

The logo for CGBMT, consisting of the letters 'CGBMT' in a bold, sans-serif font, enclosed within a white circle.

CGBMT

The words 'PROJECT BRIEF' in a large, bold, white, sans-serif font, set against a black rectangular background in the top right corner.

PROJECT
BRIEF

A background of green bamboo leaves, with some leaves overlapping the text.

THE BAMBOO CITY

IS BAMBOO A NATURE BASED SOLUTION FOR CARBON
NEUTRAL AND REGENERATIVE CITY?



ABOUT CGBMT

In 2004, the Centre for Green Building Materials and Technology (CGBMT) was established by Ar. Neelam Manjunath to promote sustainable building technologies. Initially, the lack of data and skilled personnel in the industry prevented the advocacy and implementation of sustainable practices. To bridge the gap, CGBMT started with workshops on sustainability, advocacy through talks and print media, and later moved into on-ground skilling to address the challenges.

CGBMT operates as a trust under the Societies Act and works towards promoting eco-friendly solutions for sustainable living through research, training, skilling and development, and advocacy.



CGBMT Copyright Disclaimer

This Copyright Disclaimer (“Disclaimer”) sets forth the rights, limitations, and obligations concerning the use of copyrighted materials owned by CGBMT. By accessing or using any materials, content, or intellectual property owned by CGBMT, you acknowledge and agree to the terms of this Disclaimer.

Copyright Ownership: All materials, content, and intellectual property, including but not limited to text, images, graphics, logos, audio, video, and software, made available on CGBMT’s website, publications, or other platforms, are protected by copyright laws and owned by CGBMT unless otherwise stated.

Permission for Personal Use: You may view, download, or print copyrighted materials from CGBMT’s platforms solely for personal, non-commercial use.

Disclaimer of Liability: The Owner shall not be liable for any direct, indirect, incidental, consequential, or special damages arising out of or in connection with the use of copyrighted materials, including but not limited to errors, omissions, or inaccuracies in the content or loss or damage of any kind incurred as a result of the use of any copyrighted material.

By accessing or using any copyrighted materials owned by CGBMT, you acknowledge and agree to abide by the terms of this Copyright Disclaimer. If you do not agree with any of these terms, please refrain from accessing or using the copyrighted materials.

For any inquiries regarding this Copyright Disclaimer, please contact CGBMT at cgbmtblr@gmail.com

Date: 1 December, 2023; CGBMT, No 7A, Aditi Green Scapes, Sampigehalli Road, Dr. Shiva Ram Karanth Nagar, 2nd Stage, near Amruthahalli Railway Gate, Bengaluru, Karnataka 560077; cgbmt.org



The era of global warming has ended; the era of global boiling has arrived. Leaders must lead. No more hesitancy. No more excuses. No more waiting for others to move first. There is simply no more time for that. It is still possible to limit global temperature rise to 1.5 degrees Celsius and avoid the very worst of climate change. But only with dramatic, immediate climate action.



- UN Secretary-General António Guterres

AUTHOR

Ar. Prof Neelam Manjunath

Proprietrix, Manasaram Architects, Bangalore, India

CEO, Founder and Managing Trustee, CGBMT,

Sustainability & Bamboo Consultant, DEI, Dayalbagh, Agra

World Bamboo Ambassador, WBO

Key Expert, Bamboo Construction Task Force, INBAR

National Convenor-ADCE, BSI

Member, NGC, Bamboo Society of India

Member, Sub Committee on Bamboo Construction, Niti Ayog

C40 Cities Women4Climate, Bangalore Cohort

Research Associates

Ar. Sree Lalitha,

M. Arch - Bangalore University, India

Er. Mohan Reddy Vedukala,

MIP - University of Stuttgart, Germany

INDEX

INTRODUCTION — 6

**IS BAMBOO A NATURE
BASED SOLUTION — 12**

METHODOLOGY — 15

CONCLUSION — 16

INTRODUCTION

“At COP27, Bamboo was declared as one of the top five solutions to mitigate global warming, by replacing traditional housing materials such as carbon and steel with bamboo, helps reduce carbon emissions caused by the global housing sector.”

(Washington Post 2022)

Cities, as engines of growth, consume substantial amounts of energy and emit greenhouse gases (GHGs) with the **building sector contributing 40% of all global emissions** (IEA 2019).

The adverse effects of unsustainable built environment have put a strain on the environment affecting humanity. In this scenario, Bamboo stands as an ideal **nature-based** solution capable of achieving soil and moisture conservation, providing water security, preventing soil erosion, repairing degraded lands, improving air quality, and providing eco-friendly buildings because of its manifold uses and industrial applications rendered possible by recent advancements.

The **2030 Climate and Energy Framework** states that 27% of energy should be sourced from sustainable energy sources to meet the target for 2030. (EU 2021). **This project is part of a C40 Cities Women4Climate initiative by the author. It examines the current state of environmental impacts of Air and water pollution in cities like Bangalore and intercede through nature-based interventions with Bamboo as a mainstream material in construction, phytoremediation, and air pollution mitigation** by collating available data, engaging with stakeholders and identifying points of action consistent with national and international climate action and sustainability commitments among governments.

The Bamboo City project will be a **plug-in to the main Climate Action Plan** with a **roadmap for lowering GHG emissions and building community climate resilience to achieve carbon neutrality by 2030 and regenerative status thereafter**. Using bamboo for sustainable development for the city will not only cut greenhouse gas emissions but also provide income opportunities ensuring the triple bottom line of environmental, economic, and social growth fulfilling the SDGs.

PROJECT AT A GLANCE

Project Title

“The Bamboo City” – A Nature-Based Development Model for Regenerative Cities- A Case of Bengaluru 2030

Author

Ar. Prof Neelam Manjunath

City (area, elevation and coordinates)

Bangalore

(2196 sq. km, 920m)

Latitude: 12°58'18" N Longitude: 77°35'37" E

City (Population)

13 Million

City GDP

US\$110 Billion

Aim

Make Bengaluru a Carbon Neutral City by 2030 and Regenerative thereafter

Project Timeline

2023-2030

Climate Risks Assessed

- Urban Heat
- Urban Flooding
- Air Pollution
- Water Pollution
- Water Scarcity

Stakeholders Involved

Citizens, Construction Professionals, Bamboo Industry, Academia, WBO, INBAR, IWST, IPRITI and others.

Stakeholders proposed

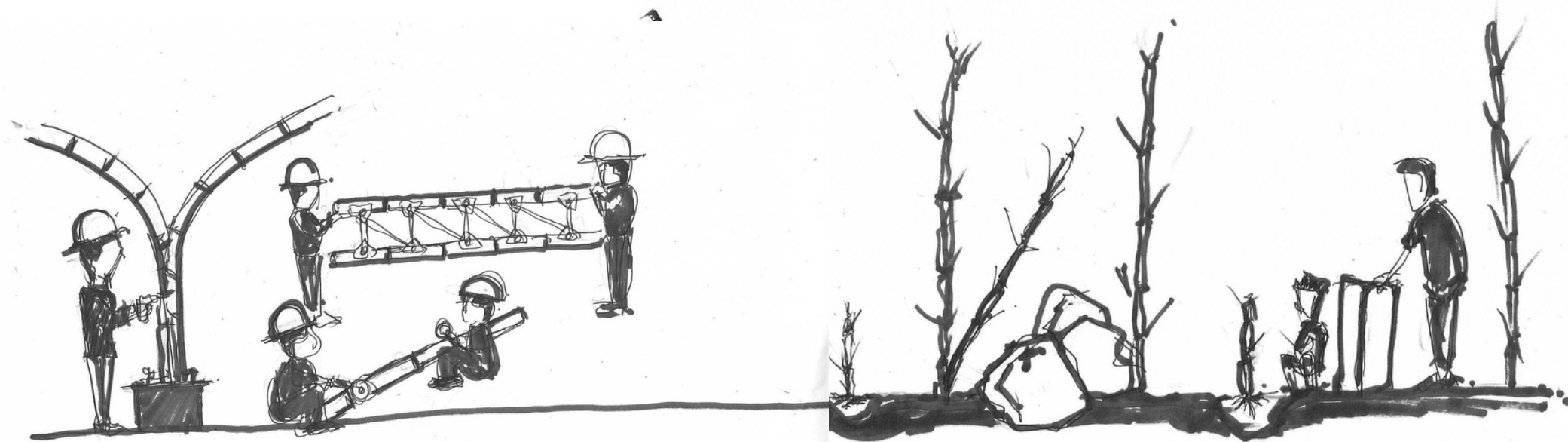
BBMP, BMRDA, BIAPPA, BDA, Individual Researchers, NGOs, Private Institutions, Corporates, and others.

Important Sectors Addressed

- Housing and Infrastructure
- Urban Greening
- Water Resource Management
- Air Pollution
- Energy and Waste Management
- Enterprise Development

Main Proposal of the Project

- The project proposes one bamboo plant per citizen in the city.
- The project proposes 30 % inclusion of bamboo in the construction sector in the city



BAMBOO CITY CLIMATE CHANGE MITIGATION OBJECTIVES

URBAN GREENING

Growing Bamboo in the city helps in reforestation, and in the process, the soil undergoes phytoremediation.

LESS CARBON FOOTPRINT

Mainstreaming bamboo into the construction sector significantly reduces carbon footprint.

REJUVENATION OF WATER BODIES

Bamboo's Phytoremediation along the water bodies will absorb heavy metals and prevent soil erosion.

CARBON SEQUESTRATION

Bamboo is a highly renewable resource that grows quickly. Bamboo plantations in the city can mitigate the greenhouse effect by absorbing CO₂.

CONTROL AIR POLLUTION

Bamboo plantations in the city can control air pollution and create Oxygen Parks and Oxygen Corridors.

ENERGY GENERATION

Bamboo waste from the sector can be used as Bio-fuel.

SUSTAINABLE DEVELOPMENT GOALS ADDRESSED



Bamboo plays a significant role in regional and global carbon cycles and carbon sinks, offering substantial carbon sequestration potential. Moreover, it has been effectively employed in absorbing wastewater from agriculture and related industries. Consequently, bamboo is considered an ideal solution for reducing atmospheric carbon dioxide concentrations and mitigating the adverse effects of climate change.



The high strength and flexibility of bamboo make it an ideal building material. Its sustainability, abundance, and carbon-negative properties (Manandhar, Kim, and Kim 2019) position it as a preferred choice for constructing sustainable cities. Studies have also demonstrated bamboo’s suitability for flood-resilient structures (Das and Mukhopadhyay 2018) and its excellent mechanical and anti-seismic properties (Galmarini, Costa, and Chiesi 2022).



Bamboo species can be harnessed to create various products, generating green livelihoods for communities and helping to eradicate poverty. By harnessing the potential of bamboo, communities around the world are able to create green livelihoods that generate income while also contributing to the protection of the planet. This is particularly important in areas where poverty is prevalent, as bamboo products offer a viable means of improving economic conditions without compromising on sustainability.



The extensive root and robust rhizome systems of bamboo make it an effective tool for controlling soil erosion, maintaining slope stability, and preventing landslides. Bamboo plantations in the city can control air pollution and create Oxygen Parks and Oxygen Corridors. All of the above will significantly improve quality of life (air, water and soil) in Bangalore.



This project involves a diverse group of stakeholders, including citizens, government officials, NGOs, bamboo industry representatives, urban planners, construction professionals, academic institutions, and research organizations, to address climate change through an inclusive and collaborative process. The goal is to engage groups with an interest, expertise, or influence in climate action so that we can successfully mitigate climate change in Bangalore.

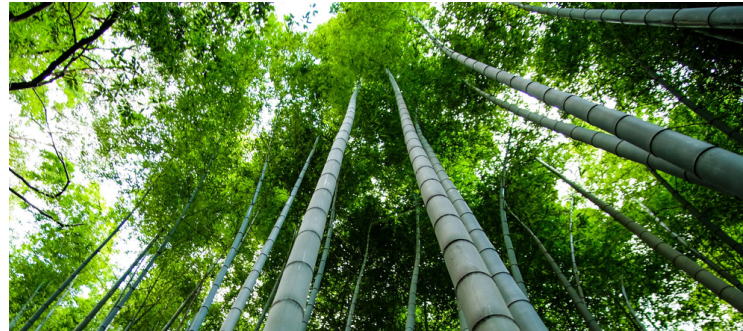


Bamboo serves as a sustainable source of affordable, clean energy in the form of pellets, chips, and wood charcoal, reducing carbon emissions. Bamboo is fast-growing and requires minimal resources, making it a more sustainable option compared to traditional materials like wood or cotton.

IS BAMBOO A NATURE BASED SOLUTION?

Bamboo is a woody grass, with more than 1600 species of bamboo in the world, and around 127 species in India.

Bamboo: a one stop solution for preventing soil erosion, soil enrichment, reforestation, carbon sequestration, and regeneration.



CO2 ABSORPTION

- ABSORPTION OF 400 KG OF CO2/ PLANT/ YEAR
- RELEASE OF 300KG OF O2/PLANT/ YEAR



FALLEN LEAVES

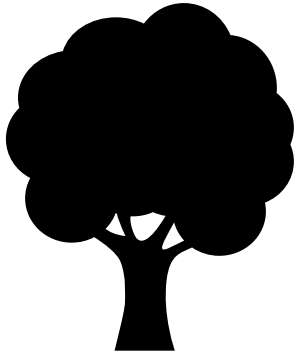
DECOMPOSE AND FORTIFY THE TOPSOIL



RHIZOME ROOTS

HOLD THE TOPSOIL TOGETHER AND PREVENT SOIL EROSION

COMPARISON BETWEEN TRADITIONAL TREE AND BAMBOO



VS



Traditional Tree (average values)	Parameter	Bamboo (average values)
The lungs of the planet A tree produces 200kgs of Oxygen per year (bigger the tree, more oxygen is produced)	Oxygen release	Produces 35% more Oxygen A bamboo produce 300kgs of Oxygen per year
200kgs/year/plant	CO2 absorption	400kgs/year/plant
Mature for lumber in 30-40 years (approx.)	Harvest Cycle (years)	Mature for harvest in 3-5 years
Tree is killed when it gets cut down	After harvest	New Culms emerge from the Clump after every harvest
Very slow	Growth rate	Very fast
Thick trunks require chainsaws and heavy machinery	Equipment and labour to cut	As hard as Oak , lightweight, hollow and easily cut with hand saw



Bamboo creates a micro-climate condition with a **reduction of 4-5 degrees** in temperature.



Planting bamboo can retain and **increase the ground water table** by holding up to 5000 liters of water per bamboo, equivalent to **200-400 mm** of water.



Bamboo's phytoremediation qualities make it effective in **removing toxins** from soil.

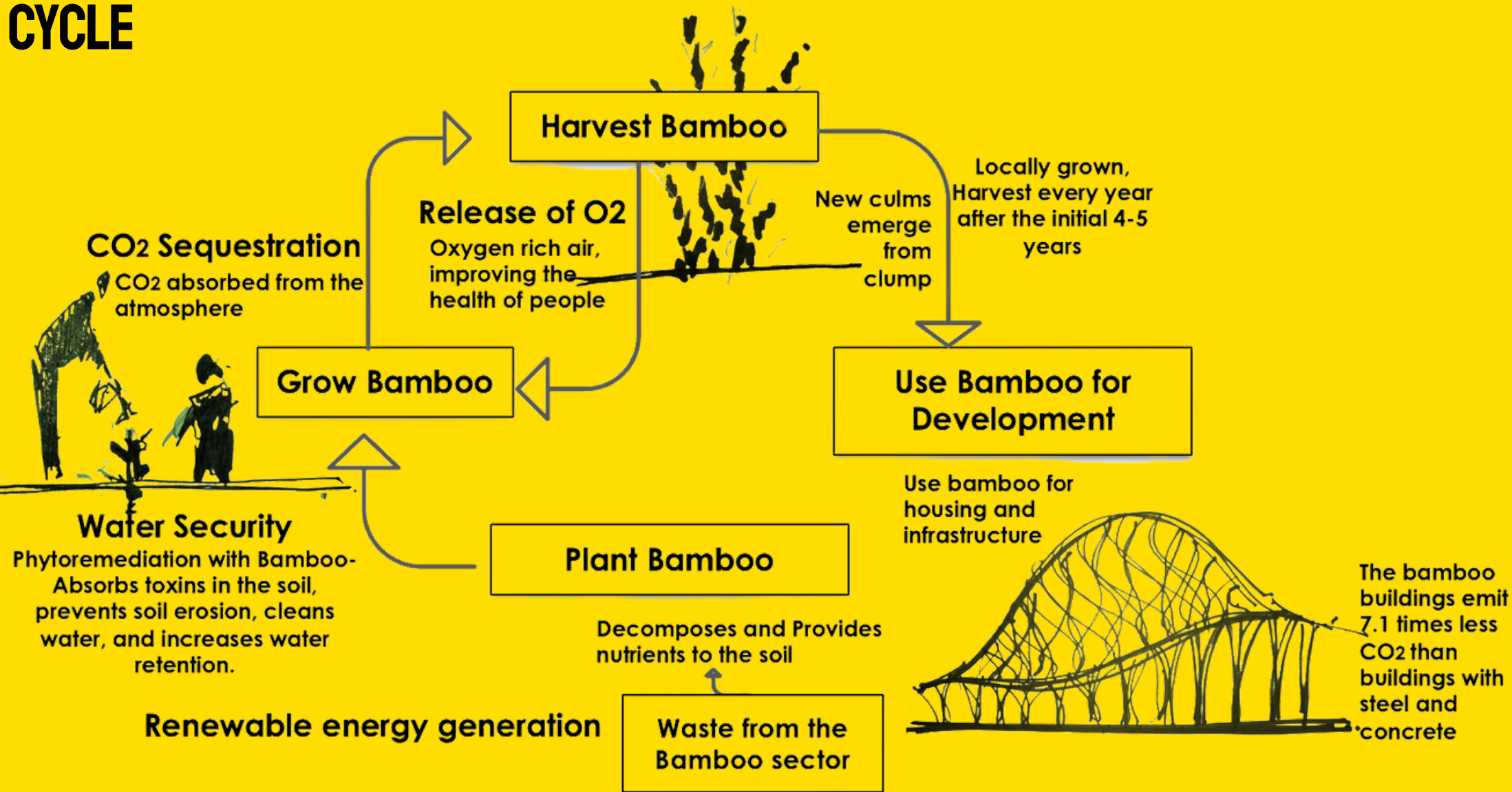


Bamboo **reduces dust level** by **70%-90%**



Bamboo can be a replacement to plastic - **Green Circular Economy**

BAMBOO REGENERATIVE CYCLE



METHODOLOGY

Development of the model is an inclusive, collaborative process with input from a diverse stakeholder network, engaging groups with interest, influence, or expertise in climate action.

This includes residents, especially those adversely impacted by climate change and inequality, civil society groups, private companies, business associations, universities, various experts, state and national government, local government agencies, departments, and so on. An inclusive, collaborative process for climate action planning is as important as the development model itself, as it builds widespread community and political consensus and support, fosters credibility, and strengthens the resulting plan.

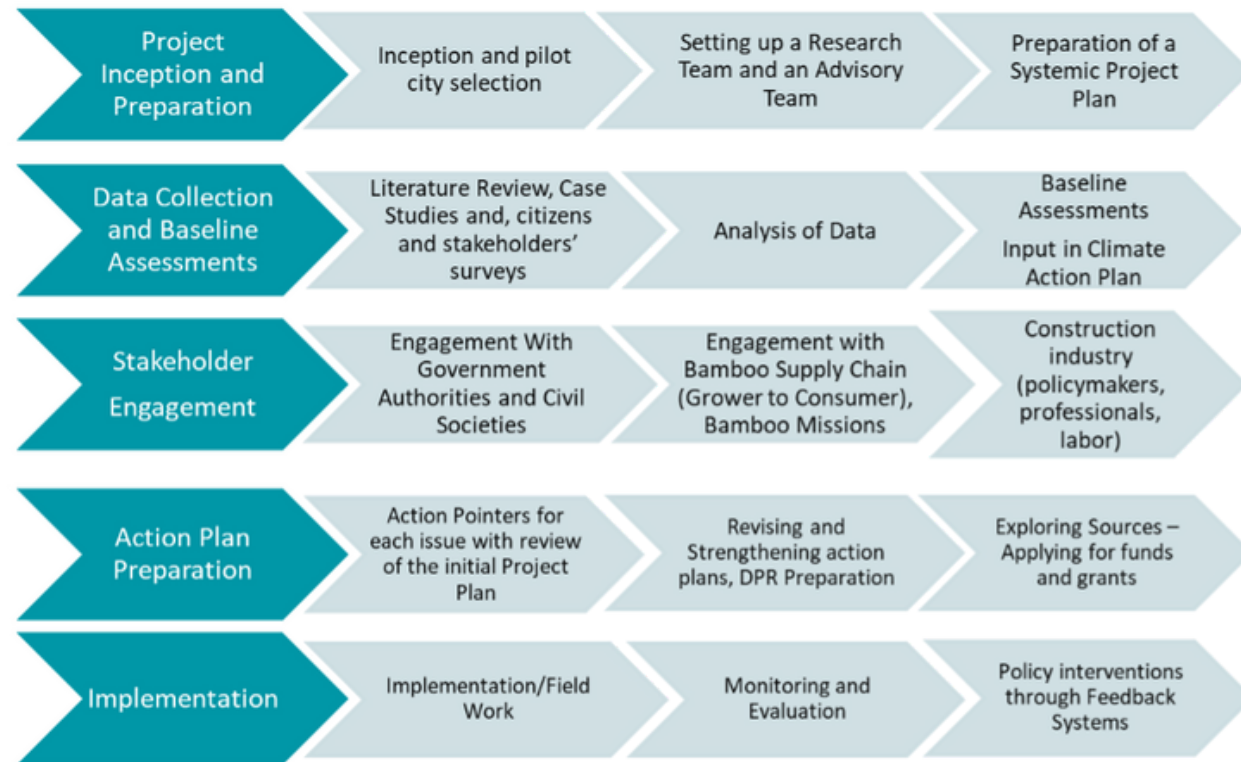


Table 1: Systemic Project Plan

CONCLUSION

Nature is regenerative by default. Nature underpins the complex web of life and the life-sustaining ecosystem services upon which human livelihoods depend. Cities depend on nature. Hence, the model of a Regenerative city has to take **nature as the fundamental stakeholder in drawing out the Action Plan to address the urban environmental, economic, and social issues.**

Urban greening with bamboo can absorb and store carbon, help mitigate greenhouse emissions, provide bamboo for housing and infrastructure, repair degraded lands, rejuvenate lakes, and reverse air pollution. It will provide inclusive, equitable, resilient, and safe urban spaces, clean water, clean air, and local livelihood options, especially for the marginal population.

Thus, Bamboo Cities can be the nature-based solution to curb global warming to reach net-zero carbon goals and become Regenerative Cities thereafter.



“Nature is the source of all true knowledge.”

- Leonardo da Vinci



www.cgbmt.org



cgbmtblr@gmail.com



(+91)8396018019, 9731814333

