



**TECHNICAL MANUAL
ON**

**MIYAWAKI METHOD FOR AFFORESTATION
OF
DEGRADED LAND**

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MIYAWAKI METHOD

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MIYAWAKI AFFORESTATION METHOD

INTRODUCTION: Miyawaki method is an afforestation technique that uses native species to create dense, multilayered forest. It is also called Dense Planting of potted seedling method. In this type of technique, various native species of plants are planted close to each other so that the foliage receives sunlight only from the top and grow upwards than sideways

Environmental benefits:

- Reduction of pressure on natural forests
- Efficient recycling of nutrients by deep rooted trees on the site
- Better protection of ecological systems
- Improvement of microclimate, such as lowering of soil surface temperature and reduction of evaporation of soil moisture through a combination of mulching and shading.

METHODOLOGY:

Under this technique, dozens of native species are planted and raised according to the agro climatic condition. A sample of native species planted in dozen are shown in fig.1.

Sample Database					Sample Plant Order List					
Sl. No.	Botanical Name	Common Name in Local Language	Common English Name	Type	Advantage		Ht. (Mtrs)	Layer	Availability	%
					1	2				
Ex 1	Azadirachta indica	Turakevu	Neem	Evergreen	Medicinal		25	Tree	Yes	8
Ex 2	Tectonia grandis	Sagavani	Teak	Deciduous	Timber		40	Canopy	Yes	3
Ex 4	Punica granatum	Daalimbe	Pomegranate	Perennial	Fruit	Birds	8	Sub Tree	Yes	2
Ex 5	Jasmine sambac	Dundu-Mailige	Jasmin	Evergreen	Flower		3	Shrub	Yes	2

Fig: 1.

Keywords:

- The plantation becomes approximately 30 times denser, grows 10 times faster and becomes maintenance-free after a span of 3 years.
- The first is of shrubs that grow upto 6 feet, the second layer is of trees that grow upto 25 feet, the third of trees that grow upto 40 feet and the final layer is the canopy that grows above 40 feet.
- The minimum size of the forest should be 4 and 3 meters in width and the plantation site should receive sunlight for at least 8 hours per day.
- 3-5 saplings per square meter should be planted.
- It has to be noted that the same species should not be planted next to each other.

- Before creating a forest, surveying of sites has to be conducted so as to monitor the indigenous species present in the area and to classify them according to their categories as mentioned.

This technique involves the different models of eco-restoration based on the site selected for Miyawaki method. Brief descriptions on the basis of Model eco-restoration are as follows:

Basic steps for creating forest by Miyawaki method include 6 processes.

- i) Soil preparation:** Loamy soils are preferable for planting, as it contains a mixture of sand, clay, silt, and organic matter. They also provide the right balance of oxygen, water, nutrients, and drainage for the forest to blossom.

The method of soil preparation is as follows:

1. The plantation area should be outlined with pegs/markings.
2. The soil should be ploughed for about 1-2 feet.
3. The plantation sites should be worked to ensure smooth and quick perforation of water to the roots by using biomass that is both spongy and dry like rice or wheat husk or groundnut shells.
4. Water and moisture retainer should be added, like coco peat or straw.
5. To protect the soil and prevent sunlight from directly hitting the plants, mulch the soil with organic and bio-degradable ingredients, like agro-waste.
6. Manure should be added to the soil in order to increase and provide nutrients to microbes and to ensure that they are mixed in the same ratios for each mound.
7. After completing the above method the mixed soil is refilled and it has to be noted that the land is not compressed or walked upon so as to leave the soil aerated and loose.

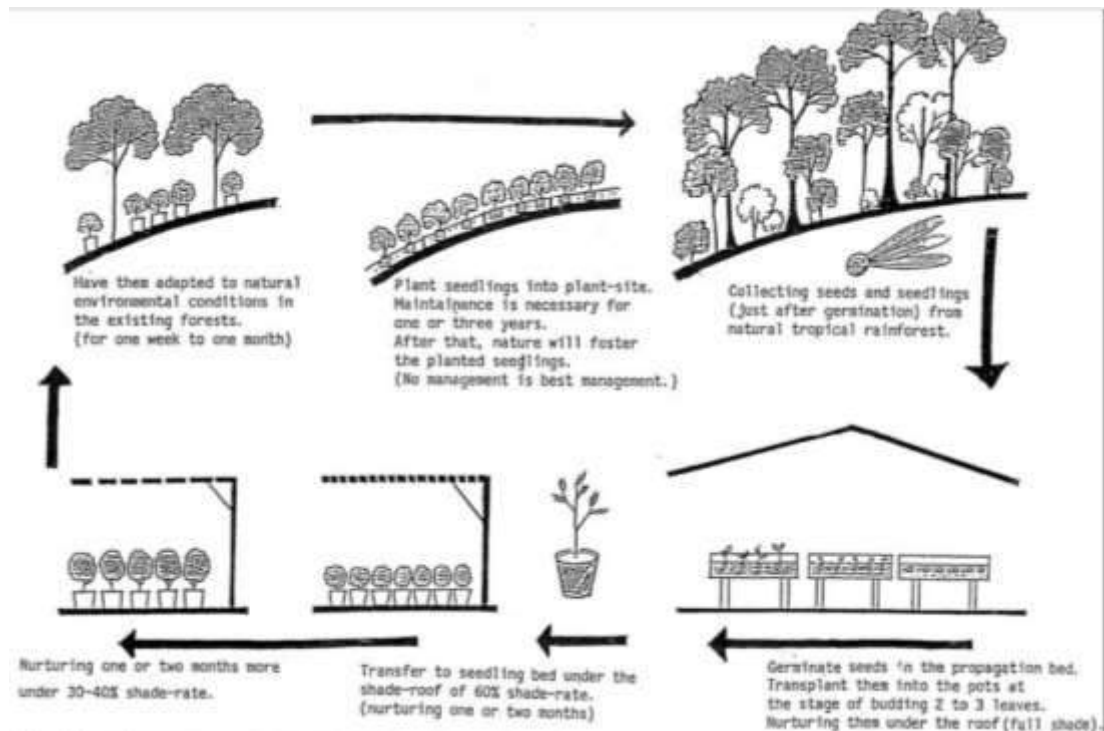
- ii) Species Selection:**

Miyawaki method includes growing of indigenous species that are adaptable to the area according to the agro-climatic condition. Native species can be classified into four layers. The first is of shrubs that grow up to 6 feet, the second layer is of trees that grow up to 25 feet, the third of trees that grow up to 40 feet and the final layer is the canopy that grows above 40 feet. It has to be noted that the same species should not be planted next to each other. Surveying of sites has to be conducted so as to monitor the indigenous species present in the area and to classify them according to their categories as mentioned.



iii) Seed collection: After selecting and marking good mother trees, several seed collection methods can be used.

- *Collection from natural falls:* Collection from natural seed fall is suitable for trees with large fruits, pods, and seeds by using rake, sieve, seed container and cloth.
- *Shaking the trees:* If natural seed fall is spread over a long period of time, manual shaking of the tree is a useful method to get seeds to fall to the ground at the same time.



- *Species:* Potential natural vegetation is good as it is a most stabilized vegetation society, the final figure of vegetation succession (No other groups can replace it) and strong enough against disaster, disease, insects.

- *Seedling*: Not mature trees but young seedlings.

The method of making pot seedling are describe in the following images:



Image 1: Soaking in water



Image 2: Sowing in shallow boxes



Image 3: Growing in nursery.

Through Miyawaki method we can re-create forest density on wasteland and barren land. The rehabilitation method on different surface area as described below.

A: MODEL 1: REHABILITATION ON ROCKY SURFACE.

Species grown on this type of surface usually acts as ground anchorage securing the land from erosion and holds the soil together. In nature, trees grow in rocks by seeking out any nutrients they can get. Tree roots will find a hidden water source to keep themselves alive.

A(1): SITE SELECTION: Selection of sites depends on major judgments and careful study, especially if practiced on a rocky surface. The factors influencing the selection of sites are:

- Species to be raised
- Soil water supply
- Slope, aspect and environment

A (2): SELECTED SPECIES: Trees with non-invasive roots are usually preferred for cultivating in these areas. Tree species like *Pandanus sp.*, *Palm sp.*, Pine species, herbs like ferns, *Begonia* and shrubs like *Agapetes*, *Vaccinium*, etc.

A (3): DESIGN FOR SITE PLANTATION:

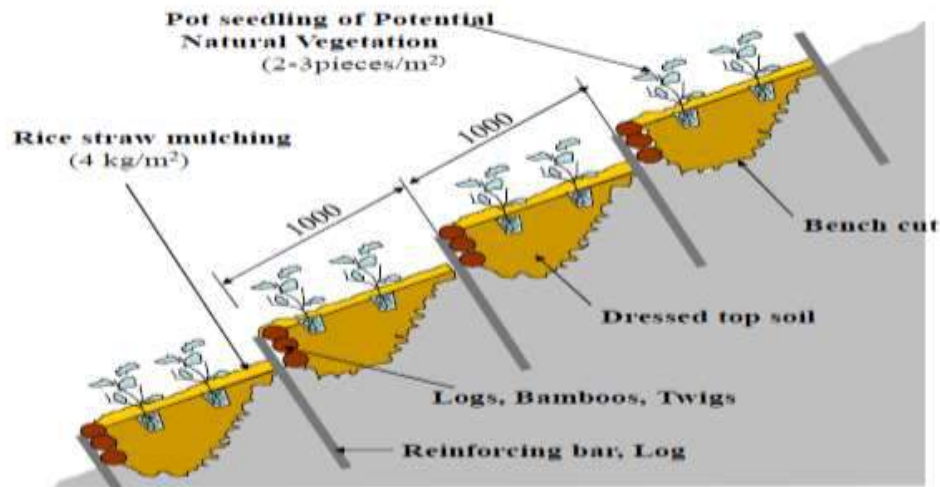
Rocky soil is not great at holding water or nutrients, which will leave your plant deprived of these essentials. Even worse, the more rocks there are, and the harder it will be for plant roots to establish. But, with the right tools and materials, we can transform a bed of rocky soil to a suitable planting site.



A (4) PREPARATION OF PLANTING AREA:

1. Before planting, clearing of land and removing of rubbish is required.
2. Drilling is carried out before placing the MS bars of 20mm in diameter upto a depth of 30 cm.
3. We need to place the bars in a position and filling the gap with cement mortar.
4. Arrangement of wooden log as shown in figure is required
5. After this preparation, back filling is carried out for planting.

On the slope



A(5): PLANTING TECHNIQUES:

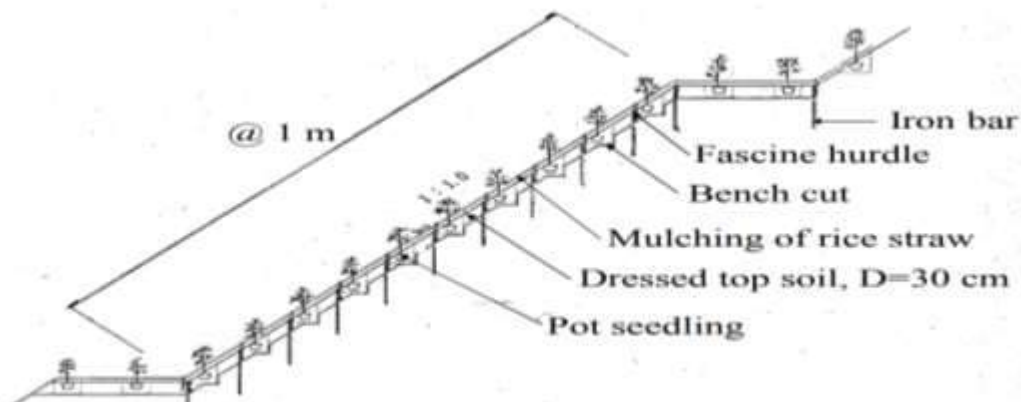
TO PLANT GRASSES IN ROCKY SOIL:

In order to be able to grow grasses on a rocky soil we will need to follow the following procedure.

1. We will need to select a small area and to dig down 4 to 6 inches into the soil. The soil condition should be moist and not too dry.
2. We should rake the soil for an even grade before we add the grass seed.

TO PLANT TREES ON ROCKY SOIL:

1. The soil condition should be moist and not too dry.
2. The pit for sowing trees should be at least 2-3 times as wide as the tree's diameter, allowing for the top 1"-2" of root ball to rest above grade.
3. Once the tree is placed in the hole, we need to fill the gap with a mixture of one half compost and one half original soils.



B: MODEL 2: REHABILITATION ON SLOPE SURFACE/NARROW TERRACES

B(1): SITE SELECTION:The selection of site is an important factor as it helps in accessibility, to determine the cost, climatic condition and soil type for growing any species. The area for practicing Miyawaki method can be of a mini forest type or it can be of any specific area as per the requirements. The figure of the place must be or near a square.

B(2): SELECTED SPECIES:Species that are indigenous to the site are considered to be more preferable for practicing Miyawaki method. It has to be noted that the species selected for growing should be fire retardation, evergreen broad leaved trees with thick leaves as they are considered safe and can protect the herbs and shrubs from direct penetration of sunlight. Species with leaves containing oil and bamboo species are not safe for growing as they can easily get burnt.

B(3): DESIGN FOR SITE PLANTATION:



B(4): PREPARATION OF PLANTING AREA:

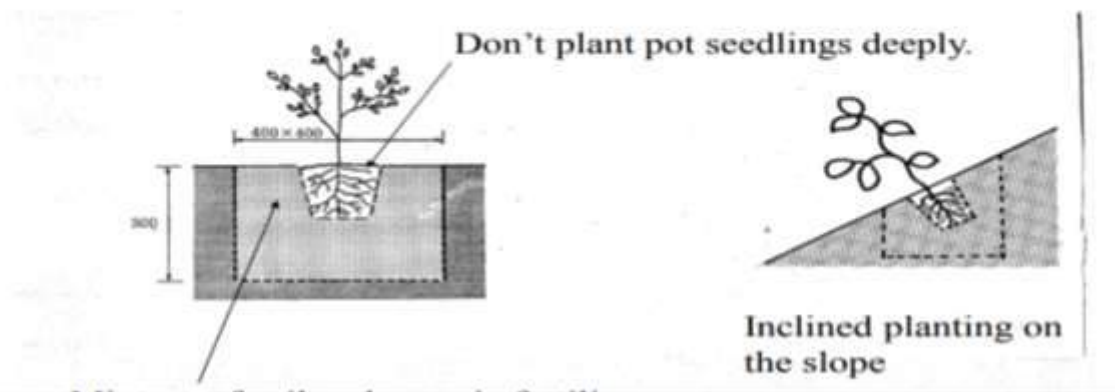
1. Before planting, clearing of land and removing of rubbish is required.
2. We need to place the bamboo in a position so as to help in anchoring the soil from being eroded.

B(5): PLANTING TECHNIQUE:

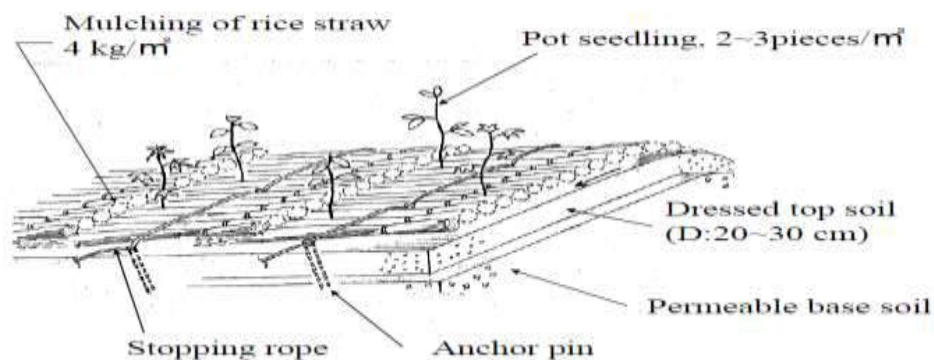
1. Saplings can be planted at a depth of one meter pit and we will need to outline the planting area with chalk powder or align with rope.
2. Plant 2-3 saplings per square meter.
3. Saplings should be planted at a distance of 60 centimeters between the saplings.
4. The soil should be level around the stem of the plant.
5. To ensure that plants do not bend during the initial period, we need to insert stick to the soil and tie the plant to it.

6. During the initial stage, cultivate the saplings under net designed to cut out 40% of the sunlight.
7. 5-7 inch layer of mulch should be added to the soil. We need to consider at least half a kilo of mulch per tree. The rice straw used for mulching should be tied with jute ropes and to ensure that the mulch does not fly around during strong winds. The jute rope should be tied to a bamboo pegs that are nailed at the forest periphery. This will ensure that the rope is pressed down on the mulch.
8. The method for planting species are shown below:

Planting method of pot seedlings



Completed figure of planting



Mulching can be done with paddy straw and dried grasses. This helps in maintaining the humidity of the surface soil, prevent erosion, improve soil fertility and increase the microbial activities in the soil.



B(5): MAINTENANCE:

1. In order to achieve good results, proper management has to be maintained precisely and continue for the first- three years. 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 during the first 8-12 months. After that, nature will foster the planted species.
2. For the first time, the trees must be watered daily to ensure the mulching and the soils settled on the soil.
3. A proper drainage system should be maintained so that water does not get accumulated anywhere in the forest.
4. Mortality rate of plants is usually 2-5 percent. Mortality is to be checked only after 3-4 months of planting.
5. 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. Leaf litter should not be removed from the forest floor as it will kill good soil microbes.
6. As the tree grows taller, longer support sticks may be needed so that the tree shoot does not bend and become weak.
7. We should not cut or prune the forest as it could make the forest weaker.

C: MODEL 3: REHABILITATION ON FLAT SURFACE AREA/HARD SOIL SURFACE.

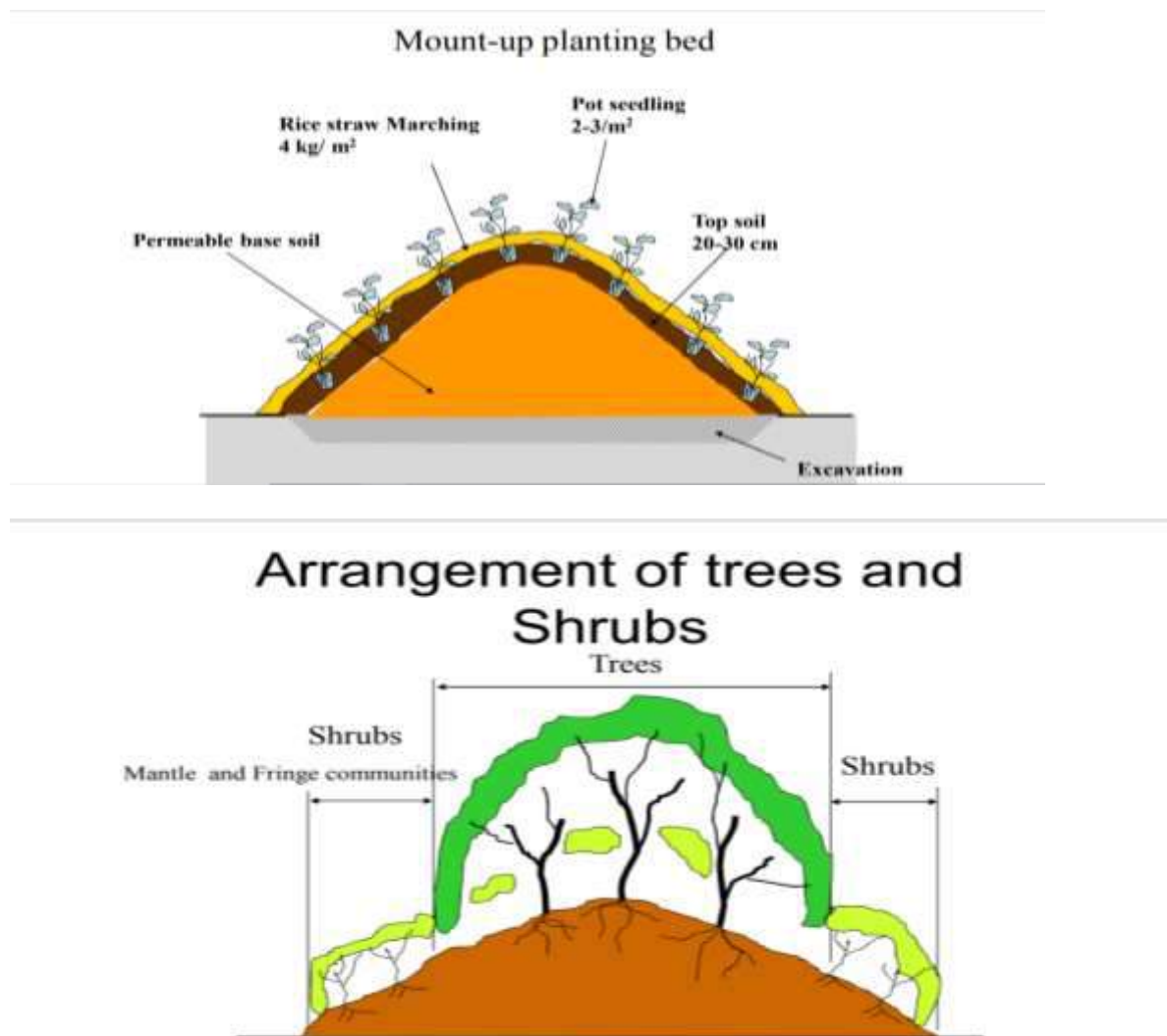
C(1): SITE SELECTION:The selection of site for this method is mostly on a hard soil surface. This helps in re-creating forest on wasteland and barren land.

C(2): SELECTED SPECIES:Potential natural vegetation. Species like Impatiens, Lantana, *Quercus sp.*, *Salix sp.* etc.

C(3): DESIGN FOR SITE PLANTATION:

The practice of Miyawaki method on flat ground (on the rich rainfall land) depends on the following

Method:



C(4): PREPARATION OF PLANTING AREA:

1. Before planting, we will need to dig a pit of one meter and fill it with debris mixed with soil.

2. After filling the gap, we will need to make a mound, filled with top soil of 20-30cm, organic materials; decomposer (like earthworm, soil micro organism) should also be added.

C(5): PLANTING TECHNIQUE:

1. Tree selected for growing should be feasible to the planting site and that are deep rooted, free from pest and diseases.
2. Saplings can be planted at a depth of one meter pit.
3. The soil should be level around the stem of the plant.
4. To ensure that plants do not bend during the initial period, we need to insert stick to the soil and tie the plant to it.
5. 5-7 inch layer of mulch should be added to the soil. We need to consider at least half a kilo of mulch per tree. The rice straw used for mulching should be tied with jute ropes and to ensure that the mulch does not fly around during strong winds. The jute rope should be tied to a bamboo pegs that are nailed at the forest periphery. This will ensure that the rope is pressed down on the mulch.
6. Pot seedlings are preferable for planting.

C(6): MAINTENANCE: Proper management for the first-three years after planting is mandatory.

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