GROWING A FOREST

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We know that forests help in temperature regulation, flood control, building soil fertility, supporting pollination, and carbon sequestration. But how do forests grow? Can we grow one in congested urban spaces or degraded land? Can we grow a dense forest of native species in 25–30 years?

Contrary to the popular image of forests, it is possible to rapidly restore forest cover in small spaces using the Miyawaki method. Developed by Akira Miyawaki, a Japanese botanist, this method offers a systematic approach to growing dense multilayered forests of native species within a short period of time (see **Box 1**). Each forest grown by this method is therefore a microcosm of local forests. This approach has been used in diverse locations — from small urban spaces and degraded land, to large stretches of semi-arid land — in many countries, all over the world.

Box 1. Who is Akira Miyawaki?

Born on 29th January 1928, Akira Miyawaki grew up in a farming community to Wakichi Miyawaki and Tsune Miyawaki in the Okayama Prefecture of Japan. He studied and worked as a researcher in the fields of ecology and plant biology at universities in Japan and Germany. Inspired by remnants of natural forests preserved around temples and cemeteries in Japan, Miyawaki came up with the idea of growing such forests in the 1970s. First implemented for the Nippon Steel Corporation, today there are more than 4000 Miyawaki forests spread across the world.

In Miyawaki's own words (2006), *"Rather than simply restoring forests that were there before, this work involves creating genuine native forests through rigorous field surveys and research into the ecology of the vegetation in order to ensure a future without making mistakes that have been made so far... Native forests protect the lives of all the people born and raised in the area, and the people who go to school or work there. They sharpen the senses of the people for the creation of culture and give rise to their intellect for new developments.... The conviction and the activities with which I devote myself to creating forests for life are not something that came about overnight; I hope you will look at them as the way I have lived for 78 years."* Akira Miyawaki remained actively involved in several afforestation activities till his death on 16th July 2021.

Akira Miyawaki.

Fig. 1. The soil is prepared and grids are used to designate where each sapling will be planted. Each square in the grid holds one sapling. The depth of the pit varies depending on the size of the sapling, and the plant it will eventually grow into.

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Planting a Miyawaki forest

Step 1. Analyse the soil at the location for its texture, pH, organic carbon and nitrogen content, and the presence of micro- and macro-fauna. While the last parameter can be assessed visually, soil samples will need to be sent for lab testing for the others. This step will help identify any additional nourishment that the soil may need.

Step 2. Prepare and condition the soil based on the results of the soil analysis in Step 1 (see **Fig. 1**). For example, if the top soil is too hard to allow the percolation of water, groundnut shells or the husk from wheat, corn, or rice can be used to improve porosity. Since soil moisture is crucial in the initial years of sapling growth, dry soils may need mulching with straw, coco peat etc., to retain soil moisture. Similarly, degraded soils may need to be enriched up to a depth of one metre with organic soil conditioners, like cattle and goat manure or vermicompost (a mixture of decomposing vegetable, food waste, and other decomposing organic material).

Step 3. Prepare a list of plants to be grown through visits to local forests, referring to books, or through conversations with people about local natural history. Choose native species because they are better adapted to local ecological conditions. Selecting a mix of plant species (like some flowering plants and vines, some shrubs, some tall trees with a canopy, and some trees that grow taller than a shrub or to sub-tree level) is recommended.

Step 4. Procure healthy saplings of plants from reliable nurseries, like those run by the Forest Department in many states in India. Typically, it takes three months in a nursery for saplings of forest species to become well-rooted.

Fig. 3. Coir pith is spread around the saplings to prevent the loss of soil moisture in the heat of the sun. Photo from Shantapara in Munnar, Kerala.

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Fig. 2. The saplings are procured and planted. (a) The saplings of various plants are grown in grow bags and pots. **(b)** Care is taken to ensure that the saplings of plants that are likely to grow into big trees are not planted next to each other. Photo from Thiruvananthapuram, Kerala.

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Fig. 4. Growth at different stages. (a) After 6 months. **(b)** After 12 months. **(c)** After 2 years.

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Step 5. Plant each sapling in a pit, and then cover with soil (see **Fig. 2**). The size of the pit will need to be determined based on the species to be planted, particularly its rooting system. If needed, the soil (particularly degraded soils) can be enriched with additional soil conditioners. To prevent moisture loss, mulch each sapling pit with a six-inch-thick layer of dried leaves, flakes of tree bark, wood shavings, rice straw, corn stalk, or compost (see **Fig. 3**). Support the saplings with bamboo stalks or other locally available firm supports. This method can be used to plant around 30 saplings in a 10 square meters area, as long as plants of the same species are separated from each other to avoid competition for resources (access to light, water, nutrients).

Step 6. Care for the saplings by watering them at least once a day for the first two years of growth (see **Fig. 4**). The frequency of watering may need to be increased in summer to offset any water loss due to the higher temperature. To ensure regular watering, access to a reliable water source is necessary. Depending upon the size of the forest and available water resources, a water distribution system or micro-irrigation system (drip or sprinkler) may be set up. Weeds need to be managed, again, for the first two years, after which the forest will self-regulate weed growth. Regarding long-term care, Akira Miyawaki says: *"No maintenance is the best maintenance. If a forest requires maintenance after the first 2-3 years, then it's a fake forest."*

While this method has captured the imagination of several people and organizations, the high costs of its early stages of implementation can pose a challenge. These include costs of procuring saplings, soil conditioners, and access to a water source for two years. Since this method involves dense planting, the number of saplings required to raise such a forest can further raise costs. Given that urban land is often in a degraded state, the cost of preparing the soil and land can also be quite high.

Miyawaki forests as learning spaces

This method has inspired students of some schools in Thiruvananthapuram to set up small Miyawaki forests on their campuses. Apart from being an effort in creating or restoring vegetative cover and serving to sequester carbon, such forests can also support a range of student explorations. For example, the soil investigation needed in Step 1 of growing these forests can make an interesting middle or high school biology and chemistry activity. Students can also be encouraged to observe and document plant growth, the diversity of fauna and other life forms that the forest supports, as well as any changes in microclimate at different stages of forest growth.

Key takeaways

- Dense multi-layered forests of native species can be grown in a short period of time in small urban spaces and degraded land using the Miyawaki method.
- This method was developed by Akira Miyawaki, a Japanese botanist, who was inspired by remnants of natural forests preserved around temples and cemeteries in Japan.
- When grown in school campuses, such forests not only help create or restore vegetative cover but also support a range of student explorations of interactions between the flora, fauna, and abiotic components of a forest ecosystem.

Note: Source of the image used in the background of the article title: Miyawaki forest — 9 months after planting. Credits: BemanHerish, Wikimedia Commons. URL: https://commons.wikimedia.org/wiki/File:Miyawaki_forest_-_9_months_after_planting.jpg. License: CC-BY-SA.

Additional Resources:

1. To walk through a 15-month-old forest grown bottom-up the Miyawaki way, visit: https://youtu.be/I4tvAizYfGw.
2. For more information on the Miyawaki method, including several success stories of forests created through this method, visit: https://www.crowdforesting.org/.
3. For more specific things to consider before choosing this method: https://www.thehindu.com/sci-tech/energy-and-environment/they-grow-fast-and-easy-but-do-miyawaki-forests-meet-the-fundamental-principles-of-ecological-restoration/article65258901.ece.

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