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Cost Analysis of Forest Restoration in India by Miyawaki Method

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***Abstract*: For the life on earth forests are one of most essential component. Approximately three hundred million people on the earth live in forests and 1.6 billion depend on them for their livelihoods. Forests provide habitat for various species of plants and animals, many of which are still undiscovered. Evaluation criteria and due dates for the research paper are also provided. In the 1980s, in Japan, Prof. Akira Miyawaki introduced an innovative reforestation approach. The implementation of plantation technique along with reduction in cost might provide a new and innovative tool to foresters, ecological and environmental engineering experts for environmental reforestation and sustainable development program. The Miyawaki Technique is proven to work an unique methodology worldwide, irrespective of soil and climatic conditions.**

This paper describes costing of 100 square meters of forest by Miyawki method.

***Keywords*–** Miyawaki, ecology, forest.

I. INTRODUCTION

Miyawaki forests are a method of afforestation that involves planting a large number of native species in a small area to create a dense, self-sustaining forest. This method was developed by Japanese botanist Professor Akira Miyawaki and is based on the principles of natural forest ecology. Miyawaki forests are characterized by high species diversity, rapid growth, and low maintenance needs, making them an attractive option for restoring degraded or urbanized landscapes. More than 3,500 forests have been successfully created worldwide using this technique. Forest created by this methodology gives upto 30 times more dense forest as compared to conventional plantations, 30 times better noise control and dust reduction, and upto 30 times better Carbon-dioxide absorption as compared to a conventional plantation. The Miyawaki forest is proven to be completely maintenance-free, wild and native forest after the first three years and completely chemical and chemical fertiliser free forest. This forest sustains itself without any maintenance and supports local bio-diversity.

It involves the steps: selection of site, preparation of soil, selection of plants, planting and maintenance. The dense planting and high species diversity of this

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forest help to protect against soil erosion, improve water retention, and provide habitat for a variety of wildlife. This method of forest restoration has been implemented successfully in many countries and is widely recognized and accepted as an effective way to restore degraded or urbanized landscapes.

II. OBJECTIVES

The aim of the study is to estimate the cost of 100 square meter of forest restoration by Miyawaki method. The Miyawaki method aims to create a self-sustaining forest and that requires minimal maintenance once established. The dense planting and high species diversity of the forest help to protect against soil. The dense planting and high species diversity of the forest help to protect against soil erosion, improve water retention, and provide habitat for a variety of wildlife.

III. METHODOLOGY

A. Determination of Soil Texture:

Perforator:

It helps to improve soil permeability and allow roots to grow quickly. For this, biomass like husk can be use that is spongy and dry in nature. Husk is a by-product and easily available at grain mills and animal feed stores, such as rice husk, wheat husk, corn husk chipped, groundnut shells, etc.

Water Retainer:

It helps soil to retain more moisture, as compared to natural water retention capacity of soil. Coco-peat or dry sugarcane stalk like natural materials can be used. Before actual use, this material is dip into water for some time, and take it out and squeeze. After squeeze if water oozes out during squeezing, then the material can be used as water retainer.

Organic fertilizers:

These are required for nourishment of the plants. Depending on region and availability different materials can be used, such as cow dunk manure, goat manure or vermicompost. Compared to vermicompost, cow dunk manure is a slow nutrient-releasing fertilizer. Cow dunk manure provides small amounts of nutrients over an extended period, whereas vermicompost gives high doses of nutrition initially but very less later on.

Mulch: It insulates as well as protects the soil microorganisms form sunlight as it prevents sunlight from falling directly on the soil. Direct sunlight reduces the soil moisture and make conditions difficult for the young saplings. Moisture plays important role in the first 6-8 months, as the plants are young. It plays a huge role in preventing water evaporation. Options for mulch include rice straw, wheat straw, corn stalk or barley stalk.

B. Selection of Tree Species

It is good to plant variety of species as possible for biodiversity. For selection plant species following points to be considered.

- Make a list of all native species of the area where restoration of forest is to be done. Identify its type like evergreen, deciduous or perennial; advantages, maximum height and assign layer.
- Check the availability of native species saplings in the nursery, their age and height of sapling. Ideal height of sampling is 60 to 80 centimeters.
- Major species: Choose atleast five different species to be the major forest species. These major species should be commonly find in that area. These major

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species will constitute 40-50 percent of number of trees in the forest.

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

C. Design of Forest:

- Master Plan: Identify the exact area so as to procure materials and execute the project of for afforestation. The minimum width of the project area should be 3 metres, whereas 4 metres is recommended.
- Watering Plan: The water pipeline layout may need to be designed, based on the daily water requirement for the plants, and backed by bore wells or open well and overhead tanks. The forest should be watered regularly for atleast 2-3 years.
- Planning Project Execution: Identify spaces such as the material/ sapling/ equipment storage areas, site office and resting area for labourers. There should also be approach roads for earthmover access, and to the materials/ saplings storage areas for truck access, etc.

D. Site Preparation:

- Visit the site to determine the feasibility and scope of the project. Take pictures of the site from various angle/ direction, and confirm the availability of fencing, maintenance staff, water source availability and sunlight. The site should get sufficient sunlight for a minimum of 8-9 hours a day. No existing pipeline/ drains/ wires or debris should be present in the area.
- Removing debris and weeds: Weeds consumed and take away nutrition of the soil, and also restrict movement of materials and working people. So they should be cleaned either manually, or using a machineries, ensure that the pulled out weeds are disposed away; else they may re-grow.
- Watering facility installation: The provision of a main line with watering outlets for hoses should be provided at site, which can reach the entire area of the forest. Watering should be done everyday manually using a hosepipe with a shower, whereas the drip irrigation, sprinklers, etc. should be avoided. The requirement of water is around 5 litres/sq metre per day.
- Physical demarcation of areas: The areas should be marked with the lime powder wooden peg, tape, etc., ensuring that the marking of areas matches 100 % with the master plan.
- Making approach roads: Clear weed growth, big stones and boulders and construct a temporary path could be of any material (soil, sand, gravel, tar etc.), so that trucks/tractors should be able to use it.
- Mound identification: The forests are usually created on 100 sq metre mounds. Each mound 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.

E. Plant the Trees:

- Perforator, water retainer and fertiliser, all should be mixed together. They should be mixed in the exact same ratio for each mound.
- Each forest unit is created on a 100 sqm mound area. Dig the earth to a depth of 1 meter on the 100 sqm land then put half the excavated soil back into the pit and spread it uniformly, to make the soil loose. The half quantity of the biomass prepared in the previous step is put into

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the pit. Then put the remaining soil back into the pit and spread it uniformly. Now mix the remaining biomass with this soil evenly, and shape the soil into a mound. In the Miyawaki method, all saplings will be planted together on a mound.

- Place plants on the mound and try to group plants that grow into different layers. Do not 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 60cm between each consecutive saplings. The goal to follow this is to have random, dense plantation of native tree species.
- Dig a small pit on the mound an, remove the root bag, and gently place the plant in the pit. Level the soil outside gently, but do not press or compact the soil near steam . There should not be more than 8-10 people on a mound at a time.

Fig.1: Plantation on a Mounds.

- Saplings need support during the initial months to avoid its droop or bend. Tie the support sticks to the plant stems using thin jute strings. Support sticks will be needed for at least every alternate plant.
- Mulch should be evenly laid on the soil, of thickness 5-7 inch. To ensure that the mulch remain in position on the ground and does not fly around, it should be tied down with jute ropes. The bamboo pegs should be nailed at the periphery of the forest then tie the pegs to each other with rope, pressing down on the mulch. Mulching should be maintained for at least one year.

Fig.2: Mulching and Support to Plants

- The first time, the forest should not be watered for more than an hour. Minimum water requirement is 5 litres per sqm, i.e. 500 litres per 100 sqm mound. The soil should be re-mulched with time, since dry soil is detrimental to forest health. Never remove organic matter like fallen leaves, stem from the forest floor, as it will kill good soil microbes.
- Never cut or prune the plants in forest as it could make the forest weaker.

IV COST ANALYSIS

The cost analysis of Miyawaki forest is found out for 100 square meter of land by considering plant density as 4 plants per meter. For this, various items such cost required for site preparation excavation, biomass, backfilling, sampling, plantation, watering, maintenance, etc. are taken into

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account. The expenditure is as tabulated below.

Sr. No.	Description	Unit	Qty	Rate	Amount (Rs.)
1	Excavation (25m*4m*1m)	Cum	100		
a	Excavator	Hrs.	8	1000	8000
b	Earth mover	No	1	2000	2000
2	Weat Husk	Cum	9	1000	9000
3	Sugarcane bagasse/ cocopeat	Cum	3	1000	3000
4	Cow dunk manure	Cum	12	1000	12000
5	Jiwamrut	Lit	1000	5	5000
6	Back filling				
7	Excavator	Hrs.	5	1000	5000
a	Plants	No	400	120	48000
8	Pit Excavation (0.3m*0.3m)	No	400	10	4000
9	Grass stros for Mulching	No	1	3000	3000
10	Supporting Steaks	No	400	10	4000
11	Miscellaneous				5000
12	Watering & maintenance (Labour for two year)	Lump some			40000
	Total cost of creating the forest				**148000**
				Cost per Plant (Rs.)	**370**

CONCLUSIONS:

The study was conducted to study the feasibility and to obtained the cost of Miyawaki forest on 100square meter of land in Indian territory.

- For the plane Indian terrain the cost of Miyawaki forest restoration is found to be Rs.148000 for 100square meter of land.
- Forest created by Miyawaki technique is found 30 times denser as compared to conventional plantations.
- It gives 30 times better noise control and dust reduction, and also absorb Carbon-dioxide upto 30 times better as compared to a monoculture plantation.
- After 3 years, Miyawaki forest becomes self-sustainable as it will completely maintenance free, chemical and chemical fertiliser free forest and it supports local bio-diversity.

REFERENCES

1. Miyawaki, A., 1999. Creative Ecology: Restoration of Native Forests by Native Trees. Plant Biotechnol. 16, 15–25. https://doi.org/10.5511/plantbiotechnology.16.15
2. Miyawaki, A., 1998. Restoration of urban green environments based on the theories of vegetation ecology. Ecol. Eng. 11, 157–165. https://doi.org/10.1016/S0925-8574(98)00033-0
3. Burylo, M., Hudek, C., Rey, F., 2011. Soil reinforcement by the roots of six dominant species on eroded mountainous marly slopes (Southern Alps, France). CATENA 84, 70–78. https://doi.org/10.1016/j.catena.2010.09.007
4. Deslippe, J.R., Simard, S.W., 2011. Below-ground carbon transfer among Betula nana may increase with warming in Arctic tundra. New Phytol. 192, 689–698. https://doi.org/10.1111/j.1469-8137.2011.03835.x
5. Empreinte carbone − Indicateurs de richesse nationale | Insee [WWW Document], n.d. URL https://www.insee.fr/fr/statistiques/3281683?sommaire=3281778#consulter (accessed 4.20.20).
6. Escobedo, F.J., Adams, D.C., Timilsina, N., 2015. Urban forest structure effects on

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

property value. Ecosyst. Serv. 12, 209–217. https://doi.org/10.1016/j.ecoser.2014.05.002

7. Fournier, M., Moulia, B., 2018. Sensibilité et communication des arbres: entre faits scientifiques et gentil conte de fée. 11.
8. Google Maps [WWW Document], n.d. . Google Maps. URL https://www.google.com/maps/@35.3457647,139.88057,3a,75y,79.72h,104.37t/data=!3m6!1e1!3m4!1spQ2hPfK1i5fL8DpUPXAejA!2e0!7i13312!8i6656 (accessed 4.1.20).
9. Han, K.-T., 2017. The effect of nature and physical activity on emotions and attention while engaging in green exercise. Urban For. Urban Green. 24, 5–13. https://doi.org/10.1016/j.ufug.2017.03.012
10. Hladik, A., Blanc, P., n.d. Croissance des plantes en sous-bois de forêt dense humide (Makokou, Gabon) 15.
11. Howe, D.A., Hathaway, J.M., Ellis, K.N., Mason, L.R., 2017. Spatial and temporal variability of air temperature across urban neighborhoods with varying amounts of tree canopy. Urban For. Urban Green. 27, 109–116. https://doi.org/10.1016/j.ufug.2017.07.001
12. La séquestration de carbone par les écosystèmes en France, 2019. 102.
13. Long, L.C., D'Amico, V., Frank, S.D., 2019. Urban forest fragments buffer trees from warming and pests. Sci. Total Environ. 658, 1523–1530. https://doi.org/10.1016/j.scitotenv.2018.12.293
14. Chandrika Singh, and Gaurav Saini,2019. Sustainable solution for urban environment: Miyawaki Forest, IJTIMES, Volume 5, Special Issue 04, April-2019.