseen the planting of nearly 200 forests since.

Four years later, Elise van Middeltem started SUGi, which has planted more than 160 pocket forests worldwide. The company's first forest was planted on a dumping ground alongside the Beirut River in Lebanon; others were sown later near a power plant in the country's most polluted city, and in several playgrounds badly damaged by the 2020 blast at Beirut's port.

And Earthwatch Europe, an environmental nonprofit, has planted more than 200 forests, most of them the size of a tennis court, throughout the United Kingdom and mainland Europe in the last three years.

Though many of the forests are still very young, their creators say there have already been outsize benefits.

The woodlands in Lebanon have drawn lizards, geckos, birds and tons of insects and fungi, according to Adib Dada, an architect and environmentalist and the main forest creator there. In the West African country of Cameroon, where eight Miyawaki forests have been planted since 2019, there are improved groundwater conditions and higher water tables around the forest sites, according to Limbi Blessing Tata, who has led the reforestation there. Crabs and frogs have also returned, she said, along with birds that were thought to be extinct.

According to Mr. Bleichrodt, a 2021 university study of 11 Dutch mini-forests found over 1,100 types of plants and animals at the sites — kingfishers, foxes, hedgehogs, spider beetles, ants, earthworms and wood lice.

“A Miyawaki forest may be like a drop of rain falling into the ocean,” Dr. Fujiwara wrote in an email, “but if Miyawaki forests regenerated urban deserts and degraded areas around the world it will create a river.”

“Doing nothing,” she added, “is the most pointless thing.”