The University of Hyderabad Campus Master Plan: Designing for a Sustainable Future

An Honors Thesis (LA 404)

by

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May 2011

Expected Date of Graduation
May 2011
While studying abroad at the University of Hyderabad last spring, I became enraptured with the beauty of the campus and the uniqueness of its surroundings. I had never experienced a landscape like that before, but quickly realized that it is being threatened by the huge amounts of growth in the region. While the campus provided a small sanctuary for wildlife and reflected the natural landscape of Hyderabad, it has not been planned for sustainability or preservation, slowly making it part of the problem, rather than the solution.

This project started in September with research, evaluating what could be done to make the campus more sustainable. The problems, like water shortages and the disconnect from the environment that I had noticed while a student there, became more apparent as a symptom of existing regional conditions. The initial research for this project, which is shown in the following sections, illustrated a need for more student involvement in environmental matters, more use of water harvesting and filtering techniques, and a system to help conserve the habitat for the fragile ecosystem found on campus.

This design project is intended to help relieve some of the pressure the campus puts on the natural environment. It designates areas for conservation and preservation, as well as designs systems that can hold water for use during the dry season, allowing the campus to not continue depleting the nearly exhausted existing aquifers. It also creates a plan for the expansion of campus, allowing it to grow as necessary, but also protect the environment by creating an off limit zone for new growth, and illustrating a plan for how to incorporate the natural geology of the region into building plans.

This project is intended to illustrate ways that the University of Hyderabad Campus, and new and old development in the surrounding area can adapt to the changing needs of the environment and the pressure being put on it by the expanding population of India and Hyderabad. Sustainable design is something that is often ignored in the current trends of development in the region, but is something that will become increasingly important as time goes on, and this project shows some of the means that sustainable design can be accomplished.
Abstract

This project explores the possibilities of sustainable campus design for the University of Hyderabad in Hyderabad, India. It finds that the sustainable design can be achieved through a combination of water management systems that both collect for infiltration and store for reuse storm water runoff. It also evaluates the methods for environmental conservation and preservation that are applicable to the campus’s diverse and often threatened wildlife, while exploring means of integrating human activity more comfortably into the surrounding wildlife.
Special Thanks To:

Chris Marlow, John Motloch, and Burcu Yigit Turan

Martha Hunt

My classmates for all their input

My Parents and Charlie for listening to my thought process even if they had no idea what I was talking about.

Farah Alam for helping me get into contact with the Society to Save Rocks

Anna Johnson, Caroline Hughes, Laura Johnson, Allison Horton, Emily Northy, Emily Shinay, Rosemary Downing, and Melody Smith for help remembering areas of campus.

Frauke Quader of the Society to Save Rocks for helping me end the impossible topography map quest, even if it was unsuccessful.

Dr, K. Seshagirirao for providing his invaluable research on the plant species of the campus

All of the wonderful faculty at the University of Hyderabad, especially Dipankar Das for answering an endless stream of questions last spring and Bhavani Aadimoolam for showing me Hyderabad and the campus in the way only a true native and friend could.

A Special Dedication To:

Tanvi Aadimoolam everyone’s favorite trilingual Telegu toddler whose sense of wonder toward everything around her enforces the need for conservation and education.
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Civilization can never sustain itself upon cannibalism of any form.
-Rabindranath Tagore, Sadhana: The Realization of Life

Rabindranath Tagore, the Nobel Prize winning Indian poet and philosopher is often considered one of India’s heroes and most influential thinkers. He also argued that people must embrace the world around them, and find ways of protecting it as a means of sustaining themselves. This philosophy of sustainability is important to the continued growth and prosperity of the nations of the world, and particularly applicable to Hyderabad, India. Hyderabad is one of the largest cities in India, the capital of Andhra Pradesh, and one of the centers of the growing technology industry in India. It is also the site of turmoil in the form of violent protests regarding many political issues that can be traced back to one thing, the scarcity of resources. The University of Hyderabad is located outside of the city center and is the ideal place for an exercise in sustainable design. The campus is a haven for animal and plant life, which is becoming increasingly rare as the population of India climbs rapidly to over a billion people. It also is one of the premiere institutions of higher education in the country, and provides the ideal place to explore new ideas and institute practices to make the campus sustainable and retain its beauty and environmental health for future generations.
Review of Literature
Sustainable Campus Design

Sustainable campus design is one of the critical philosophies when dealing with campus planning for the future. With the world’s population growth and continued depletion of resources, sustainability becomes increasingly important to not just study but put into action. Campuses are intended to not only be places of learning, but also, ideally, bastions of cutting edge thought, design, and social conscientiousness. In order for the students to strive for these ideals, the environment that surrounds them must also achieve them. As a result, campuses are embracing sustainable design as a means of maintaining themselves for the future and encouraging their students to design and adopt the principles that make campuses successfully sustainable.

The idea of sustainable campus design has changed over the years, but has been present in design since the mid 20th century. One of the early examples of sustainable design occurred at Heriot Watt University, designed by Weddle Landscape Design, and the methodology for this design is presented in Deng, Bromwell, and Wareham’s article “Applying Ecological Landscape Design Principles to University Planning.” It becomes a precedent for the University of Hyderabad because the campus was designed on an ecologically diverse former estate where university leaders and designers wished to conserve the environment while still allowing for human activity. While the campus proves to be an excellent case study for the incorporation of naturalized spaces into designed areas, the article is one of the most comprehensive in terms of presenting the design process that includes ecological conservation. The steps that the authors describe are “habitat survey, detailed ecological survey, ecological impact assessment, mitigation measures and methodology, landscape master plan, and long term management and review” (Deng, Bromwell, and Wareham 99). These steps can be applied in all designs that account for ecological conservation, and are particularly useful for the University of Hyderabad master plan because of the similarities in the need to preserve diverse ecological systems. The University of Hyderabad design will use these steps to the greatest possible extent in order to help create ecological conservation on campus and try to maintain it in the long term. The article also articulates the idea that the campus plan is constantly up for review and revision based on the needs of the students, making it consistently sustainable because of the ability to adjust and update as technologies and needs change.

Within green campus design, there is an emphasis on the integration of sustainability in the environment into education and importance of aesthetic. Calkins’s article emphasizes the importance of green designs in campuses as tools of education and leaders in sustainable design. Calkins’s primary objective in her article is to stress the need for campuses to be “a teaching tool for environmental literacy,” a trait which should be applied not just to campuses with a design school, like the ones that she primarily calls on, but ones, like the University of Hyderabad, where programs exist to study native wildlife and where technology is becoming increasingly important as a field (40). The capability of turning the campus into a learning environment is particularly useful to centers, like the Centre for Regional Studies, which provides a cross disciplinary study of the culture, environment, history, and geography of Andhra Pradesh. Calkins places emphasis on
designing with native plants and working towards changing aesthetic preferences to ones that embrace native species because despite native species’ superior ability to adapt to the climate, they are often considered weeds or too ragged for the traditional aesthetic. This assessment of the need to use native species and adjust the aesthetic to fit with these plants is particularly important to the design of the University of Hyderabad master plan, because current practices do not always use plants that are suitable for the locale and in an area where the climate requires plants that can survive periods of drought, eschewing native species for roses and turf in formal areas. The campus’s unique and huge range of native species could easily provide the palate for all areas of formal plantings, like the gardens near the library and science building, without detracting from the formality of the area, nor loosing the sustainable integrity of these gardens. The campus to an extent does use native species, but has emphasized areas that must be consistently irrigated because of plant choices like roses and turf better suited for climates with more consistent precipitation.

An aspect that is applicable to the University of Hyderabad’s campus that is brought up in Calkins’s article and strongly stressed in the book by Simpson is the idea that sustainable initiatives must be achieved from both administrative decisions and student involvement. Simpson evaluates many situations in which sustainable design decisions were either solely determined by the administration or by student groups. There is a significantly lower rate of success when this is the case, compared to when these initiatives are jointly decided upon. The ability of students to work jointly with the administration at the University of Hyderabad has been strained at times, due to the perceived corruption of members of the administration; however, the two could work together easily if different spheres of influence are exerted over aspects of the masterplan. The administration could take care of the infrastructure, while the students’ most important job will be to adjust certain behaviors, such as the treatment of trash, to help control some of the campus’s pollution problems. The University of Hyderabad students are typically politically active, and many belong to the regional Save our Rocks Society, which promotes the conservation and integration of the Deccan Plateau geology, so student involvement in campus conservation is not one that is out of reach. Students can also embrace the idea of the living classroom and incorporate their studies into the sustainability of the campus. This idea seems logical, but is an important factor to keep in mind for the masterplan of any campus, especially the University of Hyderabad.

All of the literature about sustainable design for campuses gives many fairly vague means of making a campus “green” which can be applied to the University of Hyderabad, such as the steps in determining an ecologically conservative design, the need to incorporate the campus as a teaching resource, and the need for sustainable initiatives to be a collaboration between students and the
administration. While the information in the literature is excellent in many regards, it is lacking insight into campuses that need to be redesigned and planned to account for sustainability initiatives, like the University of Hyderabad. In many cases presented in the literature, like in Simpson’s book, the initiatives are overlying additions to control energy or runoff, but not ecological conservation. In other cases, like Deng’s article on Heriot Watt University, ecological conservation has been a goal since the outset of the project, and the other factors of sustainable design have been added in the framework of the ecological conservation. In the University of Hyderabad masterplan, there will need to be incorporation of the existing natural area into the design of the plan, as well as accounting for growth and the addition of sustainable energy and water management.

**Storm Water Runoff Management**

The University of Hyderabad master plan is not exempted from needing water management as a design feature. The primary reason for the location of Hyderabad is its natural deposits of water, which have been greatly reduced over the years due to mismanagement and large growth rates (Subooth). Storm water runoff management is used to collect, filter, and slow water, allowing it to infiltrate into the ground, as well as control pollutants’ entry into the water body where the runoff goes. In many areas, this is important in keeping the water quality acceptable, but is particularly important in Hyderabad, where water-borne illnesses are prevalent in times heavy rain due to runoff and the inability of sanitation systems to keep up with the rain fall and runoff (Huchon and Tricot 48). Located in the Telangana region of Andhra Pradesh, the campus suffers from some of the same water shortages and related problems that have caused political unrest and a separatist movement in the region. The campus has periodically suffered water shortages in student hostels and classrooms, resulting in student protests and boycotts of classes. The ability of the campus to control storm water runoff is an important factor in the master plan of the University of Hyderabad’s campus.

Water management for sustainable development is not a new concept in India, however the focus has been more on agricultural water needs than storm water runoff itself. Due to the semi-arid tropical climate, irrigation is necessary for many of the crops to grow successfully, and water often becomes short because of the overuse of the land and aquifers, which in turn are not given a chance to recharge, the semi-arid climate of the region has influenced water management practices to emphasize conservation and harvesting. Ballabh and Thomas discuss the case study of Shankerpura, a village in which methods for sustainable land development have been applied to help the economic state of the area. The primary focus of the land development has been toward soil and water conservation, through check dams, lift irrigation systems, and forestry efforts to prevent excess erosion during the rainy season (Ballabh and Thomas 154-162). As a design feature, check dams and the need to maintain forestry in order to sustain the land use on the campus.
The combination of the two design features, in strategic locations, should help control soil erosion, in turn preventing it from entering the water bodies, and from upsetting the ability of plant life to grow around campus. The primary idea is that there must be an element of economic and cultural sustainability as an incentive to promote environmental sustainability. The largest reason that sustainable land development in Shankerpura has been successful is because of its ability to drastically improve the life of the residents, helping increase the percentage of households with two full meals a day from 20% before the sustainable development to 80% after it was implemented (Ballabh and Thomas 163). This success is linked with the ability of the residents to focus less on subsistence living and therefore are capable of expanding the amount and quality of crops. While the residents of the University of Hyderabad's campus are not suffering from the same levels of poverty as the residents of Shankerpura, if some element of economic incentive is included in the master plan, the environmental sustainability will be more successful. This economic incentive could come in the form of selling some conserved water, or simply in cutting costs by not having to pay for city water.

Dealing with rainwater collection and harvesting in areas that are periodically dry or under monsoon conditions has been experimented with in the form of Jahad harvests, or the practice of using local materials to collect and store surface water runoff to increase infiltration (Argarawal and Narain, 129). This type of harvesting works well in many areas of India, and has potential to be part of a useful system on the University of Hyderabad's campus, but must be integrated with several techniques of water collection, filtration, and reuse, because the geology of the campus faces the same problems as much of the Deccan Plateau; primarily granite and hard, fairly impermeable rock causes infiltration into the aquifers it be slow and therefore cannot be the sole means of dealing with excess water (Deshparde and Jyotisti 282). The groundwater in the area surrounding Hyderabad is being over used to sustain the growth of the city, and Deshparde and Jyotisti believe that the groundwater in the area should be considered a valuable resource that needs to be protected, and that alternatives to using groundwater should be found (284). This thought leads to the conclusion that multiple systems of storm water management should be used on the University of Hyderabad's campus, some that encourage recharge and filtration, so as not to take away from the natural systems, while others should deal with rainwater harvesting, so that water can be used without having to drain the aquifers. This combination will likely deal with both rain barrels and more vegetated areas, as well as potentially using Jahad harvesting techniques and other forms of retention.

One of the means of storm water management that is presented by Grava is the need for a larger regional and local plan for water management. Since the University of Hyderabad exists almost as a small town on its own, with both students and faculty and their families living, working, and going
to school on campus, any storm water system can be administered locally, as is suggested by Grava. This administration of storm water management practices once again emphasizes the need for the members of the community to be involved in aspects of campus sustainability. Administration of storm water management would include monitoring the amount of pollutants in the water and identifying areas in which pollutants are more likely, either through discharge or in the more likely case of the University of Hyderabad, open areas of litter and trash that is left outside and exposed and can be easily swept away into the water (Grava 88). This trash predictably causes major ecological problems, not just on campus, but also within the watershed by damaging the integrity of the water quality. On campus, the ability to keep pollutants from the water will help the wildlife as well as the human population of campus. While ideally, the storm water management should be in a more regional scale, particularly with the growth rate of the surrounding area, the University of Hyderabad master plan cannot include management for outside of the campus, and must focus on local rather than regional management.

There are several methods of storm water management that are used frequently enough that Larson and Safferman were able to evaluate their effectiveness as well as chart which method works best in which condition. Their evaluation of bioretention, grassed swales/filter strips, infiltration trenches, porous pavement, rain barrels, and wet detention ponds includes information such as soil types and effectiveness of the system (Larson and Safferman). Of the means presented in the article, the most effective on University of Hyderabad’s campus would be the use of rain barrels, since they do not require heavy use of plants or quick infiltration, a problem due to the rocky nature of the soil and volcanic geology found on campus and the surrounding area. Rain barrels would be a useful addition to the hostiles and classroom buildings because the rainwater could be used to flush toilets and in showers, thereby reducing the amount the campus relies on filtered water, and preventing the strike causing water shortages that the campus has seen in the past. Another method that is mentioned by Larson and Safferman is detention ponds, which is a technique used by early settlers of the Hyderabad region, primarily as a means of storing water for use in Golconda Fort and the palaces associated with it (Subooth). This ancient technique could potentially be used as a means of storing water that cannot be retained in rain barrels, and then can be used in the campus buildings. Its major disadvantage is a the rapidity of evaporation, making it more unreliable as a source of water. As in Ballabh and Thomas’s article, the methods of storm water management are reliant on the need for plant life to help infiltrate and hold water, while preventing soil erosion. This element can be achieved on the campus easily in conjunction with the elements of sustainable campus design that emphasize the importance of native plants, because of their abilities to survive in the area, as well as the desire to conserve the ecology of the campus.
Ecological Conservation

The University of Hyderabad's campus is over a thousand acres and has a unique biodiversity, which is becoming increasingly encroached upon due to both the campus's growth and the expansion from the center of Hyderabad to the further outskirts of the city. The campus's "Deccan scrub jungle" has a wider variety of species than many much larger areas of the state of Andhra Pradesh, making the campus a unique and valuable resource with over 734 documented plant species (Seshagiriao). These plants are not just dry plants, but also include a range of habitats due to the lakes, forests, and scrub lands found on campus. The diversity of the plant life leads to a large diversity of animals, particularly birds and reptiles, of which the campus has an estimated 150 varieties of each (Rayaprol).

Much has been written about the need for ecological conservation because of its benefits to both the human and natural world. Arguments have been made that ecological conservation in fact protects cultural and economic sustainability as well as environmental because of the advantages of biodiversity and the potential of the natural environment to produce important goods (Beatly 6). This fundamental aspect of the argument for biological diversity conservation is particularly applicable to the University of Hyderabad, where over 300 of the plant species found have medicinal uses in traditional Indian medicine, and even more have practical and potentially commercial uses (Seshagiriao). Beatly also suggests, once again, the need for community and administrative involvement in the habitat conservation and cites local property owners as a major stake holder in conservation efforts, being the ones that are often the most affected by the economic limitations that may be a result of the conservation efforts (43). In the University of Hyderabad's case, the growth of the campus could be potentially detrimental to the existing biodiversity. This problem is being addressed because the campus administration already recognizes the natural area as a major asset to the campus, making it easier to maintain the biodiversity while finding more room for expansion as it is needed.

There are many suggested methods for ecological conservation, each with its own advantages and disadvantages and variability of usefulness based on the individual project concern. Haufler examines several of the common methods of maintaining biodiversity, including bioreserve, in which areas are protected from all development and human involvement, emphasis area strategy, in which the most sensitive areas are conserved, coarse filter strategies, in which enough of the area is conserved to maintain a balance of biodiversity, and larger scale conservation efforts, which are not applicable to the University of Hyderabad master plan (219-230). Of the methods discussed, the idea of a bioreserve seems to be the most impractical for the University of Hyderabad because of the need of the campus to function as a small community, with large
amounts of human activity. The concept of completely protecting the natural areas from human interaction would dissuade people from using the natural area for anything and therefore also lessen their investment in the ecological diversity. A combination of the emphasis area strategy and the coarse filter strategy seems the most applicable to the University of Hyderabad because they help select the areas that need to be conserved the most, while still allowing for growth. The emphasis area strategy would help identify sensitive or increasingly rare habitats, like the lakes and wetlands on campus, as major focus areas for conservation, while the coarse filter strategy would help maintain the abundant biodiversity that exists already because of the large variety of habitats.

One of the recurring themes in the literature, through all of the topics is the idea that sustainability efforts must be achieved through a combination of human involvement. Ecological conservation is no different and as cited by Brown, one of the important features in successful conservation efforts. When conservation efforts have failed, it has often be the result of lack of compromise and recognition of the stakeholders, who at times are adversely effected by conservation efforts if they area not involved in the decision making process (Brown 12). In the case of the University of Hyderabad, there are a large variety of ways that the students and faculty can become involved as stakeholders in conservation efforts, much of them stemming from the community's lack of reliance of the campus land for agriculture, the example used as the most detrimental to widespread conservation efforts in Brown's article. The University of Hyderabad community members could easily become involved in the campus conservation efforts as a means of academic pursuit. With many courses' emphasis on science, it would be a practical step to include educational opportunities regarding the conservation of the land and the usefulness of biodiversity. This same effort would also be applicable to the primary school that is located on campus, to educate the students of the surrounding area about the importance of sustainable and conservational efforts.

For Definitions, see Appendix B


Project Summary
Problem Statement

This project will explore the possibilities for a new campus master plan for the University of Hyderabad, in Hyderabad, India in order to help the university manage its large campus and growth. It will investigate the school’s expansion and ways that it can be done sustainably by improving storm water management systems and locating areas for ecological conservation.

Significance

The University of Hyderabad Campus Plan builds upon the ideals of sustainable design, but transfers the principles to an area that has not utilized these design techniques extensively. As a result, there is very little information regarding the effectiveness of best management practices commonly used in other parts of the world. As water and natural environments become more and more scarce especially in developing industrial nations, and ones with large population growth, like India, the impact of sustainability cannot be an afterthought, but rather must be incorporated into designs and plans for the future. The area surrounding Hyderabad currently struggles with drought and degradation of the environment, and the problem will likely only intensify as the population continues to grow and strain the limited resources. With little data to determine the most effective methods of sustainable design in the region, this research will seek out the best practices to sustain long-term growth through planning. The research used to determine the University of Hyderabad's most sustainable systems can be applied to other projects in the area.

This topic would be a chance to create a campus plan for a university that is growing rapidly, like the country and city that it is in. The University of Hyderabad is just outside of Hyderabad, and is in the process of building new areas, but there is currently a huge separation between the two sets of classrooms and the living quarters, often ranging between two to four kilometers. A campus plan would help join the areas and organize the paths that can be taken to them. It would also attempt to beautify areas of campus that are neglected, and provide more places for students to gather, like a quad, near the newer end of campus. A plan would also have to take into consideration the professor and worker housing on campus, the elementary school that serves them and the surrounding community, and the unique, compound like, nature of the campus. This project would also have to address sustainable and safe methods of construction, waste disposal, and water management in both the dry and rainy seasons that would be feasible economically. Additionally, this project would need to incorporate the abundant wildlife that inhabits the campus, which includes peacocks, over one hundred species of birds and snakes, monkeys, pigs, buffalo, and many other types of animal and plant life. This project would plan for the growth of the school as well as the methods of maintaining the naturalistic feeling of the campus that separates it from the surrounding area.
- Limited Space
- Encroaching surroundings
- Large granite outcroppings that constrict and shape development.
- Large ecological diversity, including many endangered and threatened species.
- Disconnect between students and environment.
- Limited water availability.
- Trash disposal.
- Pollutants entering waterway.
Goals and objectives

Distinguish Areas for Expansion
- Encourage infill where possible
- Conserve natural rock formations, or incorporated them into new structures.

Celebrate Campus as a Natural Resource
- Protect and conserve endangered and threatened species.
- Create wildlife corridors.
- Encourage student interaction with wildlife through education and integration.

Protect and Conserve Water
- Collect and reuse water from runoff.
- Filter water as it enters water bodies.

See Appendix for Delimitations
Expansion
- New faculty housing, student housing and classroom buildings
- Develop a plan for the South Campus
- Create a Student Center on location on South campus that incorporates:
  - Food
  - Indoor and Outdoor gathering spaces.
    - The indoor space will need to hold 100 + students
    - The outdoor space should be able to hold 500-600 students, with spillover space.
  - Incorporate the rock formations as seating, tables, and construction elements.
  - Incorporate water resource reuse and filtration

Wildlife and Natural Resources
- Create a series of trails to connect two ends of campus
- Integrate a learning experience, in the form of signage along the trails
- Incorporate wildlife corridors that weave in and out of the classrooms

Water
- All new construction will incorporate water use best management practices
- Water systems will be visible
Heriot Watt University is a university located in Riccarton, near Edinburgh in Scotland and designed by Weddle Landscape Design. In the late 1960s the university was moved in order to create a larger and more modern campus. The site of the new campus was a 200 hectare estate that had been designed during the period of pastoral landscape design. Although the site of the campus was man-made, it had developed a large amount of ecological diversity due to a variety of habitats. The primary concern for the creation of the new campus was to design it in such a way as to not upset the robust ecological diversity and still accommodate the 10,000 students that would use the campus.

The initial project analysis and environmental impact began in 1968 and site construction started in 1973. This time gap illustrates the significant amount of time spent in analyzing the environment and developmental impacts of the site. The campus design encompasses many aspects of sustainable design by incorporating design features that help protect the environment from human pollution, allow the campus to conserve energy, and rehabilitate water runoff from hardscapes. The most important aspect of the campus’s design is that it is ongoing, with a management plan in place to allow the campus to change to meet the current and future needs of its students and environment.

The design process and Heriot Watt’s ability to incorporate human interaction with natural preservation goals are the largest influences on the University of Hyderabad Campus design. Although Heriot Watt was planned to incorporate the natural areas with the human interaction, its properties can still be applied to the University of Hyderabad.
Case Study: Harmony, Florida

Harmony, Florida, is a planned community by Jim and Martha Lentz, designed with the focus of preservation and conservation of the delicate environment of that area of Florida. The development plan includes a large number of restrictions and regulations that are intended to help with wildlife conservation and preservation. The plan has extensive provisions made for "animal-human coexistence" and is intended to be a green and sustainable community (Wolch 35).

The project was conceived in 1996 and is ongoing, being built in stages. It currently has around 1,000 residents and the project is successful so far in its interactions with wildlife. It allows for both human comfort and the needs of the plants and animals that inhabit the area. While it is not a campus design, it does provide good examples of how to incorporate human activity into a sensitive ecosystem, as well as plan for a diverse range of uses within the community. It provides an interesting study in how to balance people and the requirements of development with the wildlife conservation goals for an area that is sensitive and currently threatened by development.

Although Harmony is a planned community, it has several similarities with the University of Hyderabad, most noticeably the ability to incorporate wildlife and a diverse residential community.
Inventory and Analysis
The University of Hyderabad site is located about twenty kilometers from the center of Hyderabad, in an area called Gachibowli. When the school was first built, the area was practically wilderness, but has rapidly built up due to the technology boom that funds Hyderabad. As a result, The University of Hyderabad is becoming an enclave of green and natural area in a sea of new development of technology related corporations and housing colonies that accompany them.

The campus itself can be divided into two primary areas, the north end and the south end of campus. The north end is the older section, and currently the primary location of the majority of classrooms and hostels. The south end of campus is relatively new, and houses such programs as the Integrated Studies program and the Study in India Program, their associated classroom buildings, and other newer classrooms dedicated to technology and engineering research and development. About two kilometers and a largely naturalized area that is distinctive because of its exposed granite and shrub forest separate the two areas.

The campus has two lakes, Buffalo Lake and Peacock Lake. These areas are not easily accessible, although Buffalo Lake can be seen from many of the classroom buildings on the north end of campus. Small lakes like the two on the University of Hyderabad’s campus are very common throughout Hyderabad and its surrounding area, and are often very polluted or drying out due to the large number of people who have moved to the area, and therefore should be treated as a valuable resource.
The campus wildlife is diverse. At least one troop of common Indian monkey travels around the campus, and interact with people near the botanical garden and Arts Building.

Habitats vary from scrub and grass land to a denser forest and underbrush. This underbrush is found near the sports complex on the north end of campus.
The Main Road creates a formal entrance to the campus. This picture, taken near the entrance gate, is the first impression a visitor has of campus.

Gops is the main food court and one of the major gathering spots on campus. This is where students often go to eat and socialize, and it is often the location of group meetings, rallies, and holidays.

The Shopping Complex, located near the entrance to the university is an important location for students to buy the things they need, ranging from school supplies to toiletries, to food, to shoes from the cobbler. It is also a major meeting spot for students all over campus.
Explanation of Inventory

The University of Hyderabad Campus is over one thousand acres of diverse ecological and cultural uses. It varies between student and faculty housing, classroom and administration buildings, intermittent streams and Deccan Scrub Jungle. Figure 3.10 illustrates the locations and clusters of the various building typologies, as well as the locations of endangered species habitats. The two distinctive areas of campus, the North Campus, which is largely built out, and the South Campus, which is under construction, becomes apparent through their diversity of uses.

There is a distinctive separation of housing and classroom buildings in which the bulk of the classrooms are centralized with the housing on the outskirts of these classrooms. This separation creates distinctive areas for living and for schooling. Areas for food and administration are in between the primary social spaces, making opportune places for gatherings, however these areas are solely located on the North Campus. Both of the areas are separated from the primary wildlife zone, or the zones where there is an abundance of endangered species.

There is a considerable distance between the North and South Campus; it is about two kilometers from the intersection of the two main South Campus Roads and the main cluster of classroom buildings on the North Campus, where most of the students currently attend classes. There is one connection between the North and South campus, and it is the main road that runs from the main gate through campus.

The location of endangered plant species habitats is fairly centralized on campus, between the North and South campuses. The endangered plant species are indicators of the diversity of the wildlife on campus, and are members of ecological communities that include endangered animal species as well. More information on the thirty-nine endangered plant species can be found in Appendix C.

The water systems of the University of Hyderabad Campus create an interesting seasonal dynamic. There is about thirty inches of rainfall every year, nearly entirely between June and October, creating seasonal intermittent streams and larger lakes. Figure 3.11 illustrates the variances in water every year, with the dark blue representing year round standing water, and the green-blue representing the intermittent areas. The bulk of this water is located between the North and South campuses and in the same area as the bulk of the endangered plant species.
Figure 3.10 - Campus Inventory

Figure 3.11 - Location of Permanent and Intermittent Waterbodies
Explanation of Analysis

The clustering of the housing and classroom buildings creates the first major decision from the analysis of the site. These clusters create a range of water usage needs, from high to low. These areas become different priorities for water harvesting reuse. The highest priorities for rainwater harvesting are in areas where there is the highest density of people living. These areas are focused around student housing, where hundreds of students can live in one hostel, and around faculty housing, where the housing serves not only the faculty members, but their families as well.

The location of the endangered plant species' habitats is located between the North and South campus, in the areas that are intermittent streams, or in the rockier scrub area. The different habitats border on each other, making the extents of the area an ideal space for ecological conservation. This space is large enough to give the endangered species and their communities a sanctuary in the midst of the encroaching construction.

The prominence of the clustered housing units that are high priority for water harvesting along the border of the area where the ecological conservation needs to occur reflects the idea that there needs to be a buffer between the human residences and the wildlife. This would help ease the amount of trash and grey or brown water that enters the wildlife zone and the streams and lakes that it encompasses.

The distance between North and South Campuses is long enough that new construction should be included on the South Campus, in order to create a stronger sense of connection within the South campus community and allow the area to have some of the utilities that are found on the North Campus. Additional housing, both for faculty and students, as well as more classrooms and gathering spaces would help create a distinctive South Campus zone, while links in the form of trails and road transitions would help unite the North and South Campuses.
Design Process
The basis of the main concept for The University of Hyderabad Campus Master Plan is to divide the campus into zones based on their priority for water harvesting, new development, and conservation.

The bulk of the new development is located on the South Campus, extending further north and south along the existing road. This area will be explored in more depth beginning on page 48, as well as methods for water harvesting.
Connections are a vital part of creating a unified campus. The zones in the first concept illustrate what will be where, but the connections along the roads help create a sense of cohesion in an area that is naturally strongly divided.

In conjunction with the road typologies, trails will connect The North and South Campuses. These will be elaborated upon, beginning on page 42.

The individual areas that highlight the transitions and road typologies will be elaborated on beginning on page 43.
The Master Plan for The University of Hyderabad’s campus creates a sustainable university setting that incorporates the natural and social needs of the site. It restricts the new construction to areas that will not further limit the habitats of endangered and threatened species and encourages all growth to be created in a sustainable way.

One of the major features of the campus master plan is the conservation of wildlife and the creation of corridors for the wildlife to move through. These corridors, highlighted in bright green in Figure 4.6 connect to each other and to different areas of the central conservation zone.

New and additional housing and classroom buildings are added to parts of campus, especially South Campus. These new buildings are primarily infill or create the pattern of South Campus. They are highlighted in brown in Figure 4.6 and all subsequent drawings. The housing on campus often borders the conservation zone or the wildlife corridors based and requires not only a water harvesting method (see Page 63) but also some form of buffer to keep residue from entering the waterways.

The trail system is another important part of the master plan. It allows students and faculty to travel from each side of the campus to the other not only along the main road, but through the conservation zones. The trails intersect with each other and the roads at the midway point of the conservation area.

Figure 4.3- Wildlife Corridor

Figure 4.4- New Faculty Housing

Figure 4.5- Trails
The trail system (see Figure 4.7) connects the North and South Campuses. It has terminuses near the new student center and student housing and in the midst of the new classroom buildings on the South Campus and in the main campus and classroom areas on the North Campus. The trails follow existing trails on campus, and create stronger connections to the different areas.

Figure 4.7- Trail System

Trails that cut through the ecological conservation zone are designed to help introduce students to the beauty and wonder of the environment that encompasses the campus. Special learning stations, noted by signage (see Figure 4.8) inform passersby of the special features of the area that surrounds them. These signs will be placed near endangered species, medicinal or commercial plants, or things that elicit special interest.

Figure 4.8- Students Using a Trail
The North and South Campuses are only connected through the main road of campus, which runs from the front gate to the end of the campus property. This road has several character features that create a disjointed feeling as it moves from the formal boulevard at the entrance to the less formal and spacious roads that define the other parts of campus. There is no existing road transition from the current typologies, and creating transitional zones for specific road typologies will help unite the campus.
Road Typology 1- Boulevard

The first section of the road typologies is a traditional boulevard with wide sidewalks, a median, and two driving lanes. Keeping with the existing structures, the road is distinguished by evenly spaced, uniform trees that provide shade.

This typology is the most formal of the four, and is found at the beginning of the campus, nearest to the main entrance, the administration building, and the North Campus classrooms, or, the first place visitors, guest lecturers, and important benefactors will see. This Boulevard Road Typology gives the university an air of formality and tradition when first entering it.
The Transitional Road Typology is designed to ease visitors from the formality of the boulevard to the more natural zone that follows it.

This typology is defined by removing the median and one side of the sidewalk from the Boulevard typology. This allows a similar use of separated pedestrian and vehicular spaces, but does not retain the definition of spaces. It is more typical of existing roads near housing and classroom buildings.
The Natural Area Road Typology is part of the effort to make it easier for students to interact with their natural surroundings.

This typology is defined by pulling pedestrians off of the main road and directing them to a trail. The trail is part of the larger trail system and serves as a means not only for pedestrians to travel along the main road, but also to help connect them to other parts of the trail system.
The Boulevard-Plaza Road Typology is the defining road feature of the South Campus. It is a bookend to the Boulevard of the North Campus.

This typology provides the formality of the North Campus Boulevard while acting as a woonerf, allowing pedestrian and vehicular traffic in the same zone, which is the typical pattern of how students use the roads, regardless of the presence of sidewalks. The central median is recessed, and allows water to be collected and moved from the road, while being filtered before it enters the water bodies.

As a means of traffic calming, the Boulevard-Plaza Road is cut by slightly textured pathways, which also cross the median, allowing pedestrians to more freely move across the road.
Master Plan of the South Campus

Figure 4.14: South Campus Plan
The South Campus is the current and future location of many new programs at the University of Hyderabad. Already the home to the Nanotechnology Centre and the Integrated Studies Program, the area provides the perfect space for the University to expand as the demand for new centers and programs, and the students and faculty that will accompany them.

A sense of formality is added to the South Campus by incorporating rows of street trees and a median, which reflects the North Campus academic area. The northern portion of the South Campus is designated as the space for the classroom buildings. The clustering of these buildings makes it easier to go from class to class, as well as creates a separation of uses. Classroom buildings are designed to incorporate courtyards, which facilitates air movement, lessening the need for air conditioning. These courtyards also become places for students to congregate. The spaces outside of classrooms can become formal and informal gathering spaces.

The southern portion of the South Campus is designated as the area for student housing. In addition to the existing hostels, one will be added to house the women of the Integrated Studies Program, currently housed as far from the Integrated Studies building as possible. Each of the new hostels will incorporate green technologies to reuse and harvest water.

The South Campus emphasizes the need for green infrastructure to help maintain the ecological diversity and purity of the site. Runoff will be filtered through the site by moving toward the north end, via a swale in the median of the road. It will be further filtered from a formal garden at the northern tip of the south campus.

Figure 4.15- View of the South Campus Road
Parts of South Campus interact with the wildlife corridors and the human and wildlife aspects will literally cross paths. One of the additions and improvements to the existing infrastructure of the South Campus is to increase the amount of vegetation and slow the traffic so that wildlife can cross safely. Collisions with water buffalo at night are not uncommon currently, and drawing attention to the need for motorists to slow down and watch out for wildlife. Increasing the vegetation along the road increases the habitat for a variety of species that thrive in the low lying scrubland, as well as decreases erosion and slows water.
The northern end of the main South Campus road terminates in a formal garden. It will be a sanctuary, and celebrate B.R. Ambedkar, the primary drafter of the Indian Constitution and influential figure in social justice and educational equality and opportunity. This garden reflects others found throughout campus, but it is intended to emphasize the beauty of the native vegetation of the region, something that is often ignored in the other formal gardens. It will incorporate a variety of shrubs, flowering ground covers, and trees that have seasonal interest, including fruit, flowers, and interesting shapes during the dormant season. The formal garden will also be a visible filter for the runoff on the South Campus.
Student Center: Concept

The Student Center is located on the southern side of the South Campus, in the midst of the new student housing. The placement of the Student Center is determined by the location of a series of boulders, which are incorporated into the structure of the Student Center and used as places for students to gather, sit on, and help break up the space.

Program
- Create a Student Center on location on South campus that incorporates:
  - Indoor and Outdoor gathering spaces.
  - The indoor space will need to hold 100+ students
  - The outdoor space should be able to hold 500-600 students, with spill over space.
  - Incorporate the rock formations as seating, tables, and construction elements.
  - Incorporate water resource reuse and filtration
A major influence for the design of the Student Center was the traditional Indo-Islamic structures and gardens found in Hyderabad and throughout India. These landmarks make use of axial alignment with spaces divided by water features or paving changes in the less elaborate structures. The Student Center divides the spaces, and makes focal points out of the existing boulders and added areas of vegetation to create a setting that is reminiscent of the historical structures and gardens.

The Society to Save Rocks, a local environmental protection association, encourages using the unique boulders of the Hyderabad area as a building tool, rather than destroying them. This goal, and their prototype, Luther's House in Banjara Hills provide the inspiration for the incorporation of boulders into the Student Center's structure.
Student Center

Figure 4.21- Student Center Plan

Figure 4.22- Section of Student Center
The Student Center is a courtyard bounded by a study space, an area for a food court and stores, an indoor gathering center, and a wall, which serves to keep animals out (more on page 67). The space, although large, is divided by changes in elevation, vegetation, and the boulders that already exist on the site (see Figure 4.22). The axes, in accordance to the inspiration of the Indo-Islamic landscapes, divide the space visually, with blocks of vegetation and boulders at their intersections. Picnic tables provide spaces in the Student Center for students to sit and work or enjoy a meal. The study area is located at the entrance of the space and connected to the food and shopping pavilion. The indoor meeting space opens onto the elevated gathering space to the south, allowing a spot for meetings to spill over.

The Student Center is entered from the east side. There is a formal garden that incorporates native species that are notable for their commercial and medicinal uses and a semi-circular drive that also has a small area for parking bicycles and motorcycles, the most common form of non-pedestrian student transportation. The entrance sits on an axis with the student housing that is across the street, however the housing is gated, leaving only a visual connection between the two areas.

In order to fit in with the rest of campus, the Student Center is situated amidst as much wildlife and natural planting as possible. It maintains the scrub jungle that is native to the area, as well as incorporates plantings around and within it that are native species based to form the formal atmosphere that is needed to create the space.
The entrance to the Student Center is a tree-lined path that is capped by an arch. It draws students and visitors into the space by showing part of the courtyard and allowing the rest to appear as they pass under the arch.
One of the Student Center's busiest times will be at night, during dinner hours, after the classes are done for the day and students can take some time to eat, socialize, and relax. The food court and shopping area will provide the perfect place for students to eat food from all over India, enjoy a cup of chai, and pick up any personal supplies that they might need.

Figure 4.25- View of the Student Center Food Court at Night

The Student Center Gathering Space provides an area for students to hold meetings, hang out, and eat.

Figure 4.26- View of the Student Center Gathering Space
Water Harvesting Details

Figure 5.1-Diagram of Rain Barrel Water Harvesting System

Figure 5.2-Diagram of Topography Capped Harvesting System
The need to conserve and harvest water is one of the primary concerns of the University of Hyderabad Campus and the surrounding area as a means of protecting the environment and sustaining human settlement in the area. The city, founded because of its proximity to water, has been suffering from decreasing water tables that result in the astronomical growth of the region, as well as buildings and development blocking the natural flow of water (Subooth).

The University of Hyderabad has two options for harvesting water to be reused. For existing buildings, a system of rain barrels that collect water during the rainy season and store it for the dry season would successfully alleviate some of the pressure that university buildings put on the existing water supply (see Figure 5.1 for details).

Other buildings, primarily new construction, could use the existing topography changes to collect and store water. Since the granite bedrock of the site is so close to the surface, digging deep enough into the ground to store water would be nearly impossible, so enclosing the ground would create the tank. Figure X is a prototype, designed from the Student Center. The Student Center would have the yearly runoff of approximately 800,000 gallons of water, which, if entirely harvested, could be held in a capped tank, like Figure 5.2, whose dimensions would be 600ft long (as through the section cut) by 113 ft wide, making it a feasible storage system for the area without having to dig into the ground.
Student Center Paving Patterns

Figure 5.3-Primary Lower Level Paving Pattern

Two areas are distinguishable by the paving patterns selected. The first is the lower level of the student center, which uses a less formal style of paving pattern, with flagstones rather than an unorganized shape (Figure 5.3). This pattern is derived from Golconda Fort, the founding fort of Hyderabad, which used fitted stones and boulders to create a paving style.

Figure 5.4-Accent Paving Pattern

The decorative pattern that runs along the axes of the Student Center is based on the paving pattern that is used on existing campus sidewalks. It is composed of interlinking hexagonal pavers (Figure 5.4) that form a simple and unobtrusive pattern, which is ideal for the Student Center.

The paving patterns in the Student Center are modeled after paving patterns found throughout Hyderabad and India. They are intended to help create interest in the courtyard and help break up the space, so that it has zones within the spaces which are distinguishable through the variations of paving.
The patterns are derived from the same Indo-Islamic architecture that is found throughout Hyderabad and India. These patterns play on geometric shapes, like stars and diamonds, while using alternating colors, most often in northern India, sandstone and marble (Figure 5.5). At the University of Hyderabad Student Center, the paving would use the same alternation of colors, but use different materials, like manufactured pavers, in order to maintain durability and cost efficiency.

Other motifs commonly used in the traditional Indo-Islamic structures is the division of spaces by strips of color or paving changes that distinguish different areas of movement or direct flow (Figure 5.6). This motif is continued through the student center and found in both the elevated and lower areas.
Boulder Wall Construction Details

Figure 5.7 - Elevation of the Boulder Wall

Figure 5.8 - Screen Detail

The screen is made from cast concrete and constructed in the same style as screens found throughout campus. The screens allow students to see outside of the walls, around the boulder construction, and keep the space from becoming too enclosed.
One of the key features of the Student Center is the wall that is required to enclose it. This wall is necessary as a means of keeping out unwanted wildlife, namely feral pigs and dogs that live in the area, but the need for it creates the risk of cutting off the students from the wilderness, counteracting the goals of the trails and conservation areas. In order to keep nature involved in the Student Center, the wall is built into the natural boulders of the site and punctured by screens (Figure X).

The details on this page illustrate how the wall is constructed around the boulder and how the screens fit into it.
The goals of The University of Hyderabad Campus Master Plan are to distinguish areas for expansion, celebrate the campus as a natural resource, and protect and conserve water. This project achieves these goals through a series of large and small-scale plans, designating areas for expansion and conservation, and designing details that incorporate the unique geology and environment of the University of Hyderabad.

The plan accounts for the endangered and threatened species that live on campus, the special rock formations that epitomize the Deccan Plateau, and the seasonal changes in water flow, and the problems that those create. It plans for means to incorporate water harvesting into every building, allowing the water to be reused, slowing runoff and easing the pressure that the campus places on the rapidly depleting aquifers.

The University of Hyderabad Campus Master Plan not only serves as a plan for that school, but also provides the opportunity for similar structures and forms to be used throughout the region. It stands alone in sustainable campus design for the region, and takes regional water and environmental problems into account in a nearly unprecedented way. Through this project, other projects can go further and incorporate sustainable systems to an area where they are rare, but desperately needed.
Appendices
Appendix A- Delimitations

This project:

Does not include a source of funding

Will not incorporate exact construction details, but rather suggestions that can be followed according to site specifications.

Will not have on-site interviews regarding the project

Will not provide suggestions or in depth information regarding the surrounding area.

Will not design the entire 1000 acres, but rather will designate critical areas for development and conservation

Figure 6.1- Water Buffalo Near Construction
Appendix B- Definitions

Sustainability- refers to design that will be able to be used in the future while continuing to protect the environmental, economic, and cultural aspects of its surroundings.

Storm water management- refers to the design element that controls runoff by filtering, storing, and/or slowing it to the benefit of larger water bodies and the surrounding environment.

Grey water- refers to runoff that is reusable but not potable and can be used in toilets, showers, and for cleaning.

Ecological Conservation- refers to the practice of protecting the natural environment while also allowing its carefully controlled use as a resource to promote sustainability of the environment.

Natural Areas- refers to the places on the campus that have been minimally disrupted by human involvement and are the primary locations of the majority of the campus wildlife.

Deccan Scrub Jungle refers to the landscape that is found on the University of Hyderabad and is typified by low lying shrubs, grasses, and other plants that are typical to the Deccan Plateau in India.

Course- refers to students' program of study or major, rather than their individual classes.

Centre- refers to an organization of often interdisciplinary professors and students who research and study a specific topic, for example the Centre for Regional Studies focuses on social, scientific, and cultural aspects of Hyderabad and northern Andhra Pradesh.

Hostel- refers a dormitory, or the location where students live.

Integrated Students- refers to the students minority group of students on campus who are pursuing a bachelor’s as well as a master’s degree.
Appendix C- Additional Information about Hyderabad and the Campus

Hyderabad

Founded: In the sixteenth century when the Qtub Shah Dynasty relocated to alleviate the effects of a drought. The area had been sparsely inhabited for centuries before. This spread Islam into the area, making Hyderabad a major Islamic center in South India. The Qtub Shah Dynasty is responsible for the creation of many of Hyderabad's famous sites.

History: Hyderabad has gone through a succession of rulers. After the Qtub Shah Dynasty was overthrown, Hyderabad was incorporated into the Mughal Empire, and was put under control of a viceroy as the Mughal Empire collapsed. The Nizam became the ruler of Hyderabad and the surrounding area until India's Independence in 1947, acting as an independent principality during the British occupation India. This resulted in Hyderabad never being fully incorporated into the British Raj, allowing it to retain riches and characteristics that were lost in other parts of India.

Government- Hyderabad is the capital of the State of Andhra Pradesh. It is the location of the state's parliament and courts. There is a movement to form a new state from the northern 10 districts of Andhra Pradesh, called Telengana. So far, the state has been denied, but the movement has been on going since India's independance and goes through periods of violence.

Size: 6.3 million people in the metropolitan area. It is the 6th largest city in India.

Languages Spoken: Telegu, English, and Urdu (official) Hindi and other regional languages (unofficial)

Important Industries: Information Technologies (Microsoft and Facebook have large headquarters), Lacquered Bangles, Pearls, Biotechnology.

Climate: Semi-arid climate with a monsoon season, which peaks in September. Almost all 30 inches of rainfall for the year happen between June and October. Coolest temperature in winter is around 60 degrees, while the warmest temperature in the summer can be well over 100 degrees.

Major Sites: Charminar and the Laad Bazaar, Mecca Masjid, the 7th largest mosque in the world and the 2nd largest in India, Hussain Sagar Lake and the Buddha that sits in the middle of it, The Parliament of Andhra Pradesh, Golconda Fort, Qtub Shah Tombs.
The University

Founded: 1974, as an act of the Indian Parliament. The university is federally funded and run.

Students: over 5,000 and growing rapidly.

Programs of Study: Masters' and PhD emphasis in all areas of study. There is a new Integrated Program that allows students to achieve their Bachelors' and Masters' degree simultaneously in 5 years.

Location: Gachibowli- about 20 km from the center of Hyderabad. The bus system has a stop just outside of the gates of the campus, making the city accessible.

The Campus

Size: Over 1000 acres, enclosed by a fence with guarded gates.

Plants: Deccan Scrub Jungle. 734 different species have been accounted for, 300 plus have medicinal or commercial uses, 39 are endangered or threatened. Include: Cashews, Mangos, 2 types of insectivorous plants, Aloe Vera, Periwinkle (like what is used in annual gardens here), Gardenia, Tamarind.

Animals: 120 + different species of birds and reptiles, several species of larger mammals. Include: Kingfishers, owls, fruit bats, common Indian monkeys, water buffalo, wild swine, semi-feral dogs, parakeets, peacocks.

Water bodies: Buffalo Lake and Peacock Lake

Figure 6.2 Charminar and Laad Bazaar
Appendix D- Endangered and Threatened Plant Species

The following is a list of the 39 endangered species found on the University of Hyderabad Campus. Some plants have more information than others, and their habitat is included, as well as any pertinent of interesting information.

Abrus fruticulosus- found in arid land

Aegle marmelos- found on dry hills. This tree is a larval food for the following two Indian Swallowtail butterflies: Papilio demoleus and Papilio polytes. There is a danger from falling fruits, which are very hard and heavy. They can cause injury and property damage.

Aerva lanata- Common weed found in arable lands and fallow fields.
Aloe vera- Found in wooded areas and scrublands. Has valuable medicinal uses and is included in foods as a cooling agent to ward against the hot Hyderabadi weather.

Andrographis paniculate- Found in sunny areas in plains, hillsides, and disturbed and cultivated areas, such as roadsides, farmlands, and wastelands.

Anisomeles indica- Found along streambanks and fence rows

Asparagus resemosus – Found in gravelly, rocky soils.

Cadaba fruticosa- Found in scrubland.

Catharanthus roseus- Can thrive in many areas, including disturbed soils and woodlands. It is not a native species, but is not invasive on the University of Hyderabad’s Campus.

Ceropegia bulbosa- Found in dry areas.

Ceropegia spiralis- Found in sunny or shady dry areas.

Chlorophytum heynei- Found in rocky areas.

Chlorophytum tuberosum –Found in masses in moist soils, like the stream beds and near the lakes of the campus.

Chloroxylon swietenia- Found in rocky and dry areas.
Convolvulus rotterianus- information not found

Drosera burmannii – Found in riverine areas. It is insectivorous.
Drosera indica- Found in swamps and streams. It is an annual insectivorous plant.

Euphorbia fusiformis- Found only along hillsides and often with grasses.

Euphorbia tortilis- Information not available.
Gardenia gummifera- Found on degraded slopes and surrounding rocks. It is a small tree found throughout southern India.

Gloriosa superba- Found in dry soils.

Gymnema sylvestre- Found in forests. Is a climbing species with Ayruvedic medicinal uses and interferes with the ability to taste sweetness.

Habenaria marginata- Found on grassy, rocky slopes. Grow in clusters of hundreds.

Habenaria roxburghii- No information available.

Hybanthus enneaspermus- Found in forested areas.

Iphigenia indica- Found in the rock crevices of large rocks.

Iphigenia mysorensis- No information available.

Justicia adhatoda- Found in dry soils. Is edible and medicinally useful for respiratory illnesses like asthma.

Plumbago zeylanica- Found in disturbed, arid areas, primarily dunes and scrublands.

Pterocarpus santalinus- found in stoney or gravelly areas.

Saraca indica or Saraca asoca- Found in dry areas. Is closely linked to Three major Indian religions, Hinduism, Buddhism, and Jainism. In Buddhisms and Jainism, it is linked to kindness, and in many Hindu traditions, linked to Kamadeva, the god of love, and the major god, Hanuman. It is identifiable by its large compound leaves and bright orange and red flowers.

Soymida febrifuga- Found in dry forests and along stony hills. At maturity, provides a place for critically endangered forest owlet, ideal in denser forest areas. May have links to medicine directed at pancreatic cancer cures.

Sterculia uren- No information available.

Trichosanthes tricuspidatus- Vine plant. Traditionally used to cure migraines, treat epilepsy, ease muscle and joint inflammation, and many other uses.

Urginea indica- Found in sandy soils and on hills.

Vitex trifolia – Found near water.

Withania somnifera - Found in open and disturbed areas.

(Seshagirirao), (Center for New Crops and Plant Products, Purdue University), (Andhra Pradesh Forest Department)
Appendix E - Medicinal and Commercially Used Plants

The plants listed below are plants that have traditional Ayurvedic or contemporary medicinal uses, or can be used commercially, either as a food, fragrance, dye, or building material. The below list is only a selection of the more than 300 plant species found on the University of Hyderabad Campus that have medicinal or commercial uses. These plants show a cross section of the variety of plants that have such uses, and where available, descriptions of the plants or their locations on campus.

Achyranthes aspera - used as a laxative and is useful in treatment of vomiting, bronchitis, heart disease, and a wide variety of other common ailments. Common to cultivated areas, and paths, looks like mint.

Aerva lanata - used for sore throats and diarrhea, root for snake bites, flowers for pains, also good luck talisman. Entirely edible

Aloe vera - Found in wooded areas and scrublands. Has valuable medicinal uses and is included in foods as a cooling agent to ward against the hot Hyderabadi weather.

Alangium salvifolium - edible flowers, laxative, astringent root bark, alleviates spasms, antiprotozoal and hypoglycemic leaf. Found near classrooms.

Alternanthera sessilis - used as a vegetable, can make hair oils and kohl (a type of eye makeup).

Anacardium occidentale - Cashew

Andrographis paniculata - treat infections

Annona reticulate - unripe and bark fruit used as an anti-diarrhea. Fruit is edible and used for ulcers, abscesses, and boils,

Artabotrys odoratissimus - used as a fragrance and for dyes

Carissa spinarum - used for joint pain

Calotropis procera - used as soap

Ceropegia bulbosa - Used as a remedy for deafness and to cure bladder stones

Ervatamia coronaria - used as an anti-diarrheal and fragrance

Gymnema sylvestre - Found in forests. Is a climbing species with Ayurvedic medicinal uses and interferes with the ability to taste sweetness

Hygrophila auriculata - used for jaundice, urinogential system, cough

Incnocarpus frutescens - used for rheumatism, asthma, may help inhibit tumors and protect liver cells.
Justicia adhatod- Found in dry soils. Is edible and medicinally useful for respiratory illnesses like asthma.

Justicia Procumbens- used for eye disorders

Lannea coromandelica- used as a form of gum

Mangifera indica- Mango

Nerium indicum/ oleander- highly toxic but used in traditional medicine

Plumaria rubra L.f. forma acuminata- used for perfume

Polyalthia longifolia- used for making masts and carving wood. Tall skinny tree, often confused with Ashoka, often ornamental.

Semecarpus anacardium- nut used as an anti-inflammatory

Soymida febrifuga- Found in dry forests and along stony hills. At maturity, provides a place for critically endangered forest owlet, ideal in denser forest areas. May have links to medicine directed at pancreatic cancer cures.

Trichosanthes tricuspidatus- Vine plant. Traditionally used to cure migraines, treat epilepsy, ease muscle and joint inflammation, and many other uses.

Vallaris solancea- edible, used for flavor

Wrightia tinctoria- used for dyes, indigo color

(Seshagirirao), (Center for New Crops and Plant Products, Purdue University), (Andhra Pradesh Forest Department)

Figure 6.3-Bamboo Planted by the Department of Plant Sciences
### Appendix F—List of Figures

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