

Internship Project Report

**Increasing Biodiversity In the forest &
Design for Sustainable lifestyle**

Sadhana Forest,
Auroville.

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Acknowledgement

To my parents, brother and friends for their enduring support and encouragement.

To my IDC faculty, for guiding me through the field of design and encouraging me to explore the different perspectives of design.

To the Sadhana Forest people, especially Yorit and Aviram to open up their doors to volunteers and students to experience the place, and Eran Dolev to give me this opportunity to be part of this project.

Also to Nikki, Vineeth, Jaimie and other volunteers for the lessons they thought me and for the support during my stay in Sadhana Forest.

To my friends in IDC for their support through out.

Background

Internship project was done in Sadhana Forest which is a part of Auroville, Pondicherry. I came to know about this community through a lecture which is part of Art Design & Society module in 1st semester by Mr. VK Bharadwaj.

And I got a chance to visit the place during semester holidays of last December. Which made me interested in their way of living and the project that is very close to nature.

So when I got the chance to select for the place to intern, this was obviously one of the option. I ringed and mailed them, and got the reply as follows dated April 30, 2013.

*“Thank you very much for your email!
Following our telephone conversation, I am attaching the
volunteer response email for your viewing below.
Regarding the project title, we suggest Practicing
Sustainable Design in Everyday Life. “*

PLACE

SADHANA FOREST, AUROVILLE, TAMIL NADU, INDIA



Sadhana Forest started its ecological revival and sustainable living work on December 19th 2003.

The vision of its founders, Yorit and Aviram Rozin, is to transform 70 acres of severely eroded, arid land on the outskirts of Auroville. In a spirit of human unity, their aim is to introduce a growing number of people to sustainable living and veganism. Their energy and resources are focused on the creation of a vibrant, indigenous Tropical Dry Evergreen Forest (TDEF).

The main activities of Sadhana Forest:

Planting the indigenous plants that constitute TDEF, an ecosystem unique to this region, and one that is currently endangered and to support the local rural villages: By retaining water and filling the aquifer, Environmental education for all. We include as many children and young people in the process of ecological revival and sustainable living as we can. Our aim is to encourage them to share and propagate our vision of an ecologically responsible and sustainable way of living, and for them to help take urgent actions that are necessary for the future of their environment.

Children and young people from nearby Tamil villages take an enthusiastic and active part in this project. A forest that once extended from northern Tamil Nadu down to Kanyakumari in the south was destroyed many decades before they were born. Our dream is to create, with their participation, the opportunity for them to experience the original forest of their forebears. For most, it is their first 'hands-on' experience in sustainable living, an exciting and transformative experience for them.

On April 8th 2010 we started Sadhana Forest Haiti, a daughter community of Sadhana Forest India. Our aim in Haiti is to create a huge food forest with local and international volunteers, to provide nutrition to the town of Anse-a-Pitre in the south eastern corner of Haiti. This is one of the poorest communities in the world, and we feel inspired to create a long-term sustainable solution for their acute challenges.

Sustainable Infrastructure:

Sustainable infrastructure was installed that can host local and international volunteers. All structures are built from local natural materials. A 5,000 Watts solar system, 16 dry composting toilets, and a grey water system have been installed. Water infrastructure has been built that enables to water trees on 30% of the land.

For more information about Sadhana please go to: www.sadhanaforest.org (For information about new Sadhana Forest project in Haiti please go to: www.sadhanaforesthaiti.org)



Photographs taken at different places and time of Sadhana

Auroville

Sadhana Forest is part of the international community of Auroville, 6km north of Pondicherry, in Tamil Nadu, South East India.

"Auroville wants to be a universal town where men and women of all countries are able to live in peace and progressive harmony above all creeds, all politics and all nationalities. The purpose of Auroville is to realize human unity."

Auroville Charter

- Auroville belongs to nobody in particular.
Auroville belongs to humanity as a whole.
But to live in Auroville, one must be a willing servitor of the Divine Consciousness.
- Auroville will be the place of an unending education, of constant progress, and a youth that never ages.
- Auroville wants to be the bridge between the past and the future. Taking advantage of all discoveries from without and from within, Auroville will boldly spring towards future realisations.
- Auroville will be a site of material and spiritual researches for a living embodiment of an actual Human Unity.

Management

The founders Yorit and Aviram opened up their home for the volunteers for the unique experience of sustainable living and to get the first hand experience of reforestation and water conservation.

The project and the community is managed by a team of project directors and long term volunteers who are the office bearers of different departments.

Our Aim

The main project is the reforestation of 70 acres of severely eroded land. We are working to create the Tropical Dry Evergreen Forest indigenous to our area. This forest type is found only in Southern India and Sri Lanka and provides a rare biological richness due to its very high species abundance (over 1000 species of trees, shrubbery and liana). The Tropical Dry Evergreen Forest is now close to total extinction as only 0.01% survives. We are also working on water conservation and soil management.

Our Volunteers

The experience with volunteers has been very positive. Volunteers from all over the world create here a dynamic community atmosphere. Living and sharing in a communal atmosphere brings us in harmony with nature and with ourselves. One of our volunteers put it very nicely in her letter to us when she left, "May there be many forests to grow people".



Volunteers should not smoke cigarettes, use drugs, or drink alcohol, inside or outside of Sadhana Forest, during their entire stay! GO to Sadhana Forest if you are 100% sure that you are able and willing to completely respect this!!!

Sadhana Forest appreciate creativity and initiative and welcome any ideas you may have to improve our project and our community.

Way of Life

They practice an eco-friendly way of life including veganism, alternative construction, solar energy, biodegradable toiletries, and compost toilets.

Accommodation for volunteers is in exchange for a 25 hour work week with additional community shifts which consists of cooking meals and cleaning after meals. Volunteers mainly plant, mulch, and water trees during the season, work on water conservation in the forest and around the community, work in our little vegan-organic vegetable garden, maintain the community area, and spend time with the community kids.

Free facilities for volunteers include a small swimming pool, free 24/7 unlimited access to the Internet with your own laptop (weather and technical issues permitting). 5 hours each day (excluding Fridays) of AC power to charge electrical items (sun permitting), a small collection of books. The use of several bicycles, and a playground for children. There are also daily workshops offered that are run by our volunteers and vary each week.



Photographs taken at different places and time of Sadhana

Area of Work I:

Sadhana community works in the restoration of TDEF forest which is indigenous to that area for the last 10 years, for the eco balance and bio diversity the flora and fauna has to be developed,

The animals, birds and insects play a very important role in maintaining the ecological balance of a forest. since the forest is in a early stage of growth we should help to create the atmosphere to attract more fauna .

Increasing the bio diversity by understanding of the eco system and developing habitats for animals, birds and insects.

Especially Bees, which are the primary pollinators of a eco system. Through research and study of different sustainable and industrial bee keeping , apiculture methods adopted in different areas, design and develop sustainable bee hives/environment with local material for the local geography of Sadhana forest and increase the population of bees.

Area of Work II:

Sadhana forest is a model of sustainable living. Sustainable infrastructure of Sadhana forest that can host local and international volunteer and give them chance to get their first 'hands-on' experience in sustainable living, an exciting and transformative experience for them.

By exploring the place and their method of living and understanding the conscious way of living with the environment open up lot of opportunity for sustainable design.

Come up with ideas or design for the local needs or help to improve the project and community.

Area of Work I

Increasing the bio diversity of Sadhana forest by understanding of the eco system of TDEF and developing habitats for animals, birds and insects.

Scope:

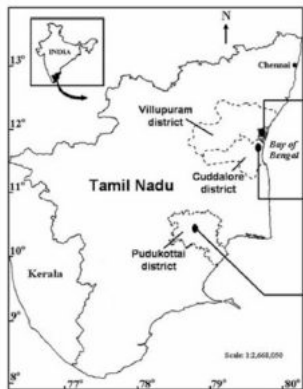
- Initiatives taken now will be fruitful to achieve the considerable increase in the bio diversity in the long run of the reforestation project.
- Observation and study of bees will help me to learn a lot about the little active creature and to pursue that as hobby
- As a designer it is a complete different approach and experience to design something for the nature.
- The project opens up other perspective of design and it is an opportunity to work with the nature enthusiasts and people who really care her.
- It will give me a chance to connect with nature and explore myself.

Tropical Dry Evergreen Forest

Each region of the world has a vegetation type that has, over countless eons, evolved as the plant community most suited to the environmental conditions of the area. The Tropical Dry Evergreen Forest (TDEF) is the indigenous forest of the coastal seaboard of South East India which comes under group seven of the Indian forest subdivision. Historically the forest extended from Vishakapatnam to Ramanathapuram as a belt of vegetation between 30 and 50 km wide, bordered on one side by the sea and on the other side by a forest that becomes increasingly deciduous as one moves inland.

It contains over 160 woody species of which around 70 are found within the pristine climax forest. This is predominantly composed of trees and shrubs that have thick dark green foliage throughout the year. There are six vegetative elements: trees, shrubs, lianas, epiphytes, herbs, and tuberous species. In the pristine state these components weave together to form a complex diverse habitat that is home to a myriad of animal species, mammals, birds, reptiles, amphibians, insects, as well as a host of microbes.

When one includes all of the herbaceous species that grow in a variety of ecological niches within the range of the forest the number of species approaches 1000, of which over 600 have a recorded use for mankind either medicinally, culturally or in religious rituals.



TDEF Restoration work in Sadhana

http://tropicalconservationscience.mongabay.com/content/v1/08-06-09-Parthasarathy_et_al.html as on 04.07.13

The Vegetation

The forest when in its pristine state is a tightly woven matrix of vegetation about 6m high with the occasional emergent rising above the canopy to 10 meters. They are evergreen, responding to the rains with a flush of new leaves. The leaves are mostly simple, thick and waxy, with a size around 6cm by 3cm. The flowers are small, 1 cm in diameter, often white with a perfume, the season for them is generally between February and August. The fruits are small and fleshy, ripening mainly between April and September. The habit of the trees is generally to have around two meters of clean trunk, and then to branch. In some species buttressing is found. The overall height of the trees is between 4 and 7 meters.

Some of the common species exhibiting all or most of these characteristics are *Atalantia monophylla*, *Diospyros ebenum*, *Drypetes sepiaria*, *Garcinia spicata*, *Glycosmis mauritiana*, *Ixora pavetta*, *Lepisanthes tetraphylla*, *Manilkara hexandra*, *Memeylon umbellatum*, *Syzygium cumini*, *Pterospermu*.

Other important vegetative components of the forest are the climbers/liana (eg. *Combretum ovalifolium*, *Capparis zeylanica*) and also the orchids that are both epiphytic (eg. *Vandia tessellata*) and pseudobulbous (eg. *Eulophia epidendreae*). The lianas can be up to 30cm in girth and can extend over 10 or more tree canopies. The orchids are rarely found in the forests now as these are the most vulnerable species to disturbance.

The Animals

In present times the highly degraded state of the forest, and the high human population pressure means that the larger predatory mammals can no longer be found in the region. However it is still surprising the number of small mammals that hang on especially in the larger reserve forests of the area. It is thought that the pangolin, the honey badger are still to be found, and in much larger numbers the porcupine, the hedgehog, the fox and the mongooses reside in the forests. In specific areas (Point Calimere) the black buck and the chital are found, and the bonnet macaque is resident in most forests.

The reptiles of the forest include the monitor lizard, the chameleon, and other lizards, as well as 19 species of snake, including the 4 venomous species of the plains, the cobra, the krait, and the two vipers.

The bird population of the forests has been estimated around 80 species, and in certain areas the trees provide valuable roosting sites for water birds at night. The bird population is made up of residents, who stay through out the year, and migrants who arrive with the rains and who often take advantage of the burgeoning insect population that is concurrent with the monsoon.

Less glamorous, but perhaps more important to the healthy functioning of an ecosystem is the insect population, and the other microfauna found within the leaf litter and humus layer. For example in the leaf litter of an undisturbed forest in a sacred grove, from an area of one square meter 5 species of spiders, 2 species of roaches, 2 species of ants, a bug and a cricket were found, all accounting for 368 individual specimens!

Habitat - Owl

Of these indigenous birds we tried to create habitat for Owl and Bat. And learned the whole process and methods of Bee keeping-apiculture.

The design and the model making is carried out under the guidance of Mr.Eran Dolev (Project Director) who is specialized in ecology.



Indian Owl

<http://utkarshspeak.blogspot.in/2010/12/owl.html>

Owl, a bird of prey found in most parts of the world except Antarctica. The number of owls is becoming smaller because the woodlands in which they live are being destroyed.

Owls vary widely in size according to the species. The females are slightly larger than the males. Like most birds of prey, owls have hooked beaks and curved talons (claws). The birds are mostly brown or mostly gray and many kinds are barred or speckled. Owls have large eyes and round faces. Owls have stout bodies, rounded wings, and short, square tails.

Many owls are active only at night. Because of their keen senses of sight and hearing, they can hunt successfully in dim light or in the dark. Night-hunting owls can also see in daylight.

Shelter:

Owls need somewhat dense, mature trees with good trunks to roost during the day, preferably in a shaded, secluded area. Both coniferous and deciduous trees are suitable if they are a good size. Hollow tree trunks and empty owl nest boxes are also good alternatives to natural shelter, but providing natural spaces where the owls can feel safe during the day is the best way to encourage them to use the shelter.

Nesting Sites: Hollow trees are most owls' preferred nesting sites, but smaller owl species that are more likely to be common in backyard will also use large nest boxes that are positioned 10-20 feet above the ground on a large tree. Barn owls may also use abandoned buildings for nesting, and leaving a barn or shed open for the birds to access can give them a great place to raise a brood. Nest boxes should be put up in January or February for nesting owls – these birds nest much earlier than other backyard species – and the boxes should be monitored to be kept free from wasps, squirrels, rodents or other birds.

Design



3d model of the Owl Nest following the standard dimensions

Actual model made in teak wood and kept in a tree in the forest



Habitat - Bat



Indian Bat

<https://www.defenders.org/bats/basic-facts>
As on 05.07.13

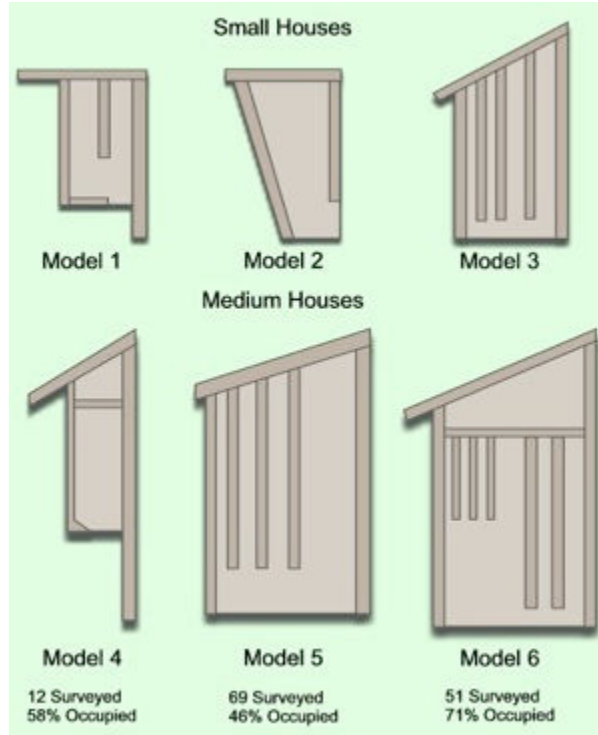
Bats are fascinating animals – the only true flying mammal. There are over 1,100 species of bats in the world, and more are still being discovered.

Bats play an essential part in the natural world and are indicators of a healthy environment. Their future is directly linked to our quality of life and the quality of our environment. 70% of bats consume insects, sharing a large part of natural pest control. There are also fruit-eating bats; nectar-eating bats; carnivorous bats that prey on small mammals, birds, lizards and frogs; fish-eating bats, and perhaps most famously, the blood-sucking vampire bats of South America.

Bats help reduce the insect population
Bats help pollinate plants and disperse seeds
Bat guano fertilizes soil because it contains nitrogen and phosphorus which is critical for plant development
It is estimated that about 70% of all bat species worldwide feed on crop damaging nocturnal insects. This means that bats not only help reduce pests such as mosquitoes that inconvenience many, they help the world economy and food supplies by controlling insect populations naturally.

While some bat populations number in the millions, others are dangerously low or in decline

Design



All bat houses should be at least 2 feet tall, have chambers at least 20 inches tall and 14 inches wide, and have a landing area extending below the entrance at least 3 to 6 inches (some houses feature recessed partitions that offer landing space inside). Taller and wider houses are even better. Rocket boxes should be at least 3 feet tall and have at least 12 inches of linear roost space. Most bat houses have one to four roosting chambers – the more the better.

Roost partitions should be carefully spaced 3/4 to 1 inch apart. All partitions and landing areas should be roughened. Wood surfaces can be scratched or grooved horizontally, at roughly 1/4- to 1/2-inch intervals, or covered with durable, square plastic mesh (1/8- or 1/4-inch mesh). Where average July high temperatures are 85° F or more, include vents approximately 6 inches from the bottom of all houses that are 24 to 32 inches tall. Front vents should be as long as a house is wide, side vents 6 inches tall by 1/2-inch wide. Houses 36 inches tall or more should have vents 10 to 12 inches from the bottom

<http://www.creaturecomfortsinc.com/ThePetZone/BuildYourOwnBatHouse.html> as on 05.07.13



3d model of the Bat house



Actual model made in teakwood and kept in a tree in the forest

Habitat - Bee



Indian
Honey Bee

Bees are flying insects closely related to wasps and ants, and are known for their role in pollination and for producing honey and beeswax.

Bees are a monophyletic lineage within the superfamily Apoidea, presently classified by the unranked taxon name Anthophila. There are nearly 20,000 known species of bees in seven to nine recognized families, though many are un-described and the actual number is probably higher. They are found on every continent except Antarctica, in every habitat on the planet that contains insect-pollinated flowering plants.

THE POLLINATION WORK OF BEES

If we look at the many colorful and different looking flowers, we should not forget that they have developed as an adaptation for the bees and other pollinators, and not to please humans! Bees and most flowering plants have developed a complex interdependence during millions of years. An estimated 80 percent of flowering plants are entomophilous i.e. depending more or less on insect pollination to be able to reproduce, and it is estimated that half of the pollinators of tropical plants are bees.



Pollens solid form of
sunlight



Bees turn them in to
white wax



Humans turn it in to
light again

Habitat - Bee

BEES ARE GOOD FOR TREES AND TREES ARE GOOD FOR BEES

Bees and trees belong together. The honeybees and stingless bees have originally developed in forest biotopes. Given the choice, wild honeybees chose nesting places in trees rather than in an open landscape. Most often the honeybees prefer to build their combs or nests high in trees instead of close to the ground, but bees nests can be found everywhere in a tree. In savannah areas with bushfires in the dry season, a high nesting place is an advantage. When beekeeping is present in a forest, the bee keepers will be interested in protection of the forests and especially the tall trees preferred by the bees. When enough bees are present in a forest, they provide a better pollination that leads to improve degeneration of trees and conservation of the forest's biodiversity. Bees and their role in forest livelihoods



Indian
Honey Bee

BEES AND BIODIVERSITY

Without bees there would be no flowering plants, and without flowering plants there would be no bees. Without bees biodiversity would not be so great. Biodiversity is measured as the number of different plant and animal species found in a certain unit area. Biodiversity is highest in tropical forest areas and lowest in the Arctic.

High biodiversity is related to the high age of the ecosystem, and a stable environment. A stable environment creates the possibility of development of specialization and use of narrow ecological niches. The explanation of the high biodiversity in tropical forests can be as the species' efforts to avoid attack by diseases and pests. Both can be much more serious in a tropical forest biome with a constant supply of water, and a hot and stable temperature. The high diversity with its high specialization in pollination relationships can also be a danger for the forest. The specialist pollinator must have access to food all year round. Many of the smaller trees flower all year round or nearly all year, but the larger trees have blooming seasons. Some flower every year, others every third or fifth year, where all trees from the same species bloom at the same period and maybe even at the same hours. If the specialized bees lose their stable resources by tree cutting, they will not be there when the bigger trees require their pollination service.

The reproduction of plants is simplest as vegetative reproduction – a new tree could just come from a root shoot. The new tree would then be genetically identical with the mother tree. Vegetative reproduction alone would be no problem if the environment were stable, but most environments aren't stable over time, they change. It can be climatic changes, new diseases or pests. To be able to adapt to environmental changes there need to be genetically different plants. In that way there will always be some plants, which are better adapted than others because of special genetic constitutions. The only way to constantly mix the genes for the plants is by cross-pollination, where pollen from one plant is transported by bees to another so that the offspring become genetically different. In that way, there is a greater chance for at least some of the offspring to survive in the competition of life. In this we find the bees as one of the most important factors.

BEES AS PART OF ECOSYSTEMS

Pollinators strongly influence ecological relationships, ecosystem conservation and stability, genetic variation in the plant community, floral diversity, specialization and evolution. Bees play an important, but little recognized role in most terrestrial ecosystems where there is green vegetation cover for at least 3 to 4 months each year. In tropical forests, savannah woodlands, mangrove, and in temperate deciduous forests, many species of plants and animals would not survive if bees were missing. This is because the production of seeds, nuts, berries and fruits are highly dependent on insect pollination, and among the pollinating insects, bees are the major pollinators. In rain forests, especially in high mountain forests where it is too cold for most bees, other pollinators like bats and birds play a greater role in plant pollination. In farmed areas, bees are needed for the pollination of many cultivated crops. And for maintaining biodiversity in 'islands' of non-cultivated areas. The main role of bees in the different ecosystems is their pollination work. Other animal species are connected with bees: either because they eat the brood or honey, pollen or wax, because they are parasitic to the bees, or simply because they live within the bees nest.

Types of Indian bees:

There are four native species of honey bees in India and one exotic species. They are as

- The Indian honeybee (*Apis indica/cerana*).
- Giant rock bee (*Apis dorsata*),
- The little bee (*Apis florea*)
- The Dammer bee or mosquito bee, (*Melipona iridipennis* Dal) and
- The Italian bee (*Apis mellifera*)

Studying bees adds significantly to the wider education of pupils. For example:-

Bees are pollinators vital to our food chain. One third of the food we eat would not be available but for bees. Bees, like other insects, are part of a food chain.

The social life of the honey bee colony provides a controversial start to thinking about the structure of societies.

The tools which have evolved on the limbs and mouthparts of bees are neat examples of adaptation and engineering.

The harvest from honey bees of honey, pollen, wax and propolis has nutritional, craft, manufacturing, and medical applications.

Pollination by bees is important for genetic sustainability. Genes that have evolved in other animals are important to our future, too.



<http://www.discoverlife.org/mp/20q?search=Apis+cerana&guide=Apis>



http://www.discoverlife.org/mp/20p?see=I_JSA3232&res=640



http://www.discoverlife.org/mp/20p?see=I_HHG550&res=640

1. *Apis indica*:

It is the common Indian bee found both in the forests as well as in plains throughout our country. It is smaller than rock bee but larger than little bee. This bee builds many parallel combs in the cavities and hollows of trees, caves and such other hidden sites. It is mild and is the only form capable of being domesticated and is commonly reared in South India. The annual yield of honey is 2 to 5 per colony

2. *Apis dorsata*:

It is the largest of the honey bees. It builds an open single comb of huge size about a meter in diameter. The comb is fully exposed and huge from inaccessible branches of trees, along the sides of steep rocks in the forest and even from the walls, rafters and other parts of buildings. It produces plenty of honey and the annual yield from a colony is about 37 kg. The rock bee honey represents a major portion of the honey sold in our markets. It is impossible to domesticate it because of its irritable and ferocious nature.

2. *Apis florea*:

It is known as little bee since it is the smallest of three species of *Apis*. It is seen only in the plains. It also builds single but small combs on bushy plants and corners of roofs. It yields very little honey, about 0.5 to 1.0 kg. per year from a colony.



<http://cyberbee.net/gallery/index.php/bees-on-flowers>



http://commons.wikimedia.org/wiki/File:Apis_mellifera_carnica as on 05.07.13

4. *Melipona iridipennis*:

Besides true honey bees, two species of stingless or dammer bees, viz. *Melipona* and *Trigona* occur in our country in abundance. These bees are much smaller than the true honey bees and build irregular combs of wax and resinous substances in crevices and hollow tree trunks. The stingless bees have the importance in the pollination of various food crops. They bite their enemies or intruders. It can be domesticated. But the honey yield per hive per year is only 100 gms. The dammer bee is very tiny with a vestigial sting and is different from the former three species in appearance and habits. The comb is made up of a dark material called 'cerumen' which is a mixture of wax and earth or resin.

5. *Apis mellifera*:

It is the Italian bee which swarms less and has good honey gathering qualities, yielding about 45-180 kg per year.

Natural hives



Natural Beehive found in Sadhana

Honey bees in the sub genus *Apis* use caves, rock cavities and hollow trees as natural nesting sites. Members of other subgenera have exposed aerial combs. The nest is composed of multiple honeycombs, parallel to each other, with a relatively uniform bee space. It usually has a single entrance. Western honey bees prefer nest cavities approximately 45 liters in volume and avoid those smaller than 10 or larger than 100 litres. Western honey bees show several nest-site preferences: the height above ground is usually between 1 metre (3.3 ft) and 5 metres (16 ft), entrance positions tend to face downward, Equatorial-facing entrances are favored, and nest sites over 300 metres (980 ft) from the parent colony are preferred. Bees usually occupy the nests for several years.

The bees often smooth the bark surrounding the hive entrance, and the cavity walls are coated with a thin layer of hardened plant resin (propolis). Honeycombs are attached to the walls along the cavity tops and sides, but small passageways are left along the comb edges. The basic nest architecture for all honeybees is similar. honey is stored in the upper part of the comb; beneath it are rows of pollen-storage cells, worker-brood cells, and drone-brood cells, in that order. The Peanut-shaped queen cells are normally built at the lower edge of the comb.

Traditional artificial hives

Traditional beehives simply provided an enclosure for the bee colony. Because no internal structures were provided for the bees, the bees created their own honey comb within the hives. The comb is often cross-attached and cannot be moved without destroying it. This is sometimes called a "fixed-frame" hive to differentiate it from the modern "movable-frame" hives. Harvest generally destroyed the hives, though there were some adaptations using extra top baskets which could be removed when the bees filled them with honey.

Mud and clay hives

Bees in a baked clay jar in Malta

Mud hives are still used in Egypt. These are long cylinders made from a mixture of unbaked mud, straw, and dung.

Clay tiles were the customary homes of domesticated bees in the eastern end of the Mediterranean. Long cylinders of baked clay were used in ancient Egypt the Middle East and to some extent in Greece, Italy and Malta They sometimes were used singly, but more often stacked in rows to provide some shade, at least for those not on top. Keepers would smoke one end to drive the bees to the other end while they harvested honey.

Bee keeping methods



http://honeysunapiary.files.wordpress.com/2013/02/bee_gum006.jpg



<http://www.hibbitt.co.uk/prodinfo.php?prod=WH001.jpg>

Bee gums

In the eastern United States, especially in the southeast, sections of hollow trees were used until the 20th century. These were called "gums" because they often were from black gum (*Nyssa sylvatica*) trees.

Sections of the hollow trees were set upright in "bee yards" or apiaries. Sometimes sticks or crossed sticks were placed under a board cover to give an attachment for the honeycomb. As with skeps, harvest of honey from these destroyed the colony. Often the human bee "robber" would kill the bees before even opening their nest. Inserting a metal container of burning sulfur into the gum did this.

Skeps:

which are baskets placed open-end-down, have been used for about 2000 years. Initially they were made from wicker plastered with mud and dung but from the Middle Ages they were made of straw. In northern and western Europe, skeps were made of coils of grass or straw. In its simplest form, there is a single entrance at the bottom of the skep. Again, there is no internal structure provided for the bees and the colony must produce its own honeycomb, which is attached to the inside of the skep.

Skeps have two disadvantages: beekeepers cannot inspect the comb for diseases and pests, and honey removal is not easy.

Bee keeping methods

Modern artificial beehives

Different types of beehives were in use in various parts of our country. They are pot hive, book hive, Madhusagar hive, house hive, nucleous hive, single walled and double walled Dadant hives, British standard hive, Langstroth hive, Jeolikote hive and Newton hive.

Of all these types, the one designed by Rev.Fr.Newton is the most popular one in South India. Newton's hives, BIS hives and Marthandam hives are suited for rearing Indian bees



Newton type Beehive from Marveille farm

Langstroth

Langstroth equipment accounts for about 75% of worldwide beekeeping kit, however within that term 'Langstroth standard' there are about ninety sub species, some of which are totally incompatible with each other.

Some of the Imperial dimensions for the height of a brood box that I have found, have given 9 7/16" (1930 Hooper & Morse), Wedmore stated 9 1/2" in 1932, and yet others at 9 9/16" (New Zealand 1990). The 9 5/8" measure must be recent due to the use of timber that is still 'green'. The older the information the shorter the box, which suggests that the timber was progressively better, seasoned the further we go back in time. Or perhaps the bees of yesteryear required a smaller bee space

Dadant

This type of bee hive has many common features with the Langstroth type and is often confused with it, so much so, that the terms Langstroth/Dadant or Dadant/Langstroth are in common usage for all parts, not just those that can be used on either system.

The largest influence of the Dadant hive is in the Dadant depth supers and frames commonly employed on many Langstroth hives.

Bee keeping methods



<http://beehivejournal.blogspot.in/2010/01/national-hive.html>



<http://beehivejournal.blogspot.in/2010/01/national-hive.html>

National hives

The National hive is the most widely used hive in the United Kingdom. It is a square hive, with rebates (grooves) that serve as hand grips. The frames are smaller than standard Langstroth and Commercial hives and have longer hand grips (or "lugs"). Many beekeepers now view the brood box of the National as too small for the laying activity of modern strains of queen bee, so many beekeepers operate the National with a brood box and one super (known as "Brood and a Half"), or even two brood boxes (known as "Double-brood"). While this provides enough room for the brood, it also increases the number of frames that have to be checked through regular inspection. Because of this the National hive brood boxes are also now available in a 14 x 12 inch size that gives a brood size similar to the Commercial or Langstroth.

Commercial hives

Commercial hives are of exactly the same external dimensions as a National hive, but instead of having a rebate the hive is a simple cuboid. Because of this the frames are larger and have shorter handles or lugs. The brood box is picked up using small hand holds cut into the external wall of the hive. Supers have this same feature, which can make them difficult to hold when full of honey. Some beekeepers therefore use National supers on top of a Commercial brood box.

Bee keeping methods

WBC hives

The WBC, invented by and named after William Broughton Carr, is a double-walled hive with an external housing that splays out towards the bottom of each frame covering a standard box shape hive inside. The WBC is in many respects the 'classic' hive as represented in pictures and paintings, but despite the extra level of insulation for the bees offered by its double-walled design, many beekeepers avoid it, owing to the inconvenience of having to remove the external layer before the hive can be examined.

Dartington Long Deep hives

The Dartington Long Deep (DLD) hive takes 14 x 12 inch and can take up to 17 frames. It is possible to have 2 colonies in the brood box as there is an entrance at either end. It has half-size honey supers, which take 6 frames that are lighter than full supers and are correspondingly easier to lift. The Dartington was originally developed by Robin Dartington so that he could keep bees on his London rooftop.



http://www.omlet.us/products_services/?cat=Beehaus&subcat=The+Beehaus

The Beehaus

The Beehaus is a new kind of beehive specially designed for keeping bees in your garden or on your rooftop. Developed to provide your bees with a safe, modern home in which to live it makes beekeeping straightforward and fun. The brood box has two entrances - one at either end. There is enough space to accommodate 22 frames, which is double the number of frames in a traditional National hive.

Bee keeping methods



<http://www.cbrp.org/SDBluebirds/beekeeping.htm> as on 05.07.13

Top-bar hives

The top-bar or Kenya-hives were developed as a lower-cost alternative to the standard Langstroth hives and equipment. They are also popular, owing to their simplicity and low cost, in developing countries. Top-bar hives have movable comb and make use of the concept of bee space.

The top-bar hive is so named because the bees draw their comb from a top bar, suspended across the top of a cavity, and not inside a full rectangular frame with sides and a bottom bar. The beekeeper does not provide foundation wax (or provides only a small starter piece of foundation) for the bees to build from. The bees build the comb so it hangs down from the top bar. This is in keeping with the way bees build wax in a natural cavity

Log hive

Log hives are the most widely used in Africa.

They are inexpensive to make.

They can be produced locally and require little knowledge of carpentry. They can house large amounts of bees.

They are the best hive if one is looking to get large quantities of wax.

Any log hive that is jarred while lowering to the working surface will lose its honeycomb. The weight of the heavy comb causes it to break off and pools honey on the bottom of the hive. Lots of honey is lost in this process. Log hives are difficult to work with.

The bees can pull their comb from any direction

Bee keeping methods



Sustainable Split pothive design from Marveille farm

Split Pot Hive:

Using pots for bee keeping is very traditional method followed in many parts of the world. But the extraction of honey is a problem as the whole colony has to be transferred or destroyed to extract honey.

Since the pot has a natural shape of the beehive it is easy for bees to recognize that as a safe place to reside.

In the split pot hive top portion of the hive is cut in to a separate piece which will give access to the top portion of the bee hive and it acts as the super of the bee hive.

Keeping few bamboo sticks at the top of it will help in designing it as a top bar hive. Which can be used for the division and the regular health checking and feeding.

This is one of the sustainable method of bee keeping since it serve the purpose of the regular modern bee at 10 times lesser cost.

Easy to manage the disease affected hives or colonies.

Bee keeping methods



Bamboo sticks as top bars



Top part act as 'super' and the Bottom of the pot will be brood



Bee keeping methods

Understanding the Sadhana forest Geography for bee keeping

Sadhana forest has the forest cover of 70 acres in these most of the area is developing young forest, In these 7 acres are used for community living, which has sufficient water facility. Forest area has few mud pools which are filled during the monsoons. There are few places where there is spread of dense forest and a sacred grooves.

From the observation we find the places where there is proper atmosphere for bee hives and we found out one natural bee hive of the of Little bees.

From the study of different bee keeping methods we found out few methods which might be suitable for our forest environment. Since in nature nothing is universally same. we planned to execute few methods and keep track of it.

We divided the process of the project in to two stages and

Stage I :

- a. Designing sustainable bee hives using local material for the local the local need.
- b. Identifying suitable environment and attracting bees by creating favorable situation of water/flowering plants

Stage II:

- a. keeping track of the created hives and visiting bee varieties for long term and develop the most adopted one increase its number.
- b. Creating a bee sanctuary and increase the bee population and pollination in the are.

Bee keeping methods

Stage I :

a. Designing sustainable bee hives using local material for the local the local need.

Sadhana forest is a vegan community and the main motto of developing bee hives is to save bees and to increase plant pollination which will help in the bio diversity of the project. Hence the extraction of honey is completely avoided justifying that the honey saved by the bees is for their own use.

which implies the non necessity of the split pot hive other than for the division of the colony.

so normal clay pots used or damaged can be tried since it increases the sustainability value of the project.

Also checking from the recycle hut and the tool shed

Wooden boxes can be made out of old planks can also be tried, Old tyres can also be used in certain places and checked for the suitability.

The wood log hives are another preferred option

Bee keeping methods

With these ideas in mind we went about finding materials and making it suitable for hives.



Collecting used pots from nearby villages with Hallel.



Making boxes using the used wooden planks

Bee keeping methods

The collected and made habitats are placed in different parts of the forest to check for suitability of the model.

To work with nature we have to observe, understand and wait and observe for her to reveal.



The pots and boxes being placed in different trees and places .

Bee attracting plants of TDEF

ACANTHACEAE	1	Asystasia gangetica
	2	justicia procumbens
AMARYLLIDACEAE	3	Polianthes tuberosa
ANACARDIACEAE	4	Lanneacoremandelica
	5	Mangifera indica
APOCYNACEAE	6	Cassia spinarum
	7	Wrightia tinctoria
ASCLEPIADACEAE	8	Watakaka volubilis
ASTARACEAE	9	Tagets patula
	10	Centratherum punctatum
BALSAMINACEAE	11	Impatiens balsamina
CACTACEAE	12	Cereus pterogonus
CAESALIPINIOCEAE	13	Bauhinia racemosa
	14	Peltophorum pterocarpum
	15	Pterolobium hexapetalum
	16	Tamarindus indica
CAPPARACEAE	17	Capparis zeylanica
	18	Cleome viscosa
CASUARINACEAE	19	Casuarina equisetifolia
COMBRETACEAE	20	Terminalia arjuna
	21	Terminalia catappa
COMPOSITAE	22	cosmos
Famaly		Name
	23	Gaillardia pulchella
	24	Helianthus
		Melampodium paludosum
COMPOSITAE	25	paludosum
	26	Synendrela nodiflora
	27	Tithonia diversifolia
	28	Tridex procumbens
	29	Wedelia jacq.
	30	Zinia

Next step is to plant bee foraging plants to attract more bees on seasonal basis. Here is the list of plant species.

CONVOLVULACEAE	31	Jacquemontia pentantha
CORDIACEAE	32	Ehretia pubescens
CRUCIFERAE	33	Lobularia maritima
CUCURBITACEAE	34	Cucumis sativas
	35	Cucurbita pepo
	36	Cucurbita pepo melo pepo
	37	Momordica charantia
	38	Mukia maderaspatana
EUPHORBIACEAE	39	Drypetes sepiaria
	40	Flueggea leucopyrus
	41	Manihot glaziovii
	42	Phyllanthus amblica
	43	Ricinus communis
FABACEAE	44	Pongamia pinnata
Famaly		Name
	45	Pterocarpus indicus
	46	Pterocarpus marsipium
	47	Peterocarpus santalinus
FLACOURTIACEAE	48	Flacourtia ramontchi
LABIATAE	49	Hyptis sauveolens
LORANTHACEAE	50	Lorenthus longiflora
LECITHIDACEAE	51	Barringtonia acutangula
	52	Barringtonia racemosa
	53	Couroupitia guianensis
LILIACEAE	54	Asparagus racemosa
LYTHRACEAE	55	Cuphea sp.
MAGNOLIACEAE	56	Michelia champaca
MALVACEAE	57	Sida acuta
	58	Sida spinoza
MELASTOMATACEAE	59	Memecylon umbelatum
MELIACEAE	60	Walsura trifoliata

Bee attracting plants of TDEF

MIMOSOIDAE	61	Acacia coleii
	62	Acacia leucopholia
	63	Acacia melifera
	64	Albizia sp.
	65	Calliandra heamotocephala
	66	Haematoxylon campechianum
Famaly		Name
	67	Leuceana leucocephala
	68	Mimosa pudica
	69	Millettia ovalifolia
MYRATAEAE	70	Eucaliptus sp.
	71	Sizigium cumini
MUSASAE	72	Musa paradaisika
NYCTAGINACEAE	73	Boerhavia erecta
NYMPHAEACEAE	74	Nelumbo nuciferum
	75	Nymphaea
OXALIDACEAE	76	Averrhoa carambola
PALME	77	Borrassus flabellifer
	78	Cocos nucifera
	79	Phoenix loureirii
PAPILIONOIDIAE	80	Dalbargia paniculata
	81	Dalbargia lanceolaria
	82	Dalbargia sissoo
	83	Derris ovalifolia
	84	Derris scandens
	85	Gliricidia sepium
PEDALIACEAE	86	Seasamum indicum
POLYGONACEAE	87	Antigonon leptotus
	88	Antigonon leptotus
PORTULACACEAE	89	Calendrinia grandiflora
	90	Portulaca oleraceae

Famaly		Name
RHAMNACEAE	91	Scutia martima
	92	Ziziphus oenoplia
	93	Ziziphus xylopyrus
RUBIACEAE	94	Anthocephalus cadamba
	95	Benkara malabarika
	96	Canthium coromondolicum
	97	Canthium dicocum
	98	hamellia patens
	99	ixora pavetta
	100	Pentas lanceolata
RUTACEAE	101	Citrus Sp.
	102	Glycosmis pentaphylla
	103	Murraya paniculata
	104	Todalia asiatica
SAPINDACEAE	105	Dodonia viscosa
	106	Sapindus emerginata
	107	Sapindus mukorissii
SAPOTACEAE	108	Mimusops elengi
STERCULIACEAE	109	Durenta erecta
TILIACEAE	110	Muntingia calabura
TURNERACEAE	111	Tumera ulmifolia
VERBENACEAE	112	Citharexylum subseratum
Famaly		Name
VERBENACEAE	113	Stachytarpheta jamaicensis
	114	Vitex nigumdo
VITACEA	115	Cissus vitiginea

Bee sanctuary



Stage II

By planting these seasonal bee foraging plants and keeping track of the visiting bees will give a clear idea of the different varieties of the area.

Also periodic review of every month of the habitats in place and finding out which models suit them best can help for the future modification in design.

With this data the plans for bee sanctuary has to be proceeded

Bee sanctuary



Stingless bee culture-Meliphona culture

Beekeeping with honey bees is more profitable than with stingless bees, considering honey production and engaged people

Stingless rearing improves environment conservation

Stingless bees are highly diverse and common in nature

Management of stingless bees are easier when compared to other colonies





Sting less beehive,
Using split clay pot & bamboo

Hive for Stingless bee culture

Proposed a design is based on Bamboo and split pot hive for the stingless bees.

The design is yet to try out in the field.

Bee sanctuary



<http://indiatoday.intoday.in/story/elephants-ransack-tribal-villages-in-chhattisgarh-in-search-of-mahua/1/267948.html> as on 06.07.13

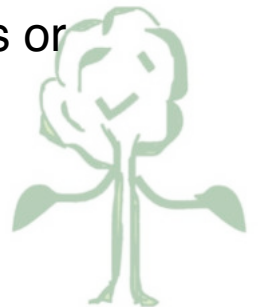


<file:///localhost/Users/apple/Desktop/moopi/New%20Folder/BBC%20-%20Earth%20News%20-%20'Beehive%20fence'%20deters%20elephants.htm> as on 06.07.13

Additionally with the kenyan topbar/ log beehive method we can avoid the elephant intrusion in agricultural lands and in living areas.

Which will also become a sustainable local income for formers

After the trial in forest the suitable model will be chosen and will be popularized in attack prone zones as a sustainable solution instead of electric fences or violent methods.



Area of work II

By exploring the place and their method of living and understanding the conscious way of living with the environment open up lot of opportunity for sustainable design.

Come up with ideas or design for the local needs or help to improve the project and community.

From the stay of four weeks time I experienced a complete different way of living by producing very less carbon foot print. I was introduced to varied techniques and understandings to live a sustainable way of life.

Things like washing dishes, hand wash, toilets, laundry, shower, kitchen, blender every thing has value of being conscious.

Their policies on schooling system , gift economy, no competition , no discrimination, veganism are adding more value to our lives and sadhana stand out as a model of living.

They employ different methods in their reforestation project. One of that is wick irrigation. I explored on the system and tried to make a sustainable planter.

Wick Irrigation



Wick irrigation method employed in Sadhana and the made bottles for the same

Wick irrigation offers the potential for very low cost, robust micro irrigation in difficult environments. Wick irrigation was first used in India in combination with buried clay pot irrigation. It has proven itself in the most severe desert conditions

Wick irrigation involves using “ropes as wicks to supply water to plant roots below the soil surface and thus minimize evaporation.” The water inside a pot or raised water container can be transferred to the soil by a rope wick (often inside a plastic tube to prevent evaporation). The concept is similar to a kerosene lantern with a wick, which keeps drawing fuel up the wick when the lantern is lit. Initially, water moves through the wick by capillary action. Later, water is continually pulled through the wick to replace water taken up by plants’ roots.

Advantages of wick irrigation are many:

- 1) water consumption is reduced since evaporation is all but eliminated;
- 2) less time is needed for refilling containers;
- 3) there may be fewer problems with salt build-up, since the water will not evaporate at the surface and leave behind salt.

Wick Irrigation

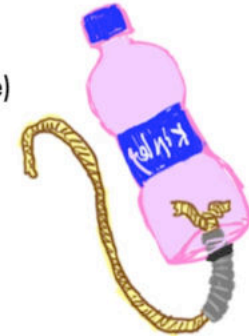
The method employed is recycling the water bottles also there are products available in the market in the name of self watering planter.

Wick Irrigation Bottles 101

6.6.2013

What will you need?

- metal bar, or a driller (to make the holes in the bottle)
- an empty bottle + cap
- cotton rope, 60-65cm per bottle
- plastic hose, 12-15cm
- some M-Seal (about 16-20 per pack)
- a bowl of water



stage 1 - make a hole at the bottom

Start a fire and let the metal bar warm in it.

Use the hot metal bar to drill a hole in the center of the bottom part of the bottle.

note: The hole should be about the same diameter as the rope is!

stage 2 - cut the ropes, 60-65 cm each piece!

Keep ONE ORIGINAL piece, to make sure you're still cutting the correct length every now and then!

stage 3 - insert the rope, tie it, CLOSE the cap

Open the bottle.

Insert the rope through the bottom hole, and out through the top hole.

Untangle the edge and tie a small knot in it.

Pull the rope back down.

Close the bottle! note: The cap is important, don't lose it!

stage 4 - cut the plastic pipe, 12-15 cm each piece, and apply it

Cut straight!

Simply pass the rope through it, if hard, try to rotate the rope like a screw.

stage 5 - mix M-Seal and apply it

Only mix SMALL portion every time!

Use same amount of both compounds for the mixture, as in the instructions.

make a small "snake" and wrap it around the green plastic hose.

Dip your finger in the water bowl to smoothen the M-Seal and make it stick to the base.

Wick Irrigation

Market study



8 Best Indoor Self-Watering Planters For the (Black-Thumbbed) Design Lover
[TreeHugger.html](#) as on 28.06.13

Table top planter

By fusing the method of wick irrigation in the planter I designed a sustainable self watering table top planter using coconut shell.

Coconut shell by nature has a eye opening at one half of the shell, which made that a best material for the wick irrigation planter.



The table top planter made using coconut shell



Proposal:

This can be made in house by the volunteers in the community and given as a souvenir for visitors of Sadhana forest.

Quotes by people

“Leave the place a little better than how u get it”

“IF you want to help her go to her”

“Sit with her and observe you will never reveal yourself to strangers”

“May there be many more forests to grow people”

“Being Conscious”

By exploring Auroville and Sadhana forest and their method of living and understanding the conscious way of living with the environment open up lot of opportunity for sustainable design.

From the stay of four weeks time I experienced a complete different way of living by producing very less carbon foot print. I was introduced to varied techniques and understandings, to live a sustainable way of life.

Even things like washing dishes, hand wash, toilets, laundry, shower, kitchen, blender has value of being conscious.

Their policies on schooling system , gift economy, no competition , no discrimination, veganism are adding more value to our lives and make sadhana stand out as a model of living.

Got chance to work and learn different ethics and culture from volunteers from around the world

Environment conscious attitude towards design

To reach them their telephone numbers are 2677682 or 2677683 or 2902655 and we can write them at sadhanaforest@auroville.org.in.



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Softwares used: MS Powerpoint, MS Word, Photoshop.