Engaging Academic Institutions in Biodiversity Mapping and Conservation: A Case Study of University of Mumbai

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Abstract

Urban sustainability has emerged as the most alarming issue with nearly 37 percent of population getting concentrated in the mega urban regions in India with mega urban regions getting reselected as spaces of development. The megacities like Mumbai, Delhi, Hyderabad, Bangalore have been experiencing massive scale of urban restructuring in terms of infrastructure and real estate-led development as a part and parcel of globalisation and global urban competition. Consequently, there have been major compromises on the environmental norms and the quality of bio-physical environment leading to the aggravation of various urban environmental issues. Nonetheless, the already grave situation has been worsening with the newer dimension of climate change. Cyclonic activities, torrential rains, flash floods, heat, smog and so on, are some of the many recent issues that are found to have affected the urban environment adversely. The intensification of urban environmental issues thus has induced policy concerns at various scales and levels to mitigate with the consequences of urban climate change, notably, the SDGs as a larger umbrella framework.

With this background, how one can position the academic institutions is the real question. It may be through research, curricula, and so on, that the institutions are conventionally involved in the issue. The institutions may also emerge with some scientific and technological solutions. But what really is needed is behavioural and attitudinal change in people to opt sustainable behavioural practices. Education for Sustainable Development Goals becomes most relevant in this situation. The present article reports the experience of implementing ESDs (Education for Sustainable Development Goals) with reference to the community (stakeholders of educational institutions) initiatives in Biodiversity Audit of University of Mumbai.

I. Introduction

Globally, there have been constant efforts to promote livable and sustainable cities with effective and strong policy resilience mechanisms to improve mitigation and adaptation practices in general and with reference to climate change. The challenge of resilient cities becomes more crucial with 22 cities from India getting

listed in the top 30 most polluted cities in the world (Hindustan Times 2021). It has been also highlighted at various negotiations that the challenges of an emerging economy like India include how to balance growth with low carbon emission. The six emerging economies including India are accounted for one-third of the global GDP, but their share in carbon dioxide emissions (from fossil fuel use) is 41 percent and they have 42 percent of the world's urban population, as they are amongst the fastest growing urban economies (Hindustan Times 2021). The urban sustainability with reference to megacities in India is becoming a major concern with the unprecedented scale of development that is largely guided by finance capital and gets expressed through postmodern urban architecture. Skyscrapers, high rises, high speed transport corridors, real estate development, office space development (Sassen 1991; Banerjee-Guha 2002; Harvey 2010) are the common ingredients of contemporary forms of urbanisation in Indian megacities and their regions. The contemporary discourse on development portray concretisation as symbol of 'urban development'. Concretisation has been done at the cost of destruction of natural water ways, wetlands, mangroves, vegetation, coastal plains, creeks and so on. The risk of such haphazard concretisation in coastal cities like Mumbai comes with a major toll on life with intensification of water logging, floods, flash floods and epidemics. It has been evident by now that the coastal cities are most vulnerable to climate change due to increased cyclonic activities, sea level rise, urban heat island phenomenon, flash floods, water logging and so on. For example, the incidence of cyclonic activities in the Arabian Sea have increased by 52 percent in recent decade (The Hindu 2021). Recently, scientist Brian Mapes has discovered a newer climate phenomenon over Western Indian Ocean. A scientific term 'atmospheric lake' has been coined to describe this novel phenomenon (AGU Press 2021) that can bring torrential rains in short spans of time.

When the above discussion is placed in the urban context, climate change and its consequences are anticipated to emerge fatal to the very sustenance of the coastal cities. There is an urgent need to recenter the eco-sensitive discourse on urban and regional planning to help these gigantic cities and their regions to emerge climate resilient.

The larger frameworks to build urban resilience have been already in place in the form of Sustainable Development Goals proposed by United Nations. Additionally, India is also one of the signatories to the Organisation for Economic Co-operation and Development (OECD) guidelines since 2001 and abides to ratify them at various internal scales (OECD, accessed in 2021). Despite various mandatory requirements in terms of policy making and implementation at several levels of governance, the state of natural urban environment remains fragile and continues to deteriorate. The lack of political will power to implement stringent environmental protection regulation can be identified as one of the major reasons for the current state of cities in India. However, the citizens are to be blamed equally. Violation of rules and regulations has become the norm of everyday urban life. The lack of metropolitan consciousness makes these cities into spaces of indifference leading to self-centered and individualistic attitudes of various stakeholders of the urban space.

To build resilient and sustainable cities, it is necessary to invoke metropolitan consciousness amongst the common citizens. Metropolitan consciousness thus promotes the integration of citizens with the city through the voluntary acts of citizens to keep their city healthy, happy, and prosperous. The conscious metropolitan mind would also prefer to shoulder responsible and sustainable urban change; protect the city and emerge with collective solutions to the pertaining urban problems (Simel 1950). Metropolitan consciousness shapes the urban communities to shape their attitudes, values and behaviour to reciprocate on individual and social life (Bhaduri and Gopal 2017). To train the common citizens to become sensitive about their natural and social environment, it is necessary to come up with creative ways of educating and engaging them in various kinds of activities that could draw them close to nature. Educational institutions can lead such creative efforts through various initiatives.

One conventional way of dealing with these issues could either be through academia i.e., in the form of framing a curriculum and offering it with compulsory credits at higher secondary, undergraduate level or exploring scientific, social, cultural and economic dimensions of the urban environment through research. The impact of conventional methods could be limited as they fall prey to subjectivity, narrow academic and research interests and credit earning activity

rather than being comprehensive and wholistic learning efforts that would make an impact in terms of inducing proactive behaviour at the personal and social levels. The limited success of the compulsory inclusion of subjects like Environmental Studies/Environmental Science at undergraduate level in India (despite a compulsory 'project' component) is the best example of how an academic curriculum is not enough to promote sustainable behaviour.

There is a need to promote action and output-oriented education through experiential learning, participatory approach, and self-learning enhancement. United Nations Educational Scientific and Cultural Organization (UNESCO) has already offered a wider role of education in promoting Sustainable Development Goals (SDG). As per UNESCO, education for Sustainable Development (ESD) is expected to empower learners from all categories; learners, irrespective of their age, need to be empowered with the knowledge, skills, values, and attitudes. It further tries to connect all the global challenges that are faced by humanity and planet earth as an integrated system and advocates the study of the challenges in an interconnected/holistic manner. Climate change, environmental degradation, loss of biodiversity, poverty, and inequality, for example, have been listed as global issues that need to be dealt with in a holistic approach. UN has also declared the decade of 2005 to 2014 as the Decade of Education for Sustainable Development (DESD) (Kitagawa, accessed in 2021). The objective of UNESCO is advocating experiential learning through creative methods and train them into action and solution-oriented research and policy making to resolve the challenges at various levels and scales.

At University of Mumbai, with the aim of converting the campuses into green campuses, an initiative of conducting biodiversity audit of its main campuses was undertaken. This article proposes to explore the culmination of the entire effort of biodiversity audit, focusing on the initiative of academic community participation in the preservation of natural environment.

II. Context:

The role of universities has become highly essential in this context as they are connected to young students who receive learning and training into particular

Science or Humanities disciplines. With more emphasis on interdisciplinary and multidisciplinary approaches, students are able to learn cross-disciplinary subjects through the recent credit and choice-based systems that have been made mandatory by University Grants Commission (UGC). The much larger emphasis on the best practices centred around universal values and ethics, gender sensitisation and equity, and environmental education and awareness in the quality assessment of Higher Education Institutes (HEI) by National Assessment and Accreditation Council (NAAC) has re-emphasised the responsibilities of HEIs in incepting sustainable behavioural practices. Integrating the ESDs and the national frameworks guidelines for HEIs provided by apex institutions like UGC, NAAC, has made larger creative spaces available for HEIs to emerge proactive in the field of environmental protection, sustainable development and the like.

Academic institutions, especially universities in India are known for their huge campus establishments. Most of these universities are found to have supported the coexistence of natural landscapes in the form of plantations and gardens simultaneously with the buildings. The universities located in urban areas/ megacities with such natural landscapes have proven themselves as the lungs of the cities. The academic campuses like Jawaharlal Nehru University, New Delhi, Savitribai Phule Pune University, Pune and many others, have proven very vital in sustaining the air quality of their respective cities by contributing towards the reduction of air pollution.

University of Mumbai is one of the premier and oldest academic institutions that equally contributes to the better health of the city and suburbs. It has 2 main campuses and 2 sub-campuses. The Kalina campus is spread over 243 acres of land and situated in the new central business district, i.e., Bandra-Kurla Complex. The Fort campus occupies 14 acres and is situated in the older central business district, i.e., Fort. Both the campuses are main campuses and located in highly vibrant, busy, and crowded areas of the city and suburbs. Though Fort campus of University of Mumbai is small, it has at least some 100 trees, including some rare species, as part of its decorative landscape amidst its buildings with Gothic architecture exhibiting its link with the colonial times.

Kalina Campus is comparatively younger and has been developed in early 1960s. Often called Vidyanagari Campus, it is one of the rarest green patches maintained in the highly concretized pockets of western suburbs of Mumbai (The biodiversity Audit Team 2021). This singular green zone serves as the lungs in its highly polluted surroundings. With most of the major economic and commercial activities (infotech parks, passport and visa issuing offices, foreign embassies, offices of financial institutions, office space of Mumbai Metropolitan Regional Development Authority, stadium, forensic lab, international and domestic airport and so on) getting concentrated in and around the Vidyanagari Campus in recent decades, the area has emerged as one of the busiest nodes in suburban Mumbai. The area witnesses a major traffic flow from Eastern, Western, and Harbour suburbs every day so frequent traffic jams are a concomitant issue. To resolve these issues of constant traffic jams, several flyovers, bridges, and link roads have been constructed encouraging the cutting of trees for road expansion and intensive concretization. All these changes have contributed towards the overall degradation of natural environment in and around Kalina Campus. Bandra-Kurla Complex (BKC) and Sakinaka are the areas with the worst air quality index in Mumbai and its suburbs (Bhalerao 2020).

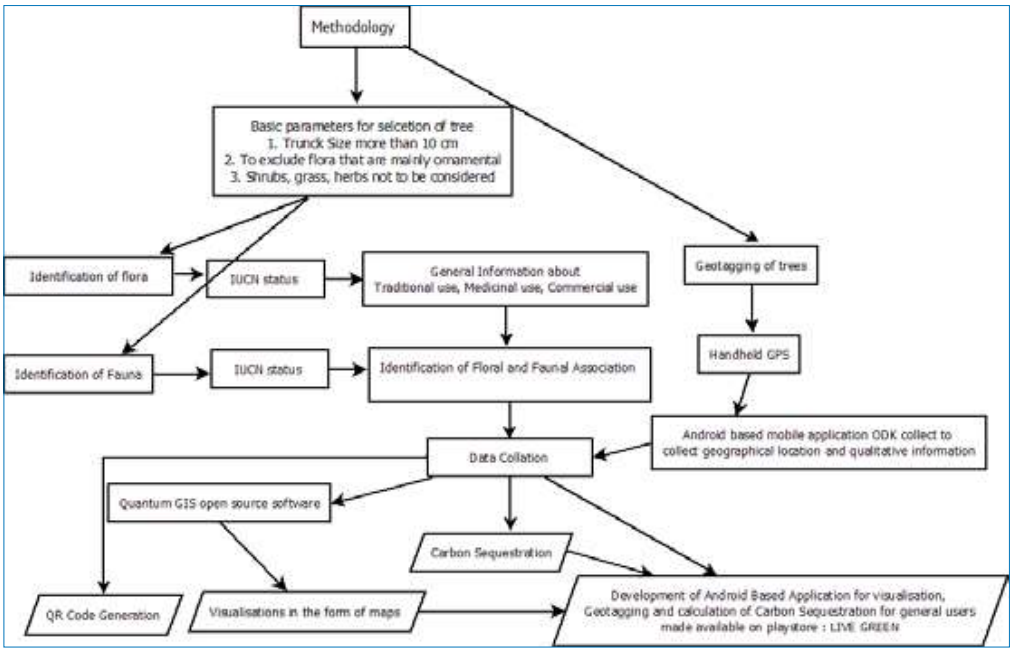
Kalina campus, boasting over 5500 trees, is located in a low-lying area and, geographically, it is a flood plain of River Mithi. To date, there are trees of more than 50 years of age. The campus though landscaped, also supports natural habitat spaces that are not interfered by artificial landscaping, offering a natural habitat for various floral and faunal associations to develop freely. The presence of a small wetland, as a remnant of the flood plain of Mithi River, supports diverge floral and faunal life. The wetland acts as a buffer, sponge and carbon sink, to arrest flood water through seepage and actively absorbs the carbon in the air. As one of the activities planned with the celebration of National Science Day on 28th February, 2021, a biodiversity audit of Vidyanagari Campus was conducted.

III. Objectives and Methodology:

The objectives of the exercise were promoting participatory and collaborative learning to emerge with systematic analytical thinking. Faculties from two

premier HEIs – University of Mumbai (UoM) and St. Xavier's College, Mumbai – joined together to provide their specific expertise in setting the broader objectives and methodology for conducting the survey. In a joint venture of Department of Geography and Life sciences from UoM and Blatter Herbarium from St. Xavier's College, the objectives and methodology were finalised. 18 postgraduate students, 5 doctoral students (department of English, Biophysics, Geography) and one engineering student, and 24 volunteers worked for 4 months towards fulfilling the objectives. While framing the objectives, the core elements offered by UNESCO in promoting ESD were kept at the core – Learning content; Pedagogy and learning environment; Societal transformation and Learning outcomes (UNESCO, accessed in 2021). UNESCO has further proposed the framework for the year 2030 that include five priority action areas – advancing policy, transforming learning environments, building capacities of educators, empowering and mobilising youth, accelerating local level actions (UNESCO, accessed in 2021)

Figure 1: Biodiversity Audit – Methodology



Source: Conceptualised by author.

The workflow of the audit consisted of collection of spatial and nonspatial data

1. Identification of flora and fauna was done by conducting field surveys mainly for identification of trees and geotagging of trees. Details like height and trunk size of each tree were recorded.

2. Geotagging of trees was done using handheld Geographical positioning system, Open Data Kit collect mobile application.

3. Preparation of International Union for Conservation of Nature (IUCN) list using the data published by Forest Research Institute, Dehradun.

4. Collection of information about the plants – Common name, Botanical Name, Local Name, IUCN status, medicinal use, commercial use, traditional use and other important information and preparation of database.

5. Preparation of various maps representing spatial distribution of trees by using the Geographic Information System (GIS) software like Quantum Geographic Information System (QGIS).

6. For the calculation of carbon sequestration, various methodologies were referred. For example, GEOGY focused on a simple way where three major tree factors were considered for calculation of carbon sequestration - size, age, and the species of individual tree to evaluate the estimated carbon sequestration take place by calculating an individual tree detail (rgsgeogy, 2020). According to Sharma, Pradhan, Kumari & Bhattacharya (2020) the trees have big potential of carbon sequestration. The team first prepared a detailed list of species in the campus and then calculated the individual tree above and below-ground biomass through non-destructive sampling method. They took 50% of total biomass per tree as almost 50% of total tree biomass. With the help of the equation "CO2 (eq.) = (Carbon content × 44)/12", the final carbon sequestration of an individual tree for the Amity university campus was derived. (Sharma, Pradhan, Kumari, & Bhattacharya, 2020). The survey was detailed to also count the number of branches. Kaul and others (2010) all have discussed the potential carbon sequestration of Sal, Eucalptus, poplar and teak tree species native to tropical location and also for India. The carbon sequestration method is same as mentioned by GEOGY; in addition to that they are worked on the time slab taken by individual tree and the carbon sequestration at each slab was calculated to achieve more output by planting and harvesting the particular trees in a set ratio to achieve the maximum carbon sequestration. (Kaul, Mohren,

& Dadhwal, 2010). According to the Konnagar Municipality and Clean Blue Planet Services the carbon sequestration in their municipality was carried out by considering five sections. Section one is estimating the total stem biomass; section two is estimating the total branch biomass; section three is estimating the total leaf biomass as per the following expression; section four is estimating the carbon and carbon dioxide by Vario MACRO elementar CHN analyser which gives the percentage of carbon content for each part of each species; and section five is for soil pH analysis. Hence the report states that, after evaluating all five sections, the carbon sequestration is totally dependent upon the biomass capacity, climate, tropical or temperate location, topographic and geological factors. (Mitra, Zaman, & Konnagar Municipality, Not Defined).Alabama Forestry Commission's provides one of the detailed and illustrated methodology to measure carbon (CO2 equivalent) storage in trees with methods suitable to the individual locations and criteria. The commission has also developed the Excel spreadsheet which allows user to enter the specific information as per the forest or crop land and know the estimated carbon sequestration and carbon credits earned in their land without needing any tedious calculation. The commission also mentions that the carbon is also stored and needs to be calculated even after trees are harvested and processed into the multiple products and it is completely depending upon the use of the harvested wood. To calculate the carbon sequestration from harvested wood the commission provided two approaches. In the first approach the decaying of the wood or wood product is calculated for the carbon emission to estimate the carbon sequestration from it and for how long it will be. Second approach is estimating the carbon stored in the harvested wood products 100 years after harvest, by calculating Carbon Stored in Harvested Wood Products = Weight of Carbon Harvested x 100-year Carbon Residual Percentage. (Alabama Forestry Commission's, 2009).

While calculating the carbon sequestration for the trees in Kalina Campus, the team considered height and trunk size of the trees for the calculation. The method suggested by Fransen (2019) has been used for calculation of carbon sequestration.

IV. Observations and Findings

a) Preparation of a comprehensive directory of species found in the campus

The output of the biodiversity audit could be seen in the compilation of detailed information about plants, mainly trees, present in the Kalina Campus for years together. The trees having trunk size more than 10 cm were counted in the audit as per the instructions by Dr. Singh – the taxonomist – and as per the set norms of conducting tree census. The plants that have only flowering were excluded from the audit. For each tree the height and trunk size was recorded as it is needed for calculation of age of the tree and carbon sequestration.

There is total 5357 trees that have been identified and detailed information has been documented about every tree. Total 137 species of plants have been identified.

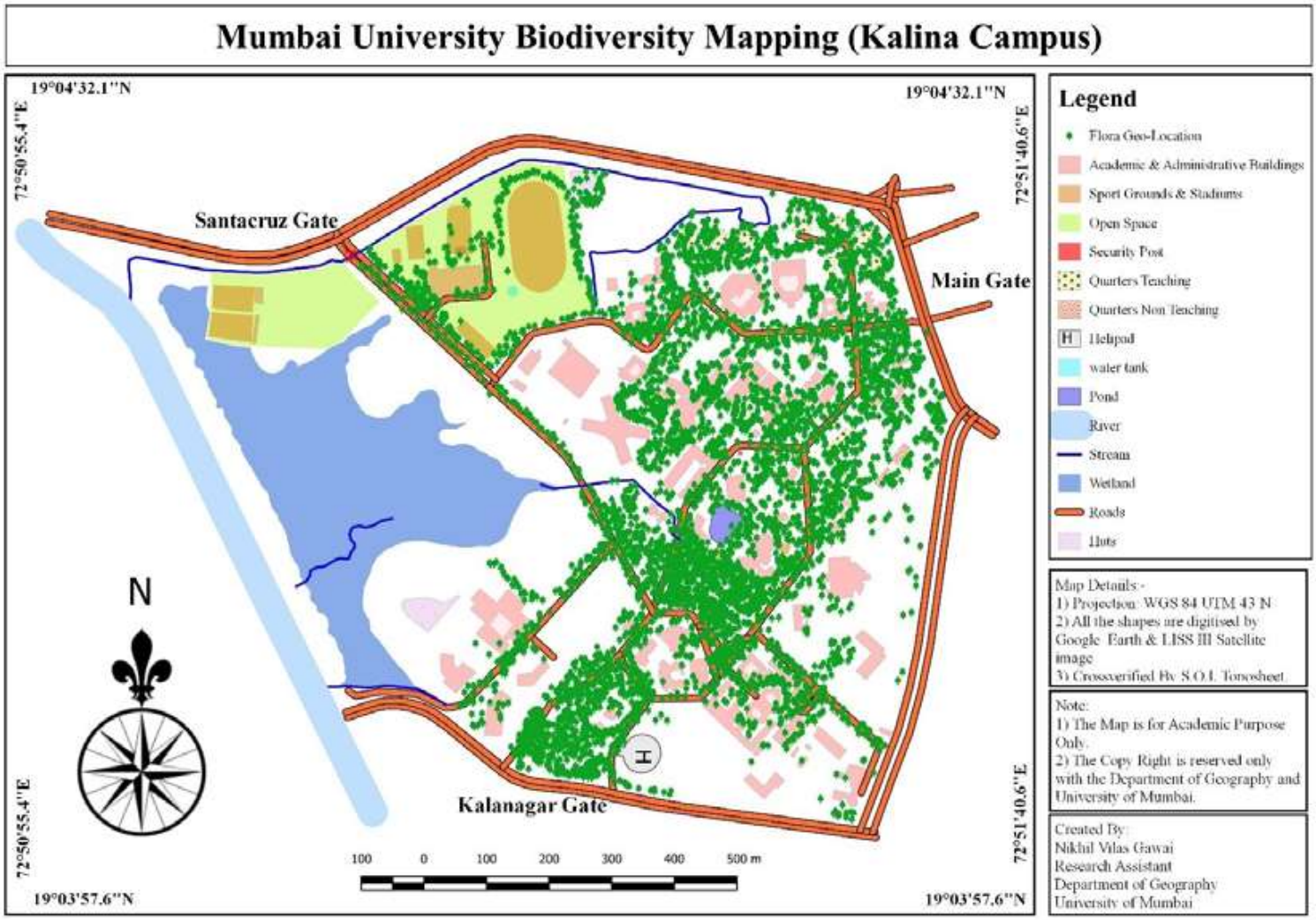
It is revealed through data that many trees belonged to the exotic variety like Gulmohar, Rosy Trumpet, Subabul, Copper Pod, etc., and they are also plenty in number. This could be because of the general tendency in the gardeners to plant the trees that grow quickly and turn the landscape green. These trees offer limited ecological services to the local habitat in maintaining the ecological balance. Nonetheless, there are also native varieties of trees that are uncommon in Mumbai Region. The presence of Banyan tree, Peepal tree, Mango, Amala, and Neem balance and support faunal existence. The botanical garden managed by the Mittal Ayurvedic College adds diversity to the trees in the campus. Their ecological significance is much higher than the exotic species of plants.

b) Geotagging and mapping of the trees

Open Data Kit (ODK) is an open-source software that allows the user to build their own server with google, provides for questionnaire building and allows the user to access the same questionnaire in their mobile through ODK collect mobile application. For geotagging the trees, a questionnaire was developed that contained questions related to location, common name, botanical name, height, trunk size, medicinal use, etc. The student volunteers filled this questionnaire for every tree and also captured the location of the tree. The advantage of ODK is that it allows the spatial and nonspatial information to be collected together. A

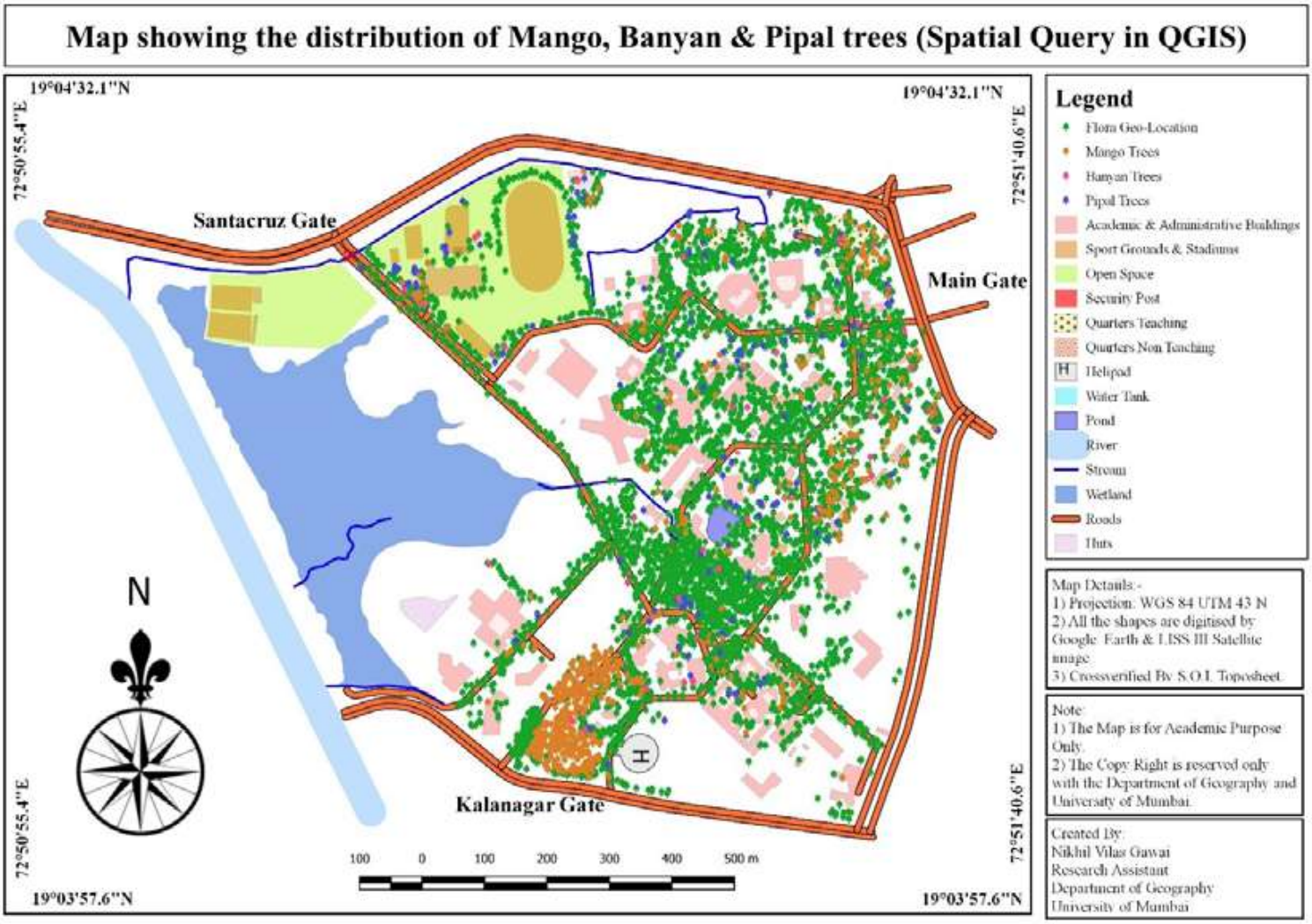
spatial query feature in QGIS allows the user to run various queries to produce specific results. For example, if the spatial distribution of mango trees needs to be shown, a spatial query can be run to produce a map showing the location of mango trees only. Figure 2 represents the location of all the trees that have been geotagged. The trees are shown with the help of dots.

Figure 2: Location of Geotagged Trees in Kalina Campus



Source: Biodiversity Audit Survey

Figure 3: Spatial Query – Showing distribution of selected tree species in Kalina Campus



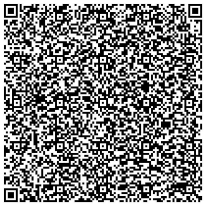
Source: Biodiversity Audit Survey

c) QR Coding of the Trees

Generation of Quick Response Code (QR Code) has been initiated as the next step in arriving at a logical conclusion to the Biodiversity Audit. For each species of trees QR codes have been generated. These QR codes have been installed on the tress in the form of plates. The QR code has all necessary information about the tree like Place, Botanical Name, Common Name, Family, Flowering and Fruiting Season, IUCN Status, Description of Plant Morphology, Medicinal Uses and Miscellaneous information.

The very objective behind putting the QR codes is to create awareness among all stake holders in the university campus about the importance of trees and the kind of biodiversity that is maintained in the campus. It is also expected that the visitors will be encouraged to scan the codes and read the information about the trees. Specially the younger generation would find the QR codes interesting and would be encouraged to scan and know about the trees as they are more comfortable with digital and virtual space.

Figure 4: QR Code and the Description after Scanning



Place : Mumbai University
Tree Number : 1
Botanical name : Tabebuia rosea (Bertol.) Bertero ex A.DC.
Common name : Rosy trumpet tree
Flowering & Fruiting : January - August
Family : Bignoniaceae
IUCN status : Least Concern

Description
Large deciduous tree with a rounded or spreading crown. Leaves are compound, digitate and deciduous. Each leaf has five leaflets of variable size, the middle one being the largest. Flowers are large, in various tones of pink to purple, and appear while the tree has none, or very few, leaves.
Miscellaneous
Native of Tropical America. It is one of the most important timber species in Central America, and is widely harvested for a range of purposes. Timber is used for construction, furniture and cabinet work. It is used as a shade tree in coffee and cocoa plantations.

Source: Biodiversity Audit Team

d) Identification of fauna

The fauna experts from student volunteers dedicated themselves for the identification of different types of fauna. The most important location for the birds has been the wetland in the University campus. The wetland of the size approximately 0.15 sq.km., is a major habitat for not only the indigenous species of birds but also the migratory birds. There have been 64 birds spotted on the campus. Around 10 species of frogs, reptiles have been spotted. Many different species of ants, insects and butterflies also have been observed. This indicates

that the flora supports the faunal life through ecological association, symbiosis, and interdependence. For example, the nest of pagoda ants is also the nest for Rufus Woodpecker. They allow the birds to lay eggs. Otherwise, these ants are very aggressive. In our campus, there are several such Pagoda ants' nests. There has been a clear association between the colony of bats and copper pod trees. Several such symbiotic relationships could be marked while taking the survey in Kalina campus. In ecological settings, therefore, there is a tremendous importance to these Wh questions like what, where, how, and when. Future ecological planning needs to address these delicacies of nature and their interrelationships.

e) Floral Biodiversity and Carbon Sequestration

The carbon sequestration has been calculated by using the formulas and steps given by Fransen (2019).

Step 1: Determine the total green weight of the tree

The green weight is the weight of the tree when it is alive. First, you have to calculate the green weight of the above-ground weight as follows:

Wabove-ground= 0.25 D2 H (for trees with D<11)

Wabove-ground= 0.15 D2 H (for trees with D>11)

Wabove-ground= Above-ground weight in pounds

D = Diameter of the trunk in inches (1 cm = 0.3937) H = Height of the tree in feet.

The root system weight is about 20% of the above-ground weight (Fransen, 2019). Therefore, to determine the total green weight of the tree, multiply the above-ground weight by 1.2:

Wtotal green weight = 1.2* Wabove-ground

Step 2: Determine the dry weight of the tree

The average tree is 72.5% dry matter and 27.5% moisture. Therefore, to determine the dry weight of the tree, multiply the total green weight of the tree by 72.5% (Fransen, 2019).

Wdry weight = 0.725 * Wtotal green weight

Step 3: Determine the weight of carbon in the tree

The average carbon content is generally 50% of the tree's dry weight total volume. Therefore, in determining the weight of carbon in the tree, multiply the dry weight of the tree by 50% (Fransen, 2019).

Wcarbon = 0.5 * Wdry weight

Step 4: Determine the weight of carbon dioxide sequestered in the tree

CO2 has one molecule of Carbon and 2 molecules of Oxygen. The atomic weight of Carbon is 12 (u) and the atomic weight of Oxygen is 16 (u). The weight of CO2 in trees is determined by the ratio of CO2 to C is 44/12 = 3.67. Therefore, to determine the weight of carbon dioxide sequestered in the tree, multiply the weight of carbon in the tree by 3.67. (Fransen, 2019)

Wcarbon-dioxide = 3.67 * Wcarbon

Though the accurate calculations of Carbon sequestration are not yet possible, still the estimates help in fighting the issue of climate change (University, accessed in 2021). Based on the girth size of the tree, age of the tree also can be calculated. Roughly, every 2.5 cm of girth represents about one year's growth. So, to estimate the age of a living tree, divide the girth by 2.5. For example, a tree with a girth of 40 cm will be sixteen years old.

For the calculation of carbon sequestration total tree samples available were 5357. Out of which 5351 trees were considered for the carbon sequestration calculation.

Total Tree 'Green Weight Above Ground' is 11687052lbs

Total Tree 'Green Weight above Ground + Roots' = 14024463 lbs

Total Tree 'Dry Weight' = 10167736 lbs

Total Tree 'Weight of Carbon in the Tree' = 5083868 lbs

Total Tree 'CO2 Sequestered in the Tree' = 18657795 lbs

Total Tree 'CO2 Sequestered in the Tree' = 8463026 Kgs

Following method has been used for the calculation (Fransen, 2019).A key "feature" of a tree is that trees sequester carbon – the process of removal and long-term storage of carbon dioxide (CO2) from our atmosphere (Fransen, 2019).

EcoMatcher and its tree-planting partners estimate that the trees planted sequester CO2 at an average of 25 kilos per tree per year; we use an average of 250 kilos over a tree's lifetime. Of course, the sequestration changes with different species. The rate of carbon sequestration depends on the growth characteristics of the tree species, the density of its wood, the location's conditions for growth, and the plant stage of the tree (Fransen, 2019).

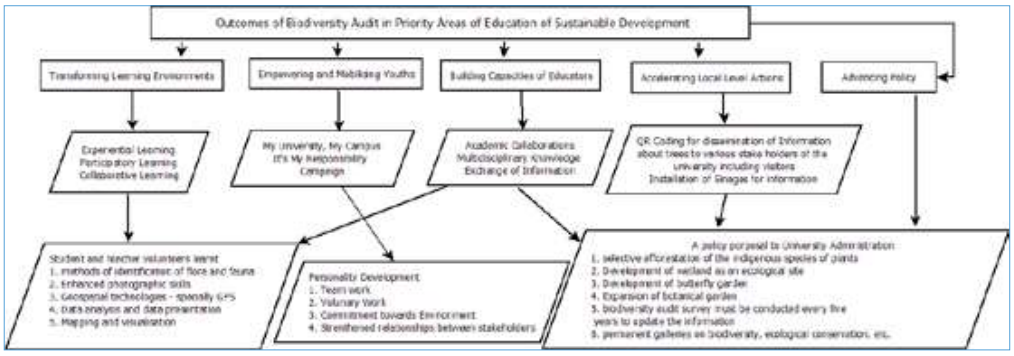
V. Outcomes

Through the biodiversity audit survey, we could capture glimpses of some faunal diversity in Kalina Campus. Yet there is much more to explore, especially in the area of diversity of insects, butterflies, zooplanktons and so on. In case of floral diversity too weeds, herbs, shrubs, grasses are yet to be covered. The success of biodiversity audit could be seen in the form of transformation of learning environments. The student volunteers selected various aspects studied under biodiversity audit for their semester IV dissertations. Their deep involvement allowed them to emerge with good research work for postgraduation. Their participation emerged as a major contribution to their resume. Many students became eligible for applying to various internships offered in biodiversity.

The survey enhanced the knowledge and integrated application of taxonomy and geospatial technology. The same has encouraged the students of subjects other than Geography to get trained into Geospatial technologies and its application in environmental management and preservation. The students, teachers, and non-teaching staff were seen to be more curious, attentive and aware about trees as all the trees were QR coded. QR codes were 10 signages and a photo gallery has been established to extend the information about campus habitat to the staff and visitors. The teaching and nonteaching members have also grown vocal on various environmental related issues associated with campus. There has been a positive approach from the University administration in converting

the Vidyanagari campus into Green campus by initiating more of such activities that would bring focus on ESD.

Figure 5: Biodiversity Audit – Outcomes



Source: Conceptualised by author.

The effort of documenting, geotagging and collecting detailed information of flora and fauna in Kalina Campus has emerged as one of the innovative endeavours of approaching the current issues relating to ecological and environmental deterioration. The need to create awareness about various environmental problems could be fulfilled by involving the various stakeholders in the biodiversity audit survey. The effort also has been highlighted by the print media encouraging others to undertake similar activities. The team has also emerged as a major expertise in biodiversity audit and in a position to offer consultancy. The team could work together to also have some policy interventions to continue the efforts of transforming the Vidyanagari campus of University of Mumbai into Green Campus. The effective implementation of ESD could be achieved through this exercise. The final culmination of the same is the development of Android based mobile application named as Live Green. The application has visualization of Mumbai University Vidyanagari campus where the trees have been geotagged and their carbon sequestration has been calculated. The user after visualization can also geotag trees in his own area with basic details like name, height and trunk size. The application will return the carbon sequestration rate of the trees the user has geotagged. This exercise will help the communities to do floral audit for their own spaces and also take a decision to plant trees of specific varieties to improve the quality of natural environment. The application is available on Google Play store with the name “Live Green”.

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