

IMPACTS OF CHARCOAL PRODUCTION ON ENVIRONMENT AND SPECIES PREFERENCE IN YAQSHID DISTRICT MOGADISHU, SOMALIA.

ABSTRACT

Rangelands have been degraded in Somalia as a result of trees cutting or removal to supply the rising demand for charcoal. Charcoal is a common home fuel, and earnings from its commerce. Its production has resulted in deforestation and environmental deterioration. The objective of study was to determine the Impacts of charcoal production on the environment and identification of plant species utilized in charcoal production in charcoal trade Yaqshid district, Mogadishu Somalia. Methods: The study's design was descriptive, particularly cross-sectional. The target population was 86, Seventy participants were purposefully chosen among the charcoal traders, and the data was analyzed using SPSS (version 20), descriptive statistical tools, and Microsoft Excel 2013 for charts. Results: The charcoal production is one of the leading causes of deforestation, with average mean 1.51 and Standard deviation of 0.959 out of 5. Land degradation caused by charcoal production in the environment, with average mean 1.89 and Standard deviation of 0.956 out of 5. Although charcoal production results in the loss of biodiversity. *Acacia bussei* (Galool), *Acacia tortilis* (Qurac), *Acacia nilotica* (Tugaar), *Acacia Senegal* (Cadaad), *Terminalia prunioides* (Hareeri), and *Prosopis Julifora* (Ali gorob, Geed gaal, garanwaa) were the most commonly used trees for charcoal production. Conclusion: Due to a lack of availability and the high cost of cooking gas, demand for charcoal is increasing. As a result, the government should provide a steady supply of cooking gas at a minimum cost. This will ensure that households had access to cooking gas and thus dependent on forest will also be reduced which will be helpful in environment protection.

Keywords: Charcoal, Environment, Species, preference, Somalia.

I. INTRODUCTION

Charcoal is a reliable, accessible, and inexpensive source of energy for many urban poor communities. Even if electricity and gas are the most preferred cooking fuels in metropolitan areas, most impoverished households cannot afford both the energy resources and the devices needed to use them. As a result, many homes resort to burning kerosene or charcoal. Charcoal is a common home fuel, and it is a source of income for small charcoal traders. Its production has resulted in deforestation and environmental deterioration. The removal of the protective tree layer, for example, increases the vulnerability of the underlying soil to erosion by exposing it to agents such as desiccating winds and strong rains [1].

Charcoal production hastens desertification by reducing the quantity of land available for cultivation or grazing, as well as driving inhabitants out of regions that have become uninhabitable after charcoal producers have cut down all the trees, and in urbanization, people can intentionally cut down trees for habitation, and desertification is accelerated. [2]. Deforestation also reduces biodiversity because species that rely on tree groves are unable to live in the absence of them. Rangelands have been degraded in Somalia as a result of trees cutting or removal to supply the rising demand for charcoal [2]. Acacia plant species are losing 5% of their population each year, according to a new FAOSWALIM (2013), report in Puntland state Somalia. Another SWALIM study anticipated decline in plant cover in the Jilib Area, middle Juba, within a short period (2011-2013), a trend that is seen throughout Somalia [12].

By keeping in view all these facts in mind, research was carried out to determine the effect of charcoal production on the environment and identification of plant species utilized in charcoal production, in the Yaqshid region of Mogadishu, Somalia, this district has charcoal market.

II. LITERATURE REVIEW

Charcoal is a soft, fragile, lightweight, black, and porous substance that mimics coal, according to FAO (2017) [3]. Burning charcoal is one of the oldest chemical processes known to man. From a policy aspect, challenges connected to household energy choice and transitions are crucial for a number of developing countries, including Somalia. Many of these countries call for efforts to encourage households to adopt alternatives that will result in more efficient energy consumption and less negative environmental, social, and health consequences [13].

Efforts are still being made to improve the efficacy of charcoal morphological analysis for identifying fuel types and reconstructing fire regimes. By incinerating known plant materials sourced from American prairie, tropical, and Arctic ecosystems in the laboratory, Mustaphi, & Pisaric, (2014), Crawford and Belcher (2014), and Pereboom et al. (2020) conducted morphology measurements of the length, aspect ratio (length / width), and size distribution of charcoal particles. Longer fragments are graminoids, whereas shorter fragments come from wood, bushes, and leaves, according to the researchers [4][5][6].

As a result of the deforestation and lack of replanting, the *Acacia bussei* was added to the Red List of vulnerable species maintained by the International Union for Conservation of Nature. Pastoralists have relied on this evergreen, drought-tolerant indigenous tree for fodder and drought resistance for years. The *Acacia bussei*, on the other hand, is becoming an unfeasible source of feed as demand for charcoal rises. Many pastoralists' livelihoods have been compromised as a result of this. The losses incurred as a result of such recurrent droughts and in future will continue to expand: Somalia was placed 7th out of 233 countries and regions in a global evaluation of climate change risk [7].

In Nigeria, Adeniji, et al. (2015) they found traditional method of charcoal production (earth mound kiln and earth pit kiln) is used in the study area [8]. (22) 65% of the producers use earth mound kiln method while (12) 35% use earth pit kiln method. In Brazil were used two methods of charcoal production methods such as traditional "hot-tail" kilns and higher-yielding metal "container" kilns (Bailis, et al. 2013) [9]

In Somalia, charcoal is made in 'kilns,' which are ovens. The felled trees are stacked, coated in iron sheets, and buried in sand. The sand and sheets are removed after the oven has burned for up to a week. The wood is subsequently processed into charcoal, which is then packed into bags/sacks for export or home usage (typically using rails and 'dhows,' Indian Ocean lateen-rigged ships with one or two masts). Despite a UN ban on charcoal export, large amounts are transported to the Arabian Peninsula each year. (FAO, 2017)[3]

III. METHODS

3.1. Study design

The study adopted a descriptive approach where cross sectional data was used to measure the outcomes or effects of charcoal production on the environment and use in the study area, so that we could measure environmental changes and charcoal use for selected respondents.

3.2. Study Area

The study was carried out in Yaqshid District, Mogadishu, Somalia. Yaqshid District is located in southern Benadir region of Somalia, it has latitude 2° 3' 27.381"N and longitude 45° 20' 50.1512"E. It is neighbored by Dayniile District to the west. It is also bordered to the east by Karan District and to the north by Hilawa District. Towfiq charcoal market, is the largest collection of charcoal vendors, dealers, and purchasers were all present, is located in this district, Mogadishu Somalia.

3.3. Sampling methods

Purposive sampling technique was used in the study sample. Charcoal sellers were visited in Yaqshid district; the Towfiq market selected for sites where charcoal traders are more dominant. The Target population was 86, with 95% confidence interval and sample size was seventy (70), were purposively distributed the charcoal traders, because of overcrowding and busy condition in market, not suitable to take probability sampling. Researchers listed the Names of Plants in Somalia language, which were later on represented by the researcher in scientific names.

3.4. Data Analysis

Data analyzed using SPSS (version 20) for Descriptive statistics tools were used to analyze the variables and excel 2013 © Microsoft were used for charts. Demographic variables were including first Variables sex, age, educational status, and marital status, were analysed after which impact of charcoal making on the environments was assessed. And third variables were includes listing Common trees in the study area were also presented.

IV. RESULTS

4.1. Demographic characteristics of respondents

The demographic characteristics of the seventy (70) respondents are shown in Table 1. The majority of the respondents, 84.3%, were Female, which is the outcome of non-randomly selected respondents using standard purposive sampling. 78.6% of the respondents are between the ages of 36 - 45 (44.3%), and ages of 26-35 (34.4%). 60% of the respondents were married while 40% single. 94.3% of respondents have obtained Secondary education, while 5.7% have completed Primary school, whereas the national average of primary was 35.5 [14].

Table 1. Demographic data

| Sex | | | | |
|------------------|---------------------|-----------|---------|--------------------|
| | | Frequency | Percent | Cumulative percent |
| Valid | Female | 59 | 84.3 | 84.3 |
| | Male | 11 | 15.7 | 100.0 |
| | Total | 70 | 100.0 | |
| Age | | | | |
| Valid | Age 15 - 25 | 15 | 21.4 | 44.3 |
| | Age 26-35 | 24 | 34.3 | 78.6 |
| | Age 36 - 45 | 31 | 44.3 | 100.0 |
| | Total | 70 | 100.0 | |
| Marital | | | | |
| Valid | Married | 42 | 60.0 | 40.0 |
| | Single | 28 | 40.0 | 100.0 |
| | Total | 70 | 100.0 | |
| Education | | | | |
| Valid | Primary education | 4 | 5.7 | 5.7 |
| | Secondary education | 66 | 94.3 | 100.0 |
| | Total | 70 | 100.0 | |

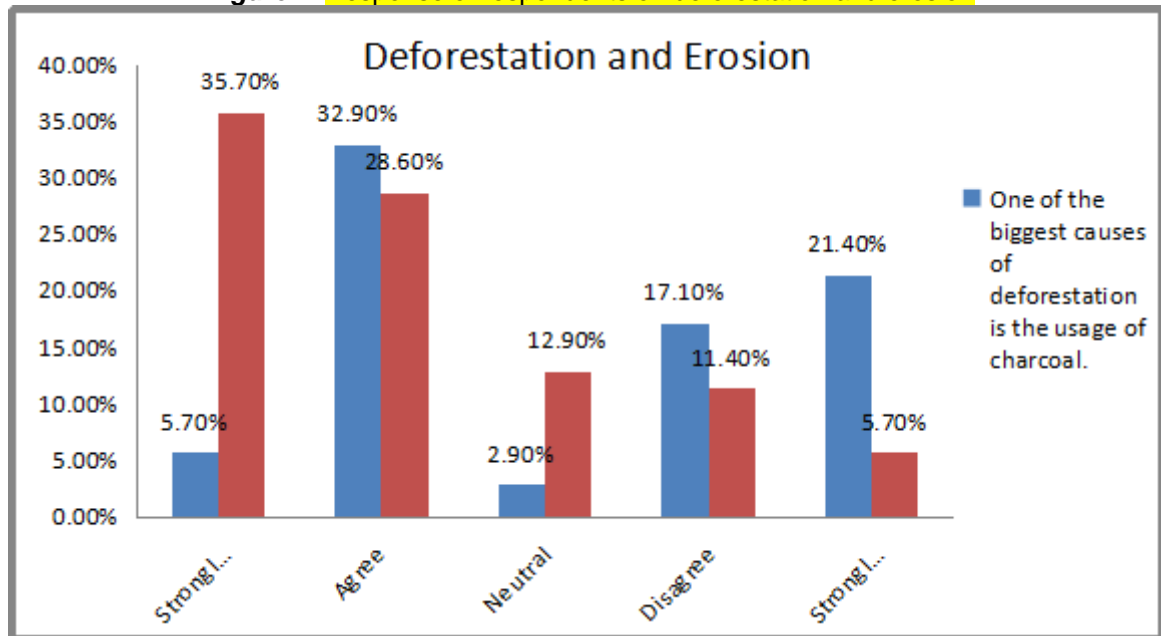
UNDER

4.2. Impacts of charcoal production on environmental

As illustrated in Figure 1, its well-known fact that charcoal production causes deforestation and erosion. According to 32.9 percent of respondents agreed, charcoal production is one of the leading causes of deforestation with average mean 1.51 and Standard deviation of 0.959 out of 5. Whereas 35.7 percent strongly agreed that charcoal production causes soil erosion after deforestation, and 28.6% agreed that soil erosion can happen after deforestation with average mean 2.00, and standard deviation of 1.142 out 5. Soil color became darkened, soil-surface temperature increased and higher infiltration rates were measured on charcoal-site soils, as mentioned by Oguntunde *et al.* (2008), in Ghana [10]

UNDER PEER REVIEW

Figure 1. Response of respondents on deforestation and erosion

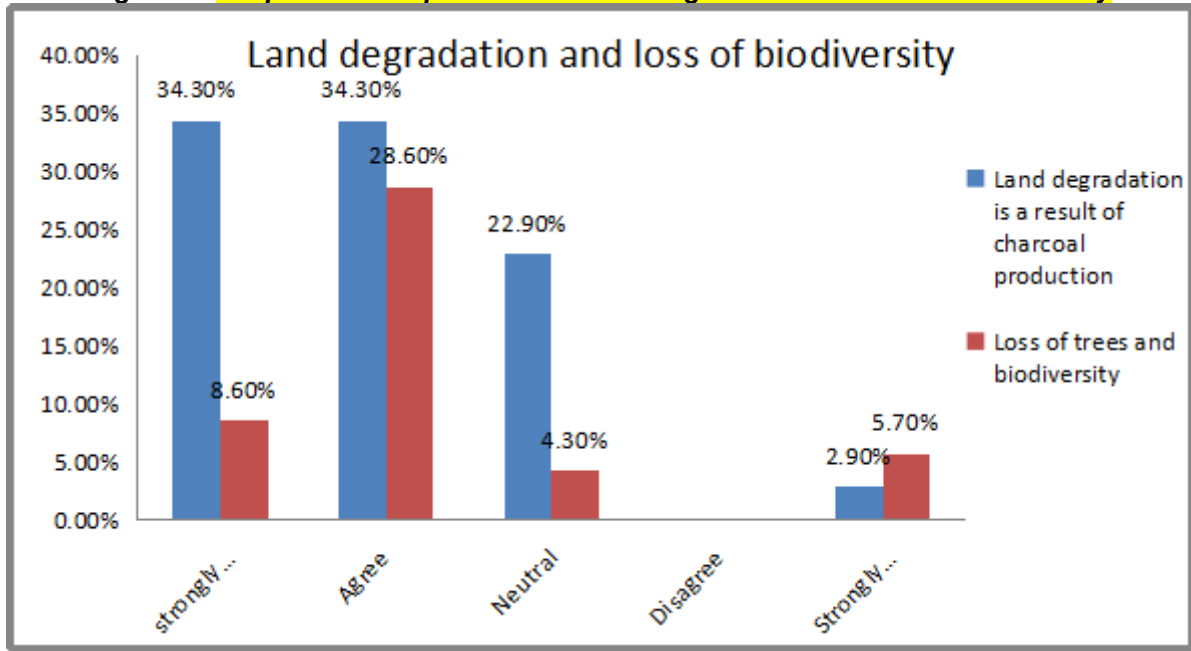


UNDER PEER REVIEW

Deforestation and erosion are two impacts of charcoal production in general, as seen in Figure 2. Land degradation caused by charcoal production in the environment, according to 34.3% of respondents who strongly agreed and 34.3% that agreed with average mean 1.89 and Standard deviation of 0.956 out of 5. Although 28.6% of respondents agreed that charcoal production results in the loss of Plants and animal biodiversity, 22.9% of respondents were neutral with average mean 1.59 and Standard deviation of 0.825 out of 4.

UNDER PEER REVIEW

Figure 2. Response of respondents on land degradation and loss of biodiversity



UNDER PEER REVIEW

In order to ensure the sustainability of natural resources, researchers asked respondents about the impact control methods on charcoal production, as illustrated in Figure 3. According to 20% of respondents who strongly disagreed and 17.1% who disagreed, replacing trees is an unnecessary strategy to protect the environment with average of mean of 2.70, and Standard deviation of 1.526 out 5. This shows that only a small percentage of the respondents were aware of the environmental sustainability and benefits of replanting trees. Despite the fact that 27% of respondents strongly thought that tree replanting is unnecessary.

UNDER PEER REVIEW

Figure 3. Respondent's response on tree planting

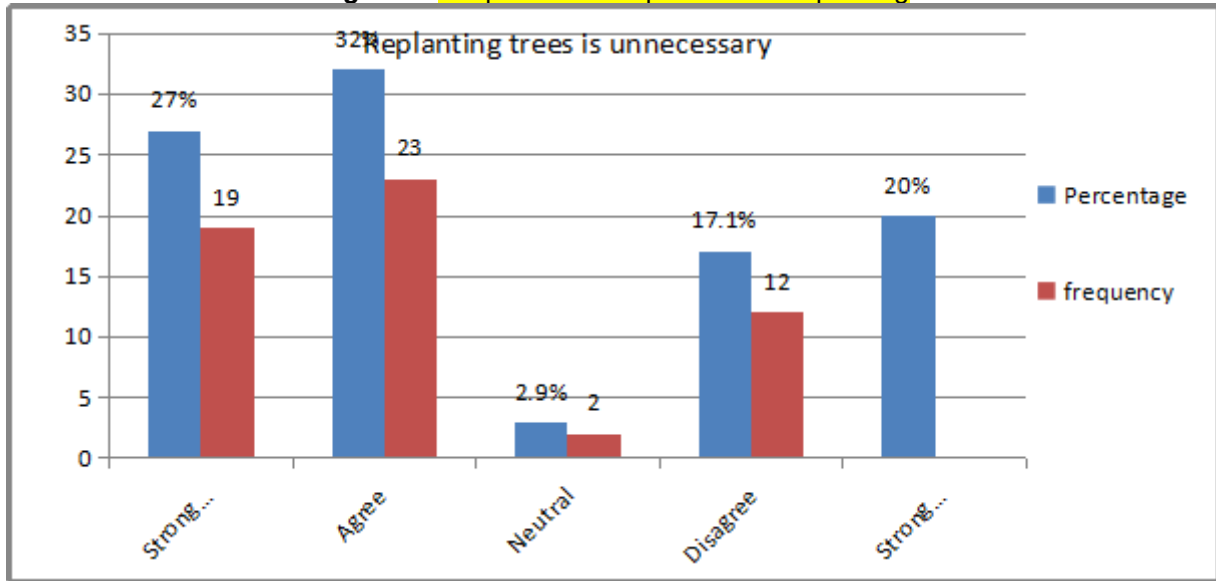
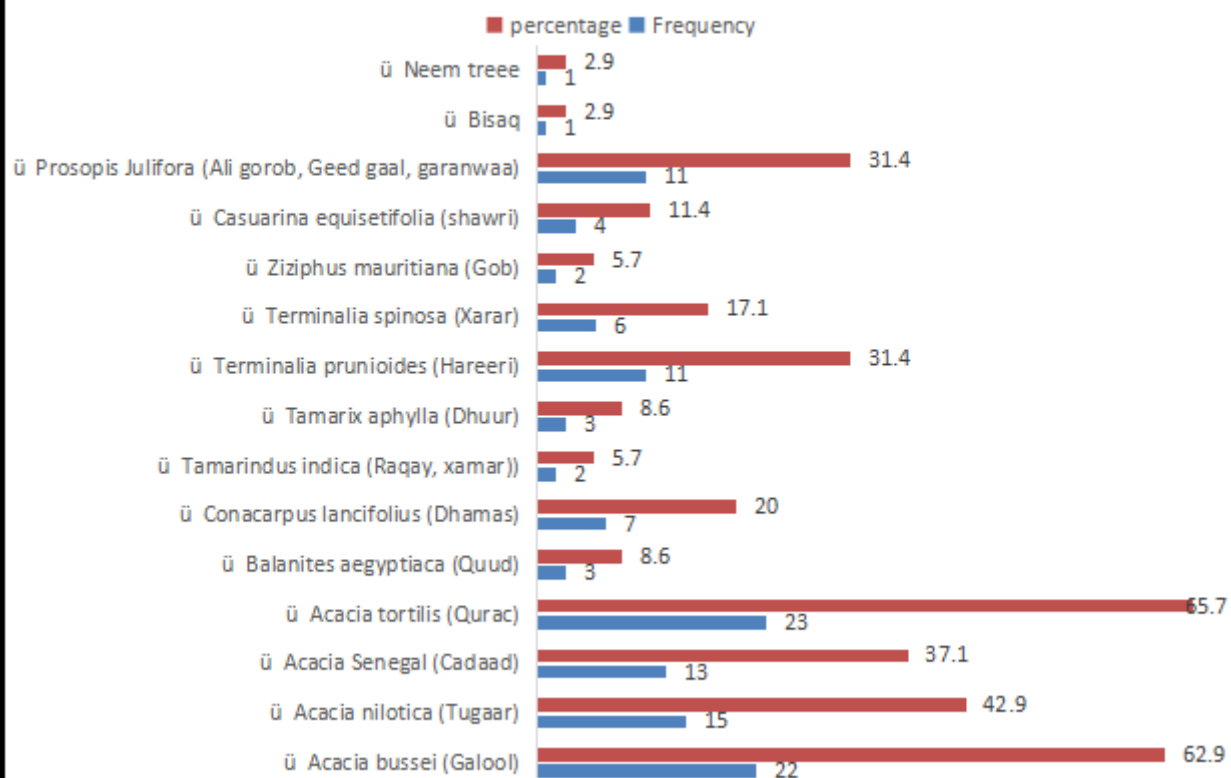


Table 2. Descriptive statistics

| Descriptive Statistics | | | | | |
|--|----|---------|---------|------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| One of the biggest causes of deforestation is the usage of charcoal. | 70 | 1 | 5 | 1.51 | .959 |
| Erosion is caused by the creation of charcoal. | 70 | 1 | 5 | 2.00 | 1.142 |
| Land degradation is a result of charcoal production | 70 | 1 | 5 | 1.89 | .956 |
| Charcoal production can cause loss of Biodiversity of trees and animals | 70 | 1 | 4 | 1.59 | .825 |
| Replanting trees is unnecessary because forests can regenerate on their own. | 70 | 1 | 5 | 2.70 | 1.526 |
| Valid N (list wise) | 70 | | | | |

Figure 4. Common plant Species preferences

Common Plant species preference



UNDER PEER

A list of tree species employed for charcoal production in the study area is shown in Figure 4. *Acacia bussei* (Galool), *Acacia tortilis* (Qurac), *Acacia nilotica* (Tugaar), *Acacia Senegal* (Cadaad), *Terminalia prunioides* (Hareeri), and *Prosopis Julifora* (Ali gorob, Geed gaal, garanwaa) are the most commonly used trees for charcoal production. and Other species like *Conacarpus lancifolius* (Dhamas), *Terminalia spinosa* (Xarar), *Casuarina equisetifolia* (shawri), *Tamarix aphylla* (Dhuur), *Balanites aegyptiaca* (Quud), *Tamarindus indica* (Raqay, xamar), *Ziziphus mauritiana* (Gob), *Terminalia Orbicularis* (Bisiq), and *Azadirachta Indica* (Neem tree) are only utilized to varying degrees.

Figure 4 shows that 22 (62.7%) of respondents listed *Acacia tortilis* (Qurac) as one of the tree species used for charcoal production, 23 (65.7%) listed *Acacia bussei* (Galool), 15 (42.9%) listed *Acacia nilotica* (Tugaar), 13 (37.1%) listed *Acacia Senegal* (Cadaad), and *Terminalia prunioides* (Hareeri) and *Prosopis Julifora* (Ali gorob, Geed gaal, garanwaa), have 11 (31.4%), were listed in two equal percentages.

V. CONCLUSIONS AND RECOMMENDATIONS

The charcoal production is now widespread in many regions of Somalia, particularly in Mogadishu, following intense pressure from Al Shabab in 2016. They fled and began charcoal production in and around Mogadishu, Somalia's capital city. The research began with a survey to determine community perceptions on impact of charcoal production on environment.

The respondents' preference for charcoal as a cooking fuel was strong, and they believed that charcoal had a low environmental impact, resulting in a high demand for charcoal use and production. With an average mean of 1.51 and a standard deviation of 0.959 out of 5, 32.9 percent of respondents agreed that charcoal production is one of the leading causes of deforestation in the environment. 35.7 percent strongly agreed that charcoal production causes soil erosion after deforestation with average mean 2.00, and standard deviation of 1.142 out of 5. The both have figure 1 of which have major impacts on charcoal production that the respondents knew very well

Figure 2 illustrates Land degradation caused by charcoal extraction in the environment has been witnessed by the respondents, who have seen trees cut down and land used for charcoal production. So, when compared to other sites, 34.3 percent of respondents strongly agreed and 34.3 percent agreed that charcoal producing areas have substantial soil degradation. Although 28.6% of respondents believed that charcoal manufacturing reduces tree and animal biodiversity, this suggests they have little clue how soil moves when trees are taken down.

Figure 3 shows that replanting trees is an unneeded way to safeguard the environment, with 20% strongly disagreeing and 17.1 percent disagreeing. With an average of 2.70 and a standard deviation of 1.526 out of 5, this indicates that only a tiny percentage of the respondents were aware of the environmental sustainability benefits of replanting trees. In figure 4. The commonest plant species that respondents mentioned are includes *Acacia bussei* (Galool), *Acacia tortilis* (Qurac), *Acacia nilotica* (Tugaar), *Acacia Senegal* (Cadaad), *Terminalia prunioides* (Hareeri), and *Prosopis Julifora* (Ali gorob, Geed gaal, garanwaa). That other minor plant species used in charcoal production that the respondents agreed were includes *Conacarpus lancifolius* (Dhamas), *Terminalia spinosa* (Xarar), *Casuarina equisetifolia* (shawri), *Tamarix aphylla* (Dhuur), *Balanites aegyptiaca* (Quud), *Tamarindus indica* (Raqay, xamar), *Ziziphus mauritiana* (Gob), *Terminalia Orbicularis* (Bisiq) and *Azadirachta Indica* (Neem tree or Geed Talaal).

The respondents have more knowledge about deforestation, soil erosion, and land degradation, but less knowledge about how charcoal can lead to a loss of biodiversity in trees and animals, as well as a strategy for tree management that involves replanting trees and giving them time to recover and grow more vigorously. Due to a lack of availability and

the high cost of cooking gas, demand for charcoal is usually strong. As a result, the government should provide a steady supply of cooking gas at a low cost. This will ensure that households had access to cooking gas and thus dependent on forest will also be reduced which will be helpful in environment protection. To ensure their survival, the government should start providing alternative businesses to charcoal sellers. Woodland management, unregulated tree harvesting without replacement, and making policies and strategic plant vast tree plantings should all be addressed.

VII. REFERENCE

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APPENDIX

Table 3. Replanting trees is unnecessary because forests can regenerate on their own.

| Replanting trees is unnecessary because forests can regenerate on their own. | | | | | |
|---|-------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Strongly Agree | 19 | 27.1 | 27.1 | 27.1 |
| | Agree | 23 | 32.9 | 32.9 | 60.0 |
| | Neutral | 2 | 2.9 | 2.9 | 62.9 |
| | Disagree | 12 | 17.1 | 17.1 | 80.0 |
| | Strongly Disagree | 14 | 20.0 | 20.0 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

Table 4. Erosion is caused by the creation of charcoal.

| Erosion is caused by the creation of charcoal. | | | | | |
|---|-------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Strongly Agree | 31 | 44.3 | 44.3 | 44.3 |
| | Agree | 20 | 28.6 | 28.6 | 72.9 |
| | Neutral | 9 | 12.9 | 12.9 | 85.7 |
| | Disagree | 8 | 11.4 | 11.4 | 97.1 |
| | Strongly Disagree | 2 | 2.9 | 2.9 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

Table 5. Land degradation is a result of charcoal production

| Land degradation is a result of charcoal production | | | | | |
|--|----------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Strongly Agree | 30 | 42.9 | 42.9 | 42.9 |
| | Agree | 22 | 31.4 | 31.4 | 74.3 |
| | Neutral | 16 | 22.9 | 22.9 | 97.1 |

| | | | | | |
|--|-------------------|----|-------|-------|-------|
| | Strongly Disagree | 2 | 2.9 | 2.9 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

Table 6. Charcoal production had double effects loss of plant and animals

| Charcoal production had double effects loss of plant and animals | | | | | |
|---|----------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Strongly Agree | 41 | 58.6 | 58.6 | 58.6 |
| | Agree | 20 | 28.6 | 28.6 | 87.1 |
| | Neutral | 6 | 8.6 | 8.6 | 95.7 |
| | Disagree | 3 | 4.3 | 4.3 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

Table 7. One of the biggest causes of deforestation is the usage of charcoal.

| One of the biggest causes of deforestation is the usage of charcoal. | | | | | |
|---|-------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Strongly Agree | 49 | 70.0 | 70.0 | 70.0 |
| | Agree | 12 | 17.1 | 17.1 | 87.1 |
| | Neutral | 5 | 7.1 | 7.1 | 94.3 |
| | Disagree | 2 | 2.9 | 2.9 | 97.1 |
| | Strongly Disagree | 2 | 2.9 | 2.9 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

Table 8. Species preference for charcoal production

| Tree species | Local (names) | Frequency | Percentage |
|-----------------------------------|--------------------------------|------------------|-------------------|
| <i>Acacia bussei</i> | Galool | 22 | 62.90% |
| <i>Acacia nilotica</i> | Tugaar | 15 | 42.90% |
| <i>Acacia Senegal</i> | Cadaad | 13 | 37.10% |
| <i>Acacia tortilis</i> | Qurac | 23 | 65.70% |
| <i>Balanitesaegyptiaca</i> | Quud | 3 | 8.60% |
| <i>Conacarpuslancifolius</i> | Dhamas | 7 | 20% |
| <i>Tamarindusindica</i> | Raqay, xamar | 2 | 5.70% |
| <i>Tamarixaphylla</i> | Dhuur | 3 | 8.60% |
| <i>Terminaliaprunioides</i> | Hareeri | 11 | 31.40% |
| <i>Terminaliaspinosa</i> | Xarar | 6 | 17.10% |
| <i>Ziziphusmauritiana</i> | Gob | 2 | 5.70% |
| <i>Casuarinaequisetifolia</i> | shawri | 4 | 11.40% |
| <i>ProsopisJulifora</i> | Ali gorob, Geed gaal, garanwaa | 11 | 31.40% |
| <i>Bisaq</i> | Bisaq | 1 | 2.90% |
| Azadirachta Indica (Neem tree) | Geed talaal | 1 | 2.90% |