

# The Charcoal Sector

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## Odweyne Region-- Somaliland



# The Charcoal Sector in Odweyne Region—Somaliland

Candlelight for Education, Health and Environment

SAVE The Children

**Final draft**

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A. E. Abdullahi  
Hargeisa, Somaliland

## Abstract

Odweyne region which lies in the Haud Plateau of Somaliland has extensive rangelands along with crop growing areas and is a major producer of livestock in the country. A study was conducted in August 2012 in Odweyne region to assess charcoal production, consumption, and environmental impact based on interviews with relevant groups as well as field observations. Charcoal is produced using the earth pit-kiln method which is considered an inefficient system. Producers sell their charcoal to wholesalers who transport it on big trucks to the major urban centers in Somaliland. This charcoal is sold in markets by retailers who pass it to consumers. Most charcoal produced in the region is exported to Hargeisa and Burao, which have large urban populations. Only charcoal and wood are used for cooking and heating in the region. Seventy-five percent of Odweyne town households use charcoal and 25% use wood for cooking, whereas almost all rural residents use wood for the same purpose.

The region is considered the biggest producer of charcoal in the country and this sector is likely second to livestock as a means of earning income and livelihoods for Odweyne communities. The charcoal sector generates approximately one million US dollars annually for the communities in the region according to estimates from this survey. The government in the region issues neither licenses to charcoal producers, nor permits to trucks transporting charcoal and has attempted at halting this business on several occasions in the recent past with no success.

Improved cooking stoves are not available in the region and households use the common metallic one. Introduction of alternative fuels requires large financial investments and cannot replace the more affordable charcoal in the foreseeable future. Charcoal is a vital energy source for most urban residents in the country and banning its production and trade may become counter-productive as some African countries have experienced. Instead, the authorities, communities, and NGOs in the region should focus on how to utilize best the tree resources in the region so that the most benefit goes to the communities in the region while ensuring sustainability at the same time.

Adoption of sustainable charcoal production strategies, establishment of tree propagation centers, formation of charcoal producer association, promotion of improved stoves, and encouragement of private investment in the sector, are among the recommendations. Coordination of activities and programs by all actors including the resident community is essential, as isolated interventions are unlikely to succeed.

## 1.0 INTRODUCTION

### 1.1 Background

Some thirty years ago issues related to charcoal production, trade, and consumption in Odweyne district were insignificant and did not attract the attention of the public or government authorities. The reasons behind that low profile of the charcoal sector were the existence of huge, diverse, and extensive rangelands rich in plant communities including the native Acacia trees as well as in wildlife; the abundance of dead wood; the absence of overgrazing pressure; the low human population; and the sustainable utilization of forest and rangeland resources based on the then prevalent nomadic culture.

During the years since then, a gradual and sometimes abrupt shift in land use and natural resources utilization methods has led to the appearance of an intensive, if unorganized, charcoal production and trade in the now Odweyne region. The nomadic livestock herders are increasingly adopting a sedentary life style based on claiming and privatizing land as their own farms, quickly enclosing their newly acquired private land with thorny branches chopped from Acacia trees. Some natives to the region returning from overseas have joined the land grabbing culture and have fenced large areas in the region as private farms. Since the overwhelming majority of people living in Somaliland use charcoal for cooking and heating, the demand for charcoal has been growing steadily. This demand is fuelled by ever expanding urban centers in the country with simultaneously skyrocketing human populations. The increasing sedentary agriculture has also resulted in rangeland degradation and shortage of fodder for livestock, thus resulting in many men turning to making charcoal to earn some, though meager, income. Because formal employment is almost nonexistent in Odweyne region, young men find charcoal production the only task that can bring them some money. And they are doing this in large numbers. Unfortunately, many men resort to charcoal production only to pay for their daily khat consumption.

Use of charcoal for cooking is very widespread in developing countries, particularly in the African continent. However, charcoal production in many of these countries including Somaliland is unsustainable and threatens the natural base for agriculture. Moreover, unsustainable charcoal making adds to greenhouse gas emissions and contributes to global warming which further leads to climate change. In Somaliland, the Odweyne region is widely considered to be the most suitable area for livestock production with its extensive grazing plains and almost ideal temperature regimes. Charcoal production is changing the landscape of the region and the potential of its natural resources. Only a fraction of the charcoal produced in the region is consumed by its residents, while the bulk of the product is transported to and sold in the large urban centers, Burao and Hargeisa.

Charcoal production and trade are poor people's business and banning it is not reasonable and may even prove to be counter-productive. Thousands of Odweyne

region residents derive their livelihoods from charcoal. The charcoal problem should be approached with solid information at hand, and sustainable use of forest resources should be outlined and introduced. Solutions to the charcoal challenge should be based on full participation of all stakeholders and concerned groups. The reality is that charcoal is needed now and will be so for some time to come. We should find how best to utilize our forest resources in sustainable methods without depleting our tree stocks and rangeland resources.

Many studies have been carried out on charcoal production and consumption in the African continent (NL Agency, 2010; Kambewa et al., 2007; Mugo and Ong, 2006; van Beuring et al. 2007; Uganda Ministry of Energy, undated). Some studies have also been conducted in Somaliland and Somalia (Guleed, 2012; Academy for Peace and Development, 2006; Ministry of Environment and Rural Development, 2004; Smale et al. 1984).

This report summarizes information gathered from the region through face-to-face interviews with stakeholders, households, charcoal producers, and charcoal retailers. The main findings are presented, alternative fuels discussed, and recommendations are put forward.

## **1.2. Objectives of the study**

The study aimed at the following objectives

- Determine the scale and importance of charcoal production, consumption, and trade in Odweyne region
- Identify the environmental impacts of the charcoal sector in Odweyne region
- Review the existing environmental policies and propose appropriate actions
- Identify alternative fuels to charcoal and/or improvements in charcoal use efficiency
- Put forward recommendations regarding sustainable biomass management options

The goal of the study is to highlight the real situation of charcoal production and consumption in the region including the social, health, and environmental consequences of the charcoal sector.

## **1.3. Limitations of the study**

A usual challenge for anyone conducting a study in Somaliland is the limited availability of data and publications and this case was not an exception. The time allocated to the study was rather brief, and in addition, coincided with the fasting month of Ramadan

when people are unavailable for interviewing during parts of the day, particularly in the afternoons.

Moreover, some relevant information on charcoal production could not be verified because it required controlled experiments, for instance the charcoal producers could not confirm the number of trees cut per 100 bags of charcoal. Finding the needed interviewees was not either a simple task as many were busy in their usual chores, while some individuals were suspicious about the intentions of the survey and were reluctant to comment.

#### 1.4. Description of the area

Odweyne region with an area of 8342 square kilometers is located in the Hawd Plateau of Somaliland and shares borders with Togdheer region on the east, Sahel region on the north, Maroodijeex region on the west, and Ethiopia on the south. The landscape is characterized by extensive flat or gently sloping plains interrupted by several dry rivers, which pour into larger rivers that eventually drain into the Red Sea in the Sahel region. The soils are predominantly sandy or sandy-loam in texture with high infiltration rates and low water-holding capacity. Consequently runoff is substantial after rainy events with significant potential for soil erosion. Strong winds blowing from the south in the summer aggravate the soil erosion scale in the area further depleting the land of its top fertile soil. Moreover, the soils in this semi-arid region are low in organic matter and are deficient in phosphorous and nitrogen. These two macronutrients are major factors limiting plant productivity in Somaliland.

The vegetation in the region is dominated by *Acacia* species with *Acacia tortilles*, *Acacia reficiens*, *Acacia bussei*, and *Acacia nilotica* being the dominant trees and diverse grasses and forbs. However, little remains of the original bush vegetation as this has been cleared for farming, both crop and livestock, as well as for large and dispersed human settlements. For instance, there are about fifty villages in the region, the majority of which are older than 20 years. The climate of the region is quite similar to those of other neighboring regions (except the much drier Sahel) of Somaliland, with rainfall averaging approximately 350 mm annually and potential evapotranspiration far exceeding precipitation. Most precipitation falls in the Gu season, and smaller amounts, despite yearly fluctuations, in Karan and Deyr seasons. Rain in the latter two seasons is not evenly shared in the region with Karan being more common on the western parts of the region and Deyr on the eastern parts.

Odweyne residents derive their means of living primarily from raising livestock, particularly sheep, goats, and camels, and to a lesser extent from cattle in crop producing areas. In the past, livestock were mainly grazed on public lands, but this type

of land has been steeply declining throughout the last three decades as can be confirmed by the elders of the communities in the region who have witnessed the land and other natural resources devolution. The shift in land use patterns has been steadily toward privatization for farming. Large areas in the region have been fenced as private livestock farms and/or put to the plow for crop production. Some communities are basically crop farmers such as Hahi (Xaaxi) and have been so for decades. These farmers utilize water flowing from other sites and converging in their land, thereby significantly recharging the soil moisture reserves enough to raise a field crop.

Demographically, the overwhelming majority of the population in Odweyne region are young people less than 30 years old, a situation that prevails not only in the rest of Somaliland but also in eastern Africa. Employment is extremely low and the youth have no means of earning income except to turn to hard tasks that pay little such as burning wood to produce charcoal or to sell khat. It is worth noting that the human population in the region is steeply increasing just as the case is in the IGAD region. The infrastructure in the region is still in its infancy with no tarmac roads or bridges for crossing the sandy dry rivers, Communication poses little challenge since many people, especially the youth, have access to mobile phones and can communicate with all continents. Many people in the region can read and write Somali language. This year seven students sat for the Secondary School completion exam.

## **2.0 Methodology**

### **Household survey questionnaire**

Sample households were surveyed in Odweyne town. The samples were chosen to represent members from each house category: small houses (two or fewer rooms), medium houses (three to four rooms), and large houses (five or more rooms). A systematic sampling was used involving every fourth house and changing directions while sampling. Forty-eight households were interviewed and the questionnaire administered is shown in the appendices.

### *Charcoal producer questionnaire*

Since the number of charcoal producers present in a village or town at any particular time is small due to their engagement in production in the bush, interviewing was based on their availability. Three charcoal producers were interviewed in Odweyne town in a detailed manner; charcoal producers in selected villages were interviewed together with village leaders and elders. The questionnaire used is included in the appendices.

### *Charcoal retailer questionnaire*

Charcoal retailers were mainly available in Odweyne town since wood rather than charcoal is used in villages in the region. Five charcoal retailers in Odweyne town were interviewed and the questionnaire employed is reported in the appendices.

### *Focus group discussion*

The focus group discussion involved community leaders, elders, and authorities in the area. This was an open discussion encompassing exchange of views and comments. The questionnaires utilized for members of village communities as well as those used for government authorities are shown in the appendices.

## **3.0 Results and Discussion**

### **3.1 Charcoal production**

#### *General background*

Traditional charcoal making is a very tedious operation and requires an intimate practical knowledge of the principles of combustion. Charcoal is produced from wood in a process called carbonization. Carbonization is the method of burning wood or biomass under limited air supply after which it breaks down into liquids, gases and charcoal. During the charcoal production process in the kiln, water, combustible gases, methanol, acetic acids and tars are driven off. At the end of this process what remains is the carbonized wood or charcoal.

#### *Source of raw materials*

All charcoal in Odweyne region is produced in the rural areas. This charcoal is produced mainly in communal lands, and a growing portion in private farms. The radius of the area from which wood is gathered is constantly increasing, with charcoal makers needing to travel further and further to obtain the wood. Travel distances to find the wood vary from location to location within the region. For example, charcoal producers in Odweyne town at present travel up to 15 km to find trees, whereas about five years ago this distance was about 7 to 10 km.

A few years ago, the charcoal makers were cutting trees selectively targeting the most desirable trees for charcoal making, particularly *Acacia bussei*. In contrast, at the

present cutting is nonselective and producers cut almost all types of trees for charcoal production: qudhac (*Acacia tortilles*), qansax (*Acacia reficiens*), kidi (*Balanites schilin*), maraa (*Acacia nilotica*), maygaag (*Boscia minimifolia*), and galool (*Acacia bussei*). The most common method of felling trees is by burning them at ground level while they are still standing. The trees are then chopped after they fall to the ground.

Selective cutting is less destructive than nonselective cutting in terms of tree conservation but has the potential of driving certain species to extinction. Charcoal producers in the region do not utilize tree branches after felling for charcoal and this is a source of wood wastage.

### *Charcoal production process*

At the present, the whole process of charcoal production from collecting wood to obtaining the final product takes about 32 days as reported by the charcoal makers in the region. About five years ago the same process used to take only 20 days. This prolonged time of charcoal making has been attributed to diminishing tree populations and increasing distances to the sites where trees are available.

Once the wood is loaded into the pit-kiln, charcoal is ready after three days. The major part of the time required to produce charcoal is consumed by felling trees and collecting wood. Donkey carts are usually employed to transport the wood to the kiln. The efficiency of converting wood to charcoal depends on the skill of the operator and the water content of the wood. After retrieving the charcoal from the kiln it is packed into standard bags and taken to the roadside for transport on trucks to urban centers. Three to five producers work together to burn wood in the kiln. They cooperate in all the phases of the production process. All producers consume khat while carrying out this work to, according to their explanation, stimulate their nerves and muscles and become more capable of completing this hard work. For the steps and activities involved in charcoal making see Table 3.1.

Table3.1. Steps and activities in charcoal making

Step	Activity
Raw material preparation	Felling of trees Cutting wood into short pieces Wood drying
Kiln building	Building of kiln base Loading wood into the kiln Kiln covering with sand
Carbonization	Ignite the wood Burning control Cooling phase
Packing and transport	Pack into bags Transport to village and/or roadside

## 3.2 Social and cultural aspects

### *Motives to produce charcoal*

The major reason getting people in the region to charcoal production is lack of alternative employment. Charcoal is a high-demand product that can be sold for cash in a short time. Charcoal making requires minimum capital input (axe, safety match, and a shovel) and labor is basically the major input. Labor in the region has zero opportunity cost. Producers collect their wood mainly from communal areas for free, but occasionally collect it from private farms after negotiating with the landowners. In the latter case, the charcoal maker pays the farmer one-third of the total value of charcoal produced.

Another significant reason for going into charcoal production, especially among young men, is the habit of khat consumption. Chewing the stimulant leaves and branches of khat (*Catha edulis*) imported from Ethiopia is a common custom in rural men in Odweyne region as well as in other rural areas of Somaliland. Since alternative sources of income are very limited in the region, charcoal production provides quick cash for those men who have to buy their daily khat needs. However, it should be noted that all charcoal producers in the region are khat consumers. One-third of these producers are in the charcoal business only to get cash to pay for their khat consumption, and have no families or dependents.

In addition, some crop farmers on the western areas of the region have joined the charcoal production occupation after their farms had been damaged by flood flashes.

These farmers see charcoal production as the only opportunity for earning cash to spend on the basic needs of their families.

Two groups of charcoal producers exist in the region, full time charcoal producers and occasional producers. However, the majority of producers belong to the full time group. Occasional producers have other significant sources of income such as larger herds of livestock or are crop farmers. This group only make charcoal in times hardships such as during the dry season or during drought episodes. While charcoal making is accepted today by rural people as a normal occupation, prior to the 1980s it was considered an inferior work (Box 1. Case study).

Often conflicts arise between charcoal producers and livestock herders because of the former group's destruction of trees resulting in less fodder availability for livestock. Such conflicts are usually strong verbal protests from livestock keepers and rarely lead to violent clashes. Elders and village leaders are very skillful in handling such confrontations in a peaceful manner. This type of intervention is deeply enshrined in Somaliland's culture and dates back to hundreds of years.

*Case study 1.*

HuseinJama is a resident of Habasweyne village. He first became a charcoal producer in 1956 after his livestock were wiped out by a drought named "cul iyo abaar" meaning hostility and drought. It was difficult to be a charcoal producer at that time, he said, because it was considered an inferior work. After making some good money from the charcoal business, he bought some livestock and stopped making charcoal. He could save enough money from charcoal to buy livestock because he was not a khat consumer. However, he returned to the charcoal business again and was a big producer in Habaswein. But he quit charcoaling again and has not produced charcoal for the last two years. His reasons for quitting are old age and trees becoming increasingly scarce.

*Case study 2.*

Jama Farah, also a resident of Habasweyne village, said that, many years ago as a young man planning to make a family he approached a young woman who eventually promised to marry him during the rainy season. When rains arrived, he lost no time and reminded the woman about her agreement to his proposal. However, she rejected him without elaborating her reasons for so doing. He was perplexed as he was a well-off young man with significant numbers of camels and sheep. Eventually he got the explanation from his women relatives in the area: a cousin of Jama Farah was charcoaling.

Consumers like to use charcoal for cooking because it is available and costs less than other energy sources such as electricity, LPG (liquid petroleum gas), and kerosene. Charcoal is a domestic product, requiring no foreign currency transfers, and its income stays within the country.

At present the metallic stove is commonly used in Odweyne town. This is less efficient than the improved ceramic stove, introduced from Kenya, and available in Hargeisa markets. The Kenya Ceramic Jiko(KCJ) has been widely accepted in many African countries for its reduction of energy wastage. Pictures of KCJ and the common metallic stove are shown below (left: KJC).



*Charcoal production statistics*

Generally, charcoal producers work in groups of three to five, with three being the more usual number encountered. Such a group produces charcoal bags ranging from 150 to 200 per month, with a mean of 175 bags per month (Table 3.2). The higher quantity of 200 bags is achieved during months when all three individuals in the team are working regularly without anyone on sick leave.

*Table 3.2 Charcoal Production statistics (bags of charcoal)*

Category	Period	Range	Mean
Group <sup>1</sup>	One month	150-200	175
	One year	1800-2400	2100
Individual	One month	50-67	58
	One year	600-804	702

<sup>1</sup>Group consists of three producers working together

*Estimated total charcoal supply*

As stated by the Regional government, exact figures on charcoal quantities produced in the region are not available. This is due, in part, to the nature of charcoal business which is primarily run in illegal manners. However, the office of the Ministry of Environment and Rural Development (MERD) in Burao reports that during the first half of 2012 about 6750 bags of charcoal were being imported every month from Odweyne region to Burao city. Assuming that at least an equivalent quantity of charcoal from the region is also exported to Hargeisa city, the total exported to these two large urban centers is around 13500 bags of charcoal per month. The third major importer of Odweyne charcoal is Berbera city. Assuming that Berbera imports only 20% of the quantity imported by Burao based on the population of Berbera in relation to that of Burao, 1350 bags are exported to Berbera per month. The total of charcoal produced in Odweyne region and exported to these three urban centers sums up to 14850 bags per month. An additional 5100 bags of charcoal are also consumed monthly in Odweyne town according to the data obtained from the household survey. This results in a grand sum of 19950 or approximately 20,000 bags of charcoal produced per month in the region. This means 75% of charcoal produced in the region is exported to other urban centers. For quick reference, these estimates are shown in Table 3.3

Table 3.3 Total charcoal supply estimate (exported and locally consumed)

Zone	Period	Bags
Hargeisa	One month	6750
	One year	81000
Buraq	One month	6750
	One year	81000
Berbera	One month	1350
	One year	16200
Odweyne town	One month	5100
	One year	61200
Totals	One month	19950
	One year	239400

### 3.3 Economic aspects

#### *Income*

A charcoal producer in the region produces on average 50 bags per month and sells for 18000 shillings per bag, earning a gross income of 900,000 shillings per month (about 138 dollars). When the producer gets the wood from communal lands, the only input to this production process is his labor. Producers do not hire labor for charcoal making and do the work themselves. Thus this gross income is nearly equivalent to net income from charcoal if the production is in communal land. On the other hand, if the production is in farmland, one-third of the charcoal value goes to the landowner, resulting in a net income of 600000 shillings for the producer. Currently, most production comes from communal lands. However, this type of land is becoming steadily scarcer, because of land privatization as farms by many residents of the region. If this trend continues, and it will likely do so, the price of charcoal will increase sharply to reflect the private ownership of trees.

The charcoal sector is a significant economic activity employing thousands of people in the country who in turn support a much greater number of dependents. Other sources of income for charcoal producers are very limited. Most of them have some livestock, usually fewer than 20 heads of goats or sheep per producer. Cash income from such low number of livestock is quite limited. The owner may sell three to five heads of his livestock in a year to buy basic needs such as food and clothing for his family. The

major economic benefits from livestock are milk for home consumption and occasionally meat also for family consumption. Some families receive cash remittance from relatives living abroad. This type of income is not made public and remains a family secret. However, it is an important source of assistance in times of hardships such as during drought.

#### *Profits from charcoal sales*

Charcoal producers incur little expenses in charcoal making as mentioned previously. About two-thirds of producers use the income from charcoal to buy food and clothing, pay school fees, and get medical services for their families, whereas the other one-third are in the business to pay for their khat consumption. Producers sell charcoal directly to wholesalers who come with their trucks to the site of charcoal production. Wholesalers make profits equal to or greater than that of producers.

Charcoal retailers in the region receive the least profit from charcoal. This group in the charcoal value chain buys a bag of charcoal for 18000 shillings and sells it for 21000 shillings. Charcoal retailers in the region are concentrated in Odweyne town and usually sell charcoal in their premises. Considering the total estimated 240000 bags of charcoal exported to Hargeisa, Burao, Berbera, and consumed in Odweyne town annually, and taking into account that a significant additional quantity of charcoal is sold through other channels by residents of the region, and noting that many of the truck owners who transport charcoal out of the region are themselves Odweyne region residents or with families in the region, the total income generated from the charcoal sector by the regional communities is approximately one million US dollars per annum.

### **3.4 Environmental aspects**

#### *Deforestation*

Deforestation is a serious ecological problem in Odweyne region and in all zones of Somaliland. A multitude of factors contribute to deforestation in the region including the following:

- Privatization of communal lands as farms by residents of the region. Inevitably, trees in these farms are destroyed to clear the land for plowing or to stimulate grass growth.
- Increased urban settlements, which also reduce forest areas and utilize trees for construction and other purposes
- Cutting of trees to cater for the fuel needs of the expanding urban centers with high population growth rates
- Overgrazing due to unsustainable land use methods and overstocking rates. As grazing pressure increases and fodder availability declines, livestock consume even tree seedlings contributing to deforestation

- Increased vehicle traffic in rural areas opening extensive rural roads, which also contributes to deforestation.

Visual assessments of plant cover during this survey indicated a high variability of tree density ranging from zero around villages to a maximum of about 600 trees per hectare in well protected private farms. Tree density is sparse in communal lands, because being free for all these lands are overgrazed and targeted by charcoal producers (see pictures on this page).



### *Reduction of biodiversity*

Charcoal making, through its detrimental effects on rangelands and soil fertility, leads to the reduction of wildlife and biodiversity. A large number of soil fauna and plant species are immediately killed by the fire. Selective cutting of trees for charcoal has also caused the decline of some tree species e.g. *Acacia bussei*, and is threatening others. Trees provide refuge for a wide variety of animals and other plants. The declining tree populations in the region are leading to the disappearance of some species.

### *Soil erosion*

Trees are an important component in the region's landscape. Charcoal production, by removing trees from the landscape, contributes to increased rates of soil erosion. The soils in this semiarid zone are fragile and highly susceptible to disturbance and erosion. Reduced plant cover, partly due to charcoaling, is resulting in loss of top soil and decreased soil fertility. Trees are a major factor protecting soil from erosion by improving water infiltration rates, reducing runoff, and modulating wind speed. Moreover, trees add organic matter to the soil, thereby improving soil water-holding capacity, and recycle nutrients from deeper soil layers.

### *Deterioration of watersheds*

Destruction of trees can damage watersheds in the region. Increased water runoff is associated with decreased water infiltration rates due to loss of trees and more compacted soils. Increased runoff also results from increased soil water due to diminishing evapotranspiration rates. This higher soil water content can cause more frequent flash floods. Underground water recharging rates also decline because of lower infiltration rates (van Beukering et al. 2007). Thus water availability may decline during the dry season.

### *Human health aspects*

Most interviewed groups in this survey complained about some type of ailments attributable to charcoal production or use. Sixty-five percent of respondents said they suffer respiratory ailments from charcoal use, 25% suffer from eye irritation, and 10% said they experience other types of health problems that they believe is due to charcoal use. It should be noted, however, that all these ailments are very mild and do not result in any serious or chronic disease. Incomplete burning of charcoal, particularly in a confined space, can lead to exposure to carbon monoxide, an odorless gas which, by combining with hemoglobin, deprives the body of oxygen and can cause death.

## Environmental awareness

All interviewed charcoal producers, retailers, and community leaders were strongly aware of the deteriorating rangelands and the negative effects of deforestation. About 100 percent of respondents expressed their knowledge about the declining tree populations in the vicinities of their town or villages. Almost 90% of respondents in the rural areas stated that finding firewood in nearby areas is becoming more difficult compared to the situation only five years ago. A smaller percentage of respondents were aware of the declining population of specific trees targeted for charcoal (Fig. 3.1). This is probably due to the demographic picture in the region with young people constituting an overwhelming majority.

Most respondents believed that the forests of the region will disappear within eight years, if the current unsustainable methods of land use continue, whereas fewer numbers thought that the forests will moderately or slightly decline (Fig. 3.2).

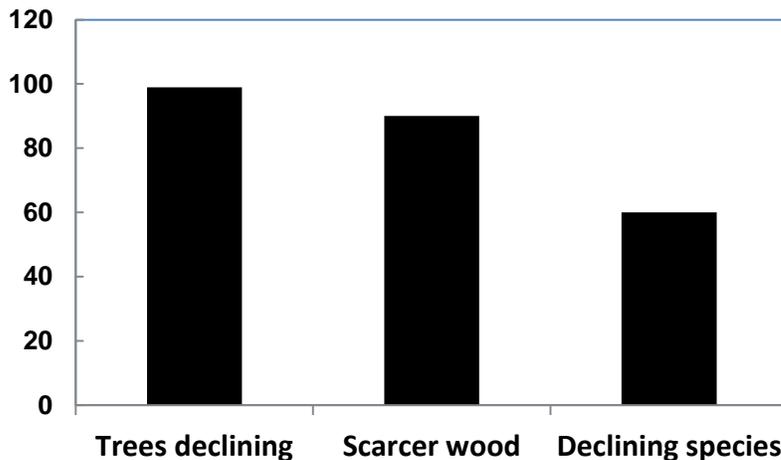


Fig. 3.1 Perceptions among respondents (percent) about changes due to deforestation

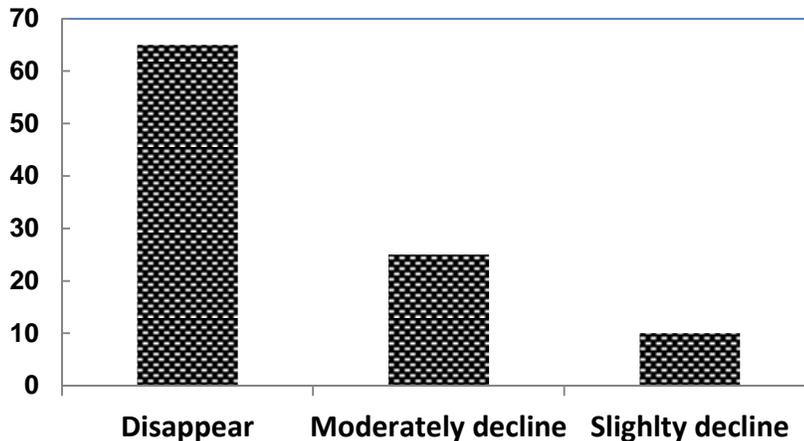


Fig. 3.2 Perceptions among respondents (percent) about expected changes in the forests of Odweyne region

### 3.5 Technological aspects of charcoal production

#### *Charcoal kiln efficiency*

At present, the most widely used kiln in Odweyne region for charcoal production is the earth pit-kiln. Several years ago, the earth mound kiln was popular among producers (MERD, 2004). The shift to the pit-kiln can be attributed to declining tree populations in the region. Both types of kilns are considered very inefficient and wasteful, with the earth mound kiln slightly more efficient than the pit-kiln (van Beuring et al. 2007). The efficiency realized in any type of kiln depends on the moisture content of the wood and the skill of the charcoal producer. The efficiency of the earth mound kiln is about 10-20% and that of the pit-kiln about 10-15% (van Beuring et al. 2007). In comparison, a brick kiln, which has not been used in Somaliland yet, has an efficiency of 25-35%, nearly double that of the pit-kiln. However, the brick kiln is not portable and is better suited to charcoal being produced in well managed tree plantations.

#### *Contribution to greenhouse gas emissions*

In the charcoal making process, the major greenhouse gases, carbon dioxide and methane are released into the atmosphere. Greenhouse gases are widely believed to be contributing to global warming and climate change. On a global scale, however, the biggest volumes of these gases are released through fossil fuel burning. In the African continent where charcoal is the dominant fuel for cooking, the production and consumption of charcoal may be significant contributors to greenhouse gas emissions.

### 3.6 Policy and legal aspects

#### *Central government*

Somaliland has policies and regulations in place to better manage its plant and wildlife resources and protect the environment. The Ministry of Environment and Rural Development has issued a rangeland resources policy, an environmental policy and an act for the prevention of rangeland degradation and soil erosion (Act number 4/98). The act makes provisions for the creation of rangeland rangers tasked with protection of rangeland resources from unscrupulous use together with the police. In addition, the act gives directives on licensing (including licensing of charcoal production), issuance of permits of transporting charcoal, and penalties on offenders. Furthermore, it lists some trees which cannot be cut and for which no permits can be issued (endangered plant species). Unfortunately, these policies and acts basically exist on paper and have yet to be enforced and implemented (APD, 2006).

Hence the main challenge in policy and regulations is not lack of them, but failure to implement them. A major reason for this is scarcity of funds and not lack of will by government authorities. The government of Somaliland operates on a small budget that cannot effectively cover all government areas of responsibility. This lack of capacity to enforce environmental and forestry regulations is a major factor for the widening unsustainable methods of natural resources use.

#### *Regional government and NGOs*

The government in Odweyne, being a recently created regional administration, has even less funds and the means of enforcing these laws intended for the conservation of natural resources. Currently, the trend in Somaliland is banning charcoal production. Experience from several other African countries shows that this type of intervention is doomed to fail (NL Agency, 2010). The current regional governor has tried on many occasions to halt charcoal production in the region by imposing heavy penalties of up to two million shillings on trucks transporting charcoal and by imprisoning charcoal producers caught while making charcoal. This has not been a successful intervention due to the high demand for charcoal in the large urban centers of Somaliland, lack of alternative employment, and the charcoal workers' urging need for survival. Additional obstacles to the governor's efforts include:

- Other people including community elders are intervening
- Lack of police and funds make enforcement of regulations extremely difficult
- The village leaders often make special arrangements for charcoal producers and traders.

Several NGOs are active in environmental conservation in Odweyne region. These include Save The Children, Candlelight, and the Danish Refugee Council. Their

activities include support to education, health, environment, and livelihoods for the resident communities. Unlike government authorities, enforcement of regulations is outside the jurisdiction of NGOs.

### *Community efforts*

Community leaders including elders and village chiefs as well as other environmentally conscious individuals have tried to stop the practice of charcoal production in the region. However, their efforts did not yield any positive results because of resistance from producers and lack of the means needed to implement the regulations. An outstanding exception is the village of Haydanle (Xaydaanle), which up to now have succeeded in stopping charcoal production and export. Whether the efforts of the community in Haydanle will stand the test of circumstances surrounding production and trade in charcoal remain to be seen; but there is no doubt that such initiative should be encouraged and supported by the wider Odweyne region residents.

## **3.7 Charcoal consumption**

The major user of charcoal in the region is Odweyne town, which has about 2000 households (local government officers, Odweyne). The results from the household survey showed that 75% of households in Odweyne town use charcoal and each uses on average 3.4 bags per month resulting in a total consumption of 5100 bags per month. The remaining 25% of Odweyne town residents use wood for cooking, whereas almost all rural people use only wood for cooking and heating. Thus the entire population of the region is heavily dependent on biomass energy for food preparation.

The proportion of charcoal produced and consumed in the region is very small compared to the proportion that is exported to urban centers outside the region. Less than eight percent of the charcoal produced in the region is consumed therein. Hence the major bulk of charcoal produced in the region is exported. Household data further indicated that a household in Odweyne town consumes on average 3.4 bags of charcoal per month. The average charcoal consumption per household is highly correlated positively with the size of the household (number of persons in the household). Most poor households buy charcoal in small amounts which is more affordable than bags. For all residents charcoal is still more affordable than other fuels such as kerosene. In addition, charcoal supplies are more reliable than other fuels, and some consumers even believe that food cooked with charcoal tastes better than one prepared with other fuels.

### 3.8 Trade and transport

Charcoal production and trade are important sources of livelihoods for thousands of workers and their dependents in Odweyne, as well as many more in other regions of the country. The charcoal value chain includes producers, wholesalers, retailers, and transports. The bulk of charcoal produced in Odweyne region is transported to major urban centers in the country as was noted earlier in this report. . on destination to Hargeisa, and Burao are usually transported on heavy trucks capable of accommodating more than 200 bags. Small trucks also carry small quantities of charcoal to Burao, a city not far from Odweyne region.

Charcoal is transported to Odweyne town on donkey carts and camel back. No vehicles bring charcoal to the town since the regional government is making efforts to stop charcoal production. Another reason for using only animals to transport charcoal to the town is the relatively low quantities consumed in the town. Charcoal prices vary among regions of the country, but it is usually related to the distance from the production site, and to the size of the urban center. For instance, a bag of charcoal sells for 20000 shillings in Odweyne town and 46000 shillings in Hargeisa. This large difference is due to the long distance the charcoal is transported and the high demand for charcoal in the big city. A bag of charcoal produced in the outskirts of Hargeisa will still sell for 46000 shillings.

Charcoal is sold in various quantities at the retail market. The poor usually buy charcoal in small quantities enough for the day's cooking needs. This way of purchasing charcoal results in higher costs incurred but the poor cannot afford to buy a whole bag. This also involves more frequent trips to the charcoal market. Those who can afford to buy charcoal in bags end up saving money, and they don't make many trips to the market as is the case with the poor.

Some informants claimed that Odweyne charcoal is even shipped to Yemen and the United Arab Emirates, but this could not be confirmed during this survey. Although charcoal consumption and production is largely concentrated in developing countries, some developed countries import charcoal.

*Case Study 3. Mr. Anbul Ahmed lives in Habasweyne village with his wife and five children. He has been producing charcoal for the last six years. He sends about seven bags of charcoal every week to Burao with the Pickup truck that also transports milk to Burao. His client in the city sends him back food items and some cash from the sale of the charcoal. The only other assets Anbul has is a herd of 15 goats. The income from charcoal is barely enough to feed his family. He sells two to three goats a year to buy clothes for his family and pay for the Koranic school which his children attend.*

## **4.0 Alternative fuel sources**

### **4.1 Solar power**

Solar energy is abundant in Somaliland and is available throughout the year. Solar power is utilized in some African countries to generate electricity as well as for cooking using solar cookers. However, the utilization of this source of energy is insignificant still compared to fossil fuels and charcoal. The initial investments needed to establish solar panels are very high and out of reach for Odweyne residents at the present. These solar panels also require maintenance and repairs which involves the engagement of skilled technicians. However, solar energy has a potential for entering the energy market of Odweyne, when economic and technical feasibility become more favorable.

### **4.2. Wind power**

A company known as Somaliland Free Energy is involved in promoting windmills in the country (Academy for Peace and Development, 2006). There is plenty of wind power in the country, and strong winds blow from the south during the summer months. Installation of windmills, however, involves large outlays of funds, and requires regular maintenance.

### **4.3. Coal**

Coal deposits have been confirmed in some regions of Somaliland, e.g. Sahel and Sanaag. Coal mining requires substantial investments. In addition, coal is known to be an environmental contaminant producing greenhouse gases such as methane and carbon dioxide along with the acid rain causing sulfur dioxide. Coal utilization in Odweyne region should only be considered when it becomes available and feasible in the whole country.

### **4.4. Liquefied Petroleum Gas (LPG)**

LPG is currently in use in Hargeisa and Burao, although the number of households using this source of energy for cooking in the two cities is very low. LPG is more costly than charcoal, and some people are suspicious about its safety margins. In addition, LPG is an imported product and foreign currency must be transferred for its acquisition.

Many poor households in Odweyne town buy charcoal in small quantities costing a few thousand shillings and cannot afford to buy a cylinder of LPG.

#### **4.5. Kerosene**

Kerosene is available in the region, and many households use it for lightening but none for cooking. Like LPG, kerosene is a fossil fuel imported from abroad and consumes foreign currency. The relatively higher cost of kerosene compared to charcoal discourages Odweyne town residents from using kerosene. Rural households in the region predominantly use wood for cooking which needs only labor input. Labor has almost a zero opportunity cost in the region.

### **5.0. Conclusion**

The present survey has highlighted the existence of extensive charcoal production in the region. Charcoal and wood are vital energy sources in the region employing hundreds and supporting the livelihoods of thousands of individuals. Most charcoal produced in the region is exported to Burao and Hargeisa. However, the methods used for charcoal production are inefficient and unsustainable. Attempts by local authorities, both government and community chiefs, to stop the charcoal production and export, were unsuccessful. Banning the business may not be the right approach to tackle the negative aspects associated with charcoaling such as deforestation, rangeland degradation, and soil erosion.

The charcoal sector should be recognized as an important one providing fuel and employment for people. Intuitive estimates from this survey indicate that the sector generates approximately one million US dollars for the Odweyne communities. However, sustainable methods for charcoal production and consumption should be introduced. Such methods include establishment of tree nurseries, promotion of private investment in growing trees in plantations, introduction of improved crop production practices, rehabilitation of damaged farmland, promotion of alternative livelihoods, promotion of efficient stoves for cooking, and formation of legal charcoal producer association. The authorities, communities, and NGOs in the region should focus on how to utilize best the tree resources in the region so that the most benefit goes to the communities in the region, while ensuring sustainability at the same time. Implementation of existing policies and regulations are sufficient to better manage charcoal production and conserve the natural resources of the region. Coordination of activities and programs by all actors including the resident community is essential, as isolated interventions are unlikely to succeed. The success of Haydaanle village community in managing charcoal production is a useful model that deserves special consideration. The Prosopis tree which is expanding at an alarming rate in the region

can be utilized for charcoal making and consequently reduce its negative ecological impact in the area.

## 6.0 Recommendations

1. Recognize charcoal as a useful, affordable, and renewable fuel source that generates employment and livelihoods for many charcoal workers and their dependents if managed sustainably.
2. Inclination to banning charcoal production in Odweyne region is unlikely to bear fruit as has been learned from previous attempts. Experiences from other African countries have repeatedly demonstrated that such attempts are doomed to fail and only bring about higher charcoal prices and more underground business
3. Awareness of issues related to charcoal should be raised among communities in the region including its positive and negative aspects and opportunities of reducing its negative impacts.
4. The successful efforts in managing charcoal production by Hayndaale community deserves special consideration. Lessons can be learned from this community that are relevant to the whole Odweyne region
5. Promote and train charcoal producers in utilizing more efficient methods of charcoal production taking models from existing improved kilns in neighboring countries such as Kenya. The predominantly used pit-kiln in the region is very inefficient and wastes wood.
6. Promote and encourage private investment in tree plantations for charcoal production. The regional government along with the Ministry of Environment and Rural Development should provide land on a lease basis e.g. 20 years to these investors. Investment in tree plantations is a major step toward sustainable charcoal production since this form of fuel is renewable.
7. Establish a tree propagation center in Odweyne town for dissemination of trees in the region. Farmers who own land should become the first participants in tree planting. Introduce fast growing trees that can be harvested for charcoal making within few years e.g. *Leucaena leucocephala*, while also including indigenous trees in the scheme.
8. Acquire novel sustainable charcoal production and management methods from countries which have succeeded in this regard such as Sudan by sending a selected team to that country. Members of such a team should include officers from Candlelight and the Ministry of the Environment and Rural Development.
9. Introduce some form of employment to reduce the dependency of workers on charcoal and the pressure on trees. This may include food or cash for work projects which may include:
  - Introduction of projects on soil and water conservation. Land degradation is the most serious problem affecting the region and its people. There is urgent need to curb the alarming rate of soil erosion and rangeland deterioration. Cheap labor is abundantly available in the region that can be utilized for this purpose taking many men away from charcoal making. A

major limitation on this type of intervention is the relatively high capital required for its implementation but ultimately the benefits will outweigh the costs if the project is conducted properly

- Provision of beekeeping tools as well as training in beekeeping
  - Assistance in improved livestock raising. Providing fodder seed and assistance in establishing pastures and/or rehabilitating rangelands can be very helpful in this regard
  - Promotion of improved crop production technologies including the provision of improved seed, reduced postharvest losses, and training in improved production practices. A significant community of crop growers are already established in the region.
10. Provide technical and financial assistance to farms damaged by flash floods. Such assistance may include provision of plowing, seed, and soil erosion control
  11. Promote the utilization of *Prosopis julifera* (Garanwaa), which has invaded the country, for charcoal making. This will also eliminate this exotic, invasive species from the region. A useful study on this alien tree including its social and environmental impacts together with suggestions on how it may be utilized in Somaliland, was conducted by Candlelight in 2006. However, the populations of this tree in Odweyne region are still relatively very low although it has the potential to increase rapidly if not managed. *Prosopis* is more shrub than tree lacking a single thick trunk. It appears to be more suitable for firewood than for charcoal production because of its shrublike growth form.
  12. Facilitate formation of Charcoal Producer Association. Members of this association should be organized to become licensed professional charcoal producers. This should improve accountability and responsibility towards the tree resources in the region and turn charcoal production into a transparent and legal sector of the economy
  13. Promote the use of efficient cooking stoves such as the Kenya Ceramic Jiko.
  14. Work toward finding an affordable and feasible fuel alternative
  15. Coordination of charcoal policy and natural resource management in the whole country is essential; improvements in Odweyne region may not be very effective if other regions are cheating by not taking similar actions.
  16. Coordination of activities and programs by all actors with community participation is essential, as isolated interventions are unlikely to succeed. A comprehensive approach encompassing multiple interventions are needed for successful management of the sector

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## Adjunct: summary of interviews

Table A1. Summary of interview with Odweyne Regional Governor and local government officers

Question topic	Response
Extent of charcoal production and trade in Odweyne region	Charcoal production and charcoal trade are widespread in Odweyne region
Export destinations of Odweyne region charcoal	Charcoal produced west of Odweyne town is exported to Hargeisa city while charcoal produced east of Odweyne town is exported to Burao city. Some charcoal is also exported to Berbera and even to Puntland.
Comparison of charcoal amounts produced in Odweyne region with amounts produced in other regions	Odweyne region produces and exports more charcoal than any other region in Somaliland. Exact figures on charcoal produced in the region are not available due to lack of constant monitoring and documented statistics
Fuel types used by Odweyne town residents for cooking	Residents of Odweyne town use both charcoal and wood for cooking.
Tree species mostly used to make charcoal	Most trees used for charcoal making or for firewood are Acacia species such as <i>Acacia tortilles</i> (qudhac), <i>Acacia nilotica</i> (maraa) and <i>Acacia bussei</i> (galool).
Most preferred tree for charcoal making	The most preferred species for charcoal production is <i>Acacia bussei</i> (Galool) which is declining rapidly in many areas
Khat as a factor	A large number of young men in the region chop trees for charcoal making only to pay for their daily khat consumption.
Means of transporting charcoal to Odweyne town	Charcoal enters Odweyne town only on donkey carts and sometimes on camel back; no trucks bring charcoal to the town.
Attempts by regional authorities to control charcoal production	The regional government tried on several occasions to halt the production of charcoal by imposing heavy penalties on trucks transporting charcoal. These penalties were up to two million shillings per truck. The regional government even imprisoned chiefs of some villages and fired others for their assistance to charcoal producers. However, these interventions proved futile for various reasons among which are lack of funds to enforce regulations and interference from high profile community members including those residing in other regions of the country. In addition, village leaders often make special arrangements for charcoal producers and traders.
Licensing charcoal producers and transporters	Most charcoal is smuggled out of the region. No one is licensed to produce or transport charcoal.
Who are the charcoal producers in the region	All charcoal producers in the region are residents and native to the region.
Reasons for entering the charcoal business	The main factors pushing young men to charcoal making are poverty (basic need for survival) and addiction to khat.
Effect of charcoal production on security in	Charcoal production often leads to conflict between pastoralists and charcoal producers.

the region	
Tax on charcoal	The regular tax on charcoal is 2500 shillings per bag at the market
Suggestions on how to manage the charcoal business	Introduction and enactment of strong regulations Raising a common awareness in the community of the charcoal sector and its social and environmental implications Providing employment for charcoal producers including food for work. WFP had in principle agreed on this with the regional government.

Table A2. Summary of interview with charcoal producers

Question topic	Response
Number of years in charcoal making	From one year to twenty years
Making charcoal as individuals or in groups	Most producers work in groups of three to five individuals
Type of kilns used	The most common kiln used these days is the earth-pit-kiln. Use of the earth mound kiln is on the decline
Number of bags produced per month by a group of three workers	Amount of charcoal produced by such group ranges from 150 to 200 baqs per month
Amount produced by an individual working alone	About 50 to 60 bags per month
Time taken five years ago for a group of three workers to produce 150 to 200 bags of charcoal	Only about 15 days (compare to the current 30 days for the same output)
Reasons for the longer time now needed to produce the same amount of charcoal as was produced five years ago	Trees were abundant and we had to travel very short distances to find them.
Time charcoal is processed in the kiln	Once the wood is loaded into the pit-kiln, charcoal will be ready in three days
Type of trees cut for charcoal making	We cut all types of trees for charcoal production: qudhac ( <i>Acacia tortilles</i> ), qansax ( <i>Acacia reficiens</i> ), kidi ( <i>Balanites schilin</i> ), maraa ( <i>Acacia nilotica</i> ), maygaag ( <i>Boscia minimifolia</i> ), and galool ( <i>Acacia bussei</i> ).
Preferred trees for charcoal making	Best trees for charcoal making is galool, followed by qudhac and qansax.
How trees are harvested for charcoal making	We begin the harvesting process by burning the tree at ground level while it is standing. We then chop the tree after it falls to the ground.
Maximum distance travelled to find trees	The maximum distance travelled to find trees and produce charcoal is about 15 km from Odweyne town for those workers residing in the town but shorter for those living in the rural areas

Trees accessed free or bought from private owners	Usually we harvest trees for free from communal lands, but on some occasions we use trees in private farms by negotiating with the farm owner. In the latter case, we pay the farmer one-third of the total value of charcoal produced.
Producer current selling price per bag of charcoal and the price five years ago	Our selling price per bag of charcoal to wholesalers and retailers, who come with their trucks or donkey carts at the site of production, is 18000 shillings. Five years ago the selling price was 13000 shillings per bag.
To where charcoal is exported	Most charcoal is exported to Burao and Hargeisa
Reason for producing charcoal	About two-thirds of producers make charcoal to support their families with basic necessities, while one-third of producers use the income from charcoal to buy khat. We are uneducated individuals and have no skills other than making charcoal. What we earn from charcoal is barely enough to buy food for our families, although we spend one-third of our income from charcoal on khat since charcoaling is a tedious task requiring the stimulation one gets from khat.
Awareness of the impact of charcoal making on the environment	We are aware of the ecological and environmental consequences of the charcoal production system currently in use: rangeland degradation, soil erosion, and loss of wildlife species.
What type of assistance will be enough for you to quit charcoaling	If each of us gets 40 sheep or goats then we can quit charcoal production
Comment on the future of charcoaling	We believe charcoaling has no future. Under the current situation, within eight years no trees will be left on the land.

Table A3. Summary of interview with charcoal retailers in Odweyne town

Question topic	Response
Time in charcoal retail	From five months to three years
Reasons for becoming retailers	We joined the charcoal business only to earn the minimum daily basic needs. We do not get anything above that from selling charcoal.
Other assets owned by retailers	Most retailers have no other assets. These other assets are usually a small number of livestock or a farm.
Place of selling charcoal	All charcoal retailers in Odweyne town sell charcoal in their homes. There is no common market for charcoal sales in the town.
Number of bags sold per retailer per month	Mean number of charcoal bags each of these retailers sells per month is 22 and ranges from those who sell only 10 bags per month to those who sell 30 bags per month.
Purchase and selling prices	Purchase price is 17000 and selling price is 19000 S/land shillings per bag
Most preferred tree for charcoal	All said they prefer charcoal produced from Galool ( <i>Acacia bussei</i> )
On the future of charcoaling	All retailers agreed that charcoal will disappear from Odweyne

	because of declining tree numbers.
Suggestions on how to stop cutting trees for charcoal production	They suggested creation of employment for those involved in charcoal trade as possible solution to the charcoal problem and prohibiting burning of live trees for charcoal production.

Table A4. Summary of interview with leaders and elders of several villages (Habaasweyne, Geeldidiska, Cabdi-Faarax, Galoolay, Xaaxi)

Question topic	Response
Types of trees cut for charcoal making	All types of trees are cut for charcoal making; no species is spared.
Are live trees cut	All trees cut are live trees; all dead wood had been harvested years ago.
Type of fuel used for cooking in rural areas	Only wood is used for cooking in rural areas
Time taken to gather firewood from the bush by an individual	At present it takes about half an hour to collect firewood from the bush and bring it home. Five years ago it took only 15 minutes to collect firewood
Who collects firewood	Usually women and children collect wood
Proportion of men in villages actively producing charcoal	This ranges from 30% to 60% of men in villages
Why men make charcoal	The factors forcing men to produce charcoal are poverty and khat consumption.
Proportion of men making charcoal only to pay for khat	This ranges from 33% to 50% of men making charcoal
Other assets owned by charcoal makers	On average each charcoal maker has about 10 goats. The majority of these men are married.
Who are the charcoal producers	All charcoal producers are natives of the villages where they operate
To whom producers sell charcoal	Producers sell charcoal to truck owners who carry the charcoal to large urban centers
Any conflicts due to charcoal making	Occasionally conflicts due to charcoal production arise in the community, but no violent clashes.
On the future of charcoaling	We think the future of charcoaling is grim; trees will be eradicated within five years with the current state of affairs
Attempts by village leaders to control charcoal production	The village elders have tried to stop production and export of charcoal in their villages but were unsuccessful.
Suggestions on how to reduce charcoal making in the region	Interventions that generate income or provide food for charcoal producers may help

Table A5. Summary of Interview with Ministry of Environment and Rural Development, Togdheer region

Question topic	Response
To where is Odweyne charcoal exported	Charcoal produced in Odweyne is exported to Hargeisa, Burao, Berbera, and even to Puntland
Are private farms becoming significant sources of charcoal	Most charcoal is now made in private farms
Do you issue licensing for producing or transporting charcoal	No license is issued to anyone to produce or transport charcoal
How much charcoal is transported from Odweyne region to Burao city	Every month 6750 bags of charcoal are imported from Odweyne region to Burao city
Any conflicts due to charcoal	Every month we address four to eight cases of conflict due to charcoal between livestock herders and charcoal producers destroying trees
Any suggestion on how to manage the charcoal sector	The only viable solution to the charcoal problem is to find and introduce an alternative, affordable fuel.

## Appendices

### Appendix 1 Interview questions for regional and local government officers

1. How widespread is charcoal production in this region?
2. Where is charcoal transported to from here?
3. Are all charcoal producers residents of the region or are some from outside the region?
4. Why do young men join the charcoal business?
5. Have you attempted to control charcoal production in the region?
6. If your efforts to control or manage the charcoal production have failed, then what are the reasons?
7. What do you think should be done to manage the charcoal production so that its negative impacts are minimized?

### Appendix 2 Charcoal Producer Questionnaire

Enumerator: -----

Date: -\*.\*-----

Town or village .....

District .....

1. How long were you producing charcoal?  
.....
2. In which sites do you produce charcoal?  
.....  
.....
3. What method do you use for producing charcoal?
  1. Mound method
  2. Pit method
  3. Other (specify) .....
4. How many charcoal bags do you produce in a month?  
.....
5. How do you transport your charcoal to the market?
  1. By big trucks
  2. By medium size trucks
  3. By small trucks
  4. On animal back (donkeys, camels)

6. Which type of trees you prefer most for charcoal production?  
.....  
.....  
.
7. How do you access the trees for charcoal production?
  1. On free basis
  2. Pay the landowner
  3. Use trees on my own land
  4. A combination of the above
8. Do you find it more difficult to access trees for charcoal production than in the past?
  1. Yes
  2. No
9. Are you aware of any environmental problems caused by the use of charcoal?  
.....  
.....  
.....
10. What do you think should be done to conserve our trees and rangelands?  
.....  
.....  
.....  
.....
11. Does charcoal production cause conflict in the community?
  1. Never
  2. Only occasionally
  3. Sometimes
  4. Often
  5. Very frequently
12. Do you experience any of the following health problems from working with charcoal?
  1. Difficulty to breathe
  2. Eye irritation
  3. Chronic respiratory problems
  4. Other (specify) .....

**Appendix 3 Charcoal Retailer Questionnaire**

**Enumerator:** -----

Date: -----

Town or village .....

District .....

- 1 How long were you selling charcoal?  
.....
  
- 2 Why did you join the charcoal business?  
.....  
.....  
.....
  
- 3 Do you have other means of living besides charcoal production?
  1. Some livestock
  2. A crop farm
  3. A crop farm and livestock
  4. Another occupation (please specify) .....
  
- 4 From which places your charcoal comes?  
.....  
.....  
.....
  
- 5 Where do you sell your charcoal?  
.....  
.....
  
- 6 How many charcoal bags do you sell in a month?  
.....
  
- 7 How much do you pay per standard bag of charcoal?  
.....
  
- 8 How much do you charge per standard bag (S/Land shillings)?  
;.....
  
- 9 Which type of trees you prefer most for charcoal and why?

.....  
.....  
.....

10 Do you find it more difficult to get charcoal than in the past?

- 1. Yes
- 2. No

11 Are you aware of any environmental problems caused by the use of charcoal?

.....  
.....  
.....

12 What do you think should be done to conserve our trees and rangelands?

.....  
.....  
.....  
.....

13 What do you think about the future of charcoal production?

.....  
.....  
.....  
.....

14 Does charcoal production cause conflict in the community?

- 6. Never
- 7. Only occasionally
- 8. Sometimes
- 9. Often
- 10. Very frequently

15 What problems do you encounter in getting your charcoal?

.....  
.....  
.....  
.....

16 Do you experience any of the following health problems from working with charcoal?

- 1. Difficulty to breathe
- 2. Eye irritation
- 3. Chronic respiratory problems
- 4. Other (specify) .....

**Appendix 4. Household questionnaire**

**Enumerator:** -----

Date: -----

**Household**

Household number: .....

Village or town: .....

District: .....

**Respondent**

Age: (1) less than 25 (2) 26-40 (3) 41-50 (4) above 50

Sex: (1) Female (2) Male

Education: (1) None (2) Elementary (3) Secondary (4) Tertiary

Occupation (please specify): .....

1. Household management
  1. Male headed
  2. Female headed
  3. Elder headed
  4. Child headed
  
2. What type of energy does this household use for lightening?
  1. Electricity
  2. Firewood
  3. Batteries
  4. Kerosene
  5. Other (please specify) .....
  
3. What type(s) of fuel does this household use for cooking?
  1. Only wood
  2. Only charcoal
  3. Both wood and charcoal
  4. Only kerosene
  5. Charcoal and kerosene

6. Kerosene and wood
  7. Other (please specify).....
4. How much charcoal does this household use per month (in standard bags)?  
.....
  5. How many people live in this household?  
.....
  6. How does this household obtain charcoal for cooking?
    1. By buying
    2. By harvesting and preparing it from trees
    3. As a gift from other people
    4. Both a and b
    5. A combination of the above
  7. How does this household obtain wood for cooking?
    1. By buying
    2. By gathering it from the bush
    3. As a gift from other people
    4. Both a and b
    5. A combination of the above
  8. If this household gathers some firewood from the bush, who does the most gathering?
    1. Young females
    2. Older females
    3. Young males
    4. Older males
  9. What is the maximum distance traveled by the person gathering firewood (estimate in km)?  
.....
  10. What is the minimum distance traveled by the person gathering firewood (estimate in km)?  
.....
  11. What is the cost of one bag of charcoal to the household (S/land shillings)?  
.....
  12. Rank the following as the sources of charcoal for the household (1=biggest source, 4=least source)
    1. From the charcoal market Rank=
    2. From vehicles carrying charcoal Rank=
    3. From persons transporting charcoal on animal back (donkeys, camels etc.) Rank=

4. From persons selling charcoal in their premises Rank=

13. Does this household use more charcoal than it used five years ago?

- 1. Yes
- 2. No

14. Does this household find it more difficult to obtain charcoal than it was five years ago?

- 1. Yes
- 2. No

15. Is charcoal becoming less affordable for this household than it was five years ago?

- 1. Yes
- 2. No

16. Does this household ever fail to cook meals because of lack of charcoal?

- 1. Yes
- 2. No

17. Which tree species do you prefer your charcoal to be prepared from and why?

.....  
.....  
.....W.....

18. Where do you cook your food?

- 1. In the open outside the house
- 2. In a roofless kitchen in the house
- 3. In a roofed kitchen in the house
- 4. In one of the house rooms

19. Do you experience any of the following health problems from cooking with charcoal?

- 1. Difficulty to breathe
- 2. Eye irritation
- 3. Chronic respiratory problems
- 4. Other (specify) .....

20. Are you aware of any environmental problems caused by the use of charcoal?

- 1. Yes (please specify) .....  
.....
- 2. No

21. Tree density around our village (town) has decreased in the last five years

- (a) Strongly agree
- (b) Moderately agree
- (c) Slightly agree
- (d) Strongly disagree
- (e) Moderately disagree
- (f) Slightly disagree

22. What do you think should be done to conserve our trees and rangelands?

.....  
.....  
.....  
.....

**Appendix 5: Acronyms**

APD	Academy for Peace and Development
MERD	Ministry of Environment and Rural Development
IGAD	Intergovernmental Authority for Development

**More pictures from the region**



Charcoal bags ready for transporting to market (Geeldidiska village)



Charcoal being burned in an earth pit-kiln near Hahi (Xaaxi) village