

***Sadhana Forest Mapping and Baseline Forest Measurement Project ***February 2009

**Fieldwork and Cartography by :
Yoav Daniel Bar-Ness (USA/Australia)
www.treeoctopus.net
Landmark Trees of India
+91 98714 07336
ydbarness@gmail.com

&

Kelly Hays (Canada)
hays.kelly@gmail.com

**Field Technicians: Julia Yao (USA), John Miller (USA), Eric Sass (Germany)

*Sadhana Forest is a reforestation and conscious-living project at Auroville, Tamil Nadu, India initiated by Yorit and Aviram Rozin. If you are interested in **Sadhana Forest**, or if you have any questions, please do not hesitate to contact us at aviram@auroville.org.in. You can also call us at +91-413-2002655 or 2677682 or 2677683.

*GPS and tape measures provided by Pondicherry Institut Francais Ecology Grop

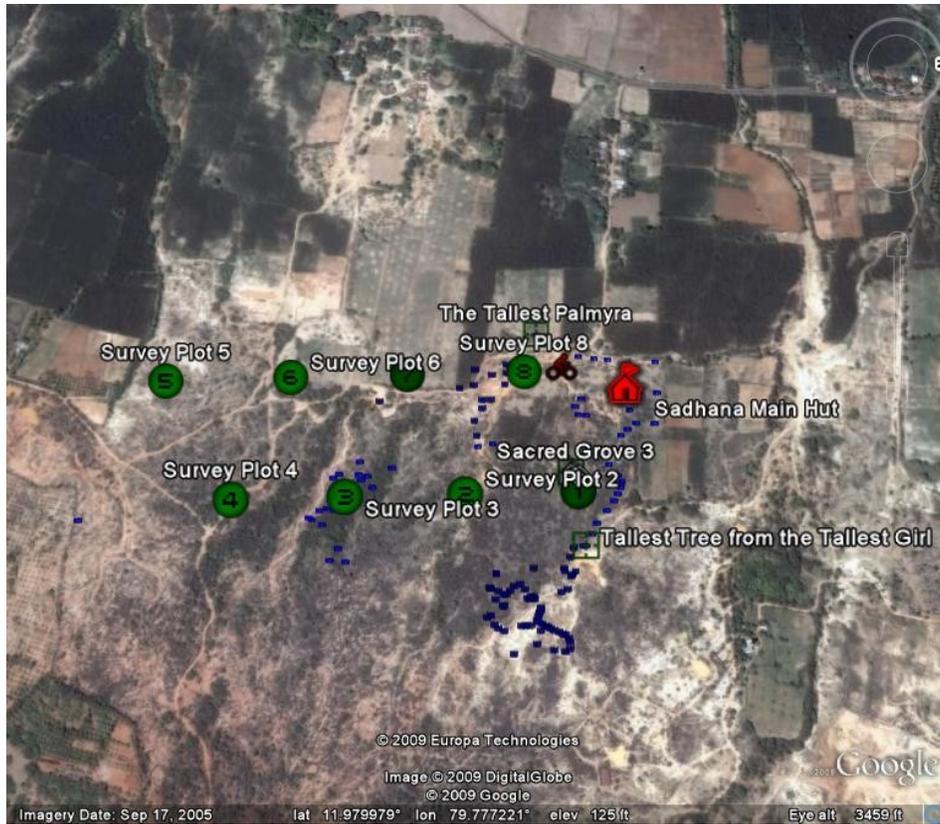
*Julia Yao's computer was used for data organization and type-up

*Kaila Binney helped with a power adapter!

*Wonderful company, yummy food and excellent times were provided by the 120 volunteers present at Sadhana.

**Introduction

Sadhana Forest is a forest regeneration project in SE Auroville, Tamil Nadu, with replantings approximately 5 years old as of 2009. This report and associated photos and waypoints form a lightning fast survey effort to establish baseline data on the forest composition and structure. Inevitably, our methods were severely limited by the time and resources available. However, it is hoped that these simple photopoints and numbers will be of use for making comparisons in the future, provide material for outreach and fundraising, and provide inspiration for future monitoring work at Sadhana Forest.



Aerial view of Sadhana captured from Google Earth

This report focuses only cursorily on analysis but offers a description of methods, data resources, and future ideas. It must be emphasized strongly that the value of this cursory survey is for future comparisons, and we hope that any future monitoring work is able to raise the level of detail recorded. While it may or may not be relevant to the future direction of Sadhana as envisioned by its founders, this type of data and knowledge is essential to connecting with the resources and rapport of the government forest department, scientifically-inclined NGO's and the forest industry.

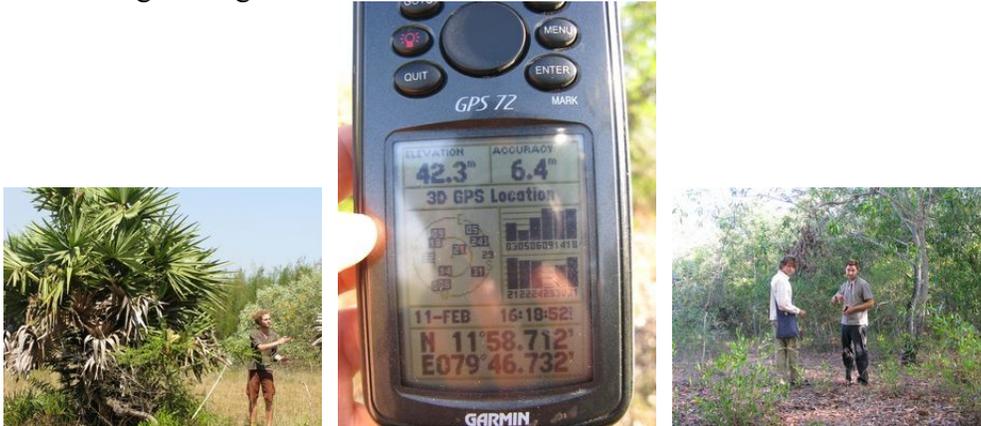


A lovely Hardwickia, Cassia; Acacia seedling showing compound leaves and flattened branches

** Methods:

Geographically linked data was generated in two stages. All geographic data is fixed in Sadhana Forest Mapping KML.kml

a) Eight evenly spaced plots were laid down in Four spaced 150 m apart along two N-S lines 150 m apart within Sadhana Forest property. Each tree measurement plots was 20x5m, oriented on a random azimuth. Surveys were performed in evening of 11 Feb 09 (plot 1) and during the morning of 12 Feb 09 (plots 2-8). Survey plot 7 was along the west edge of the roadside marking the western boundary. It therefore is and may represent an outlier, unforested plots on agricultural land neighboring Sadhana.



Eric Sass near a Borassus palm; the GPS unit; Kelly Hays and John Miller measuring a plot

No permanent marker was established. At each plot, we laid down a 20 m tape and a parallel line 5 meters to the right. Photo monitoring pictures were produced in the order North-South-East-West-Up-Down. Every stem with its base located within the plot, taller than 1.3m (a conventional value in forestry), and thicker than 1.5cm circumference was measured for a) circumference at 10 cm from the ground, b) species when possible, c) condition- live, unhealthy, or dead, d) suppressed canopy position (recorded if yes) (i.e., shaded by another tree). For every fifth tree, we estimated height in meters. (For plot 1, we only recorded the heights without linking them to the individual stem, but for the rest, the data is linked).

Because of our 1.3m minimum height, we did not record the small seedlings at Sadhana, and therefore our data does not record information about these plantings. (It is perhaps possible to create a record of planting history with the help of Yorit and Aviram.) Waypoint descriptions include a range of JPG file numbers (IMG_###). The NSEWUD photomonitoring pictures are always in sequence following a photograph of the data page.

b) An afternoon walkabout by YDB & KH, photographing interesting places, walking perimeters of forest types and water bodies, and collecting waypoint coordinates. Waypoint descriptions include a range of JPG file numbers.

All coordinates are arranged on an excel spreadsheet, Sadhana Forest Cartography Spreadsheet.xls . This file offers a good start to organizing waypoints and geographical data.

This file is converted into the Google Earth KML format at <http://www.earthpoint.us/ExcelToKml.aspx> . On this page can also be found a description of the column formats. Included in this information is a range of picture numbers by which photos can be linked to that location.

All pictures were taken with a Canon Powershot G9 12mp camera. Photos are collected in two directories: Waypointing and Photo Monitoring Points February 2009. In the Waypointing directory, all images from our two days of field work are dumped with the original file name IMG_####. This includes the systematic photo monitoring points (NSEW Up Down at each plot) which are again stored, divided into folders, in the second directory. To link the photos to their locations, check the Sadhana Forest Cartography Spreadsheet.xls for the appropriate file numbers. The Google Earth locations are visible in Sadhana Forest Mapping KML.kml

Tree measurement data from the eight points is compiled in Forest Survey 2009 Tree Measurement Data.xls . On the first sheet, raw data from our surveys is presented at the plot level (notes and GPS coordinates) and at the stem level (plot #, circumference, taxon when identifiable, diameter derived from circumference, basal cross-sectional area derived from circumference, condition when unhealthy or dying, canopy position when suppressed only, and height estimate for every 5th stem.

This raw data was reorganized using an Excel pivottable and derived data was calculated as simple descriptive statistics. These numbers are presented proportionate to a 100m² plot, and can provide a start to scaling up numbers at Sadhana forest. Any future calculations should drop plot 7. No hypothesis testing statistical analysis was performed. The information was collected and organized with future monitoring measurements in mind.



Julia Yao at the Lepisanthes Sacred Grove; Kelly Hays climbs the watertower; the solar panels and garden in the residential area.

****Data Description**

Data derived from measurements of all trees (> 1.3m ht & >1.5cm circ) on eight 100 m ² plots at Sadhana Forest, Auroville, Tamil Nadu. 11 Feb 2009						Common Name
	Avg # Stems per 100m ²	Total basal area cm ² (wood-cross section) per 100m ²	Avg Height (0m)	Avg stem diameter (cm)	Average basal area (cm ²)	
All trees	29.875	83.2656	3.609849773	6.8402328	583.0924007	
<i>Cassia siamea</i>	2.5	159.76	3.60	11.15	494.47	Hindi: Kassod
<i>Acacia holosericea</i>	22	186.40	3.60	4.41	124.05	Soapbush Wattle
<i>Borassus flabellifer</i>	3.5	286.77	3.73	34.90	4439.62	Palmyra Palm
<i>Casuarina sp.</i>	2	1012.46	(No data)	5.25	93.20	Horsetail
<i>Dodonia sp.</i>	5	1048.62	2.50	2.07	17.23	
<i>Hardwickia sp.</i>	2	1622.36	5.30	12.37	516.03	
Unidentified	1.8	5943.15	(No data)	4.39	88.04	
Unknown #2	1	14294.67	(No data)	9.55	286.77	

*Average stems per 100m²: This value tells how many trees greater than 1.3 m height and <1.5 are on a given area of land. Will this go up, as more seedlings naturally and manually sprout? Or go down, as cyclones, inter-species, and intra-species competition kill trees.

*Total basal area: A good start to getting a handle on biomass on the landscape. More total basal area on each 100m² likely means more biomass and carbon sequestered.

*Average Height: This data is a bit spotty, but offers a good start on the average height of the overstory of the forest. However, since we don't have data on the sapling growth, we can't track the competition over time between the plantings and the already established forests (mostly Acacia)

*Average stem diameter → Average basal area: Forestry operations often create a relationship between basal area and wood volume.

*Relationships: If stem count goes up and basal area goes down, what does this mean? If height goes up but stem count goes down, what does it mean. If average stem diameter goes up but average height goes down, what does it mean? What dynamics of competition or disturbance or management could be causing these interactions? And what does the relationship between circumference and basal area tell us about the universe?



At the vertex of two dams by the mudpools #2 & #3; Kelly Hays tries to avoid a nasty fall into a water capture unit; Kelly Hays in a drainage trench near pool 2

**Future Ideas

Things to consider, roughly ranked by YDB's opinion of value:

-Start measuring water. Using the waypoint clouds for the water bodies, sketch boundaries. Remeasure these often in relation to monsoon seasons. Even a simple height gauge mounted next to a dam can start providing data to connect with rainfall data from a meteorological station. I believe there's a hydrologist at Sadhana as of 16 February 2009. This information could open a whole new range of resources and connections with all of the water conservation efforts worldwide. Because there are few restoration projects like Sadhana, there is a scarcity of information on the linkage between water capture and reforestation. This could be an amazingly fruitful direction, especially as local villagers are directly aware of their water needs for their survival.

-Encourage others to come in with their own enthusiasm, working with this information. Just let people know that there's a bit of geographically linked data in the form of pictures, boundaries, and measurements. It is likely that many other visitors to Sadhana are geographically minded, or trained in forest measurements. Sadhana is a brilliant place for a masters or PhD research project. Restoration ecology is an exciting topic in many universities and Sadhana offers an optimal place for a long-term scientific relationship with a landscape and a family. With only a little bit of initiative, teams form naturally that can do amazing things. The only thing we can't do is go back in time five years and conduct measurements!

-Remeasure the plots (although they aren't permanently marked) and track growth and decline of the forest over time. No matter the frequency, at least now there's some baseline data to work with. Consider that solid, measurable and meaningful results are required to connect with many agencies and organizations. There isn't so much of a story now, but when you connect the dots on the graph....

-Keep photo-monitoring and keep a record of where the photos were taken, and when.

- Think of the future! Will we be able to read CDs, DVDs, or JPG files in the next century? Printing things may make these resources available in the future. Will the two girls growing up in Sadhana, or the local children nearby, or their children's children be able? Paper is an exciting technology available at low cost.

-Use the data, maps, and photos for outreach, web pages, fundraising. Geo-linked photos offer a perfect tool for before/after presentations. Contact Deborah Penna penna.deborah@gmail.com journalist from Brazil- about articles.

-Make a photo illustrated aerial map- talk to Kelly Hays hays.kelly@gmail.com! I regret I cannot stay to work on this, but believe that this sort of document can go a long way to sharing and explaining Sadhana. If there is the right information on it, i.e. a blurb about Sadhana, the map can be given away as a self-explanatory document. Don't forget: compass rose with declination, scale, calendar date for waypoints, aerial photo date, a block of text (maybe with some of the numerical data), contact information for Sadhana and Auroville and lots of pretty pictures. I look forward to seeing this in print! I can be reached by email and can offer a small amount of time to work on this via correspondence...but Kelly, and potentially others, has the skills and enthusiasm to see it through.

- Make a BIG aerial photo map to post in the main hut to introduce people to the site.
- Get a record of treeplanting phases, and include these small saplings <1.3m in the data set. Tracking the height growth of these trees in relation to the height growth of the predominantly Acacia cohort will tell an excellent story about the reestablishment, or failure to restablish, of the native species. Also, record information on whether any stem is naturally or manually planted.
- Play a bit more with the data. You can get a handle on relative proportions of each taxon to forest cover.
- Sketch in the buildings and fence of the residential area, gardens, roads, and trails.
- Look for later aerial photos. Try looking at the Geohack utility in Wikipedia.
- Continue with taking geographically linked, timestamped photos.
- Survey of the sacred grove, measure the old trees there and compare the species composition
- Herb and shrub surveys- perhaps the Auroville or Pondicherry Botanical Gardens can help.
- Start a big binder for nature observations. Label it prominently and ask anyone interested to contribute observations, hopefully time and geography linked. A thermometer is the easiest tool to start this with, every morning or midday someone can check the number. Rain gauges can be made very simply.
- Round up some field guides- there is definitely resources and dedicated expertise for the bird population. Ask a volunteer to research online what is available. Contact the authors directly, if possible, and ask if they can give you an idea of what they'd expect to see at Sadhana. Invite them to visit, and ask if/where a copy of their book is available.
- Contact YDB in Delhi- +91 98714 07336 about donating a simple Garmin Etrex GPS navigation unit to Sadhana Forest... if it will be of use, and if it will be used.
- Use individual trees as ambassadors for the Sadhana project- take a look at www.treeoctopus.net/india.htm
- Keep using your heart!
- Best of luck! See you again soon!



Yoav and Kelly