TURNING VACANT LANDS INTO URBAN FARMS

CASE STUDY OF MUMBAI

By

Krutika Patel

* McGill University, Montreal

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Preface

The research is based on the comment that I received once, while having a discussion with my Professor during my Bachelor's Degree of Architecture that, 'Community farming is not going to work in India.'

This statement came around with a question that I asked myself as to Why a country which has a large population in farming, not accepting it as the most powerful asset for productive development? My research is the outcome of the interest and thought process that I was going through since then. Trying to understand the scope of urban agriculture as a means of sustainable development of the cities in India, focusing on Mumbai. Mumbai has the history of urban agriculture since 1968, a step taken by Indian Government under "Grow More Food" movement to curb the food insecurity during international development as a result of industrialization, post World War II (WWII). Moreover, Mumbai is transforming rapidly due to increasing rate of migration and hence, the need to provide basic necessities to people, is constantly growing. Mumbai has recognized the need of providing shelter to the people but food or more precisely food security, is yet not given that much of an importance. Most of the land is reserved or converted for housing or commercial projects with little consideration about productive landscape. but not for the 50 % population which is living in informal settlements. So one could ask the question as to whom are we building these cities for?

This research tries to divert the focus from need of shelter to integrated production of food. It also, tries to understand different typologies of urban agriculture, promoted in Mumbai by both Governmental and Non Governmental organisations. It sheds light on the idea of rehabilitation of the wasted spaces by tracing the vacant lands in the city which has the potential to be

converted into community gardens and maintaining it by linking it to the clean India movement called ‘Swachh Bharat Abhiyan’. This initiative will try to keep the places clean and constructively usable for the people of Mumbai, as I found that the land besides railway incorporating urban agriculture are well maintained and clean.

Finally, the idea behind this research is to unveil the practice of urban agriculture in the cities which could be done in three ways, **t**ransforming vacant lands into community gardens, **c**onnecting urban railway farms to the market areas and the vacant lands turned community gardens to create a ‘productive circuit’, **r**eforming the design and planning strategies for real estate projects on mill lands.

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List of Acronyms and Abbreviations

MCGM - Municipal Corporation of Greater Mumbai

MDG – Millennium Development Goals

BMC – Brihanmumbai Municipal Corporation

MRVC – Mumbai Railway Vikas Corporation

DCR – Development Control Regulations

MHADA - Maharashtra Housing, Area Development Authority

GKSS - Girni Kamgar Sangharsh Samiti

UDRI – Urban Development Research Institute

UDPFI - Urban Development Plan Formulation & Implementation

SNEHA – Society for Nutrition and Health Education

PUKAR - Partners for Urban Knowledge Action and Research

UCL – University College London

NGO – Non Governmental Organisation

MMRDA - Mumbai Metropolitan Region Development Authority

UNPF – UN Population Fund

SPARC – Society for the Promotion of Area Resource Centers

NATU-ECO -*Natueco Science is all about harvesting the sunlight using farming as a medium to do that. The focus is on energy conservation and energy generation rather than on mere farm output by weight. It emphasizes optimal and efficient use of soil, water and labor. It questions many of the traditional methods used in agriculture and yet is scientific and experimental in its approach.*

Swachh Bharat Abhiyan – Clean India Initiative

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Abstract

The objective of this paper is to understand the scope of urban (re) development seen through the lens of urban agriculture based on the (edible) landscape urbanism particularly of city of Mumbai to draw inference in the form of design and planning guide. This method is important to ensure the sustainable growth of the city based on 3 major factors: reuse, reproduce and recycle. The study tries to identify the niches where (edible) landscape urbanism could be intertwined with the present urban fabric of the city of Mumbai.

A detailed study was carried out to recognize and locate the vacant lands in the city, by using ArcGIS software, Google Maps and the Land Use Maps of the Development Plan of Municipal Corporation of Greater Mumbai (MCGM); the productive area identified does not include land in dispute i.e. mill lands. The most interesting part of this analysis is that these vacant lots are in proximity of informal settlements and the ecological elements; which are often contaminated. Consequently, the vacant lands can be effectively used to restore ecological system, once streamlined they can be used for urban agriculture and serves as important public/community space for the nearby residential areas. Most importantly, the vacant lots or unused spaces in the city tend to become the dump yard. However, it was not the case as noted in the study of the spaces besides the railway tracks used for urban agriculture. Hence, this paper serves as a good example of successful practice could for transforming the Indian cities by linking it to the 'Swachh Bharat Abhiyaan' an initiative by Honorable Narendra Modi, Prime Minister of India.

Ultimately, the study identifies three major categories of urban agriculture: Linear (Railway) Infrastructure, Real Estate Development, and Community Gardens on Vacant lands. These options can be used as useful design and planning strategies in (re)developing cities sustainability.

Keywords- Edible Landscape, Urban Farms, Vacant Lots, Open spaces, Railway Farms,

Le Abstrait

L'objectif de cet article est de comprendre la portée du développement urbain perçue à travers les lunettes de l'agriculture urbaine, basée sur le paysage urbain, particulièrement celui de la ville de Mumbai, pour tirer une conclusion ayant la forme d'un plan de conception et de planification. Cette méthode est importante pour assurer la croissance durable de la ville basée sur trois facteurs majeurs : la réutilisation, la reproduction et le recyclage. L'étude essaie d'identifier les niches où le paysagement urbain pourrait être croisé avec la forme actuelle de la ville de Mumbai. Par conséquent, une étude détaillée a été menée pour reconnaitre et localiser les terres vacantes de la ville en utilisant les logiciels ArcGIS, Google Maps, et Land Use Maps pour le développement du plan de la Corporation Municipale du Grand Mumbai (CMGM).

La croissance productive dans la ville qui n'inclue pas des terres qui sont disputés, c'est-à-dire des terres agricoles. La partie la plus intéressante de cette analyse est que les lots de terres vacants sont à proximité d'implantations informelles et d'éléments de la biosphère qui sont souvent contaminés. Donc, les terres vacantes peuvent être efficacement utilisées pour restaurer l'écosystème, une fois rationalisé utilisées pour l'agriculture urbaine, et servent comme espace public important pour les quartiers résidentielles à proximité. Plus important encore, les lots de terres vacants ou les espaces non utilisés dans la ville tendent à devenir des dépotoirs. Par contre, ce n'était pas le cas dans l'étude sur les espaces près des chemins ferroviaires, utilisés pour l'agriculture urbaine. Par conséquent, cet article sert de bon exemple de pratique réussie qui pourrait transformé les villes indiennes en les liant à « Swachh Bharat Abhiyaan » une initiative de l'Honorable Premier Ministre d'Inde, Narendra Modi. Ultimement,

l’étude identifie trois catégories majeures d’agriculture urbaine : infrastructure linéaire (chemin de fer), développement immobilier et jardins communautaires sur terres vacantes. En conséquence, ces options peuvent être utilisées comme des stratégies utiles de conception et planification de redéveloppement durable des villes.

Mot clé : Paysage comestible, fermes urbaines, terres vacantes, espaces ouvert, ferme ferroviaire

CHAPTER 1

INTRODUCTION

The research focuses on the idea of urban (re)development of Mumbai city in three major fields: social, economical and ecological. The idea of (re)development is revolving around the urban agriculture as a key design and planning concept.

Firstly, the study of the topic urban agriculture based on literature including online research was carried out. In addition, to prepare to go to Mumbai for the case study I contacted via email to key individuals of both governmental and non governmental organizations indulged in urban farming activities. Also, the study of vacant land in the city of Mumbai was carried out being in Montreal by putting together the Google Earth, Arc GIS data and the land use maps of the Development Plans of Municipal Corporation of Greater Mumbai (MCGM).

Secondly, the literature review of the related topics such as landscape urbanism, lack of open spaces, utilitarian agro planning was conducted. Moreover, to understand the relation of urban agriculture with the social, ecological and environmental aspect of the cities in developing countries the review based on the articles is done. Also, the constraints of the urban agriculture in the city is also considered in the critical analysis of the study is presented.

Ultimately, the case study of the two sites: Lokmanya Tilak Terminus, which is held by the railway authorities of Mumbai and has a history of urban farming since 1968 under *Grow More Food* campaign. Another study is of the terrace farm of Don Bosco High School, Provincial House, Matunga is carried out to understand the community life around the urban agriculture and related constraints.

1.1 Millennium Development Goals:

The international commitment for sustainable urban development and poverty reduction was declared by the UN Millennium Declaration in 2000, the Declaration on Cities and Other Human Settlements in 2001 and in 2002 in World Summit out line *(Mougeot, 2010).* These commitments focus on getting the more sensible, sustainable, inclusive and comprehensive approach for designing the program of city development.

Half of the world population is now living in urban and peri-urban areas, and majority of new migrants moving to cities, will be in developing countries. Mumbai is one such destination for the thousands of people migrating to the city daily in search of improved quality of life. Some shift willingly, while others are victims of need and despair. Migration is the major reason for increasing density of city of Mumbai. Out of 1000 migrants, 370 migrants are from villages of Maharashtra state, while 198 are from villages outside Maharashtra. This is due to the development distress in the villages and natural calamities such as drought and they are unable to continue farming, one prominent example is Marathawad, district of Maharashtra state *(Times of India, 2012)*. Today, the population of Mumbai is estimated to be 21 million and is anticipated to reach to 28 million by 2030, when it would become the fourth largest city in the world. The increasing density leads to growing demand, as the city is under great pressure to provide basic services to the existing population. By 2020, majority of the population will be living in the slums forming irregular settlements and facing food insecurity, shelter, water and sanitation problems *(Mougeot, 2010).* Additionally, majority of the migrated population i.e. 50% has already been living in the most unhygienic and unsafe conditions in Mumbai. In addition, food insecurity and degrading ecology is the major factor that is the most serious factor for the

cities MDG 1 is to half the proportion of the people whose monthly income is below one dollar a day and who suffer from hunger.

In my view, urban agriculture is one strategy that could add silver line to the promises of the MDG to redevelop and redesign the new cities. Urban agriculture has the power to redefine the development of the cities by (edible) landscape urbanism. This idea is supported by the Mougeot, *"Urban agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products, (re)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area. "(Mougeot, 2010)*

Consequently, urban agriculture can help meet the MDG, in sustainable way and also enriching the ecology and economy of the cities.

1.2 Background of the study:

Growth of cities all around the world is evident and inevitable. Mumbai's population is increasing and will reach to 28 million by 2030 *(UN, 2017).* It acts as a magnet of opportunities and resources solely based on the economical development. However, it doesn't remain the same, it paints itself through different colors of social and cultural attributes from the individual that forms the community. This aspect of the city creates the life and make it more vibrant and livable. However, as we know, every aspect is like a double edged sword, uncontrolled urbanization brings about degrading living conditions.

Mumbai is struggling with the issue of increasing flow of migration and the need to satisfy their basic needs. Moreover, the major urbanization issue in Mumbai is the lack of open spaces as the land in the city is limited. The real estate developers have enormous powers to break the land reserve laws and acquire lands for conventional and commercial development. The ratio of open space per per person is 1.1 m^2 well below the basic standards of Urban Development Plan Formulation & Implementation (UDPFI) states, norm of 10 m^2 per person. Also, a study of Pk. Das, 'Open Mumbai ', shows that the major open spaces marked in Development Plan of the Mumbai are use as dump yards and encroached areas. Also, the Open Mumbai study traced 1,600 open spaces; notably, more than 600 of them are encroached upon.

In 2011, Urban Design Research Institute (UDRI) surveyed 2000 people in Mumbai and found that 87% people were not aware of the fact that Mumbai has any green cover.

This study focuses on to strategies to create more open spaces and green cover by incorporating urban agriculture.

1.3 Significance of the study:

This study explores the role of urban agriculture as a solution to meet the MDGs for development of the city by answering the question of How urban agriculture is a resilient solution to meet the MDG for development of Mumbai City? The study focuses on understanding the ecological and economical growth of the city by incorporating urban design and planning strategies at different levels.

Furthermore, the study highlights the (re) development of the city based on the (edible) landscape urbanism design and planning strategies that closely aligned with the 'Swachh Bharat

Abhiyan' an initiative of clean India by Government of India. Indian government has already stepped into the transformation of Mahim Nature park under Landscape Urbanism paradigm. This study can help to incorporate urban agriculture to protect degrading agricultural land and reduce food insecurity by re-considering laws for land reserves and zoning in the Development Plan (DP) of the city of Mumbai. Moreover, it shows how the real estate developers groups, one of the powerful agents of change, can also incorporate urban agriculture in their projects. The report can also help consulting the architects, urban designers, urban planners and environmentalists involved in restructuring the city by making urban agriculture more contextual.

Figure 1: Railway land without urban farming. Source: Krutika Patel

Figure 2: Railway land with urban farming. Source: Krutika Patel

1.4 Methodology:

The literature review is conducted to understand the scope and persistence of urban agriculture in the developing countries and specifically relating it to the case of Mumbai. It includes the study of subjects such as, (edible) landscape urbanism along with the projects instances; lack of open space study in the city of Mumbai; urban agriculture and the social, economical and ecological aspects attached to it. Also, the detail study of the vacant lands in the city of Mumbai is done based on the GIS Data, Google Earth Images and Land Use Map of Mumbai.

Furthermore, case-study of urban agriculture sites in Mumbai was carried out to answer three major question:

1. How urban agriculture and linear infrastructure such as railway lines correlate to the urban (re)development?

The urban farms on the railway land in Mumbai demonstrate the scope of urban agriculture and its capacity in redefining the edges of the linear infrastructure such as railways, roads, and transmission lines. The compound walls, instead of dividing or separating, have the potential to become the most powerful design element to connect the different land uses on the edges. Also, the linking of such urban agriculture practice to the near by market places could create the linear ecological and economical corridor. The sustainable practice of rainwater harvesting, sewage treatment and implementing reuse, reduce and recycling of resources as design and planning strategy, make these urban agriculture projects robust, ecofriendly and sustainable.

2.How to increase the open land and bring ecological, economical and social openness to the city?

To address the above question, first the study of vacant lands identified in the city by using ArcGIS software, Google Maps and Land Use Maps by Mumbai government to project the scope of productive growth in the city. The study was carried forward by understanding the connection of vacant lands with different adjoining land use along with ecological and economical transformation. Urban agriculture in vacant lands tries to connect the urban spaces with the food production; for the city to become relatively more self sufficiency. The case study of terrace garden of Provincial House of Don Bosco School, Matunga shows the potential of urban agriculture in reviving the community life in the city. It is an important project highlighting the production on a built up spaces, particularly on the roof tops and even on small and underutilized spaces.

3.How real estate projects could be considered as the potential element of the (edible) landscape urbanism strategy?

Based on the study of vacant lands it is evident that the island city of Mumbai has the least amount of vacant lands and hence has the limited scope to achieve the openness. However, the city has extensive areas of derelict and under-used industrial assets, which are under transition, being considered for re-development by real estate businesses. Old textile mill lands are one such area developed by real estate companies at present and will continue in the future. The potential of linking the mill lands with the railway line farming circuit is very strong because of their proximity and physical links. Considering this opportunity, in planning and designing future sites with rich history, developers can also become positive contributors and partners in productive urban agriculture and creative open spaces in Mumbai.

CHAPTER 2

LITERATURE REVIEW

2.1 (Edible)Landscape Urbanism:

The term landscape urbanism emerged in the year 1990s as a design theory of Urban Planning and can be considered as a paradigm shift from the 'new urbanism movement' related to Urban Design. The term explains the importance of designing the city while keeping its landscapes in center. The landscape architects started using the term in North America to reorganize the degrading post-industrial cities such as Detroit. In the late 2000s, architects in Europe started using the term to design huge infrastructures, open spaces and parks. In late 2000s, the term Landscape Urbanism became commercialized and was used in designing multi-phase parks. (Wikipedia)

At present, landscape urbanism movement is not focusing on the four parameters of the term stated by James Corner namely, "*Process over time: To understand the natural changes that is inevitable in the environment. Horizontality: Understanding the true state of landscape that is horizontal and not vertical. Working Techniques: Adapting the technique to the nature and not molding nature according to your techniques. The imaginary: Making use of imagination for extension of new relationships and possibilities." (Corner J, 2014)*

Most of the projects are more commercialized the ratio of softscapes and hardscapes is not taken into account. Most of the projects do not consider the local ecology and do not try to revive the memories that once created the space. Whereas there are projects such as Fresh Kills, a landfill project on Staten Island, New York City, which was once a huge dump yard,

transformed into nature park of 2200 acres of land with recreational facilities. The landfill was closed in 2001 and the completion of project is anticipated by 2036 *(Wikipedia).* Likewise, Mumbai has also worked on similar projects of conversion of a dump yard into Nature Park in Mahim. In 1977, the Bandra Sion link road dumping ground was closed and the same year the World Wide Fund for Nature (WWF) sanctioned the proposal of Mahim Nature Park. Later, in 1980s the US National Park service team helped design the park. Also, under the 'Swachh Bharat Abhiyan' movement Mumbai Metropolitan Region Development Authority MMRDA gave a brief to come up with the sustainable design strategies to revamp the Mahim Nature Park and Cyclist and Pedestrian trail for the Mitthi River Bridge with the initiative to clean Mitthi River *(Global Design competition, 2015).*

Another, major transformation is the High Line Park New York, which was founded by 'The friends of the High Line' in 1990 when the New York government was about to demolish this old elevated rail line. High line parks received funding from the Friends of High line group and it is one of the most remarkable landscape projects. Also, it increased the value of the neighborhood and it is the most recognized initiative all around the world. This short list of projects is a good example of how the urban projects could play an important role to revamp the natural resources and urban infrastructure *(Wikipedia).*

However, the cities today need to recognize the challenge of food insecurity due to rapid urbanization and the need for creating the growing opportunities for the development. In the near future the food insecurity will increase. Food insecurity problem is not new, North America in World War II and Europe in World War I, were affected and they promoted urban farming to get out of it. Today, urban agriculture should be taken into consideration to design and redesign

resilient cities on the basis of sustainable development. One such example is the Downsview Park in Toronto's suburb on the former industrial property. It is basically a 'Tree City' concept employed for recreational and residential development *(Gorgolewski, Komisar & Nasr, 2011).* The project would restore the old buildings on the site and also the open spaces. Food production is the major design component for the development of the 20 acres huge Cultivation Campus in the program. This zone will comprise a horticultural center, green houses, gardens and educational program facilities.

Another interesting project is the Andy Guiry's Gardiner urban agriculture hub, a theoretical project, promoting the idea of using the elements of urban infrastructure; for example, elevated highways, cycling and pedestrian trails, railway lines etc. incorporate food production *(Gorgolewski, Komisar & Nasr, 2011)*. The proposal was for the waste space below the Gardiner expressway at the intersection where Don River enters Lake Ontario. The site is contaminated by the oil refinery and has the waste land along and below the highway. The idea supports the Jane Jacobs concept that "gaps within the urban fabric isolate communities and are places for developing strategies for appropriating unused spaces to accommodate the needs of the local population, including food." *(Gorgolewski, Komisar & Nasr, 2011).* The project uses the space below the express way as the green house for food production as the area gets ample sunlight entering below the expressway due to it east to west expansion. The concrete highway mass adds to the benefits of maintaining the temperature of the green house. The flood water from the river is to be collected and used for farming. However, the water is contaminated; hence, the walls on the northern side has plants that can absorb the contaminants from the soil. In addition, the columns with plants that could absorb air pollution are installed around the site. Ultimately,

the proposal is designed to stabilize the relationship between the natural systems, infrastructure and urban development.

2.2 Utilitarian Agro-Planning:

Delft, The Netherlands

In this city, the planning regulation is adapted to incorporate agriculture in peri-urban areas of Delft *(Adre, Bohn & Howe, 2005).* The Eastern edge of Delft has about 35 hectares of land which is rented to the farmers on short 12 year leases for agriculture. Farmers committed to organic farming are allotted the land in collaboration with the environmentalists and planners. The public and private lands are differentiated via the transition area for wildlife habitat on the perimeter of the farms. The farm lands also have cycling paths and walking trails and recreational areas for the nearby residents. Moreover, the wetlands, marshy lands, reed beds and water bodies help improve the ecology and state of water management in the area. The planning focuses on the horizontal intensification and not the vertical intensification which promotes all the agricultural practices by stacking the floors. The major drawback of this planning strategy is that the lease is given for 12 years and hence it's not permanent.

Kathmandu valley, Nepal

In Kathmandu the agriculture is incorporated by reserving the agriculture zones in the Madhyapur Thimi Municipality development plans *(Adre, Bohn & Howe, 2005).* The major challenge for this model is to convince urban planners of urban agriculture benefits within the conventional urban development strategy. The municipality has the right to release the land

from the reserved zone if they have any glittery development project. The geography of Kathmandu denies the construction in some areas and as a result, urban agriculture was the most economical way out. For a similar reason, urban development is denser in areas where sufficient use of land is made available. Hence, the local municipality promotes urban agriculture in areas where urban development is possible to a minimal extent. Biodegradable waste and sewage can be used as compost after proper processing and treatment and similarly, treated water could be used for agricultural activities. This adoption of this approach is a major reason why the government promotes urban agriculture as a city development strategy.

Gaborone Botswana

Gaborone city has always been importing food from neighboring localities *(Adre, Bohn & Howe, 2005)*. Subsequently, the city identified agricultural sites in the Glenn Valley area which is anticipated to make the city self reliant. The interesting planning strategy is adopted for the Glenn Valley, which is near to the Sewage works along the Notwane River. The concept is to use waste water from the sewage works for irrigating the non-edible plants such as fiber or wood. In Glenn Valley, plots are arranged back to back to reduce the access of the roads. Also, the contaminated water from the sewage works could be treated and used to grow flowers and ornamental plants.

Dar es Salam,Tanzania

In between 1985 and 1993, the city has recognized 30% increase in the number of goats. The government then made a decision to support urban agriculture as a strategy for city

development. Earlier, the government didn't allow urban agricultural practices, but accepted it as a measure of temporary land usage *(Adre, Bohn & Howe, 2005).* Eventually, the government began to develop buildings vertically so that one could save sufficient amount of land for agricultural practice. Likewise, the city has recognized the importance of low cost transportation of distributing the food in the city. This strategy gives importance in linking the productive landscape to transportation of food products, more efficient.

Trojan, Bulgaria

The town of Trojan in Bulgaria is a living example where urban food growing occurs in residential areas; the production is for personal use, rather than selling it. Interestingly, urban agriculture is not a part of urban planning in this area, but the awareness of it exists in this community, and it has resulted in the development of 'Experimental Rules' for urban agriculture. This positive approach has led Urban Planners to initiate an action plan where the promotion of peri-urban agriculture has been adopted and this in turn, allows the municipality to co-ordinate the implementation of agricultural projects *(Adre, Bohn & Howe, 2005).*

To achieve this, the extensive area of under-utilized lands or portions of private gardens are utilized, local farmers and professional gardeners who manage them and share the produce with the home owners.

2.3 Lack of open spaces:

Mumbai lacks open spaces, the least ratio of open space per person i.e. only 1.1 m^2 of open space per person which is almost a size of a big picture frame, in comparison, New York and London have more space per capita 26.4 m^2 and 31.68 m^2 respectively *(The guardian, 2016).* The issue related to open space in the city of Mumbai are evident in the study done by P.K Das. According to the survey, there are about 2152 reserved or designated open spaces in the city of Mumbai. Amongst these spaces, 800 are reserved under Mumbai Development Plan, other 600 open spaces are encroached upon and the remaining 752 spaces have no evidence in government records and which also have the highest ecological value *(Das P.K, 2011)*. This data indicates that such lands are quite vulnerable to be exploited in the name of development.

A major portion of the urban development pie is perceived as a piecemeal by real estate developers who built luxurious high rise buildings ignoring real demand of affordable housing *(Business insider, 2015).* Additionally, the ecology of the city of Mumbai is degraded as the city is rendered by the sole goal of development from the real estate perspective. Still in the development plan of 2034, the Mumbai Municipality, looks forward to providing an area of 2 m^2 per person *(Times of India, 2013)*. Alongside, there are numerous studies that present persuasive facts to support the idea of giving open spaces to the city for social, cultural and environmental development.

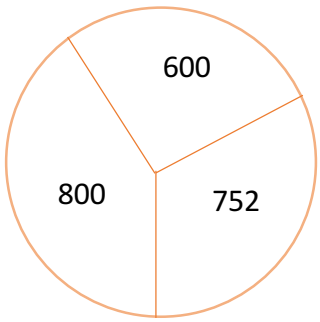

Figure 3: Total 2152 reserved open spaces, Source: P.K Das,2011, Mumbai's Open Spaces

Figure 4: Typology of open spaces in Mumbai. Source: Google images

Mostly, open spaces in the city of Mumbai are unplanned, they are left over or vacant spaces after construction on sites. These vacant lands are 'vacant' physically and metaphorically. Theoretically, vacantness of the land in any city has several aspects attached to it such as remnant lands, lands with physical limitations, reserve parcels, speculative parcels and derelict lands *(Eryilmaz, Yesim & Greenstein, 2004)*. The development of remnant lands is unsuitable and low due to its small size. Also, the site conditions in a low lying area are not suitable due to drainage issues. In addition, the places with public and private ownership are less likely to develop due to the reserve nature of the land. More evidently, lands which are contaminated

and brownfield have the least chances of development. In Mumbai, the major reason of vacancy is just the forceful stagnancy created by the real estate developers who hold on to the land to earn maximum profit. Unfortunately, the mill lands are one such example of unused land which is mostly unoccupied, derelict, and least maintained and therefore, also prone to criminal activities. The idea is to convert such vacant lands into urban farms that can give life to such spaces and increase safety in the surrounding neighborhoods.

Such spaces could become vibrant with least scope of any new construction and can still be revitalized. It can also provide economic benefits to the former mill workers who lost jobs due to mills' closing, as it is the most suffered community during the whole movement of land acquisition. As per the 2030 development plan of Mumbai, there are about 170 hectares of vacant lots that Municipal Corporation of Greater Mumbai (MCGM) are planning to give back to the city to improve the ratio of open space per person from 1.1 m^2 to 2 m^2 per person. It is critical to identify and understand the nature of these vacant lands and their appropriateness for urban agriculture and investigate methods on how it will affect the community around it. The vital aspect to consider here is to evaluate such vacant lands, not from an aesthetic point of view, but from a sense of urgency to address the urban poor in Mumbai. They constitute fairly large that is, 50% of the total population and face serious issues such as food insecurity and lack of space. Access to such vacant lands in turn, can provide a work platform for them and a sense of place to increase their social status by providing an opportunity to work in their area of passion and expertise and as a result, improve their quality of life and financial status.

2.4 Urban agriculture and environment of cities:

Today, cities are greatly affected by the climate change, and urbanization adding to the odds. According to UN Populations Fund (UNFPA), slum dwellers in the city, are the most affected community due to climate change. This is because they settle on steep hillsides and low lying coastal zones which are poorly drained *(Zeeuw, Veenhuizen & Dubbeling, 2011).* There are over 3000 cities in such zones all around the world and about 64% are in developing regions and are growing at very high rate *(Zeeuw, Veenhuizen & Dubbeling, 2011)*.

Rapid migration of land occurs when rural areas come under stress due to heavy rainfall, floods and droughts. It's the chain reaction that shifts from one place to another, adding several layers to the issues. Hence, to accommodate growing urban populations, World Meteorological Organization suggested that urban farming should be carried forward as a mean to attempt to reduce impact of climate change. Similarly, UN Habitat mentioned urban agriculture and urban forestry to have high potential for improving the urban environment and climate change adaptation *(Zeeuw, Veenhuizen & Dubbeling, 2011).*

Environmental benefits of urban agriculture include building resilient communities by providing food security and employment opportunities, reducing vulnerability of urban groups. It allows growers to understand and learn technologies which are important to conduct land and water efficient food production *(Eryilmaz,Yesim & Greenstein, 2004).* The demand for fresh water in the city is increasing which is a serious problem *(Zeeuw, Veenhuizen & Dubbeling, 2011).* In this context, urban agriculture helps the micro climate by maintaining the green open spaces and enhancing vegetation cover (Eryilmaz,Yesim & Greenstein, 2004). It can also reduce the risk of flooding, landslides; and several other disasters are reduced due to improved urban biodiversity;

in essence, quality of life is elevated *(Eryilmaz,Yesim & Greenstein, 2004).* The environmental benefits of urban agriculture and other attributes fit perfectly in the context of the city of Mumbai. Majority of vacant spaces in the city of Mumbai are in the flood prone areas due to the location of the city in between the sea and river. Most of the slums are located on these swampy lands such as Dharavi. It replaced the Koli community whose major occupation was fishing who once occupied the land *(Shannon, Kelly & Gosseye, 2004)*. Moreover, monsoons are extreme, which run from early June through mid-September, during which it receives on average 250 centimeters rain. One can find every inch of land covered by flora and fauna due to such climate. However, due to increasing demand of housing and related services the open spaces are ignored and most of the spaces are covered with asphalt creating non porous surfaces and precious rain water is wasted. The original development of Mumbai city was basically based on the water ways connecting different fishing villages; the traces of this are the creeks, rivers and canals with patches of wetlands and mangroves breaking the hard border of land and sea *(Shannon, Kelly & Gosseye, 2004)*. Unfortunately, these wetlands are disappearing under illegal developments or eroding. Urban agriculture can help restore this ecological decline of a great city.

The increase of asphalt that links the city, leads to scarcity of water for public use. Alternatively, people obtain water from private water tank contractors who draw water illegally from the sources of water. This practice disturbs the ground water level immensely. Tapping of sources can serve as a temporary solution, but it leads to a whole new set of issues affecting the ecology of the city. Paradoxically, the city which has maximum rain also faces scarcity of water throughout most of the year. It's a serious matter of concern. Mumbai's development should take a holistic approach where the combination of policies is considered dealing with agriculture

and green spaces, land use, transport and water, sewage and drainage, energy use and conservation, solid waste collection and disposal and pollution control *(Veenhuizen Rene Van, 2006)*. Urban agriculture can help to resolve major issues in the ecological cycle of the city of Mumbai. For example, urban agriculture can lead to reduction in the use of energy and greenhouse gas emissions by producing food in the vicinity and avoiding producing waste and transportation of the resources. To grow locally is the most important factor that can eradicate the use of materials that affects the environment. Most developed countries spent lots of money transporting food from distant countries to the plates of the people *(Eryilmaz,Yesim & Greenstein, 2004).* Most of the developing countries are taking the same path. In my opinion, Mumbai with its surrounding areas is endowed with good resources to grow its own food and should take full advantage of these opportunities.

Furthermore, decentralized reuse of wastewater in the urban gardening can reduce the flow rate of waste water in the fresh water sources of the city of Mumbai. Most of the waste water is reported to be polluting the Mumbai's coast as effluents from the Manori, Malad and Mahim creeks are affecting the beach environment. Also Malad and Mahim creeks are said to be the most polluted creeks in the city *(Shannon, Kelly & Gosseye, 2004)*. Hence, waste water treatment and re-use in the city farming will stop polluting cities' rich ecological assets. In addition, the organic waste produced in the city can be recycled and used as manure in the urban agriculture process. This would reduce the need for land-fill areas and enhance local productivity.

Domestic wastes in the developing countries contain 60% - 90% of total bio-degradable material *(Veenhuizen Rene Van, 2006)* and can be used as manure. This manure will reduce the use of pesticides and chemical fertilizers and thereby reduce the mining of finite mineral resources and

energy expended to produce. Mumbai's city farming authority has adopted this aspect of urban agriculture to support the idea of agriculture in the city. Mumbai Municipal Corporation spends a huge amount of money about 4,500,000,000.00 INR (70,380,000.00 USD) per annum on solid waste management. Also, these wastes can be health hazards. Dr R.T Doshi adopted this process of reusing urban organic waste as a fertilizer in growing your own food movement. Besides, the Jhanvi Trust who took a step to clean the dump yard in the vicinity of Ambedkar Nagar Slum into a community garden as the community and nearby areas were suffering with several health issues. Therefore, waste recycling can solve problems of urban pollution and health and also be beneficial to urban agriculture at the same time.

The spaces created by urban gardens and farms provide the city much necessary healthy living areas to reduce the disorder called 'nature deficit disorder' which is the case in today's world due to concrete jungles many urbanites live in. These spaces can be linked to the interesting concept of 'Nature Pyramids'. The concept states that the nutritionist provides the nutritional pyramid to improve the health by following the diet on the pyramid. Similarly, the cities should be designed based on the Nature Pyramid where it helps to improve the health of its citizens. This is to guide the designers, planners and public decision makers. The bottom of this pyramid reflects the importance of the open and green spaces in the neighborhood. Healthy adult diets need spaces in the city for walking, strolling and sitting in the open spaces and stay connected to the nature. Moreover, the school children should have opportunity to stay in sun for healthy learning. Moving from the bottom to top of the pyramid corresponds to both, the temporal dimension of nature and its location reflected on life of individual for healthy living.

As you move to the top in the Pyramid, the intensity and duration of experience of nature is greater at different scale *(Beatley, 2014)*.

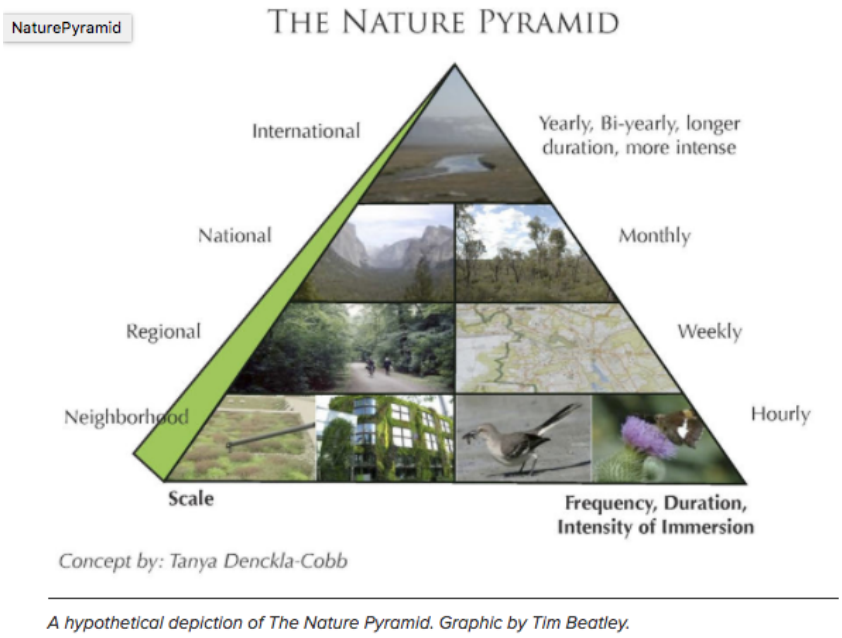

Figure 5: The Nature Pyramid Concept. Source: Tim Beatley, 2014

Urban agriculture in the city has the potential to become the foundational asset of the Nature Pyramid at the neighborhood level. Also, the city has vacant lands, which are often turned into garbage dumps and spread health issues, rather these vacant lands has a great potential to be turned into urban gardens which can improve the overall health of the city. These spaces act as a catalyst for socializing among varied community groups and to work together. The issue of lack of open spaces in the city of Mumbai can be alleviated by turning such vacant lands into urban gardens.

2.5 Urban agriculture and fortification in Mumbai:

The formation of gated communities in the city of Mumbai is based on three factors *security, pleasant environment, and lifestyle.* Safety is the major reason why people opt to leave in gated communities. However, they may not be safe as one might think; there are several incidents reported where residents have complained of theft and even murder by their own servants. The sole motto of gated communities, if it were the case to be safe from the disturbing elements, is seldom fulfilled. Likewise, the scholars working on the rise of gated communities see a threat to social strata of the society. In the views of Caldeira, gated communities are linked to the complex dynamics of fear *(Falzon, 2004)*. According to Google, complex dynamics is a study of dynamical systems defined by iterations of functions on complex number spaces. This negative relationship of social life and fortified communities was discussed in 16th century by Machhiaveli who wrote that "the prince who has more to fear from people than from the foreigners ought to build fortresses, but the one who ought to fear from foreigners need to leave them alone *(Falzon, 2004).*

In addition to safety, another reason due to which gated communities are mushrooming is the pleasant environment. As the city keeps on growing and getting congested day by day, the demand of open space to relax and for leisure also increases. The public places in Mumbai are commonly encroached by the pavement dwellers, hawkers and beggars and people don't feel safe anymore. Gated communities provide all the amenities in one place; they are like the treasure boxes. Hence, they are more lucrative to attract customers. Real estate developers nowadays, advertise and promote the new life style and blind fold the reality of the life in the city. This approach encourages discrimination of different sections of the society where the rich

are gated from the poor sections of the society. For example, the newspapers are flooded with the sharp lines such as:

Enjoy the bliss of Country life without leaving town.

At Country Park, there is an abundance of space, fresh pollution free air and refreshing greenery.

"The aesthetically landscaped surroundings begin to work their magic almost as soon as you step inside draining stresses and refreshing your senses. The beautiful gardens are perfect for tacking a leisurely stroll and the children's play area offers a tremendous sense of safety and is a sheer delight." *(Falzon, 2004)*

It is clearly stated that these communities are ready to accept the poor class as the servants but are not ready to accept them as the humans *(Falzon, 2004).* The same attitude is also reflected in the design of public spaces also. One such example is the Bandra Bandstand, developed as the public space by the efforts of Bandra Bandstand Association. This public space is not public, it's gated and disguised as a public space. The hawkers, beggars and other poor classes are not allowed near it. The beautification of the place doesn't allow anything or anyone, especially ordinary people, to fit into the frame of pleasant environment. Hence, the poverty and overpopulation is the major reason that affects the definition of urban serenity of middle class community of Mumbai who can't tolerate the poor people who for instance, tries to rest in the parks and gardens which are elements of public entity. The community is not ready to accept the people who don't match the standard of their life style.

Urban agriculture helps to create open spaces that welcome all classes of people if planned accordingly. These sites serve potential to provide status to all groups of people. Poor class people get the food security and can be employed on the site to earn livelihood. Social inclusion

is the major advantage of incorporating urban agriculture in the city. Mumbai is one such place that necessarily needs to break the barriers that surround around the concept of public spaces. Moreover, the beautification or pleasant environment is not just to be considered physically, but metaphorically too. Beautification of tangible and intangible aspect of public spaces can be done by adopting urban agriculture in the city planning. There are several examples of ongoing urban gardens reflecting the non-barricaded community life. These community gardens not only provide space to socialize to the community, but also give employment to the poor class of the society. Consideration given to the lower class of the community helps to build the city sustainably. Urban Leaves, Fresh and Local, Green Souls are such NGOs that help to achieve the unity among the residents.

Additionally, Green Souls has established community gardens in remand homes, hospitals and schools that help to heal the disturbed community and also focus on the youngest group of the community. The project by Green Souls in the St. Jude's Children Hospital produces organic food for the children suffering from cancer. Urban agriculture's aspect of providing food security and nutritional food to the poor community is the most important factor of its incorporation in the city than in the rural areas. The urban food production not only satisfies the need of the urban dwellers, but also satisfies other parts of the population. It is estimated that 15 to 20 % of the world's food could be produced by the 200 million populations in the urban *(Zeeuw, Veenhuizen & Dubbeling, 2011).*

2.6 Urban agriculture and community development:

The open spaces per person in the city of Mumbai are close to nothing, it strives for the spaces to breath. Every city provides the sense of contentment to its citizens by providing resources for the survival such as food, water, shelter and related infrastructure. But it also offers the spaces to socialize which are very much in demand in Mumbai. Most fruits and vegetables are bought in grocery stores, thereby distancing urban residents from the land on which the produce is grown *(Barton 2002).* Urban farming in the city at a small or large scale helps to connect people and make the social capital out of it. A neighborhood in Spence, Manitoba has urban garden that allow one to come in contact with the Earth and socialize *(Zubrycki, 2006).*

The implementation of urban farming ideology can help attain the sustainability goals set by United Nations Local Agenda and World Commission on Environment and Development's Our Common Future in 1987 *(Zubrycki, 2006)*. Urban farming can facilitate the sustainable development of any city which is not a new approach. Whereas, for Indian city, its intensity is less compared to that of other western countries but it's not impossible to reimagine the urban development on the same trail. Moreover, Howe suggests that 'a city's ability to feed itself is perhaps an important component of sustainable development *'(Howe, 2002).* Also, urban poor can get more food secure if this ideology is sanctioned and promoted officially. There are almost 170 hectares of vacant land in the island city of Mumbai and these spaces can play a very vital role in changing the image of the city. If one considers these vacant lots as the assets and convert them into community gardens, it can help bring communities together. Karen Schmelzkopf in urban Community Gardens as Contested Spaces, describes that community gardens made people from diverse background come together, to make it work (Schmelzkopf K.,

1995). She further continues that during her case study of community gardens in Loisaida, in lower Manhattan she found that gardens, along with Sunnyside Garden and Miracle Garden, are run mainly by whites. Gilbert's Sculpture Garden, All People's Garden and a Squatter Garden were looked after by African Americans. One Squatter Garden is part of the Lower East side Ecology Center, which also functions as a recycling site *(Howe, 2002).*

Chris Firth, Damian Maye & David Pearson observed from different perspectives the social capital that generated from these spaces. It is important to understand this ideology of authors to value the concept of community development through urban farming. They describe based on the bonding, bridging and linking the social capital: *Bonding social capital is defined as strong ties between individuals in similar socio-demographic situations, such as immediate family, close friends or neighbors. Bridging social capital is used to describe more distant ties of like persons, such as loose friendships or workmates. Bridging social capital tends to be outward looking and brings together people from across diverse socio-demographic situations. Linking social capital concerns connectivity between unlike people in dissimilar situations. It refers to connections with people in power, such as those in politically or financially influential positions (Firth, Maye & Pearson, 2011).* They demonstrate the idea of the described by two case studies; one of which is Arkwright Meadows which falls under bridging the social capital as it helped to eradicate barriers between Asian and Black community.

According to this study, volunteering is the most important aspect of community gardening. It not just helps wider population, but also helps an individual to learn new skills and improve its social work. Also, he explains how the common space outside the house helps to create bonding and develop the social capital. Also, the activities like cooking, eating and growing food helps to

socialize all ages, ethnicities and socio economic backgrounds to interact informally. Lastly, the social capital can be developed by linking institutions and authorities that have access to the resources which may be beneficial to the gardeners. The argument that comes up with the last point is that it can also prove critical to involve authorities as if it doesn't work ethically and can take advantage of it.

Food, in particular, has a unifying role in the community contexts (McGolne P. et al. 1999).

Community gardens thereby, provide a space where people can gather, network and identify with one another as residents of the neighborhood (Glover, Troy, Diana & Kimberly, 2004).

As the space for urban farming is important, people's involvement is equally important for success of the movement. The Vacant lands have several layers of ownership attached to it. Since ages, there are different ways that people try to acquire the spaces by legal and illegal ways. Karen Schmelzkopf's paper states how the city owned fenced land, was taken by a small group of thirty, by throwing balloons filled with seeds and bulb until they got permission to garden on the lots (Schmelzkopf K., 1995). Moreover, Blomley N. described that if residents will maintain the Greenway, Vancouver the result will bring the responsibility for the street as a whole rather than for only your own property *(Boomley, 2004)*. In addition of the attainment of the land with people's involvement, it is also important to get the experts such as horticulturist and botanist who has major area of interest to run the urban farms to it's best.

In addition to this, more volunteers who participated for this movement will always be welcomed, but it's very difficult as people in Mumbai work too hard and party too hard and then they don't have time to spend on such activities. Unlike New York, Mumbai has no sufficient financial resources to hire full-time or part-time volunteers *(Satterlee, 2015)*. To maintain the

urban farms is not an easy task to take on; it requires lots of energy and labor work to maintain a piece of land. However, it is not impossible to reach the goal if one has a structure of work affiliated with the authorities and institution from where they can get financial and Labor resources. This aspect of making community life more vibrant by adopting the idea of urban agriculture is evident in the city of Mumbai. There are several nonprofit organizations, which work towards the movement of city farming and are inclined towards the goal of environmentalism, chemical free produce and education on food security *(Sparling & Jeoy, 2016)*. Moreover, State Agriculture Board of Mumbai is encouraging the Farmers' Market and is about to roll out 100 such markets throughout Mumbai city *(Hindustan times, 2016)*. These discussed practices are evidence that people of Mumbai are aware and ready to take the path of urban agriculture. They can pressurize the authorities to open the gates for such social, ecological and environmental intervention in the form of urban agriculture. Community of Mumbai is taking steps and is aware of its power to bring change. Reclamation of Bandra waterfront is one such example of urbanism that is outcome of pot of energy of individual from different disciplines such as designers, local resident, government representatives and private companies. The former dump yard is now converted into public space.

"In a city that has often underappreciated its natural environment and island geography, the initiative is a visible demonstration of the significance and value of open space for all of Mumbai's citizens. It also illustrates how such urban projects can be initiated by ordinary residents, and the significance of community participation." *(Rosa, Marcos, Ute & Ana, 2014)*

Informal settlements of Mumbai have major issues of sanitation and so, health risks are very prominent in such areas. However, there is a community organization called Triratna Prerna

Mandal that took a noble initiative to maintain community toilets to the Khotwadi informal settlement. Under slum sanitation program which was funded by the World Bank and led by Municipal corporation of Greater Mumbai and Implemented by SPARC (NGO) *(Rosa, Marcos, Ute & Ana, 2014)*. TPM not only maintains toilets, but they go beyond their limits to help the community. First floor of the toilet complex has computer classes to teach English to the community. Simultaneously, the space also has kitchen where they cook for the school children under the government program. They also provide gym, yoga and dance classes facilities in the derelict buildings which were unused and less maintained. They also installed solar panels on this building to generate energy and also a rainwater harvesting system was adopted in such derelict building. Most likely, they are indulged in several recycling, waste sorting and gardening activities that enhance the neighborhood.

"In an area that many would dismiss as a 'slum' the project demonstrates the ingenuity, capacities, and capability of the local community to improve its environment and circumstances through partnerships and alliances. It shows how even basic infrastructure and limited space (the community toilet building) can provide and impetus for much wider community activism and urban change." (Rosa, Marcos, Ute & Ana, 2014)

The above instances depict the depth and willingness of the people of Mumbai to work towards the betterment of the community. They are trying hard to bring life to the city by groundbreaking ideas which are very inexpensive and down to earth. The public spaces need not to be fortified or beautified instead; they just need to be humanized by understanding the needs of the users in the context. The impact of new intervention at urban level is only possible by the participation of the community and is boosted by the backing of the authorities. Hence,

incorporating urban agriculture as the idea to improve the community life in the context of Mumbai city will work for sure. Furthermore, the impact of it will inspire the authorities of other cities in India to build resilient cities and live a sustainable life.

2.7 Constraints of urban agriculture in city:

Urban agriculture could enhance four vital pillars such as Health, Community, Economy and Environment for the sustainable city development. It's a two-way beneficial approach not just for the environment, but people too. However, there are constraints that are attached to its implementation and growth. Involvement and Knowledge of people from different discipline is very much essential for adopting urban agriculture as a movement in making the city and community sustainable.

The major barriers that threaten the pace of acceptance of urban agriculture in the city are financial and policy barriers. Financial barrier mainly deals with the land acquisition in and around the city. The vacant lots in the city are very expensive to own or lease by the authority from the owner. As vacant land located in the city of Mumbai is very difficult to acquire.

In such cases many people go for guerilla gardening which is a method to do urban gardening in an illegal manner. Moreover, it is very difficult to fight for open space and housing demands in the city like Mumbai where 50% of the population lives on the 8% of the land. Then, the green space ratio to people is extremely low compared to cities around the world.

One such case is the Sanjay Gandhi National Park in Mumbai where the Public Interest Litigation (PIL) was filed by the forest authorities to stop the encroachment from the informal settlements. However, deep down it was revealed that the encroachment was not just done by the poor class of the city but there were several commercial and residential activities going on that belonged to

higher class which was least recognized by the people. The relocation of these informal settlements was ordered by the government, but only half population was recorded to be moved on the peri-urban areas. However, several conflicts occurred related to this which depicts that such communities are isolated and accessibility to services and employment is least. Hence, the demand for housing is more compared to open spaces in the city *(Marie, 2007)*.

In addition to the land acquisition issue, there is another major constraint for the urban agriculture practice that is to understand the type of soil suitable for it. The contaminated sites in the city are not suitable for growing food as they have maximum lead content in the soil. Also, the roots of any vegetation show affinity to the lead. This makes the whole process of growing healthy food not acceptable. Hence, to grow food one should use containers, raised beds or site remediation. These practices are very inexpensive and can be easily assembled by the community around and reused. Furthermore, the use of access water for gardening is the major concern for the practice of urban agriculture. Hence, city should consider the several water harvesting techniques in the planning of urban agriculture on site. There are other factors like site fencing, sheds and greenhouses that adds to the expenses.

Also, the organizations or authorities who possess all rights to farm and garden on the specified lots, still have to go through several policy regulations. Municipal government could help to regulate the policy barriers related to the urban gardens. There are varied zoning regulations for different municipalities for implementing urban agriculture in the inner city. For instance, the lawn vegetation should be at a certain height. Also, some zones do not permit to have community garden related to its proximity to industrial areas. Furthermore, the on-site sale is not allowed in the city area depending on the city policy and should be done beyond the city

limit. The farmers' market and vendors are not allowed in certain areas as they create congestion by activating vehicular movements in the areas *(Mukherji, 2009)*.

Depending upon the constraints discussed above, it is very important to investigate the condition of the urban gardens in Mumbai city. Most of the urban farms are on the roof tops of the residential buildings and they often conduct workshops to spread awareness about the urban agriculture. It is quite essential to look into detail the structure of the workshops and use of space in such conditions. Moreover, the type of vegetation should be studied in detail to understand the rules and regulations. Also, the reaction of the people living around such sites is important to understand as it will help to analyze the urban gardening concept in detail that can be easily fit into the different residential or commercial concepts.

CHAPTER 3

Traces of Urban Agriculture in Mumbai

3.1 Emergence and spread of UA in Mumbai - 1968 to 2017:

It is paramount to be aware of the history of urban agriculture to cognize the role of urban agriculture in the Indian cities. Contemporary agricultural system stems from dearth of food in the 1940's during British imperial rule. During the period of Indian independence, curbing food shortages was the primary concern of the government and food insecurity was the immediate priority of new Indian National Government in 1947 *(Bipan Chandra, 2013).* Ultimately, the introduction of fertilizers and pesticides were at boom to get the quantity of crops and neglecting the quality. In addition to this, U.S in 1968 coined the term 'Green Revolution' which was used by Agency of International Aide in accordance to the high yielding varieties of the crops in developing countries. Due to this, crop production dramatically increased throughout the countries which were part of this movement *(International Food Policy Research Annual Report, 2002)*.

Growing your own food on the rooftops, kitchen windows and backyards was a common practice in Mumbai. These activities helped people to grow extra food and earn an extra dime for the family. This approach helped people to exchange their produce with neighborhoods and socialize at the same time *(Ganapathy R. J, 1983)*. However, the Green Revolution and Industrialization of 1960's and 70's led to urbanization and ceased the practices of growing your own food. Surprisingly, formal urban agriculture began in Mumbai in 1975 when Indian Railway launched their "Grow More Food" campaign. Under this campaign the "vacant lands" along the railways

were leased to the railway employees for vegetable production. The intent of this movement was to avoid the encroachment of these lands by slums. These vacant lands around the railways sum up to 33,176 acres and are still in use as urban farms and also available for temporary leases

Figure 6: Lokmanya Tilak Terminus Railway Farms. Source: Krutika Patel

until now. *Grow More Food* campaign was introduced when 'Green Revolution' was at the peak level and the farms were marked accordingly *(Ganapathy R. J, 1983)*.

In recent years, urban farming is in the air of Mumbai. Dr.R. T Doshi, a strong believer of city farming is leader of the movement of a city farming on a small scale basis. He teaches people from all classes and age groups, the techniques of growing their own food with no waste. Also, there are several non profit organizations, working on city farming and are inclined towards the goal of environmentalism, chemical free produce and education on food security *(Sparling &*

Jeoy, 2016). Also, State Agriculture Board of Mumbai is encouraging the Farmers' Market and is about to roll out 100 such markets throughout Mumbai city *(Hindustan times, 2016)*. These discussed practices are evidence that people of Mumbai are aware and ready to take the path related to urban agriculture. They can also influence give pressure authorities to promote social, ecological and environmental intervention in the form of urban agriculture. In addition, there are several other NGOs with similar goal of providing organic food based on the reuse, recycle and reproduce methodology.

Consideration given to lower income group of the community helps to build the city sustainably. Urban Leaves, Fresh and Local, Green Souls are such NGOs promoting the unity among the residents. Moreover, Green Souls has community gardens in the remand homes, children and youth hospitals and schools which helps to heal the disturbed community and also focuses on the youngest group of the community. The project by Green Souls in the St. Jude's Children Hospital produce organic food for the children treated for cancer. Additionally, the Fresh and Local NGO produces organic food in the small portion of the Dharavi slum in the cultural center where it also runs small kitchen. They also have gardens for the restaurants providing healthy food to the community.

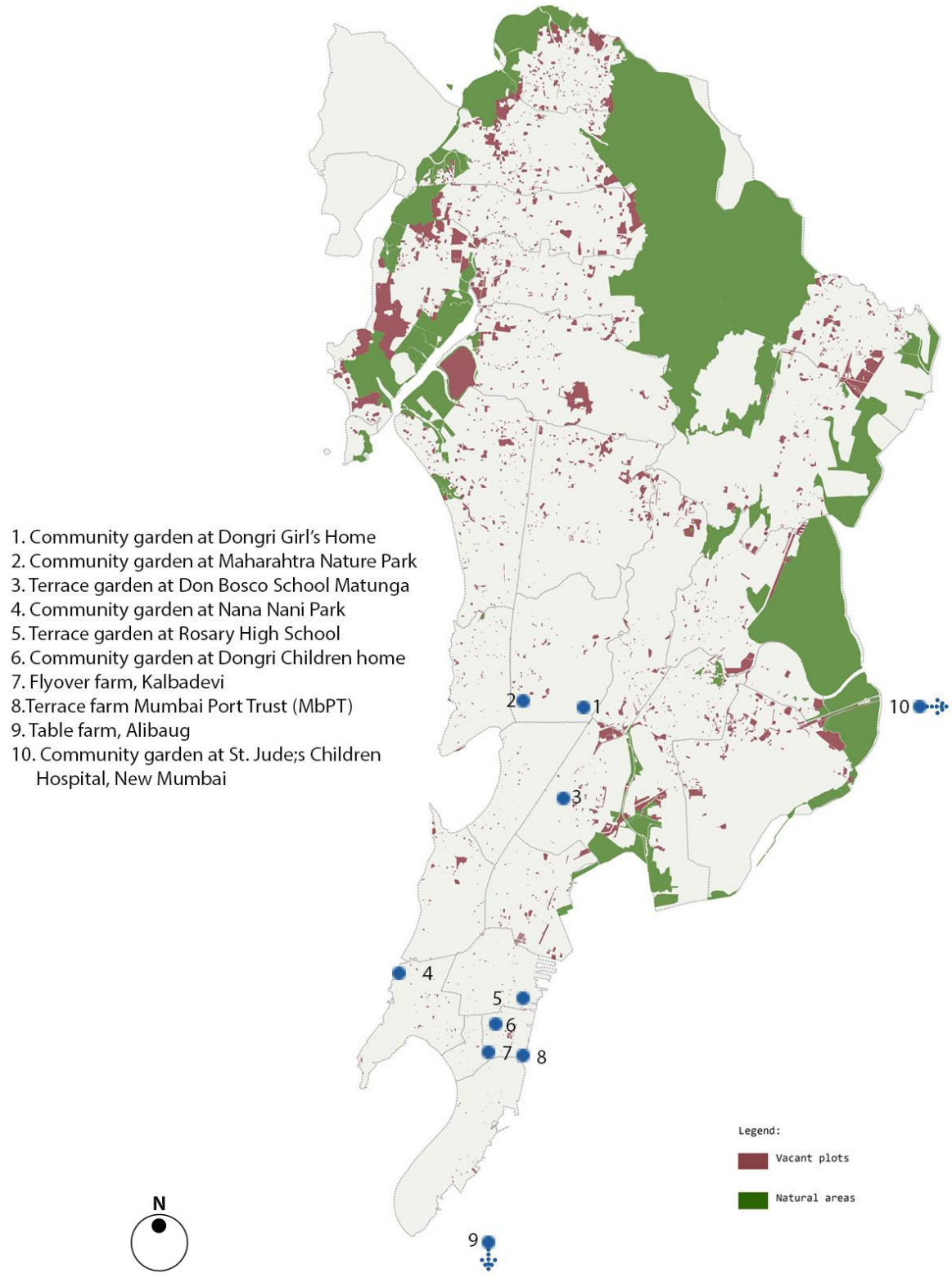

Figure 7: Map showing locations of Community Urban Farms in Mumbai. Source: Arc GIS by Krutika Patel

This demonstrates the urban agriculture's aspect to provide food security and nutritional food to the poor community, the most important factor of its incorporation in the city. It is estimated that 15 to 20 percent of the world's food could be produced by the 200 million population in the urban markets *(Mougeot, 2010).*

3.2 Urban Soul:

Urban Soul is the Non Profit organization (NGO) in Mumbai working on two major areas: Environment and Community. Founded in the year 2012, by Julius Rego, a volunteer in Bombay Natural History Society (BNHS) in 2008, who gained knowledge about organic farming and laid the foundation for his own dreams. The aim of the NGO is to produce food by using natural resources and unused land in the city.

Firstly, environmental strategy of the initiative is to identify and convert the unused spaces in the city into urban farms; secondly producing organic food free from pesticides using natural resources at each and every stage of the production. The objective is to provide healthy and uncontaminated food which is out of reach for ordinary citizens. Also, the unused spaces are given utmost importance as these spaces are the most ignored and ill-treated, end up being used as refuse dumps. The Volunteers of the NGO transform such spaces into the most beautiful edible gardens which helps people to incorporate healthy intake which is not the case these days in Mumbai. Before, the volunteers start organic farming on the identified sites, tons of organic waste on the land is nurtured and converted into organic manure. Likewise, whatever waste is produced on the site, such as dry leaves, over ripped vegetable or fruits are not thrown away but used in the manure. This forms the closed loop of the reuse and recycle as a key concept of the

organisation.

The community life is also given utmost importance in the whole initiative. It is based on three parameters: strengthening trust, solidarity and reciprocity among citizens and considered as natural therapy. Gardening is not just the way of producing food but also a bridge to connect to the people of different age groups and from different backgrounds. It is linked to the proverb *connecting the dots*, where the dots, 'mind' & heart' connect to the like minded people. The voids in the hearts are filled up with the hope and joy of creating and nurturing something. It brings the community together by taking care of the plants, producing organic manure, collecting waste, harvesting produce and watering them. This NGO supports social issues through urban farming movement in various ways whether it's growing food for Cancer patients, the victims of women trafficking in rehabilitation. Urban farming is the way to help combat social issues in the community and making the life more sustainable and save the planet.

Community Projects

St. Jude Child Care Centre, Khargar Navi Mumbai (2012)

It is located on abandoned 1acre plot which is converted into urban farm, producing food for the children treated for cancer at the hospital. The major challenges that project faced were: poor quality of soil and limited budget for the resources such as raw material and labor. The parents of the children suffering from cancer come from the distant rural farming communities and help with gardening so the issues of labor and raw material is taken care of as they advised on how to farm and landed helping hand. The land was made fertile and fit to grow by collecting organic waste such as dry leaves, coconut shells and other organic waste from the surroundings.

Corporate donations were used in buying a shed, tools and to set up a drip irrigation. Local volunteers help out with different tasks related to gardening.

Children's Remand Home, Dongri (2013)

It's an initiative to provide safe, creative and healing play are to the children of the remand home. The unused plot of 5000 square feet is transformed into organic growing area with the help of children being the volunteers. The children were taught to grow their own food. Also, the setup includes a rural style cooking stove so that children can cook, the space is also used for story telling, playing games and reading. The idea was to have a creative place where the children can learn and develop.

Lady's Home for Boys, Dadar (2012)

This the boarding school for the young boys in need for care and shelter. Green Soul created the terrace farm on the roof of the building occupied by the boys. They are taught to produce organic manure from the waste around the site and grow their own food.

Government Observational Home and Rehabilitation Centre for Girls, Deonar

Rehabilitation Centre for Girls is the shelter for supporting girls who suffered from woman trafficking. The project is well hidden from the Sion Trombay Highway. Here, the land provided for farming is very fertile with a dense green cover and hence its very fertile for urban farming. The idea was to help these women to be independent and empower them with the vocational skills of urban farming which could help them in future. This could also elevate their self esteem

so that they could lead their life with confidence and spread the awareness of sustainable lifestyle *(greensouls.in).*

The NGO has reinforced their actions by reaching out via the media. They have online face book page that plays vital role in spreading the word and mobilizing the resources in the form of volunteer land and money.

3.3 Fresh and Local:

The Fresh and Local NGO stepped in the field of organic farming in the year 2010, established by Adrienne Thadani and Nicola Antaki. The initiative was based on three major factors: Environment, Community and Economy. The aim of the group is to provide organic produce to the community and use underutilized niches of the city to grow the food. Besides, their idea also touched upon the economic growth of the poor communities by providing the gardening workshops.

The major reason to start the initiative in Mumbai was because it's one of the densely populated cities in the world. In addition, the lack of open spaces and ongoing reduction in the farmable land due to growing population. Moreover, 40% wastage of food from farm to table as it takes about 5 days to reach to the markets from farms due to tropical climate. There is about 11% increase in the food prices in Mumbai since last year. Also, the lack of access to the quality food for the ordinary people of Mumbai as most of the food has been ripen by chemicals and that can create neurological damage.

The percentage of undernourished children is highest in India, along with Nepal, Bangladesh and Ethiopia. Also, the urban children are malnourished than children in rural areas due to

unavailability of nutritional food. Hence using the derelict spaces in the city of Mumbai for urban farming could reduce the above issues of affordability and accessibility of healthy and organic food. Also, it makes one more equipped and capable if one has the land, water and seeds to sow.

Community Projects

Flyover Farm, Kalbadevi Mumbai (2012)

Fly over farm is located on the roof top of the old residential building in Kalbadevi which is the busiest and old street of the Mumbai. The location is still used as the residential building for low income group and the people have initiated this step of farming on the roof top to improve the temperature of the building. Also, as there is no other open space in the 1km radius of the area, hence, this could also used as a community gathering space. The area of the roof is the 5000 square feet and the whole project was realized into 2 phases. The focus of phase 1 was to convert 2500 square feet area under use which require $ 5500 about $2 per square feet. It comprised 20 square feet area for vegetable and herb garden ,15 fruit trees and yoga classes in the area till 2013. The vision is to convert 750 square feet area into elevated vegetable herb garden, 20 fruit trees, nursery and vertical garden structures. Also, in order to activate community life workshop spaces with tables and seating spaces are also induced. A composting unit and storage area is also provided. The budget of $5500 was used in soil and potting mix, different species of trees and seedlings, shading, vertical structures, seats, tables, tools and drums. The pots are made of bamboo strips and it's done by the urban poor community who has the talent of weaving these pots. In this way the opportunity was used to augment their earnings *(Antaki, 2017).*

This idea was initiated to reflect the possibility of converting the dense and underutilized spaces into green and open spaces which could be implemented throughout the city to make it more green and open. Also, phase two is still under process of completion.

Growing Fresh Air, Kumbharwada (Potter's Community) Dharavi (2014)

This is yet another innovative initiative of Fresh and Local along with SNEHA, Mumbai based non profit organization and University College London (UCL) to purify air in the Kumbharwada. Kumbharwada is evidently known for the Kilns for baking pots and smoke. Hence the research project was initiated by UCL and along with which Fresh and Local consulted as an urban gardeners. The types of plants such as Areca Palm and Money plant to reduce the pollution created by the smoke. Moreover, they encouraged the potters to design pots for the same to create a vertical screen which could also act as a partition. Even the residents gave the idea of using hanging pots to use the space efficiently and according to their convenience could move the pots around *(Biennale, 2017).*

Sneha Pop Up Garden, Mumbai (2012)

The aim of the project was to make the public places more safe and accessible for women. According to the PUKAR, report by BMW Guggenheim Lab has an evidence of the top need of safe public spaces for women in Mumbai. About 87 % of the women find public spaces are not safe *(The New York Times, 2013).*

Hence, Fresh and Local collaborated with SNEHA who was the supporter of urban farming as an initiative to empower the women of their NGO. The group of 30 women designed the urban farm in the unused space in between SNEHA building and a compound wall of the adjacent

building which is used as trash bin and created a garden to grow organic vegetables and herbs and for a nursery. They designed a shed accommodating 8 seats and a vertical gardening technique to get more space *(Rudyruddell's blog, 2012).*

The Table Farm, Alibaug

Fresh and Local has started the farm at the home of the Jay Yousuf and Gauri Devidayal in Alibaug to produce fresh and nutritious fruits, herbs and vegetables that are used in their restaurant in Colaba called 'The Table'. The farm provides the seasonal produce grown in an acre of land. Presently, the farm could produce several nutritious veggies such as carrots, spinach, radish, beetroot and other leafy greens. Now, the farm is opened for workshops by the owners for people who are interested in urban agriculture to try their hands on *(Brownpaperbag.in).*

3.4 Urban Leaves:

The success of Mumbai Port Trust (MbPT) terrace farm which was initiated by Preeti Patil, the catering officer of the MbPT, was the stepping stone of the Urban Leaves. The striking factor of the idea is that the organic waste from the canteen was used as the manure for the produce. There are about 100 species of plants on the 3000 ft^2 of area. Later in 2009, Preeti Patil and 500 volunteers founded Urban Leaves with the green initiative of Vidhya Varidhi Trust.

The organization tries to create closed environmental loop based on the three parameters: reduce, reuse and recycle. The aim of the NGO is to "transform the concrete jungles into sustainable urban food gardens". It focuses on spreading awareness regarding the food people

eat and how it is produced? what are their benefits? How important it is to understand the source of the food? People are taught to produce their own food and work in the community.

Environment and community development are two major thrusts of the NGO. They carry out workshops, seminars, community activities and social networking activities. The mission of the Urban Leaves family was very clear from my visit to the one of the terrace garden on roof of the Provincial House in the compound of Don Bosco school, Matunga, Mumbai. The volunteer in charge during my visit was Premila Parera and she demonstrated the daily activities of the farm. Urban Leaves has the unique way of growing organic food by preparing a soil for plants called 'Amrut Mitti (Fertile Soil)', which is not the case in other NGOs this is the way they promote Natu-eco principles of organic farming. Natu-eco is the way of harvesting energy from the sun and using farming as a medium. This helps to conserve the energy in the form of produce not considering the farm output by weight *(Beyond organic, 2011).*

Community Project

MbPT Kitchen Garden, Gadiyali Godi (2000)

It was in the year 2000, when Preeti Patil who is the catering officer since 1992 decided to start a kitchen garden on the 3000 ft^2 area of the canteen roof. The driving force behind this movement was the piling waste of the kitchen that was thrown away. Preeti Patil then, decided to reuse this organic waste. She designed a roof garden which can the produce by reusing the waste from the canteen as a manure. Today, this roof top garden could house about 100 species.

This idea of reusing the waste around you and converting it into a magical manure was borrowed from the radio recording of Dr R. T Doshi who encouraged Preeti Patil to implement the idea in

the MbPt premises. Later, 20 MbPt officers with Preeti Patil and Catering Team visited the farm by R. T Doshi in the suburban Mumbai and learnt the techniques of producing the food in the dense areas. The garden house the more than 100 varieties of trees, shrubs, herbs and fruits such as chikoos, bananas, coconut and lemons.

Also, mint, tea and tulsi has variety of species. The produce has not just the nutritional value but has medical and aesthetic values to it. After two years, the garden became the habitat of biodiversity as it attracts several species of native birds and butterflies which is very rare to find in the chaos of city life. It houses the life in different forms and created the beautiful biodiversity on the terrace by urban farming initiative this makes clear how urban farming can improve the ecology of the place *(Pendharkar Anand, 2008).*

Don Bosco School, Provincial House, Matunga

My visit to the Don Bosco School, Matunga, Mumbai gave me an insight of how these terrace garden work. It is the outcome of the joint venture of the sensible client, the school authority and the Urban Leaves NGO to provide helping hand to make it a reality. The terrace initially had a small garden looked after by the client.

This school campus is made sustainable by adopting water swale to collect runoff water and also solar panels as renewable source of energy. They grow more than 100 varieties of edible plants year around based on the season. They also prepare organic manure which has three major factors: structure, fertility and Microbes and it is called 'Amrut MItti' (fertile soil). This includes all natural ingredients such as cow dung, cow urine, jaggery or sugar cane juice, biomass and water it takes more than 120 days to prepare this mixture. Additionally, when it comes to holding this

manure they prepare a retention walls by bricks and lay sugarcane waste at the bottom to give buffer space between concrete terrace slab and mud. This sugarcane waste is the major waste taken from the vendors by the Brihanmumbai Municipal Corporation (BMC) and dumped in the dump yards. The terrace had all the waste products as a structural element such as drums, bricks, bamboo poles and Jute trellis.

Figure 8: Don Bosco School Provincial House Terrace Farm, Matunga, Mumbai. Source: Krutika Patel

Maharashtra Nature Park, Mahim

The community Garden in Maharashtra Nature Park (MNP), Mahim is the joint venture of Urban Leaves Ngo with the Avinash Kubal, deputy director of MNP. The idea was to avoid dumping of the domestic kitchen waste into landfills, as it contains 40% of organic waste and according to

the City Farming association Brihanmumbai Municipal Corporation (BMC) spends about 4,500,000,000 INR (70,279,556 USD) per annum for solid waste management *(Omkar Gokhale, 2014).*

Hence, to reduce the waste production the Urban Leaves initiated a spread awareness program among the people by the community garden in the MNP. This community urban garden worked with the community living around the park and prepared manure by using collected organic waste from the surrounding. However, the MNP garden was closed recently, due to increasing trespassing and drug activities from the neighborhood. The place was no longer considered safe and hence was difficult to maintain. The initiative was though a good way for city authorities to start a cost effective waste recycling circuit by promoting urban farming in daily life.

CHAPTER 4

Vacant Plots in Mumbai

4.1 Introduction:

In every city one finds empty and derelict spaces Mumbai is no exception to this, the figure 9 shows these 'vacant lots' drawn from the land use maps from the Mumbai authority (MCGM) from the year 2014. Moreover, the land use maps by the government is miscommunicating and create a lots of confusion between the categories of land.

Hence, this data of recognizing and locating vacant land is created by using the ArcGIS software and merged with the Google Earth image to get data near to precision. Agriculture has always been the part of life since ages and has always been outside the residential zone.

History of 10,000 years reflects the importance of agriculture in the day to day life of all civilizations such as India, China and Egypt *(Philips, 2013).* However, now-a-days, the real estate demand is eating up the agricultural land and there by the people are forced to move to cities and opt for new employment practices to earn the living. In addition, the selling and buying of land has become rapid and easily accessible due to websites and application that sells the land in the fraction of seconds. Also, there are several methods that corrupts the authorities and its easy to convert the zoning of land i.e. form agriculture to residential or commercial. There has been no evidence till date that shows the conversion of any residential or commercial land to Agricultural land.

Furthermore, to begin with Detroit and other shrinking cities have done this. Urban agriculture itself demands lots of financial and physical resources to initiate and be the part of day to day life. Hence, the vacant lots could be the major resource to start this venture of turning it to the vibrant community spots within the densely populated areas. Mumbai has the breeze of change by turning old residential building terraces to urban gardens, buildings unused compounds for community farms and Urban farms besides railways.

This method of conversion of vacant lands to urban gardens can make the city safe and reliable as many unused lands are encroached by the squatters and become hot spots for crime. Also, it provides a vision and opportunity to the people of informal settlements to improve the quality of life. Most importantly, it will play a vital role in supporting the 'Swachh Bharat Abhiyan' movement, which is introduced by the Indian government. Once such initiative in Mumbai itself is the Mahim Nature Park, the site was the dump yard before and now it is being transformed into Nature Park and open for the people.

Furthermore, the analysis of Vacant land will focus on the connection of vacant lots with the four different components of the city i.e. transportation, water bodies, green spaces and informal settlements. Thereby, these vacant lots conversion to urban agriculture sites helps to reduce the social, ecological and economical issues based on the concept of (edible) landscape urbanism.

Ward	Total Vacant Area (Meter Square)
A	41234
B	47225
C	13007
D	78514
E	45465
F/N	808886
F/S	445372
G/N	49239
G/S	225397
H/E	196676
H/W	138759
M/E	1545103
M/W	765041
N	1222413
P/N	3345558
P/S	3076003
R/C	1090853
R/N	681047
R/S	1585472
S	2495137
T	1402216
K/E	875295
K/W	382797
L	640341

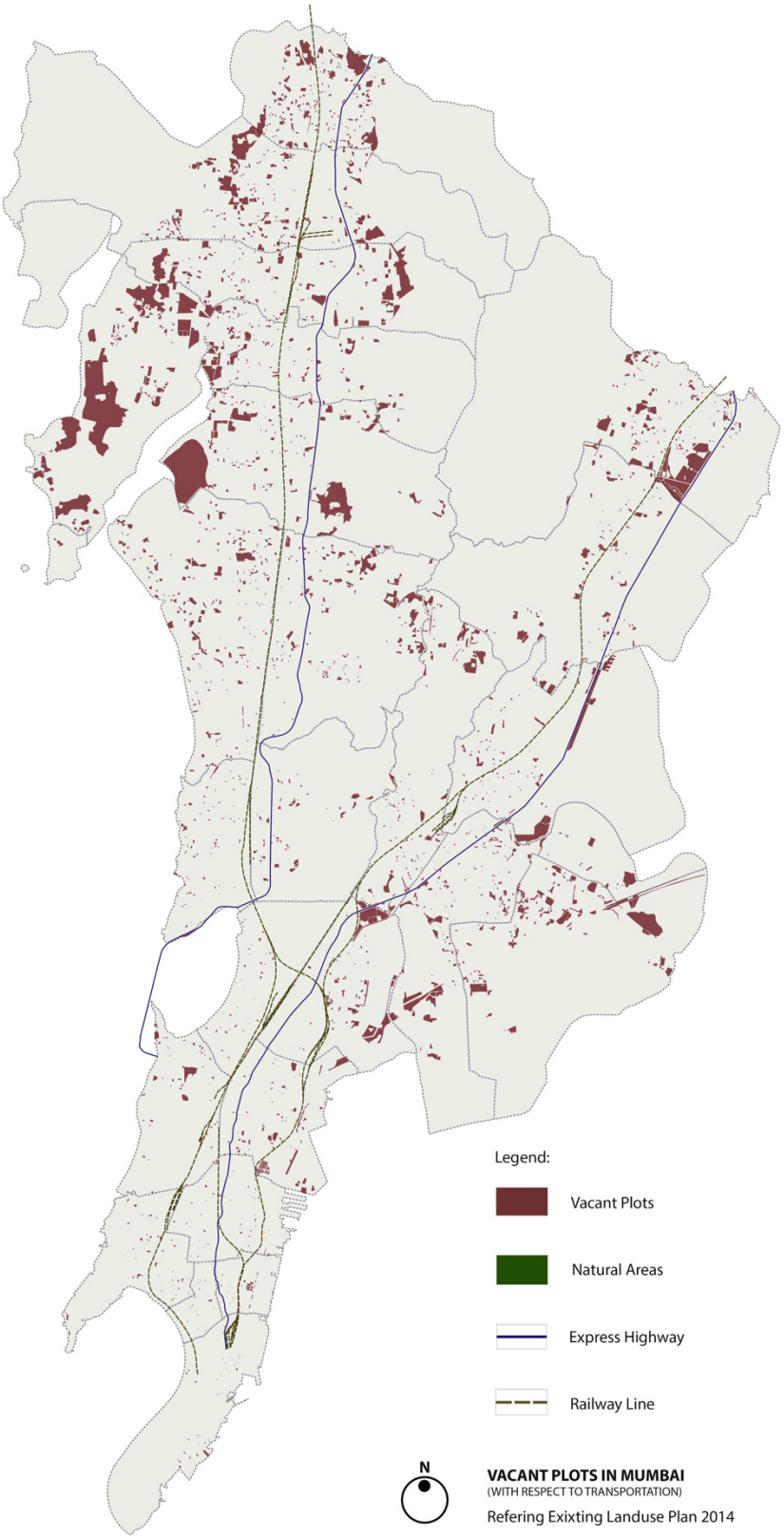

Figure 9: Map and Table showing location and number of vacant lots in Mumbai. Source: Krutika Patel

4.2 Vacant lands and openness:

Evidence of the issue of Mumbai being the last in the list of open space per person ratio with 1.1 m^2 of area in comparison to other cities around the world. The open space includes gardens, parks, recreational grounds and playgrounds. The total area of 14 km^2 for 12.4 million people of Mumbai ends up giving the 1.1 m^2 of open space per person. The total area of 14 km^2 includes 2.5 km^2 of gardens and parks, 4 km^2 of play ground and 7.7 km^2 of recreational grounds. Whereas, London, New York and Chicago has 31.68 m^2, 26.4 m^2 and 17.6 m^2 open space per person *(Rajadayakshal Madhavi, 2012).*

Due to increasing corruption and lack of awareness about the reserved open spaces by the government is diminishing. The real estate developers need for residential and commercial use. Open spaces in Mumbai are seized as the money making opportunities. Out of 2152 reserved open spaces 600 spaces are encroached and are either already constructed or under process of the same. Hence, the study of vacant lands using the Arc GIS and Google Earth can help increase the open space per person ratio which the BMC has targeted to increase to 2m^2 in the Development Plan 2034. Though it is difficult to meet the Urban Development Plan Formulation & Implementation (UDPFI) norms that is to reach up to 10 m^2 per person *(Baligal Linah, 2013).*

Considering the social, cultural and economical one should not compare quantity of the open space per person in Indian cities but should consider the qualitative aspect of it. Hence urban agriculture fits into the strategy of transforming the derelict vacant space into urban gardens under the umbrella of 'Swachh Bharat Abhiyan'.

4.3 Vacant lands and livelihood:

The vacant lands in the city turn out to be the shadiest areas and tend to be the most unhygienic spots in the neighborhood. The study of vacant lands in Mumbai provides the spatial structure of the vacant land in the city of Mumbai. The study focuses on redevelopment of these sites into urban farms to upgrade the economic status of the city and try to meet the millennium goals of eradicating poverty, accessibility to food and improving human settlements.

The most important aspect that emerges out of this study is the proximity of vacant land to the informal settlements of the city. As one can easily recognize from the figure is that most of the vacant land has informal settlements around it. As 50% of the total population of Mumbai is residing in the informal settlements, this is significant. These population is looked upon as the eye sore and as a black spot on the changing face of the city. Promoters are trying to get rid of these communities by resettlement projects or ignore their existence in the name of beautification or cleansing the city. However, this is not the case as these informal settlements play major role in the economic development of the city. These people are the essential part of the day to day life of the city, because they work in manufacturing as service providers.

The Millennium Development Goals are designed to improve the condition of these people indeed because they are the one which have the least awareness and power to change. In my opinion, these settlements reflect the byproduct of our way of living. Certainly, migration is the major reason for the formation of informal settlements as cities are the source of opportunity. In addition, its growing and eating up the source of living or traditional way of life of India that is farming.

Furthermore, the people in informal settlements end up working as the laborer on the construction sites and other informal employment. Most of the people are indulged in the criminal activities which is affecting the youth of the city. In addition, due to proximity of sea on three side of Mumbai the growth of the city is restricted. Hence, transforming these vacant lands into urban farms will not just improve the physical state of the city by making the city clean but also will also open up the job opportunities for the informal settlement residents and sustainable development.

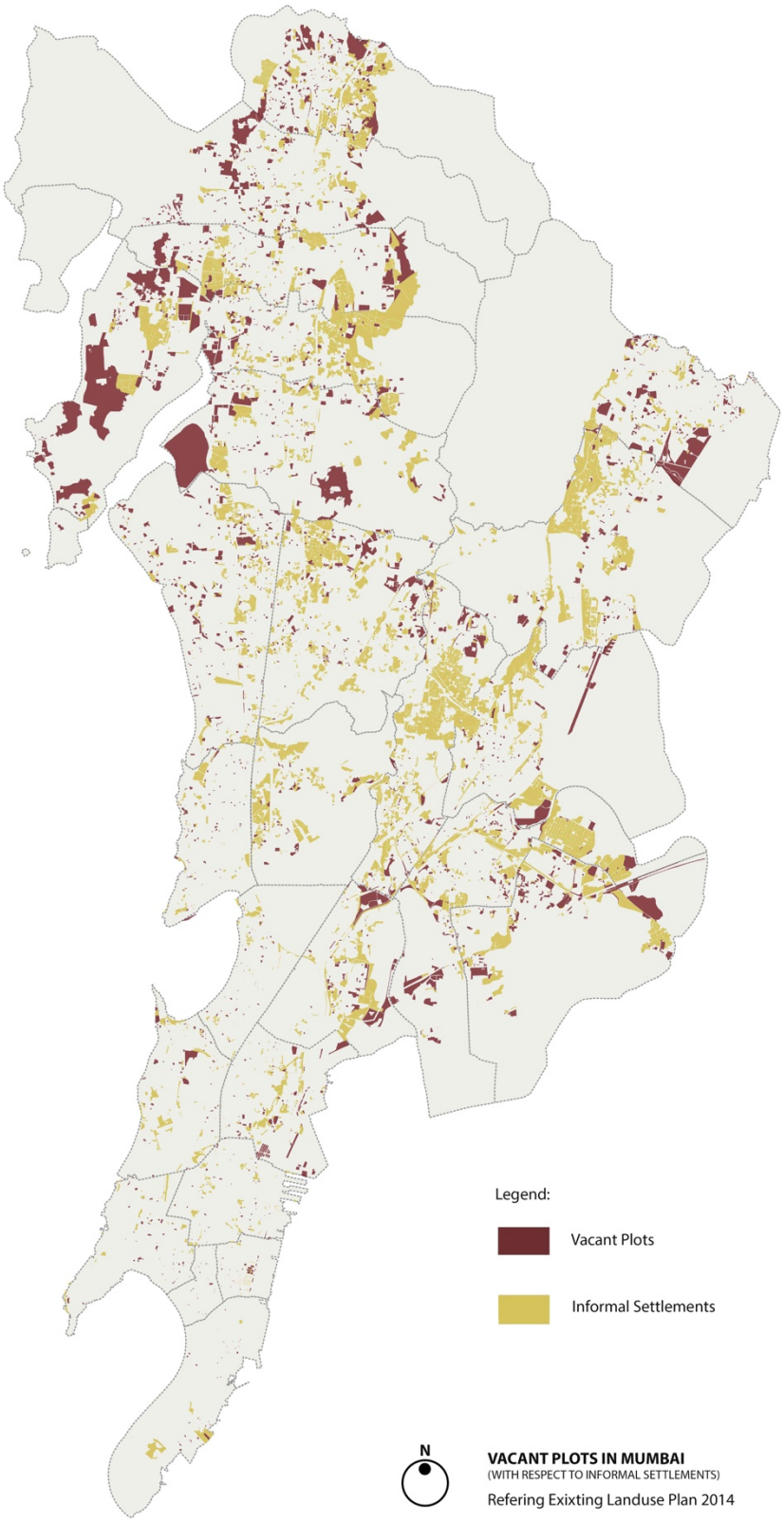

Figure 10: Vacant Plots and Informal Settlements. Source: Krutika Patel

4.4 Vacant lands and ecological reform:

Urban farming in the vacant lands has the capacity of reforming the ecological aspect of the city of Mumbai. As I mentioned before urban farming has the tendency to transform the derelict spaces into luscious green spaces with the thriving community life surrounding it.

Mumbai is rich in biodiversity which has the several ecological components such as forest cover, natural parks and water bodies such as creeks, rivers and nullahs or rivulets. The major source of water in the city of Mumbai is the six major lakes: Vihar, Lower Vaitarna, Upper Vaitarana, Tulsi, Tansa and Powai.

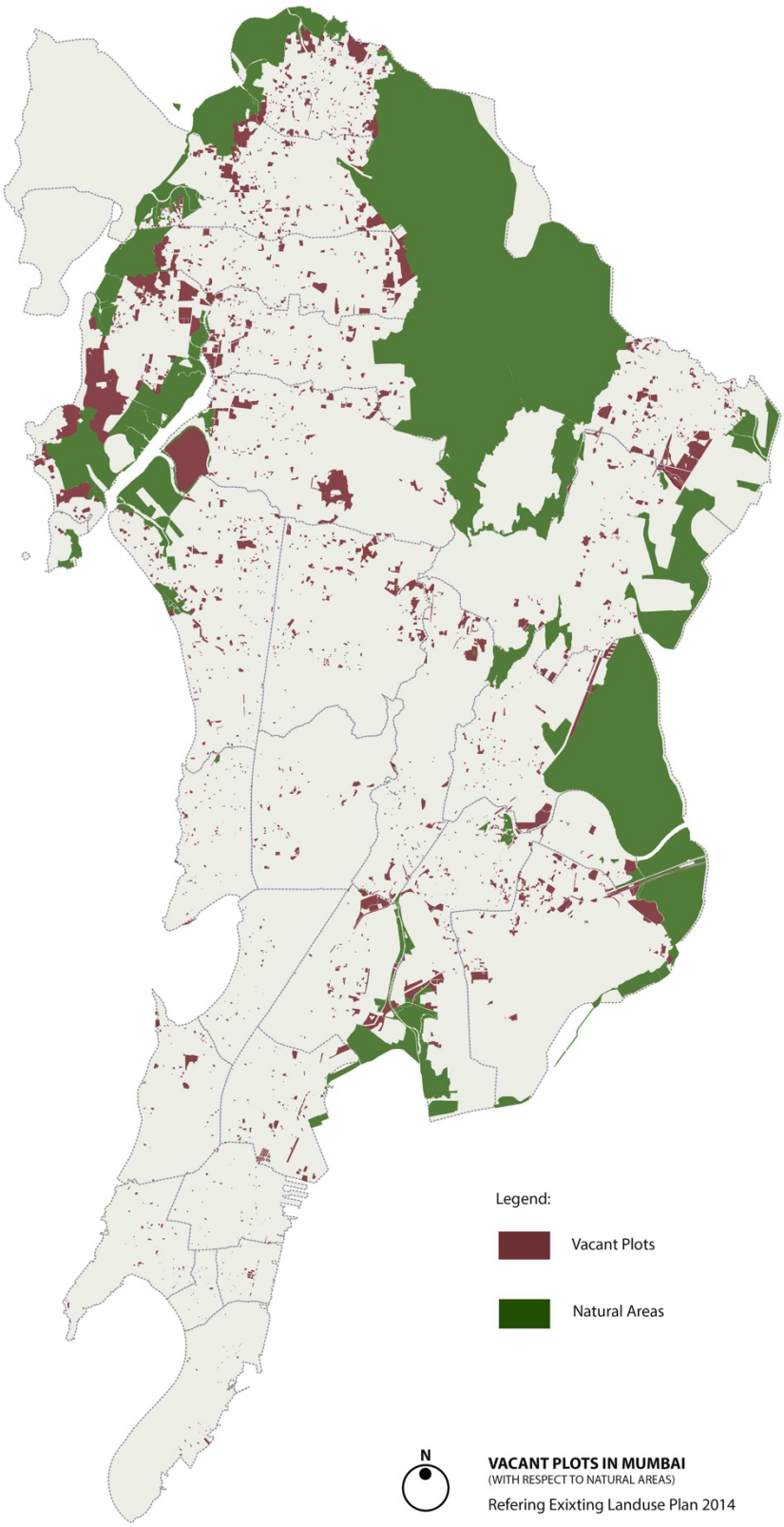

Figure 11: Vacant Plots and Natural Areas. Source: Krutika Patel

The water from the Powai lake is the mainly used for the agricultural and industrial purpose. However, while travelling through the train one can witness the most polluted water bodies. Mithi river is one such water body in the city which is is originating from the Tulsi lake and also collect water overflowing from the Vihar and Powai lakes, that gets polluted as it progresses through the industrial and informal areas in the city *(Wikipedia).* My visit to Urban farm in the Lokmanya Tilak Terminus helped me see the complexity of water for irrigation. The onsite farm coordinator use gutter water for growing the produce. This is because if they want to have a water for irrigation they need to pay extra for irrigation water. Hence avoid hassle of spending extra they use untreated water for irrigation.

The aim of considering urban agriculture as the center of redevelopment of the city and converting the vacant lands into urban farms can create pressure and need for understanding the importance of waste water treatments and its reuse. Several water saving techniques such as rainwater harvesting, water swales could also be considered as the major part of the design. The vacant lots turned urban agriculture sites could be the hot spots for following strategies:

- Collecting flowing water through swales on sites
- Promoting rainwater harvesting in the neighborhood blocks
- Creating waste water treatment plant depending on the size of the neighborhood.
- Use of Solar panels on site for electricity.

Hence if the urban agriculture sites are transformed as the hub which has all the above mentioned design strategies then the city will have the enriched ecology. This will create the whole new network of ecology throughout the city. People would definitely develop the respect for the nature around them and will be motivated.

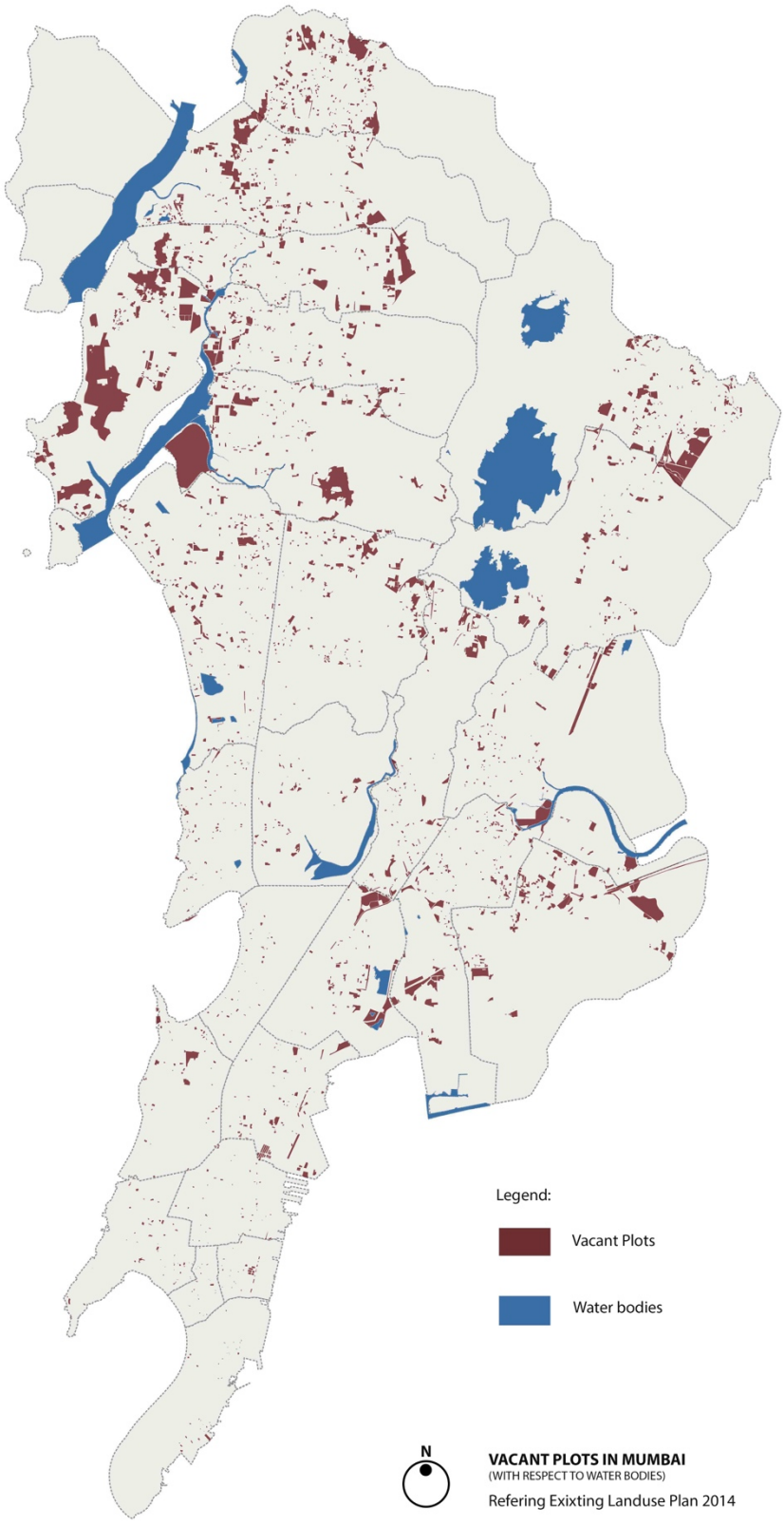

Figure 12: Vacant Plots and Water Bodies. Source: Krutika Patel

CHAPTER 5

Case study

5.1 Urban agriculture & linear infrastructure:

Food insecurity during the post colonial nationalism in 1940s was the major priority of Indian Government. In order to meet huge demand of food during the time the contemporary ways of of agriculture was taken into consideration. High yielding crops were promoted to increase the production and meet the demand. Hence, in 1950s, fertilizers and pesticides were introduced as technological advancement. Ultimately, in 1968 under Green Revolution Movement the crop production was increased drastically. *(International Food Policy Research Annual Report, 2002)* Green Revolution and Industrialization of 1960s and 70s brought forth urbanization and it adversely affected the practice and pedagogy of growing your own food.

Later in 1975, Indian railway emerged with the new campaign called *Grow More Food*. The major goal of this movement was to cease the encroachment of the railway's vacant land from the informal settlements and also to avoid popping up of the unwanted plants and trees that could affect the railway lines. Also, the major advantage of it was to generate extra revenue from the idle land. In total, Indian Railways has about 43,000 hectares of vacant land. However, only 3585 hectares of vacant land is licensed for farming under *Grow More Food* campaign out of which 340.85 hectares falls under Mumbai, with 43.88 hectares in Central Railways and 296.97 hectares in Western Railways. In addition, there is about 930.75 hectares of land, which is encroached and 230 hectares is under illegal activities. Hence to avoid further encroachment railway is planning to lay new railway tracks and expand it for future use.

Grow More Food campaign has aimed more at the quantity rather than quality of the production. Moreover, government has announced a new project worth 240,000,000,000 INR (3,748,243,011 USD) for laying new tracks, increasing railway facilities such as railway yards, platforms, Railway housing for staffs. Ultimately, land could be licensed for commercial purpose which could end up densifying the cities around the nodes ensuring the growth in the linear way. *(The Pioneer, 2016)*

Zonal Railway	Area under GMF(in acres)
Central	733.83
Eastern	626.73
East Central	2309.25
East Coast	440.51
Northern	1233.55
North Central	162.18
North Eastern	15.00
North East Frontier	2473.55
North Western	0.00
Southern	265.39
South Central	2.47
South Eastern	0.00
South East Central	371.32
South Western	0.00
Western	108.45
West Central	116.93
Total	8859.18

Figure 13: Zone wise details of land under *Grow More Food* campaign as on press release on 31.03.2016. Information given by the Minister of State for Railways Shri Rajen Gohain in a written reply to question on Lok Sabha on 14.12.2016. Highlighted Under Mumbai Railway Authority. Source: https://indiarailinfo.com/news/post/288636

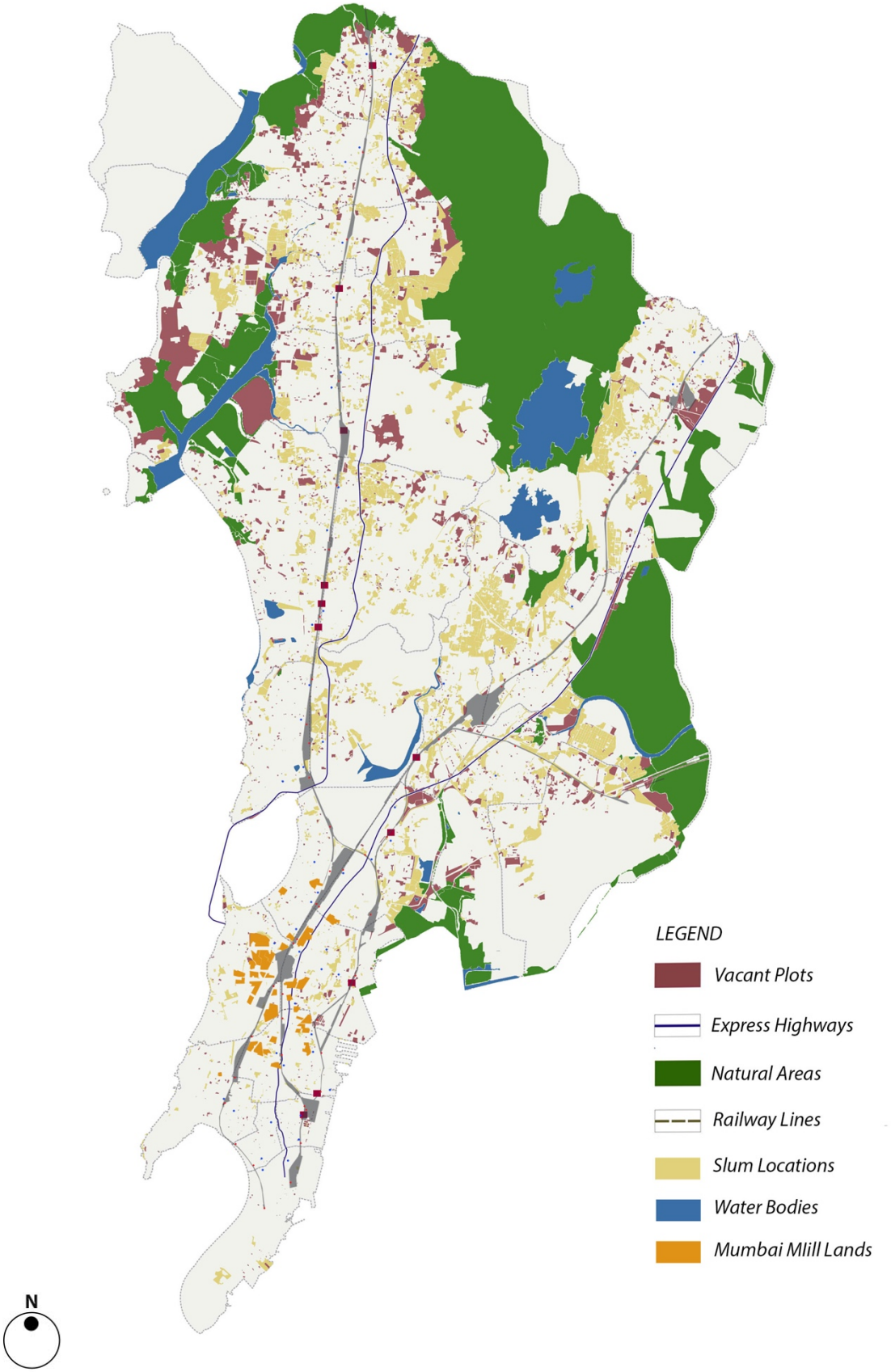

Figure 14: Connectivity of vacant lots with infrastructure of the city. Source: Krutika Patel

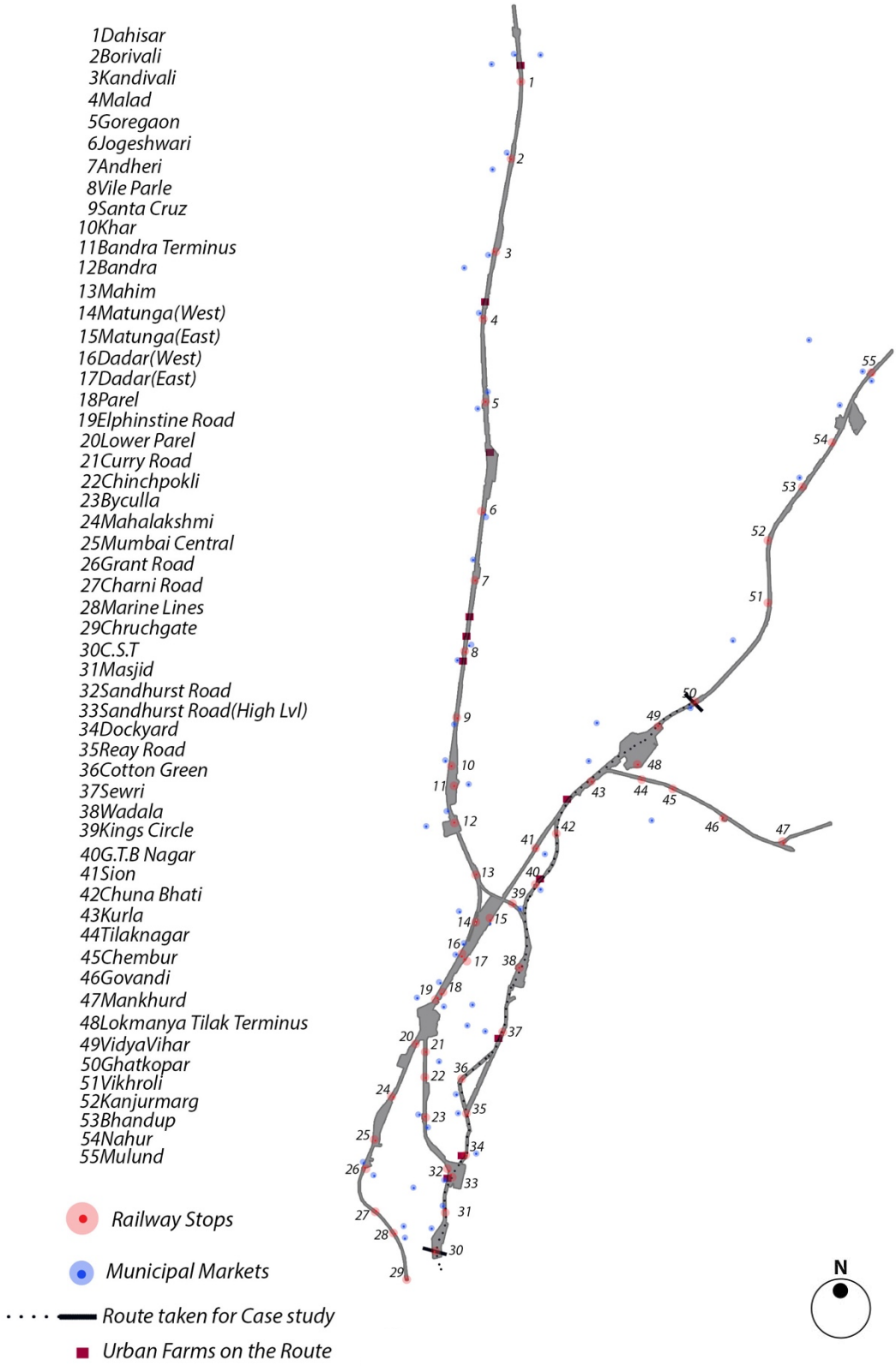

Figure 15: Map showing railway stops with municipal market proximity. Source: Krutika Patel

5.2 Rolling on rails:

I visited Mumbai to understand the depth of the urban agriculture. Urban farms on both sides of railway tracks were my starting point. While travelling by train from the North and reaching to the Chatrapati Shivaji Terminal (C.S.T) station, I saw the fields emerge from the Dahisar station and it is very overwhelming, with impressive spread of urban farming that emerges in its full physical form.

My study started from Montreal with back and forth emails asking for the appointments to visit the people involved in the *Grow More Food* campaign. Upon reaching Mumbai, I visited the Mumbai Railway Vikas Corporation (MRVC) office to get data which accounts for the number of Vacant lands they hold for farming. The information was difficult to gather because of the authority's unwillingness.

Ultimately, I prepared maps and identified the location of farms bordering railway tracks using high resolution Google Earth images and GIS data from the Urban Development Research Institute (UDRI) (login Mumbai.org). Additionally, from this online study I found a location where there is huge amount of land undergoing urban farming at Lokmanya Tilak Terminus.

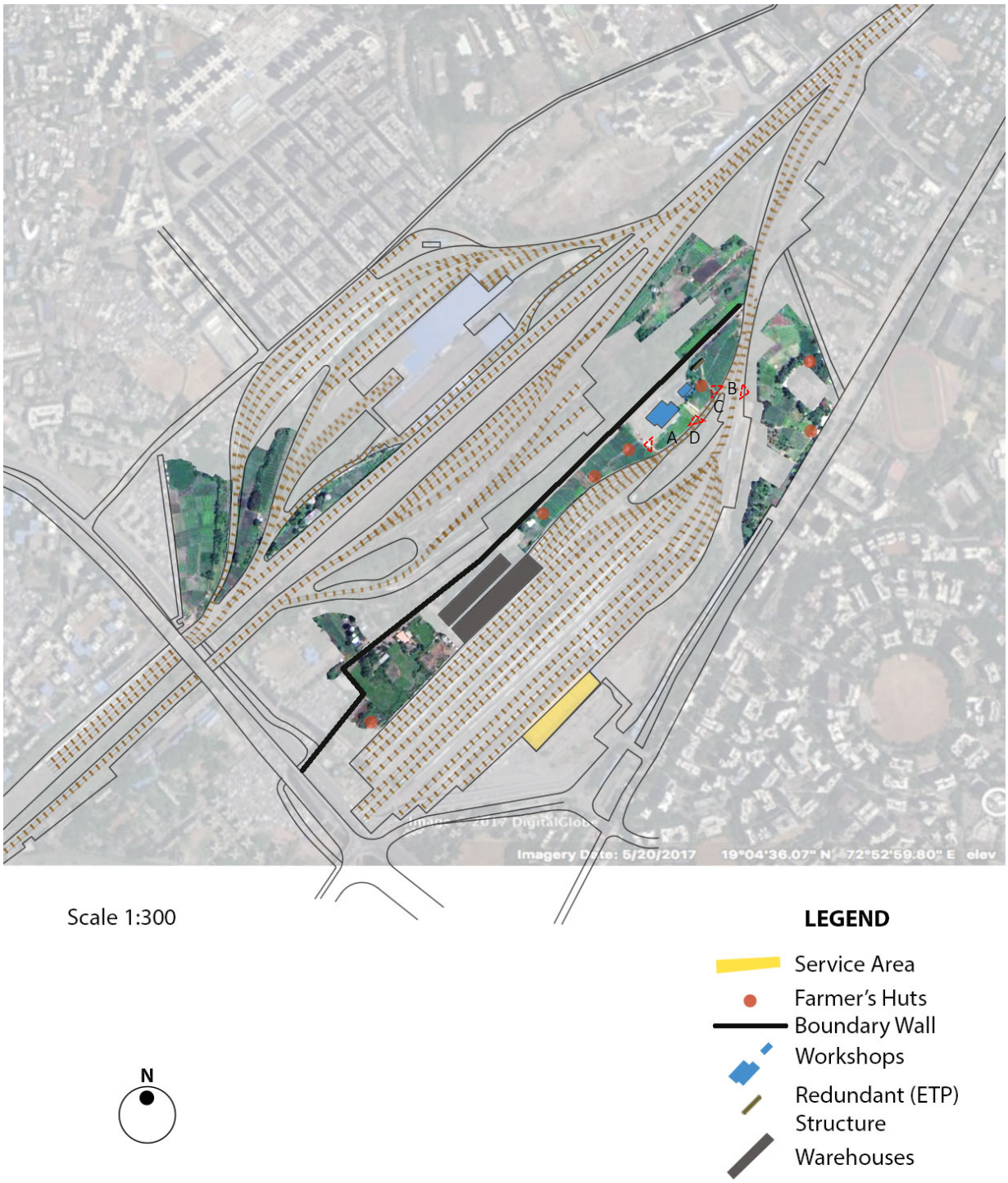

Figure 16: Map of Lokmanya Tilak Terminus. Source: Krutika Patel

Figure 17: Image at ‘A’ (See figure 17). Source: Krutika Patel

Figure 18: Image at ‘B’ (See figure17). Source: Krutika Patel

Figure 19: Image at ‘C’ (See figure17). Source: Krutika Patel

Figure 20: Image at ‘D’ (See figure 17). Source: Krutika Patel

In total about 1000 acres of land comes within Lokmanya Tilak Terminus compound, out of which, 100 acres form the utility area. This utility are 5 platforms, the Lokmanya Tilak Terminus complex, canteens, offices, an ETP plant (to clean coaches and to water farms), farmer's sheds and a railway workshop. As the railway falls in the flood prone zone, the government has adopted a rainwater harvesting project on Lokmanya Tilak Terminus. This will help save water upto 40 % which will meet the need of water on Lokmanya Tilak Terminus. Due to urbanization water has no space to percolate in the land and hence the government has adopted this strategy. However, while visiting this site and talking to urban farmers, I heard no one mention or talk about the rainwater harvesting. I noticed most of the farming uses the untreated water on the site. Overall, the site intakes of about 1,800,000 liters daily. However, most of the water is used for cleaning trains and coaches and the urban farming operation. Undoubtedly, this project will ensure the improvement of ground water level. This will improve the quality of crops on Lokmanya Tilak Terminus and also its growth rate. The vacant land on the site is occupied by the urban farms taken care of by 7 farming families. They all produce bhindi (lady finger or okra), palak (spinach), lal chola (red fenugreek) and brinjal (eggplant) in common. In the Monsoon season, they produce only lady finger as this vegetable stays above the flood level. These farms work without any middlemen. Vendors come to farms and buy vegetables at half the market rate.

The Government gives the vacant lands on lease to the railway employees in C and D categories (gate keepers, gang Man) for farming. This action ensures extra income besides their monthly salary. Let us say a person in C or D category in Mumbai earns 4,000 INR per month then he could earn about an extra 2,000 INR per month by selling the produce in the market. The cost of

seeds, water and labor has to be borne by the grower to the railway employee. Factoring in all additional costs, the person earns 1,000 INR extra per month by hiring laborers/farmers for working on the field. Most of the time, the buyers, who are vendors, come directly to the farmers and sell their products at a market price that is double the amount they buy from the railway employees. These lands are well maintained due to the urban farming strategy and can be merged with a better organised rain water harvesting and water treatment plant to incorporate use of adequate and clean water. Just the rainwater harvesting tanks will save up to 1,000,000 INR (160,000) per annum *(DNA, 2015).* Besides, in order to make the urban farming production steady, level farming should be incorporated in future development on the vacant lands held by the railway.

Figure 21: Man buying Vegetables to sell in the Vashi Market. Source: Krutika Patel

Fade the boundaries

Most importantly, the railway farms and the settlements around the railway farms are very much disconnected by the boundaries. This is obvious as the railway lines and farms have to be protected from any encroachments. These boundaries have its own importance, but this continuous element could become a major design element that can help fade the lines of disconnection. The study includes the different shades of the boundaries between the urban farms and the residents. While travelling from Surat to Mumbai and from C.S.T to Vidyavihar to reach to the Lokmanya Tilak Terminus, whole picture library was created during the travel as a method to reach to the places in the limited time.

These boundaries could be looked upon as the major design intervention based on the typologies of walls adjoining to the functions: housing, institutional, Commercial or other uses. The railway land has its own government loop for ownership of land. Hence this could include inference in the three ways:

-Recycling and storing water on site by rainwater harvesting and water treatment plants.

-Fading boundaries and connecting with the context by responding accordingly. Creating safe passages to the context and compound wall for flower farming that can be used for religious function and generate more revenues and it can beautify and transform the neighborhoods.

-Linking the railway land to the vegetable and flower market and creating a whole new market places as most of the people could buy vegetables going back to home. This can create employment opportunities for the low income groups and make the spaces more-lively.

Figure 22: Connection of railway farms with context & boundary wall. Source: Krutika Patel

Figure 23: Connection of railway farms with context & boundary wall. Source: Krutika Patel

Figure 24: housing, boundary wall & railway farms. Source: Krutika Patel

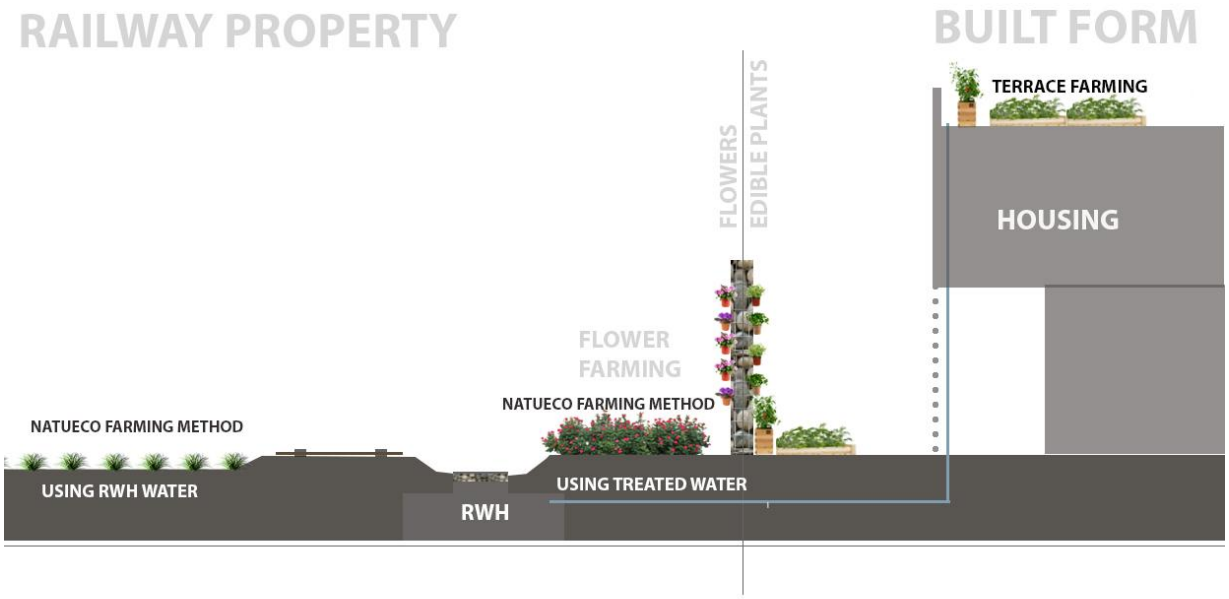

Figure 25: Design strategy for boundary wall aligned to housing. Source: Krutika Patel

Figure 26: commercial street, boundary wall & railway farms. Source: Krutika Patel

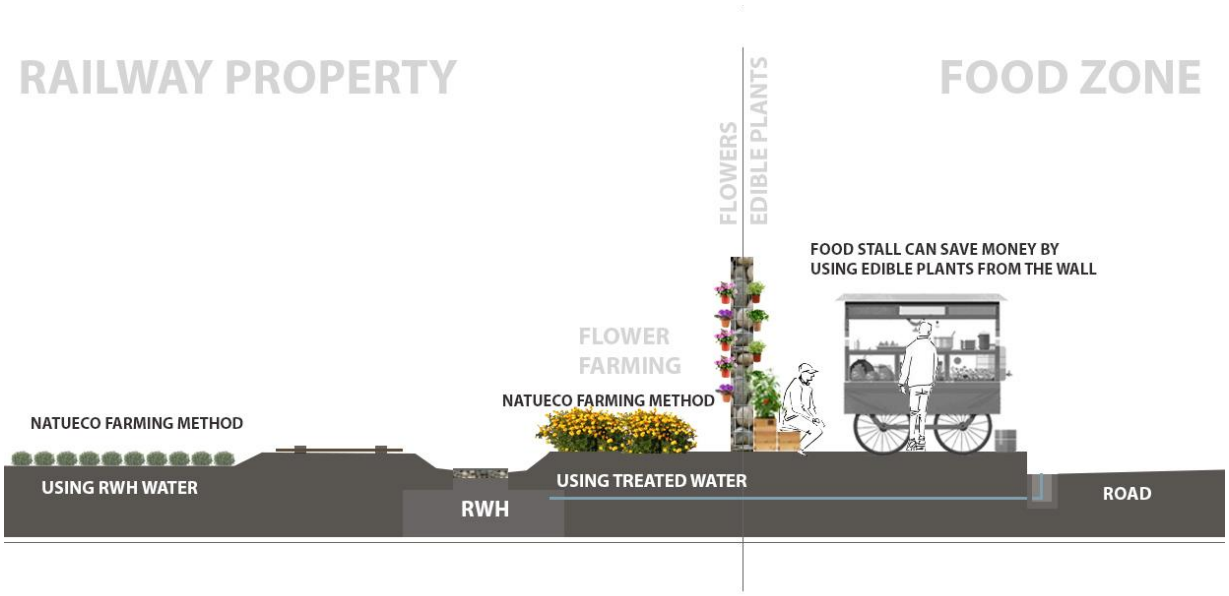

Figure 27: Design strategy for boundary wall aligned to commercial street. Source: Krutika Patel

Figure 28: Parking plot, boundary wall & railway farms. Source: Krutika Patel

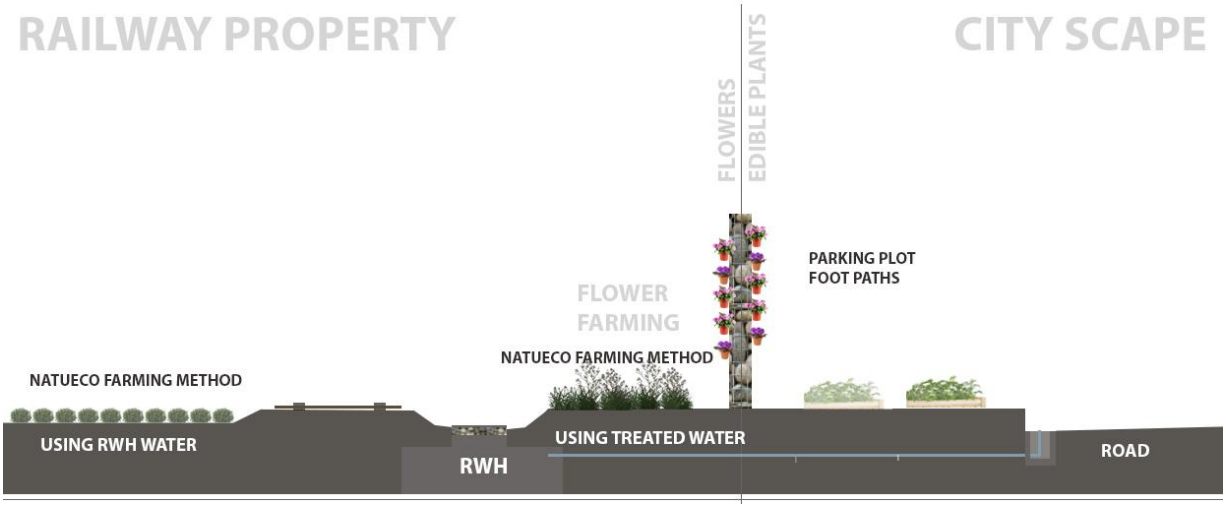

Figure 29: Design strategy for boundary wall aligned to parking plots and path ways. Source: Krutika Patel

5.3 Turning on terraces:

Figure 30: Map Showing terrace garden at Don Bosco High School, Matunga. Source: Krutika Patel

To understand the another attribute of urban farming in the context of Mumbai; particularly related to community life my visit to Urban Leaves terrace garden in Don Bosco school, Provincial house proved remarkable.

Urban Leaves farms in Don Bosco School is the joint venture of the Provincial House and the Urban leaves NGO. The terrace of the Provincial House had small 5 to 6 pots growing some herbs and vegetables. Later, to take it at further level the father at provincial house came in contact with the work of Preeti Patil and they started the terrace farm in the Don Bosco school. I visited the urban garden and met the coordinator Premila Martis she explained to me the whole process of producing food. She mentioned about the availability of vegetables grown in the unhygienic ways on the railway tracks and explained, how the people lack the awareness of what they are eating on daily basis.

The crux behind the urban leaves initiative is the concept of reduce, reuse and recycle resources. They are reusing by using the terrace of the school building and also help in keeping it cool. Also, the material used to plant the vegetables are recycled old drums, tires, bricks and reused pots. The jute threads and bamboos are also used for making sheds and give support to the climbers. The 10 volunteers who take care of the farms at interval of every 3 days in turn, Premila is one of them. Additionally, they have a gardener who help them during the process of harvesting and maintaining the site. They sow according to seasons and rotate the plants and make the soil more nutritious. The water used is the municipal tap water available in the school and the school has swales that helps them to store more water and use it when needed.

They grow more than 100 varieties of plants including drumstick, gauvas, lemongrass, limes, malabar, spinach, paan (betel Leaves), promogranete, pudina (mint), purslane, spungeGuard,

starfruit, gherkin/tendli, waterleaf, haldi (turmeric), gilki, sonchapa, papaya, amaranth greens, ambadi, basil Italian, Basil Thai, okra, eggplant (brinjal), chawli, chikoo, chilli, citronella, colocasia leaves, cucumber, curry leaves, custurd apple, dudhi and flowers.

Plants	4th June	7th June	11th June	14th June	18th June	21st June	23rd June	29th June
Drumstick	118	-	-	-	-	-	-	-
Guavas	-	-	-	-	-	-	-	-
Lemon Grass	-	-	266	86	260	-	49	-
Limes	-	-	-	-	-	-	-	-
Malabar Spinach	1200	500	1560	165	900	-	-	-
Paan	-	-	-	26	27	-	23	-
Promogranate	-	-	-	-	-	-	-	-
Pudina	-	-	16	-	75	35	-	-
Purslane	600	-	366	-	390	-	-	-
Spunge Gourd	318	-	314	-	1213	-	-	229
Star Fruit	-	-	-	514	51	-	-	416
Tendli	116	433	385	290	189	908	594	569
Water Leaf	58	-	148	-	152	-	-	-
Haldi	1204	-	-	-	-	-	-	-
Gilki	-	318	-	-	-	452	257	-
Sonchapa	-	-	-	5	-	-	-	-

Drumstick Leaves	-	-	-	-	61	-	-	-
Papaya	-	-	-	-	450	-	503	-
Amaranth Green	792	-	1136	176	-	-	-	-
Ambadi Leaves	100	-	-	89	-	-	45	-
Basil Italian	-	-	-	-	76	-	-	-
Basil Thai	-	-	-	-	29	-	-	-
Bhindi	-	-	-	-	-	-	-	-
Brinjal-Kanta	666	-	203	117	-	-	70	-
Big Brinjal	-	391	-	-	-	238	295	-
Chawli	-	371	-	-	-	-	-	-
Chickoo	-	-	-	-	-	97	-	-
Chilli	-	-	-	-	-	-	6	-
Citronella	-	-	-	22	-	-	-	-
Colocasia Leaves	-	-	-	-	-	-	-	-
Cucumber	-	300	-	-	781	1159	270	887
Curry Leaves	-	-	-	-	-	-	26	-
Custard Apple	-	-	-	-	-	284	-	160
Doodhi Round	-	-	-	-	-	990	-	-

Figure 31: Table showing growth rate of vegetable at terrace garden of Don Bosco School. Source: Urban Leaves NGO

Nutritious soil is the most important part of producing nutritious food. Urban Leaves take care of preparing good soil which is has three basic contents, structure, fertility and microbes. They try to prepare soil, which is similar to the soil in the forest which is prepared by the fallen leaves, fruits, the sun, rain and wildlife. They try to give not the same, but near to the forest soil texture to the soil called 'Amrit Mitti'. It takes more than 120 days to prepare this soil and it is called Natueco farmig. The major incredients of the Amrit Mitti are:

-10 Liters of Water

-1 Liter of Cow Urine

-1 Kg of Fresh Cow Dung

-50 grams Organic Black Jaggery

- Sugarcane Waste for aeration above the floor

- Biomass prepared with dry leaves, stems and fruits

The aim of the study is to understand the urban farming practice on the roof top of the buildings and build community life around it. The process of Amrut Mitti helps to understand the use of biodegradable materials and use it as a manure such as cow dung. Premila says," The sugarcane waste is dumped to the dump yards by the BMC and when they ask for the same for using it in Amrit Mitti they don't give it for free." This process of using organic waste around us could be recycled and reused and accordingly one can reduce the waste going into the dump yard. This process could be utilized for urban farming on the selected vacant lands around the city and one could create the natures abode in denser areas. There are two major design intervention that can be intertwined in three fields:

-In my opinion, the urban farms could be well maintained by the commercial and institutional

buildings similar to Urban Leaves NGO.

- Vacant land in between the residential building blocks has a great chance of transformation into urban farms that can provide space for community life and make the space clean. This could be taken ahead of the 'Swachh Bharat Abhiyan' a clean India Initiative.

Figure 32: Reusing resources for building the structure, Don Bosco Terrace Garden, Matunga.

Source: Krutika Patel

Figure 33: Use of 'Amrit Mitti' for gardening, Don Bosco Terrace Garden, Matunga.
Image Source: Krutika Patel
Pictograms Source: Google Images

5.4 Rising on real estates:

The huge cluster of land in Mumbai which is prone to real estate development. This huge cluster of land is the mill lands in the heart of the city. The commercial and economical foundation of Mumbai today, was the raw cotton trade and textile industry. In mid 19th century, this industry flourished and mill workers were at the foci of the history of a vibrant city. They are the first clan that migrated to Mumbai city and created the cultural identity of the city by going through several social and political changes. Chimneys of the mill land are the main element of the skyline of the Mumbai city *(Shannon, Kelly & Gosseye, 2004).* Until 1990, these lands, measuring 243 hectares, were protected from any development that would change its land use.

However, since the 1980s, real estate developers were inclined towards developing these lands for making a huge amount of money. In 1991 amendment of DCR 58, allowed development of these lands in a way of its revival. But, under mill regulations, if the mill owners close the mill under this act than they have to give 33% of the land to city Municipal Corporation of Greater Mumbai(MCGM) for public open space and 30% to Maharashtra Housing, Area Development Authority(MHADA) and the rest of 37% of land was owned by mill workers. Later in 2000 Girni Kamgar Sangharsh Samiti(GKSS) proposed an idea of using 50% of the land for an industrial use that give employment opportunities to earn the livelihood who are working as vendors and hawkers in the streets of Mumbai. However, in 2001 under DCR 58 act several things were modified to prohibit the industrial development and as a result, MCGM gets 8% of the land, MHADA gets 6% and mill owners now have 86% *(Shannon, Kelly & Gosseye, 2004).*

If properly developed these land have a huge scope of being the groundbreaking example by incorporating urban agriculture in the real estate projects. The life of the former mill workers these days is not easy. The source of employment for them is the small commerce: grocery shops, vegetable and flower vendors. If the real estate projects include urban agriculture, it could open up the new gates for a job opportunity. These land have the great opportunity that could be transformed sustainably at three levels:

- Economic growth by providing job opportunity to the mill workers and other informal groups if the urban agriculture is included in design program the real estate project by consulting the Architects. These should follow a strong guide to include open spaces and parks for all.

- Also, the 6% land under MHADA has the great opportunity to merge the design strategies with the existing housing, redevelopment of low-cost housing and urban farming as a major design idea.

- Remaining 8% of land under MCGM could be designed as the public place that could help to make Mumbai open by consulting the urban designers and urban planners.

Figure 34: Mill land and Real estate development. Source: Krutika Patel

Figure 35: Mill land and Existing Housing. Source: Krutika Patel

Figure 36: Mill land structure with interesting elements. Source: Krutika Patel

PRESENT STATE OF MILL LAND AND PRECINCT

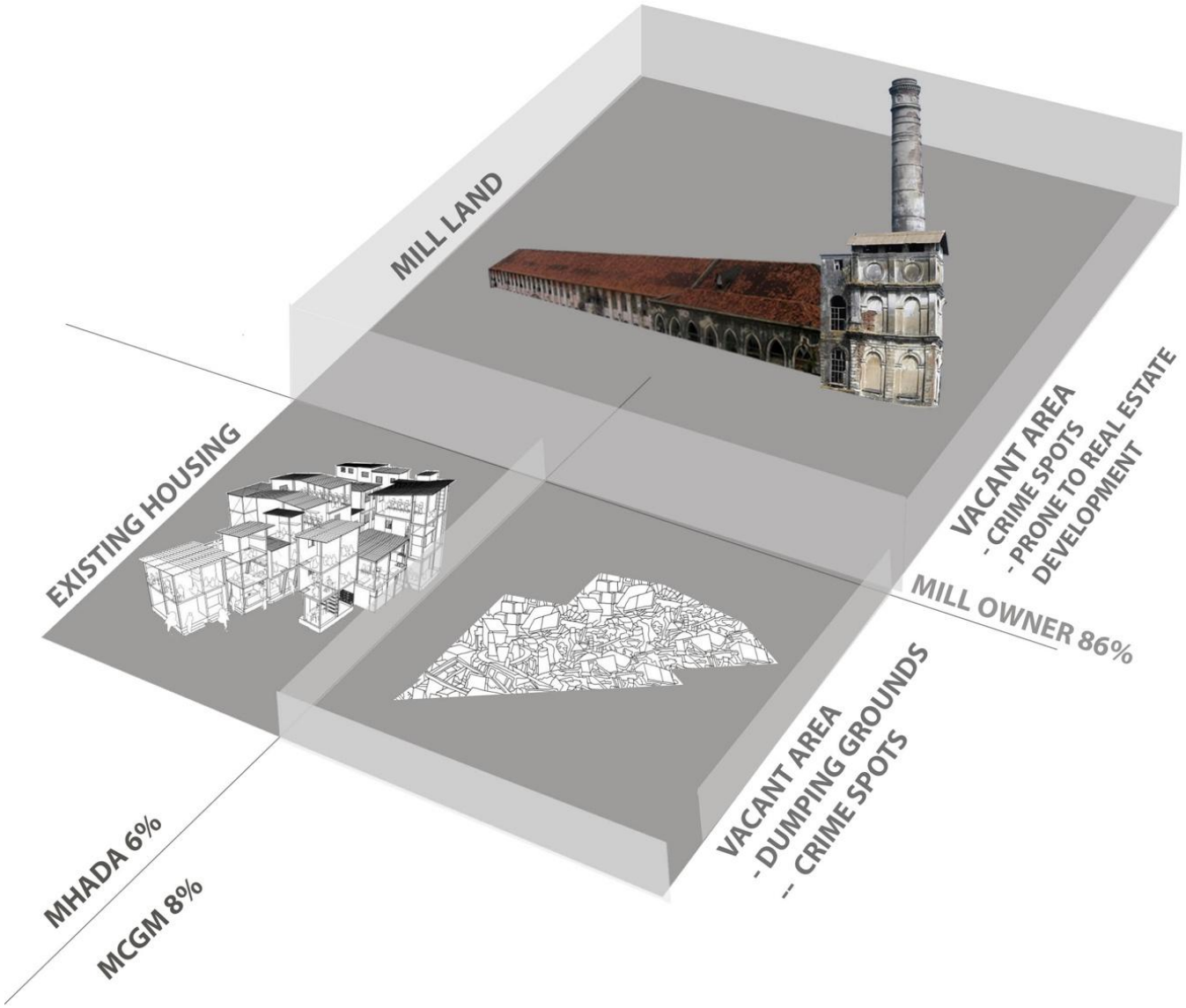

Figure 37: Present condition of the Mill lands. Source: Krutika Patel

VISION OF MILL LAND AND PRECINCT DEVELOPMENT

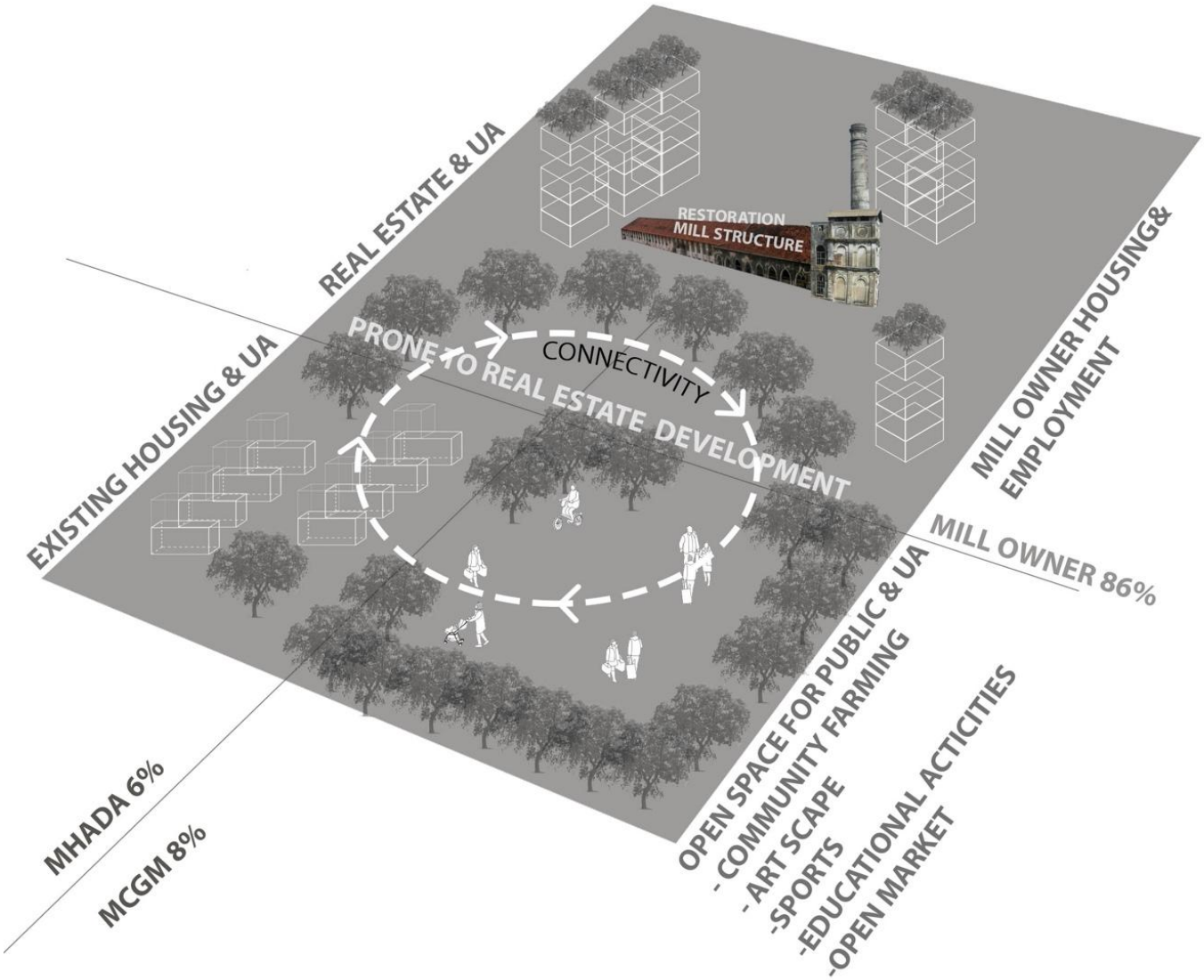

Figure 38: Vision of the mill land developments. Source: Krutika Patel

CHAPTER 6

CONCLUSION

6.1 Findings and Lessons Learned:

My argument has started with the major question as to How Urban Agriculture is a resilient solution to meet the MDG for development of Mumbai City?

While I was thinking about this, I tried to answer the following three major questions that arose during my case study of Mumbai and they are as follows:

- *How could one increase the open land and bring ecological, economical and social openness to the city?*

To answer the above question, the study of vacant lands has been carried out by using the ArcGIS data, Google Earth images, and existing land use maps. The study reflected that there is ample amount of vacant lands in the city of Mumbai that could double up the ratio of opens space per person which is 1.1 m^2 in today's date. Moreover, these vacant lands have a great potential to incorporate urban agriculture into a basic design program and create rich community gardens in the city. These community gardens can be planned based on its proximity to the type of land use. Typically, residential lands which can be linked to spread urban agriculture on terraces and balconies. Also, institutional surfaces such as Don Bosco School Matunga, have a tendency to be well-maintained within the ecosystem of the institution. Further, the study of these vacant lands with focused land use, gender, and occupation of the area could help make, more profound design strategies.

- *How urban agriculture and linear infrastructure (railway lines) correlate to the urban (re) development?*

Urban agriculture and Railway farms have a great capacity to build a linear circuit of food production throughout the city of Mumbai. However, according to the case study of Lokmanya Tilak Terminus, it shows that the major constraints concerning the disagreement of the people towards them are the use of drainage water in farming. Therefore, the implementation of rain water harvesting tank, and water treatment plants could play a major role in the process of healthy food production. Besides, the land near this terminus could also have the outlet to sell food to the majority of people traveling through trains in the Mumbai. Additionally, the railway tracks throughout Mumbai fall in the low lying area and are prone to flood and hence the rain water harvesting tanks could help to maintain them and store the water, thereby improving the ground water levels. Additionally, most of the market spaces lie within, 1 km radius of the railway lines and hence, it could be a major transformation project to create a whole circuit of linear food production chain and radial commercial circuit. Also, a detailed study of these market places could help to link and understand the demand, supply and production chain from the railway farms.

- *How could real estate projects be considered as the potential element of the (edible) landscape urbanism strategy?*

The major reason for lack of open spaces and reserving the land for the same is the growing real estate in the city. Irrespective of the housing demand typology, which is basically for low-income groups, is ignored and the high rise expensive apartments are continued to be built. The major real estate development projects with increasing Floor Space Index (FSI) is carried out on the

former mill lands. Hence, my study gives an idea of incorporating urban agriculture into real estate development as a law and a priority need for future development. The study of one such former mill land along with the study of mill worker community could help to design and develop a new way, the real estate development should be carried out in future.

6.2 Actors in Transformation:

The above stated design and planning idea should be carried out with major actors that could add leverage to the implementation of such strategies. Vacant land study and design strategies should be supported by the BMC for providing the history and data of Mumbai city. Urban Planners should understand the data prepared by the government and try to understand the overall strategies envisioning the future growth and upcoming development projects.

Moreover, urban designers could undertake a profound study of the precinct and create a detailed study of the population, gender, employment rate and available waste production so that they could make better use of resources for spreading urban agriculture. The environmentalists and the NGOs could work together to understand the ecology of the area and decide to implement the urban agriculture strategies. Railway Lands have a land leasing strategy and so, have to be taken care of, by the MRVC authority. Real estate development should be merged with urban agriculture and for which the architects and developers have a major role to play with a detailed research on the context. Also, these projects could be merged with the NGO's to implement urban agriculture and generate employment opportunity. Digital Media could be considered as a powerful entity to regulate the whole chain of urban agriculture in

different sectors such as vacant lands and community garden, railway farms and markets and real estate development and regulate data of access food and Job opportunity that is open to all. There are several good examples of urban agriculture in the city, but they are not well recognized and most of the people are unaware of these in the city. It is important to make them visible. Also, share their experiences widely.

Turning vacant lots into urban gardens would for sure change the ecological, social and economical state of the city. The informal group of the city can benefit from it directly. They work to attain a new way of living by the urban agriculture urbanism as it will give them more opportunities and safe neighborhood. It will help to keep the city clean and there by people will get more sensible towards the natural resources as the whole scheme will rotate around the 3 major factors such as reuse, recycle and reproduce resources.

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