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BIODIVERSITY CONSERVATION AND COMMUNITY LIVELIHOODS SUPPORT THROUGH SOLAR FENCE POSTS TREATMENT: ARABUKO SOKOKE FOREST.

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1.0. ACKNOWLEDGEMENT.

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2.0. ACRONYMS.

ASF	Arabuko Sokoke Forest.
BCP	Biodiversity Conservation Programme.
KM	Kilometre.
ASF-FADA	Arabuko Sokoke Forest Forest Adjacent Dwellers Association.
CDF	Constituency Development Fund.
ASFMT	Arabuko Sokoke Forest Management Team.
FD	Forest Department.
KWS	Kenya Wildlife Services.
NMK	National Museums of Kenya.
KEFRI	Kenya Forestry Research Institute.
NFP	Natural Forests Programme.
GRRC	Gede Regional Research Center.
IGA	Income Generating Activity.

3.0. TABLE OF CONTENTS.

1.0. INTRODUCTION AND BACKGROUND.

The communities adjacent to Arabuko Sokoke Forest (ASF) have suffered for many years due to animal/ human conflicts. The worst has been damages to crops caused by Elephants almost on a daily basis leaving the communities with nothing to eat other than relaying 100% on relief food (Msolo), year after year. Damages to houses and injuries to livestock and human beings including deaths have also been reported from time to time. Introduction of income generating activities (IGA), aimed at alleviating poverty among the communities like planting of *Casuarina equisetifolia* for pole production, *Aloe vera* farming, and butterfly farming are facing destruction by Elephants defeating their livelihood improvement objective. Several deaths of livestock, and even human beings have occurred leaving the communities more poorer because as per the previous wildlife Act, compensation for human injury was only Kenya shillings 15,000.00 and 30,000.00 for death, while for crops it was none.

It is from this perspective that the Arabuko Sokoke Forest (ASF) adjacent communities have been constructing a barrier for Elephants in form of a solar fence since 2003. The first phase was completed in 2003 with support from government of Kenya and the European Union through Biodiversity Conservation Programme (BCP). During this phase, KEFRI participated by treating 4500 poles that were used for the fence. This was erected on the South- Eastern part of the forest. The farmers, who were almost shifting (some had already shifted due to inhabitability following the frequent elephant raids) from the place to realize some good maize harvests in the area during 2004 and 2005 harvest season, and they are expecting to have a good harvest this season, having been protected from the elephants for 3 years now. They are witnessing more food security than before. The value of the fence to the community can be seen from the enthusiasm with which the communities have been maintaining the fence and the interest shown in clearing the fence. The less cries from the community adjacent to the fence have made the politicians who used to complain on behalf of the communities realize the effectiveness of the fence.

Plate 1: 3-year-old fence on the left, adjacent to it is maize farming on the right with Arabuko Sokoke Forest on the background.

2.0. JUSTIFICATION.

Arabuko Sokoke Forest unlike other forests in Kenya is jointly managed by a team of stakeholders known as Arabuko-sokoke Forest Management Team (ASFMT). Due to these positive results of the first phase, the Arabuko-sokoke Forest Adjacent Dwellers Association (ASF- FADA) this year managed to secure some funds from the Malindi Constituency Development Fund (CDF), to assist in extension of the fence, to benefit more people. Since the activities were supposed to be implemented jointly with the Arabuko Sokoke Forest Management Team (ASFMT), which comprises of communities (ASF-FADA) and Government institutions, which comprise of Forest Department (FD), Kenya Wildlife Services (KWS), National Museums of Kenya (NMK) and Kenya Forestry Research Institute (KEFRI), each partner was expected to contribute towards the activity. The other partners were more willing to play their role to ensure that the fencing project succeeds. These initiatives proved that AS-FADA was maturing as a CBO to a point that it was able to initiate, solicit for funds and manage projects almost on their own.

The partners were expected to give in their support for the construction of the fence. Forest Department assisted by providing Eucalyptus posts to be treated. Communities

contributed in kind by providing labour for cutting, de-barking, carrying the posts from the forest to the treatment site, clearing the fence line, digging of the holes and general maintenance of the fence. KWS was supposed to meet the cost of wires, other installation requirements and technical input during the installation of the solar fence. CDF supported feeding members of the communities participating in pole carrying, de-barking, hole digging, payment of felling and splitting services, clearing of the fence line, guarding the treatment site 24 hours and digging of holes. Communities were given 2 kg of maize flour and 1 kg of beans as food for work at the end of each daily target.

KEFRI's role was to treat 4,500 fencing poles. This was to be both financial support and technical backstopping throughout the whole process of the treatment. It is from this that Gede Regional Research Centre (GRRC) requested and received Kenya Shillings 300,000.00 from KEFRI, through Natural Forests Programme (NFP) to implement the pole treatment exercise, which was released in two trunches, of Kshs 150,000 each. All these will be expected to contribute to forest conservation by making sure that the communities have enough harvests from their farms and do away with poaching since many do it as an alternative source of livelihood.

By contributing towards such projects, KEFRI

i. Is improving its corporate image to the communities, other departments, the provincial administration and the political fraternity as a whole,
ii. Contributes towards improvement of partnership and linkages with other institutions.
iii. Contributing towards poverty reduction and biodiversity conservation.

Plate 2: Communities and KEFRI officers preparing to start pole treatment exercise.

3.0. Materials and methods

3.1. Implementation Activities.

The process involved the following.

i. Meeting to view the plantation that the Forest Department had offered to be clear felled. It was the plantation from which the first lot of fencing posts (2003) was selected. This time, it required clear felling.
ii. Deciding on the right manageable size of posts to be treated for fencing.
iii. Selection of pole cutters through competitive bidding exercise.
iv. Deciding on the treatment site to reduce transportation costs.
v. Purchase of treatment material and termitecide (Gladiator, hand gloves, and mouth masks)
vi. Making of two treatment jikos in readiness for the process.
vii. Purchase of used oil (anti rot/ ant bores) that was mixed with Gladiator for treatment.
viii. Selection of the treatment site from the general cutting site.
ix. Collection of fuel wood for the heating process.

3.2. Wood Posts and Treatment Equipment

5000 fencing posts 2700mm were cut, debarked and split to the required sizes. They were allowed about 30 days to season before starting treatment process. Some of the posts however were treated after more than four months after cutting, which gave enough time to loose substantial amount of moisture.

A metallic trough 600mm wide, 600mm deep and 3000mm long was fabricated using a 16G metal sheet reinforced at the edges to give it the necessary strength against warbling. The same was tested before being taken for use to check on leaking joints.

Figure 1 shows the trough.

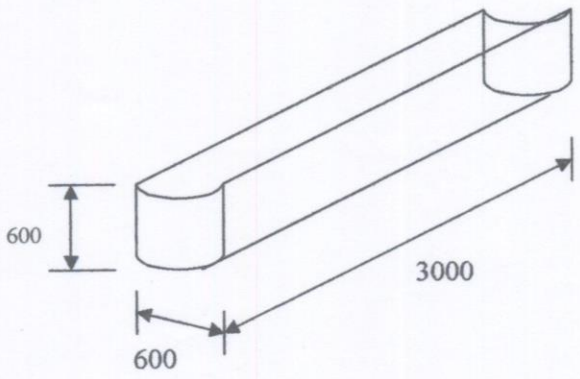

Figure1. Metallic trough for boiling posts in the
Chemical

A fireplace was constructed using cement and stone blocks. Fire baked bricks would have been the best alternative for this but since the same was not available, stones were used

instead. This fireplace was built in such a way that the metallic trough would sit on a stone jiko 1 foot high fitting well, with the rare end closed to minimizing heat loss during firing. Figure 2 shows the assembly.

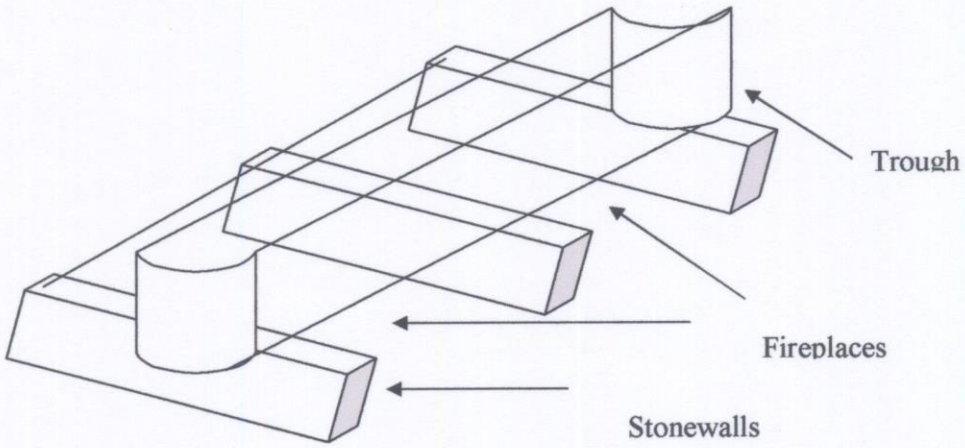

Figure 2. Trough and fireplace

3.3. Chemicals

An anti termite pesticide (Gladiator) was mixed with used engine oil at a ratio of 1 litre to 500 litres and used as the chemical for treating the wood. Firewood was used as fuel for the boiling process. Enough chemical was poured into the trough and posts lowered in slowly avoiding chemical splashing. Each charge took about 45 minutes boiling in the boiling chemical.

Gladiator itself is a termiticide, aimed at treating timber by protecting it against attack from termites/ants, and other pests with a tendency of boring dry timber, thus reducing its strength properties. Insects (borers) usually attack the sapwood for it is softer as compared to the heartwood, which is a mature part of the stem. It is this sapwood that is targeted for treatment. As the posts are boiled into the mixture, liquid gladiator penetrates into the sapwood along side the hot oil, making it resistant to any form of insect attack.

In addition to the used oil being a carrier of the anti termite, it also has other important functions in the wood. These include;

i. Protecting the sapwood that is rather juvenile and more porous from the weather conditions especially moisture. Rains and hot sun makes the sap wood wear out quickly.
ii. Oil reduces the rate of evaporation of the chemical during boiling, hence increases the possibility of absorption into the wood
iii. The oil also ensures that the chemical is not washed off the posts during the rainy season for its thick nature enables it remain almost permanent.

iv. It also increases the volume of the solution to accommodate several posts when being boiled.

3.4. Other Requirements

- The personnel involved need to be equipped with heavy duty leather and heavy duty plastic hand gloves and gas masks during their working time. Boiling oil/chemical produces poisonous gases and the use of gas masks should be enforced. Posts from boiling oil are hot and should be handled with care to avoid burns from splashing oil and the hot posts.
- Inclined posts need to be kept in place for sufficient time to allow all the excess chemical to drain out so as to save it for re-use.
- Treated posts are poisonous and are stored in safe places to minimize environmental effects due to the leaking chemicals.

After boiling, hot posts were removed by use of metallic hooks and transferred into another trough where they were inclined to cool down and drain excess chemical. They were then transferred to a storage yard. Treated posts were allowed at least 7 days for chemical to completely sink in to the wood and to stabilize before being transferred to the fencing area.

Plate 3: The team on the right removing treated poles from the trough while on the far left posts being inclined to cool down and drain excess chemical.

Plate 4: The team removing posts from boiling oil n the foreground already treated posts arranged to season in the middle ground while un- treated posts lie on the far right.

The treatment process requires concentration and proper coordination. Any slight mistake would lead to a bad accident considering that both the oil and the posts being removed are very hot. Reluctance on the side of supervision could lead to a situation whereby the crew can end up dipping the posts in the oil for only a shorter period of time and then remove them in order to achieve the daily target faster, or to be seen to have treated more of post in a day. Quality was therefore maintained by ensuring that commitment and supervision was to the maximum at every stage.

Plate 5: Treated posts well seasoned ready for the fencing.

4.0. Results

The process continued until the eighth trip is done which took averagely 8 working hours per day with a few minutes spared for tea and lunch break. By the end of each day, having treated averagely 10 posts per trip, and 8 trips per day, the average number of posts treated was 80. At the end of the exercise, a total of 4658 poles were treated.

4.1. Cost of Production.

Basing on the above information, the cost of treating 1 post was calculated as, the amount of money used in to the whole activity, divided by the number of poles treated, but remembering that the cost of un-treated posts and fuel wood was free from the Forest Department. It was somehow tricky to cost the two items, and therefore this may end up lowering the final cost of treating one post. In this case therefore, only the cost of treating was calculated.

One treatment position (jiko) was managed by six casuals at every one time.

Money spent ÷ number of posts treated = Treatment cost per post.

Kshs 300,000 ÷ 4,658 = **Kshs 64.41** per treated post. This is the cost of treating 1 debarked post. Other costs are not included. They are costs for cutting, transporting and debarking of the posts.

If a farmer was to invest in pole treatment as an income generating activity (IGA), the cost of production will have to be higher keeping in mind the price for fuel wood and the un-treated posts.

4.2. Estimated amount of fuel wood for the process.

Fuel wood used throughout the activity was collected from the material left after the posts were cut. These included branches, crooked parts and those that were smaller than the

size to be treated. A stack of fuel wood lasted at least 7 days. The treatment period took averagely 58 working days, the amount of fuel wood used for the whole process was estimated as 58 days ÷ 7 = 8.3 stacks. This could form a basis on which the cost of fuel wood can be calculated in areas where the cost of the fuel is known.

4.3. Challenges.

The implementation of this activity faced some challenges that made it somehow slow to accomplish. The challenges included the following.

1. Un-availability of used-oil in the market. This made it very expensive to go round the coastal (Malindi, Kilifi, and Mombasa) towns looking for as little as 5 and even 10 litres of the used oil. This was the main problem that led to the slow implementation and actual target achievement since it forced suspension of the operation several times until an amount that was economical for implementation was acquired. At some point, as few as 5 to 6 posts were treated in the trough at a time instead of the expected 10 or 11.
2. Sometime, the used oil could come mixed with some water, which made that the mixture would be heated for along time for the water to evaporate and leave behind pure oil for use.
3. Permanent leakage of one of the treatment troughs resulted in using only one trough hence making the treatment process take double the number of days it was expected to take.
4. There was interference by the rains in May and June that are the coastal rainy months for the process extended up to end of June, making it slower to operate effectively.
5. The type of posts provided for treatment was from an old mature *Eucalyptus camaldulensis* plantation. Penetration is usually easier and faster in young juvenile wood than the old one. This forced the lengthening of the treatment time.
6. A lot of time was spent sorting out the right size posts from the crooked and oversize ones due to improper sizing by the logging team.

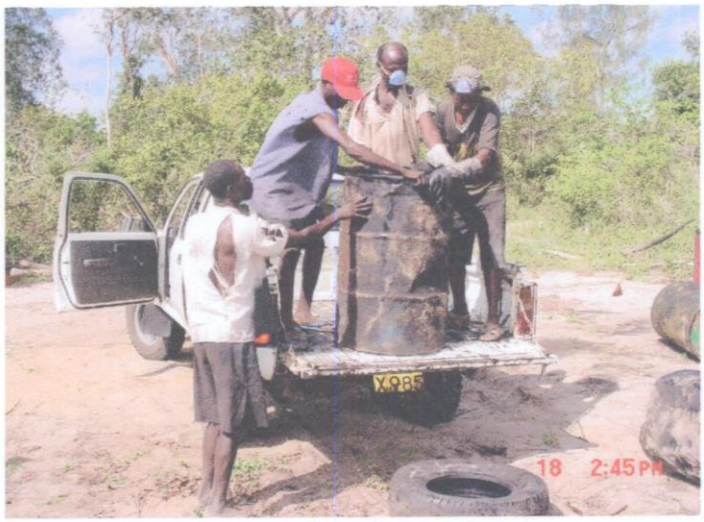

Plate 6: Delivery of a tank of used oil to the treatment site.

4.4. Number treated per phase (Output).
Using the first phase allocation that was Kshs 150,000, the team managed to treat 2,066 poles, during the 2nd quarter (October- December) 2005, which was followed by 2,592 poles during the second phase that was in the 4th quarter (April-June) 2006. This totals to 4,658, up from the targeted 4,500 posts.

4.5. Monitoring of the posts treated in 2003.
Monitoring was also done to ascertain and check on the performance of the posts treated in the year 2003. 80 posts were sampled from Kakuyuni to Mida area and subjected to different conditions namely,

i. Young (juvenile wood) posts in an open area.
ii. Mature heartwood also in an open area.
iii. Young (juvenile wood) under wet conditions.
iv. Mature heartwood under wet conditions.
v. Young (juvenile wood) under swampy conditions.
vi. Mature heartwood under swampy conditions.
vii. Posts exposed to termite prone conditions on an anthill.

From direct observation, all the categories of sampled posts looked still very strong. However, young (juvenile wood) posts showed some form of cracks at the pith indicating some form of early damages due to exposure to sunshine and rainfall. By March this year, these posts were 3 years old, and monitoring will go on every year until they are 15 years old. This is expected to generate data that will be useful in promotion of this method on the farm level.

5.0. CONCLUSION AND RECCOMENDATION.

5.1. Conclusion.
Pole treatment by boiling in used oil is a viable project which one can venture in especially in areas where Eucalyptus trees are growing and where there is a high demand for fencing posts. This can be done by starting as a small-scale enterprise and enlarging as demand dictates.

5.2. Recommendations.
The method used is good although it needs to be researched on further to

i. Control air pollution from the chemical smell, which was being felt a radius of 1 km from the treatment site especially during the windy days.
ii. Reduce the amount of fuel wood used.
iii. Increase the daily out put to reduce the cost of production.
iv. Reduction of potential accidents from spillovers of boiling oil. A pulley system could be invented to reduce the potential accidents.

APPENDICES

APPENDIX 1. List of plates

Cover plate: One team member makes fire as the rest relax waiting for the time of removal of the treated posts.

Plate 1: The solar fence on the left with a maize plantation just adjacent to it on the right.

Plate 2: A KEFRI officer giving instructions on how to mix the chemical with used oil just before the treatment exercise started.

Plate 3: The team prepares to remove treated posts from the boiling treatment tank.

Plate 4: A team member on the fore ground demonstrates manually how the job is done.

Plate 5: Stacks of the already treated posts ready for use with the forest in the background

Plate 6: Removal of a tank of some used oil moments after the purchase.

Durability Observation Data for Arabuko-sokoke Solar Fence posts

Title: Monitoring Durability of fencing Poles.

Experiment code: FF/KR/25

Location: Arabuko sokoke forest- Malindi

Principal Investigator: Muthike G. M., KEFRI-Karura

Collaborators: J. K. Githiomi, Centre Director- KEFRI, Gede, KWS
Duration: Initial five years
Starting Date: Dec 03

Expected ending Date: Dec 08

Objectives: To make observations after every six Months for the first five years.

replicate	pole number	wood species	treatment	age	canopy	state	Date: 6/03 score	Date:12/03 score	Date: 06/04 score	Date: 06/05 score	Current Observation Date: 06/06 score
1	DaSM1	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
2	DaSM2	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
3	DaSM3	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
4	DaSM4	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
5	DaSM5	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
6	DaSM6	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
7	DaSM7	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
8	DaSM8	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
9	DaSM9	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
10	DaSM10	Euc.salig	Old Oil	Mature	Shaded	Damp	4	4	4	4	4
11	DaSJ1	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
12	DaSJ2	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
13	DaSJ3	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
14	DaSJ4	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
15	DaSJ5	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
16	DaSJ6	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
17	DaSJ7	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
18	DaSJ8	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
19	DaSJ9	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4
20	DaSJ10	Euc.salig	Old Oil	Young	Shaded	Damp	4	4	4	4	4

21	DaOM1	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
22	DaOM2	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
23	DaOM3	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
24	DaOM4	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
25	DaOM5	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
26	DaOM6	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
27	DaOM7	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
28	DaOM8	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
29	DaOM9	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
30	DaOM10	Euc.salig	Old Oil	Mature	Open	Damp	4	4	4	4	4
31	DaOJ1	Euc.salig	Old Oil	Young	Open	Damp	4	4	4	4	4
32	DaOJ2	Euc.salig	Old Oil	Young	Open	Damp	4	4	4	4	4
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77	DrSJ7	Euc.salig	Old Oil	Young	Shaded	Dry	4	4	4	4	4
78	DrSJ8	Euc.salig	Old Oil	Young	Shaded	Dry	4	4	4	4	4
79	DrSJ9	Euc.salig	Old Oil	Young	Shaded	Dry	4	4	4	4	4
80	DrSJ10	Euc.salig	Old Oil	Young	Shaded	Dry	4	4	4	4	4