Thadagam - Valley of Brick Kilns

Lost River and Disturbed Wildlife

EIA Resource and Response Centre (ERC)-Nilgiri Unit
New Delhi

2013

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Content

I. Brick Kilns Industry

In India, the history of making bricks is almost 5000 years old which is as old as the earliest known Indian civilization "Indus Valley Civilization". It is actually owing to the discovery of Indus Valley Civilization. The people of that civilization extensively used bricks to lay complex mathematically planned cities. Some of these towns were almost 3 miles in diameter and housed as many as 30,000 residents. Even now, nearly 5000 years later, bricks are being used extensively across the country, so much so, that India is the second largest producer of bricks after China. Brick production is highly concentrated in four countries (~75% global production):

- China 54% ~700-800 billion/year
- India 11% ~140 billion/year
- Pakistan 8% ~100 billion/year
- Bangladesh 4% ~ 50 billion/year

Early days brick kilns were concentrated at the river bank for easy access to sediments and alluvium soil, which were used for the preparation of the bricks and transport this to the village and city. But these days, brick kilns are being constructed in agriculture land which is close to village to reduce the labor and transport cost

The process of making bricks generally consists of the steps– Excavation of Mud ► Mixing the ingredients ► Moulding ► Drying ► Loading the kiln ► Firing the kiln (progressively) ► Taking out the burnt bricks (Progressively) ► Inspection ► Delivery

II. Thadagam Valley

The Nilgiris landscape, spread across the states of Tamil Nadu, Karnataka and Kerala, is known to harbour the maximum number of Indian Tigers and Asian Elephants. Coimbatore Forest Division spanning a land area of about 690 sq. km abutting Coimbatore city is an integral part of the Nilgiri Biosphere Reserve.

The landscape in this Division is a mosaic of forested towering hills and escarpments dropping down to deep crescent shaped valleys. Owing to the rapid urbanisation of Coimbatore city, forest cover left in the valleys and the wildlife is confined to notified Reserve Forests in the hills making these forests crucial for protection and preservation. In Tamil Nadu, Thadagam valley in particular, has witnessed mushrooming of brick kilns consequent upon the tremendous construction boom that has been going on for the past two

decades. The operation of these kilns releases huge amounts of toxic pollutants into the environment which progressively make the area around their location unfit for flora, fauna and health of the people. Thadagam valley, is located close to Coimbatore about 10 km from the main city.

Map showing Coimbatore Forest Division

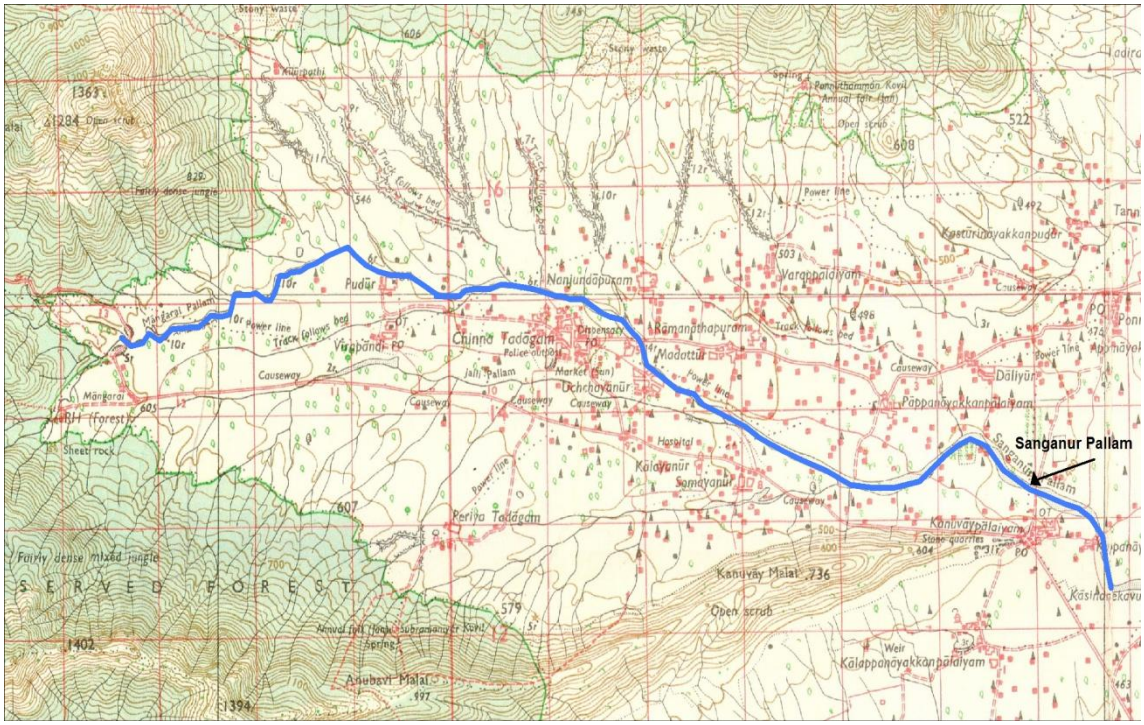
Source - http://www.coimbatoreforests.org/maps.htm

The Thadagam Valley is an important drainage basin and numerous streams originate in the forested slopes of this valley. The streams eventually drain into Sanganur Valley (*Pallam*) which was an important water source for agriculture and domestic consumption not long ago. The valley is also crucial as an elephant habitat. The proliferation of brick kilns in this valley has fractured the land, leading to the death of the streams, drying up of the Sanganur canal and effectively blocked routine migratory paths resulting in disturbed human-elephant co-existence in the valley.

Google Earth Image Showing Thadagam Valley

III. Significance of Thadagam Valley

'Thadagam' in Tamil language means '*pond*" or '*tank*', and as the name suggests, the area was a rich reservoir of water. Many streams originate in the surrounding hills and the Thadagam valley forms a drainage basin for these streams forming the Sanganur canal, which carries rain water to the important water bodies such as the Singanallur lake and the Noyyal river.



Survey of India Map showing numerous streams draining into the Sanganur Valley (*pallam*)

The mosaic of vegetation in the surrounding ranges such as the Annamalai range and the Munnar range provides for a rich array of fauna, supports a rich assemblage of large mammals and serves as an important connectivity region for the elephants migrating between the wet forests of Silent Valley National Park and the dry forests of Sathyamangalam Wildlife Sanctuary and further east-wards. The outskirts of the city are important elephant areas and serve as traditional elephant migratory corridors. The Reserve Forests of Coimbatore come under the Project Elephant Reserve No.8 (The Silent Valley-Nilambur-Coimbatore Population) under the Project Elephant of the Ministry of Environment and Forests (MoEF). They are five Panchayats/Revenue Villages located in Thadagam valley. They are

1. Pannimadai
2. Somaiyampalayam
3. Nanjundapuram
4. Chinna Thadagam
5. Veerapandi

IV. Impacts of Brick klins in Thadagam Valley

From Agriculture to Barren Land

Coimbatore city is fast developing and the city limit is expanding till the near boundary of forests and impinges heavy pressure on the last remaining forest cover. To meet burgeoning demand for construction material such as bricks and earth, patta lands where once agriculture thrived, are being converted to brick kilns. Brick making is a whooping lucrative business now in Thadagam valley with hundreds of chambers baking millions of bricks day and night.

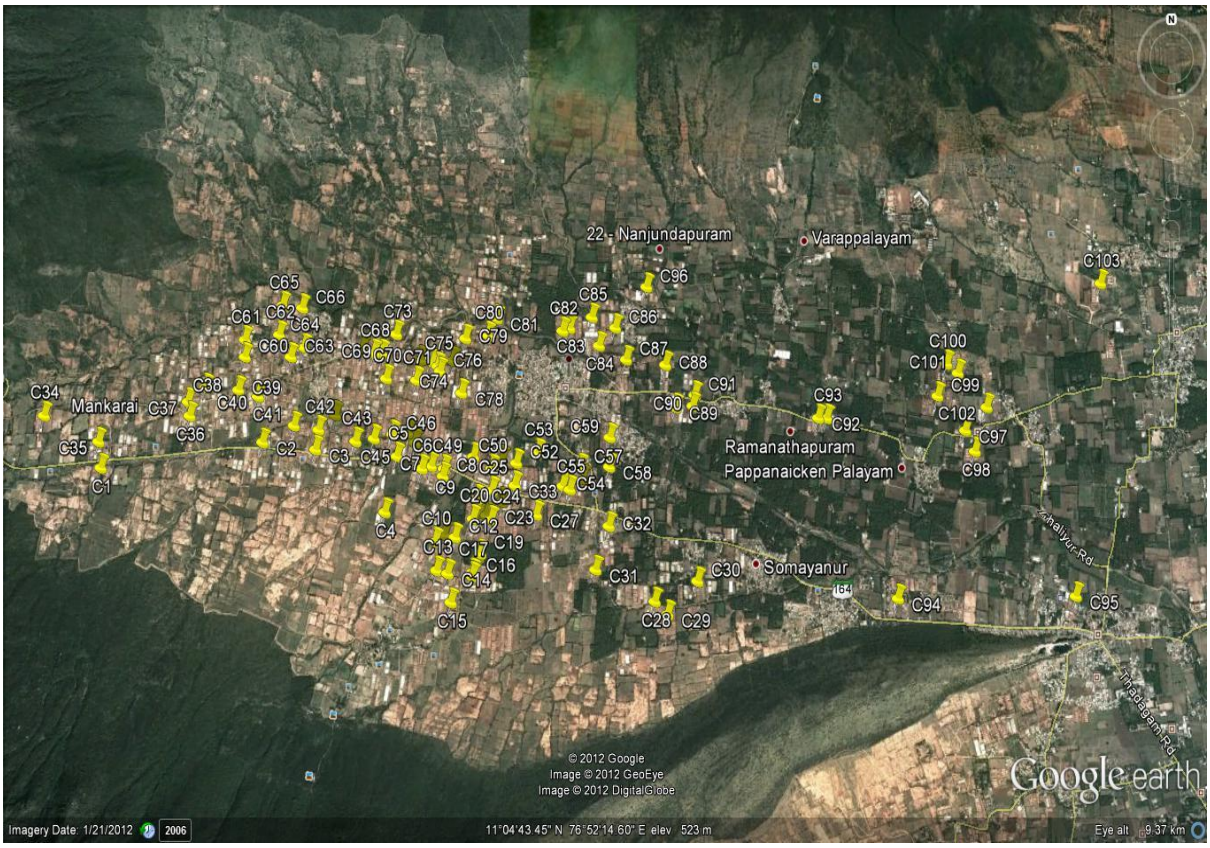
Till about two decades ago, Thadagam Valley was a dominantly agricultural area. Along the foothills, traditional agricultural pattern has been that of subsistence agriculture and farmers mainly cultivated fodder crops serving as the fodder suppliers for Coimbatore. Rapid urbanisation and population growth in the city coupled with increased spending capacity in recent times has resulted in a need for physical infrastructure, increasing the demand for residential and commercial buildings across the city and in the suburban area. Consequently, the construction sector in the city steered a high demand for bricks. In a short span of time, brick kilns came to be highly remunerative businesses with one load of bricks fetching a high price of Rs. 14,000 giving a very high profit margin. Lured by the high profit, farmers from surrounding areas started shifting from agriculture to the brick industry.

Brick Kilns Industry in India

India is the second largest producer of clay fired bricks, accounting for more than 10 percent of global production. The country is estimated to have more than 100,000 brick kilns, producing about 150-200 billion bricks annually, employing about 10 million workers and consuming about 25 million tons of coal annually. India's brick sector is characterized by traditional firing technologies; environmental pollution; reliance on manual labour and low mechanization rate; dominance of small-scale brick kilns with limited financial, technical and managerial capacity; dominance of single raw material (clay) and product (solid clay brick); and lack of institutional capacity for the development of the sector.

Building construction in India is estimated to grow at a rate of 6.6 percent per year between 2005 and 2030 providing a steady demand for bricks. The brick making industry is utilizing 2.5 crore tons of coal and other biomass fuels per year. 35 – 50 percent of cost or brick making is for the fuel itself.

The Thadagam valley gradually became the core area for brick production and demand centre for bricks in Coimbatore and surrounding areas. Close to 75 conventional brick kilns with movable chimneys and nearly 125 modern eco friendly brick kilns with static chimneys are located in Thadagam and Anaikatti. These kilns accounted for 7-8 loads each day thus turning out 1600 loads with 3000 bricks in each load every day (The Hindu 2006). Numerous brick kilns were established, wiping out old ways of farming and changing the dynamics of the entire landscape causing irrevocable damage to the ecology, drainage and elephant migration route.



Google Earth Image showing more than 100 brick kilns (chimneys only) in the Thadagam Valley

There are more than 100 brick kilns located with chimneys in the valley. There are more than 300 chambers producing un-baked brick and supplying to kilns. Only some Chambars are registered with Tamil Nadu Pollution Control Board (TNPCB).

List of Brick Chamber Registered in Coimbatore district (Thadagam Valley) for the last 5 year (RTI reply[1] on 06th December 2012, Annexure I)

Sl.No	Village	No. of brick chamber registered
1	Pannimadai	4
2	Somaiyampalayam	8
3	Nanjundapuram	10
4	Chinna Thadagam	18
5	Veerapandi	12

Rest of the brick chamber in the Thadagam Valley are not having legal permission from the Tamil Nadu Pollution Control Board (TNPCB).

V. Environmental Impacts of Brick Kilns

a. Air

Brick kilns are highly polluting industries as brick making involves burning of large amounts of fuel that emit particles into the air. Fuel burning during brick making leads to emission of pollutants and ash into the environment. Bricks are fired to a temperature of 700-1100 degree Celsius requiring a large amount of fuel for the firing operation. Combustion of coal and other biomass fuels in brick kilns results in the emission of Suspended Particulate Matter, Particulate Matter (PM 2.5), including Black Carbon and Gaseous pollutants like Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x), Carbon Dioxide (CO_2) and Carbon Monoxide (CO). The emission of these pollutants has an adverse effect on the health of workers, local atmosphere and vegetation around the kilns. A study conducted by Tuladhar (2006) in Kathmandu valley shows that brick kilns were responsible for 27% of PM10 and 31% of TSP. The results showed that TSP, PM10 level was about two times higher and SO_2 level was three times higher in Brick Kilns season compared to off season. Another study conducted in Bangladesh by Ahmad and Hussain (2007) found pollution load was very high within the cluster region of brick kilns for SO_2 and particulate matter, and the study found particulate matter was a major pollutant in the region. Brick industries also increase air pollution, which may be due to open burning of bricks which has also been reported by other workers like Bhanarkar *et al* (2002), Pangtey *et al* (2004), Dwivedi and Tripathi (2007)

[1] RTI response by Geology and Mining, Coimbatore on 06th December 2012

Clusters of polluting chimneys

b. Soil and Groundwater

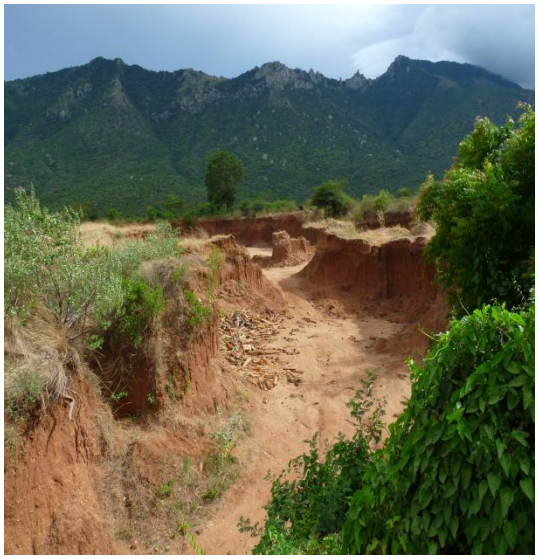
The most important raw material for the production of bricks is soil, for which good quality agriculture top soil is used. Areas having large concentration of brick kilns are known to suffer from land degradation (Maithel *et al* 2012).

As a core area for brick production, the industries extract soil from the valley at all possible places including depths beyond the permissible levels. The entire valley is criss-crossed with deep soil excavation sites forming big ravines. Such unfettered soil mining alters the hydrology of the area, interfering with the dynamics of the water cycle in the valley and the surrounding hill slopes. It is obvious to the naked eye that the streams have dried out. Ironically, the industries excavate soil even from the drying and dried out streams, effectively blocking any attempt at its rejuvenation.

The changing dynamics of the water table affect not just the water levels, but also the vegetation patterns in the adjoining forests. Experts opine that the wet and dry tropical forests are gradually being replaced by thorn and secondary forests as a response to the dropping water table.

Soil extraction at one of the sites beyond the permissible levels

Deep pits close to the forests in the path of the elephants



One of the many excavated sites

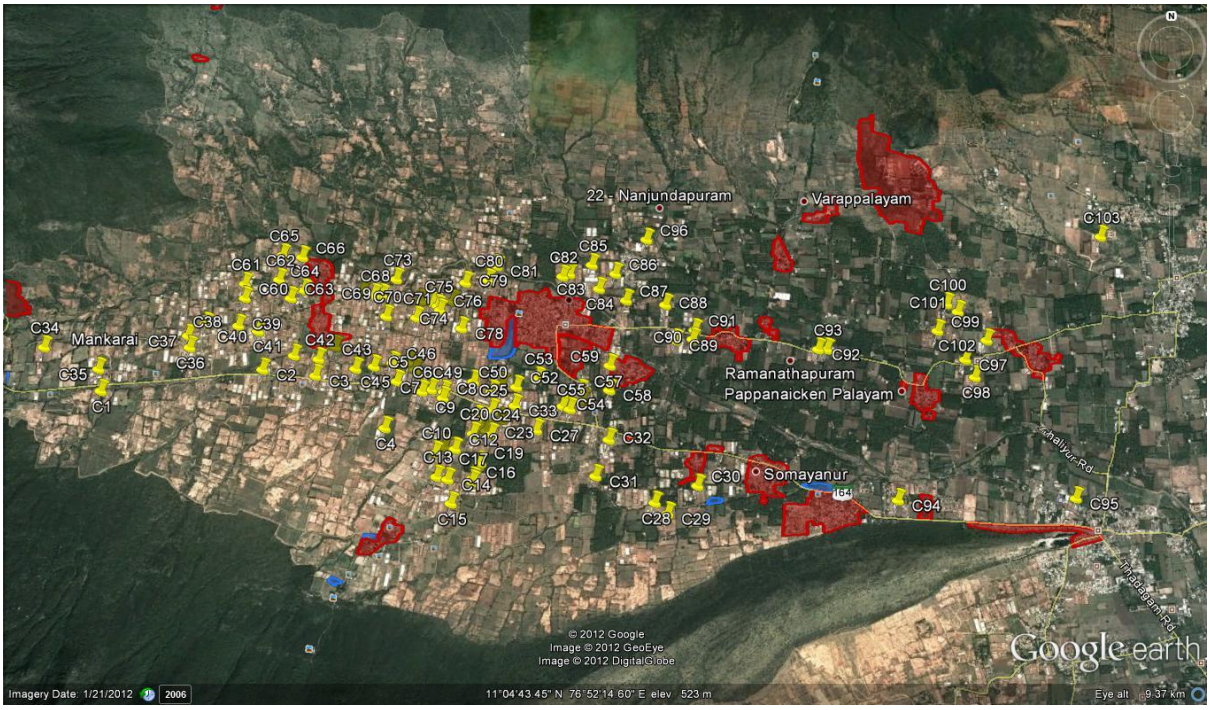
c. Social Impacts

The main environmental impact of brick kilns is the emission of fine particulate matter, which can have an adverse impact on the respiratory systems of local people. The

brick production process is based on manual labour, and brick kilns are estimated to employ around 10 million workers. Most of the workers migrate with their families from backward and poor regions of the country. Majority of the workforce is from the Southern districts such as Theni, Dindigul, Pudukottai, Sivaganga, Madurai, Dharmapuri and Krisnagiri.

Families, including young children, work in harsh, low paying conditions. There is generally a lack of basic facilities, such as access to clean drinking water and sanitation. Workers live in sheds that are hardly 10x10 feet, arranged in regular lines, many of which have no proper roofing material.

The residential complexes are located very close to the brick kilns, further increasing their exposure. There are about five villages in the valley and they all fall within a 5 km radius of the brick kilns. The brick kilns are spread across the entire valley, in clusters in some places and isolated in others. Residents of the villages are also affected by the pollutants from the kilns and the numerous vehicles transporting raw materials and finished products.



Residential areas (marked in red) are interspersed with the brick kilns increasing levels of exposure

There are ten schools located in the valley, also located within the 5 km radius of the brick kilns. Children are adversely affected due to the industries, and it is a well known fact that children are more susceptible to any kind of emissions than adults are, as their levels of immunity are quite low and not fully developed.

A study in conducted in Kathmandu by Joshi and Dudani (2008) found that the concentration of various air pollutants was higher during the operation of Brick kilns and the health status of school children attending the school close to the vicinity of the Brick kilns was worse compared to the students attending the school away from the Brick kilns. Further they found significant high odds ratios for respiratory problems like tonsillitis and acute pharyngitis were observed among the students in close vicinity to the brick kilns.

It clearly shows the schools which listed below are highly vulnerable to the air pollution due to the brick kilns industry.

List of Schools in the Thadagam valley

Government Schools

1. Panchayat Union Elementary School, Somaiyanur
2. Panchayat Union Elementary School, Ramanathapuram
3. Panchayat Union Elementary School, Nanjundapuram
4. Panchayat Union Elementary School, Chinna Thadagam
5. Government Middle School, Veerapandi
6. Government Higher Secondary School, Chinna Thadagam
7. Panchayat Union Elementary School, Kasthurinaickenpalayam
8. Panchayat Union Elementary School, Kalappanaickenpalayam

Private Schools

9. The Monarch International School, Pannimadai
10. Dr. P.G.V. Matriculation Higher Secondary School, Thadagam

d. Health Impacts

Brick kilns workers are exposed to dust particles and are susceptible to multiple pulmonary complications. Problems like asthma, chronic obstructive pulmonary symptoms, and silicosis are more common among them (Monga 2012). Respiratory symptoms include cough, phlegm, wheezing, breathlessness, running nose, throat irritation and asthma. A brick manufacturing plant uses many different raw materials and produces many intermediates, by-products and products. Among these, there are many substances potentially harmful to the health of brick kilns workers. Hazardous dust is one of the most important exposures in brick kilns. On interaction, brick kilns workers expressed smoke related respiratory discomfort at home and surroundings. It has been reported that the workers in brick industries are prone to respiratory diseases such as silicosis (Hai et al 2001), pneumonocosis (Zuskin Eugenija et al 1998) and musculoskeletal disorders (Trevelyan and Haslam 2001). A study conducted Shaikh et al (2012) found workers involved in brick baking were more likely to have Chronic Bronchitis and asthma compared to those involved in carriage and placement work.

e. Occupational Hazards

Brick making involves crude techniques causing considerable worker drudgery. Brick workers, especially moulders, are exposed to the sun for long hours. They are also exposed to high concentrations of respirable suspended particulate matters (RSPM), during monitoring and regulating the fire, as the furnace chamber is covered with ash (ash acts as an insulator). The kilns are a semi tight environment and are exposed to high temperatures. Work exposure to the high temperature and the high density dust and particulate matter over a long time can result in occupational health problems, including serious diseases such as cancer.

Adults and Children alike in the brick kilns

VI. Human Elephant Co-Existence in the Thadagam Valley

The broad definition of human–elephant conflict (abbreviated as HEC) adopted by the IUCN/SSC African Elephant Specialist Group (AfESG) is "any human-elephant interaction which results in negative effects on human social, economic or cultural life, on elephant conservation or on the environment" (Hoare, 2001). Conflict between elephants has become common throughout the elephant ranges across the country. Elephants often venture into

human areas and destroy crops, raid food reserves, damage property, occasionally injuring or killing people.

Thadagam valley is wedged between well wooded forests that were once extensive and impenetrable. Quick successions of human advancement on the Kerala slopes (Attappady valley) led to indiscriminate destruction of elephant habitat, leaving only a narrow strip of natural forests intact. These forests are under the administrative control of Coimbatore Forest Division. In Tamil Nadu as well, forests were extensively cleared and sold as patta lands in which constructions have mushroomed in recent years.

Elephants are mammals that require a wide range in landscape and home ranges of bull elephants may span over 400 sq. km. The loss of forests in the Nilgiri region, especially in the Attappadi valley, may have led to constriction of elephant populations in the few remaining habitats such as those available in the Coimbatore Forest Division.

a. Extensive Usage of Habitat by Elephants

Over 8 individually identified adult bull elephants have been using this valley extensively during the last 2 years. Family herds with identified individual cows (based on morphological features) were found using the forests around Thadagam valley extensively throughout the year. Amusingly, local enthusiasts have even named these individual elephants and, as per their anecdotal reports, elephants were sighted in forests in and around this valley for over 300 days a year.

b. Proliferation of Brick kilns and Associated Issues for Elephants

- Elephants in this area are known to have led a peaceful coexistence when traditional agricultural patterns of fodder crops were common. The farmers of the area recall raids by elephants in a particular season when the pachyderm raided their lands, fed on the fodder, and carried on its way into the adjoining reserve forest without damage to person or property. Left out and standing crops were harvested and marketed. Change in traditional patterns has changed the way elephants move and co-habit this area, forcing the animals to move out of their traditional foraging range.
- Extraction of earth around the forest for brick making has left gaping holes around the forest where water fills during the rains and is retained for longer periods even during the summer. It is now known that artificial increase in the surface area of water may alter the ranging behaviour of elephants.

- Deep ravines left after soil extraction have resulted in continuous and disjointed fractures in the land, making it difficult for elephants to manoeuvre in their range and forces them to constantly switch their routes, as soil in these areas is extracted randomly on a daily basis.
- For baking bricks a variety of fuel wood is used, prominent among them being the Palmyra stems. Huge quantities of Palmyra stems are brought and stored in large numbers. The exposed portions of the stems ferment, exuding a strong smell of alcohol which invites elephants in. In the wild, the *Palmae* family constitute one of the important food species for elephants. Thus, extensive use of Palmyra palm stems are an irresistible attraction for elephants, and this is one reason why they raid the brick kilns.

Cut palmyra stems stored in the kilns

- The brick industry is labour intensive. To meet the labour demand, workers migrate from across the state and even across the country. Such migratory labour is often quite ignorant about the ways of elephants in such a traditional setting. Confronted with elephants for the first time, the migrants reacted in fear with stone pelting, further aggravating and goading the aggrieved pachyderms.

- The brick kilns were void of basic amenities such as toilets. The labour had to move into the cover of the jungle, aggravating the risk of people getting killed by elephants when they unwarily got too close to the elephant, often taking them for granted.
- Proliferation of brick kilns resulted in increased movement of vehicles carrying earth, baked bricks and firewood. Hundreds of trucks now ply on roads which were relatively calm not long ago. The interstate traffic has also picked up and Anakatti, a sleepy village situated in the interstate border, has now become a busy trade centre attracting thousands of people from villages located in both the states. Elephant herds using the narrow corridor on this highway are finding it extremely difficult to cross the highway and this again increases conflict.

Crossing elephants rushing to avoid the traffic

Intruding close to the territorial space of the elephant

During late evenings, when elephants are found foraging in the vicinity, the local people provide a constant provocation to the elephants by way of miscreants who get too close to the elephants. They are also hostile towards elephant herds during such confrontations, making herds with calves extremely anxious.

c. Conflict-related Deaths

The frequent intrusion of elephants in human spaces has led to the ever-increasing human-elephant conflict. The situation continues unabated, despite various government measures. The human-elephant conflict attains serious proportions, where casualty is common on both sides, but more human mortalities were reported. Some bull deaths have also been encountered in these conflict zones. One adult bull identified as a crop raider was relocated to Sathyamangalam forests.

According to the Forest Department, the number of elephants straying into farmlands and the surrounding brick kilns in the year 2010 is 680. Local enquiry reveals that in the last year, about 11 human deaths have occurred due to elephants. Most incidences take place in the dark, during poor visibility and the deceased, in most of the cases, are elderly people with poor reflexes that approach the elephants.

Change in the attitude of people who show more intolerance to elephants is a cause of concern in this area. Influx of people from areas where they have never encountered elephants is another cause for worry. Aggressive behaviour by people towards elephant herds, which are generally placid, may be causing stress and behavioural changes in the animal.

Elephants appear to be cornered in the Thadagam valley and need to fight out battles in their migratory path. Elephants show home range fidelity and possess ingrained genetic memories making the traditional pathways the only pathways for their migration. Owing to the innumerable obstructions in their path, they have to go about a longer route to migrate, confronting humans and other threats along the way.

VII. Recommendations

- ***Allow Brick kilns as Permissible in the Law and Carrying Capacity of the Valley-*** Brick kilns should be allowed as per the law and the carrying capacity of the valley without affection the agriculture land and elephant migration route.
- ***Regulate Brick Earth Quarrying in the Thadagam valley*** – Soil extraction in the valley happens sans proper permissions from the local body or the Department of Mines and Geology. Such illegal mining should be ceased coupled with stringent action on the violators.
- ***Monitoring of Traffic in the Valley*** - Hundreds of trucks transport soil and other raw materials for and from the brick kilns industries every day. These trucks are uncovered, resulting in substantial spills of soil and prevalence of dust particles in the air posing a constant health problem. Regulations to cover the trucks and monitoring mechanisms should be put in place.
- ***Ensure Rights and Provide Better Living Conditions for the Migratory Labour –*** Concerned authorities and the industry owners should make provisions for improved living conditions for the migrant labourers currently living in undignified conditions without the barest of facilities or snitation.
- ***Health and Environment-*** Responsible government bodies should conduct a widespread health and environmental survey to assess the existing damage and identify rehabilitation measures. Further damage to the environment should be averted with scientific and local inputs.

- ***Socio-medical Rehabilitation for Children and Brick kilns Workers –*** Those working in brick kilns and their children should be taken care of by putting into action a comprehensive and realistic rehabilitation plan taking into consideration all aspects, including the social, health and economic status of the children employed. Children should not be allowed in the kilns and alternative facilities such as Balwadis and access to education need to be addressed as a matter of priority. Other resident children in the valley affected by the brick kilns emissions should be medically tested and given special paediatric care to address any complications they might suffer from or contract.

- ***Carrying Capacity Assessment -*** A study should be done for assessing the carrying capacity of the area for more brick earth quarrying, if at all. The feasibility of allowing more quarrying should be critically reviewed and areas delineated for quarrying based on the specifying strictures like permissible depth so that the area can be revived for activities such as agriculture.

- ***Regulatory Authorities*** - Regulatory authorities should form to monitor the activity of Brick klins industry. It should have representative for civil society groups, researchers and local villagers.

- ***Sanganur pallam*** - Sanganur pallam which carries rain water from the valley need to be protected for the sand mining.

- ***Human-Elephant Conflict*** - The industries and kilns have come up too close to forest boundaries. It is imperative to regulate the non-forestry activities and immediately stop further expansion of brick kilns in the boundary.

  Effective strategies need to be evolved to contain the situation. This can only be done by giving elephants their rightful passage. Buffer zones and tolerant zones in the fringes of forests have to be identified with the help of experts, and a comprehensive cropping and planting program designed in such a way that brick kilns and excavated pits do not pose an impediment in order to gives elephants their path and activities inviting elephants like storage of fuel (palmyrah) are closed and regulated to avert human elephant conflict.

  A survey of the entire landscape to assess the movement pattern of elephants could lead to knowledge that could help determining several critical factors like range, pathways, season, favourite food, etc., crucially for the management of these forests.

VIII. Conclusion

Open ended consumption and ever growing demands of human societies often push the limits of natural systems. The case of Thadagam valley is a clear reminder of how an exploitative activity such as soil mining and its related hazardous processes can impact the health of forests and streams and influence changes in wildlife movement and behaviour in the region. The social concerns related to migration of labour workers and their health risks are equally high and need to be addressed on priority.

Action Plan
Assess the carrying capacity of the area for brick kilns
Allow only legal brick kilns and sand mining to the extent of carrying capacity of the valley.
No brick kiln in the migration path of elephants
Ensure that nothing is stored at the Brick kilns which attracts elephants and consequently Man-animal conflict
Ensure workers rights and health
Ensure regulation of traffic on the road
Lobbying, representations and legal action for closure of illegal brick kilns and sand mining.

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