

MIYAWAKI FOREST IN WEST BENGAL

Handbook



1. About Miyawaki Forest

The Miyawaki afforestation method is a unique way to create an urban forest and was pioneered by Japanese botanist Akira Miyawaki. With this method of plantation, an urban forest can grow within a short span of 20-30 years while a conventional forest takes around 200-300 years to grow naturally. In the Miyawaki technique, various native species of plants are planted close to each other so that the greens receive sunlight only from the top and grow upwards rather than sideways. As a result, the plantation becomes approximately 30 times denser, grows 10 times faster and becomes maintenance-free after a span of 3 years.



Watch a short video to know more -

<https://www.youtube.com/watch?v=I5jtg2q1gnU>



Planting density

2 to 7 trees per m²



Green surface area

30 times more than a meadow



Survival rate (Natural Selection)

2 to 7 trees per m²



Growth rate

1.5 m/year [rainforest], 1 m/year [temperate forest], 0.3 m/year [Mediterranean forest]



Growth stabilization:

from 15-20 years [temperate zone], 30-40 years [tropical zone]



Final average size:

20 m [upper layer], 4m [lower layer] Density after stabilization: 0.5 to 2.5 trees per m² Biodiversity (fauna): 18 times more (mean of different species)

1.1 CASE STUDIES

1979 - 40 cm



20 YEARS

1999-15m



Hirohata Works, Nippon Steel Corp, Hyogo Prefecture, Japan

1980 - Ø



10 YEARS

1910 - 10m



Nara prefecture, Kashihara highway, Japan

1982 - 30 cm



16 YEARS

1998-15m



Eidai, Brazil

1992 - 40 cm



10 YEARS

1999-10m



2. Basic Steps to create an urban forest

A. Soil Survey



B. Native Species and Biomass Survey



C. Sapling Preparation/ Procurement



D. Prepare Soil And Mound



E. Plantation With Community



F. Maintenance And growth monitoring





2.1 Site Selection

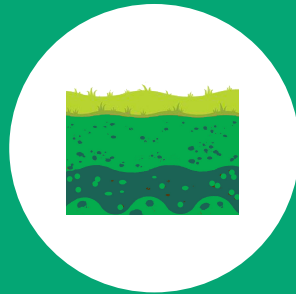
Ideally the selected site should have minimum immensions of 4 by 3 metres and receive sunlight for at least 8 hours a day.



2.2 Soil Preparation

Determine the soil texture and quantify biomass on following parameters

- Physical texture
- Organic Carbon
- Nitrogen
- Soil pH
- Visible evidence of micro or macro fauna in the soil



2.2.1 Soil Texture

helps determine water holding capacity, water infiltration, root perforation capacity, nutrient retention and erodibility. Check if the texture is sandy, loamy or clayey.

2.2.2 What to add to the soil



Water retainer such as coco-peat or dry sugarcane stalk.



Mulch including rice straw, wheat straw, corn stalk or barley stalk.



Perforator such as grain husk, rice husk, wheat husk, corn husk (chipped) or groundnut shells (chipped).



Organic fertilisers such as cow manure, goat manure or vermicompost



Liquid Soil Microbiology enhancer such as Jeevamrit.



Solid Soil microbiology enhance such as Ghanjeevamrit.

2.3 Select tree species for plantation

We should try to plant as many species as possible for biodiversity.



Make a database of all native species of your area. Identify its type (Evergreen, Deciduous or Perennial), advantages, maximum height and assign layer.



Check the native species saplings availability in the nursery, their age and sapling height. Ideal height is 60 to 80 centimeters. Refer to annex 1 for details on native trees in Kolkata.



Major species: Choose five different species to be the major forest species; these should be the species that you commonly find in your area. This will constitute 40-50 percent of number of trees in the forest.



Supporting species – other common species of the area will constitute 25-40 percent, and minor native species will make up the rest.

Layer : Canopy ↑ 40 Mtrs

Teak

Botanical Name : **Tectona Grandis**
Local Name : **Sagavani**
Type : **Deciduous**
Advantage : **Timber**

Layer : Tree ↑ 25 Mtrs

Neem

Botanical Name : **Azadirachta Indica**
Local Name : **Turakevu**
Type : **Evergreen**
Advantage : **Medicinal**

Layer : Sub Tree ↑ 8 Mtrs

Pomegranate

Botanical Name : **Punica Granaturn**
Local Name : **Daalimbe**
Type : **Perennial**
Advantage : **Fruit**

Layer : Shrub ↑ 3 Mtrs

Jasmine

Botanical Name : **Jasmine sambac**
Local Name : **Dundu Mallige**
Type : **Evergreen**
Advantage : **Flower**

Select plants that grow up to different levels.

Credit: Afforestt

2.4 Design the Forest

Preparing the area



Site inspection:

Visit the site to determine the feasibility and scope of the project. Take pictures of the site, and confirm the availability of fencing, maintenance staff, running water and sunlight. The site should get sunlight for a minimum of 8-9 hours a day. No pipes/drains/wires or debris should be present in the area.



Removing debris and weeds:

Weeds should be cleaned either manually, or using a JCB/John Deere Tractor if the area is huge. Ensure that the pulled out weeds are disposed away from the site.



Watering facility installation:

There should be a main line with watering outlets for hoses, which can reach the entire area of the forest. Watering should be done everyday manually using a hosepipe with a shower, and not by drip irrigation, sprinklers etc. The requirement is around 5 litres/sq metre per day, depending on the rainfall in the region.



Physical demarcation of areas:

The areas should be marked (with limestone powder or wooden peg/rope) before earthwork starts. Ensure that the marking of areas matches 100 percent with the master plan.



Making approach roads to marked areas:

Clear weed growth, big stones and boulders. The path could be of any material (soil, sand, gravel, tar etc.), but trucks/tractors should be able to use it.



Mound identification:

The forests are usually created on 100 sq metre mounds, and each of these need a serial number in the order in which they will be created. Only after one mound is created and plantation completed on it, can the next mound be created.



2.5 Plant the trees!



1 Mixing materials:

Perforator, water retainer and fertiliser, all without clumps, should be mixed together. They should be mixed in the exact ratio as was decided initially, for each mound.



2 Preparing the ground for plantation:

Each forest is created on a 100 sqm mound. Using an earthmover machine, first dig the earth to a depth of 1 metre on the 100 sqm land. Put half the earth back into the pit and spread it uniformly. This is to make the soil loose. Mix with the soil half the biomass prepared in the previous step. Then put the remaining soil back into the pit and spread it uniformly. Now mix the remaining biomass with this soil evenly. Afterwards, shape the soil into a mound. In the Miyawaki method, all saplings will be planted together on a mound, unlike conventional plantations where individual pits are dug up for each sapling.



3 Selecting trees for plantation:

Place plants on the mound to create a multi-layered, natural forest. Try to group plants that grow into different layers – shrub, sub tree, tree and canopy – in each sqm. Try not to place two trees of the same kind next to each other; also, don't follow a pattern while planting the trees. Try to maintain a distance of 60 cm between saplings. The goal is to have random, dense plantation of native tree species.



4 Plantation:

To plant the tree, dig a small pit on the mound with a trowel, remove the root bag in which the plant was growing, and gently place the plant in the pit. Level the soil outside gently around the stem of the plant, but do not press or compact the soil. There should not be more than 8-10 people on a mound at a time, since the idea is to plant on loose, aerated soil.



5 Support the plants with sticks:

Saplings need support during the initial months so that they don't droop or bend. Insert support sticks into the soil close to the plant, without damaging the roots of the plant. For plants shorter than 1 metre, use 1 metre-long bamboo sticks. For taller plants, use slightly thicker 2-2.5 metre-long bamboo sticks. Tie the sticks to the plant stems using thin jute strings. Support sticks will be needed for at least every alternate plant.



6 Mulching:

Mulch should be evenly laid out on the soil, in a 5-7 inch layer. To ensure that the mulch stays on the ground and does not fly around, it should be tied down with jute ropes. For this, bamboo pegs should be nailed at the periphery of the forest. Tie the pegs to each other with rope, pressing down on the mulch. There should be 30 pegs, each around 2 ft long, around every 100 sqm mound.



7 First watering:

The first time, the forest should be watered for an hour. Minimum water requirement is 5 litres per sqm, or 500 litres per 100 sqm mound.



2.6 Look after the forest for three years

MONITORING

The forest should be monitored once in 1-2 months, to check if the targets have been achieved and if any changes should be made to improve results. This should be done the first 8-12 months. Count the number of saplings that have survived, and record the data. Growth of selected species should also be monitored.

MAINTENANCE

- Water the forest with hose pipe once a day, depending on the rainfall in the area.
- Keep the forest weed-free for the first 2-3 years. Once the forest starts growing, weed growth will stop.
- Ensure that the plants stay straight, are not buried under the mulch, and are only loosely tied to the support stick.
- Keep the forest clean, and free of plastic, paper etc.
- Maintain proper drainage system so that water does not get accumulated anywhere in the forest. Do not build bunds in the forest, as accumulated water can kill plant roots.
- Mortality rate of plants is usually 2-5 percent. Mortality is to be checked only after 3-4 months of planting.
- Do not use any chemicals like pesticides or inorganic fertilisers. If you notice pests, leave them undisturbed. The forest will slowly build its own mechanism to keep itself healthy.
- Mulching should be maintained for at least one year. The soil should be re-mulched with time, since dry soil is detrimental to forest health. Also, never remove organic matter like fallen leaves from the forest floor, as it will kill good soil microbes.
- As the tree grows taller, longer support sticks may be needed so that the tree shoot does not bend and become weak.
- Never cut or prune the forest as it could make the forest weaker.

3. What are the benefits ?

Trees in a Miyawaki forest grow up to ten times faster at around a metre per year, reaching a stable multi-layered forest community in **20 to 30 years instead of hundreds of years**

The growing **trees absorb more carbon in a Miyawaki forest** than in a plantation or in standard afforestation projects because they grow more quickly and there are thirty times as many

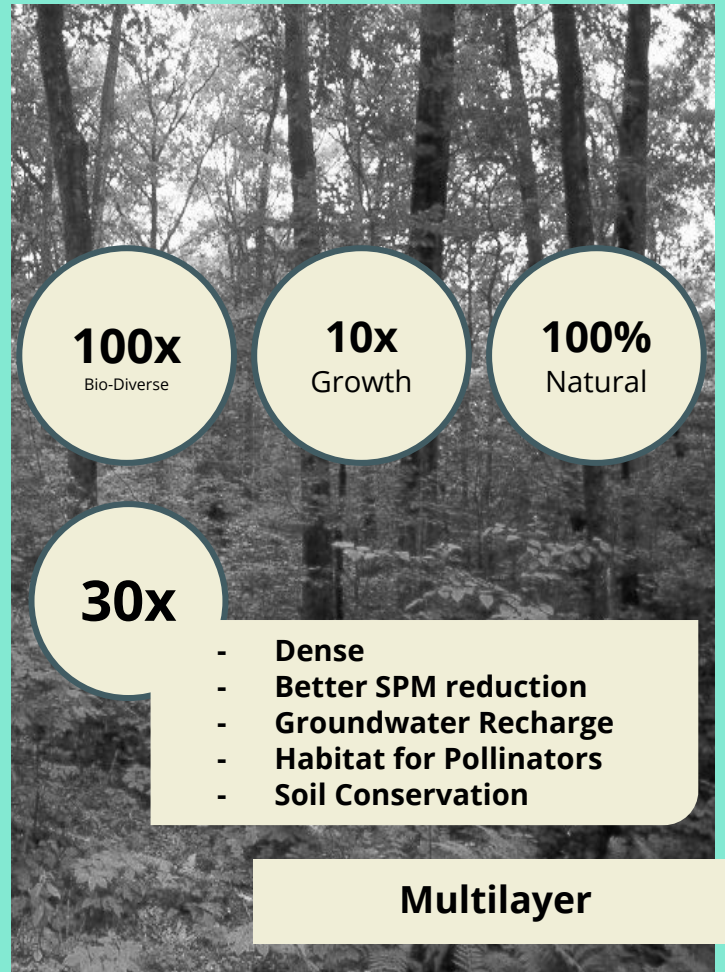
The Miyawaki method has **been successful where other planting projects have** failed, such as in arid Mediterranean habitats, due to high survival rates

Native trees thrive in the conditions to which they are adapted and are **more resilient to environmental changes**

Miyawaki forests have been found to have **far higher biodiversity** than neighbouring woodland, on average 18 times higher



Monoculture



100x
Bio-Diverse

10x
Growth

100%
Natural

30x

- Dense
- Better SPM reduction
- Groundwater Recharge
- Habitat for Pollinators
- Soil Conservation

Multilayer

4. APPLICATIONS OF THE MIYAWAKI METHOD

The Miyawaki Method has been used successfully around the world in over 3000 projects and the numbers are now also rising in Europe. The ability to create a dense native forest quickly has made the technique useful for **creating urban micro forests**, for **restoring rainforest** and Japanese evergreen broadleaf forests and for **planting in arid Mediterranean habitat** where other forestry techniques have not been successful. Miyawaki forests have also proven effective when used for a specific purpose, such as **providing tsunami protection, stabilising mine dump slopes**, as typhoon protection and for carbon sequestration. There has been particular focus on planting Miyawaki forests in urban environments as there are significant benefits to tree planting in towns and cities, and this method maximises the space available. Urban forests **reduce local temperatures (-1.3°C in one study), improve air quality by reducing pollutants, sequester carbon**, and **improve the wellbeing of residents**, as well as creating a natural oasis for invertebrates and birds. There remains, however, much scope for research on the Miyawaki method. In particular the carbon sequestration rates could be significantly higher than on forest plantations because of the density both at planting and at the final forest stage.

5. Nursery



Tall Tree Nursery

098744 22398

Adjacent to Tank No. 9, Street Number 326,
Action Area I, Newtown, Kolkata, West
Bengal 700156

AnandaMayee Nursery

089818 41609

Lake Mall ,5th gate, Parasar Rd, Lake Market,
Kalighat, Kolkata, West Bengal 700029

Behala Sukumar Nursery

098744 22398

Auddy Bagan Basti, Behala, Kolkata, West
Bengal 700034

Basanti Nursery

098305 73130

3, Beliaghata Main Road, Hawkers Corner,
Beliaghata, BB Ganguly Street, Sealdah,
Belegkata, Kolkata, West Bengal 700014

Maa Nursery

098314 62358

CD-27, Salt Lake Bypass, CD Block, Sector 1,
Bidhannagar, Kolkata, West Bengal 700064

BHARAT AGRO PRODUCTS

9830111201

64, HARISH CHATTERJEE STREET, KOLKATA,
700025,

Orchid Nursery

9830344376

Vill. & P.O.- Muchisha, South 24
pargana, pin- 743377, W.B

Rahanok Nursery

8961293715, 6290648702

Vill. & P.O.- Muchisha, South 24
pargana, pin- 743377, W.B

Mamata nursery

98832500834

Vill. & P.O.- Muchisha, South 24
pargana, pin- 743377, W.B

R.H.ML Nursery

9674395005, 8777511898

Vill. & P.O.- Muchisha, South 24
pargana, pin- 743377, W.B

Kajal Majhi

8013994344

Vill. & P.O.- Muchisha, South 24
pargana, pin- 743377, W.B

Native Trees of Kolkata

Aswattha, Peepal

Bandar-lathi, Amaltas

Karanja

Shimul

Palash

Chatim, Saptaparni

Debdaru, False Ashok

Rozia

Kathbadam

Banyan

Neem

Shishu

Jarul, Pride of India

Ashok

Segun / Teak

Kanthal, Jackfruit

Amloki, Amla, Indian Gooseberry

Aam, Mango

Haritaki / Black Myrobalan

Rakta-chandan, Red Bead Tree

Chalta

Koth Bael

Piasal

Sada Kanchan

Pakur

Kadam

Bael, wood apple

Bahera

Rangan, Ixora

Jangli Badam

Patransiva

Jog dumur

Kanak chapa

Karabi

Sada kanchan

Lal Kanchan

Lal kadam

Coconut

Kul

Gab

Khejur

Kamini

Akunda

Sheth lojjaboti

Sheth makal

Sheth chandan

Lal chandan

Shiuli

Jaba

Gandharaj

Falsa

Sajne

Furush

Paras Peepul,

Arjun

Bakul

FAQ

1 What is the minimum parcel of land needed or desirable and what is the cost involved for the same ?

A minimum of 1,000 sq ft is required to set up a dense Miyawaki forest where 250 saplings can be planted. However, it is also possible to create forests in an area as small as 100 sq ft, but that would be much less dense. Thus, Miyawaki forests can also be created in one's backyard or a private space. The creation and maintenance cost per tree for two years would roughly be around Rs 300. The cost also varies from one locality to another, depending on the plant species and soil type.

2 What is to be expected after a time frame of 15-20 years ?

Trees in a Miyawaki forest grow up to ten times faster at around a metre per year, reaching a stable multi-layered forest community in 20 to 30 years instead of hundreds of years

3 How do Trees in Miyawaki Forests Resist Heavy Winds ?

High density planting, one of the key principles of the Miyawaki Model of Afforestation, is the secret behind such a phenomenon. The trees in Miyawaki Forests Resist Heavy Winds because they stand bunched together.

4 How to Protect Local Variety Mango Trees using Miyawaki Method ?

The advantages of using the budding technique to propagate indigenous species of the mango tree, and planting them in Miyawaki forests. Both factors will hasten the growth of the tree and it will bear fruit faster. The other advantage is that by adopting these measures, we will contribute to enhancing the biodiversity of our area.

FAQ

5

Can we use Grafted Tree Saplings in Miyawaki Forest ?

Yes, we can use Grafted Tree Saplings in Miyawaki Forest because grafted plants grow to maturity and put out fruits in a shorter period of time. But special precaution should be taken to ensure the root stock is a healthy one.

6

Rate of growth of plants.

On average, trees grow at a pace of 20 cm/year over the five first years. Whereas Miyawaki tropical forests grow at a pace of 110 cm/year.

7

Miyawaki Method of Afforestation is scientific or not ?

The allegation that the Miyawaki Model of Afforestation is unscientific. No one has been able to prove the truth of this criticism. The model does not work against Nature either. In these times when the effects of rampant deforestation have begun to afflict us, this tried-and-tested method should be implemented wherever possible. Its promotion of indigenous species, the guaranteed fast growth, and the ecosystem it soon creates are factors that work in its favour.

8

What are the Low cost methods for Miyawaki Forest ?

It requires an investment of nearly Rs 395/- per one square metre to prepare a seedbed. This is because the potting mixture contains soil, rice husk, coir pith and dry cow dung in equal quantities to ensure that the saplings get enough nutrients, the soil retains water and does not solidify. The amount also covers the cost of the saplings, the expenses incurred in tending them in grow bags that contain similar potting mixture, transportation expenses, and so on.

FAQ

9

Will Miyawaki Forests attract snakes



The possibility is very slim but we can avoid confrontation by adopting a few precautions, like hitting the ground with a stick as we walk through the forest so that the vibrations will send any snake away, fencing in the forest, keeping the outer skirting litter-free, securing our house with wire-mesh, and so on.

10

Is Miyawaki model afforestation too costly



If we work out a cost-benefit analysis, we will find that the advantages will far outweigh the initial investment. In order to get a mature forest in 15-30 years, we have to prepare the best seedbed, nurture the indigenous saplings, do regular irrigation and pruning. This is equivalent to laying a good foundation for a skyscraper, and therefore the right method.

11

How to Source Saplings at Cheap Rates



The major source is the Forest Department. Besides this we can go to local private nurseries. Another source is our own plot which, after a spell of rain, will host a great number of plants. Seeds, dropped by birds and small creatures, or good saplings that we may find lying on the roadside can also be collected. In the process, we may end up discovering plants that belong to rare species.

12

Planting grass is allowed or not



Grasses come at a much earlier stage of ecological succession. The final stage i.e. The Climax Stage is what the Miyawaki method tries to replicate. Grasses are absent in this stage. If we put grasses along with trees, then the trees will suffer in the long run. Bamboo too is a grass and cannot be planted. Nevertheless, grasslands are important and should be created separate from forests.

FAQ

13 Is cutting and pruning good for Miyawaki forest ?

NEVER cut or prune even a single stem in the forest. Natural forests are never pruned. If any cutting or pruning is done, the forest will become weaker. Dr. 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."

14 Should we clean the forest floor ?

NEVER remove the mulch or the forest's organic matter (leaves, flowers, twigs, seeds, wood, stems) from the forest floor. If organic matter is removed and the soil is exposed, it will kill good soil microbiology and degrade the forest.

15 Why are you promoting Miyawaki, when we are also promoting natural forest ?

We are not replacing natural forests. Miyawaki forests are growing dense plantations in a short time in dense spaces and increasing green cover and biodiversity.

16 Will the native plants or japanese forms of cultivation work in India ?

Yes, the native plants or japanese forms of cultivation work in India. The growth of Miyawaki forests in many patches across India has helped increase in the green cover and generated a lot of optimism as it helps create amazing biodiversity through the Native trees planted.

17 Are we not going to be able to enjoy nature ?

We will definitely enjoy nature. Miyawaki forests is trying to help create Micro bio-diversity & restoring the ecosystem of the Land & surroundings as fast as possible. The Native multi species forest & its trees start bearing fruits, attracting subsoil creatures to come up for eating the dead leaves & fruits, which in turn attracts birds. Flowers & leaves attract butterflies and bees.

References

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