Comments on Project Design Document and Application for Validation of Nallakonda wind power large scale CDM project

29 August 2012

Introduction:

I respectfully submit the following comments on the *Nallakonda Wind Power Large Scale CDM Project*.

The proposed PDD and the contribution of the project to sustainable development related to the activities described in it, fail to indicate with clarity and in a credible manner, how the 2% of CER revenues (as described by the Indian DNA) is to be spent.

According to my study, there seems to be some serious deficiencies in the local consultation process mentioned in the PDD. There has been insufficient communication from the PD's side with the local communities, absence of information through local newspapers or in the local language.

The significant negative environmental and social impacts that I have witnessed and have been told by the project affected people seems to has been completely omitted in the PDD.

Furthermore, it fails to give an orientation and is too general as to how it should be used to deliver social and ecological benefits. The absence of numbers and specificities in the PDD with regard to job-creation during construction and operations shows that the statement related to alleviation of poverty as major part of the employment is unjustified.

The claim that power generated in the area will benefit local populations cannot be true because power will be supplied to high voltage long distance transmission lines for supply to other than local areas and consumers.

My comments below reflect mostly the local environmental and social realities, especially affected by 48 windmills that have been erected in a community conserved forest area. They include negative effects currently happening and caused by the project and almost completely omitted in the PDD. The windmills have been erected inside 7,000 acres of land, that has been protected and regenerated into a forest, over a period of 20 years by the people Kogira, Mushtikovila, Shyapuram and Kambalapalli villages under the aegis of the 'Kalpavalli Tree Growers Cooperative". Neither the communities nor the people's organisation were consulted

before this project was commissioned. Infact there has been no local stakeholder consultation process.

I respectfully request the DOE to take our comments into account and respond to our questions especially in view of the complete absence of an environmental impact assessment (EIA) and a clear deficient local stakeholder consultation process as perceived among local communities. Finally, I request clarity through a list of possible impacts the project may or has been already triggering especially during the construction phase.

Comments are added after the PDD Sections mentioned with Red coloured text underlined and in *Italics.*

Section A – Description of project activity - in sub-section titled Social well being – (page 2 of PDD)

- *"The project activity would help in providing job opportunities to the local population during installation and operation of the WEGs."*

The following detail relates to employment generated by the Nalakonda wind farm project among the local population in the protected area from initiation of work to the erection of towers and Grid line Poles…..

Wind mill interventions…..

Sr	Activity	Engaged Machine / Human	Skilled/ unskilled	Local persons/ outsiders engaged
1	Road work (cut-removed trees,vegetation, big stones, hilltops, etc.)	Machines-Earthmovers, big lories	skilled	Outsiders
2	Road & Site Clearing	Human	Unskilled	Local persons (100 man-days generated @ Rs. 150 per day in a year)
3	Watchers engaged (For Material	Human	Unskilled	Local persons (52) 8 pers. on 21 Mar'11

	safety)			44 pers on 21 Aug'11 (all these 52 watchers have no written appointment letter , ie no Job Security)
4	Foundation preparation (Base preparation)	Machine	Skilled	Outsiders
5	Sand Transportation	Tractors	Skill in knowing of local sand resources. Local persons (5 tractors owners) engaged in this because they know from where to mine sand. Outsiders can not mine sand as villagers will object.	Local tractors = 5 5 rounds per tower @ Rs. 1500 per day (This is vehicle hiring cost not labour cost). **Company paid the tractor hiring cost only, not the Sand cost to the local village governance body. Sand mining done without permission.**
6	Windmill base construction - Material preparation	Human	Skilled= 2 persons per Tower Unskilled = 12 persons per Tower	All local persons (including 2 local masons) 576 labour-days generated and approx. 41 local

				persons engaged @ Rs.150 per day in a year
7	Windmill base construction - Beam making, Welding, etc.	Human	Skilled	Outsiders , from Tamilnadu & Bihar States
8	Windmill base construction - Final completion of Foundation	Human	Skilled	Outsiders , from Tamilnadu & Bihar States
9	Grid line installation - Pit digging	Human	Unskilled	Local persons 25 persons @ Rs. 150 per day, 150 labour-days generated
10	Transportation of Grid poles and other materials	Tractors	unskilled	Tractors from outside Kalpavalli area For loading & unloading, local persons engaged (they are included in the above Pit digging persons)
10	Grid line connection (final)	Human	Skilled	Outsiders

Now that the erection and construction is completed there is no labour work and only a few windmill watchers are employed. In comparison with the total

population of project affected villages, no significant employment has been generated by the project.. This detail is as follows:

Sr	Village	Families	Population	Watchers employed till August 31, 2012	No of watchers to be employed from September 2012
1	Mustikovila	340	1528	21	10
2	Shyapuram	153	745	13	5
3	Kambalapalli	250	740	13	5
4	Kogira	422	1652	5	2
	Total	**1165**	**4665**	**52**	**22**

- In the windmill erection/installation work, all the skilled people are mainly- Engineers, Earthmovers & other big machine-drivers, Site supervisors, Beam makers, Welders, Electricians. All these skilled persons were brought from outside the project affected villages.
- The only skilled persons who were employed from the project affected villages were 2 – 4 Masons.
- Unskilled labour work done by people from the project affected villages (given above), is not significant in terms of employment generation.
- Now after the final installation of Wind turbines and Gridline poles, there is no employment for local people.
- It also may be noted that not all the 52 Watchers will receive continued employment. They have been given verbal warnings from the company that only 22 watchers will remain employed Watchers at Wind Mills after the 1st of September 2012.
- During the installation work, few Tea stalls were set up by the local villagers but have since shut down as installation work has been completed.

➢ *"The project activity would also lead towards development of infrastructure like construction of roads and expansion of telecommunication network. These factors will give a boost to the social amelioration of the community and would also help in improving the living standards of the local community"*

- While it is true that the company has constructed mud roads to carry the equipment required to install the Windmills and the Grid line poles, these roads cannot be considered as infrastructural development as most of these roads have been badly planned and constructed. Under the last monsoon rains the roads have all but collapsed and the eroded soil and land slides are creating major damage to the ecology of the area.
- In the name of infrastructural development and road construction the company has removed large chunks of dense vegetation in the area and this is causing massive soil erosion which unfortunately is not mentioned anywhere in the PDD.
- The forest cover in the project area is the main factor preventing soil erosion and supporting rainwater recharge of the streams, tanks and wells. Unfortunately the 40 kms of road construction has destroyed 79.3 ha (190 acres) of forest cover affecting the whole watershed flow to the streams, tanks, small water bodies and wells. This too is not reflected in the PDD.
- Apart from this all the roads have been constructed without proper engineering support and legal permission from the Government. "No permission has been granted to the companies to construct roads" and is therefore an illegal act. This information has been obtained from Government records under Right to Information Act.
- To add to this, none of these roads will be used by the local population as they traverse hills and forest areas and lead to no where in particular. Neither the buses, the autorickshaws nor the bullock carts, that are main transport

vehicles of the villages concerned, will or can use these temporary mud roads that can collapse anytime.

- Not only are these roads badly planned and executed and so dangerous, they are also a big problem for the sheep and shepherds who use this area for grazing. Over 50,000 sheep, 6,000 cattle from 20 odd villages graze here. Now with these roads the traditional grazing area has been badly affected as the animals cannot climb the steep walls created by the roads. This has already begun to impact the livelihoods of a large number of people from the area. This too has not been mentioned in the PDD.
- As regards the "expansion of telecommunication networks" one wonders how this is going to happen. It is important to mention that there is already an excellent telecommunications network and the local villagers already have mobile phone connections and Subscribers Telecom Dialling booths everywhere and they are not dependent on this windmill company for telecommunication. There is no comment in the PDD as to how this expansion of telecommunication networks will happen or how this will help boost the amelioration of the community or help in improving the living standards of the local community. Such claims are false and need to be challenged.
- The above employment generation statistics prove that there is no improvement in livelihoods of the local villagers and so their living standards. In fact, because of this project the life support system of the area is damaged and in some cases destroyed. This detail is given in the comments on SECTION D below.

Section A – Description of project activity - in sub-section titled Environment well being – (page 2 of PDD)

➢ *"The project activity not only helps in reducing GHG emissions but also help towards conservation of fossil fuels. Therefore, project*

activity is contributing towards mitigation of impact of climate change and hence the environmental well being "

Following are the comments in this regard :

- While in theory this statement is incontestable, it is important to note that the construction of this Wind farm has been highly fossil fuel intensive and ecologically destructive.
- Given below is a table that lists the significant use of fossil fuels for construction of the windmills and grid lines:

Sr	Activity	Machinery used	Fossil Fuel
1	Road construction	Huge machinery used- big Earth movers, JCBs, Lorries, etc.	**Yes**
2	Water lifting from water bodies	Water pumps	**Yes**
3	Water transportation	Water tankers	**Yes**
4	Sand transportation	Tractors	**Yes**
5	Construction material transportation (Cement, concrete, steel, etc.)	Trucks & other vehicles	**Yes**
6	Turbine parts transportation (Tower parts, Blades, etc.)	Huge trucks & Lorries	**Yes**
7	Grid line Pole parts transportation	Huge trucks	**Yes**
8	Grid line Cables, Wires transportation	Trucks, other vehicles	**Yes**
9	Human transportation	Jeeps, other vehicles	**Yes**

	(Engineers, Site supervisors, Welders, Beam makers, electricians, contractors, labours, etc.		
10	Turbine maintenance	Lubricants will be used as the Turbines have started generating electricity	**Yes**

- We are unable to calculate the amount of fossil fuels used for the construction activities as yet. However it is important to note that construction of 40 kms of roads in the hills, transportation of all the parts for 48 windmills and supporting gridlines across the hills and erection of the windmills themselves must have consumed huge amounts of fossil fuels.
- This ofcourse does not take into account the amount of fossil fuel used in the manufacture of the massive wind blades and the towers themselves.
- It also does not take into account the amount of fossil fuel used in the transportation of all this materials from the factories few thousand kms away in 36 to 50 wheel trucks.
- Neither does it take into account the foundation that needs to be constructed with cement and steel concrete.
- While all the above activities have used a huge amount of fossil fuels, the PDD does not mention the use of water for construction of the foundations of the windmills (preparing and curing the concrete). As per calculations made from local data, for the foundation of each windmill, 5,000 litres of water was used for preparation of concrete, followed by another 5,000 litres of water per day for 15 days to cure the foundation. In other words, around 80,000 litres of water was used to construct the foundation of each windmill. And so in real

terms, around 4 million litres of water was used for construction of only the foundations of 48 windmills. Not to mention the significant loss of water due to leakage from the old and rusted tankers that were used to transport water all over the hills. This indeed is a huge amount of water to be used in a highly water deficient area such as Anantapur district.

- In addition to this, what the PDD does not mention is the amount of water that will be used by the cooling systems during energy generation by the windmills in summers.
- The PDD also does not talk about the loss of carbon that had been sequestered by the flora that has been destroyed due to the flattening of the hill tops and construction of roads in the project area.
- While such consumption may be comparatively less than electricity generation from fossils, nevertheless this will have to be deducted while calculating the potential benefit from CDM. These are generally considered to outweigh the benefits in terms of the Carbon free electricity generated by the wind farms. However, the PDD mentions on page #6 in Table A2 Technical specifications of WEGs, that the Turbine life is only 20 years. It is therefore important to calculate the potential benefit from the windmills as against the fossil fuel used in the manufacture, transport, construction and erection of the windmills when the 'active age' of the windmill is only 20 years.

Section A.2.3. City/Town/Community etc. (page 3 of PDD)

➢ *District : Anantpur*
Village: Gondipalli, Duddebanda, Kogira, Mustikovila

The PDD gives incomplete information as there are two more villages in the affected area that have not been mentioned in PDD. The villages not mentioned are Shyapuram and Kambalapalli.

This is clear when one refers to Table A1: Physical locations of the WEGs, on page 4 of the PDD. The geo-coordinates when mapped include Gondipalli, Duddebanda,

Kogira, Mustikovila, Shyapuram and Kambalapalli villages. However, Shyapuram and Kambalapalli have not been listed in the PDD in Section A.2.3.

Section A.2.4. Physical / Geographical location (page 3 of PDD)

Figure A.1: Project Location Map (page 5) is misleading as none of the 4 villages mentioned in the PDD are shown. This may imply that the people of all the villages have not been consulted and the stake holder consultation process remains incomplete.

Section D - Environmental Impacts (page 29 of PDD)

Sub-section D.1. Analysis of Environmental impacts

- *Alos, the project activity does not cause any negative impact on the environment, no EIA study was conducted"*

Sub-section D.2. Environmental impact assessment

- *"There are no significant environmental impacts due to implementation of the project activity."*

While it is true that the Govt of India does not require EIA to be conducted for Wind farm projects, we cannot understand how the PDD states that "the project activity does not cause any negative impact on the environment" without having done any EIA study.

However, after a local NGO, The Timbaktu Collective (www.timbaktu.org), which is working in the project affected area for the past 22 years, carried out a Biodiversity and Environment impact study (attached as Annexure 1) to get a neutral, independent and dispassionate assessment report on the negative impacts of the Wind farm project activities in the area, it became clear that an EIA study should have been conducted.

The glimpses of the study are as follows:

This study was conducted over a period of two years by an independent organization (Society for Promotion of Wasteland Development, New Delhi, India - www.spwd.org)

- All the grazing potential sites are destroyed due to the massive road constructions and large areas reserved for wind turbine towers on all the hilly terrains. The 'Clean Development Mechanism' has not provided or developed any fodder-security mechanism for the huge livestock population of the region. The project developers, Company heads, Engineers have not calculated the cost (and overall value) of these destroyed pasturelands which will now come on the head of the poor farmers and their animals. These impacts are being felt by all the livestock dependent livelihoods and this cost of the big lost are not calculated in the '*Net-benefits*' from CDM. All the grazing animals generate energy in terms of milk, meat, manure and work-force (bulls in agriculture and transportation), which contribute top the life support systems of Kalpavalli as well as in larger areas and systems. On the other hand, whatever energy is being generated by Wind turbines do not contribute to the local systems but this energy is being used to power factories and plants (more automatic systems) which compared to the investment in them, generate very little employment.

Impacts on Biodivesity

Sr	Activity	Biodiversity loss	
1	Road & Site construction	Mature Trees & Shrubs (including forest produce providing trees)	More than 50000 from the whole affected area
		Grasses- Pasture areas	All these cannot be calculated individually as they cover very large areas
		Herbs & undershrubs	
		Medicinal plants	
		Climbers	
		Damage of pasture routs	More than 40 km
2	Throwing of landmass	Destroyed regenerations	All these can not be calculated
		Grasses	

	dumps after cutting hilltops & edges in side areas- slopes	Herbs	individually as they cover very large areas
		Medicinal plants	
		Climbers, lianas	
		Exposing of roots of big trees and shrubs, all these are losing their life due to root damage	All at the edge of 60 km. (length).
3	Throwing of landmass dumps after cutting hilltops & edges in rivulets and streams	Blocked rivulets and streams carrying water to water bodies	Negative impacts on agriculture. Earlier 2 crops were in practice now not water in water bodies for 1 crop
		Soil & Moisture & water conservation works very badly affected	This may reverse the process of soil foundation
		Massive Soil erosion	High Siltation in water bodies
		Exfoliation of slabs	Blocking water ways
4	Impacts of project works	Increased hard work on women for collecting fuel wood and fodder from more remote-far areas.	Social threats and socio-economic loss
		Grazing of cattle and small ruminants become tougher as herders need to travel more for far pasture areas.	Social threats and Socio-economic loss

- Number of transects done to study on the negative impacts of the giant wind turbines and their additional supporting infrastructure (including heavy-duty roads, transformers, and power lines) on wetlands, birds, bats, beneficial insects, and other wildlife - both directly and by degrading, fragmenting, and destroying habitat for their erection.
- Kalpavalli region is rich in biodiversity resources (attached report). All the birds and bats are flying in water body areas for water, food, nesting and roosting. Tanks of Mustikovila, Nyamaddala, Kuntimaddi, Cherlopalli, Akkampalli are important bird areas. All these water bodies are now affected due to the giant windmills on their catchment areas, which have created a big disturbance and danger for birds and bats for their movements. So these windmills are harmful for Kalpavalli forest area. The presence of large wind turbines have caused birds to avoid the site, thus losing a foraging resource and requiring extra energy to fly around it. It is also important to mention that windmill installation in the corridor area have given negative impacts on the remaining small population of vultures who play key role in disposing of the dead bodies of domestic animals. Because they are large birds of prey that like to fly in the same sorts of places that developer constructed giant wind towers. The cumulative effects of multiple facilities have a serious toll on bird populations. The activities of birds, including mating and nesting, are easily disturbed by the construction and now Blade rotation of wind turbines!
- The installation of large windmills in wild areas, along with supporting roads and transmission infrastructure and the clearing of trees on mountain ridges, inevitably has a negative effect as degradation and fragmentation of habitat, especially ecologically vital interior forest. The turbines are now moving (producing noise and vibration) adding to the distressing impact they likely have on other wild animals. In just the near past, number of bats, wild birds, flocks of Deers and wild boars were reported which are now not seen in the same areas.

Impacts on overall Life-support system of Kalpavalli

- All the major hilltops are cut which has already affected the water channels. Last year and this year monsoon could not help the Mushtikovila tank to get sufficient water, not even for one crop cultivation, from the river streams, because the catchment area is destroyed and the removal of parts of mountains (for site and roads construction) which is then dumped in the water channels and streams. Since the rocks of the mountains are very old, their exposure has increased the danger of soil erosion and slab exfoliation.
- The Enercon Company has destroyed more than 190 acre of densely vegetated area and the waste of removal is thrown anywhere convenient for them. They have uprooted green mature trees and also their irresponsible dumping has destroyed the standing vegetation, regeneration and plantation on the hillocks.
- Also many trees are going to die because they are on the edges which are sharply cut for roads and parking on hill-contours. Large patches of hillocks, where earlier trees and grasslands were breathing, have now been rendered lifeless.
- Roads which are made in the mountains are weaker due to their basic rock structure, the dumped material has moved down the slope towards Mushtikovila tank during the last monsoon. Big threats are there to the tank which is getting massive amount of soil and parts of rocks, negatively affecting the water holding capacity of the tank and the whole tank network. Currently all the water bodies of affected areas are facing huge siltation problem. Hence, needless to say that agriculture and other natural resource dependent systems are also threatened. This concludes that the wind energy projects in Kalpavalli are damaging all the natural resources and dependent community’s life support systems.

SECTION E. Local stakeholder consultation (page 29)
E.1. Solicitation of comments from local stake holders

- We have been searching for the two newspapers where the local stakeholder consultation notice was supposed to have been published. As these are Hyderabad based publications with restricted circulation we were unable to trace the editions anywhere in Anantpur district and in the project affected areas.
- The notice seems to have been published in English language newspapers. Unfortunately the villagers of the project affected area cannot read or understand this language.
- Through the discussion with local villagers of affected area, it is confirmed that they were completely in the dark about these newspapers or the consultation date and venue as there was no announcement or notice in villages, village governance body meeting or in widely circulated local language newspapers.
- In PDD there is no information or details regarding the number of people, names of villages, etc., who attended the stakeholder consultation that was supposed to have been held.
- We urge the PP to prove that such a consultation did happen and the stakeholders from the project affected villages did participate.

SECTION F. Approval and authorization

➢ *It indicates "Host Country Approval not received yet from the National CDM Authority of India."*

Without host country approval how could project proponent proceed to register at the UNFCCC?

In such condition, the CDM registration should not be approved as the host country has not yet examined and approved.

Concluding remarks

- The details of estimating the Nall and Ndiff has not been explained in the PDD.
- The PDD lacks substantiation of factors / parameters / statements that are considered crucial for registration of CDM projects with the CDM EB. For example the mode of sale of power, tariff details, eligibility of RECs, details of GBI claimed should be outlined clearly along with other financial parameters like salvage value etc.,
- The internal benchmark for investment decision by TWEL has not been provided in the PDD.
- The transparency level and detailing aspects are lacking in the PDD. It looks like they were intentional.
- Though the financial closure has been successfully completed the actual financial details have not been included in the PDD.
- As PLF is directly related to the wind resource availability. The PDD does not give enough information and reference to assess the reliability of the wind data and consequently the emission reduction potential.
- The environmental impacts during construction has not been documented and included in the PDD. The details of the land (forest or agricultural) also has not been stated in the PDD.
- There is no clear account of employment benefits accrued to the local community in the PDD.
- The sustainable development spending plan and activities are neither specific nor has an annual outlay and activities been clearly mentioned in the PDD.

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Annexure: Study Report

LANDGRABBING ISSUE AND ITS IMPACTS IN KALPAVALLI FOREST OF ANANTPUR DISTRICT, ANDHRA PRADESH: LAND & RESOURCE GRABBING THROUGH 'CDM' IN A COMMUNITY CONSERVED FOREST ON BARREN WASTELAND

'CDM'

"Clean Development Mechanism"

OR

"Capital Development Mechanism"

Dr. Leena

Funded by

RIGHTS AND RESOURCE INITIATIVES, WASHINGTON DC

Report submitted to

SOCIETY FOR PROMOTION OF WASTELANDS DEVELOPMENT

NEW DELHI

2011-2012

DEDICATED

TO

KALPAVALLI FOREST,

FOLK

&

TIMBAKTU COLLECTIVE

ABSTRACT

Since 1982, SPWD is playing a very significant role in regeneration and management of Natural Resources and livelihood enhancement of tribal and rural communities across the nation. The society has worked in 16 agro ecological regions (out of 21) of the country. In this 30 year period, many new developments, policies and acts have been introduced in India. SPWD has been exploring the implications of these acts and policies on the ground, in the context of impact on natural resources on the one hand and livelihoods on the other. While, SPWD was in the process of examining the impact of FRA (Forest Right Act) and the proposed MMDR Act (Mines Minerals Development Regulation Act), RRI- Washington approached SPWD with the necessity to seriously examine the global phenomenon of land grab in the Indian context with specific reference to the impact on 'Common Lands'.

At about the same time, Timbaktu collective brought to SPWD's notice the problem Kalpavalli (a saga of regeneration of barren wasteland) was facing from the proposed CDM projects for Wind Energy generation by Enercon Company. The major issue facing the local community was the lack of legal title and entitlements of the local community to the land that they had regenerated. SPWD therefore suggested that there was a need to properly document the natural wealth of the region which had come up as a result of the efforts of Kalpavalli community. The study which was commissioned as a result also, examined the Wind Energy policy and relevant policies related to land. It became clear that many aspects need to be taken into account in order to develop a holistic perspective on livelihood, development and sustainable ecology.

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Kalpavalli forest

Kalpavalli village community

Timbaktu Collactive, Chennekothapalli, Anantpur, Andhra Pradesh

Dr. Prof. Ravi Prasad Rao, SK Uni, Anantpur, Andhra Pradesh

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Society for Promotion of Wastelands Development, New Delhi

Rights and Resource Initiatives, Washington DC

ABBREVIATION

CDM	Clean Development Mechanism
UNFCCC	United Nations Framework Convention on Climate Change
CER	Certified Emission Reductions
MNCs	Multi National Companies
MoEF	Ministry of Environment and Forests
MNRE	Ministry of New and Renewable Energy
C-WET	Centre for Wind Energy Technology
KW	Kilowatt
MW	Megawatt
Ltr	Litre
Mtr	Meter
GSR	Global Status Report
NCES	National Clean Energy Summit
GBI	Generation Based Incentive
KWH	Kilowatt hour
APERC	Andhra Pradesh Electricity Regulatory Commission
NEDCAP	Non-conventional Energy Development Corporation of Andhra Pradesh
MT	Metric tonne
km	Kilometer
RF	Reserve Forest
BNHS	Bombay Natural History Society

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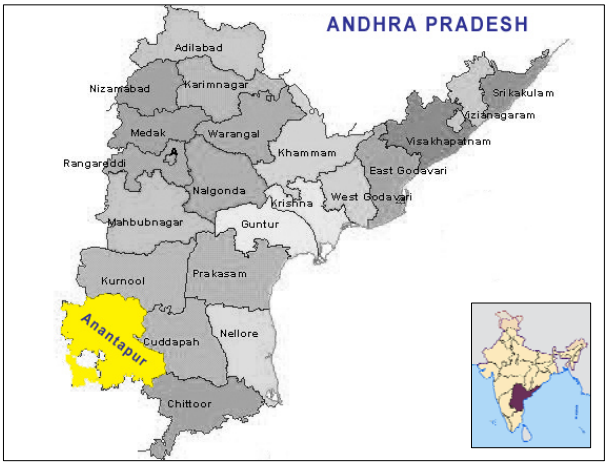
CHAPTER 1

GENERAL INTRODUCTION: ANANATPUR

AREA DESCRIPTION

The study area is located in Anantapur District, part of the Rayalseema belt of Andhra Pradesh (map) and lies between 13°41' and 15°14' Northern Latitude and 76°47' and 78°26' Eastern Longitude. It is generally held that Anantapur is known after the big tank, 'Anantasagaram' (boundless ocean) and was formed in the year 1882 having been separated from Bellary District. Later on, it was expanded with the addition of various revenue mandals. The district is roughly oblong in shape, the longer side running north to south with a portion of Chitradurg District of Karnataka State intruding into it from the west.



It has 11 taluks and 63 mandals. The district may be divided into three natural divisions.

They are 1) Northern mandal of Rayadurg, Kanekal, Beluguppa, Gooty, Guntakal, Vajrakarur, Uruvakonda, Vidapanakal, Yadiki, Tadipatri, Putlur and Yellanur containing larger areas of black Cotton Soils 2) Kalyandurg, Kambadur, Settur, Brahmasamudram, Ramagiri, Kanaganapalli, Chennekothapalli, Dharmavaram, Bathalpalli, Tadimarri, Mudigubba, Anantapur, Kudair, Pamidi and Peddavadugur in the center which are mainly made up of arid treeless expanse of poor Red Soils. 3) High level land of Penukonda, Roddam, Somandepalli, Hindupur, Lepakshi, Chilamathur, Madakasira, Rolla, Gudibanda, and Agali which connects with Mysore Plateau at higher elevation of the rest of the district. This part has average sandy Red Soils of normal productivity.

Over 10 % of the geographical area of the district is covered with hills. The Muchukota range of hills runs in the north between the Tadpatri taluk on the one side and Gooty and Anantapur on the other. The range extends right from the north of the Gooty town down to the Chitravathi River and is nearly 35 miles in length and at some places even seven miles wide. The Nagasamudram hills starting from the Northern limit of Gooty taluk and traversing Anantapur and Dharmavaram are the next most important range in the district. The range is 50 miles long and is often interrupted by several breaks. Another range which covers the

eastern half of the Penukonda taluk is the Mallappakonda. The range starts from Dharmavaram town and branches off into Mysore State and Cuddapah District.

The range of Penukonda hills, the fourth in the series, takes off from the south of Dharmavaram taluk and runs 40 miles through the taluks of Penukonda and Hindupur finally entering into Mysore state. Another line of hills divides the Madakasira taluk into two. Along the eastern side of Tadpatri taluk run the Erramalas of Kurnool. Besides these well marked ranges, there are numerous isolated peaks and rocky clusters.

The important river in the district is Pennar. It has its origin in the Nandi hills of Karnataka State where it is called "Uttara Pinakini" and enters the district in the extreme south of Hindupur mandal and flows through Parigi, Roddam, Ramagiri, Kambadur, Kalyandurg, Beluguppa, Uravakonda, Vajrakarur, Pamidi, Peddavadugur, Peddapappur and Tadipatri mandals and finally enters Cuddapah District. The other rivers are the Chitravathi and the Vedavathi or Hagari River. Apart from these, a number of streams flow in this region.

Anantapur is the second most drought affected district in India and is characterized by harsh environmental conditions, such as very low rainfall, intense solar radiation, high temperature during summer and high wind. Temperatures normally soar up to 45^{o}C and wind velocity reaches 50 to 60 km. The region comes under the massive rain shadow area of the Southern peninsula. The average rainfall in the district is around 520 mm per annum ranging from 120 mm in some parts to 650 mm in some other parts of the district. Being equidistant from the east and the west coast, the district does not enjoy the benefit of both the south-west and the north-east monsoon. Therefore the district is deprived of timely and sufficient precipitation and is subjected to recurring droughts. On an average six droughts occur every ten years.

The geological formations in Anantapur District can be broadly classified into two distinct and well marked groups - an older group of Archaean rocks and a younger one of Sedimentary rocks. Minerals and metals like Gold, Diamonds, Iron, Copper, Steatite, Calcite, Corundum and Asbestos are known to occur in this region. Gold bearing quartz veins near Ramagiri in Dharmavaram taluk were mined from 1909 to 1927 and 136739 ozs of Gold were produced.

Basic statistics

Rainfall:
Average rainfall: 520 mm
South-west monsoon (June-Sep): 340 mm
North-east monsoon (Oct-Dec): 130 mm
Winter (January-February): Nil
Summer (March-May): 40mm

Temperature:

Avg temperature: Between 24.5 to 32.5^{o}C

Maximum mean temperature: 43.4 ^{o}C

Minimum mean temperature: 17 ^{o}C

Winter average temperature: 24.5^{o}C

Summer average temperature: 32.5^{o}C

Number of towns : 10

Total geographical area: 19.13 lakh ha

Total population: 36,40,478

Density of population: 190 per sq km.

Sex ratio: 958 Females/ 1000 Males

Table 1: Rainfall data- Anantapur District

MONTHLY RAINFALL DATA FOR ANANTAPUR DISTRICT (1978-2005)												
Total in mm												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1978	-	12.7	0.4	5.9	36.1	30.3	76.0	42.1	161.5	54.0	62.3	22.8
1979	-	-	3.7	13.7	46.1	48.2	45.0	61.2	228.2	47.3	108.4	-
1980	3.8	-	14.6	10.0	47.6	51.0	32.8	39.2	101.6	48.4	46.6	4.7
1981	-	-	0.7	15.7	44.6	37.8	76.8	81.7	276.1	86.1	40.8	6.8
1982	-	0.1	-	0.1	50.5	69.2	67.3	12.6	138.5	65.6	121.6	-
1983	-	2.9	33.8	15.0	10.9	79.8	55.1	100.9	179.2	41.2	3.5	21.4
1984	0.9	-	2.8	13.2	29.0	8.5	113.8	10.6	77.5	59.5	5.3	7.8
1985	11.7	11.9	-	7.5	14.4	34.5	57.3	17.6	48.3	75.9	13.4	2.1
1986	-	-	0.8	0.3	21.4	65.8	15.8	42.4	128.9	37.6	38.2	3.9
1987	-	0.4	5.4	32.4	87.2	66.0	6.4	95.4	66.6	170.2	30.5	11.8
1988	-	-	12.4	8.4	10.0	11.7	138.1	233.3	250.5	21.1	4.6	16.9
1989	0.1	-	4.8	1.1	98.4	44.7	258.0	21.7	208.4	21.5	4.1	1.8
1990	1.9	-	1.8	22.6	53.4	47.0	31.5	43.7	42.1	110.6	68.0	4.3
1991	-	-	-	6.5	52.4	115.1	14.8	23.9	79.1	184.9	59.4	-
1992	-	-	-	5.1	24.2	61.6	41.7	59.7	72.9	83.6	80.4	-
1993	11.7	1.6	-	18.4	36.8	66.1	40.4	88.6	92.7	49.0	36.0	53.8
1994	1.6	-	1.0	7.0	42.3	19.8	45.2	34.1	29.7	171.5	23.5	-
1995	-	-	-	35.7	29.0	32.7	112.2	153.0	97.3	80.1	5.1	-
1996	1.2	-	8.7	4.3	5.0	170.2	44.5	120.6	188.3	188.4	4.4	9.0
1997	-	-	0.4	11.4	24.7	39.5	10.3	63.0	161.5	41.5	43.0	9.0
1998	-	4.5	0.8	3.4	57.8	25.8	111.2	165.5	151.3	139.2	37.3	4.3
1999	-	29.5	-	10.5	55.4	31.8	41.1	92.4	125.3	110.0	24.3	0.3
2000	0.3	-	2.3	58.1	9.8	70.3	54.3	171.3	75.8	159.1	5.5	5.4
2001	6.6	1.6	0.1	18.6	83.2	18.9	20.9	69.2	244.1	226.2	11.7	1.0
2002	-	0.1	4.9	7.4	0.2	38.3	21.5	38.0	59.5	105.1	14.3	1.0
2003	-	0.1	0.1	4.9	7.4	21.2	40.7	71.6	46.1	171.6	1.4	-
2004	1.3	-	11.3	32.8	125.2	18.2	108.3	14.8	121.5	69.8	10.7	-
2005	1.5	5.3	1.5	28	53.9							

CHAPTER 2

ANANATPUR FORESTS:

HISTORICAL CONDITION AND CAUSES FOR DEGRADATION

Though the area once had dense forest cover, it now has only a few bush forests and is almost completely devoid of any green cover. The district has lots of hills (over 10% of the geographical area). These had at one point helped in conserving soil and water while providing green manure and agriculture, tools for agriculture and minor timber and fuel wood for household use. The area was rich in wildlife with Panthers (*Pantherus pardus)* being spotted here till as late as 1920s.

The District Gazetteer 1905 says that the "Local tradition declares that not so long ago the hills which are now so bare were covered with jungle of respectable dimensions, but the point is one which is not now easily susceptible of either proof or disproof". The earliest description of these forests was made by Col. R H Beddomme, a forest officer, in his report to the Government, dated 30th March 1880, wherein he observed that the forests of Penukonda taluk were certainly the best forest tracts in the district and that for long they must have been really good forests for the dry eastern portion of the Peninsula. Writing of the forest round about Kottakota in Penukonda taluk, he goes on to say that though he could then nowhere find a single *Hardwickia* tree which had escaped the bill hooks of the grazers, and it was impossible to get beams of this wood in those parts, the houses in all the adjoining villages showed that some thirty or forty years before "fine beams were procured in large quantities". He considered that " the destruction in these hill forests probably commenced only some forty or fifty years back; in the turbulent times prior to 1800 it is not likely that the villagers owned large herds of cattle or goats, and there was ample grazing ground without driving the herds to the hills, and it is well-known that until about forty or fifty years ago these hills were the haunts of the worst class of dacoits in this part of the Presidency, and were probably a *terra incognito* to all others."

According to the 1905 Gazetteer, *Hardwickia binata* was a much persecuted tree, as the inner bark of its young branches yields a valuable fibre for ropes and its leaves made good manure. It was therefore used extensively by the ryots. But worse enemies of the forests then seem to have been the bangle makers. The alkaline earth of which 'Bangle glass" is made was very common in the district, and since in those days before forest conservancy began fuel could be

had for nothing, the manufacture of bangles was a profitable business. In 1880 Mr Gamble found in 14 villages in Penukonda taluk, no less than 93 bangle-kilns, of which 75 were abandoned and 18 working. “The kilns which were abandoned were not working,” he wrote, “are chiefly those which are beyond the reach of wood. They were worked and worked until all the wood in the neighborhood had disappeared and then the scene of operations were shifted.” The large amount of fuel required for the business may be gathered from the fact that furnaces were sometimes kept glowing for sixteen days on end. Destruction of the forests continued in the coming years.

Two of the tree species growing here ‘Nara yepi’ (*Hardwickia binata*) and ‘Teaku’ (*Tectona grandis*) were used extensively by the British in the laying of railway lines between Gudur and Madras (today’s Chennai). There is even a village called Teaklodu from where teak was loaded in huge quantities. Major tree cutting and lopping was done post independence to meet the demands of the growing rural townships. Trees were also chopped on a large scale for brick making, house construction and firewood. Government policies further added to the degradation. Post independence land came under either the Revenue Department or Forest Department. This revenue land in the 70s and 80s was redistributed by the government to the landless for the purpose of agriculture. Subsidies were provided for groundnut cultivation which being a hardy and resistant crop was suited for this area. Groundnut grows best without any shade and so this led to further chopping of trees.

According to the livestock Census of 1961, the district then claimed the largest number of sheep and goats in the state. This gives an indication of the pressures that grazing subjected the area to. Goats, hardiest among the grazers were also provided to the farmers under the Integrated Rural Development Program scheme by the government. Goats are browsers who pull the plants from the very roots and eat away any small saplings and plants not allowing them to grow. Overgrazing therefore nipped in the bud natural growth in virgin lands causing further degradation of hills and common land. Grasses for fodder were rarely allowed to grow for long enough duration before they were harvested. Fodder thus became a scarce commodity. The grass was also collected extensively for thatch for houses and for making brooms.

This large scale lopping of trees and even shrubs from the hills thus increased the rainwater run-off dramatically. This led to severe erosion of top soil and very poor recharging of groundwater. The absence of green cover in these dry areas meant that 60% of the rainfall was lost due to evapo-transpiration leaving little water for the soil. Fires during summer were an additional reason that added to the degradation of the land.

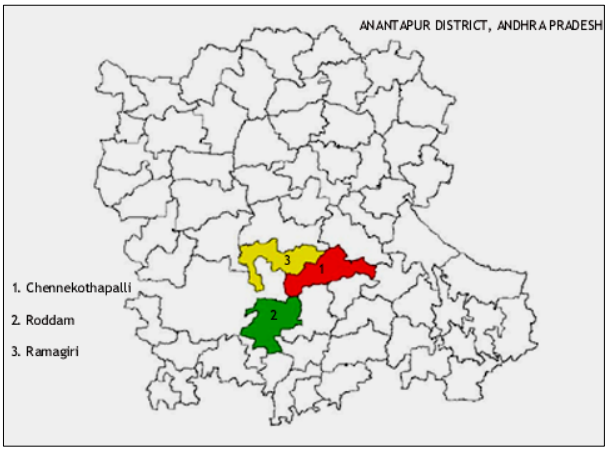
The actual forest cover in the district today according to satellite data is only 2.03% of the total geographical area as against the forest area of 10.8% in the district. A majority of them are of a dry deciduous and open scrub type with trees of an average height of about 15 ft. There is also evidence of heavy sand casting in a few places pointing towards desertification. Today the area is notified as an arid zone.

CHAPTER 3

TIMBAKTU COLLECTIVE- THE ORGANIZATION

Timbaktu Collective (TC) is a registered voluntary organization that was initiated in mid 1990 to work for sustainable development in the drought prone Anantapur District of Andhra Pradesh, India.

The Collective works in about 100 villages of Chennekothapalli, Roddam and Ramagiri mandals of Anantapur District, serving about 30,000 marginalized people.



The focus of work is on landless, small and marginal farmers with special emphasis on women, children, youth, Dalits and disabled. These are the people who are most affected by situations like chronic drought, unproductive land, unemployment and poor infrastructural facilities. The work is carried out through its various working groups and Community Based Organizations (CBOs).

The main activities of the Collective falls within the following categories:

i. Ecological restoration and natural resource management.
ii. Women's empowerment through creation of alternative banking institutions.
iii. Alternative education for children.
iv. Awareness building and leadership development among local youth, Dalits and the disabled for self betterment.
v. Capacity building for local self governance.

TC has been instrumental in the formation of two major networks in the district-Ananta Pariyavarna Parirakshakana Samiti (APPS) working on natural resource management and Voluntary Action Network-Anantapur (VANA) working on issues of voluntary organizations and drought with special emphasis on women and Dalits in Anantapur

TIMBAKTU: THE EXPERIMENT

In the year 1990 a 32 acre plot of dry, degraded land was bought and given the name "Timbaktu". The idea was to find a way to heal and regenerate this ravaged land and create

an agro forest habitat. Thus, the eco restoration work in Timbaktu began as an experiment and went on to become the model for all eco restoration work that the Collective (registered in 1991) undertook.

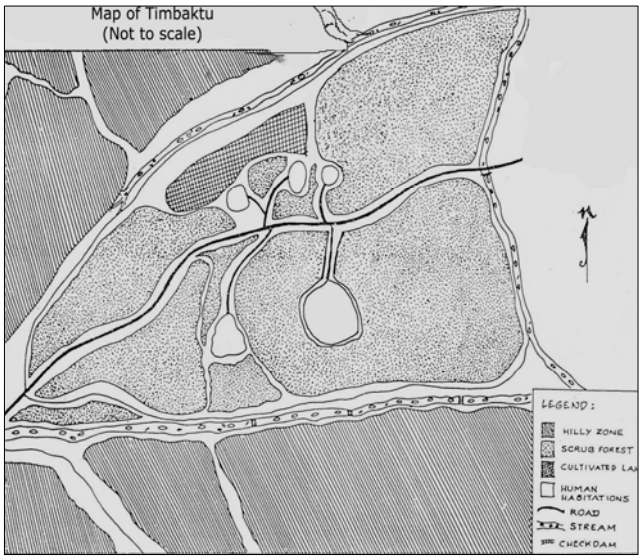
Objectives

The objectives of the eco restoration work in Timbaktu and its surroundings are:

- To make a positive intervention in the process of regeneration and healing of the land within TImbaktu and the common lands surrounding it.
- To bring soil erosion under control.
- To regenerate a forest which produces minor forest produce which can be raw material for the community living in Timbaktu and the villages nearby.
- To increase water recharge in the area.
- To create a habitat that attracts a wide variety of animals that had left the area.
- To reestablish different plants and trees.
- To set and example for other eco restoration projects.
- To learn and acquire knowledge in the field of eco restoration, which can be used to support a similar project.

The land:

The Timbaktu land extends to 32 acres ($14^{o}16'$ northern latitude and $77^{o}35'$ eastern latitude) and is situated five kilometers from Chennekothapalli village in Anantapur District. The terrain is undulating and surrounded on all three sides by hills which are classified as Reserve Forest. The average elevation is 380-420 m above mean sea level, the highest point of which reaches 480 m on Gundlakonda. The conspicuous feature of the hills is the presence of black-colored granite stones on their tops, in a necklace fashion. These hills used to be one of the finest deciduous forests in south India.



All this area was traditionally used by the people of Guttur, Venkatagiripalayam, Chennekothapalli and Nyemaddala villages as grazing land. Initially a 90 acre plot of land was gifted to a family of Chennekothapalli village by the British in early 1900 for grazing

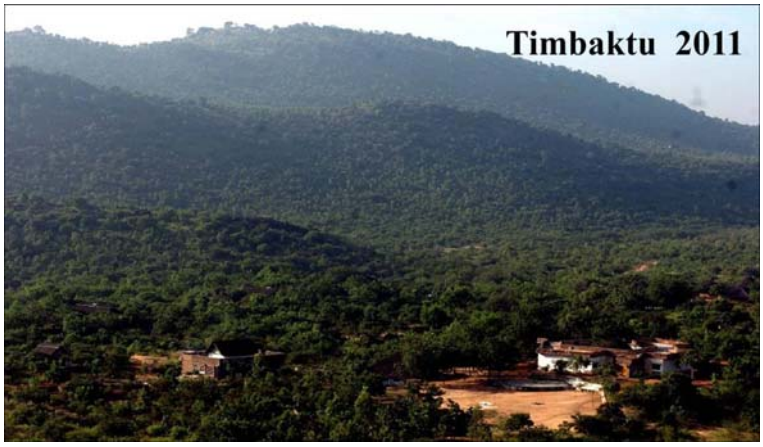
their cattle. During a land survey conducted in 1929 it was reduced to 50 acres and a survey conducted in 1956 further brought it down to 32 acres.

The soil here is red sandy loam with a pH ranging from 7.6 to 8.1 representing slightly alkaline conditions. It is of poor quality having too many minerals, mainly calcium and lacks clay which has been washed away by the rains over the years.

The area has good drainage and with two seasonal streams. One stream, originating from the nearby hill top sacred grove, “Kanvashramam” passes through Timbaktu and the other flows from Gundlakonda area (extreme western part) crosses southwards of Timbaktu.

Activities undertaken under eco restoration work at Timbaktu

Timbaktu land was severely degraded. When the work was started in 1990 there was not a blade of grass growing. A ‘bonsai’ shrub forest, of unhealthy stunted ‘Sundra’ (*Acacia sundra*) trees was all that existed. The earth had become hard packed and crusted with hundreds of gullies flowing into two dry streams that border the land. The hills around were barren, with very few trees.



Protection: The Timbaktu community believed in the ability of nature to heal itself. This however was possible only if no further destruction or exploitation was allowed. Therefore one of the first steps was to protect the land by fencing it using thorny branches of ‘Sappidi’ (*Rhus mysorensis*), ‘Reni’ (*Zizyphus jujuba*), ‘Gotiki’ (*Zizyphus xylopyrus*), ‘Sundra’ (*Acacia sundra*) and ‘Burrajala’ (*Acacia latronum*) thus keeping sheep, goats and cattle out. It was also decided that regenerative development was possible only if the surrounding hills too were protected. They had officially been protected by the Forest Department since 1929 but this was never

seriously enforced and tree felling and grazing was rampant. Policing of the hills was started and trespassers were counseled. Both tree cutting and grazing were stopped nearly completely.

Firefighting:

Every year fires burn the hills causing vast ecological damage to the flora and fauna of what remained of the forests. Most of the fires are caused by humans. Some of the shepherds start fires so that the new grass after the monsoons would grow faster, regardless of the devastating ecological effects of these fires to the slowly recovering forest. Other people start fires to cover the traces of tree cutting. Some trees that had actually survived the fire are also cut claiming that they were dead and would not regenerate. One of the hazards of fires is that they can seriously alter the species composition of the region. Those species of grasses and trees that are more resistant to the fire would regenerate quickly while other species would die out. The third major cause was the irresponsibility of the people who throw away lighted cigarettes. The main weapon of Timbaktu against fires was firebreaks and awareness building among the villagers.

Rainwater harvesting and soil conservation: The Timbaktu land was so barren that every year the monsoon washed away more fertile, unprotected soil. With the soil becoming more and more infertile the plants could not recover as quickly as humans destroyed them leading to increasing erosion every year. At the same time the rainwater runs off instead of recharging the groundwater. It was therefore crucial to stop run-off of rainwater and the erosion of the remaining soil. One of the first steps was construction of small earthen bundings in the area surrounding the center of Timbaktu. The bunds slowed down rainwater and prevented soil from being washed away. Bigger check dams and rock filled dams were built in the larger streams to save as much rain and soil as possible.

Planting and trimming: In the last 19 years more than 15000 trees have been planted. The results of the planting activities over the years have been mixed. While some saplings have taken well to the adverse soil, moisture and wind conditions, others have not succeeded due to poor rainfall and dry winds of summer. Initially, survival rate for trees was only about 5% to 10%, today this has reached a respectable 85%. The reason for the low survival rates initially were:

1) They were not the right kind of species.
2) Not very clear about how to plant and look after them.
3) Soil and environment was not ready for them.

Today larger pits are dug, more manure is applied and better soil is brought so that the roots of the small plants can establish themselves easier. Neem (*Azadirachta indica*) seeds are used as natural pesticide. Stone mulching and drip irrigation with mud pots were done for the plants to help them grow better. Plants have grown well near streams, catchments areas, check dams, swales etc. Trimming bush trees growing in Timbaktu was done to help trees grow faster while the wood was used as firewood and leaves for mulch.

Nursery:

After much experiment and thought it was concluded that in a semi arid, low rainfall area the surest way of growing trees is to grow the seedlings in a nursery. Initially the saplings were grown in the nursery for a period of two years. This was later reduced to six months and then further to three months. The reason being the longer they were kept in a nursery and moved the greater was the damage to the tap root. To ensure better survival by reducing damage to the tap root, saplings were planted after being kept in the nursery for three months.

In the initial years attempts at procuring indigenous species of saplings proved difficult and it was found that the exotic species supplied by the Forest Department and others were not useful in the environment, it was decided to start a full fledged nursery of indigenous plant species. Work on the nursery began in July 1992 with the decision to focus on the lesser appreciated species which had the potential of being more suitable to the area. As seeds were not available locally, they were procured from seed centers like Odukkam. The purpose of the nursery was two fold:

Use of local material for home construction
Main policy of Timbaktu: live according to Nature, follow Nature, love Nature

1) For planting in Timbaktu and the forest area surrounding it.
2) To experientially learn which of the species were not suitable for the area.

This also showed which trees were more likely to survive and cope with the difficult situation. The tougher species included ‘Nara yepi’ (*Hardwickia binata*), ‘Kunkudu’ (*Sapindus emarginatus*) and ‘Vepa’ (*Azadirachta indica*).

Seed collection and dibbling: Seed dibbling done in the early years was not successful with many of the seeds being eaten up by rats and other animals. Pelletizing seeds also rarely worked. However seed dibbling is still carried out in Timbaktu and the surrounding hills. Seed collection is also carried out regularly. Most seeds collected are from the hills which though do not have immediate economic use significantly provide green cover for other species to grow. Both seed collection and dibbling is usually a community effort involving workers and school children of the school.

Brief about year wise activities

The Timbaktu land was bought in early 1990 and work on the land began in May of the same year. A bore well was dug and hand pump installed. The initial works involved making small gully plugs and contour trenches. The soil was hard packed and digging was extremely strenuous. Initially about 7,000 fruit trees of five species were planted – 'Mamidi' (*Mangifera indica*), 'Jama' (*Psidium guajava*), 'Kobbari' (*Cocos mucifera*), 'Papaya' (*Carica papaya*) and 'Sitaphalam' (*Anona squamosa*)- and earthen pots were used for drip irrigation. None of these plants survived as the soil was completely lacking in nutrients and no presence of microbial activity.

In 1991, in the month of March summer hit the Anantapur region with temperatures soaring and the hills caught fire. Some of the land on the eastern side of Timbaktu was burnt. This land had been kept to build a 'genetic bank'. However, the regeneration efforts were beginning to be successful. Because of the earth works done and protection given to the land from animals and humans the grass and bush growth in some places had been phenomenal. Hundreds of newly germinated plants could be seen. Saplings were planted on the burnt land of which a few survive today.

In 1992 things started accelerating, the soil was beginning to heal and plants were growing well.

In 1993 seeds of about 20 species of shrubs and trees were collected for broadcasting in the land in and around Timbaktu. In 1993–94, 4,000 trees of nearly 62 species were planted. Of this eight species had a survival rate of above 90% (mostly acacia species), 19 had survival rates of above 60%, 21 above 40% and 14 below 20%. About 3,000 plants were planted in the forest area and the survival rate was about 45%. Three check dams were built this year.

Up until the beginning of the monsoon in 1994 it was noticed that most of the regeneration taking place was from the root stock. Only a few seeds of two or three species were germinating naturally and then dying out in the summer months. However after the 1994

monsoon almost 20 species were noticed germinating from the seed and quite a few of them made their way though summer.

As per estimates in the year 1994-95 about 400 cartloads of grass valued at Rs. 350/- per cartload (Total value Rs. 140,000/-) were taken by the people from eight adjoining villages. If the same grass had been allowed to grow to full height and ripen in the hills it would become more useful for thatching ('Bodha grass', *Cymbopogon coloratus*) and each cartload would have been valued at Rs. 850/- (Total value Rs. 475,000/- as the number of cartloads would have automatically increased.

In 1995 seed collection was carried out in and around Timbaktu. Some of the seeds were collected in other areas within the district and some which were not available were procured from other sources like Auroville and the Palani Hills Conservation Council. Quantity of seed collected varied from 250 gms to 200 kgs and 22 varieties of seeds were collected. The seeds were used for dibbling and broadcasting in the natural regeneration site at Mustikovila and Shyapuram hills. This was the first time that such large quantities of seeds were collected. During the monsoon of 1995 2,000 'vepa' (*Azadirachta indica*) and 1,000 other forest species were planted in small pits the size of packets in Timbaktu. These have shown about 30 % survival rate but growth was stunted. In one area in Timbaktu, terracing was done as against the building of gullies. This helped to spread the water over a larger region. Terracing was found to be effective and the plants grew well.

In 1996 only about 50 fruit trees were planted in well prepared pits which grew well.

In 1998 seed dibbling was done and about 5,000 saplings were planted. A lot of changes were observed within Timbaktu and the surrounding hills of about 700 acres:

- The trees had grown five to 10 feet taller and were powering their way up.
- The water level had risen by 30 feet in the first bore well and 20 feet in two others, a reversal that one doesn't hear often in the district.
- The 1991 rough census had revealed the existence of 23 species of flora in Timbaktu. In 1992-93 it revealed 90 species in Timbaktu and 200 species on the hills .In 1996 a survey conducted by a taxonomist has concluded that there were 320 species. These are now in a herbarium.
- Protection from fire and restricted grazing in the hills promoted good growth of grass, which is of great use to the villagers to overcome the shortage of fodder due to crop failure. Farmers who used to go out to other areas to purchase paddy straw for fodder could now cut grass from the hills.

- In 1998 it was estimated that about 600 cartloads of fodder grass and about 400 cartloads of thatch grass had been removed from the hills.

  The broom grass, not available anywhere else has been found to grow quite extensively inside Timbaktu. An arrangement with the villagers was worked out – as a token contribution to Timbaktu for every five brooms that they are able to make out of the grass they harvest, the villagers give Timbaktu one. Broadcasting of the seeds of this grass in the surrounding hills was also done.

  Sufficient quantities of 'Kunkudu' (*Sapindus emarginatus*) were collected from the hills for Timbuktu's own use. The same was also harvested by the villagers but no estimates were made.

From September 1998 to March 2001 the protection measure continued. Temporary fences were erected around selected plots that were especially marked out for total protection from grazing. A full time watcher was appointed to slow down and if possible stop any excessive grazing in the hills and common lands. Fire lines were made every year on the hills and common lands. Lines 25 feet wide were marked in a grid all across the protected area of approximately 100 acres and the dry grasses were cut, thrown into the center and burnt. About 20 kilometers of fire lines were burnt in the year 2000. Soil and water conservation measures were carried out extensively on 39 acres of common land near Timbaktu. Many small structures like rock filled dams, trenches, gully plugs and swales were constructed. One large rock filled dam and two large rainwater harvesting structures (farm ponds) were also constructed. More than 1,200 kgs of seeds of indigenous tree, grass and bush species were dibbled or broadcasted. 15,000 plants were planted in 1999-2000. Every year trees and bushes in certain sections of the protected area were pruned. When basins were required they were made so that water could be retained at the base of the tree.

From 2001 till date while little work has been done on the land, the trees have been growing well. It is likely that at least fifty more floral species could have been added but a detailed survey needs to be done to assess this accurately.

Results and current scenario

The results of the efforts can be easily observed. Timbaktu and surrounding hills are covered with trees and plants, a stark contrast to the barren land around. Even in summer the hills are green and full of wildlife. Birds are considered as best indicators for land use change. They are important for seed dispersal and by using the wilderness as habitat increase the pace of reforestation, In TImbaktu the number and variety of birds have increased sharply-from about

40 species in 1992-93 to over 100 species today. A variety of snakes are also found here. Besides a number of bears, deer and wild boar have made the hills surrounding Timbaktu their home.

Almost all the rainwater that falls in this land is now conserved while the water from the hills is slowed down when there is heavy rain. The quality of soil is improving. The trees grow better and the type of plants has changed. After an initial drastic increase in the number of species, the variety of plants has now stabilized at a high level. The groundwater in the bore wells had been initially 30 to 40 feet. This is up now to 25 feet. The villagers profit from the eco restoration efforts and are now able to take away 400 to 600 bullock carts of grass from the hills every year as cattle feed. Fruit trees like 'Neredu' (*Syzgium cumini*) have come back providing villagers with some source of income. Another source of income is the grass used to make brooms and special grass for thatching ('Bodha grass' *Cymbopogon coloratus*). Earlier some of the mulch and fuel wood requirements were raised on the land in Timbaktu. Today there is enough manure produced for the fields and trees.

The regeneration process has yielded good results. Each of the residents of Timbaktu has played a role in the regeneration process. The experiment has been a learning process for members of Timbaktu as well as for the landless laborers who have been contributing their labor and wisdom while learning as participants of the process. Timbaktu does not see this experiment as an end in itself, but saw its main role as an intervention in the process of development of the communities around it, among the poor and marginalized sections especially women and children.

NATURAL REGENERATION - KALPAVALLI FOREST

From a barren and stark landscape the 32 acre land called Timbaktu was transformed into a thick, productive forest, essentially by protecting the land from excessive grazing and allowing nature to heal itself.

Timbaktu Collective (TC) meanwhile began a systematic effort to transfer learning and experience acquired to the surrounding area. The regeneration of Kalpavalli forest is the result of the Collectives attempts to motivate the local communities especially the small and marginal farmers to protect and take responsibility for regenerating their common lands (in the next chapter).

CHAPTER 4

JOURNEY OF KALPAVALLI FOREST REGENERATION

VISION

To become a pioneer in the field of eco restoration meaning…….common lands, lands belonging to the common (marginalized/disadvantaged) peoples, rural agricultural assets like ponds, tanks, streams, hills, soil and grazing lands to name a few.

MISSION

The mission of Kalpavalli may be described very simply as regeneration, rejuvenation, restoration of the earth and its ecology, of the agricultural practices and its lifestyles, of the common (disadvantaged) peoples, their lands and their wisdom. In the verbalization of its mission/vision Kalpavalli sees clearly the relationship between agriculture and forests, between common lands and common people, regeneration and women, equity and political/civil/human rights be it the common man, woman or child.

GOALS

The long term goals of Kalpavalli are the regeneration of the common lands in the villages, rejuvenation of the production assets of the rural areas, the restoration of the common lands to the common (disadvantaged) people to whom it traditionally belongs.

Kalpavalli 25 years ago

There is a clear relationship between its long-term goals and mission. It sees itself as operational for the next 20 years or so. Yet its objective is not to become a huge centralized institution that will grow bigger every year. It sees the possibility of the working members and the village leaders taking up more and more responsibilities as and when they are able to share the vision and develop the

required skills. The organization hopes to develop a process that will make this a reality. If this is achieved then the Collective itself will remain a small support/resource organization.

STRATEGIES

The long term strategies of Kalpavalli are to organize the village communities, empower the marginalized people (women, children, landless laborers and small and marginal farmers) to achieve sustainable development, promote the concept of healing of the earth and support the people to rejuvenate and take responsibility of the village common lands and resources.

Short-term objectives

These are as below:

- ✓ Protect and take responsibility of the common land, forest and resources.
- ✓ Manage resources of the village like soil, tanks, ponds, streams, hills and grazing lands.
- ✓ Green the barren hills in the watershed from the catchments area tanks.
- ✓ Design the greening activity in such a way that the land can provide minor forest produce like fuel, fodder, fruits, fiber and green manure for the people in the watershed area.
- ✓ Ensure rotational and discriminative grazing.
- ✓ Provide income to marginal, landless people particularly women and Dalits in the form of minor forest produce and employment.
- ✓ Improve the condition of water resources in the watershed for the purpose of agriculture.
- ✓ Adopt soil and water conservation methods.
- ✓ Recharge the groundwater.
- ✓ Promote the concept of tree farming.

Long term objectives

In the long term it is envisaged that Kalpavalli will be an independent social action group and the CBO would become an independent people's organization. This would require great attention to developing resources for the organization and for Kalpavallii both in terms of financial, technical and management skills and resources as well as social, human and organizational terms.

In social terms the perspective is to develop the revenue wastelands as village commons under the control and management of people's organization with the local village communities having rights and privileges as well as taking responsibilities for the programs. Priority of terms of involvement as well as terms of rights, benefits and responsibilities will be the Dalits, women and other poor marginalized people.

Development perspectives

The following is the development perspective of the Collective on which all its work on eco restoration in the villages is grounded.

Eco restoration and natural resource management are two of the most crucial areas for developmental intervention. Though crucially important these interventions are difficult because of the following reasons:

- They are long-term interventions. The development trends over the past decades have been moving more and more towards short-term interventions.
- Both eco restoration and natural resource management are concepts not very familiar. Some of the activities that contribute to both such as soil and water management are more familiar than eco restoration and natural resource management in their totality and comprehensiveness.
- Both eco restoration and natural resource management are generally perceived as the responsibility of the state or "others". The accountability has weakened at community levels over the past years.

All the developmental activities of the Collective in the field of eco restoration and natural resource management is based on the mission of building strong and sustainable peoples organization on the concept of eco restoration and natural resource management". Towards this familiar activities such as soil and water conservation are used as a means.

People and land cannot be separated or viewed in isolation. Eco restoration and natural resource management implies restoration and management of land, agriculture and the forests, the people and other creatures living on and off it- this is based on a holistic way of looking at life and the development process itself. Land cannot be managed well unless sound agricultural practices are followed. Sound agricultural practices are dependent on forests as only a sound ecosystem can support agriculture. This is where the mission of building a strong and sustainable people's organization becomes important as proper management of natural resources lies in the hands of the people who live on or off it.

The eco restoration and natural resource management process consists of four stages

i. Rejuvenation

ii. Regeneration
iii. Revitalization
iv. Management

Common resources are resources of and for the common people. The eco restoration process becomes meaningful when common and natural resources become peoples resources, owned and managed by the common people. As of now the common people do not consider common and natural resources as "our resources" because these resources in their present state are more of a liability than an asset. When the resources become productive assets they become resources that are wanted by all. The common people should therefore establish their right to equal share in this resource.

Some milestones and indicators for the eco restoration and natural resource management process

- The common people begin to look at common land as their own
- The common lands begin to give returns and start becoming productive
- The common people begin to claim ownership of the eco restoration and natural resource management process itself.
- The common people begin to assert their rights over the resources.
- Changes in agricultural productivity begin to show.
- The people's organization built on eco restoration and natural resource management starts becoming an authentic peoples forum for participation – a parallel Panchayati Raj – which will ultimately be the peoples representative identity in communities.
- Changes in water distribution system, land tenure, public distribution system etc begins to happen.
- The system becomes one of equity and equitable sharing of resources.
- Changes in agricultural practices and land related productivity towards sustainability begin to show.

Chosen target group and geographical area of work

The people Kalpavalli is working with are the common people of seven villages of Chennekothapalli and Roddam mandals of Anantapur District. The seven villages are – Mustikovila, Subbrayanpalli and Guvvalagondipalli, of Chennekothapalli mandal and Shyapuram, Kogira, Kambalpalli and Bedanpalli of Roddam mandal. (Burujuguttapalli of Chennekothapalli mandal were involved in the regeneration for a few years but withdrew from the same in 1997. This was a very small village with few households but many internal

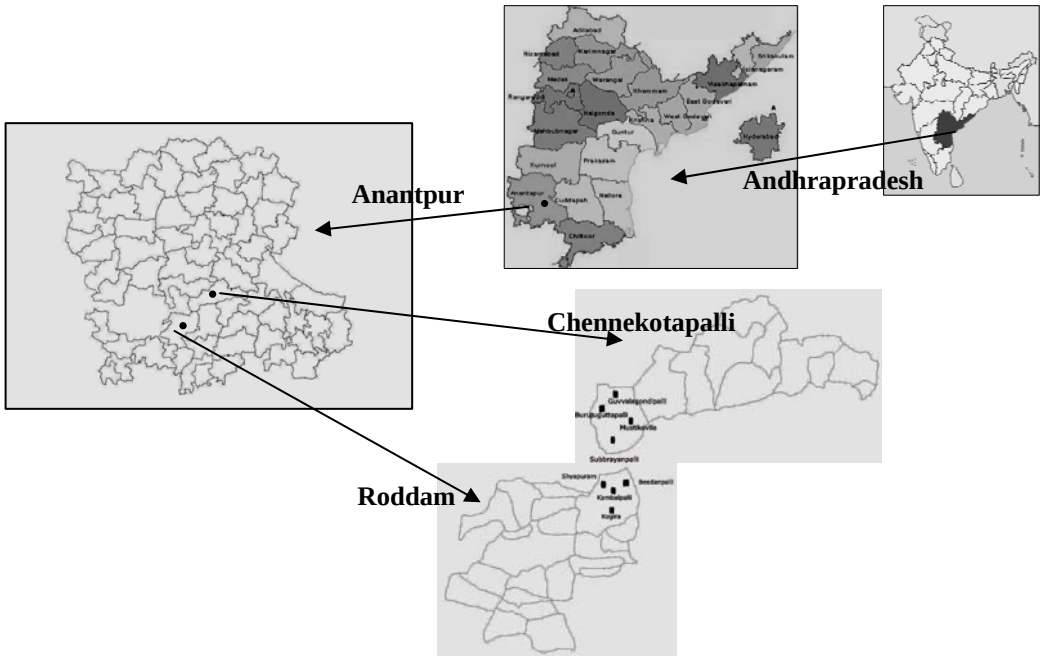
issues.). This ‘common people’ include the disadvantaged, the marginalized peasants, the landless and agricultural laborers, the Dalits, the women, the children of all these sections.

Majority of the villagers are agriculturists working on their own land or as agricultural laborers. 95 % have their own land. There has been little conflict within communities over sharing of resources. The poorest of the poor could directly be involved in the program and share the benefits from eco restoration. This is partly because the social structure of communities in the region had not posed any serious challenges on this front and partly because the quantum of benefits still remain small (fodder being the most valuable resource generated). There is a three fold stratification in the village communities: a small elite class (traders, rich peasants, commercial farmers etc), who are not interested in forest resources, a large “middle class” consisting of small and marginalized peasants who see the benefit from increased fodder and water availability and a small percentage of landless laborers who could contribute their labor and benefit from the forest resources. Doubts have been expressed however that in the long run when the quantum of benefits from forest increase, conflict could increase. It is hoped that over the years these groups will achieve a sense of equity with the more advantaged people of the villages.

PHYSICAL FEATURES OF LAND

The natural regeneration area, geologically, is a ridge running northeast to south. The region falls into two large contiguous watersheds (Mustikovila and Kogira) and one small watershed of Subbrayanpalli. Mustikovila watershed has three villages while the Kogira watershed covers four villages. The Subbrayanpalli watershed for convenience is considered to be a part of Mustikovila .Based on the varying topography on east and west the benefit of the flow into Mustikovila is more than that of Kogira. The watersheds together cover approximately 4,000 acres common lands (uncultivated revenue wasteland) and 4,000 acres of cultivated lands. These contain two large traditional rainwater harvesting structures (tanks) and a number of smaller ones (kuntas) along with hills and valleys and rain-fed streams. The land is highly undulating with a number of small hills.

Map 2: Kalpavalli region in Anantpur district, Andra Pradesh



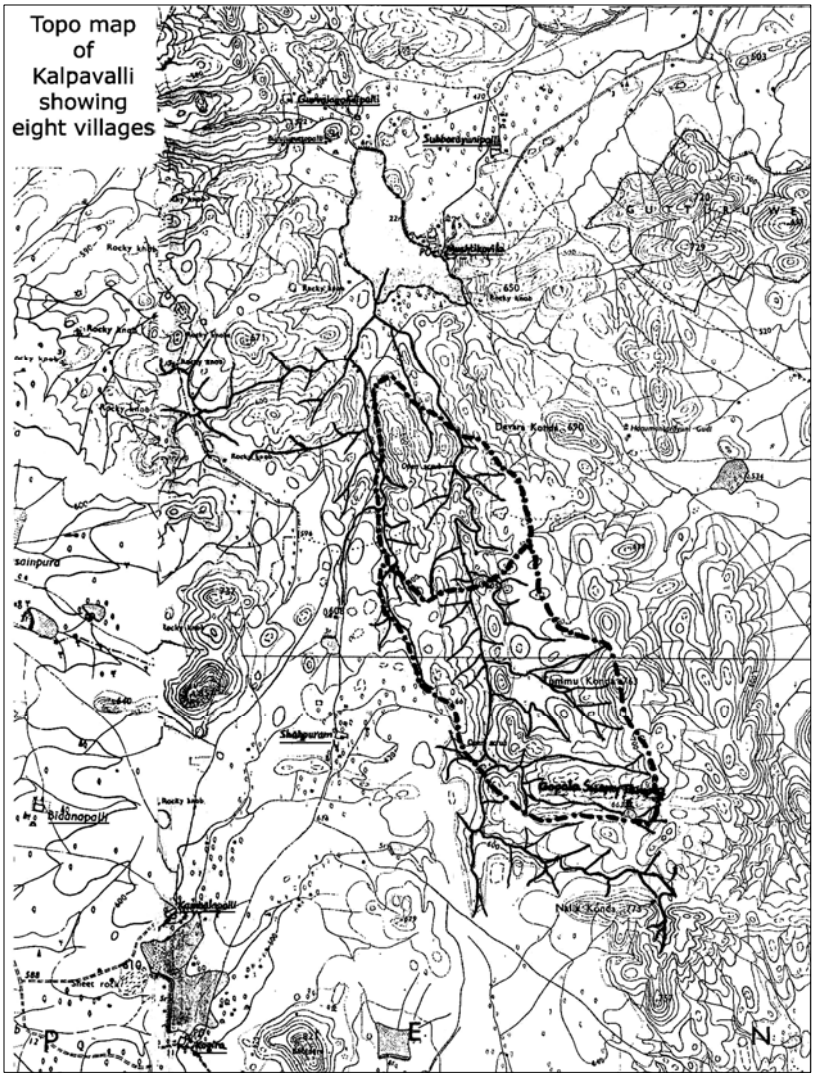


Table: Rainfall data - Chennekothapalli mandal

Monthly rainfall data in Chennekothapalli rain gauge station (1978-2005)												
												Total in mm
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1978	-	-	-	-	-	60.0	94.4	44.6	148.6	54.2	92.2	35.6
1979	-	-	-	-	42.2	22.0	74.4	79.6	243.8	81.2	109.0	-
1980	-	-	-	-	140.8	25.8	14.2	34.6	41.2	-	8.2	-
1981	-	-	8.0	-	85.6	48.4	157.2	83.0	301.2	63.0	57.4	-
1982	-	-	-	16.8	24.6	72.2	29.8	13.0	72.8	42.4	120.6	-
1983	-	-	-	-	50.8	170.8	13.4	129.6	344.0	35.2	6.8	42.8
1984	-	-	36.4	7.6	-	1.2	83.4	2.0	113.6	92.0	13.0	15.4
1985	-	-	-	-	83.8	54.8	44.4	16.4	44.2	107.2	9.8	-
1986	3.0	-	-	-	13.8	29.0	7.0	45.0	113.0	110.0	55.0	-
1987	-	-	-	-	5.2	68.6	2.4	19.6	66.6	143.2	39.8	3.0
1988	-	-	-	13.8	60.6	8.8	80.0	115.0	224.8	16.8	3.0	4.2
1989	-	-	2.0	5.4	19.8	36.2	122.0	6.2	162.6	-	9.2	-
1990	-	-	15.4	2.2	60.2	31.8	2.6	16.6	53.4	132.8	50.2	-
1991	4.0	-	-	14.0	5.4	30.0	9.2	12.8	35.0	124.2	49.6	-
1992	-	-	-	-	11.8	14.8	7.0	3.8	10.2	84.6	47.8	-
1993	-	-	-	-	17.4	66.8	2.8	111.4	15.0	107.8	69.0	49.6
1994	5.8	-	-	-	18.6	1.2	26.8	2.0	12.2	126.4	11.6	-
1995	7.2	-	-	19.4	35.2	2.6	58.8	113.8	118.0	54.4	-	-
1996	-	-	-	15.8	3.2	105.6	22.0	53.0	57.6	170.8	-	16.6
1997	-	-	21.0	12.8	7.6	53.6	-	33.6	115.8	14.0	27.6	16.0
1998	-	-	-	5.8	38.6	6.0	59.2	65.0	92.0	149.4	58.8	13.4
1999	-	4.2	-	-	42.6	4.0	45.6	51.8	74.4	121.2	15.2	-
2000	-	21.8	-	-	-	49.0	10.8	100.6	22.0	152.4	5.0	7.0
2001	-	-	-	33.0	54.0	1.0	9.2	40.0	91.6	205.4	14.2	-
2002	-	-	-	9.0	-	12.0	4.0	5.0	54.0	25.0	3.0	-
2003	-	-	-	-	107.0	3.2	27.6	13.2	9.0	103.6	-	-
2004	-	-	20.0	11.2	53.6	6.0	53.6	3.2	82.0	23.6	5.4	-
2005	-	1.4	-	30.8	19.6	40.6	46.8	78.6	93.2	83.2	30.0	4.0

Table 3: Rainfall data -Roddam mandal

Monthly rainfall data in Roddam rain gauge station (1978-2005)												
												Total in mm
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	-	-	12.0	12.0	38.0	46.6	42.0	19.0	104.0	47.0	12.0	-
1986	16.6	39.0	-	-	47.6	80.4	15.0	44.0	245.8	43.4	41.2	-
1987	-	-	-	-	12.6	76.6	8.4	123.6	43.4	205.6	28.4	9.6
1988	-	-	5.2	55.8	120.6	9.2	220.8	256.2	283.0	30.0	21.2	25.4
1989	-	-	7.4	10.4	35.2	88.4	289.2	11.8	218.4	5.2	9.0	0.2
1990	-	-	2.6	8.6	230.6	52.4	11.8	33.8	65.8	143.2	100.0	5.6
1991	-	-	-	21.6	91.6	113.0	9.6	22.6	119.6	352.8	90.4	-
1992	-	-	-	-	84.4	105.0	37.0	71.2	68.0	352.8	65.8	-
1993	-	-	-	19.2	7.4	104.4	35.4	254.4	66.0	277.2	32.6	72.6
1994	16.4	-	-	12.6	55.4	16.6	52.2	26.8	53.8	248.2	34.6	-
1995	3.6	-	-	3.8	64.6	29.6	115.8	127.0	96.4	88.4	9.2	-
1996	-	-	-	37.2	31.0	139.2	88.8	102.8	207.8	116.6	8.6	37.4
1997	24.2	-	35.6	25.0	24.4	149	7.6	35.4	266.0	69.0	45.8	12.8
1998	-	-	-	5.6	12.4	53.8	62.8	197.6	246.0	140.4	29.2	18.2
1999	-	-	-	-	58.6	56.6	118.4	91.2	302.0	195.8	32.2	-
2000	-	-	-	2.6	125.2	113	32.0	186.4	87.2	229.2	7.6	14.0
2001	-	-	-	77.2	52.6	42.8	10.8	73.2	181.4	334.2	23.2	1.6
2002	29.6	2.0	-	26.4	47.8	53.8	21.4	23.8	66.2	45.2	6.2	-
2003	-	-	2.0	13.4	-	50.4	58.8	53.8	*****	*****	*****	*****
2004	-	-	-	40.4	77.6	-	68.6	49.7	17.0	28.0	9.0	-

2005	-	7.0	-	8.0	36.6	42.6	162.1	63.6	93.4	11.96	43.4	17.4

Note: Rainfall measurements in Roddam Manndal Revenue Office were recorded only from 2004 onwards.

The rainfall data from 1985 to 2003 is from the Mandal Revenue Office, Penukonda. Roddam mandal falls under the Penukonda Taluk.

***** - No data was recorded for these months

Description of area prior to start of eco restoration work

The soil was covered with stones and had grown thin and unstable. Most of the area was devoid of any vegetation and consisted largely of a scrub forest. Fires that raged every year wrecked havoc preventing growth of any kind of vegetation.

Use of region by villagers and relationship of people with land

Prior to start of the regeneration work the area was used by the villagers, near and far, for grazing their cattle, sheep and goats and for collection of fire wood and green manure from whatever remaining trees. The relationship of the people and land was a one-way relationship with the people only taking but doing nothing to preserve or help in the growth of the land and the resources.

Identification of site and convincing the villagers

In November 1992 a Collective member visited and held a survey in the village of Mustikovila, 13 kilometers from Chennekothapalli village situated at the base of a 2,500 acre watershed. The reason for choosing this village was because of its location- large tracts of common land, presence of a large tank and abundant hills surrounding the village. The member spoke to the villagers about the need for eco restoration and his efforts were initially met with a lot of resistance. The villagers were suspicious and thought that this was all a ploy to grab their land. With persistence and exposure visits to Timbuktu, Needimamidi in Anatapur and Hulikala in Kalyandurg things began to turn around. At Hullikallu village the villagers had been protecting a single hill next to their village for nearly 10 years (since 1983-84). The Mustikovila people were impressed and decided to carry out similar efforts in their area as well. 150 acres of land near their village was demarcated. In March 1993 a VSC was formed and April of the same year a watcher was appointed to oversee the protection of the common lands from over grazing and tree felling. Meetings were held and a number of land works undertaken in this area which helped win the trust of the people. They increased the area protected to 1500 acres. No grazing or cutting wood for firewood was allowed. As there was ample land available around the villagers did not protest as they could still meet their needs.

However a large number of nomadic grazers continued to come to graze their sheep in the area adjacent to the protected area near the village of Kogira. Camping near Kogira they

illegally entered into the protected area to graze their sheep. The Mustikovila villagers decided to talk to the villagers of Kogira and encourage them to take up protection works around their village too. This was in the year 1994. At this time an incident happened - villagers from Mustikovila beat up villagers from Shyapuran when they attempted to "steal" fodder from Mustikovila. Here in a significant expression of community spirit the culprits were rounded up and a fine of Rs. 4,800/- was levied and collected. Shyapuram too joined the eco restoration efforts. Kambalpalli which was a part of the same Panchyat followed. And by early 1996 convinced by the work done so far Burujuguttapallii, Subbryanpalli, Beedanpalli and Guvvalagondipalli had all begun protecting the land and a total of 8500 acres were protected by the villages.

Land ownership and permissions

The eco restoration program usually begins with identification of revenue wastelands by the villagers, demarcated by marking with stone heaps coated with Lime slurry, *"burujulu"*, which make the boundaries clearly visible (photo) and then meeting with the government to inform them of the villages desire to protect the land. Meetings are held in the villages surrounding the protected area to explain about the proposals of forest protection work and the restriction imposed on access to the area to avoid future clashes with the villagers.

ACTIVITIES UNDER REGENERATION PROCESS AND DAILY MAINTENANCE WORKS DONE

Fire prevention:

The impact of fire protection work is visible only if an area is safeguarded from annual fire. The annual forest fires are a major problem in this area. During the dry months it becomes very dry, hot and windy in these parts. Sometimes there are fires that are more than 10 feet high. These fires have been one of the greatest constraints to regeneration. Their effect on vegetation cover is disastrous as the grass will be completely burnt up along with newly germinating seedlings/planted saplings. Fodder from the

regeneration area is one of the major benefits to the villagers as the fodder is available throughout the year. Fires cause extensive damage to the biomass existing resulting in loss of good fodder and fuel.

Protection from fires is a primary activity for regeneration of wastelands. This involves motivating and forming voluntary fire fighting groups in the villages, educating them about the adverse impacts due to burning of the hills, putting out fire and making fire lines. The watchers need to look out for fires and inform the VSC who will organize fire-fighting squads to fight them. These groups are 20-30 in number and are formed from the interested members. Eight teams are formed in each of the eight villages.

Preventive measures include formation of firebreaks and fire fighting groups. Fire lines of 20 feet width are drawn at regular intervals so that even if a particular fire is not put off it will not spread throughout the area. All grass and other dry material within the lines are cut and burnt. This restrains fires from jumping and spreading.

Protection:

No program can be permanently successful unless social fencing becomes a part of the peoples psyche. As the area being protected is very large social fencing is the main form of protection. In the time that was taken to raise awareness among the people sectors were cordoned off while treatment was on using thorn bushes and *"burujulu"*. People were educated to cut grass to stall feed animals and grazing animals were not allowed to stray in even by mistake. Bio/live fencing was explored as an added source of revenue for the people.

Monitoring of grazing and fuel wood collection:

To ensure that the fodder regenerated is not over grazed the watchers monitor the grazing of sheep, cattle and goats in the protected area. The VSC have definite policies on over grazing. Earlier the herds of sheep used to be brought from different outside areas. Now it has been stopped. Only villages involved in the natural regeneration process are permitted grazing in demarcated area in specific seasons. No grazing is allowed in regions where seed dibbling has been done. Fodder can be collected by other villagers at a cost; one cartload at Rs. 10/- or tractor at Rs. 50/-. Head loads can be collected free of cost. Collection of fuel wood is allowed only for these villages but no cutting of trees for this purpose can be done. Only fallen dead wood can be collected.

Monitoring collection of minor forest produce (dates, date palm fronds, toddy, grass for brooms and thatching):

The regeneration process has created incomes for the communities in the form of minor forest produce mainly Dates, Date palm fronds, toddy and grass. To ensure that these resources are

not over exploited monitoring is carried out by watchers, VSC members and villagers who ensure that the norms drawn for collection are strictly adhered to.

Seed collection and dibbling:

One of the most important components of regeneration is collection of seeds of indigenous trees, bushes and grasses and dibbling them before or after pelleting and broadcasting them in the rainy season. This is a cheaper and better method of operation.

The biomass establishment on a large area through nursery raised saplings has limitations of being highly intensive and more resource demanding to raising plants, transportation and planting. The regeneration of new forest in large areas and inaccessible terrains through direct dibbling of seeds has advantages as it is simpler and easy to carry seeds and a group of people can cover a larger area with less effort and expenses. Also plants raised from direct dibbling will have undisturbed root formation without deformation of taproot.

Soil and moisture conservation:

These include gully checks, mini rock filled check dams, stone bunds, trenches, vegetative/earthen contour bunds, and crescent bunds along with swales. This is all done using locally available material like rubble stones, sized stones, mud and grass. Survivals of seedlings solely depend on all these treatments at different places. Legume and fodder grasses were broadcasted all over the area treated to help check soil and water run-off from slopes. Soil binder bushes like 'Bandaru' (*Dodonea viscosa*), 'Tangedu' (*Cassia auriculata)* are grown in the nursery and planted to check soil erosion.

Area demarcation by construction of boundaries:

The protected area has been divided into 20 blocks depending on which village it belongs to and what kind of vegetation is growing there. Boundaries are constructed using "burujulu"- a heap of stones covered with lime slurry at distances of 10 m.

Nurseries:

The experiences with nurseries were not very successful as it was labor intensive and costly. At the same time there was greater damage to the tap root and many trees were destroyed. Today small nurseries are maintained by watchers in Roddam near the Gopalswamy temple. The saplings are transplanted when they are small to prevent minimum damage to tap root and ensure better growth.

Plantation:

During the year 2000, the Collective began an experiment for planting tamarind orchards in common lands that were being protected. During 2001-02 the district administration came up with a scheme to plant tamarind orchards on revenue wastelands all over the district to improve the green cover and fetch income for the low income groups. The Collective thus initiated the plantation of tamarind orchards in Kogira, Kambalpalli, Shyapuram, Subbrayanpalli, Chandamuru, Kanumukkala, Nagasamudram, Obulampalli and Kothagadikunta village with the support of the district administration. Watchers were appointed for these orchards and their responsibilities include watering, cutting grass around the trees, basin formation, fencing, mulching etc.

Under the Food for Work Program (FWP) trenching was done on the boundaries of the tamarind orchards promoted by the thrift groups and VSCs. This helped in controlling grazing. The rainwater collected in the trenches also helped faster growth of tamarind trees planted. The thrift groups promoted by the Collective had been protecting areas of revenue wastelands for three years before they began converting the common lands into tamarind orchards. In Subbrayanpalli and Mustikovila villages the lands selected for tamarind orchards had been protected by VSC. Land leveling and pitting were also taken up in these areas under FWP.

There are about 10,000 Tamarind plants in about 250 acres of common land. These trees are considered to be a better alternative in dry and chronically drought prone area as these. Once established they will bring in sustained income in addition to creating tree cover.

Planting works:

Proper deep pitting is done even if the same is more expensive as experience has shown that it leads to more plant survival and quicker growth. Every plant is mulched with grass, available vegetative material and stones.

Conflict resolution:

The area of 8,500 acres is common land and sharing of its resources often lead to disputes. Over the years disputes have risen between the eight villages protecting the region and with other villages who come here to use the forest resources. Disputes arise over sharing of resources and illegal collection of forest produce, fodder and fuel wood. Some of them are resolved by watchers themselves who counsel the wrong doers. In other cases the VSC members are called in to intervene. Fines are also imposed on the wrong doers. Sometimes disputes that are not resolved at the VSC are taken till the KAS meetings. As the villagers perceive that the value of the common resources increases there are bound to be increasing

conflicts. It will be the responsibility of the CBOs and villagers to develop a mechanism for their resolution.

Awareness generation:

Generating awareness among the villagers is critical for the success and sustainability of the eco restoration work. The CBOs have carried out a number of activities to increase awareness about the eco restoration work being carried out. Shepherds are counseled about the regeneration work and the hazards of over grazing by watchers and VSC members. Seed dibbling and collection activities involve school children, watchers, visitors, villagers etc. Competitions are held for the school children and prizes distributed by the VSCs. VSC members explain to them the work being done at Kalpavalli and generate awareness among the children about whom the forest belongs to, its uses, need to protect the forests and how they can be involved. All these activities are ideal for building awareness.

The tradition of "Vanabhojanalu" is being revived. "Vanabhojanalu" means "eating in the forest". This is a tradition that is fast disappearing. Traditionally the people of the village used to go to the forest for a day, get together and celebrate the glory of nature. They would cook there and have a feast and some fun. This tradition builds a relationship with forests and the commons. This channelises the energies and motivates the people to protect their own forest, to reflect on protection measures in-built in traditional practices and to take concrete measures in revitalizing the soil conservation effort. Vanabhojanalu occasions have been successfully used as meeting points for people to voice their concerns for their immediate environment. At the Vanabhojanalu there have been many suggestions from the villagers. Seed dibbling, plantation, construction of watchers huts also have been undertaken on these occasions.

The Collective also organizes the "Paryavaran Parasa" or Environment Festival in June. Hundreds of people from the three mandals and others visit and participate in this festival. The Kalpavalli stall displays the different varieties of seeds collected from the forest, apart from photographs and posters outlining the activities being carried out.

Training:

The success of regeneration depends a lot on the watchers as the area does not posses any physical barriers. They play an important role in checking incidents like cutting of trees, grazing and providing warning about fires. The watchers are trained in all areas of natural regeneration including fire control, seed collection, seed dibbling, soil and moisture conservation works, area demarcation, tree numbering, developing areas marked for promotion of minor forest produce, developing orchards and nurseries. The area that is to be

protected by each watcher is clarified and the concerned watcher is to take responsibility of the area.

Trainings are also conducted for thrift groups members, VSC members, farmers and the youth. These have helped increase the level of understanding about forest environment and educating others to take responsibility for the common lands.

TIMELINE

Since the beginning of the eco restoration work in 1992 a number of activities were carried out regularly at the Kalpavalli forest area. Initially the work was restricted to mere protection of the area from grazing, cutting of greenery. This was quite effective in the improvement of vegetative cover due to copious growth. The overall effect of biodiversity of the area was not substantial as there was no improvement in the species composition of the area. Collection and dibbling in the area was initiated in monsoon of 1994.

Village nurseries were initiated in 1994 to grow saplings for the protected area in both Mustikovila, Kogira and in Haryancheruvu.

While the hills were almost barren when Collective initiated the activity, the rootstock began regenerating and the grass seeds began to germinate, birds began to come back and new trees began to establish themselves. The soil improved and many more varieties of grasses and trees have comeback. Animals such as the blackbuck have also begun to flourish. Even the Sambar has been sighted. (**Annexure**: Time line of activities year wise, and theme based – Kalpavalli)

Evaluations and extent of achievement

Evaluation of the works done and the results are important to assess success of the eco restoration work. Review meetings held regularly by CBOs and the Kalpavalli group to evaluate the work done and results achieved. External evaluations too have been conducted. One such evaluation was conducted in April 1999. The evaluation team adopted common minimal indicators and measurable for the evaluation analysis. These were in terms of minor forest produce, awareness generation, capacity building of CBOs, and increasing green cover of the hills and control of grazing.

Impact:

Eco restoration work takes many years before its objectives can be fulfilled but the below can be seen happening:

- Creation of awareness: This is indicated by greater and more participation of people VSC in managing many of the programs and taking greater administrative and operational responsibility.

- Greening of the barren hills: Density of trees in area has been on the increase. In a tree count done for native species in April 99 indicated that the 4000 acres of ridge had an average of 55 trees. The regeneration is apparent especially in contrast to the surrounding adjacent hills.
- Minor forest produce: This is a long way off a long way off but fodder and roofing grass is available in relative abundance. Villagers are able to make income from collection of dates, date palm fronds, tapping toddy and sale of grass for brooms.
- Control of grazing has been achieved to a great extent by proper monitoring.
- Strengthening of CBOs: The regeneration process has not only seen creation of CBOs but these CBOs have over the years grown in numbers, strength and independence. There are instances where Incomes received by the CBOs like the VSC are also used to meet the needs of villages ex. In Mustikovila teacher's salary was paid out of the VSC income, a school building was built.
- The streams in the regeneration area have water available for longer periods of the year. Earlier the main stream used to dry up by January end. Today there is water even till end of May and are almost perennial. These are especially useful as sources of drinking water for animals brought here for grazing.

Perception of villagers on benefits derived and skills acquired:

The villagers today have a sense of ownership of the project. This is clearly because of the benefits that they have been able to get from the forest. They realize that the regeneration efforts have enabled them to meet to a great extent their household requirements of fodder and fuel wood and at the same time are able to get income from the forest in times of need. Today they do not consider this as revenue wasteland owned by the government but have with a sense of responsibility begun to protect and nourish the forest. The villagers have a greater understanding of the different soil and water conservation works like rock filled dams, gully checks and trenches. There is also an increased, spontaneous participation of the people in several activities like fire fighting or seed dibbling.

Specific benefits to women:

Women are largely involved in the household tasks of fuel and fodder collection and fetching water to meet the household needs. Thus any degradation in the environment means that they have to spend longer and more arduous hours in these activities. Even though they devote such long hours and time for the household they have little say in any decisions being made which are largely left to the husband or male elders. The regeneration has helped increase

availability of fodder thus reducing the need to travel long distances for the same. While trees cannot be cut for fuel wood the dead branches can be collected. At the beginning there was a great resistance on the part of the men to include women and reluctance on the part of the women to participate. Today women are active in the eco restoration works and form a large part of the labor force employed to do any work in the regeneration area.

Stakeholders today and their rights:

The stakeholders today are the villagers who have been involved in the regeneration efforts. As they have taken the responsibility of protecting the forest they are able to reap the benefits of their efforts. Grazing and collection of fuel wood is the exclusive right of these villagers.

COMMUNITY BASED ORGANIZATIONS AND ROLE OF OTHER RELEVANT ENTITIES

Community Based Organizations (CBOs):

Sustainable institution building at the grass root level is one of the most important strategies of the Collective. Formation of CBOs is the first step in this direction. The different programs of the Collective are carried out through its various CBOs. While the VSC is involved in the eco restoration work the other CBOs like the DYS and the thrift groups have contributed to development of Dalits and women empowerment. The latter two though started with specific purposes have been marginally involved in the eco restoration works in their own ways. CBOs are known by different names in different villages. Every CBO meets once a month on regular dates where all monthly plans are made and evaluated. In case of emergencies meetings are called immediately to settle disputes on urgent matters.

Capacity building of CBOs will ensure that the people take responsibility for the development of their villages, own the process, the programs as well as the sustainability of the intervention, in other words, good local self governance. The people have benefited in a number of ways from the different CBOs. They have helped build unity, good relationships among people, improved the social status of Dalits, increased awareness and created more opportunities to speak out.

CBOs in the different villages operate their own bank accounts, manage the funds allocated and keep track of all expenditures and incomes.

Vana Samrakshana Committee (VSC):

The first VSC was setup in Chennekothapallii itself in October 1992 with the forest ranger and the village sarpanch as its important members. This incidentally was the first attempt to set up a Joint Forest Management Committee in the district. This however proved

unsuccessful as it was formed in haste with insufficient participation from the local people. The first VSC was set up in Mustikovila and over the years eight such VSCs, one each for each village, have been formed. The VSCs have been setting the standards for all other CBOs that have been set up to take up the eco restoration work. After the communities decide which areas they want to protect the VSC are set up to carry out protection and monitoring of the activities. The VSCs are an important platform for the villagers to discuss problems and solutions in the villages. They have been crucial in the effort to develop awareness among villages. VSC members are also taken for exposure visits to help increase their awareness and knowledge.

Any person who wishes to become a member of the VSC general body can do so by making a payment of Rs. 10/- per annum. From this general body are elected committee members who number between 10 to 15 depending upon the strength of the VSC general body (50% representation by women). Elections are held once a year.

All the VSCs are federated to form the Kalpavalli Adavi Samakya (KAS). The VSCs take up issues at the village level whereas the KAS (photo) takes up issues on a more macro level like opposing a government plan to resettle displaced persons (from Srisailam) in a regenerated forest, dealing with date palm contractors, regulating grazing and cutting of trees by “outsiders”. The VSCs are known by different names in the villages:

Village name	VSC name
Mustikovila	Adarsa
Subbrayanpalli	Jana Chaitanya
Guvvalagondipalli	Seva
Burujuguttapalli	Thellahamsa
Shyapuram	
Kogira	Kokila
Bedanpalli	Dontirallu
Kambalpalli	Santhiswaroop

Meetings of the VSC are held once a month on pre defined dates and attended by members. The agenda for the meetings include review of work done and any planning for work to be undertaken in the protected area. Other issues like the work of watchers, collection of fines, depositing of money collected from fines and sale of forest produce, seed dibbling, nursery, tamarind orchards etc are also discussed. General body members of all VSC attend the VSC network meetings. Those who wish to be a member of the VSC have to pay an annual membership fee of Rs. 10/- per annum.

Dalit Yuvajan Sangha (DYS):

The Dalits are the poorest in the village communities. Their lands are usually the most degraded and they are the first to suffer from decrease of groundwater levels and the desertification of the commons on which they rely on for their livelihood. An essential part of the Collectives mission as to help the marginalized sections of the society it was decided to form the DYS. A separate CBO was essential as it was difficult to include them in VSCs due to the discrimination faced by them. Moreover the Dalits themselves were afraid to speak up and fight.

The DYS carry out several eco restoration activities and also participate in planting of fruit trees and desiltation works.

Timbaktu Collective members – Kalpavalli group:

These consist of senior cadres, junior cadres and project coordinators who work closely with the VSCs and the other CBOs. The coordinators are experienced personnel in the field of eco restoration and they are responsible for the transfer of knowledge and experience to the other cadres. Fund mobilization for eco restoration work, monitoring the work and capacity building are their responsibilities.

Watchers:

All the 8,500 acres that are being regenerated has been socially fenced. There is no physical fence anywhere. As the area is rather large for the people to monitor from the villages, watchers are employed to protect the area. Their responsibilities include the below:

- Watchers have to keep a look out for fires (especially during the day as fires are not easily visible) and inform the VSC members who will organize fire squads to put out the fires as quickly as possible.
- Watchers are required to accompany those who come to hunt wild boar and rabbit till they leave the forest and see that trees are not cut and fires put out.
- They are responsible for the maintenance of their huts.
- Each watcher is required to grow a nursery of saplings.
- Individual watchers are also required to collect a minimum of 50 kgs of seeds to be used for seed dibbling or broadcasting.
- Watchers need to cut grass that grows around trees.
- Watchers need to make basin for trees to grow well and mulch them.
- Counseling to shepherds who bring their sheep, goats for grazing on the benefits of forest regeneration and encouraging them to participate in the process.

- Where boundaries are not clearly demarcated watchers are required to construct "*burujulu*".
- Watchers are required to collect information about people who come to the area
- Watchers meeting are to be held on the first Tuesday of every month.

The work of the watchers use to be reviewed during the monthly meeting. Any watcher who absents himself from meetings is fined Rs. 20/-. The watchers are provided with identity cards, which they need to carry with them while entering the protected area. They are also provided with "khakhi" uniforms and green turbans.

Village and village panchayat:

Most of the villagers in the natural regeneration region are members of the VSC and are involved in the regeneration efforts. The VSC works with the village panchayat and it is envisaged by the Collective that in the future the panchayat will include eco restoration as a part of its developmental activities.

CONCLUSION

The natural regeneration of forests under the eco restoration program was initially not accepted. However, at present one does see a broad socio –cultural acceptance of the eco restoration program, given the immediate economic benefits accruing from it. However, there could be some conflict within communities over control of forest resources if and when returns are substantial .The VSCs will have to develop mechanisms to accommodate diverse groups with different interests and at the same time meet the objective of serving small farmers as well as marginalized landless people. Moreover, there is also pressure from people from other areas trying to utilize the forest resources and these could develop into a wider regional conflict.

Long term financial viability of the eco restoration program will require an estimation of resource generation from toddy palm, trees (timber), fodder and minor forest produce. Long term costs are those of fire lines and forest watchers which the VSC will have to raise. A corpus will need to be created.

The institutional viability of the eco restoration depends on the ability of the VSC to resolve conflicts within the community that may arise from resource distribution.

CHAPTER 5

METHODOLOGY

Kalpavalli forest is legally “Revenue Wasteland” but in the long period of successful ecorestoration and management it has been converted to “Natural Forest”. To understand the ecoservices of Kalpavalli forest in terms of life support system and also to understand the impacts of Wind Energy project operations going on in Kalpavalli region, a detailed study was done through the following process.

Distribution of animals and plants is not according to legal and political boundaries. Their distribution is according to ecological boundaries. Hence to understand distribution pattern of flora and fauna, areas beyond Kalpavalli have also been studied. To and fro movements of animals keep on going between Kalpavalli and surrounding areas including Guttur Reserve Forest, fallow areas, Ramagiri Wind Farm area, etc.

Line transects were laid in different habitats like wetland, valley, hilltops, streams, cliffs, dense and degraded patches, grass patches, sacred groves, paddy fields, Toddy and Datepalm groves, spring proximities, Windmill operation areas (in Kalpavalli), adjoining Guttur Reserve Forest, Wind Farms and Gold mine dumps of Ramagiri and other open areas. Attention was given to the Windmill legal (on purchased-authorised land) and illegal operations (on unauthorised area for road constructions without legal permissions) to understand the impacts of such projects on local vegetation, catchment area, streams and water flow towards tanks.

Surveys were conducted in terrestrial and aquatic (lentic and lotic) ecosystems. Trees, shrubs, herbs, grasses, climbers were reported and specimen collected for herbarium. Threats, pressure on resources, community dependency on the forest, interlinkages between the forests, agriculture, pasture lands, windfarms were also studied to understand the status of the forest. Information on the historical profile of the area was collected from local community of Kalpavalli, authentic documents and members of Timbactu Collective.

Aspects studied

Status and composition of riparian forest in valleys, role of valley, tank and streams, availability of water in streams and tanks, agriculture status and water use pattern. Livelihoods like, agricultural practices, animal husbandry, MFP collection, craft making,

brick making, rope making and fishing. Ecological indicators to understand the Natural Forest status of Kalpavalli.

Floral aspects : Vegetation composition, succession pattern, Terrestrial, Epiphytes, parasitic plants, Pteridophytes, Bryophytes, Thallophytes, (Fungi etc.), climbers and lianas, grasses, sacred groves, vegetation under Windmills and at distance.

Faunal aspects: Non-chordates (insects, land snails, spiders), Snakes, Lizards, amphibians, birds and mammals. Fallen feathers and scales were studied as indirect evidence. Flying, roosting and nesting sites of birds and bats in Windmill area of Ramagiri to understand the impacts of Wind energy project on living organisms.

Photographs & Sketches:

It has been stated that a single photograph would in many ways be better than the best description of an object. Following aspects were photographed during study period:

Forest types, storeyfication of forests, grasslands, ecotone of habitats, various micro-habitats, landscapes of the area, water bodies, sacred groves, temples, fire events. Various life forms of plants like trees, shrubs, herbs, grasses, climbers, lianas, their flowers, fruits, seeds etc. Various faunal species of non-chordate and chordate taxa. Community life, agricultural fields, agricultural practices, grazing, Windmill operations, Floral and Faunal species sitings in and out side Windmills areas.

Such photographs used as pictorial real-story document (of Kalpavali community struggle) in village meetings to understand the community perspectives on Kalpavalli forestry issues including Wind Energy projects and their impacts. All the photographs are not used in the report. Only a few selective ones have been used. More than 3000 snaps have been taken during study period and have been stored in CDs for reference and evidence.

Sketches were drawn to understand the current situation in the field showing the Windmill operations in the area, catchment area scenario, etc.

Maps:

GPS coordinates taken of important habitats, sacred groves, tree groves in valleys, location of Windmills under construction (in Kalpavalli). Maps of Kalpavalli tank network and overall area were developed with the help of Google Earth and Quantum GIS softwares.

After completion of field surveys, writing and tabulation work was completed. Photographic evidence was studied in detail. It is important to mention that the study is STILL GOING ON.

CHAPTER 6

KALPAVALLI: AN IDEAL LIFE SUPPORT SYSTEM

This chapter reveals the Natural Wealth of Kalpavalli, their uncountable ecoservices and its significance at landscape level.

KALPAVALLI ECOSYSTEM

Characteristics of Kalpavalli biotope are as follows:

- Presence of dry mixed deciduous forest on hill slopes.
- Presence of evergreen species along streams.
- Presence of Eastern Ghats biotic elements.
- Presence of many arboreal faunal species.
- Presence of Date Palm groves.
- Presence of perennial water sources.
- Presence of Sacred Groves
- Presence of a layer of soil of varying depth on hill slopes

- Presence of traditional water storage Tanks and kuntas
- Flow of water and soil deposition towards tank channel.
- Presence of Mushtikovila tank environ as ‘Corridor’ between Kalpavalli and Guttur Reserve Forest.

BIODIVERSITY OF KALPAVALLI

Biodiversity may sound like an abstract concept, but in reality it touches almost every aspect of our life. Kalpavalli has an enormous variety of plants and animals, both domesticated and wild, as also a wide array of habitats and ecosystems. This diversity meets the food, medicine, shelter, spiritual as well as the recreational needs of local people in and around the Kalpavalli region. It also ensures that ecological functions such as the supply of clean water, nutrient cycling and soil protection are maintained (soil erosion started due to irresponsible, illegal and unsystematic Windmill operations).

The diversity and richness of genes, species, habitats and ecosystems are the real wealth, far more important than money. Perhaps the most important value of biodiversity, particularly in a region like Anantpur, is that it meets the basic survival needs of a vast number of people. A large number of traditional communities depend, wholly or partially, on the surrounding natural resources for their daily needs of food, shelter, clothing, household goods, medicines, fertilizers, religious customs, economy, etc.

FLORA (WILD):

Kalpavalli is quite rich in plant diversity including Cryptogamous plants (lower plants) and Angiosperms (higher plants). In the preliminary survey a total of 386 species were reported from Kalpavalli forest, pasture patches, sacred groves, agriculture fields, Guttur RF[1] fringe area (border area) and other outside areas of Kalpavalli.
Out of 387 species, 3 belong to Cryptogamous group and 384 species belong to angiosperms. The detail of each group of plant kingdom is as follows:

Cryptogamous (Lower) plants

Thallophyta (algae, fungi, bacteria and lichens), Bryophyta and Pteridophyta are the Cryptogamous or lower plant forms. Plants of this group generally need a cool and moist micro-climate to survive. Few such localities are available in Kalpavalli, like dense valleys, which provide micro-climate to lower plants. A brief description of members of these groups, seen in and around Kalpavalli are as under:

Since extensive network of streams and tanks are available in Kalpavalli (see map of tank network), enormous growth of blue green algae and algae diversity can be seen easily. Many unidentified Algae species were seen down stream and in Mushtikovila tank. . Due to time and resource limitations, justification could not be done with this taxa.

Moist, cool and shady places are available in Kalpavalli dense valley areas, which harbour Bryophytes. Mosses like *Riccia* spp. was identified and reported on vertical rocks.

[1] Only one transect was done in fringe area of Guttur RF. Detailed study is needed in buffer and core area of RF.

During the study few Pteridophytes (fern) were reported. *Actinopteris radiata*, a xerophytic fern was seen in vertical cut surface on ground floor of moist area, enduring high intensity of radiant energy. *Azolla* sp, was reported as free floating aquatic (hydrophytic) fern. Both these ferns are sun loving (heliophilous) in nature. Crown contact and crown overlapping stages can be seen in the dense valley of the main stream of Kalpavalli, which make the ground floor quite shady. This is a perfect habitat for bryophytes and pteridophytes. Detailed study is required to understand the diversity and richness of mosses and ferns.

The significance of lower plants group in terms of their ecoservices are mentioned later in "Benefits from tanks"

Angiosperms (higher plants)

All the life forms of higher plants like tree, shrub, herb, climber, liana, parasite, tuberous plant can be seen in Kalpavalli region. A total of 384 angiospermic species are reported till date from the field (Annexure 1). Of these, about 298 plant species were recorded from inside the line transects while the rest 86 (including 52 agriculture crop varieties) were recorded from the cultivated fields. Other than these, there are still more plant specimens, which are unidentified and unconfirmed and need timely exploration (in different seasons) for their identification. In view of this, the plant diversity of Kalpavalli is expected to be well over 500 plant species, including cultivated and ornamental plants. However, the taxonomic analysis presented here is based on the 332 plant species excluding agriculture varieties (52 nos). The detail of agriculture diversity is given in "Agro-diversity" in this chapter.

Among Angiosperms, 261 (79%) were dicots while the rest 71 (21%) were monocots. Around 43% of total plants were recorded under herb category (143)

followed by trees (63), shrub (37), under shrub (10) and climbers and twiners (25). Of the total listing of plants about 45 species of grasses and 9 species of sedge were recorded from the study area.

All the reported 332 species belong to 79 families. Poaceae family is the most dominant family with 45 species followed by Fabaceae (39), Asteraceae (15), Euphorbiaceae (15), Amaranthaceae (14), Mimosaceae (11), Caesalpiniaceae (11). Collectively the leguminous group (Fabaceae, Mimosaceae, Caesalpiniaceae) is richer with 61 species, which helps to rejuvenate the health of soil by nitrogen fixation. The sedge family (Cyperaceae) is reported from wetlands and tanks with 9 species. The dominance of Poaceae family is because of the rich grasslands everywhere in the hillocks in Kalpavalli. Major species were reported from the sacred groves.

The region has range of micro habitats and some of the species reported from specific habitats, are explained here:

A very dense Kewra grove (*Pandanus fascicularis*) was reported in moist and marshy part of the Mushtikovila tank near the temple. A dense grove of *Borassus flabellifer* (Toddy tree) was reported from the *Marima Gudi* Sacred grove area. Among others,

Riparian species: *Syzygium heyneanum*

Forest outskirts: *Cordia dichotoma*

Aquatic & semi aquatic: *Bacopa monneri, Typha angustata, Saccarum spontaneum*

Valleys: *Tecomella undulate, Phoenix sylvestris, Desmostachya bipinnata*

Foot hills*: Barleria prionitis, Tectona grandis, Gmelina arborea, Gloriosa superba*

Along streams: *Vitex negundo*

Moist open & fields: *Digera muricata*

Gravelly rock area: *Pupalia lappacea, Aristida adscensionis, Melanocenchris jacquemontii*

Moist, shady places: *Commelina benghalensis*

Hill slopes: *Apluda mutica, Heteropogon contortus*

Agro fields: *Urochloa panicoides*

Three parasitic species *Dendrophthoe falcate*, *Cassytha filiformis* (stem parasites) and *Santalum album* (root hemi-parasite) were also reported. In the Kailashkona area, *Dendrophthoe falcate* is very dominant parasite species. Seed dispersal of parasitic plants mainly depends on avian activities. Parasitic plants are indicator of good forest and rich avifauna.

Other than this, three major invasive species were reported form Kalpavalli. *Prosopis juliflora* is the most dominant invader followed by *Lantana camara* and *Parthenium hysterophorus*. Their increasing population is harmful for the indigenous vegetation especially in the valley areas.

FAUNA (WILD):

Fauna diversity is dependent on the flora of the area. The rich vegetation of Kalpavalli supports a range of non-chordate and chordate fauna diversity. A total of 123 fauna species were recorded from the area (Annexure- 2).

Non-chordate Fauna:

Non-chordate is a very big group of animals i.e. Protozoa, Prolifera, Coelenterata, Helminthes, Nnnelida, Arthropoda (Crustacea, Arachnida, Insecta, Myriapoda) Mollusca. Due to time and resource limitations, only macro forms of non-chordate of Kalpavalli could be studied. So far, no scientific work has been done on the non-chordates of Anantpur district. Hence, this will be a pioneer effort in this field.

Earthworms (Annelids) are common in the wet areas of fields, which are well known for well being of soil health. There are many spider species existing in the area but only four species were identified. Spiders are considered biological pest controllers. Red velvet mite (*Mutella occidentolis*), a symbol of monsoon is seen during early rains; they are not parasite like ticks but are free living. Ticks were not identified.

Varied form of habitat are available in Kalpavalli like forests, patches of grasslands, agricultural fields, streams, wells, human settlements etc. which harbour high numbers and varied forms of insect life. Since winters are not severe here, insects can be seen throughout the year but during and after rains their number increases up to maximum level.

The members of insect group reported from Kalpavalli are Mantis, Grasshopper, Crickets, Dragonfly, Damselfly, Ant, Beetle, Honey Bee, Flies, Moths and Butterflies, Water bugs and Water skaters. Dragonflies and Damselflies (Odonates group) play a very crucial role in ecosystem (indicators of quality of the biotope). Being very specific about breeding habitat, they are sensitive indicators of the health of wetland and its landscape. Odonates, being predators both at larval and adult stages, play a significant role in the wetland ecosystem. Adult odonates feed on mosquitoes, flies and other blood-sucking flies and act as an important biological pest-control agent of these harmful insects. They are also known as 'Conservation Soldiers'.

Class Myriapoda is represented by two orders - Chilopoda (Centipedes) and Chilognatha (Millipedes). Among millipedes only *Julus* sp. is identified.

Among Mollusca, many fresh water and land Snail species are seen in Kalpavalli. Snails play an important ecological role in the forests. They feed on litters, fungi, dead plants and animals and help in their decomposition thereby enriching the soil. They are therefore often called as 'Soil engineers'.

Chordate Fauna:

The water bodies of Kalpavalli have good fish diversity, which support fishing activity. No identification done of fish species available in the tanks. Fishes of streams and tanks provide food to many birds like, River Tern (*Sterna aurantia*), Little Grebe (*Techybaptus ruficollis*), Little Egret (*Egretta garzetta*), Indian Pond Heron, (*Ardeola grayii*), Little Heron (*Butorides straitas*) etc.

Amphibian members are also seen in the area but only Indian bull Frog is identified. Identification of many other species of frogs and toads are yet to be done. During the study some reptiles were seen in the area. The detailed study on fish, amphibian and reptiles is essential to understand their role in food web.

During the study, Avifauna (birds) species were recorded from all the habitats mentioned above. Family Ardeidae, Phasianidae, Campephagidae, Laniidae, Muscicapidae are well represented in Kalpavalli and surrounding areas of RF. The

Mushtikovila tank is the biggest open surface water body in the area and supports big flocks of aquatic birds, can be considered an IBA (Important Birds Area). Cattle Egrets tap many foraging grounds. They follow cattle in fields and congregate in streams and tanks. Flocks of Cattle Egret can be seen following ploughing farmers in the paddy fields of tank-command areas. They roost near human habitations. The dense bed of *Typha augustata* was seen in the stream area between Ramagiri and Mushtikovila village attracts many birds.

A group of Egyptian Vulture (16 members) was seen while roosting on the open ground area near Anjana Swami Gudi Sacred grove. There is a site near to this ground where the local people throw dead cattles and these vultures feed on carcass of the cattle. Hence, they help in environment cleaning. Also three Egyptian Vultures were seen hovering in the sky near the Mushtikovila tank.

During the night transects, *Caprimulgus indicus* (Indian Nightjar) was sited two times in Kalpavalli (night transect- Kogira forest part). They roost and lay their eggs on the ground without building any kind of nest during breeding season. Nightjars prefer open areas during summer season, especially during moonlit nights. Therefore the population of Nightjars is an indicator of good status of the ground of the forest.

One species of Bee-eater (*Merops orientalis)*, two species of Rollers and one species of Hoopoe were seen in Kalpavalli. A beautiful bird Indian Grey Hornbill (*Ocyceros briostris*) was seen near Guttiwala Kunta, on the tree near Mushtikovila tank and Gopalswami Gudi Sacred grove. White-napped Tit is an endemic species in India and it prefers thorn-scrub forest. It was seen at the end of the transect near National Highway 7. Nests of Baya Weaver were recorded on Date trees in the valleys of Kalpavalli. Crested Bunting was seen in the Guttur RF periphery area near Mushtikovila.

Kalpavalli is a hard-effort-gifted natural forest worth visiting from biotic resource point of view. Since varied habitats are available over here, it is rich in mammalian fauna too. Due to the excellent network of the water bodies, drinking water is not a problem for wild animals. Big and small mammals are present in the area. Bats were seen in Kalpavalli but not in Ramagiri Wind Farm area (this aspect is covered in next Chapter). The luxuriant vegetation is suitable for bats. Bats are helping the forest in terms of seed dispersal. The species identification is not done and needs detailed study on Bat population, their habitat and habitat assessment, food habit and food niche, impacts of recent developments on their population.

Rhesus Macaque *(Macaca mulatta)* is a common primate in Kalpavalli region. Small troops were recorded in the way to Ramagiri near the tank. A big troop of this primate resides in the Kailash Kona temple area near water stream. They help in seed dispersal of many wild plant species.Asiatic Jackal and Indian Fox are two main canids of Kalpavalli. Indian Fox is identified from Jackal by more bushy tail and long ears. Its tail tip is of black colour like that of Jackal. Jackal is a nocturnal animal and sited three times during night transects. The Indian Fox was recorded from the Canal area behind Timbaktu and near Guttur RF (two Foxes on the dead cow).

Grey Mongoose (*Herpestes edwardsii*) is common in fields and human habitations in Kalpavalli. Also they were seen dead in road trampling near Mushtikovila, on the way to Kailash Kona, on the road between railway-crossing to Kailash Kona. It is important to notice that the local villagers use bullock carts, cycles and other small vehicles of low speeds for transportation. All these incidents are reported on the roads, which are in use by big and heavy vehicles for Windmill operations. Not only this, three snakes, hare, squirrel and dogs were also reported in road trampling.

According to the local people Leopard is there in the area. During the study, no direct or indirect evidences were seen of Leopard. But presence of Leopard in Guttur RF is sure. There is a corridor between the RF and Kalpavalli they visit Kalpavalli areas too (according to the local villagers) for food as the grasslands of Kalpavalli supports population of Deer. A good number of Deer herds were recorded from Kalpavalli in Kogira forest area, on the grassland on the hills near Kailash Kona and Anjaneyswami Gudi Sacred groves. The Indian Wild Boar also exists in the area. Calls of a big group of Wild Boar were reported in Marima Gudi Sacred grove area.

Indian Hare was recorded from many parts of Kalpavalli and the outskirts of Timbaktu. Among the Rodentia, Five stripped palm squirrel, mice and Porcupine were recorded. The Five stripped palm squirrel is common everywhere in the area. Indian Porcupine (*Hystrix indica*) is a nocturnal animal and the biggest rodent of Kalpavalli. Indirect evidences collected from many parts of the area.

RELATION OF KALPAVALLI WITH GUTTUR RESERVE FOREST:

Kalpavalli supports rich biodiversity evidenced by this preliminary study. Large numbers of local and migratory birds and animals are indicators of good habitat and food security in Kalpavalli. The Mushtikovila tank and adjoining plains are playing a role of corridor for the wildlife of Guttur Reserve Forest. Therefore it is very important to understand the strong connection between Kalpavalli and Guttur RF.

It was observed that the tree cover was providing a large range of food and roosting and safe habitat for various animals and birds in summer season also where the surrounding other patches are barren.

The vegetation of Kalpavalli supports numerous animals and birds shown in the table:

Sr.	Species	Part useful	Use	Used by animals/birds
1	*Acacia nilotica*	Pod	Food	Herbivorous animals
2	*Alangium salvifolium*	Flower (Nectar)	Food	Bees
3	*Azadiracta indica*	Fruit	Food	Frugivorous birds
4	*Bombax ceiba*	Flower	Food	Nectarivorous birds
5	*Borassus flabellifer*	Fruit	Food	Frugivorous birds
		Tree	Nesting site	Weaver Bird
6	*Butea monosperma*	Flowers	Food	Parakeet, Red vented Bulbul
7	*Calotropis gigantea*	Flower (Nectar)	Food	Purple Sunbird
8	*Ficus spp.*	Fruit	Food	Frugivorous birds, Langur
9	*Lantara camara*	Fruit	Food	Frugivorous bird
		Thicket	Shelter	Fowls and other ground birds
10	*Mangifera indica*	Flowers (nectar)	Food	Bees
		Fruit	Food	Frugivorous birds, Langur, Sloth bear
11	*Moringa oleifera*	Flowers (nectar)	Food	Bees, Purple Sunbird
12	*Phoenix sylvestris*	Fruit	Food	Frugivorous birds
		Tree	Nesting site	Weaver Bird
13	*Pithecellobium dulce*	Fruit	Food	Herbivorous animals, Frugivorous Birds
14	*Pongamia pinnata*	Flowers	Food	Bees
15	*Syzygium heyneanum*	Fruit	Food	Frugivorous birds
16	*Ziziphus mauritiana*	Fruit	Food	Frugivorous birds, Jackal
		Tree	Nesting site	Weaver Bird

The corridor not only provides food and safe habitat but also provides to and fro safe route to the game animals. Many animals, Bats, members of Avifauna and odonates need open surface water and the tanks of Kalpavalli are an ideal water source for them. The corridor area consists different habitats like open ground, grassland, agriculture fields and small height

hills. Small and big herbivore have good food-covered path for movements. Three transects were laid in the corridor to understand the movements of animals and birds.

There is a site in this corridor area where the local people discard dead bodies and thus it is a food zone for vultures, small and big carnivore animals and scavengers. In an easy language one can say that the Kalpavalli tanks and valleys provide food and water whereas Guttur RF provides safe hiding for animals.

It is also important to notice that the part of Guttur RF adjoining Kalpavalli do not face noise and air pollution as there are no such disturbing activities in Kalpavalli villages. Another part of Guttur RF, which is connected to National Highway 7, faces such pollution and disturbances. But for last eight months the Windmill operations going on in Kalpavalli and during these operations frequent landblasts done to remove hill tops have increased disturbances to the wild animals and birds. This is detailed in the next chapter. Six Windmills are under construction in the corridor area which will increase threats to the wild life of Guttur RF (This needs detailed observation and analysis).

AGRO-DIVERSITY AND AGRICULTURE:

As mentioned earlier, Kalpavalli region has good stream and tank network, agriculture is comparatively good. The tank system detail is given in this chapter later. A total of 86 plant species including 34 main crops and 52 crop varieties were recorded from agriculture fields (Annexure- 3.). Rice has maximum varieties (15) including indigenous and hybrids. Low water requirement, local Paddy seeds are also under cultivation in the fields.

Millets are the second staple food after Rice and under cultivation with six species and 19 varieties. Four varieties of Finger Millet and nine varieties of Great Millet were recorded. Among others, the oil yielding crop Groundnut has six varieties, 16 varieties belong to pulses followed by vegetables (18), spices & condiments (8) and fruit crops (4). The main source from agriculture field is food but the crop diversity provides good amount of fodder and feed for poultry.

GRASS LANDS AND ANIMAL HUSBANDRY

Success of the regeneration is visible in the abundance of fodder that is available today for grazing. Villagers from the natural regeneration region alone are allowed to graze their livestock and that too in demarcated plots. Due to the regular regeneration efforts fodder is now available throughout the year.

Until rains in 2004 broke it, Rayalaseema was going through a 3 year long drought. By 2003, villagers everywhere were selling their cattle to slaughterers. But not the 8 villages where the Kalpavalli Samakhya has a unit. They had more fodder than they could use. From the 8,000 acres on the Kalpavalli under regeneration, close to 7,000 cart loads of fodder were carried away by 3,000 farmers in 40 villages of Roddam, Ramagiri, Chennakothapalli and Penukonda mandals. Farmers even came from Thirumali of neighbouring Karnataka State. Additionally, the hills welcomed around 40,000 sheep from 23 villages. The regenerating hills had yielded Rs 27.50 lakhs of produce, and over 34,000 work-days of employment.

The availability of fodder supports a great genetic diversity of cattle and small ruminents (Annexure-4). Cows and Bullocks are having six different breeds with different characteristics, namely, Alikeri, Desapu, Jersey, Kwadi, Nati, Ongole.

Ongole[2] bulls (photo) look majestic, royal, attractive and alert. The Ongoles are fine, docile and suitable for heavy draught. Ongole cattle perform under varying environmental conditions (high temperature) due to their adaptability and are unique triple purpose cattle that serve as draught cattle, milk and meat animals.

The shepherds graze small ruminents in the pasture patches of Kalpavalli. During summers they set fire to the old and dry standing grass (unpalatable) so that new fresh grass will come

[2] Ongole bulls have gone as far as America, Holland, Malaysia, Brazil, Argentina, Columbia, Mexico, Paraguay, Indonesia, West Indies, Australia, Fiji, Mauritius, Indo china & Philippines. The Brahmana bull in America is an off-breed of the Ongole. An Island in Malaysia where there are many Ongoles is named as Ongole Island. The population of Ongole off-breed in Brazil is said to be around several millions.
The mascot of the 2002 Indian National Games was *Veera*, an Ongole Bull.

on the ground. Because of this practice, some times large tracts of hills and grounds get burnt. Not only the dry and unpalatable grass, other herbs, climbers, regeneration of trees and shrubs also get burnt.

Poultry:

Country poultry is also an important source of livelihood in Kalpavalli. Villagers keep domestic fowls as pets. There are 11 different breeds of domestic fowls present in the area. Hence, the area has rich gene pool. The breeds of domestic fowl include Asali, Bedasalu, Ceetikodi, Dega, Girraju, Kakinemalli, Natikodi, Padakodi, Paramkodi, Pigali, Selam

FUEL WOOD:

Fuel wood to meet the household needs is also available easily in Kalpavalli for the villagers (especially women) saving them from the trouble of going long distances in its search. Dry and dead wood are mainly used for fuel.

MINOR FOREST PRODUCE:

Dates:

One of the most useful assets created by the regeneration process at Kalpavalli is the Date palm tree. The main stream that runs through Kalpavalli is dotted with thousands of Date palms and they have begun to benefit the poorest of the poor. While the VSC have been reaping benefits from the sale of Date palm fronds to basket and mat makers and from commission received from toddy trappers, the poor have been benefiting from dates, which they collect and sell to local markets in summer months. Norms are laid for the collection of dates. Only the ripened fruits can be collected and not the entire branch cut. 160 families selling Date palm fruits earn Rs 16,000 each in three months (all economic data by Timbaktu Collective)

Date palm fronds:

These are collected for making baskets. Blocks or areas which contain date palms are allocated to individuals by the VSC of the village at a specified rate to the highest bidder who pays the amount as advance. Collection of fronds can be done only from the blocks specified and only trees that are more than five feet tall are marked out. All fronds from one tree

cannot be removed but some at the top should be left for allowing the tree to grow. Local people are given preference.

Toddy:

Collection of toddy from the date palms is another source of income for the poor villagers. Again norms are specified and adhered to. Local people are given preference. Tapping is allowed only on those palms that are more than five feet in height. The VSC member goes with the toddy tapper and indicates the trees from which he can tap toddy for a period of three months only. Toddy tappers are required to pay an advance to the VSC and are instructed to be extremely careful while carrying out tapping. If carelessly done the tree can be subjected to an attack of insects which can kill it. Also for every hundred trees, if the tapper injures more than five, he is required to pay a fine. In addition a fine is levied if the tapper taps more trees than he had been allocated. The activities of the tapper are closely monitored by the watchers on a regular basis.

Grass for brooms:

Brooms made from the 'bodha grass' *(Cymbopogon coloratus*) are locally used as well as sold in the market in the surrounding towns. In this case it was women who took the initiative. They collected grass, cleaned the same and took it to the market for selling thereby getting an income and encouraging others to do the same. 240 families earn Rs 18,000 each in four months by making and selling brooms which are made from grass.

Fibre collection from Agave leaves for rope making:

Leaves of *Agave americana* are used for rope making. Agave Americana grows on hedge of agriculture fields and near water bodies. Local farmers grow this species as biological fence.

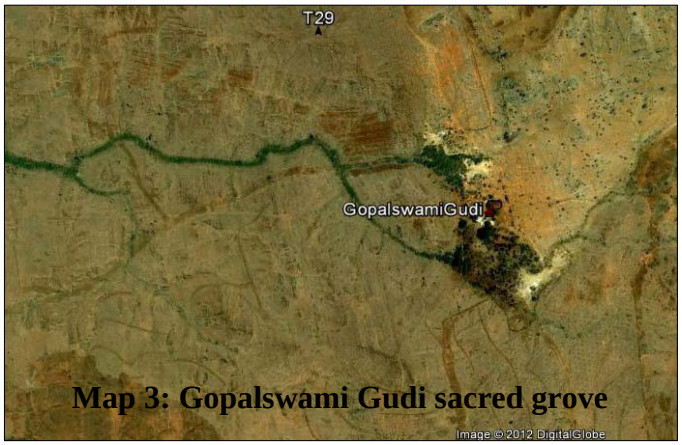
Fibre collection is the livelihood of some, mainly land less people. Usually farmers give contract to cut leaves. The leaves were cut from the body of the plant. Care used to be taken that roots do not get damaged. So that in few months leaves grow again. The fibre collectors now use machine to obtain fibre from leaves, which does the work fast and fine. One truck of green

leaves costs Rs. 2000 to 3000 and the obtained product-fibre (photo), costs around Rs. 5000 per truck, which is ready material for making rope and is transported outside Kalpavalli.

There are 90 more plants which are currently used as medicinal plants and 79 plant species collected as MFP for domestic and economic use.

SACRED GROVES

Temples called 'Gudi' are very religious and sacred places, present in each village especially in valley areas. Good forest cover is seen in the vicinity of such sacred places (map & photo). Sacred groves around valley are rich from floral and avifauna diversity point of view. Anjaneyswami Gudi, Gopalswami Gudi, Marima Gudi and Karima Gudi,Virannapadaluswami Gudi, Shri Kailasham are such sacred groves. Among all the sacred groves, some deities are male gods and some are female gods.



Map 3: Gopalswami Gudi sacred grove

In olden days, Gudi (temple) were simple and open structure (like Marima Gudi, Virannapadaluswami Gudi) but now they are covered-room like (Anjaneyswami Gudi, Gopalswami Gudi).

Forest around a temple is generally protected. Since most of temples are present inside the Kalpavalli forest area, hence, boundaries of a sacred grove remain obscure. When a Gudi is present outside the forest, a small grove of trees is seen around the deity.

Idol or symbolic idol of a deity is never placed in open area. It is generally placed under shade of stones or naturally growing trees. Once a tree is dedicated to some diety such trees are always respected and protected by the community.

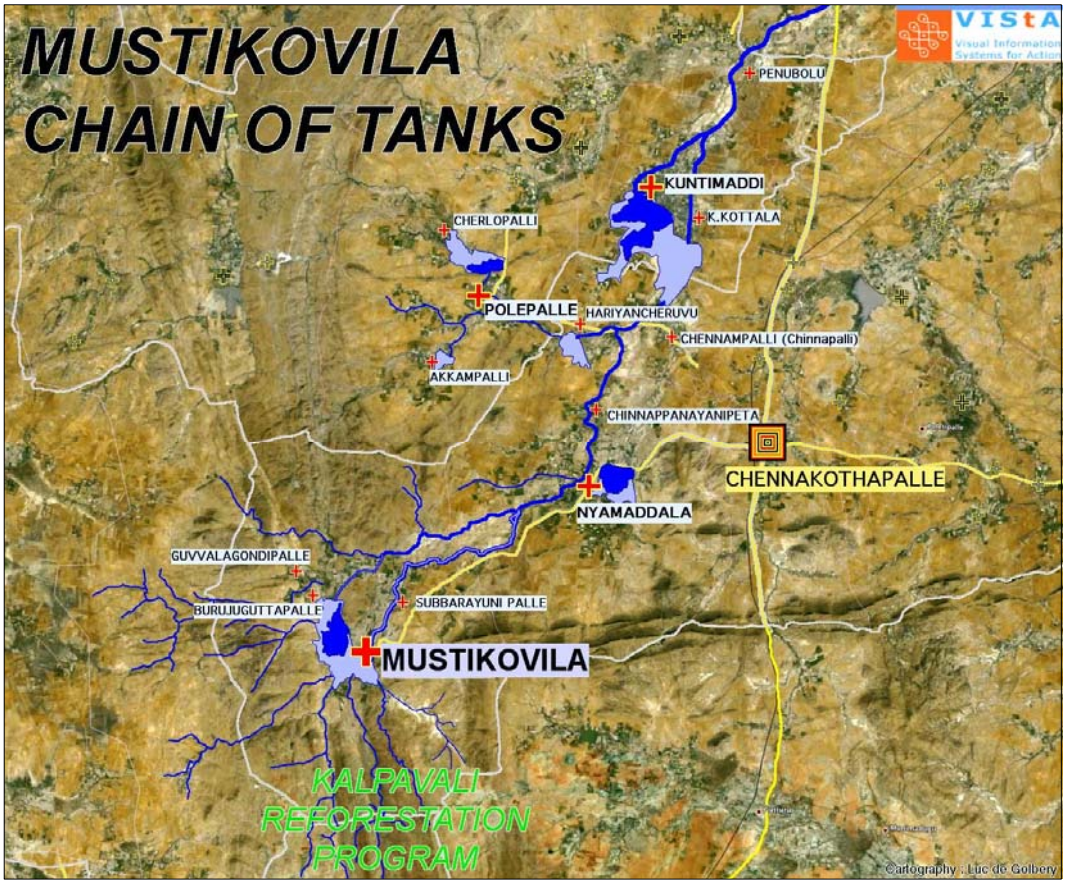
Components of a Sacred grove:

- A deity
- A flag of diety
- A long erected stone pole in front of the main deity
- A grove of trees and shrubs
- A water source: step well, stream, etc.
- Small room like covered space for resting and cooking (ancient structures still exist)
- A pair of stone for making food
- A village or villages in surroundings
- One or many paths leading to grove and diety from surrounding villages
- Certain socially accepted unwritten laws

TANK SYSTEM

Tanks are the main source for life and major livelihoods in Kalpavalli. Indigenous rain water harvesting and management systems like feeder channel, cascading chains of tanks and networking of water bodies can be seen in Kalpavalli (Map).

Map 4: Network of Tanks in Kalpawalli



The life and culture of the local community revolved around these traditional water bodies. Tanks are a complex system constituting catchment, physical structure and canals as major components. Tanks have multiple uses and have varied range of stakeholders who are dependent on the tank directly or indirectly include- farmers in tank ayacut area (with wells and without wells), farmers outside the ayacut area but well within the area of influence of a tank, livestock owners, shepherds, toddy tappers, basket weavers, tank silt users, brick makers, fishers and agricultural labourers.

Structures of Tanks: Bund, tank level, sluice, sluice outlet, sill level of sluice, deep bed level, catchment, water spread area, command area

Benefits from Tanks:

Drinking and irrigation in fields are the important benefits from tanks. Azolla and blue green algae were reported among aquatic plants in Mushtikovila tank. These plants play an important role of biological fertilizer. After drying the tank bed, the layers of these plants remain on the bed surface. This surface soil is desilted by farmers and used in the empty paddy fields. Such biofertilizer help to prevent the depletion of the soil organic matter (Jeyabal and Kuppuswamy 2001).

It was seen that fodder crop was cultivated for livestock in the dry tank.

When the water gets dry, the bed remains moist for some time which helps the wetland plants to grow. Cows, buffaloes, goats and sheep are grazing in such wetland vegetation in tanks.

The fish diversity of tank is an important food of aquatic birds and also supports fishery.

The vegetation less dry parts of tanks supports brick making activities.

CHAPTER 7

WIND ENERGY GENERATION PROJECTS: LANDGRABBING & RESOURCE GRABBING ISSUE

CDM PROJECTS

CDM projects are implemented globally under Kyoto Protocol to reduce green house gases emission and Global warming by UNFCCC. India stands second in implementing CDM projects. But it is necessary to scan CDM projects as it should only a source of money exchange. CDM is a market based mechanism under Kyoto Protocol which allows trading of Carbon as a commodity. Developing country can reduce their green house gas emission and earn CER – Certified Emission Reduction which can be traded to developed countries. Apart from project participants UNFCCC and third party validators are involved in this process. India is a hot destination for CDM projects due to diversity in project, skilled people and easy permission from national authority. India has highest number of registered CDM projects in the world.

Current problems of CDM

- ✓ The Indian government acts as a mere promoter of CDM projects rather than monitoring and evaluating these projects. Till date, not a single proposal has been rejected by the Government, even if global companies believe that such a project is not worth Carbon Credits!
- ✓ In some cases, a CDM project is in operation while in same campus some other operation causes greater pollution; this defeats the greater objective of Kyoto- saving the Environment.
- ✓ In almost all such CDM projects, prior to its implementation the local communities have been victims of pollution from these industries especially due to green house gases emissions. Ethically, CDM projects should share their revenue for the community's welfare.
- ✓ Often, there is no appropriate public consultation about such CDM projects (the Kalpavalli case is discussed below); the public is unaware of their implications. While EPH is mandatory for all other industrial setups, the MoEF is silent about making any Public Hearings for these projects - creating double standards through the law. It seems obvious then that MNCs shall opt for CDM Projects in order to do away with Environmental procedure - what remains the largest hindrance for their unchecked proliferation.

- ✓ There are 104 registered CDM projects between India and UK alone. Under these projects 16586726 Certified Emission Reductions (Almost 650 to 900 crores INR) are traded every year. However, neither the Government nor the public are stakeholders for the benefits of such revenue.
- ✓ Lack of transparency (only between Government ,companies and International bodies)
- ✓ Cheap option for developed countries to buy Carbon credits
- ✓ Community impacts (positive or negative) not evaluated.
- ✓ No monitoring at national and state government level

Wind: a resource, a commodity

Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. The earth's surface is made of different types of land and water. These surfaces absorb the sun's heat at different rates, giving rise to the differences in temperature and subsequently to winds. During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water. In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles. Humans use this wind flow for many purposes: sailing boats, pumping water, grinding mills and also generating electricity. Wind turbines convert the kinetic energy of the moving wind into electricity. The generated electricity goes to the power grid and finally the resource gets converted into commodities.

GLOBAL SCENARIO

Since mid 70s the development of wind energy technology has made significant progress. The grid connected wind electric generators have gained momentum. The technology facilitating use of wind as a major energy source has been established and ranks one of the most promising of the renewable energy technologies for generating electricity. The experiences of other countries have provided useful information on policies, incentives, technology development, institution linkages, legislation, pricing, impacts, conflicts etc.

NATIONAL SCENARIO

The wind programme in India was initiated in the year 1983-84. The MNRE has created strong base, which includes wind resource assessment, research and development implementation of demonstration projects to create awareness, involvement of industries and

utilities, development of infrastructural facilities for manufacturing and installation and provide policy support. It is estimated a gross potential of 45000 MW exists in the country and so far projects aggregating to 9041MW as on August, 2008 have been set up in different parts of the country. The C-WET, Chennai and State Nodal Agencies implement the wind resource assessment programme with support of MNRE in the Country.

INDIA'S UNIQUE PROPOSITION

It is estimated that with the current level of technology, the 'on-shore' potential for utilization of wind energy for electricity generation is of the order of 65,000 MW. India also is blessed with 7517km of coastline and its territorial waters extend up to 12 nautical miles into the sea. The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come. Potential areas can be identified on Indian map using Wind Power Density map. C-WET, one of pioneering Wind Research organization in the country is leading in all such resource studies and has launched its Wind Resource map. In a step towards identifying and properly exploiting these wind resources, MNRE has estimated state-wise wind power potential in the country.

EARLY EFFORTS IN INDIA TO TAP WIND ENERGY

Winds in India are influenced by strong south west summer monsoon which starts from May June and weaker north east monsoon which starts in October. During the period of March to August winds are uniformly strong over the Indian peninsula except the eastern coast. In India wind energy was first tapped in the 1950s for its potential to pump water for domestic use and irrigation as an alternative to diesel/electric pumpsets. Wind pumps were imported on a modest scale and installed on an experimental basis at a number of sites. A National Water-Pumping Windmill Demonstration Programme was subsequently introduced by the Government of India during the 6th (1980-85) and 7th (1986-91) plan periods and about 2800 units of the 12-PU-500 wind pumps for shallow well water pumping were installed around the country. In addition, over 200 indigenously developed gear type pumping units have also been installed in 9 states under an *Operational Research Programme* (ORP). Unfortunately due to various technical and non-technical reasons, the 12-PU-500 could not succeed except in some regions.

A *Wind Resource Assessment Programme* was taken up in 1985 comprising wind monitoring, wind mapping and complex terrain projects. The programme covered 25 states with over 600 stations. Eighty three masts of 20-25 meter height with sophisticated continuous wind data

recording instruments, and 172 masts of 5 meter height with cup counter anemometers were set up in the country. Five volumes of *Wind Energy Resource Survey for India* have been published so far which cover wind data from 198 wind monitoring stations (26-30) The programme for demonstration windfarms was initiated in 1985. Since 1992 private investors/developers took lead in setting up commercial wind power projects in the country.

A package of incentives have been offered by the Central Government such as accelerated depreciation, tax holiday, soft loans, custom and excise duty reliefs, liberalised foreign investment procedures etc., Private investors/developers took advantage of these incentives and set up windfarms.

Although subsidies and financial incentives were given liberally to wind energy, this technology remained marginalised in the over all energy scenario. Wind energy contributes about 1 per cent of the total power available in the country. While working out cost-benefit analysis and calculating internal rate of return for any power project, hidden or indirect subsidies on pricing a resource and infrastructure were never taken into account in the case of conventional energy sources. On the other hand, economic analysis of wind energy projects rarely supported their economic justification. There are number of instances which clearly demonstrate the need to create a level playing field enabling wind energy to compete with conventional energy in India.

WORLD MARKET SHARE

According to REN21- Global Status Report 2011 (GSR-2011), Indian company Suzlon was among top ten manufacturers of Wind Turbine manufacturer's in the world with world market share of 6.7%. Also major world companies are pouring into the fast evolving Wind Energy market in India: Vestas, GE Wind, Enercon and Gamesa have already opened up their establishments across various cities in India.

INSTALLED CAPACITY

According to MNRE's achievement report, The cumulative installed capacity of Grid Interactive Wind Energy in India by the end of September 2011 was 14989MW (of which 833MW was installed during 2011-2012 against a target of 2400MW). Aerogenerators and hybrid systems contributed 1.20MW during 2011-12 to yield cumulative off-grid wind capacity of 15.55MW.

INDIA IN THE WINDY WORLD

In 2008, India shared 6.58% of total wind energy installed capacity around the world, according to World Wind Energy Report-2008. According to GSR-2011, the world witnessed highest renewable energy installations through wind energy. Total installed capacity of wind energy reached 198GW by the end of 2010. India ranked third in the world in annual capacity additions and fifth in terms of total wind energy installed capacity (Annexure 5). India has been able to fast pace its growth in wind energy installations and bring down costs of power production. The GSR 2011 reported on-shore wind power (1.5-3.5MW; Rotor diameter 60-100m) at 5-9 cents/kWh and off shore wind power (1.5-5MW; Rotor diameter 75-120m) at 10-20 cents/kWh. But India's onshore wind power cost reached 6-9cents/kWh in 2008 itself (Indian Renewable Energy Status Report-2010).

WIND ELECTRIC GENERATORS

The capacity of wind electric generators so far installed in the country ranges between 225 to 1650 KW machines. The machines are commercially proved and are being manufactured in the countries like Denmark, Holland, Germany, USA, Japan etc. The Wind Electric Generators are at present are manufactured indigenously and some of the manufacturers are exporting the machines to other countries. As per the guidelines of Govt.of India, the wind machines should have type approval issued by the approved international agency. C-WET, Govt.of India notifies the list of suppliers from time to time and the list of manufacturers/a supplier. State Electricity Boards / State Nodal Agencies / developers have to verify the validity of the type approvals at regular intervals as per MNRE guidelines.

The space required for erecting single windmill will be of the order of 12 mtr each. However if a group of windmills are installed at the same location the distance between the machines has to be decided based on the topography of the site. The approximate land required for setting up of 1 MW wind farm project would be about 15 acres which will vary depending on topographical conditions and other factors of the site.

Based on the present cost of machines the capital cost for installation of 1 MW project would be between Rs.500-600 lakhs. This is only an estimate and actual cost of the project depends on size and make of the machines and location of the project.

INCENTIVES OFFERED TO NCES BASED POWER PROJECTS

A. By Govt. of India

1. Under the Income Tax Act, the Govt. of India is allowing 80% Accelerated Depreciation on specified Non Conventional Energy Devices / Systems (including wind power equipment) in the first year of installation of the projects.
2. A ten year tax holiday has been allowed in respect of profits and gains of new industrial undertakings set up anywhere in India for either generation or for generation and distribution of power.
3. The Govt. of India has announced Generation Based Incentive (GBI) @ 50 paisa per KWH in respective of developers who are not availing accelerated depreciation benefit as per MNRE lr no. 53/1/2008-WE dated 17/12/2009.

B. By the State Govt. of Andhra Pradesh:

1. Each Eligible developer may be allocated available Govt. land to harness upto a maximum of 200 MW of wind power initially. After commissioning of 100 MW capacity Wind farms in 1st stage in the allocated Govt.land, the Government may allocate land for another 100 MW capacity Wind Farms. The application from the developers for Government land will be considered on a first-cum-first-served basis.
2. The state Government has permitted DISCOMs to offer Rs.3.50 / KWH for wind power projects for 10 years from the date of commissioning of the projects, subject to obtaining the consent of AP Electricity Regulatory Commission. The tariff for the period 11th year to 20th year shall be as fixed by APERC.
3. The DISCOMS shall have the first right of refusal on Power Purchase if the Plant continues to operate after the 20th year of operation from COD. The tariff beyond 20th year shall be as mutually agreed by both the parties.
4. Wheeling charges will be at as per the orders of A.P.Regulatory Commission and as per the Open Access policy. The concessional wheeling and transmission charges for captive use or 3rd party sale may be in kind at 5% of energy delivered into the grid (which includes transmission and distribution losses). The concession wheeling and transmission charges will be subject to the approval of the AP Electricity Regulatory Commission. However, the third party sale is permitted only to the HT- I category consumers as categorized in Tariff Orders by the commission from time to time.
5. The Wind Power Projects are not eligible for Banking of Energy. The Energy generated by captive generating plants, if not consumed during the billing month,

would be deemed to have been sold to respective DISCOM and the DISCOM may pay for such un-utilized Energy at the rate of 85% of the tariff.

6. Technical Consultancy Services through NEDCAP.

FISCAL DISADVANTAGES OF THE TECHNOLOGY

i. The total cost can be cheaper than solar system but more expensive than hydro.
ii. Electricity production depends on- wind speed, location, season and air temperature. Hence various monitoring systems are needed and may be very expensive.
iii. High percentage of the hardware cost (for large Wind Turbine) is mostly spent on the tower designed to support the turbine

TECHNICAL BARRIERS IN WIND ENERGY PROGRAMMES

Lack of standardisation in system components resulting from the wide range in design features and technical standards, and absence of long-term policy instruments have resulted in manufacturing, servicing and maintenance difficulties of wind turbines (this can be seen in Ramagiri Wind Farms). The mismatch between locally manufactured components and imported parts resulted in weakening the reliability of the over all system, in some cases. The absence of effective servicing and maintenance networks, combined with inadequate user-training, resulted in a loss of confidence among entrepreneurs and customers. Another barrier is lack of co-ordination among research groups, academic institutions and private wind industry.

INSTITUTIONAL BARRIERS IN WIND ENERGY PROGRAMMES

There are many constraints, not only to the development of Renewable Energy Sources like wind but also for their wider dissemination (especially share of the local community, whose resources are used for energy generation). Technologies that are of immediate relevance in a developing country like India are now available and, while improvements may be required in individual cases, especially to reduce production costs, the hardware for harnessing wind energy is relatively well known and reliable. What is required is therefore an appropriate institutional infrastructure capable of planning and implementing a coordinated programme at all levels and of mobilizing community support for it at the micro-economic levels where it would be implemented. This strategy calls for a different approach that would need to be compartmentalised according to the sources of energy supplies and yet to be integrated and co-ordinated to bring the results to the masses. This new strategy will require an integrated

institutional approach involving political will to support it consistently, institutional arrangements to implement it and involvement of the people to sustain it (31)

Wind energy is being pushed in India because of its usefulness as a decentralised energy system. Its introduction initially generated a good deal of interest from the scientific perspective rather than its potential to meet energy demands on decentralised basis. A growing gap in demand and supply, environmental considerations and the decentralised nature of wind projects made everyone in India realise its significance in meeting the growing energy demand to some extent. Initially, wind projects were promoted in India as a panacea for all unsolved energy problems. The main emphasis on wind projects was on the target achievement rather than on consumer satisfaction of capacity building. Little efforts were made to strengthen the institutions involved in the diffusion of wind energy, or provide an enabling environment to the entrepreneur to promote the commercialization process. This resulted in raising undue demands and expectations that wind energy is unable to fulfill.

In India most of the wind farms are set up by big industries mainly as a tax shelter plan. Unless the wind projects are mass based, it is hardly possible to get the political support besides resources to set up wind projects. On the other hand the wind developments in Denmark where the installed capacity at the end of July 1998 stood at 1259 MW are worth emulating in Tamil Nadu (India). About 75 per cent of the wind turbines in Denmark are owned by local associations and private individuals (32). More than 100,000 families are involved as share holders. Over the past decade, the popularity of wind turbines has grown to such an extent that today they cater for 7 per cent of the country's total electricity consumption. This, inturn, provided an excellent basis for renewed community spirit and the growth of interest in energy and environment matters.

MICROSITING MISTAKES

Micrositing in the case of complex terrain is crucial to locate the machines to achieve higher array efficiency and to get optimal generation from each machine. Most of the identified sites in Ananthapur district in the State are having hilly region (complex terrains). Why micrositing is a must to set up windfarms especially in complex terrain areas can be understood by Ramagiri wind farm example. Ramagiri has complex terrain. The Consultants and Manufacturers of wind turbines overestimated the generation at Ramagiri based on the wind data from 3 anemometers. The actual generation fell by about 25 percent from estimated generation.

A case study of 5 numbers of 500 KW wind turbines of a windfarm at Ramagiri revealed wide variation in percentage of generation with reference to 576 level from 24.22 per cent to 7.79 per cent (33).

Table 4: Generation details with contour levels at a windfarm in Ramagiri

Sr.	Machine Capacity	Contour level	Generation in Kwh form Jan'97 to Aug'97	Difference in level (Meters)	% of energy lost w.r.t. 576 level
1	500 KW	576	617425	-	-
2	500 KW	570	569273	6	7.79
3	500 KW	564	467833	12	24.22
4	500 KW	561	490690	15	20.52
5	500 KW	561	513647	15	16.80

The variation of about 4 per cent of energy between locations 4 and 5 is due to the slope of terrain in the predominant wind direction even though both are at the same contour level. This proves beyond doubt that critical micrositing is a must to set up windfarms especially in complex terrain areas. In order to understand the net benefit from wind energy one also needs to add the loss of productivity and diversity of the natural resources due to introduction of wind turbines. Our preliminary investigation indicates that the net benefit is much less than anticipated and some times even negative. In the context that the local people do not get a share of the revenue from electricity generation, they end up being worse of than before. The employment generation in terms of tea stall, watchmen, helper, etc does not compensate for the loss in natural resources and related livelihoods.

CURRENT SCENERIO IN ANANTPUR

As part of its efforts to popularize wind energy, the Non-Conventional Energy Development Corporation (NEDCAP[3]) is attempting to tap the full potential in Anantapur, Kadapa, Kurnool and Chittoor. It is developing a wind estate in the Ramagiri area by acquiring land on its own and allotting the same to 24 developers of wind power plants for producing 20 megawatts of power, in order to prevent bureaucratic delays. Tallacheruvu, Alankanarayanapeta and Nallakonda near Penukonda have been notified as potential areas for tapping of wind power.

[3] Anantapur NEDCAP Executive engineer Mr.M. Kodanda Rama Murthy told *The Hindu* that the Centre has liberally announced several concessions to woo developers. The developers are paid Rs.3.10 per unit, which is the minimum assured price for those in the wind power generation sector.

Presently 200 mw are being produced by 24 developers in the region. However, potential exists for producing around 10,000 megawatts by tapping the wind potential identified at several places in the Rayalaseema districts. To trigger speedy development, the Centre has liberalised norms for the execution of wind energy generation projects.

A 220 kv sub station had been set up at Ramagiri. Eight new projects at Mustikovila and Kadavakallu area have been connected to a 220 kv substation and 132 kv substation in the region. An investment of Rs.5 crore is needed to produce 1 MW of power.

WIND ENERGY IN KALPAVALLI: BREATH OF LIFE OR KISS OF DEATH!!

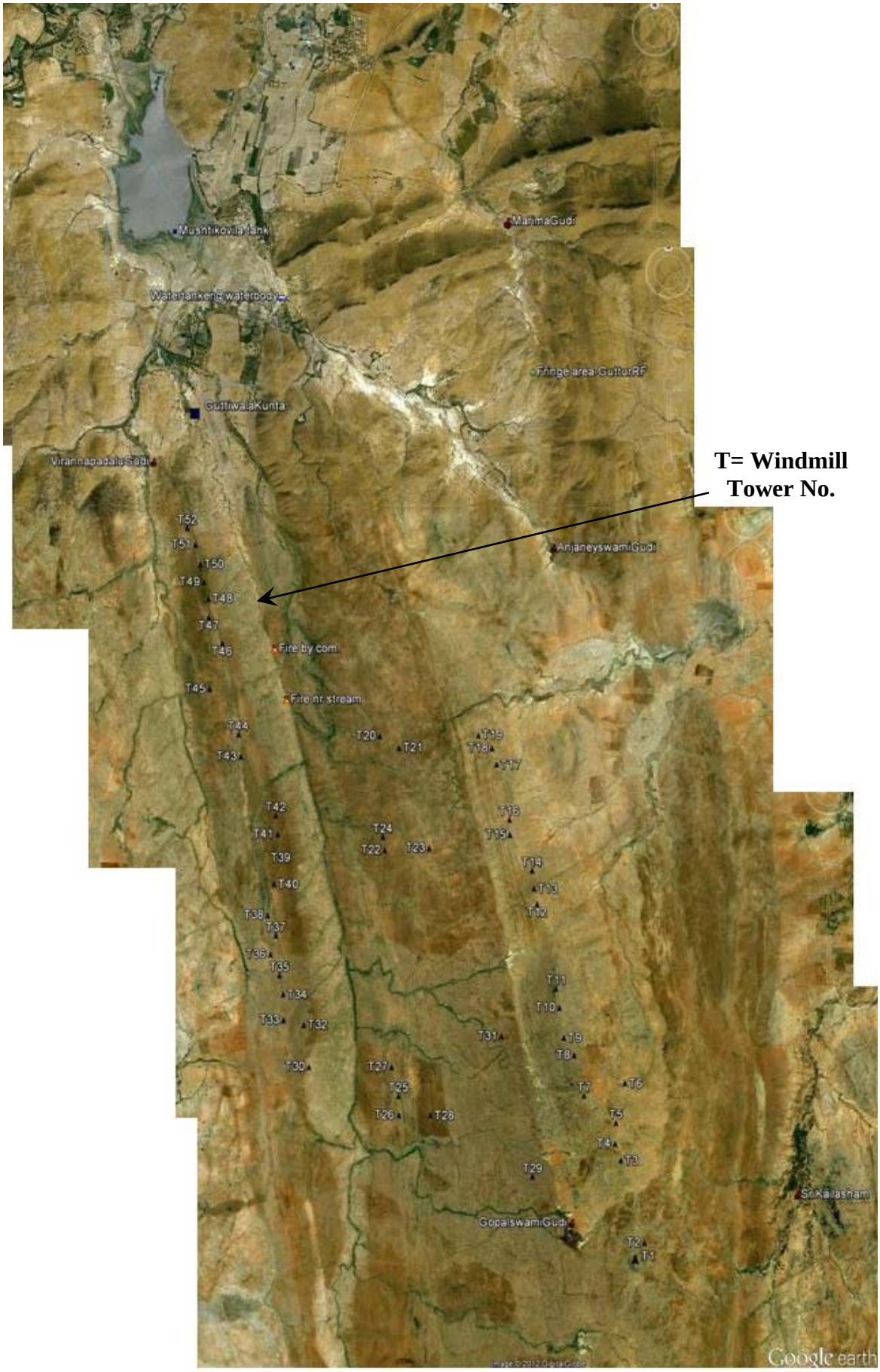
The earlier chapter provides evidence of the rich and dense resource status of Kalpavalli region. Kalpavalli is facing a problem from development of Windmills in catchment areas of regenerated forest. Large patches and roads are developed by removal of vegetation in the upper ridges which causes the area to suffer massive soil erosion. The forest cover is the main factor against soil erosion and supports rainwater recharge in streams and tanks. If this forest cover gets harmed, it will affect the whole watershed channel including stream, tanks, small water bodies and wells.

Why to take toll from the existing Green Energy?

Proper, systematic and local life-sensitive methods should be developed and utilised for area screening of prospective sites for wind power development. Wind speeds at the height of a wind turbine depend strongly on terrain elevation, exposure, slope, and orientation to prevailing winds, all these factors are professionally important for companies; but there are other factors, more important to consider during wind site suitability, such as the distance to nearby transmission lines, proximity to protected areas or reserve forest, type of vegetation cover, local life support systems including natural resource dependent livelihoods, watershed and water catchment aspects, habitat diversity, use of local resources in the power generation etc. These factors are not considered in selection of Kalpavalli region for wind power generation.

During the study, three transects done outside areas of Kalpavalli, which are not forest and also not under ecorestoration and hence are fallow areas. These areas are having similar topography and may have potential for Wind energy projects. Kalpavalli regenerated area is in continuation to Ramagiri Wind farms area. Fallow areas could be more suitable than the green and dense cover of Kalpavalli destroyed for energy generation. A variety of considerations need to be taken into about during micro-siting like, habitat and vegetation surveys, soil surveys, geotechnical assessment, hydrology, etc. but according to the crying face of Kalpavalli, all these are completely ignored. It is important to notice that the environment sensitive methods were not applied for the site selection of Kalpavalli and there is no concrete mechanism for environment protection, habitat restoration, ground risk assessment, waste management, local resource use (especially roads and water) and all these details are not discussed with the local community with transparency.

Map 5: On going operation locations of Wind Turbines in Kalpavalli



Windmill intervention in Kalpavalli without proper Community perspective

The face of Kalpavalli has completely changed in the past one year after Enercon's entry. The company has permission to install 48 windmills, and the state government has allotted 28 hectares (ha) of land at a cost Rs. 25,000 an acre (0.4 ha). Apart from the allotted land, the company has used 79.3 ha (more than 190 acres) of land for road construction without any legal permission.

The company got permission from the district administration, to set up the windmills after the Non-conventional Energy Development Corporation of Andhra Pradesh (NEDCAP) sanctioned the project in 2004. According to the company wind monitoring studies have been undertaken by the NEDCAP, and Ministry of Non-conventional Energy sources notified the location "as a proven windy site to encourage investment in the private sector".

The result has been devastating. Almost all the hillocks in Kalpavalli (all in catchment areas) are bearing the brunt of wind energy production. Vegetation cover has been removed and hilltops are being cut for windmill installation. Deep cuts of about 3 to 4 metre have been made on the slopes to develop roads, but without any retaining walls which has led to massive soil erosion. The company has so far developed 40 km of road, ranging 10m to 50m in width. The deep cuts have heavily damaged pasture routes, making it impossible for cattle to climb up the hills.

"*We have not given permission to the company for construction of roads,*" says Anitha Ramachandran, joint collector of Anantapur district who is in-charge of land allotment in the district. Despite being asked to submit a request for permission, the company has not done it so far, she says.

CARBON EMISSIONS

One of the key aims of Wind energy project development is to reduce Carbon emissions. Wind farm developments, through the materials used, the construction processes employed and the potential emissions from disturbed soils and habitats, do result in Carbon emissions. The massive wind blades need proper support at the base for which cement concrete base is to be constructed. The production of cement for this would contribute to CO^2 emissions. Windmills also need water for cooling the turbines as heat is generated during rotation. The water for curing the cement (during construction) and also water for cooling (after construction-lifetime of the windmill) would eat into potential biomass production from such water, reducing the Carbon sequestered annually.

In case of Kalpavalli there are 48 sites constructed for 48 windmills. The use of water from the local water bodies was calculated. Initially 5000 ltr water used for construction material (cement) preparation and then 5000 ltr water was poured in the huge base pit for curing for 15 days until the foundation become strong. So around 80000 ltr water used for one windmill; and consequently, around 4 lakh lrt water in use for 48 windmill foundations. It is important to mention that tankers which are in use for water transportation from water bodies to the construction site are having leakage problems and hence there is a loss of significant amount of water in the way. In addition to this, during the energy generation also the windmills will eat considerable amount of water for cooling system in summers.

In Kalpavalli, the soil health has steadily improved, resulting in the current productivity levels of the forest ecosystem which are being destroyed by the construction of roads in the region first to put up the wind towers and then later to ensure water supply by tankers for cooling. This destruction if not properly taken care of, would slowly lead to a reversal of the soil health parameters and consequently greater input cost for fertilizers and pesticides (their production also contributing to CO^2 emissions).

While such consumption may be comparatively less than electricity generation from coal, nevertheless this will have to be deducted while calculating the potential benefit from CDM. These are generally considerably outweighed by the benefits in terms of the Carbon free electricity generated by the wind farm over its lifetime. However, there is a question of lifespan of a windmill. In Ramagiri many windmills are stopped and not working for last 7-8 years. So it is very important to calculate the potential benefit from CDM with consideration of the ‘active age’ of windmill e.i. 25 years.

SIZE MATTERS

The tower (or mast) on which a wind turbine sits is an essential part of a wind turbine system. Raising a wind turbine high above the ground and surrounding obstacles such as trees and buildings increases its power output because clean unobstructed air flows are less turbulent, stronger, and more reliable - particularly at low wind speeds. To exploit wind from large area, the blade sizes increased so the blades sweep a vertical airspace of around an acre (in Kalpavalli). The bigger the Wind swept area the more power the turbine will generate. Towers are important because of their load-bearing capability to support the turbine, which weighs close to 400 MT approx (including weights of nacelle and blades), and also because they bear the onslaught of winds, rain, erosion and other naturally occurring hazards. The cost of the wind turbine tower can easily make up 50% of the total cost of the system. In Kalpavalli, Enercon Company is building a Wind Estate so it is necessary to understand their Wind turbine's main features. Towers are made from M55 grade concrete. Towers comprise 18 sections, each of 3.5 mts height with final 2 sections being made of steel so the total tower height 74 mts and total weight 400 MT approx. Such huge structured tower needs very strong foundation mainly to transfer the vertical load (dead weight) to the ground (www.enerconindia.net). Due to the high wind and environmental loads experienced there is a significant horizontal dynamic load that needs to be appropriately restrained. This loading regime causes large moment loads to be applied to the foundations of a wind turbine. As a result, considerable attention needs to be given when designing the footings to ensure that the turbines are sufficiently restrained to operate efficiently. Hence, there is a huge amount of water and material used for foundation construction in Kalpavalli. Such a large structure requires that a large vacant space (falling zone) as a safety measure against accidental falling of the tower. In order to accommodate this falling zone the entire area is flattened. This is the reason why many of the cacthment ridges have been flattened, resulting in permanent change

in topography, hydrology, micro climate and habitat diversity of the area. Besides the unpleasant noises and distracting motion, wind turbines are not safe. They are high-voltage electrical devices with large moving parts. Therefore, access to the land around wind turbines is usually restricted (Ramagiri Wind farms- lattice and tubular[4] both types of towers exist in Ramagiri wind farms).

IMPACTS OF WIND TURBINES ON LIFE

To understand the future of life in Kalpavalli after full fledged activation of the ongoing wind turbine project, detail transects were done in adjacent Ramagiri, which is an old wind farm area. It is important to mention that the wind farm areas of Ramagiri are 2-3 km from the human habitation of Ramagiri. But in Kalpavalli, the wind turbines under construction are at less than a kilometer from the village life.

Noise

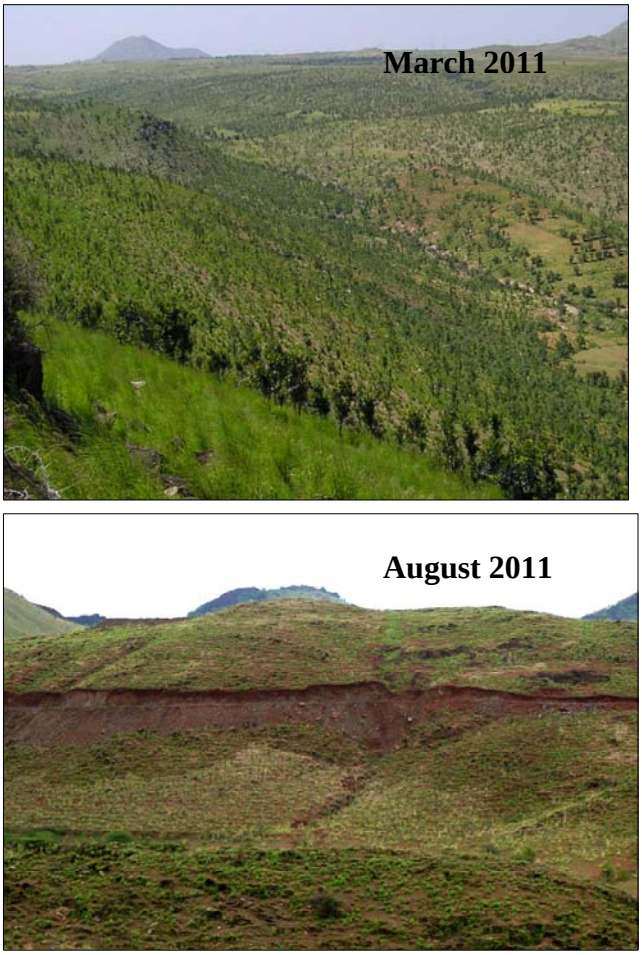
During the day and night transects, it was felt and also claimed by the local people that the continuous noise is the biggest problem in and around Ramagiri wind farms. Many studies done around the world[5], on the impacts of Wind turbine on human health mainly because of the swishing sounds wind turbines produce. Some physicians and acoustic engineers have reported problems from wind turbine noise, including sleep deprivation, headaches, dizziness, anxiety, and vertigo (34, 35, 36). Nina Pierpont, a New York pediatrician, (37, 38) states that noise can be an important disadvantage of wind turbines, especially when building the wind turbines very close to human habitations. She asserts that wind turbines affect the mood of people and may cause physiological problems such as insomnia, headaches, tinnitus, vertigo and nausea (39, 40). A 2008 guest editorial in *Environmental Health Perspectives* published by the National Institute of Environmental Health Sciences, the U.S. National Institutes of Health, stated: "Even seemingly clean sources of energy can have

[4] Tubular towers have many advantages over the lattice towers, but are far more expensive.
[5] Many other studies have been done so far on impacts of wind turbine on human health, which are either done by wind companies or sponsored by wind companies so no need to say that the results of such studies deny the impacts of wind turbines on human health.

implications on human health. Wind energy will undoubtedly create noise, which increases stress, which in turn increases the risk of cardiovascular disease and cancer" (41).

Impacts on grazing animals and related livelihoods

As mentioned in the previous chapter the Kalpavalli pasture lands support big number of domestic herbivores. Now all these grazing potential sites are destroyed due to the massive road constructions and large areas reserved for wind turbine towers on all the hilly terrains. The 'Clean Development Mechanism' has not provided or developed any fodder-security mechanism for the huge livestock population of the region. Have the developers, energy economists and wind energy supporters calculate the cost (and overall value) of these destroyed pasturelands which will now come on the head of the poor farmers and their animals? This impact will be felt by all the livestock dependent livelihoods and this cost of the big lost will never be calculated in the '*Net-benefits*' from CDM. All the grazing animals generate energy in terms of milk, meat, manure and work-force (bulls in agriculture and transportation), which contribute top the life support systems of Kalpavalli as well as in larger areas and systems. On the other hand, what ever energy generated by Wind turbines do not contribute to the local systems but this energy is being used to power factories and plants (more automatic systems) which compared to the investment in them, generate very little employment. The high productivity of these factories, plants also means that smaller factories and other ways of production have to close down. The demand for more power to meet more production needs, is therefore, not synonymous with employment generation and in many cases it will actually result in a reduction in the total employment generation potential. This besides the destruction of employment in the location where the power is generated, and also where the power is used.



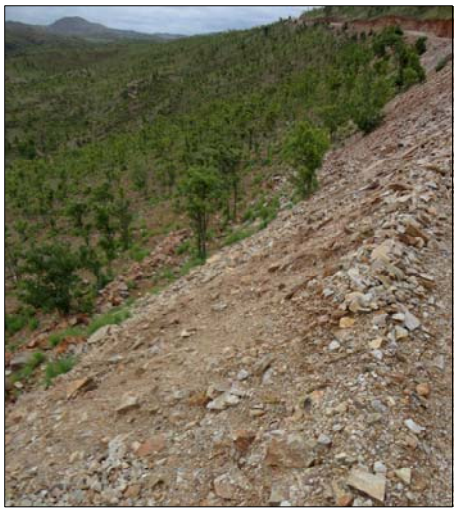
Impacts on Biodivesity

Numerous studies done on the negative impacts of the giant wind turbines and their additional supporting infrastructure (including heavy-duty roads, transformers, and powerlines) on wetlands, birds, bats, beneficial insects, and other wildlife-both directly and by degrading, fragmenting, and destroying habitat for their erection. Kalpavalli region (now Kalpavalli Wind Estate!!) is adjacent to Guttur Reserve Forest and the previous chapter gives the clear picture on the rich biodivesity of the area. All the birds and bats are flying in waterbody areas for water, food, nesting and roosting. Tanks of Mustikovila, Nyamaddala, Kuntimaddi, Cherlopalli, Akkampalli are important bird areas. All these waterbodies will now get giant windmills on their catchment areas, which will create a big disturbance and danger for birds and bats for their movements. So these windmills are equally harmful for Kalpavalli as well as the Guttur RF. A small exercise was done with local farmers and grazers. They were told to make a list of birds found in Ramagiri wind farms and in Kalpavalli region. It was found that 60% of birds were not found in Ramagiri which were present in Kalpavalli (by Gopal Swami & Viren Lobo). The presence of large wind turbines will cause birds to avoid the site, thus losing a foraging resource and requiring extra energy to fly around it. It is also important to mention that windmill installation in the corridor area will give negative impacts on the remaining small population of vultures who play key role in disposing of the dead bodies of domestic animals. Because they are large birds of prey that like to fly in the same sorts of places that developers like to construct wind towers. The cumulative effect of multiple facilities will have a serious toll on bird populations. The activities of birds, including mating and nesting, will be easily disturbed, also at a small distant Guttur RF- by the construction and continuing operation of wind power facility, which can spread over hundreds, often thousands, of acres because other areas of Nallakonda, Pennukonda are also facing the same CDM blessings!

Three species of bats were reported from Kalpavalli and Guttur RF but not a single one was seen around Ramagiri wind farms. There are reports across the world of bird and bat mortality at wind turbines. The installation of large windmills in wild areas, along with supporting roads and transmission infrastructure and the clearing of trees on mountain ridges, inevitably has a negative effect as degradation and fragmentation of habitat, especially ecologically vital interior forest. The turbines also move (producing noise and vibration) and are lit by strobes day and night, adding to the distressing impact they likely have on other wild animals. In just the near past, flocks of Deers and wild boars were reported which are now not seen in the same areas.

Impacts on overall Life-support system of Kalpavalli

All the major hilltops are cut which has already affected the water channels. This year monsoon could not help the Mushtikovila tank to get sufficient water from the river stream, because the catchment area is destroyed and the removal of parts of mountains (for site and roads construction) which is then dumped in the water channels and streams. Since the rocks of the mountains are very old, their exposure has increased the danger of soil erosion and slab exfoliation. The Enercon Company has destroyed more than 190 acre of densely vegetated area and the waste of removal is thrown anywhere convenient for them. They have uprooted green mature trees and also their irresponsible dumping has destroyed the standing vegetation, regeneration and plantation on the hillocks (photos). Also many trees are going to die because they are on the edges which are sharply cut for roads and parking on hill-contours. Large patches of hillocks, where earlier trees and grasslands were breathing, have now been rendered lifeless. Roads which are made in the mountains are weaker due to their basic rock structure, the dumped material has moved down the slope towards Mushtikovila tank during the last monsoon. Therefore there is a big threat to the tank which will get massive amount of soil and parts of rocks, negatively affecting the water holding capacity of the tank and the whole tank network. Hence, needless to say that agriculture and other natural resource dependent systems will also be threatened. This concludes that the wind energy projects in Kalpavalli are grabbing both land and resources.



Clean energy, Dirty business

Enercon started its installation works in Kalpavalli after entering an agreement with the Kalpavalli Mutually Aided Tree Growers Society. The company had agreed to pay Rs. 20 lakh and has paid only Rs. 12 lakh so far as compensation to the society. As per rule, when forestland is diverted for other purposes, Rs. 15 lakh should be paid for every 0.4 ha, points out the state biodiversity board chairperson, R Hampaiah. “It’s true that this was revenue wasteland. But it has been regenerated and has a forest which is common property,” he says. The company has bought 1.6 ha for the village community for building a school. “Apart from this, the company has paid off villagers and local politicians, causing a deep divide and mutual distrust in the community,” alleges Gopal. There was strong resistance among people initially, but later everybody kept quiet because of the money involved. A few thousand rupees is a huge amount for the marginalised farmers who are in acute distress. Enercon declined to comment on the adverse impact of its project. While the company is moving ahead with its project, the society maintains that it has been grossly misinformed before signing the agreement. “They (Enercon) said they would use only the existing paths and would take only a little space for installing the windmills,” says Roddam Pothenna, director of Kalpavalli Society and a watchman of the windmill company. “If we had known this much damage would happen, we would not have signed the agreement.” The company pays him Rs. 3,000 as salary.

Many villagers like B Ramachandra of Shapuram village, who is a member of the society and also working as a watchman of the company, says it’s really painful to watch the forest which people painstakingly regenerated and protected getting destroyed. “The company has cut a large-number of trees,” he says. Mushtikovila tank has already got silted, say villagers. They are scared to resist. “Windmill people threaten us and tell us if we go near the work site, they would call the police,” says B Nagamani of Shapuram. Apart from damaging the grasslands, catchment area of streams and vegetation, the windmills may cause water conflicts in the region. Enercon is taking water from the village wells by paying just Rs. 80 a tanker (5000 ltr).

While Enercon is setting up windmills within Kalpavalli, two other companies, Samiran Jaipur Wind Farms, an associated company of Suzlon Energy Limited, and Helios Infratech have started their own project outside Kalpavalli. Together, they will set up 168 windmills.

As the biodiversity board chairperson Hampiah points out, if the villagers are genuinely concerned about their common land getting degraded once again, they can form biodiversity

management committees and give submission to the board against the destruction in Kalpavalli. Or they can move court.

The large-scale destruction has dismayed Mary and Bablu who started the eco-regeneration programme. They are critical of the district administration's role which has been implementing water and soil conservation efforts in the water-starved district under NREGA and at the same time allowing the model project to be destroyed in the name of non-conventional energy. “There is absolutely no perspective or coordination between different wings of the government. The terms and conditions of the land allotment says the government will take back the land if it feels land is needed for any other important purpose or for mining activities,” says Ganguly.

GREEN ILLUSIONS OF GREEN ENERGY

The above detail highlights the irresponsible, nonsystematic and insensitive operation of wind energy generation project in Kalpavalli and the result in terms of collapse of life support system. Not only in Kalpavalli, all over the world the poor-local-indigenous communities are fighting to protect their land and resource rights.

In case of Jaisalmer, Rajasthan (TNN), an area of 1890 bigha on the tourist track to Sand dunes was allotted to a Mumbai-based company to set up a 159-MW wind turbine project by the district administration and state revenue department. While on the one hand, the government is trying to promote rural tourism and two of the 13 selected villages fall on the same track, wind turbine development is a death knell for tourism in Jaisalmer. This would also render hundreds of camel owners who depend on tourism for survival, unemployed. Land allotted for the windmill project traverses through village Kanoi, Khaba, Kuldhara, Damodara that fall on the Jaisalmer-Sam route, which is the only camel safari route left. Thus this development will ruin the tourism and dependent local livelihoods.

Koyna Wildlife Sanctuary, the Sahyadri Tiger Reserve in Maharashtra is a critical corridor of forest and home to tigers, bison and around 250 species of birds (BNHS). But the land inside the Tiger Reserve is up for grabs and over 200 windmills are operating inside the Sanctuary. Under the Wildlife Protection Act, any diversion of land inside a Sanctuary needs prior permission. But an RTI response from the Forest Department proved that the windmills lie inside the sanctuary without any permission and hence they are illegal (Bahar Dutt).

Similar example of the Bhimashankar Wildlife Sanctuary, where the windmill company Enercon has violated the Act. Sanctuary is home to the endangered Indian Giant Squirrel and many more wild animals and it has a sacred grove also. Setting up windmills around the

Bhimashankar sanctuary has damaged the biodiversity and water resources in the area. Despite objections from local people and groups, windmills were set up within the 10-km periphery around sanctuary. The shortest aerial distance between the sanctuary and a windmill is just 3.5 km. The local residents allege that, though the forest department has given permission to cut some trees for the project, more trees have been cut down. Experts from the Indian Institute of Science, who have studied the Indian Giant Squirrel in Bhimashankar sanctuary, have said that the Indian Giant Squirrel requires a continuous canopy cover. The Western Ghats ecology expert panel has looked at the environmental issues and the broader policy issues concerning windmills (TNN).

In 2010, the Monitor documented a case in Dhule, India, where 2,000 tribal were forced to accept hundreds of wind turbines on their traditional lands. They had lived on the land for generations but had dubious title. The government gave the land to Suzlon, which, in some cases, bought out owners.

Kammen, a strong supporter of wind power, says that by comparison, biofuels have a far worse record than wind development for land grab. Rampant abuses in Tanzania, he says, recently led to a ban there on all new biofuel investment. He says that most conflicts involving wind energy deal with land occupied – but not owned – by indigenous groups, such as in the Kutch District of India, where a case pitting local herders against Indian wind giant Suzlon Energy Ltd. went to the high court there. He worries about such conflicts arising with Morocco's nomadic herders.

Negotiating any wind contract is complex. Often in the developing world, communities are poorly educated or largely illiterate and do not understand the implications of a contract. They may simply have no access to legal and technical advice and they may be powerless to negotiate. And because parcels are small, they can be destroyed by turbine construction.

In 2001, Mr. Anaya won a landmark case in the Inter-American Court of Human Rights that involved logging rights in Nicaragua and established that indigenous people have exclusive right to their lands. He says that too often a government or business acquires land through unequal negotiations, in which indigenous people aren't given all the information or options.

In Honduras a wind energy company recently forced indigenous Lenca people who did have land title to take on a wind farm, paying each farmer as little as $80 per year to lease the land. In many cases, the owners were barred from their land.

China has doubled production capacity in each of the past five years. It has a history of driving people from land for hydropower, but wind experts say China's grip on information makes it hard to know if the same goes for wind projects.

LOW BENEFIT-HUGE NEGATIVE IMPACT

Industrial wind promoters claim their machines produce on average 30–40% of their rated capacity. For example, a 400-ft-high 2-megawatt (2,000-kilowatt) turbine assembly would produce an average of 600–800 kilowatts over a year. The actual experience of industrial wind power in the U.S., however, as reported to the federal Energy Information Agency, is that it produces only about 25% of its capacity, or 500 kilowatts. It will produce at or above that average rate only a third of the time. It will generate nothing at all (yet draw power from the grid) another third of the time. Because the output is highly variable and rarely correlates with demand, other sources of energy cannot be taken off line.

With the extra burden of balancing the wind energy, those sources may even use more fuel (just as cars use more gas in stop and-go city driving than in more steady highway driving). The industry is unable to show any evidence that wind power on the grid reduces the use of other fuels. Denmark, despite claims that wind turbines produce 20% of its electricity, has not reduced its use of other fuels because of them.

Large-scale wind power does not reduce our dependence on other fuels, does not stabilize prices, does not reduce emissions or pollution, and does not mitigate global warming. Instead, each turbine assembly requires dozens of acres of clearance and dominates the typically rural or wild landscape where it is sited. Its extreme height, turning rotor blades, unavoidable noise and vibration, and strobe lighting night and day ensure intrusiveness far out of proportion to its elusive contribution. Each facility requires new transmission infrastructure and new or upgraded (strengthened, widened, and straightened) roads, further degrading the environment and fragmenting habitats.

POLICY LEVEL FIGHT NEEDED FOR BETTER FUTURE OF WIND ENERGY

- Wind Energy projects are excluded from Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA). (EIA is mandatory in European countries).
- Because of CDM, no need environment clearance. And hence, violation of other Acts can be seen frequently in ground.
- Huge tax benefits to companies but no share of local communities in profit and energy distribution.
- No public hearing of the projects with community- no transparency.
- Ecological, archeological and socially sensitive areas should not be permitted for wind energy projects.
- Need for revisiting legal status of “Revenue Wasteland” of Kalpavalli and recognition of its productive capacity and contribution to local livelihood and life support systems at the landscape level.
- Need for community participation in governance mechanism for integrated and optimal use of Natural Resources for overall wellbeing.

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Annexure 1: Floral diversity of Kalpavalli region

Sr	Scientific name	Telugu name	Family	Life form
1	*Abelmoschus esculentus* (L.) Monench.		Malvaceae	Under Shrub
2	*Abrus precatorius* L		Fabaceae	Twiner
3	*Abutilon indicum* (L..) Sweet subsp. *indicum*		Malvaceae	Under Shrub
4	*Acacia catechu* (L. f.) Willd.	Nalla sundra	Mimosaceae	Tree
5	*Acacia chundra (*Roxb. ex Rottler.) Willd.		Mimosaceae	Tree
6	*Acacia farnesiana (L.)* Willd.	Kasturi/Kamou tumma/Arimidamu/Murki tumma	Mimosaceae	Tree
7	*Acacia ferruginea* DC.	Vanni sundra/Inupu tumma/An-sandra/Val-sandra	Mimosaceae	Tree
8	*Acacia leucophloea* (Roxb.) Willd.		Mimosaceae	Tree
9	*Acacia nilotica* (L.) Willd. ex Del.	Nalla tumma	Mimosaceae	Tree
10	*Acalypha alnifolia* Willd.		Euphorbiaceae	Herb
11	*Acalypha indica* L.		Euphorbiaceae	Herb
12	*Acanthosperum hispidum* DC.		Asteraceae	Herb
13	*Achyranthes aspera* L. var. *aspera*		Amaranthaceae	Under Shrub
14	*Aegle marmelos (*L.) Corr.	Bilvamu/Sriphalamu/Maredu	Rutaceae	Tree
15	*Aerva javanica* (Burm.f.) Juss. ex Schult.		Amaranthaceae	Herb
16	*Aerva lanata* (L.) Juss. ex Schult.		Amaranthaceae	Herb
17	*Agave americana* L.	Kala bandha	Agavaceae	Herb
18	*Ageratum conyzoids* L.		Asteraceae	Herb
19	*Ailanthus excelsa* Roxb.	Pedda manu/Pedda vepa	Simaroubaceae	Tree
20	*Alangium salvifolium* (L. f.) Wangerin	Uduga/Ooduga/Urgu/Nalla duga/Ankolamu	Alangiaceae	Shrub
21	*Albizia lebbeck* (L.) Benth.	Dirisinam/Pedda dirisanam/Sirisamu	Mimosaceae	Tree
22	*Albizia procera* (Roxb.) Benth.		Mimosaceae	Tree
23	*Allium cepa* L.		Liliaceae	Herb
24	*Allium sativum* L.		Liliaceae	Herb
25	*Allmania nodiflora* (L.) R.Br.ex Wt.	Gurugu koora	Amaranthaceae	Herb
26	*Alloteropsis cimicina* (L.) Stspf		Poaceae	Grass

27	*Aloe vera* (L.) Burm.		Liliaceae	Herb
28	*Alternanthera pungens* Kunth		Amaranthaceae	Herb
29	*Alternanthera sessilis* (L.) R. ex DC.		Amaranthaceae	Herb
30	*Alysicarpus bupleurifolius* (L.) DC.		Fabaceae	Herb
31	*Alysicarpus hamosus* Edgew.		Fabaceae	Herb
32	*Alysicarpus heterophyllus* (Baker) Jafri & Ali		Fabaceae	Herb
33	*Alysicarpus rugosus* (Willd.) DC. var. *rugosus*		Fabaceae	Herb
34	*Alysicarpus vaginalis* (L.) DC.		Fabaceae	Herb
35	*Amaranthus spinosus* L.		Amaranthaceae	Herb
36	*Amaranthus viridis* L.		Amaranthaceae	Herb
37	*Ammannia baccifera* L.		Lythraceae	Herb
38	*Andrographis paniculata* (Burm. f.) Wall. ex Nees		Acanthaceae	Under Shrub
39	*Andropogon pumilus* Roxb.		Poaceae	Grass
40	*Anethum graveolens* L.		Apiaceae	Herb
41	*Anisomeles malabarica* (L.) R. Br. ex Sims		Lamiaceae	Shrub
42	*Annona squamosa* L.	Sitaphalamu/Ganda gathram/Sitapandu	Annonaceae	Tree
43	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr.	Elama/Tiruman/Chiru manu	Combretaceae	Tree
44	*Apluda mutica* L.		Poaceae	Grass
45	*Arachis hypogaea* L.		Fabaceae	Herb
46	*Arachis hypogaea* L.		Fabaceae	Herb
47	*Argemone mexicana* L. f.		Papaveraceae	Herb
48	*Aristida adscensionis* L. var. *adscensionis*		Poaceae	Grass
49	*Aristida hystrix* L. f.		Poaceae	Grass
50	*Aristida mutabilis* Trin. & Rupr.		Poaceae	Grass
51	*Aristida setacea* Retz.		Poaceae	Grass
52	*Arundinella setosa* Trin.		Poaceae	Grass
53	*Asparagus racemosus* Willd.	Shantavari/Pilli teegalu/Pilli gaddalu/Challa gadda	Liliaceae	Under Shrub
54	*Azadirachta indica* A. Juss.	Yapa/Vepa/Vemu	Meliaceae	Tree
55	*Bacopa monnieri* (L.) Wettst.		Scrophulariaceae	Herb
56	*Balanites aegyptiaca* (L.) Del.	Gara	Balanitaceae	Tree

57	*Barleria prionitis* L. subsp. *prionitis* var. *prionitis*		Acanthaceae	Under Shrub
58	*Basella rubra* L.		Basellaceae	Twiner
59	*Bauhinia racemosa* Lam.	Ari	Caesalpiniaceae	Tree
60	*Beta vulgaris* L.		Amaranthaceae	Herb
61	*Bidens biternata* (Lour.) Merr. & Sherff ex Sherff		Asteraceae	Herb
62	*Biophytum sensitivum* (L.) DC.		Oxalidaceae	Herb
63	*Blainvillea acmella* (L.) Philipson		Asteraceae	Herb
64	*Blepharis repens* (Vahl) Roth		Acanthaceae	Herb
65	*Blumea obliqua* (L.) Druce		Asteraceae	Herb
66	*Boerhavia chinensis (Linn.) Aschers. & Schweinf.*		Nyctaginaceae	Herb
67	*Boerhavia diffusa* L.		Nyctaginaceae	Herb
68	*Boerhavia erecta* L.		Nyctaginaceae	Herb
69	*Bombax ceiba* L.	Buruga	Bombacaceae	Tree
70	*Borassus flabellifer* L.	Tati/Karatalamu/Trynarajamu/Tadi	Palmaeceae	Tree
71	*Borreria articularis* (L. f.) Mill.		Rubiaceae	Herb
72	*Borreria pusilla* (Wall.) DC.		Rubiaceae	Herb
73	*Boswellia serrata* Roxb. ex Cocls.	Dhupam/Guggilam/Anduga	Burseraceae	Tree
74	*Bothriochloa ischaemum* (L.) Keng.		Poaceae	Grass
75	*Bougainvillea glabra* Choisy		Nyctaginaceae	Climber
76	*Bougainvillea spectabilis* Willd.		Nyctaginaceae	Climber
77	*Brachiaria ramosa* (L.) Stapf var. *ramosa*		Poaceae	Grass
78	*Brachiaria reptans* (L.) Gard. & Hubb.		Poaceae	Grass
79	*Bulbostylis barbata* (Rottb.) Clarke		Cyperaceae	Sedge
80	*Butea monosperma* (Lam.) Taub.	Moduga chettu	Fabaceae	Tree
81	*Cadaba fruticosa* (L.) Druce		Capparaceae	Shrub
82	*Caesalpinia pulcherrima* (L.) Swartz.		Caesalpiniaceae	Shrub
83	*Cajanus cajan* (L.) Millsp.		Fabaceae	Herb
84	*Calotropis gigantea (*L.) R. Br.		Asclepiadaceae	Shrub

85	*Calotropis procera* (Ait.) Ait.f. subsp. *Hamiltonii* (Wight) Ali		Asclepiadaceae	Shrub
86	*Canavalia ensiformis* (L.) DC.		Fabaceae	Twiner
87	*Canna indica* L.		Cannaceae	Herb
88	*Canscora diffusa* (Vahl) R. Br.		Gentianaceae	Herb
89	*Canthium dicoccum* (Gaertn.) Teys. & Binn.		Rubiaceae	Shrub
90	*Capparis decidua* (Forsk.) Edgew.		Capparaceae	Tree
91	*Capparis divaricata* Lamk.	Budareni	Capparaceae	Shrub
92	*Capparis sepiaria* L. var. *sepiaria*		Capparaceae	Shrub
93	*Capsicum annuum* L.		Solanaceae	Herb
94	*Cardiospermum halicacabum* L.		Sapindaceae	Twiner
95	*Carica papaya* L.	Paringi/Boppai	Caricaceae	Tree
96	*Carissa congesta* Wight.	Kalivi	Apocynaceae	Shrub
97	*Carissa spinarum* L.		Apocynaceae	Shrub
98	*Cassia absus* L.		Caesalpiniaceae	Herb
99	*Cassia auriculata* L.	Tangedu/Merka tangedu	Caesalpiniaceae	Shrub
100	*Cassia fistula* L.	Rela	Caesalpiniaceae	Tree
101	*Cassia occdentails* L.		Caesalpiniaceae	Under Shrub
102	*Cassia pumila* Lam.		Caesalpiniaceae	Herb
103	*Cassia siamea* Lam.	Seema tabgedu/Niala tangedu	Caesalpiniaceae	Tree
104	*Cassia spp.*		Caesalpiniaceae	Tree
105	*Cassytha filiformis* L.		Lauraceae	Shrub
106	*Casuarina equisetifolia* L.	Sarugugdu/Chavuka	Casuarinaceae	Tree
107	*Catharanthus pusillus* (Murr.) G. Don		Apocynaceae	Herb
108	*Catharanthus roseus* (L.) G. Don		Apocynaceae	Herb
109	*Catunaregam spinosa* (Thunb.) Tirveng.		Rubiaceae	Tree
110	*Celosia argentea* L.		Amaranthaceae	Herb
111	*Cenchrus biflorus* Roxb		Poaceae	Grass
112	*Cenchrus ciliaris* L.		Poaceae	Grass
113	*Ceratophyllum demersum* L.		Ceratophyllaceae	Herb
114	*Chloris barbata* Sw.		Poaceae	Grass
115	*Chloris virgata* Sw.		Poaceae	Grass

116	*Chrozophora rottleri* (Geis.) A. Juss. ex Spreng.		Euphorbiaceae	Herb
117	*Chrysopogon fulvus* (Spreng.) Chiov.		Poaceae	Grass
118	*Cissampelos pareira* L. var.*hirsuta* (Buch.- Ham. ex DC.) Forman		Menispermaceae	Twiner
119	*Cissus pallida* (Wt.&Arn.) Nan.		Vitaceae	Shrub
120	*Citrullus colocynthis* (L.) Schrad.		Cucurbitaceae	Climber
121	*Cleome aspera* DC.		Cleomaceae	Herb
122	*Cleome gynadra* L. var. *gynandra*		Cleomaceae	Herb
123	*Cleome viscosa* L.		Cleomaceae	Herb
124	*Clerodendrum inerme* (L.) Gaertn.		Verbenaceae	Shrub
125	*Clitoria ternatea* L.		Fabaceae	Twiner
126	*Cocculus hirsutus* (L.) Diels		Menispermaceae	Shrub
127	*Cocos nucifera* L.		Arecaceae	Tree
128	*Coldenia procumbens* L.		Boraginaceae	Herb
129	*Combretum ovalifolium* Roxb.		Combretaceae	Shrub
130	*Commelina benghalensis* L.		Commelinaceae	Herb
131	*Commelina diffusa* Burm. f.		Commelinaceae	Herb
132	*Commelina paludosa* Blume		Commelinaceae	Herb
133	*Convolvulus arvensis* L.		Convolvulaceae	Twiner
134	*Convolvulus prastratus* Forsk.		Convolvulaceae	Herb
135	*Corallocarpus epigaeus (*Rottl. & Willd.) Hook. f.		Cucurbitaceae	Climber
136	*Corchorus aestuans* L.		Tiliaceae	Herb
137	*Corchorus fascicularis* Lam.		Tiliaceae	Herb
138	*Corchorus trilocularis* L.		Tiliaceae	Herb
139	*Cordia dichotoma* Forst. f.	Banka nakkera/Chinna nakkera/Botgiri/Iriki/Pedda Iriki/Botuku	Ehretiaceae	Tree
140	*Coriandrum sativum* L.		Apiaceae	Herb
141	*Crotalaria medicaginea* Lam.		Fabaceae	Herb
142	*Croton bonplandianum* Baill.		Euphorbiaceae	Herb
143	*Cryptostegia gradiflora* R. Br.		Periplocaceae	Shrub
144	*Cucumis prophetarum* L.		Cucurbitaceae	Climber
145	*Cyamopsis tetragonoloba* (L.) Taubert		Fabaceae	Herb

146	*Cymbopogon martinii* (Roxb.) Watson	Bodha grass	Poaceae	Grass
147	*Cynodon dactylon* (L.) Pers.		Poaceae	Grass
148	*Cyperus compressus* L.		Cyperaceae	Sedge
149	*Cyperus iria* L. var. *iria*		Cyperaceae	Sedge
150	*Cyperus nutans* Vahl subsp. *nutans*		Cyperaceae	Sedge
151	*Cyperus rotundus* L.		Cyperaceae	Sedge
152	*Dactyloctenium aegyptium* (L.) Willd.		Poaceae	Grass
153	*Dalbergia latifolia* Roxb.	Pacchari/Jittegi/Zitregi/Virugudi cheva/Iridi/Irigudi	Fabaceae	Tree
154	*Dalbergia paniculata* Roxb.	Sopera/Pachari/Palsaru/Porla patchari	Fabaceae	Tree
155	*Dalbergia sissoo* Roxb.	Sissoo	Fabaceae	Tree
156	*Datura innoxia* Mill.		Solanaceae	Under Shrub
157	*Daucas carota* L.		Apiaceae	Herb
158	*Dendrocalamus strictus* (Roxb.) Nees	Veduru	Poaceae	Grass
159	*Dendrophthoe falcata* (L. f.) Etting.		Loranthaceae	Shrub
160	*Desmodium gangeticum* (L.) DC.		Fabaceae	Under Shrub
161	*Desmostachya bipinnata* (L.) Stapf		Poaceae	Grass
162	*Dichanthium spp.*		Poaceae	Grass
163	*Dicoma tomentosa* Cass.		Asteraceae	Herb
164	*Digera muricata* (L.) Mart.		Amaranthaceae	Herb
165	*Digitaria ciliaris* (Retz.) Koel.		Poaceae	Grass
166	*Dodonaea viscosa* (L.) Jacq.	Bandaru/Puli vailu/ Bandam/Golla pulledu/ Bandedu/Bandhari	Sapindaceae	Shrub
167	*Dolichandrone atrovirens* (Heyne ex Roth) Sprague		Bignoniaceae	Tree
168	*Dolichandrone falcata* (Wall. ex DC.) Seem.		Bignoniaceae	Tree
169	*Dolichos Biflorus* L.		Fabaceae	Herb
170	*Dolichos lablab* L.		Fabaceae	Herb
171	*Echinochloa colona* (L.) Link		Poaceae	Grass
172	*Echinops echinatus* Roxb.		Asteraceae	Herb
173	*Eclipta alba* (L.) Hassk.		Asteraceae	Herb
174	*Ehretia pubscens* Benth.		Ehretiaceae	Tree
175	*Eleusine coracana* (L.) Gaertn.		Poaceae	Grass

176	*Enicostema axillare* (Lam.) Raynal		Gentianaceae	Herb
177	*Eragrostiella bifaria* (Vahl) Bor		Poaceae	Grass
178	*Eragrostis aspera (*Jacq.) Nees		Poaceae	Grass
179	*Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult. var. *insularis* C.E. Hubbard		Poaceae	Grass
180	*Eragrostis tenuifolia* Hochst. ex Steud.		Poaceae	Grass
181	*Eranthemum roseum* (Vahl) R. Br.		Acanthaceae	Herb
182	*Eremopogon foveolatus* (Delile) Stapf.		Poaceae	Grass
183	*Erythrina suberosa* Roxb.	Mulla moduga /Vanjiram/ Barijama/Muni moduga	Fabaceae	Tree
184	*Eucalyptus globulus* Labill.		Myrtaceae	Tree
185	*Euphorbia antiquorum* L.		Euphorbiaceae	Shrub
186	*Euphorbia caducifolia* Haines		Euphorbiaceae	Shrub
187	*Euphorbia cristata* Roth.		Euphorbiaceae	Herb
188	*Euphorbia heterophylla* L.		Euphorbiaceae	Herb
189	*Euphorbia heyneana* Spreng.		Euphorbiaceae	Herb
190	*Euphorbia hirta* L.		Euphorbiaceae	Herb
191	*Euphorbia trucalli* L.		Euphorbiaceae	Tree
192	*Evolvulus alsinoids* (L.) L.		Convolvulaceae	Herb
193	*Exacum pedunculatum* L.		Gentianaceae	Herb
194	*Fagonia indica* Burm. f. var. *indica*		Zygophyllaceae	Shrub
195	*Feronia limonia* (L.) Swingle	Velga/Yelakaya	Rutaceae	Tree
196	*Ficus benghalensis* L.	Marri	Moraceae	Tree
197	*Ficus religiosa* L.	Ravi	Moraceae	Tree
198	*Fimbristylis complanata* (Retz.) Link		Cyperaceae	Sedge
199	*Fimbristylis cymosa* R.Br.		Cyperaceae	Sedge
200	*Fimbristylis sieberiana* Kunth		Cyperaceae	Sedge
201	*Fimbristylis tenera* Schult. var. *tenera*		Cyperaceae	Sedge
202	*Gisekia pharnaceoides* L. var. *pharnaceoides*		Molluginaceae	Herb
203	*Glinus lotoides* L.		Molluginaceae	Herb
204	*Glinus oppositifolius* (L.) DC.		Molluginaceae	Herb
205	*Gloriosa superba* L.		Liliaceae	Herb
206	*Glossocardia bosvallea* (L. f.) DC.		Asteraceae	Herb
207	*Gmelina arborea* Roxb.	Gummudu	Verbenaceae	Tree

208	*Gomphrena globosa* L.		Amaranthaceae	Herb
209	*Goniogyna hirta* (Willd.) Ali		Fabaceae	Herb
210	*Gymnema sylvestre* (Retz.) R. Br. ex Schult.		Asclepiadaceae	Twiner
211	*Hackelochola granularis* (L.) Ktze.		Poaceae	Grass
212	*Hardwickia binata* Roxb.	Nara yepi/ Yepi	Caesalpiniaceae	Tree
213	*Heliotropium indicum* L.		Boraginaceae	Herb
214	*Heliotropium marifolium* Retz.		Boraginaceae	Herb
215	*Heliotropium strigosum* Willd *subsp. striogosum*		Boraginaceae	Herb
216	*Hemidesmus indicus* (L.) R. var. *indicus.*		Periplocaceae	Shrub
217	*Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult.		Poaceae	Grass
218	*Hibiscus ovalifolius* (Forssk.) Vahl.		Malvaceae	Under Shrub
219	*Hibiscus rosa-sinensis* L.		Malvaceae	Shrub
220	*Holoptelia intergrifolia* (Roxb.) Planch.	Thapasi/Nemali/Nauli/ Pulari/Nevili	Ulmaceae	Tree
221	*Hyptis suaveolens* (L.) Point.		Lamiaceae	Herb
222	*Indigofera caerulea* Roxb. var. *monosperma* (Sant.) Sant.		Fabaceae	Herb
223	*Indigofera cordifolia* Heyne ex Roth		Fabaceae	Herb
224	*Indigofera glabra* L.		Fabaceae	Herb
225	*Indigofera hirsuta* L.		Fabaceae	Herb
226	*Indigofera linifolia* (Lf.) Retz.		Fabaceae	Herb
227	*Indigofera tinctoria* L.		Fabaceae	Herb
228	*Indigofera trifoliata* L.		Fabaceae	Herb
229	*Indigofera wightii* Wt. &Arn.		Fabaceae	Herb
230	*Indoneesiella echioids* (L.) Sreemadh.		Acanthaceae	Herb
231	*Ipomoea eriocarpa* R. Br.		Convolvulaceae	Twiner
232	*Ipomoea pes-tigridis* L.		Convolvulaceae	Twiner
233	*Jasminum spp.*		Oleaceae	Shrub
234	*Jatropha curcas* L.	Nepalamu/Adavi Amudamu/Kondamudamu	Euphorbiaceae	Tree
235	*Kickxia ramosissima* (Wall.) Janchen		Scrophulariaceae	Twiner
236	*Lantana camara* L.		Verbenaceae	Shrub
237	*Launaea procumbens* (Roxb.) Ramayya & Rajagobal		Asteraceae	Herb
238	*Lawsonia inermis* L.	Gorantaku	Lythraceae	Shrub
239	*Lepidagathis cristata* Willd.		Acanthaceae	Herb

240	*Leucas aspera* (Willd.) Link		Lamiaceae	Herb
241	*Leucas urticaefolia* (Vahl) R. Br.		Lamiaceae	Herb
242	*Lindenbergia indica* (L.) Vatke		Scrophulariaceae	Herb
243	*Luffa acutangula* L.		Cucurbitaceae	Climber
244	*Luffa tuberosa* Roxb.		Cucurbitaceae	Climber
245	*Lycopersicon esculentum* L.		Solanaceae	Herb
246	*Maerua oblongifolia* (Forss.) A.Rich		Capparaceae	Climber
247	*Mangifera indica* L.		Anacardiaceae	Tree
248	*Manilkara sapota* (L.) P. Royen		Sapotaceae	Tree
249	*Melanocenchris jacquemontii* Jaub. & Spach.		Poaceae	Grass
250	*Merremia emarginata* (Burm. f.) Hall. f.		Convolvulaceae	Herb
251	*Merremia tridentata* (L.) Hall. f.		Convolvulaceae	Herb
252	*Mollugo pentaphylla* L.		Molluginaceae	Herb
253	*Momordica charantia* L.		Cucurbitaceae	Climber
254	*Morinda pubescens* Roxb.		Rubiaceae	Tree
255	*Moringa oleifera* Lam.	Munaga/Mulaga	Moringaceae	Tree
256	*Murraya koenigii* (L.) Spreng.		Rutaceae	Shrub
257	*Musa paradisiaca* L.		Musaceae	Herb
258	*Nymphaea pubescens* Willd.		Nymphaeaceae	Herb
259	*Ocimum basilicum* L.		Lamiaceae	Herb
260	*Ocimum sanctum* L.		Lamiaceae	Herb
261	*Opuntia elatior* Mill.		Cactaceae	Shrub
262	*Oryza sativa* L.		Poaceae	Grass
263	*Pandanus fascicularis* Lam.	Kewara	Pandanaceae	Shrub
264	*Panicum miliare* Lam.		Poaceae	Grass
265	*Parthenium hysterophorus* L.		Asteraceae	Herb
266	*Paspalum scrobiculatum* L.		Poaceae	Grass
267	Pennisetum typhodium		Poaceae	Grass
268	*Pergularia daemia* (Forsk.) Chiov.		Asclepiadaceae	Twiner
269	*Phaseolus aureus* Roxb.		Fabaceae	Herb
270	*Phoenix sylvestris* (L.) Roxb.	Eetha	Arecaceae	Tree
271	*Phyllanthus virgatus* Fors.f.		Euphorbiaceae	Herb
272	*Pithecellobium dulce* (Roxb.) Benth.		Mimosaceae	Tree
273	*Plectranthus amboinicus* (Lour.) Spreng.	Karpurvalli	Lamiaceae	Shrub

274	*Polycarpaea corymbosa* (L.) Lam.		Caryophyllaceae	Herb
275	*Polygala arvensis* Willd.		Polygalaceae	Herb
276	*Polygala erioptera* DC.		Polygalaceae	Herb
277	*Pongamia pinnata* (L.) Pierre	Kanuga	Fabaceae	Tree
278	*Portulaca oleracea* L.		Portulacaceae	Herb
279	*Portulaca quadrifida* L.		Portulacaceae	Herb
280	*Prosopis cineraria* (L.) Druce		Mimosaceae	Tree
281	*Prosopis juliflora* (Swartz) DC.	Seema Jali /Mulla thumma/ Jali chettu	Mimosaceae	Tree
282	*Pterocarpus marsupium* Roxb.	Yegisa/Ponna	Fabaceae	Tree
283	*Pulicaria wightiana* (DC.) Clarke		Asteraceae	Herb
284	*Punica granulata* L.		Punicaceae	Shrub
285	*Pupalia lappacea* (L.) Juss. var. *lappacea*		Amaranthaceae	Herb
286	*Raphanus sativus* L.		Brassicaceae	Herb
287	*Rhynchosia capitata* (Heyne ex Roth) DC.		Fabaceae	Climber
288	*Rhynchosia minima* (L.) DC.		Fabaceae	Climber
289	*Rivea hypocrateriformis* (Desr.) Choisy		Convolvulaceae	Climber
290	*Saccharum spontaneum* L.		Poaceae	Grass
291	*Santalum album* L.	Tella chandanam /Srigandham /Chandanamu /Malayajamu/ Sreechandanamu/Harichandanamu/Krishnachandanamu	Santalaceae	Tree
292	*Sapindus emarginatus* Vahl	Kunkudu	Sapindaceae	Tree
293	*Securinega leucopyrus* (Willd.) Muell.-Arg.		Euphorbiaceae	Shrub
294	*Sehima nervosum* (Rottl.) Stapf		Poaceae	Grass
295	*Setaria intermedia* Roem. & Schult.		Poaceae	Grass
296	*Setaria italica* (L.) P. Beauv.		Poaceae	Grass
297	*Sida cordata* (Burm. f.) Borssum		Malvaceae	Herb
298	*Solanum melongena* L.		Solanaceae	Herb
299	*Solanum surattense* Berm.f.		Solanaceae	Herb
300	*Solanum tuberosum* L.		Solanaceae	Herb
301	*Solanum virginianum* L.		Solanaceae	Herb
302	*Sopubia delphinifolia* (L.) G.Don		Scrophulariaceae	Herb
303	*Sorghum bicolor* (L.) Moench.		Poaceae	Grass

304	*Striga angustifolia* (D.Don) Sald.		Scrophulariaceae	Herb
305	*Striga gesneroides* (Willd.) Vatke		Scrophulariaceae	Herb
306	*Syzygium cumini* (L.) Skeels	Neredu	Myrtaceae	Tree
307	*Syzygium heyneanum* (Duthie) Wall. ex Gamble	Alla neredu	Myrtaceae	Tree
308	*Tagetes patula* L.		Asteraceae	Herb
309	*Tamarindus indica* L.	Chinta	Caesalpiniaceae	Tree
310	*Tectona grandis* L. f.	Teku	Verbenaceae	Tree
311	*Tephrosia purpurea* (L.) Pers.		Fabaceae	Herb
312	*Terminalia catappa* L.	Badamu	Combretaceae	Tree
313	*Trachys muricata* (L.) Pers.		Poaceae	Grass
314	*Tragia involucrata* L.		Euphorbiaceae	Shrub
315	*Tragus spp.*		Poaceae	Grass
316	*Trianthema portulacastrum* L.		Aizoaceae	Herb
317	*Tribulus terrestris* L.		Zygophyllaceae	Herb
318	*Trichodesma indicum* (L.) Lehman.		Boraginaceae	Herb
319	*Trichosanthes anguina* L.		Cucurbitaceae	Climber
320	*Trichurus monsoniae* (L.f.) C.C.Towns.	Ferrapindi	Amaranthaceae	Herb
321	*Tridax procumbens* L.		Asteraceae	Herb
322	*Typha angusta* Bory & Chaub.		Typhaceae	Herb
323	*Urochloa panicoides* P. Beauv. var. *panicoides*		Poaceae	Grass
324	*Vernonia cinerea* (L.) Less.		Asteraceae	Herb
325	*Vicia faba* L.		Fabaceae	Herb
326	*Vigna unguiculata* (L.) Walp.		Fabaceae	Herb
327	*Vitex negundo* L.		Verbenaceae	Shrub
328	*Zingiber officinale* Rosc.		Zingiberaceae	Herb
329	*Ziziphus mauritiana* Lam.	Reni/Regu/Badari	Rhamnaceae	Tree
330	*Ziziphus oenoplia* (L.) Miller	Pariki/Banka	Rhamnaceae	Shrub
331	*Ziziphus xylopyrus* (Retz.) Willd.	Gol/Gotiki	Rhamnaceae	Tree
332	*Zornia gibbosa* Span.		Fabaceae	Herb
333	*Riccia spp.*		Ricciaceae	Herb
334	*Actinopteris radiata* (SW) Link		Actinopteridaceae	Herb
335	*Azolla spp.*		Salviniaceae	Herb

Annexure 2: Faunal diversity of Kalpavalli region

sr	Latin name	Common name	Family
1	…	Land snail	
2	*Gongylus gongyloides*	Mantis	Mantidae
3	*Argiope arecuata*	Speckled Band Fourleg	Araneidae
4	*Crosspriza lyoni*	Box Longleg Spider	Pholcidae
5	*Plexippus paykullii*	Zebra Jumper	Salticidae
6	*Stegodyphus pacificus*	Pocock	Eresidae
7	*Poecilocerus pictus*	Common Painted Grasshopper	Arcridiidae
8	*Teratodes monticollis*	Hooded Grasshopper	Arcridiidae
9	*Gryllodes domesticus*	House Cricket	Gryllidae
10	*Acheta domestica* Linn.	Black Field Cricket	Gryllidae
11	…	Termite	Fermitidae
12	*Apis dorsata*	Rock Bee	Apidae
13	*Apis indica*	Indian Bee	Apidae
14	*Holcomyrmex scabriceps*	Granary Ant	Formicidae
15	*Luciola* sp.	Fire-fly	Malacodermidae
16	*Sternocera chrysis* (Fabr.)	Jewel Beetle	Baprestidae
17	*Mylabris phalerata*	Blister Beetles	Cantharidae
18	*Diplacodes lefebvrei*	Black Ground Skimmer	Libellulidae
19	*Orthetrum triangulare*	Blue tailed Forest Hawk	Libellulidae
20	*Aethriamanta brevipennis*	Scarlet Marsh Hawk	Libellulidae
21	*Crocothemis servilia*	Ruddy Marsh Skimmer	Libellulidae
22	*Hyblaea puera*	Teak defoliator	Noctuidae
23	*Pyrausta machaeralis*	Teak Leaf Skeletonizer	Pyralidae
24	*Papilio polytes*	Common Mormon	Papilionidae
25	*Pathysa nomius*	Spot Swordtail	Papilionidae
26	*Princeps demoleus*	Lime Butterfly	Papilionidae
27	*Anapheis aurota*	Pioneer	Pierinae
28	*Catopsilia pomona*	Common Emigrant	Pierinae
29	*Cepora nerissa*	Common Gull	Pierinae
30	*Eurema hecabe*	Common Grass Yellow	Pierinae
31	*Ixias pyrene*	Yellow Orange Tip	Pierinae
32	*Cynthia cardui*	Painted Lady	Nymphalinae
33	*Danaus chrysippus*	Plain Tiger	Nymphalinae
34	*Danaus gnutia*	Striped Tiger	Nymphalinae
35	*Euploea core*	Common Crow	Nymphalinae
36	*Hypolimnas misippus*	Danaid Eggfly	Nymphalinae
37	*Junonia hierta*	Yellow Pansy	Nymphalinae
38	*Junonia orithya*	Blue Pansy	Nymphalinae
39	*Melanitis leda*	Common Evening Brown	Nymphalinae
40	*Tirumala limniace*	Blue Tiger	Nymphalinae
41	*Ypthima ceylonica*	Common Four-ring	Nymphalinae

42	*Musca domestica*	Common House-fly	Muscidae
43	*Gerris sp.*	Water skater	Gerridae
44	*Hydrometra vittata*	Water bug	Hydrometridae
45	…	Centipedes	Chilopoda
46	*Julus* sp.	Millipedes	Chilognatha
47	*Hoplobatrachus tigrinus*	Indian Bull Frog	Ranidae
48	*Calotes versicolor*	Indian Garden Lizard	Agamidae
49	*Mabuya sp.*	Skink	Scincidae
50	*Varanus bengalensis*	Common Indian Monitor	Lacertidae
51	*Daboia russelii*	Russell's Viper	Viperidae
52	*Egretta garzetta*	Little Egret	Ardeidae
53	*Bubulcus ibis*	Cattle Egret	Ardeidae
54	*Ardea cinerea*	Grey Heron	Ardeidae
55	*Ardeola grayii*	Indian Pond Heron	Ardeidae
56	*Threskiornis melanocephalus*	Black-headed Ibis	Threskiornithidae
57	*Pseudibis papillosa*	Black Ibis	Threskiornithidae
58	*Elanus caeruleus*	Black-shouldered Kite	Accipitridae
59	*Accipter badius*	Shikra	Accipitridae
60	*Neophron percnopterus*	Egyptian Vulture	Accipitridae
61	*Coturnix coturnix*	Common Quail	Phasieanidae
62	*Francolinus pondicerianus*	Grey Francolin	Phasieanidae
63	*Pavo cristatus*	Indian Peafowl	Phasieanidae
64	*Francolinus pictus*	Painted Francolin	Phasieanidae
65	*Coturnix coromandelica*	Rain Quail	Phasieanidae
66	*Perdicula asiatica*	Jungle Bush Quail	Phasieanidae
67	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae
68	*Vanellus malabaricus*	Yellow-wattled Lapwing	Charadriidae
69	*Columba livia*	Blue Rock Pigeon	Columbidae
70	*Streptopelia decaocto*	Ring Dove	Columbidae
71	*Psittacula krameri*	Rose-ringed Parakeet	Psittacidae
72	*Centropus sinensis*	Greater Coucal	Cuculidae
73	*Eudynamys scolopaceus*	Koel	Cuculidae
74	*Athene brama*	Spotted Owlet	Strigidae
75	*Tephrodornis pondicerianus*	Common Woodshrike	Campephagidae
76	*Pericrocotus cinnamomeus*	Small Minivet	Campephagidae
77	*Caprimulgus indicus*	Indian Nightjar	Campephagidae
78	*Cypsiurus balasiensis*	Asian Palm Swift	Campephagidae
79	*Apus affinis*	House Swift	Campephagidae
80	*Alcedo atthis*	Common Kingfisher	Alcedinidae
81	*Merops orientalis*	Green Bee-eater	Alcedinidae
82	*Coracias garrulus*	European Roller	Coraciidae
83	*Coracias benghalensis*	Indian Roller	Coraciidae

84	*Upupa epops*	Common Hoopoe	Upupidae
85	*Ocyceros birostris*	Indian Grey Hornbill	Bucerotidae
86	*Dinopium benghalense*	Black-rumped Flameback	Picidae
87	*Chrysocolaptes festivus*	White-naped Woodpecker	Picidae
88	*Hirundo smithii*	Wire-tailed Swallow	Hirundinidae
89	*Lanius meridionalis*	Southern Grey Shrike	Laniidae
90	*Lanius schach*	Long-tailed Shrike	Laniidae
91	*Dicrurus macrocercus*	Black Drongo	Dicruridae
92	*Corvus splendens*	House Crow	Corvidae
93	*Corvus macrorhynchos*	Jungle Crow	Corvidae
94	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae
95	*Acridotheres ginginianus*	Bank Myna	Sturnidae
96	*Acridotheres tristis*	Common Myna	Sturnidae
97	*Sturnus pagodarum*	Brahminy Starling	Sturnidae
98	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae
99	*Parus nuchalis*	White-naped Tit	Paridae
100	*Turdoides caudata*	Common Babbler	Muscicapidae
101	*Turdoides malcolmi*	Large Grey Babbler	Muscicapidae
102	*Turdoides striata*	Jungle Babbler	Muscicapidae
103	*Cercomela fusca*	Brown Rock Chat	Muscicapidae
104	*Saxicoloides fulicata*	Indian Robin	Muscicapidae
105	*Copsychus saularis*	Magpie Robin	Muscicapidae
106	*Prinia socialis*	Ashy Prinia	Muscicapidae
107	*Prinia inornata*	Plain Prinia	Muscicapidae
108	*Orthotomus sutorius*	Common Tailorbird	Muscicapidae
109	*Nectarinia asiatica*	Purple Sunbird	Nectariniidae
110	*Passer domesticus*	House Sparrow	Passeridae
111	*Ploceus philippinus*	Baya Weaver	Passeridae
112	*Melophus lathami*	Crested Bunting	Emberizidae
113	*Axis axis*	Spotted deer	Cervidae
114	*Sus scrofa*	Indian wild boar	Suidae
115	*Canis aureus*	Jackal	Canidae
116	*Vulpes bengalensis*	Indian fox	Canidae
117	*Herpestes edwardsii*	Grey mongoose	Herpestidae
118	*Lepus nigricollis*	Indian hare	Leporidae
119	*Macaca mulatta*	Rhesus Macaque	Cercopithecidae
120	*Mus booduga*	Indian field mouse	Muridae
121	*Mus musculus*	House mouse	Muridae
122	*Funambulus pennanti*	Five stripped palm squirrel	Sciuridae
123	*Hystrix indica*	Porcupine	Hystricidae

Annexure 3: Agro diversity of Kalpavalli

Sr	Group	Scientific name	common name	Varieties
1	Cereal	*Oryza sativa* L.	Paddy (Vadlu)	Ankursonam
				Bapatla
				Basma
				Bavani
				Dilhibogalu
				Hamsa
				Jagityalu
				Javakodlu
				Masura
				Palubbulu
				Picchivadlu
				R.N.R
				Sannodlu
				Sonamasura
				Superfine
2	Milet	*Eleusine coracana* (L.) Gaertn.	Finger millet (Ragulu)	Hibrid ragi
				Kalayaniragi
				Muddaragi
				Yerra ragulu
		Panicum miliare Lam.	Little millet (Samalu)	Samalu
		Paspalum scrobiculatum L.	Kodo millet (Arikalu)	Arikalu
		Pennisetum typhodium	Pearl millet (Sajjalu)	Nati sajja
				Pedda sajja
		Setaria italica (L.) P. Beauv.	Foxtail millet (Korralu)	Jada korralu
				Nati korralu
		Sorghum bicolor (L.) Moench.	Great millet (Jonnalu)	Chitta jonnalu
				Hibrid jonna
				Kakimarujonna
				Muddajonna
				Mukkajonna
				Musukujonna
				Muthyaljonna
				Pasurujonna
				Swarna jonna
3	Oil	*Arachis hypogaea* L.	Ground Nut (Veruchanaga)	K.6
				Kadiri modu
				Nati kaya
				Peddakaya(J.L
				Samrat
				Thiga kaya

4	Pulses	*Cajanus cajan* (L.) Millsp.	Redgram (Kandulu)	Hibrid Kandi
				Jadakandulu
				Nati kandulu
				Thellakandulu
				Yerrakandulu
		Dolichos Biflorus L.	Horse gram (Ulavalu)	Hibrid ulavalu
				Nati ulavalu
				Thiga ulava
		Dolichos lablab L.	Field bean (Anumulu)	Chikkudu anumulu
				Nati anumulu
				Pedda anumulu
		Phaseolus aureus Roxb.	Green gram (Pesalu)	Chinna pesalu
				Pedda pesalu
		Vigna unguiculata (L.) Walp.	Cow pea (Alasandulu)	Nati alasandulu
				Pedda alasandulu
				Yerra alasandulu
5	Spice & condiment	*Allium cepa* L.	Onion (Yerragadda)	
		Allium sativum L.	Garlic (Thella gadda)	
		Capsicum annuum L.	Green chilly	Bajji mirapa
				Balapuram
				Kaddi mirapa
				Nati mirapa
		Coriandrum sativum L.	Coriander	Kothumeeri
		Zingiber officinale Rosc.	Ginger (Allam)	
6	Vegetable	*Abelmoschus esculentus* (L.) Monench.	Ladies finger	Hibrid benda
				Nati benda
		Beta vulgaris L.	Beetroot	
		Cyamopsis tetragonoloba (L.) Taubert	Cluster bean	
		Daucas carota L.	Carrot	
		Luffa acutangula L.	Ridge gourd (Beera)	
		Lycopersicon Esculentum L.	Tomato	Bangalore tomata
				Nati tomata
		Momordica charantia L.	Bitter gourd (Kakara kaya)	Pedda kakara
				Thella kakara
		Raphanus sativus L.	Raddish (Mullangi)	
		Solanum melongena L.	Brinjal	Gutti vankaya
				Mullavankaya
				Nallvankaya

		Solanum tuberosum L.	Potato	Bangaala dumpa
		Trichosanthes anguina L.	Snack gourd	
		Vicia faba L.	Indian Broad Beans (Chikkada kayalu)	Nati chikkada, Goru chikkada
				Pedda chikkada
7	Fruit	Carica papaya L.	Papaya	
		Cocos nucifera L.	Coconut	
		Musa paradisiaca L.	Banana	
		Punica granulata L.	Pomegranate	

Annexure 4: Domestic animals diversity of Kalpavalli

animal	*Sc name*	Purpose of rearing	Breed
Domestic fowl	*Gallus sp.*	Flesh, eggs	Asali
			Bedasalu
			Ceeti kodi
			Dega
			Girraju
			Kakinemalli
			Nati kodi
			Padakodi
			Param kodi
			Pigali
			Selam
Cow	*Bos indicus*	Milk, leather, dung	Alikeri Avulu
			Desapu Avulu
			Jersey Avulu
			Kwadi Avulu
			Nati Avulu
			Ongolu Avulu
Bullock		Dung, in agriculture & transport	Alikeri Eddulu
			Desapu Eddulu
			Jersey eddulu
			Kwadi Eddulu
			Nati Eddulu
			Ongolu Eddulu
Buffalo	*Bubalus spp*	Milk, dung	Natti Buffalo
			Seema Buffalo (Murrah)
Goat	*Capra aegagrus hircus*	Milk, leather, flesh	
Sheep	*Ovis ammo aries*	Milk, leather, flesh, wool	
Dog	*Canis familiaris*	Protection of house & agriculture	

Annexure 5: List of countries (Top 30) in terms of production capacity (MW)

Sr.	Country	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
1	China	41,800	25,104	12,210	5,912	2,599	1,266	764	567	468	400
2	USA	40,200	35,159	25,170	16,819	11,603	9,149	6,725	6,370	4,685	4,258
3	Germany	27,214	25,777	23,903	22,247	20,622	18,500	18,428	16,629	12,001	8,754
4	Spain	20,676	19,149	16,740	15,145	11,630	10,028	8,263	6,202	4,830	3,337
5	**India**	**13,065**	**10,926**	**9,587**	**7,850**	**6,270**	**4,430**	**3,000**	**2,110**	**1,702**	**1,507**
6	Italy	5,797	4,850	3,736	2,726	2,123	1,718	1,265	904	785	682
7	France	5,660	4,492	3,404	2,455	1,567	757	386	248	148	95
8	United-Kingdom	5,204	4,051	3,288	2,389	1,963	1,353	888	684	552	474
9	Canada	4,008	3,319	2,369	1,846	1,460	683	444	322	236	207
10	Denmark	3,752	3,465	3,160	3,125	3,136	3,128	3,124	3,110	2,880	2,383
11	Portugal	3,702	3,535	2,862	2,130	1,716	1,022	522	289	194	131
12	Japan	2,304	2,056	1,880	1,528	1,309	1,040	896	506	334	275
13	Netherlands	2,237	2,229	2,225	1,747	1,559	1,224	1,078	908	682	481
14	Sweden	2,163	1,560	1,067	831	571	509	452	404	345	295
15	Australia	2,020	1,712	1,494	817	817	579	379	197	103	71
16	Ireland	1,428	1,260	1,245	805	746	495	339	186	137	125
17	Turkey	1,329	801	333	207	65	20	21	21	19	19
18	Greece	1,208	1,087	990	873	756	573	473	365	276	272
19	Poland	1,107	725	472	276	153	73	58	58	28	22
20	Austria	1,011	995	995	982	965	819	606	415	139	94
21	Brazil	931	606	339	247	237	29	24	24	22	24
22	Belgium	911	563	384	287	194	167	95	68	44	32
23	Egypt	550	430	390	310	230	145	145	180	69	69
24	New-Zealand	530	497	325	322	171	168	168	36	35	35
25	Taiwan	519	436	358	280	187	104	13	0	0	0
26	Mexico	517	202	85	85	84	2	2	0	0	0
27	Romania	462	14	8	8	3	1	1	1	1	0
28	Norway	441	431	428	331	325	268	270	100	97	13
29	South Korea	379	348	278	192	176	119	23	19	16	0
30	Bulgaria	375	177	158	57	36	14	10	10	0	0

Annexure 6: Time line of activities year wise and theme based – Kalpavalli

YEAR	SUMMARY
1993	Introduction: Mustikovila site identified for protection.
1994	Fire fighting and fire breaks: Seed dibbling and seed collection: Seed dibbling was done during the monsoon in about 125-150 acres. The results of this were good. Nurseries: Village nurseries initiated to grow saplings for the protected area in Mustikovila, Kogira and Haryancheruvu. 70,000 saplings of *neem, babul, siris* raised in Mustikovila and Kogira and about 30,000 in Haryancheruvu. However no planting was done as there was a fear that the southwest monsoon would fail. The saplings from Mustikovila and Kogira were handed over the Forest Department and that of Haryancheruvu to the government watershed there.
1995	
1996	Fire fighting and fire breaks: Villagers from Mustikovila and Shyapuram made firebreaks. TC members also participated. Training was provided to villagers and fire fighting groups formed. The trained persons were able to prevent fires at least eight times. The Mustikovila villagers on their own initiative went and putout fires. In spite of all efforts 60 % of forest in Shyapuram was burnt. In Mustikovila because of more firebreaks and watchers and active fire fighting groups only 10 % was affected by fires. Seed dibbling and seed collection: This was the first year where seeds were collected in sufficient numbers from Kalpavalli itself.
1997	Introduction: SBR Palli one of the villages decided to start protection work on approximately 300 acres of their common lands near their village and not contiguous to Mustikovila and other villages. They also appointed a watcher for this purpose. Fire fighting and fire breaks: As the area is well protected (the grass growth is very good) summer fires have been getting more and more difficult to manage. This year they were huge, sometimes 10 to 15 feet high and wind aided. Village fire protection committees have been formed to fight the fires. This year for the first time these committees on their own initiative went to stop the fires on six occasions and yet they were unable to do so. Firebreaks work included cutting grass for breaks at lower wages. 12,000 and 13,000 m of firebreaks were made in Mustikovila and Shyapuram respectively. Fire fighting groups were formed in Shyapuram with 13 members and in Mustikovila with 22 members. Major fire fighting took place in Shyapuram on January 17th, 25th and 31st and February 2nd and 8th. Seed dibbling and seed collection: Large areas of the 4,000 acres have been dibbled with about 60 kinds of seeds collected from the forests or brought from seed collection center at TC. Due to forest fires much of the seed dibbling work done the previous year

	was affected. Yet, the tree growth and regeneration has been very good and the villagers protecting the area are very enthused. They helped in grass clearing and making pits around the seeds germinated from dibbled seeds. This year many school children and adults from the villages and 20 of the TC Panchayati members participated. Seed collection from the regeneration area was very good. Quantities collected were: (in kgs) *Neeruddi* - 120; *Rela* – 5; *Dirisinamu* – 5; *Kanuga* – 8; *Chigara* – 10; *Reni* – 5; *Moduga* – 25; *Chilla* – 5; *Vepa* – 15; *Neredu* – 5. This was followed by protection measures of seedlings germinated in dibbled seeds. Collection of seeds continued upto July-August 1997. These were mainly the indigenous forest timber and green manure varieties like *Veeruddi, rela, palavara, neredu, dirisinamu* and *moduga*. In September 1997 four seed dibbling camps were held in the common lands of Shyapuram, Kambalpalli and Mustikovila where there was strong participation. Seeds of *kutica, chinta, moduga, rela, sandra, bandara, vepa* and *nalla thumma* were dibbled. In November and December 1997 seeds dibbled the previous year were watered and looked after by watcher. Soil and moisture conservation: Nurseries: Nursery raising and promotion of fruit trees: In the nursery developed in Hariyancheruvu the saplings raised were: *Teaku* (Teak) 5000 *Chinta* (Tamarind) 2000 *Vepa* (Neem) 5000 *Naravepi* 1000 *Munaga* (Drumstick) 1000 *Kanuga* (Pongamia) 4000 *Neredu* (Jamun) 1000 *Panasa* (Jackfruit) 200 *Parang*i (Papaya) 200 *Kunkudu* (Soapnut) 1000 They were planted in the 1996-97 season 60 mango saplings were planted in the natural regeneration area. In October The watchers of each area started small nurseries of very particular forest species in the protected area near the shelter for planting next monsoon. Plantation: Conflict resolution: May: A combined meeting of the Kogira, Kambalpalli, Shyapuram

	and Mustikovila VSC members was held. It was basically a Kogira watershed area conflict resolution meeting at which the Mustikovila VSC was called for exposure and learning. The issue was the finalization of a contract for toddy leaves by one village. The other villages took umbrage feeling that they bore the brunt of the work and were being left out. It was decided to share the work equitably the Kogira watershed area would be divided into three zones with each village taking responsibility for protection and other works in a particular zone. But the produce of the sales would be shared equally by all the villages (no matter that most of the toddy palms were in the zone of one village). To finalize contracts and other matters related to produce, a joint committee consisting of two representatives from each VSC would take responsibility in the future. July: Rs. 300/- fine collected from wood cutter for illegally cutting wood. September: Some villagers from Mustikovila were caught by the watchers cutting wood without permission. They were fined Rs. 150/- October: Again some Mustikovila villagers were caught by the watchers of Shyapuram, cutting wood without permission. They were taken to Shyapuram village and kept in custody till Mustikovila people arrived. A meeting was held and the culprits were fined Rs. 300/-. November: People from unrelated villages came to steal palm fronds. The VSC members went to the villages and explained the process they were involved in. Similarly people from far away were bringing their sheep and goats. The VSC members held counseling sessions with these people to put a stop to this. Collection of minor forest produce: January: Rs. 3,000/- income for Mustikovila VSC and Rs. 9,000/- for Shyapuram VSC from sale of date palm fronds. August: Rs. 9,000/- sale of date palm fronds October: Rs 2,800/- for Kogira VSC from sale of date palm fronds. Collection of fodder and fuel wood: 136 bullock carts of grass were cut from Shyapuram Others: In October common lands were officially subdivided among the CBO's and marked with *"burujulu"*. In November the *"burujulu"* on Kogira were replaced
1998	Fire fighting and fire breaks: January: Fire protection work began in right earnest. As part of the planning in December it was decided to complete 30 km of fire lines this year. VSC members and watchers joined the work and volunteers contributed a part of their wages or worked at a reduced wage. More than 50 km of fire lines were drawn which were very effective in preventing spread of fires in the coming hot, dry months. Between May and June the watchers stopped fire with the help of local fire protection groups.

	Seed dibbling and seed collection: In August in Mustikovila 30 school children participated in seed dibbling camps. Seeds were dibbled in Vulindramaanu cheguru area in about 1,500 pits. Seed varieties included *rela, chinta, dirisinamu, rita, neem, kanuga,* Indian ivory wood, *sigara* and flame of the forest. In Kogira 100 school children, teachers, school committee members, VSC members and Pacchari working group members participated in a seed dibbling camp. Seeds were dibbled in five acres. Various varieties of seeds including trumpet flower tree, *rita, acacia nilotica,bankura, reni, rela, chinta* and *kanuga* were dibbled in about 5,000 pits. Saplings were also planted. Seed dibbling was carried out in Beedanpalli with school children and school committee members. Neem and tamarind were among the seeds planted in 2,300 pits Soil and moisture conservation: September: In Shyapuram seed dibbling was done by 60 children in two acres. Seeds included neem, tamarind, *pongamia, rita* and *rela*. In Kambalpalli 70 children, Dalit committee members, VSC members participated in seed dibbling in four acres. Tamarind, neem, *rita* and *rela* were dibbled. Nurseries: Mustikovila area watchers raised a nursery of 400 seedlings and Kogira raised 600 seedlings. Shyapuram watchers undertook watering of selected plant around the store room. Plantation: Conflict resolution: In January 1998 some individuals from a village illegally came to cut date palm. The VSC apprehended them and detained them. The village headman of the village sent a letter saying that they would not come there and repeat the act again. In April 1998 a *gram sabha* at Mustikovila was disrupted by a few people who complained that the forest regeneration was a problem to the farmers as the increased forest cover had lead to increase in wild animals, especially wild boar, and these were destroying the crops. They did not let the meeting carry on. It was pointed out to them that the regeneration activities were being carried out at the request of the villagers. It was decided that this was to be discussed later. In June 1998 during the plantation season the watcher from Kogira was beaten up by some people from Boxampalli a neighboring village when he objected to their cutting toddy palm leaves. VSC members and the youth went to Boxampalli village and held a Panchayat meeting with the village elders. The elders warned against repetition of such an incident. August: In Bedanapalli forest a watcher apprehended a toddy trapper illegally trapping today. He was brought to the VSC members who imposed a fine of Rs. 500/- and one of the VSC members took responsibility of collecting the fine. Collection of minor forest produce: January: SBR Palli VSC sold date palm fronds for Rs. 1,500/-.

<table>
<tr><td></td><td>Mustikovila VSC sold date palm fronds worth Rs. 3,100/-.
Collection of fodder and fuel wood:
Others: In April demarcation of regeneration areas (common lands) was started in by construction of “burujulu” every 100 m. This was carried on beyond June 1998. May: Vanabhojanalu at Subrayanpalli in which 80 people went to the protected area and constructed a hut for the watchmen at the highest point. Vanabhojanalu at Shyapuram attended by 200 people including women and children. They transported 3,000 bricks that were later used for construction of the watchers hut. Vanabhojanalu at Mustikovila in which nearly 300 people participated. During this occasion a plan was drawn up for watch hut, store rooms and plantation work to be taken up and the work in the protected area since the beginning was reviewed.</td></tr>
<tr><td>1999</td><td>Fire fighting and fire breaks: Firebreaks were prepared in Mustikovila (19.5 km), Kogira (9.8 km), Kambalpalli (7 km) and Shyapuram (9.8 km).</td></tr>
<tr><td>2000</td><td>Seed dibbling and seed collection: In July VSC collected 160 kgs of seeds.
In August seed collection was done as below also:
<table>
<tr><th>Village</th><th>No</th><th>Work done by</th><th>Acre</th><th>Species</th></tr>
<tr><td>Mustikovila</td><td>61</td><td>School children-49
Teacher-1
Wathcer-3
TC member-3
VSCmember-3</td><td>10</td><td>Vepa, kunkudu, velamma, maddi, moduga, guttika,rela</td></tr>
<tr><td>Kogira</td><td>23</td><td>Women-18
Watcher-2
TC member-3</td><td>15</td><td>Seethaphal, Matti,Rela Bandara, Kanuga, Guttiki</td></tr>
<tr><td>Bedanpalli</td><td>38</td><td>EMEY (?)-10
VSC-10
School children-16
Watcher-1
TC member-1</td><td>10</td><td>Kanuga,vepa, Chinta Moduga, Seetaphal</td></tr>
</table>
In Kambalpalli in October 16 members of the Dalit committee voluntarily sowed seeds in 10 acres. The varieties included gottiki,
jammi, chennikesari, vepa, bankira and chinta.
: In August VSC procured seeds from Kalpavalli. A total of 258 kgs was collected and these were distributed to Kogira, Shyapuram, Mustikovila, Kambalpalli, Bedanpalli, SBR Palli and GG Palli. Each village got 37 kgs of seeds.
Soil and moisture conservation: In September 2000 trenches and ten gully plugs were done in the Vulindramaanu cheguru in Mustikovila. In October Mustikovila four rock filled dams were constructed and in SBR Palli two rock filled dams were built.
Nurseries: In October in S B R Palli 650 pits by watchers were dug120 trees planted in nursery. In Kambalpalli soil was bought for 300 nursery covers. 38 trees were cleaned</td></tr>
</table>

	and gullies dug.100 neem trees planted. In Shyapuram gullies built around 150 trees, 10 boundary marking built. In Beedanpalli: 150 covers of saplings sown in 29acres. In Kogira 315 covers of saplings. Gullies dug for *sapota* and guava trees. Date palm leaves tied around fruit trees for support and to prevent goats from grazing. Conflict resolution: In October 2000 people from Ramagiri came and cut two cartloads of wood for fuel. When asked why they had cut firewood they said that there were no fixed boundaries and they did not realize that they were not allowed to do so. The VSC decided to build 30 boundary walls. The VSC members levied a fine of Rs.400/-. The firewood was then auctioned off for Rs 450/-. Collection of minor forest produce: January: Rs. 1,500/- for Kogira VSC from sale of date palm fronds. Collection of fodder and fuel wood: Others: July: Three committees were asked to build stone boundaries. Each committee to build 15 and a total of 50 to be built. In October four boundaries In Kambalpalli four boundaries were built were built. In GG Palli 30 boundaries were built.
2001	
2002	Fire fighting and fire breaks: In April fire was stopped in Kogira. In May fires broke out in Karadithippa till Pilligundalla area and near Nallakonda till Peddavanka. Both fires were put out. Seed dibbling and seed collection: In April 50 kgs of seeds of nine varieties were collected from Kogira, Kambalpalli and Shyapuram. In May seed collection by watchers continued. 229 kgs of 12 varieties of seeds were collected. In August 29 members from Shyapuram went to dibble seeds. Six kinds if seeds and a quantity of five kgs were planted in 2,032 trenches. In the tamarind orchards of Mustikovila, SBR Palli, and Kambalpalli gullies were made, trees watered and support sticks provided to plants. Date palm fronds were tied around trees to prevent goat's from eating foliage. Plantation: In July in Kambalpalli tamarind orchard under FWP gullies were dug for 437 trees. In November and December development works was carried out in the tamarind orchards of SBR Palli, like gullies, watering. In Kalpavalli 2,515 m trenches were dug. Collection of Minor Forest Produce: April: GG Palli sold date palm fronds worth Rs 4,500/- May: Villagers from Shyapuram, Kambalpalli, Mustikovila, Hussainpura, Nagepalli and Mustikovila numbering 60 collected 50 bags of dates from which they earned approximately Rs. 11,200/-.

<table>
<tr><td></td><td>July: In Koramudda vanka in Shyapuram datepalm fronds worth Rs. 150/- were sold. The proceeds were distributed among Kambalpalli, Shyapuram and Kogira. SBR Palli sold date palm fronds worth Rs. 2,200/-.
August: Kogira VSC sold date palm fronds for RS. 550/-
Collection of fodder and fuel wood: November-December: Fire protection in the previous years yielded a good crop of fodder. 1,543 cart loads of grass were taken valued at Rs. 125,800/- .(Rs 600/- per cartload)
Others: It was decided in the watchers meeting that each watcher is to grow 200 trees and to go to the forest at 4 am to prevent grass cutting and date palm frond collection.</td></tr>
<tr><td>2003</td><td>Fire fighting and fire breaks: In January before summer began itself 5 acres of land was burnt near Murikineelamadugu. 150 fire lines were drawn between Gutturvepamanu and Kanikirallathippa. Four watchers and two Timbaktu members participated. In February 6,655 m of fire lines were drawn by TC members of Pacchari and Harita, Kambalpalli VSC, Mustikovila Dalit Sangha, Kogira coolies and watchers.
In Shyapuram villagers from outside came to fish and set fire to 250 acres. Six VSC members and two TC members put out the fire.
Seed dibbling and seed collection: In January seed collection started in January. 24 kgs of three varieties were collected. In February seed collection was carried out 49 kgs of seeds were collected by ten TC members and watchers.
Plantation: In January in Shyapuram 1,120 tamarind trees were planted in three days. In SBR Palli watering was done for 1,200 trees. Mulching with grass was done for 380 trees and manure was applied for 62 trees.
In February in SBR Palli and Kambalpalli and Shyapuram 2,190 trees were watered and trenches dug around.
Collection of fodder and fuel wood: February: Fodder collected by 10 villages, 79 farmers were 215 cartloads estimated at Rs. 86,090/-</td></tr>
<tr><td>2004</td><td>Fire fighting and fire breaks: As a show of solidarity 68 members of the Timbaktu Panchayati did Shramdaan on March 2004 and made 1,239 m in one day in the most grass rich area of Mustikovila. Fortunately there were early showers in the year and there was no need to make any more fire lines.
Seed dibbling and seed collection: July: Seed dibbling was carried out by 172 members. 138 kgs of seeds were dibbled in 25 acres in five camps.
<table>
<tr><td>Village</td><td>Work done by</td><td>Kgs</td><td>Acres</td></tr>
<tr><td>4 from Roddam</td><td>Watchers</td><td>15</td><td>15</td></tr>
<tr><td>Shyapuram</td><td>School children, Shepherds</td><td>32</td><td>50</td></tr>
<tr><td>Kogira</td><td>School children</td><td>45</td><td>80</td></tr>
<tr><td>Bedanpalli</td><td>School children, VSC members</td><td>4</td><td>10</td></tr>
<tr><td>Kambalpalli</td><td>School children, VSC members</td><td>42</td><td>100</td></tr>
</table>
</td></tr>
</table>

	Collection of minor forest produce: May: 54 persons from Shyapuram, Mustikovila, G G Palli, Konapuram and Hussainpura (in Karnataka) collected dates from Kalpavalli earning an estimated Rs. 79,828/-. September: For trapping 40 toddy trees a person paid Rs. 1,120/- 60 trees were sold from near storeroom in Kambalpalli and an income of Rs. 1,680/- was received. Others: In May 2004 the Beedanpalli VSC found that in Pulikunta vanka area in their village neem and date palm trees were neglected and destroyed. People were taking away the date palm leaves excessively and farmers were encroaching into the land. This was shared in the VSC meeting and a"*gram sabha*" was held. It was decided that the area will be taken up as protected area and no trees would be cut.
2005	Fire fighting and fire breaks: In January in Kambalpalli 12 VSC members did Shramdan to make fire breaks of 1,000 m length. Watchers also built 3,260 m of firebreaks around tamarind orchards. VSC members also drew fire lines –Kogira 6189 m, Kambalpalli 4780 m, Shyapuram 8370 m. Fire lines were burnt in G G Palli of 750 m by the Pacchari team. February: Fires broke out near Yeddulapentachenu and Karadigutta and Kosigutta. Six times fires wee started. Watchers from the tamarind orchards and Kalpavalli put them out. In Mustikovila 1,000 acres were burnt out. Kogira watchers collected 47 kgs of nine type March: Fire burnt two acres in Yeddulapentachenu and one acre in Chinnamabbugondi. Unknown persons set fire to 600 acres and completely destroyed. The fire started in Bandravuthippa and as it was windy spread quickly. A fire that started was put out by rain after two acres had been burnt. Five acres were destroyed in the area of Ontipulakamudu, Kanikarallathippa which was put out by the Kalpavalli and tamarind orchard watchers. Seed dibbling and seed collection: Seed collection was done in Kambalpalli where 14 types of seeds of 108 kgs were collected July: Seed dibbling was done in 30 acres in Shyapuram and 20 types of seeds were dibbled. VSC members of Shyapurama, VO members and school children numbering 55 participated. Watchers also collected 4 kgs of *maddi* seeds. In four tamarind orchards 1,500 trenches were repaired. Leaf manure was applied and seeds were sown in the trenches.400 *seethpahl* seeds were applied. August: Four seed dibbling camps were conducted in which 13 watchers and 92 school children participated. VSC members educated the children about the forest and its uses. 16 types of seeds of 55 kgs were dibbled. These included *kanuga, vepa, matti, elamma, yerra chandanam, thangedu, subabul, reni, bandara, yerrakoliki, yerra guriginjalu, rela, maddi, sandra, seethapalam, eetha*. The dibbling was done in 50 acres in Kogira covering the following: Gosanibodu to Ontipalakabodu, 25 acres, Peddabodu 20 acres

	and Ontipalakkabodu five acres. In September seed dibbling at Goplaswamy temple in Pudugosomibodu. About three acres sown by 15 Kambalpalli VSC members and watchers. Kinds of seeds sown-*reni, vepa, gotiki*. October 2005: Beedanpalli and Dhuntiralla (Roddam) conducted seed dibbling at Beedanpalli. 15 school children, three committee members and 21 cadres and watchers participated. Five kgs of five types of seeds – *yerrachandanam, eetha, thangedu, subabul* and *seethaphal*-were sown in 10acres. This year it was decided to collect seeds from fruit trees from surrounding hills of the follwong villages- Jammallabanda, Kota, Daudakonda, Gundarlapalli,Yerrlagundhi, Chinnapalli, Bnagarakkammapalli villages in Karnataka. . Due to good rains the fruits in this region ripened earlier and were collected early. The villagers sold the seeds @ Rs. 8/-per kg and 14 kgs were bought. 300 fruits were collected of which some were given to the Shyapuram children and seeds collected from them. A total of 16 kgs were therefore acquired. In the previous year 470 *seethapha*l saplings were grown at Beedanpalli. 450 of these saplings grew to about a foot high. Seeing this Kogira, Kambalpalli and Shyapuram VSC also decided to plant 5,000 *seethaphal*, 1,000 *moduga* and *reni*. The nurseries for these saplings were to be set up near Goplswamy temple. Soil and moisture conservation: In November In 160 acres in Kogira, Kambalpalli, Shyapuram trimming was done and gullies were dug around 1,000 trees. Seethaphal trees were growing well and about 800 had sprouted. Weeding around these trees was done. Plantation: April: In the tamarind orchards trenches were dug, grass cut around trees, stone mulching, neem cake application and watering. September: Good rains resulted in good growth in the tamarind orchards. For all trees gullies were made to store water, pruning, support for bent trees and manure was provided. In place of dead trees *seethaphal* and *moduga* seeds were sown. In November the tamarind orchard at Kambalpalli, it was found that the land was sloping causing the rainwater to flow away. The land was ploughed deeply and grass used to retain rainwater. This was done in 10 acres. November 2005: Twenty trees were bought and planted in the Anjeneya Swamy temple land at Kogira. Kalpavalli watchers and tamarind orchard farmers participated in it. Conflict resolution: In June date palm stalks were being stolen. The thieves were apprehended and two of the four were handed over to VSC members. They were told that what they were doing was wrong and were made to sign a letter saying that they would not repeat the act.

	In July the Kogira watchers hut was torn apart. The suspect was a person from Shyapuram who was instructed to pay a fine of Rs. 300/- and replace 12 wooden reefers for the hut. In September, 6,000 sheep were brought from the Raptadu village for grazing. They were counseled by the watchers not to graze these sheep but they did not heed the same and continued to graze in the Kogira and Mustikovila regions. VSC cadres then visited the site and cautioned them against grazing. These villagers came back again to graze sheep and were told to pay a fine. They never turned up later. In October three VSC members from Shyapuram cut about three bullock cart load of trees for firewood. Seeing this villagers also went and cut another 27 bullock cartload of firewood. The members went to Shyapuram and spoke to the VSC members of Shyapuram. They were asked to pay a fine of Rs. 250 per cart load (Rs. 7,500/-). This was duly paid by Shyapuram villagers and they duly apologized. In November regeneration work was thwarted by goats. Three goatherds loped off *neredu* trees for the goats. Watchers informed the VSC members who counseled the goatherds and asked them not tog raze the goats in the forest to which they agreed. In December sheep were grazed illegally in SBR Palli. The VSC members pulled out the fence for keeping the sheep. A fine of Rs. 2000/- was imposed but the shepherds said they would pay only Rs. 800/-. Since they did not pay up the full amount one of the goats were taken. It was finally decided that they would pay Rs. 600/- as fine and the goat was then returned. Collection of fodder and fuel wood: January: 86 cartloads of fodder grass was collected by the surrounding villages valued at Rs. 43,000/-, each cart @ Rs. 500/- February: 24 cartloads of fodder grass valued at Rs. 12,000/- was collected. March: Seven villages of VSC and another seven villages collected 25 cartloads of fodder valued at RS. 12,500/-. Others: In September in Kogira grafting was done for 75 *mulla reni, gangi reni* trees. 22 of these trees grew well and five of these are fruiting. The VSC members also trained watchers on how to do grafting.

Year	Summary
Oct 2001 to Sep 2002	Food for Work (FWP) program In response to the chronic drought situation in Anantapur District, the state government introduced the FWP in 2001. TC implemented the program in three mandals –C K Palli, Ramagiri and Roddam. In four phases 47 works were taken up in 23 villages. Payment was done in the

	form of rice. The important works carried out were • 37,728 water harvesting trenches • 13,440 pits for planting trees • Land development work in 136 acres • Renovation of seven water bodies • Land leveling, trenching for tamarind orchards • Link roads and new roads Water harvesting trenches were dug in the revenue wastelands of Kogira, Kambalpalli, Shyapuram, Mustikovila, SBR Palli and G G Palli. This was taken up in the natural regeneration area. These water harvesting trenches help reduce soil and water run-off. They also collect small pools of rainwater, which in turn helps growth of vegetation around the trenches. Seeds of indigenous forest species were dibbled on the trench bunds and this resulted in faster germination and better growth of the trees. Some of the trees grew upto six feet in one year. In July seven seeds of total 20 kgs were dibbled.
April 2000 – March 2001	Seed dibbling was done by 307 people in eight camps. A total of 90.5 kgs of seeds in 108 acres were planted. Fire lines of 71.1 km length were drawn in 5,400 acres. Soil and water conservation works was done in 46 acres. 110 stone walls were constructed measuring 6 feet* 4 feet
2001-2002	60 km of fire lines Seven seed dibbling camps held 122 rock filled dams 31,990 trenches Seed dibbling in 770 acres
2002-2003	Funds were low and the VSC came forward to do 16,385 m of fire lines across 150 acres in critical areas. 227 people did Shramadan. A campaign was conducted by six members of youth groups in 29 villages regarding protection of forest from fire. Funds were low and thus Shramadans were organized for seed dibbling. Eight seed dibbling camps were held nine varieties if seeds in 775 acres especially in trench bunds dug under the FWP were done. 150 kgs of seeds were used and 340 members of VSC participated.
2003 April to 2004 March	Near Gopalswamy temple around five tamarind orchards fire lines 10 feet wide were burnt to a length of 6,420 m. In Kogira, Kambalpalli and Shyapuram 32 cartloads manure was applied to tamarind trees.

<table>
<tr><td></td><td>450 vepa and kanuga trees were planted in trenches
54 rock walls were built to delimit boundaries.
150 m thorn fencing was set up to keep away cows near tamarind orchards in Goplaswamy temple.
Seed collection was done by watchers 351 kgs of 16 types of seeds were collected.
A rally was taken out in 29 villages called “Chaitanya yatra’ to educate and build awareness on fires and fire fighting.
Seed dibbling camp held in Kogira where 19 types of seeds in 500 acres were sown totaling 175 kgs. 15,000 trenches were dug for the same.
Dibbling was done in Roddam by 22 working group members and watchers, in Shyapuram by 75 VSC members and school children, in Kambalpalli by 12 members of thrift groups, in Beedanpalli by 35 members and again in Shyapuram by 12 members.</td></tr>
<tr><td>2003</td><td>Formation of fire lines was not taken up in 2003 due to insufficient funds. As the drought continued through 2003, there was very little grass growth. The watchers and the committee members made a few fire lines at a few critical areas.
Eight watchers collected 30 varieties of seeds weighing 293 kgs. These were collected from Kalpavalli and around.
Seed dibbling was done in September 2003 in the trenches made during the FWP. 150 members participated in five such camps. Participants included VSC members, Roddam working group members, watchers, thrift group members and school children. Approximately 500 acres were dibbled.</td></tr>
<tr><td>2003-2004</td><td>In this year due to shortage of funds the normal activities of seed dibbling, fire breaks and soil and conservation works were suspended but watchers continued to do some amount in these areas.
Seed collection and dibbling of 30 varieties was carried out in the trenches.
2500 m of fire lines formation around the boundary.
54 “burujulu” constructed along the boundary.
Fencing of 150 m around Gopalswamy temple in Kogira
Two watch huts built by Shramadan of watchers.</td></tr>
<tr><td>2004</td><td>July: Seed dibbling was carried out by 172 members. 138 kgs of seeds were dibbled in 25 acres in five camps.
<table>
<tr><th>Village</th><th>Who</th><th>Kgs</th><th>Acres</th></tr>
<tr><td>4 from Roddam</td><td>Watchers</td><td>15</td><td>15</td></tr>
<tr><td>Shyapuram</td><td>School children, Shepherds</td><td>32</td><td>50</td></tr>
<tr><td>Kogira</td><td>School children</td><td>45</td><td>80</td></tr>
</table></td></tr>
</table>

Bedanpalli	School children, VSC members	4	10
Kambalpalli	School children, VSC members	42	100

August: In six orchards 17 watchers made trenches, supports, and trimmed grass and loosened the soil. They also planted seed in pit where no plants had germinated.

Village	Who	Type	Amount	Acres
Kambalpalli	50 school children and VSC members	15 types	42	100
Beedanpalli	11 school children and VSC members	4 types	5	11
Kogira	22 VSC members	12 types	15	15
Kogira	50 school children and VSC members	12 types	45	80
Shyapuram	39 VSC members	12 types	32	50

Grafting was done on 70 trees of *reni, gangireni* by a person from Sevagram Maharashtra.

September: Watchers were sent for training in grafting to Sevagram, Maharashtra. Grafting was done for 72 *gangireni* trees in various locations of which only 17 survived.

Work in tamarind orchards included support, trimming, mulching, seed dibbling in trenches where germination has not happened.

Boundaries were painted around Pulikuntavanka using "*burujulu"*.

Seed dibbling done by Beedanpalli VSC members, Gandhi Yuvata Sangham 30 people . 15 kgs of eight kinds were dibbled in 20 acres.

October: Work done in Kalpavalli included trenches for trees, boundary for demarcation, repair of kunta in Shyapuram, digging trenches near storeroom and growing of nursery.

Tamarind orchards in Kogira were provided with neem cake.

November: At Kalpavalli trenches were weeded. In Kambalpalli 150 trenches were dug for *kanuga* and *vepa* and one watcher in Shyapuram built a rock filled dam. Neem cake was applied in tamarind orchards. Nine sacks in Kogira, Kambalpalli, Shyapuram each. 45 cartloads of manure were also applied and grass was cleaned.

December: Fire breaks were built around tamarind orchards with 11 watchers. 8,000 m of fire lines were drawn. Firebreaks at Kambalpalli were also done by VSC members and watchers. 1,000 m was burnt. Seed collection was done by three members. A total of 50 kgs was collected.

2004- 2005	VSCs met regularly this year. Seed collection done by watchers- 312 kgs

	Seeds dibbled: 12 types in 200 acres by 273 children, thrift group and youth sangha members who participated in 10 seed dibbling camps. Fire lines: 42 kms of fire lines through Shramadan and 17 km fire lines by Timbaktu Panchyati. Counseling for shepherds to stop grazing and participate in forest protection

Income over the years from fodder:

<table>
<tr><td>2002-2003</td><td>Due to severe drought fodder was not available for cattle. People began selling off their cattle to butchers. In this situation the protection work done for ten years at Kalpavalli paid off. It was one of the few places where grass was available in the area. 3,136 farmers from 40 villages in Roddam, Ramagiri, C K Palli, Penukonda mandals and Thirumali (Karnataka) collected 6862 cartloads of grass worth Rs. 27,44,800/- and saved many cattle and farmers. 40,000 sheep from 23 villages were brought to graze.</td></tr>
<tr><td>2003-2004</td><td>Between Aug 2003 and July 2004 464 cartloads of grass taken by farmers. This was valued at RS 500/- per cartload. Total value Rs. 232, 000/-
3,222 farmers from 109 villages cut and took 6,948 cartloads of grass worth Rs. 34,74,000/- .
<table>
<tr><th>Mandal</th><th>No of villages</th><th>Farmers</th><th>Carts</th><th>Value</th></tr>
<tr><td>Roddam</td><td>44</td><td>785</td><td>2,918</td><td>14,59,000</td></tr>
<tr><td>Ramagiri</td><td>15</td><td>131</td><td>633</td><td>252,000</td></tr>
<tr><td>C K Palli</td><td>14</td><td>592</td><td>739</td><td>369,500</td></tr>
<tr><td>Penukonda</td><td>14</td><td>636</td><td>917</td><td>366,800</td></tr>
<tr><td>Thirumani</td><td>15</td><td>703</td><td>1,015</td><td>406,000</td></tr>
<tr><td>Sumendaplli</td><td>3</td><td>30</td><td>281</td><td>112,400</td></tr>
<tr><td>Other villages</td><td>4</td><td>345</td><td>445</td><td>178,000</td></tr>
<tr><td>Total</td><td>109</td><td>3,222</td><td>6,948</td><td>34,74,000</td></tr>
</table>
1,500 cattle, 5,000 goat and sheep were brought here for grazing.
December: Grass for fodder was collected by four villagers from Roddam 152 cartloads as fodder and 38 boda grass cartloads valued at Rs. 95,000/- were collected.</td></tr>
<tr><td>2004-2005</td><td>In the previous year 3,222 farmers from 109 villages, cut and took 6,948 cartloads of grass worth Rs. 27,79, 200/-. This year after four years the area received early showers and so there was no crisis in fodder. 338 farmers from 39 villages, cut and took grass worth Rs. 284,500/-. Besides about 45,000 cattle, goat and sheep were brought here for grazing.</td></tr>
</table>

Sale details over the years:

2004-05	VSC received Rs. 25,000/- from forest produce.

	Dates 229 ser were collected and sold. the total income received after labor was Rs. 22,828/-

Conflict resolution

April 2003-March 2004	50 toddy palms were sold for extracting toddy to a person but he extracted from 70. He was fined Rs. 28/- per tree excessively extracted. In Mustikovila one person illegally extracted toddy and he was apprehended by the watchers who handed him over to the VSC. He was fine Rs 3,000/- for 140 trees and was asked to pay another Rs. 20/- per tree for extraction.