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MIYAWAKI FORESTS

Dr.Rekha Mandowara

Professor, Department of Zoology, BBD GovernmentCollege, Chimanpura, Shahpura, India

ABSTRACT: Using the concept of potential natural vegetation, Miyawaki developed, tested, and refined a method of ecological engineering today known as the Miyawaki method to restore native forests from seeds of native trees on very degraded soils that were deforested and without humus.

KEYWORDS: Miyawaki,forests,vegetation,seeds,humus

I. INTRODUCTION

Miyawaki was primarily a botanist who specialized in plant ecology and seeds, who wrote a thesis on the subject in the Department of Biology at the University of Hiroshima. He conducted field research in various parts of Japan while working as a research assistant at the Yokohama National University, and continued his studies at the University of Tokyo.[9]

Reinhold Tüxen (1899–1980), who headed the Federal Institute for Vegetation Mapping, invited him to Germany. Miyawaki worked with him on potential natural vegetation from 1956 to 1958.

Miyawaki returned to Japan in 1960 and applied the methods of mapping potential natural vegetation. He found relicts of ancient forests still present in the vicinity of temples and shrines (surrounding sacred groves). He inventoried over 10,000 sites throughout Japan, and was able to identify potential flora affected by different types of human activity, including in mountainous areas, riverbanks, rural villages, and urban areas.[1,2,3,5]

From the data collected, he created maps of existing vegetation and maps of potential natural vegetation.[10] His maps are still used as a basis for scientific research and impact studies, and as a tool for land use, diagnosis and for mapping biological corridors. These maps of potential natural vegetation serve as a model to restore degraded habitats and native plant environments.[11]

From 1980 to 1990, in cooperation with laboratories of phytoecology and universities, Miyawaki led botanical and phytosociological inventories to map vegetation throughout Japan, compiled into a ten-volume, 6,000-page study.[7]

Miyawaki's first field trials showed that planted forests, which in composition and structure were closer to what would exist in the absence of human activity, grew quickly and generally showed good ecological resilience. He created a large seed bank (more than 10 million seeds have been identified and classified, according to their geographical origin and soil). The seeds are mostly from remnants of natural forests preserved for generations around temples and cemeteries because of the traditional belief in Chinju no Mori; it was considered unlucky to interfere with these forests. These places have allowed the preservation of thousands of small reserves of native species and tree genes descending from prehistoric forests.

Miyawaki used the principles of this tradition, and proposed a plan to restore native forests for environmental protection, water retention, and protection against natural hazards. His proposals were not initially met with positive feedback, but in the early 1970s, Nippon Steel Corporation, which wanted to plant forests on embankments around its steelworks at Oita, became interested in his work after the death of previous conventional plantations and entrusted him with a first operation.[12]

Miyawaki identified the potential natural vegetation of the area, and studied the forests surrounding two nearby tombs (Usa and Yusuhara). He chose various species of trees that he tested on the substrate to be afforested, and created a nursery where plants were mixed and then planted on the site. The steel corporation was satisfied with the results, and planted forests at its steel mills in Nagoya, Sakai, Kamaishi, Futtu, Hikari, Muroran, and Yawata.[1]

Since then, Miyawaki and his colleagues and partners have covered more than 1,300 sites with multilayered protective forests composed entirely of native species. The method has been tested successfully in almost all of Japan, sometimes on difficult substrates, including plantations to mitigate the effects of tsunamis on the coast, or typhoons in the port of Yokohama, wastelands, artificial islands, fixing crumbling slopes after road construction, and creating a forest on a cliff freshly cut with dynamite to construct the Monju Nuclear Power Plant in Fukui Prefecture.[1]

Miyawaki instructed people on planting in over 1,700 areas around the world, including over 1,400 sites in Japan as well as in Borneo, Amazonia, and China.[1] He was involved in the planting of over 40 million native trees, together

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with companies and citizens, to contribute to international forest regeneration. Since 1978, Miyawaki had contributed to vegetation surveys in Thailand, Indonesia, and Malaysia.[1]

His methodological work in the 1970s and 1980s on woodland management also formed the basis for the concept of "tiny forests", where small urban plots of land around the world can be densely planted with many different local species of trees to reintroduce varied wooded habitats that are rich in biodiversity.[13]

Italy

In 2000, the Miyawaki method was tested for the first time in a Mediterranean ecosystem in Sardinia, Italy, on an area where traditional reforestation methods had failed.[14] The original method was adapted while maintaining its theoretical principles. The results obtained after two and eleven years following planting were positive: plant biodiversity was high, and the new biocoenosis was able to improve without further operative support.[15] On the other hand, between 61% and 84% of the newly planted trees had died after a period of twelve years[7,8,9,10]

France

In 2018, the Miyawaki method was implemented by the boomforest.org team in Paris, France, to restore a 400-square meter area near Porte de Montreuil, in the Boulevard Périphérique, a controlled-access dual-carriageway ring road around the city.[17] In 2021, a 180-square meter area that used to be a parking lot in a residential district near Bordeaux's Saint-Jean railway station was converted into the city's first mini-forest.[18]

India

In 2013, the Miyawaki method was applied in the Barapani Industrial Area of Umiam in northeast India.[19]

Since that same date, the Anarghyaa Foundation has created Miyawaki forests in rural areas of North Bangalore. The Anarghyaa Foundation will be creating mini-forests by planting lakh trees with the Miywaki method across Karnataka within the next year {which year?}.[20][

In December 2019, the Annapradokshana Charitable Trust turned unused space in government schools into mini-forests by adopting the Miyawaki system at the Nonankuppam Government Higher Secondary School and the Vivekananda Government Boys Higher Secondary School in Villianur, Pondicherry.[21]

The Sikh NGO, EcoSikh, has planted over 400 forests it calls 'Guru Nanak Sacred Forests' consisting of native plant species, using the Miyawaki method.[22]

In June 2021, Xiaomi India partnered with United Way India (UWI) to create a remarkable mini-forest in Delhi NCR following the Miyawaki initiative to make a tangible difference in the Delhi NCR region, and promote ecological balance. Xiaomi's unwavering commitment is evident in this transformative initiative. Under the program 12,000 saplings of more than 60 different species will be planted.[23][24]

United Kingdom

In the United Kingdom, Miyawaki's "tiny forest" method was adopted by the environmental charity Earthwatch Europe with the aim to develop a hundred urban projects nationwide by 2021.[13]

United States

Cambridge, Massachusetts has two Miyawaki forests. The Cambridge Department of Public Works, in partnership with Biodiversity for a Livable Climate and Natural Urban Forests, planted the first one in Danehy Park in September 2021. It was the first of its kind in the northeastern United States.[25][26] Other American Miyawaki forests have been planted in Griffith Park in Los Angeles and on Yakama Indian Reservation in Washington state.[27]

Pakistan

In January 2021, Masood Lohar, a former UNDP officer, created the Clifton Urban Forest in Karachi, a private initiative operating over 200 acres on a coastline landfill site and following Miyawaki's techniques.[28] In November, Karachi municipality announced a plan for growing 300 Miyawaki forests[11,12,13,15]

In August 2021, Imran Khan, Prime Minister of Pakistan, inaugurated the largest urban Miyawaki forest project in the world at Saggian. Using a technique pioneered by the late Japanese botanist Akira Miyawaki, the forest covers 12.5 acres and has more than 165,000 plants.[30]

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II. DISCUSSION

The method's reconstitution of "indigenous forests by indigenous trees" produces rich, dense and efficient protective pioneer forests in 20 to 30 years, where natural succession would need 200 years in temperate Japan and 300 to 500 years in the tropics. Success requires compliance with the following phases:

- Rigorous initial site survey and research of potential natural vegetation
- Identification and collection of a large number of various native seeds, locally or nearby and in a comparable geo-climatic context
- Germination in a nursery (which requires additional maintenance for some species; for example, those that germinate only after passing through the digestive tract of a certain animal, need a particular symbiotic fungus, or a cold induced dorming phase)
- Preparation of the substrate if it is very degraded, such as the addition of organic matter or mulch, and, in areas with heavy or torrential rainfall, planting mounds for taproot species that require a well-drained soil surface. Hill slopes can be planted with more ubiquitous surface roots species, such as cedar, Japanese cypress, and pine.
- Plantations respecting biodiversity inspired by the model of the natural forest. A dense plantation of very young seedlings (but with an already mature root system: with symbiotic bacteria and fungi present) is recommended. Density aims at stirring competition between species and the onset of phytosociological relations close to what would happen in nature (three to five plants per square metre in the temperate zone, up to five or ten seedlings per square metre in Borneo).
- Plantations randomly distributed in space in the way plants are distributed in a clearing or at the edge of the natural forest, not in rows or staggered

According to the classical theory of succession initiated by Frederic Clements in the U.S., a young native forest with a multi-layered community would need 150 to 200 years to restore itself on bare soil in Japan, and it would take at least 300 years to do the same in the tropics of Southeast Asia.

Miyawaki extensively tested the method in deforested sites in dry tropical zones in Thailand, alluvial tropical forests in the Brazilian Amazon, and the old Nothofagus forest area in Concepción, Chile.[17,18,19,20]


The forest planted along the Great Wall of China

In 1998, Miyawaki piloted a reforestation program dominated by Quercus mongolica along the Great Wall of China, and gathered 4,000 people to plant 400,000 trees, with the support of the Aeon Environment Foundation and the city of Beijing. The first trees planted by groups of Chinese and Japanese, on areas where the forest had long since gone, grew over 3 m high in 2004 and – except for one part – continued to thrive in 2007.

Miyawaki also contributed to the massive reforestation in China by its government and Chinese citizens in Pudong, Qingdao, Ningbo, and Ma'anshan.

Miyawaki received the 2006 Blue Planet Award for environmental conservation.[3]

His method was deemed exemplary in a preparatory report[31] for the 1992 Earth Summit, and in 1994 in the biodiversity congress of the UNESCO in Paris. The method was also presented in 1991 at the Symposium of the University of Bonn, and at the congresses of the International Association for Ecology, the International Society for Vegetation Science, and the International Botanical Congress, which included new aspects such as the links between growth, natural habitat, and estimated carbon fixation.

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Criticism

Another criticism is the high cost of the first phase (nursery, soil preparation, dense planting). Some have lost most of their leaves in cyclones, but they resisted and helped protect the buildings where they were planted.[32][33]

Miyawaki forests have also been criticized for ignoring site-specific ecological niches and serving as a newer option for corporate greenwashing.[34]

III. RESULTS

"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."

SUGi follows these four stages when planting a Miyawaki forest:

1) Identifying Potential Natural Vegetation

When planting a Miyawaki forest, the first step is to identify the native vegetation best suited to the area being planted, termed Potential Natural Vegetation. To establish this, our forest makers do intensive research, often involving the indigenous community. They look to see what is growing locally, in protected areas or ancient old-growth forests.

Forests are multi-layered, and as the Miyawaki method mirrors nature, we identify and plant four layers of vegetation, building a resilient green wall of canopy trees, trees, sub-trees and shrubs. We select up to 40 different species to create balance and maximise density.[27,28,29,30]

2) Preparing the soil

The second step when planting a Miyawaki forest is soil preparation. Since SUGi focuses on rewilding nature-deprived areas, the soil is often degraded, compacted, waterlogged or bacteria-dominant. However, trees need fungi-dominant, soft and crumbly soil, so their roots can establish faster and have better access to nutrients.

Our forest makers work the soil once to restore the missing biology and put it on the path to becoming oxygenated, fertile and self-sustaining. Compost tea is also added to the earth as it's 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 the saplings

Once the soil is prepared, SUGi Pocket Forests are planted with the help of the community. We plant three to four saplings per square metre in a random manner that mirrors how natural forests grow. We choose to plant young saplings, as they're more adaptable and can form symbiotic relationships with mycorrhizal fungi in the soil far quicker than an older tree.

The denseness of a Miyawaki forest isn't just great for creating biodiversity; it also increases carbon capture, pollution filtration and produces an area more resilient to flooding and landslides. Increased canopy cover reduces the amount of rainfall that hits the ground, increases shade and promotes cooling. Not to mention the green-wall effect of the multi-layered trees, which acts as a shield if there's ever a storm surge.

4)Mulching the forest

Once you've planted the saplings, the final step is to apply a compost tea and mulch heavily using straw. The mulch 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 for it to be broken down by microbes.

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As mulching helps the soil retain moisture, you do not have to do as much watering. The more fertile the soil, the more water it holds. Miyawaki forests only need to be maintained for the first two-to-three years. After that, you can stop weeding and mulching and let the forest get on with it.

Where can you plant a Miyawaki forest?

Miyawaki forests do not require a huge amount of space; you can plant them almost anywhere in sites as small as three square meters. Even at this size, they fast become a habitat for countless species and offer multiple ecosystem services all at once. These pocket forests are perfect for the fast regeneration of urban areas, and SUGi's forest makers have transformed school playgrounds, city parks and urban rivers from grey to green.

We need the forest around us wherever we are, and instead of going out into the wilderness, the Miyawaki method brings the wild to you. SUGi Pocket Forests can be created at the front door of a community, and the social benefits of this to mental and physical health are as important as the ecological and environmental.

The Miyawaki method is community-based and people-centred and can be used to reclaim and reimagine public space for the benefit of people and the planet. For SUGi founder Elise Van Middelem, it's all about creating "pockets of hope."

Why do SUGi plant pocket forests using the Miyawaki method?

SUGi aims to restore ecosystems and build biodiversity. The Miyawaki method enables us to do precisely that, creating a flourishing forest habitat that provides a range of social, environmental and ecological benefits beyond just capturing carbon.

Miyawaki forests purify the air, manage water, regulate the climate, create oxygen, build soil and biodiversity, and provide food, medicine, shelter and joy to all those connected to it.

IV. CONCLUSION

Urban Forests uses the Miyawaki method to create urban forests. Miyawaki urban forests are fascinating complex ecosystems, in balance with today's soil and climate conditions.

This technique works worldwide irrespective of soil and climatic conditions. Over 2000 forests were successfully created using this method. Doctor Akira Miyawaki, botanist and professor, is the inventor of the technic since 1980. He is a recipient of the 2006 Blue Planet Prize, which is the equivalent of a Nobel Prize in ecology.[31,32,33,35]

The Miyawaki method in 5 key figures

Using the methodology, we create native urban forest ecosystems much quicker. The method takes its inspiration directly from processes and diversity in nature: 15 to 30 different species of trees and shrubs are planted together. This plant community works very well together, and is perfectly adapted to local weather conditions.

The habitat thus created will get more complex over time and attract much biodiversity.Vegetation becomes much denser than conventional plantations, and it has the structure of a mature natural forest. It is a multi-storey structure, where different levels of vegetation appear. The forest thus structured delivers many benefits in the form of ecosystem services.It would take about 200 years to let a forest recover on its own. With the Miyawaki method a similar result is achieved in 20 years.[35]

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