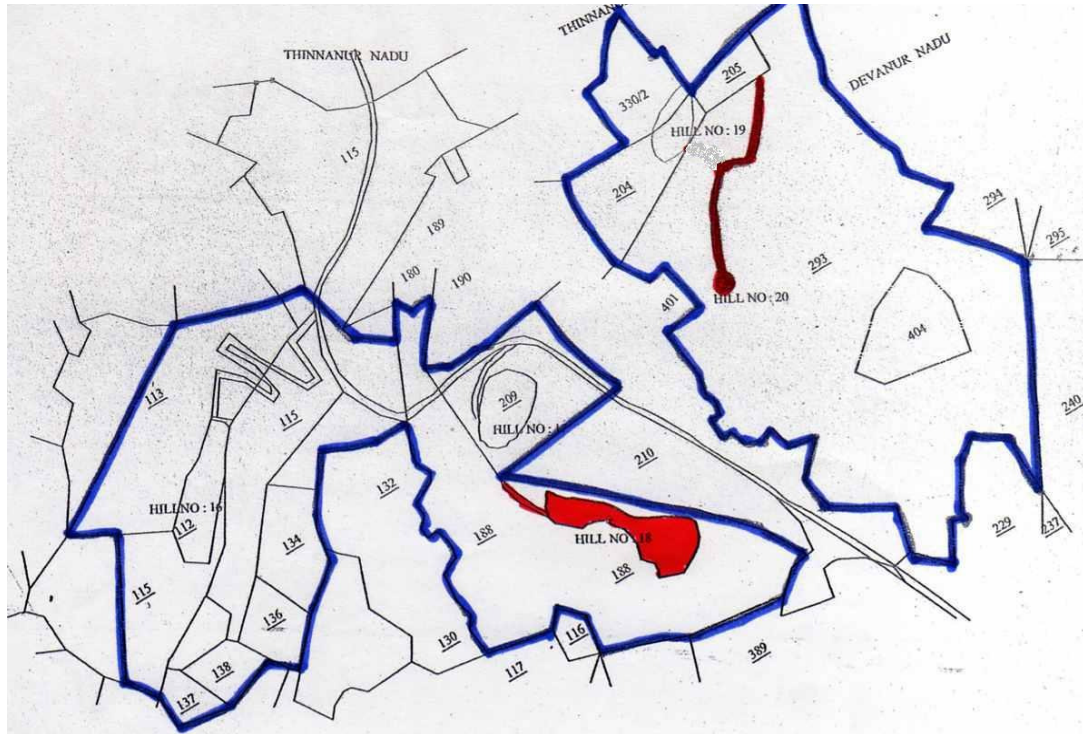


Monitoring the execution of Conservation Plan for Flora and Fauna of Kolli Bauxite Mines, Kolli Hills

M/s Madras Aluminium Company Limited,
Mettur Dam, Tamil Nadu



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December 2008

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1 INTRODUCTION

M/s Madras Aluminum Company Limited (MALCO) has been mining bauxite at Kolli hills for the past four decades. Bauxite mines at Kolli hills have two mining lease areas namely Ariyurnadu and Selurnadu (Figure 1 and Figure 2). Mineral exploitation in Ariyurnadu started during 1968 and currently MALCO holds a lease of 62.17 hectares of which, mining is being done only in 6.98 hectares. The hills numbered as VII, VIII and IX fall under this lease. Of the three hills, the largest deposit of bauxite (7,74,288 tones) occurs in hill numbered as VII. The highest extraction (5,39,902 tones) is also envisaged from this hill. On the other hand, hill numbered as IX holds only 2,880 tones of deposit of which 2,016 tones is available for extraction. In Selurnadu bauxite excavation started during 1977. Here, M/s MALCO holds a lease for 156.6 hectares. Of this, only 11.13 hectares is under excavation (mining). The lease area includes hills numbered as XVI, XVII, XVIII, XIX and XX. According to Mineral Exploration Corporation Limited (MECL) the hill numbered as XVI has an estimated reserve of around 6,65,770 tones while hill numbered as XX has the lowest deposit of 62,000 tones (Figure 3).

M/s Madras Aluminum Company Limited (MALCO), as per the advice of an expert committee of the Ministry of Environment and Forests (Government of India) has adopted a conservation plan for flora and fauna of Kolli mines developed by Sálím Ali Centre for Ornithology and Natural History (*Azeez PA, Bhupathy S, Rajasekaran A and Arun PR (2003), Conservation plan for flora and fauna of Kolli Bauxite Mines, Kolli hills M/s Madras Aluminium Company Limited Mettur Dam, Tamil Nadu, pp 47*). Upon request from MALCO, SACON has been monitoring the implementation of the conservation plan suggested by inspecting the area intermittently. The present report is a consolidation of the observations made during these visits including the field inspection undertaken during November 2008.

2 CONSERVATION PLAN

Minerals form vital raw material for several basic industries, and are considered a major requirement for the development of a nation. Environmental deterioration that is inherent to mining begins with the prospecting phase, advances with the mining and processing of minerals, and may continue with harmful effects even after the mine is abandoned. Open cast mines are known to change the landscape of the area and consequently the flora, the fauna and other components of the environment. However, considering the continued advancements in industrialisation and the ever increasing demand for energy resources and minerals, it is conceivably impossible to circumvent open cast mining. An inevitable compromise is what is achievable, stipulating a mining strategy that has reduced impacts and a provision to bring back the vegetation that is practically possible and closer to original by appropriate mine closure schemes.

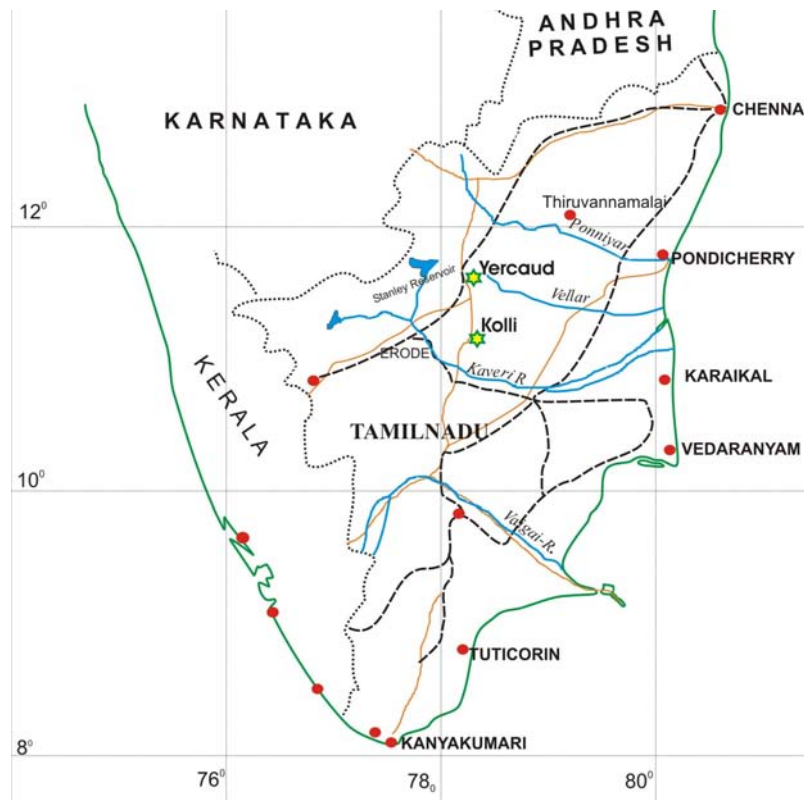


Figure 1. MALCO bauxite mines (marked in green) in Tamil Nadu

As noted in the conservation plan for the Kolli mines prepared by SACON, the habitats in most of the naturally vegetated areas have undergone drastic changes several decades ago. Areas with comparatively low level of disturbances or negligible changes are almost rare in the plateau of the hills. The wild animal populations in the area have already been decimated there and as of now, it is improbable to encounter any large wild fauna in the remnant natural vegetations. Taking note of the prevalent situation in the Kolli area, several issues were raised and steps were suggested in the above stated conservation plan. The focus of the plan was biodiversity resource conservation and some salient points are given below.



Figure 2. Mines (Ariyurnadu and Selurnadu) at Kolli

- Large number of plant species that included several medicinal plants, crop species and species of wide other uses were reported from Kolli hills despite range of disturbances. Taking note of the richness in biodiversity of the area,

M/s MALCO was suggested to take maximum care in protecting the vegetation in the area, along the slopes and immediate vicinity of the mines.

- The barriers/checks, and proper terracing and alignment of the waste dumps were to be built to curtail spilling and rolling down of mine wastes. Steps to cover the waste dumps by vegetation were required to stabilize them and reduce soil material from getting carried downstream through storm water or through wind. Measures to stabilise loose slopes by growing appropriate plant species, grasses and creepers were also suggested (Appendix 1).
- Steps were recommended for the protection and conservation of the medicinal plants in Kolli hills, which is abode for several plant species especially used in indigenous medical systems.
- To reduce erosion of agro-biodiversity and traditional ethno-botanical knowledge, sponsoring a germplasm conservation programme was suggested. Kolli hills, predominantly a tribal area, is known for several varieties/cultivars of cereals and other food plants.
- Steps to promote traditional practice of protecting forest patches as sacred groves or '*Koil kadu*' or '*Samikadu*' were recommended.
- Water conservation measures including rain harvesting, control of rapid runoff, check dams and siltation ponds were suggested.
- As a means of wider environmental protection, awareness programme to the locals, eco-development committees, development of medicinal gardens by farmers and community reserves, were also suggested to be explored.
- Re-vegetating the area with native species and declaring it, as a MALCO Biodiversity Zone was suggested which would act as a potential protected area for repository of biological and genetic diversity of Kolli hills.

3 CONSERVATION ACTIONS UNDERTAKEN

- **Biodiversity resource conservation:** As noted earlier, Kolli area is rich in floral diversity, although it is currently lean in terms of larger species of fauna. The execution of conservation plan in Kolli for conserving the local biodiversity, had identified suitable steps. In view of those plans, MALCO has taken up several steps.
 - Several local species of plants were found and grown both in reclaimed sites and in nurseries owned by M/s MALCO. According to the company sources, saplings of trees such as wattle were being drawn from Forest Department nurseries.
 - Attempts were being made to raise pioneer species and soil binder species like grass, herbs and legumes to enrich the soil.
 - About 11700 medicinal plants (Plate 1, Plate 2) such as *Adhatoda* (*Adhatoda zeylanica*) and Chitharathai (*Alpinia galanga*) have been planted in the reclaimed areas, slopes and among natural vegetation, which have gone lean for various human activities in the past. Proper manuring of the planted species at regular intervals has also been done.
 - The top soil was stored separately from the areas that were mined. This helps in preventing it being mixed up with debris of lesser nutrient value. Keeping the top soil separate also helps in retaining its seed bank. The separately stored top soil is being used in topping up the reclaimed mine areas. The separately stored topsoil is being screened using 20mm gravity screen to remove lumps and enrich its texture and soil fertility and is then utilized for topping during the reclamation of the mined out areas (Plate 3).
 - The slopes of the hillocks, on top plateau of which the bauxite mines are located were covered with natural vegetation. To avoid disturbance to the natural vegetation patches skirting the mine pits a barrier of 5-10 m width all around the pit was maintained.

- **Barriers to prevent spilling of mine waste and management of waste dump:** Spill over of the overburden and mine debris to the un-

mined areas is likely to damage the ecologic setup of those areas.

- To prevent spillage of mine material and debris appropriate barrier all along the mine boundary has been made.
- To prevent liquid flow, especially during the rainy seasons, garland drainage around the dumps has been made. If the soil is stored in mined out area and waste generated is used for refilling the abandoned mine pits, as is the case in general in Kolli mines, chances of run off from the mined out area is low.
- 15 Check/Silt dams were built around the mine area at all water outlets that reduces runoff carrying high load of silt and clay (Plate 4, Plate 5). Four settling ponds are provided in mined out area to settle the silt, encourage percolation, and reduce the velocity of run off water.
- The slopes of the dumps have been vegetated with creepers and grasses to reduce soil erosion and to stabilize the soft dumps. Creeping grass species also helps in filtering off the silt from surface run-off.

- **Protection and conservation of medicinal plants:** As mentioned above Kolli area is rich in medicinal plants.

- As a means to preserve the medicinal plants large number of them are being raised in nursery and at the mine sites. The saplings of medicinal plants are being raised in a nursery, and are reportedly distributed to the local people. In the field, the plants are raised using appropriate fertilizers and organic manure that improve the soil texture and nutrient level to enhance the growth rate of the species.

- **Agro- biodiversity and ethno botanical knowledge:** The local people raise a variety of food crops, especially cereals. As an attempt to conserve these **cultivars** M/s MALCO reportedly has taken steps.
 - Awareness about richness of the local ethnic knowledge and germplasm diversity has been created among the local tribals through training programmes involving horticulture and agriculture officials from the government.
 - M/s MALCO also reports that they have plans to sponsor a germplasm conservation programme for agro-biodiversity of the area.

- **Protecting forest patches:** Kolli hills have several floristically rich patches, skirting the bauxite-mine hillocks, for the protection of which certain steps were initiated. As mentioned above, barriers around the mines with vegetation coverage, preventions of mines debris from slipping along the slopes of the hillocks, and measures to stabilize the mine debris are some of the important steps. Other important steps taken aiming protection of natural vegetation patches are as given below.
 - In locations where bauxite is already exhausted and the area is marked for reclamation (Plate 6), planting trees and rehabilitation has been started. Activities other than greenery development are not being carried out in such areas. Local species of medicinal plants are also planted in the gaps found in the plantation areas.
 - Green belt is also developed outside the mine lease area and along haul roads. Demarcation of the mining area is also done to prevent the encroachments into the dumpsites and forest areas. Degraded forests are planted with fodder grass to meet the demand of fodder.

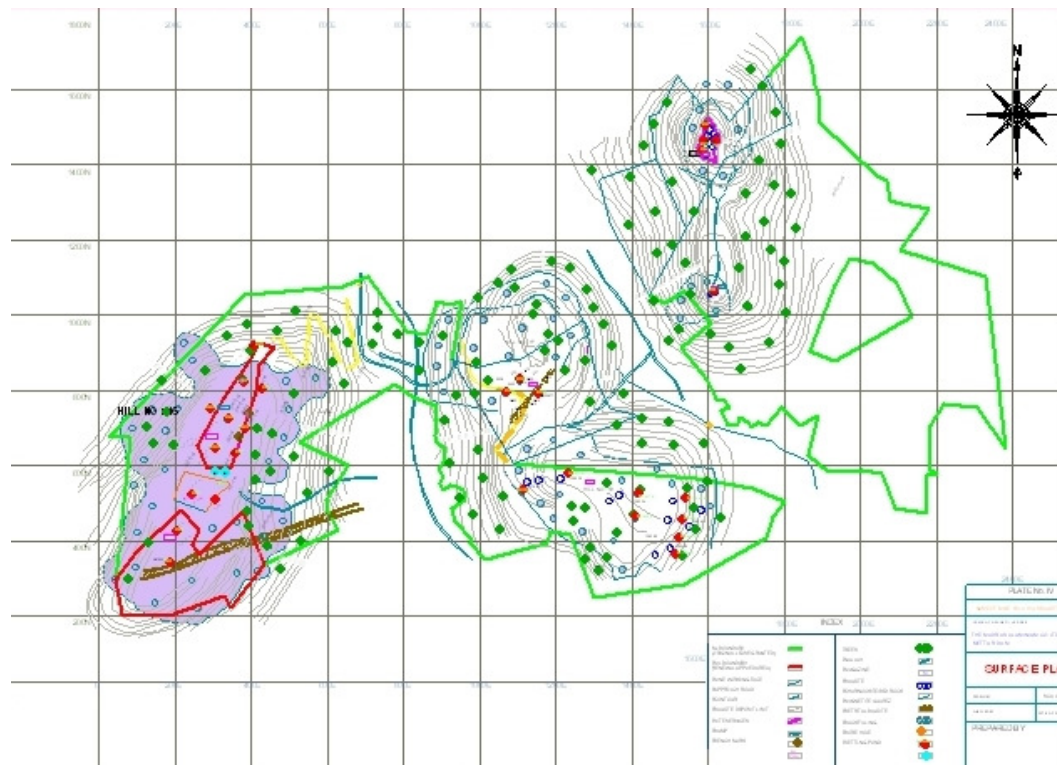


Figure 3. Surface plan of the Kolli bauxite mines

- **Rainwater harvesting:** As a water conservation measure, rainwater harvesting is done in the mined out areas by creating ponds. Five ponds have been created, each has a holding capacity of around 3000 KL. The above serves for storage during monsoon. This would promote percolation and provide water required for saplings planted during summer.
- **Fauna of Kolli Hills:** Although Kolli is rich in floral biodiversity, it is poor in larger wild mammalian fauna for various anthropogenic pressures. Mining activity also appears to have had some impacts on the fauna. However, in Kolli the mine leases would reportedly have curtailed encroachment of the government lands by the locals because of the proper demarcation of the lease areas. With the apparent concern about the conservation of environment and biodiversity and having a conservation

plan in place, the mining activity does not appear considerably affecting the habitat of the fauna currently existing in the hills.

- **Other environment protection actions:** Further to the implementation of the conservation plan, M/s MALCO proposes to continue the following activities as a measure towards conserving the local environment.
 - Environment related awareness programmes involving the local people is being conducted at regular intervals. It is reported that Environment awareness is also propagated through 10 evening study centers run by M/s MALCO.
 - A committee is formed among the mine officials with the mines manager as its chairperson, engineers and workers including contract labors as the members to discuss and implement various eco-development issues. The committee meets every month in the mines.
 - Medicinal plants are grown in the mine's nursery by engaging local persons to ensure proper manuring and maintaining the species with fertilizers and pesticides.
 - The mined out areas are being re-vegetated with the local species. M/s MALCO will reclaim and rehabilitate the lease area as per the mining plan and shall maintain the biological and genetic diversity of Kolli Hills. Before the closure of the mine, they propose to develop a fairly dense vegetation cover and declare the same as "MALCO Biodiversity Zone".

4 RECOMMENDATIONS

M/s MALCO has made considerable attempt to implement the proposed measures to conserve the natural vegetation and its animal components.

- The siltation ponds/check dams built to contain silt in the surface run-off apparently are functioning effectively obvious from the comparatively clear nature of storm water during the last inspection in November 2008. More check dams/siltation ponds at appropriate locations will further help in more or less complete settling of silt in the surface run-off.
- M/s MALCO's plantation of trees in abandoned/unused mines are picking up. However, planting more of local species is advised. Further, procedures such as mulching may increase the survival of the species.
- More of bush/shrub species along with tree species that attract bird and other species may be planted. This would help colonizing the area by several species of fauna.
- Planting/spreading more of grass species will also enrich the vegetation cover preventing soil erosion.

5 SUMMARY AND CONCLUSION

M/s MALCO has made considerable effort to implement the conservation plan stipulated by the expert committee/ authorities. Siltation ponds, check dams, nurseries and plantation in reclaimed mine sites have been established. Plantating more local species of bush/shrubs and grass is suggested. Procedures such as mulching may increase the survival of the species. Several bush/shrub species may be planted along with tree species, which may help faunal species to colonize the areas.



Plate 1. Nursery of medicinal plants



Plate 2. Some of the medicinal plant cultivation



Plate 3. Plantation in reclaimed mine sites – a view



Plate 4. Check dam for controlling silt flow



Plate 5. A check dam in rains



Plate 6. Vegetated reclaimed mine site

Appendix 1. Plant species suggested for reclamation of the mined area					
Species and local name	Use				
	Local availability	Food/fodder/fuel/medicine	Pollution abatement	Erosion control	Orname ntal
<i>Adhatoda zeylanica</i> (Adhatoda)		√			
<i>Aglaia roxburghiana</i>	√				
<i>Alseodaphne semecarpaefolia</i>	√				
<i>Alstonia scholaris</i> (Elilampala)		√	√		
<i>Alysicarpus spp</i>	√				
<i>Arisaema tortuosum</i>	√	√			
<i>Artocarpus heterophyllus</i> (Pala- Jackfruit)	√	√			
<i>Arundinella pumila</i>				√	
<i>Asparagus racemosus</i> (Neerkodi)	√	√			√
<i>Azadirachta indica</i> (Vembu)	√	√	√		
<i>Bischofia javanica</i>	√	√			
<i>Bothriochloa intermedia</i>	√			√	
<i>Bothriochloa pertusa</i>				√	
<i>Bridelia crenulata</i>	√	√			
<i>Buchanania lanzan</i>	√	√			
<i>Callicarpa tomentosa</i> (Peethai)	√				√
<i>Canarium strictum</i> (Kungilium)	√	√			
<i>Caryota urens</i> (Panai)	√	√			√
<i>Cassia spp</i>	√	√	√		
<i>Centella asiatica</i> (Vallarai)	√	√			
<i>Clerodendrum serratum</i> (Siruthekkku)	√	√			√
<i>Cocculus hirsutus</i>	√	√			
<i>Colocasia esculenta</i> (Senai)	√				√
<i>Commelina benghalensis</i>	√				
<i>Cryptolepis buchananii</i>		√			
<i>Cyathea niligiriensis</i>	√				√
<i>Cyclea peltata</i> (Padakodi)	√		√		
<i>Cymbopogon spp</i>	√			√	
<i>Cyperus spp</i> (Koraipul)	√				

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<i>Cyrtococcum trigonum</i>	√				
<i>Dactyloctenium aegyptium</i>	√				
<i>Desmodium triflorum</i>	√	√			
<i>Digitaria bicornis</i>	√				
<i>Dioscorea tomontensoa</i> (Kattukodi)	√				
<i>Dodonaea viscosa</i> (Virali)	√		√		
<i>Echinochloa colona</i>	√				
<i>Elaeagnus indica</i>	√				√
<i>Elephantopus scaber</i>	√	√			
<i>Eragrostis spp</i>	√			√	
<i>Euphorbia rothiana</i>	√				√
<i>Ficus spp</i>	√				
<i>Gloriosa superba</i> (Kanvalikizanghu)		√			√
<i>Gmelina arborea</i> (Kumil)	√				
<i>Gnetum ula</i> (Karukkodi)	√	√			
<i>Haldinia cordifolia</i> (Kadambu)		√			
<i>Helicteres isora</i> (Idampiri/valampiri)	√	√			
<i>Hemidesmus indicus</i> (Nannari)	√	√			
<i>Hemionitis arifolia</i> (Muyalkaduchedi)	√	√			
<i>Heteropogon contortus</i>	√			√	
<i>Imbatiens chinensis</i>	√				
<i>Lantana indica</i> (Unni)	√				√
<i>Litsea glutinosa</i>	√				
<i>Machilus macrantha</i> (Kulamavu)	√	√			
<i>Madhuca longifolia</i> (Iluppai)	√	√			
<i>Mallotus philippensis</i> (Senuir)	√	√			
<i>Mangifera indica</i> (Mamaram)	√	√	√		
<i>Memecylon spp</i>	√	√			√
<i>Myrstica dactyloides</i> (Kattujathikai)	√	√			
<i>Neolitsea scrobiculata</i> (Thagiri)	√				
<i>Panicum brevifolium</i>	√			√	
<i>Passiflora edulis</i>	√				
<i>Passiflora subpeltata</i>	√				



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<i>Perotis indica</i>	√				
<i>Phobe wightii</i>	√				
<i>Phyllanthus emblica</i> (Nelli)		√			
<i>Pongamia pinnata</i> (Pungam)	√		√		
<i>Premna tomentosa</i>	√				
<i>Pterocarpus marsupium</i> (Vengai)	√	√			
<i>Rubia cordifolia</i>	√	√			√
<i>Saraca asoca</i>		√			
<i>Schleichera oleosa</i>	√	√			
<i>Securinega leucopyrus</i>		√			
<i>Semecarpus anacardium</i> (Seru)	√	√			
<i>Solanum torvum</i> (Sundai)		√			
<i>Sporobolus spp</i>	√			√	
<i>Strobilanthes spp</i>	√				√
<i>Symplocos cochinchinensis</i>	√				
<i>Syzygium cumini</i> (Naval)	√	√			
<i>Terminalia bellirica</i> (Thani)	√	√			
<i>Terminalia chebula</i> (Kadukka)	√	√			
<i>Terminalia paniculata</i> (Vellaimaruthu)		√			
<i>Themeda triandra</i>	√				
<i>Thunbergia mysorensis</i>					√
<i>Toddalia asiatica</i> var <i>floribunda</i>	√				
<i>Vernonia arborea</i>	√				√
<i>Vitex altissima</i>	√				
<i>Zanthoxylum limonella</i> (Eruseengai)	√	√			
<i>Zizyphus glabratus</i>	√				

Team Members

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